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Medical Professionalism Among Orthopedic Residents in Bangladesh – A KAP Study

Syed Golam Samdani¹, Md. Abdul Gani Mollah², Syed Shahidul Islam³, Shamsuzzaman⁴, Md. Kamruzzaman⁵, Md. Farukul Islam⁶

ABSTRACT

Medical professionalism in any society demands the exhibition of a range of qualities & responsibilities in the patients care; not just mastery and autonomy. A descriptive cross-sectional study was conducted among orthopedic residents in Bangladesh working in different institute/medical university/medical college hospitals to find out the present status (Knowledge, Attitude & Practice) of Medical professionalism among them. Study period was Nov. 2017 – Jan. 2018. Sample size was 114. Among participants who responded the question about ideas of professionalism only 15% were responded correctly. More than half of the participants were not clear about the differences between ethics and professionalism. Among those who responded 'yes'; only 08% could mentioned clear difference between Ethics & Professionalism. Regarding honesty with patients, one statement like physicians should disclose all significant medical errors to affected patients and/or guardians, more than 63.2% are not agreed or confused & rigid to practice this. About 42.9% were not agreed to appear recertification exam periodically to increase professional competence. From this study it can be concluded that concept of professionalism and level of knowledge regarding its various aspects are not satisfactory among orthopedics residents. Attitude & practice towards most of the major principles of professionalism are much more positive. Seminar, Symposium, CME & CPD program on professionalism should be arranged regularly.

Key wards: Professionalism, KAP study

INTRODUCTION:

Professionalism as a word comes from a Latin 'professio' which means public declaration.¹ By definition it is well expressed as "a set of values, behaviors and relationships that underpin the trust the public has in doctors".² Medical professionalism in any society demands the exhibition of a range of qualities/responsibilities in the patients care, and not just mastery and autonomy. These qualities are professional competence, honesty with patients, patients' confidentiality, maintaining appropriate relationships with patients, improving quality of care, Just distribution of

finite resources, scientific knowledge, maintain trust by managing conflicts of interest and professional responsibilities.³ A physician's charter was published in 2002 and is now endorsed by many professional associations and societies around the world reflecting the growing importance of medical professionalism.⁴ Assessing professionalism carries many challenges but detecting professionalism is impossible without measurement.⁵

RATIONALE:

Health care system in the new millennium has been changed abruptly which leads to erode 'public trust' and

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'traditional values & behavior'. However, there is evidence of a widespread mismatch between the knowledge & attitudes of practicing physicians and their actual professional behaviors. By doing a study regarding Knowledge, Attitude & Behavioral skills about professionalism among our future orthopedics doctors we can assess what measures should be taken to eliminate all disputes. It will help to find out lacking in both formal & hidden curriculum. Present status will help in future to achieve excellent practice of professionalism by integrating professional development program in the curriculum as well as in CPD (Continuing Professional Development) schedules.

GENERAL OBJECTIVES:

To find out the present status (Knowledge, Attitude & Practice) of medical professionalism among residents of orthopedics in Bangladesh.

METHODOLOGY:

This descriptive type of cross-sectional study was done during Nov/2017–Jan/2018 among residents of orthopedics placed in NITOR; DMCH; BSMMU; SSMCH Mitford Hospital; CMCH- Chittagong; MAG Osmani Medical College Hospital, Sylhet. Convenience sampling technique was adopted. Data were collected by a pretested self-administered questionnaire. It has three parts -

- ia. Knowledge was assessed by a semi-structured questionnaire. There were 13 questions (7 structured; 2 semi-structured and 4 open questions) focused on knowledge & understanding of different topics regarding professionalism.
- ib. Attitude towards professionalism was assessed by collecting opinions of residents on 15 statements regarding 12 major professional attributes as 5-points Likert's Scale.⁶
- ic. Practice were assessed via selected response scenarios. Responses were dividing into very good, good, moderate, poor and very poor with five corresponding rates e.g. 5,4,3,2 and 1 respectively within that self-administered questionnaire.

After a short briefing; self-administered questionnaire were distributed among residents and they were requested to put their honest responses instantly without hesitation. Responses of participants were collected within one hour. Total 114 questionnaires could be collected. Data were checked and edited after collection, then processed and analyzed by using SPSS computer package. This research was conducted after getting permission from all respective authorities. Here individual confidentiality was fully maintained; only average results were used for further analysis and presentations.

RESULTS:

Table I shows that total 114 residents responded in self-administered questionnaire. Among them, 74 (64.91%) were from govt. services and 40(35.09%) from non-government services. In Bangladesh female doctors are less interested to orthopedics residency; almost all participants were male 113(99.12%) in this study. Their mean length of residency was 10.41±2.36 months.

KNOWLEDGE

- About 2/3rd e.g. 78(68.4%) were responded the question ideas of **professionalism**; among them only 18(15.8%) were responded correctly.
- **'Is there any difference between Ethics & professionalism?'** More than half of the participants 62 (54.4%) were not clear about the differences between ethics and professionalism.
- Only 09(7.89%) could mentioned clear difference between Ethics & Professionalism.

Attitude & Practice

Regarding attitude & practice more than 80% respondents were agreed with 6 of 15 statements about principles of professional responsibilities. Highest score of satisfaction (93%) was in practice of patients' confidentiality. Lowest score of satisfaction (33.2%) was in practice of altruism. Table II shows difference between Attitude & Practice towards some professional attributes.

Table I
Showing basic information of respondents (n=114)

Characteristics of respondents	Gender		Type of Residents		Name of Institute/Hospitals					
	Male	Female	Govt.	Non-Govt.	NITOR	BSMMU	DMCH	SSMC Mitford Hospital	CMCH	MAG Osmani MCH
Number of Data (n) & weighted proportion (%)	113 (99.12)	01 (0.88)	74 (66.9)	40 (35.09)	46 (40.35)	15 (13.15)	28 (24.56)	04 (3.51)	16 (14.04)	05 (4.39)

Table II
Difference between Attitude & Practice towards some professional attributes

Professional attributes/Commitments		Agreed Attitude n (%)	Satisfactory Practice n (%)
Professional competence	Should undergo Re -certification examinations to renewal registration periodically throughout career.	49(42.9)	
	To avoid repeated late arrival to clinical sessions at morning, what should do?		38(33.3)
Honesty with patients	Should disclose all significant medical errors to affected patients and/or guardians.	42(36.8)	
	Consult with seniors to involve them to correct the error and inform all to the patient		83(72.8)
Professional responsibilities	Should report significantly incompetent colleagues/any significant medical errors	79(69.3)	
	When closest friend have only six months to complete residency & currently diagnosed as HCV carrier		More than 50% try to keep it confidential
Altruism	Should always attend emergency situation voluntarily even during off days.	76(66.6)	
	In last emergency admission day when invited to treat patients in EOT as a volunteer happy to attend there with embracement		2/3rd showed embracement

Discussion:

Medical doctors share a common professional standard & responsibility throughout the world although there are enormous difference in culture and health care background. However, in many parts of the modern world healthcare services have been much commercialized; which is terrifying to damage professionalism of medical doctors.⁷ In these present situations, our future doctors should be prepared to participate in the complex clinical settings as well as they should be highly conceptualized & skilled enough regarding their professionalism.

In this study, one open question was put to describe their ideas about professionalism. About 2/3rd e.g. 78 (68.4%) were responded the question ideas of professionalism; among them only 18(15.8%) were responded correctly included 3 elements e.g. Master of Knowledge and Skills in respective areas, uphold the highest standard of ethical & professional behavior & maintain moral and social contract between patients and doctor both personally & professionally.

Almost all participants knew about word 'Professionalism' & medical Ethics. But responses to the 'Is there any difference between Ethics & professionalism?' shown that more than half of the participants 62(54.4%) were not clear about the differences between ethics and professionalism.

Among all respondents only 09(7.89%) could mentioned clear difference between Ethics & Professionalism. It indicates that the word 'Professionalism' is not a generalized term as the word 'Ethics'. Ethics refers to the guidelines in a specific context whereas professionalism refers to the specific traits that are expected of a professional. Ethics are usually stated whereas professionalism is cultivated by the individual personally.

Similarly, in "comparative study on professionalism of fourth coming medical doctors between two private medical colleges in Saver, Bangladesh" by Salam A et al, on 2012-2013 thirty seven percent (37%) students of both GSSVMC(Gono Shastho Somaj Vikttik Medical College) and EMC (Enam Medical College) were possessing positive response towards professionalism. Rest 63% either did not answer the question "What do you mean by Professionalism?" or they did not understand the issue.⁸ This finding is dissimilar with the other studies in other countries.⁹

This issue can be interpreted as Bangladeshi medical students/residence in specialist are either quite lazy to respond open ended questions or there is a possibility that they are meager in expressing their words, or they are quite shy to express their inner feelings to the teachers.⁸

In this study, majority of the participants 101 (88.6%) responded negative i.e. they never heard about 'Physician Charter'. Among those who responded 'yes'; no one could answer next question regarding 'Fundamental Principles of Physician Charter'

The physician's charter provides an ethical, educational and practical framework for professionalism to guide physicians in the practice of medicine and their relationships with patients, colleagues and society. It is applicable to different cultures and political systems. The charter is based on three fundamental principles and a set of professional responsibilities.³ Physician's charter has been dubbed as 'modern-day Hippocratic Oath'.¹⁰

Regarding attitude & practice more than 80% of respondents were agreed with 6 of 15 statements about principles of professional responsibilities. Highest score of satisfaction (93%) was in practice of patients' confidentiality. Lowest score of satisfaction (33.2%) was in practice of altruism.

Mean score in attitude was 3.98 ± 0.42 ; 95% CI was 3.92 to 4.03. Mean score in practice was 4.03 ± 0.37 ; (95% CI was 3.99 to 4.08). Practice is consistent with attitudes in this study. But there were some difference between attitude & practice towards some professional attributes. To maintain professional competence if one should undergo re-certification examinations to renewal registration periodically throughout career only 49(42.9%) will agree it. Similarly to maintain Honesty with patients one should disclose all significant medical errors to affected patients and/or guardians only 42(36.8%) will agree it; but they 83(72.8%) will like to consult with seniors to involve them to correct the error and inform all to the patient. Regarding professional responsibilities 79(69.3%) will agree to report significantly incompetent colleagues/any significant medical errors but when the closest friend have only six months to complete residency & currently diagnosed as HCV carrier more than 50% try to keep it confidential. Similarly, 76(66.6%) residents were expressed to attend emergency situation voluntarily even during off days but when in last emergency admission day those were invited to treat patients in EOT as a volunteer almost 2/3rd residents showed embracement. Role modeling from teacher may help to overcome these confusion & embracing situations.

Chen et al. done a pilot study among 390 physicians in two tertiary hospitals of China between May and July 2011. More than 90% of physicians agreed (somewhat agree or completely agree) with 9 of the 13 normative statements about 9 principles. The agreement stayed above

80% for all the statements.¹¹ According to Roland et al, (2011) 63.1% of USA doctors and 59.36% of UK doctors, respectively, 'completely agreed' that physicians should report all instances of significantly impaired or incompetent colleagues to relevant authorities.¹² In this study our orthopedics residents 45.6% completely agreed with it, while only 28.1% of Chinese physicians 'completely agreed' with it.¹¹

Campbell et al, on 2003-2004 conducted a national survey using a stratified random sample (sample size was 3504) among practicing physician of USA. More than 90% of physicians agreed with 8 of the 12 normative statements regarding professionalism posed in the survey. Agreement fell below 80% only for the question about periodic recertification.⁶ Similar normative statements were also used in present study.

CONCLUSION:

From this study, it is concluded that concept of professionalism and level of knowledge were not satisfactory in large extent. Though there were some confusing & embracing situations, but attitude & practices towards most of the major principles of professionalism were as much as positive like physicians of other countries. Regarding both attitude and practice of major responsibilities of professionalism; there was no significant difference ($p > 0.05$) between govt. and non - govt. residents working in different medical college hospitals.

RECOMMENDATIONS:

1. There should be an institutional agreement on a definition, setting expectations & curriculum framework regarding professionalism.
2. Hidden curriculum should be emphasized.
3. Teacher should be a role model for the student.
4. Activities such as a 'white-coat' ceremony & 'formative assessment' should be adopted in spiral pattern.
5. Seminar, Symposium, CME & CPD program on professionalism should be arranged regularly.

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A New Method For Closed Reduction And Percutaneous Pinning In Pediatric Supracondylar Humerus Fracture with Or Without Rotational Malalignment Those Are Difficult To Reduce (Using Anterior Schanz Pin)

Quazi Shahidul Alam¹, Md. Golam Sarwar², Mobarak Hossain³, Md. Ashfaque Rahman⁴, Sarwar Ibne Salam⁵, Ghiyas Uddin Arif⁶, Ruhul Amin Mollah⁷

Abstract

Unstable supracondylar fracture with rotational deformity of the distal humerus have instability in both flexion and extension. Horizontal rotation in a medial direction or internal rotation of the distal fragment is believed to predispose the distal fragment's varus angulation (1). Closed reduction and percutaneous fixation is difficult to achieve by the traditional reduction maneuver if rotation is present. We retrospectively evaluated 36 children (23 boys and 13 girls) with a mean age of 7.2 years (range, 3 to 11 years) who underwent closed reduction and percutaneous fixation using an anterior joystick technique for the rotational malalignment which could not be corrected by other means except open method. Clinical and functional results were assessed by the system described by Flynn. Radiographs at final follow-up were compared with immediate postoperative and normal contralateral elbow. With an average follow-up of 8.9 months (range, 2 to 20 month), there was no statistically significant difference between the operated and the contralateral normal side according to functional, and radiographic evaluation. There was no complication like pin-site infection, loss of fixation, malunion, cubitus varus, iatrogenic nerve injury, or need for further surgery. The use of Schanz pin as anterior joystick is a safe and effective method that can bypass repeated aggressive attempts for closed reduction and also the need of open reduction in unstable supracondylar fractures of the humerus in children.

Key Words: supracondylar humeral fractures, multidirectional unstable, rotational malalignment, closed reduction, percutaneous fixation, Schanz pin

INTRODUCTION

Supracondylar humeral fractures are most common fracture around the elbow in children and usually occur due to falls on an outstretched hand while the elbow in full extension^{1,2}. The anterior periosteum is torn while the posterior periosteum is intact. Mostly these fractures

are extension-type and classified according to classification system by Gartland³. In Gartland Type 3 fractures, the periosteum is usually torn circumferentially and these fractures are defined by instability in both flexion and extension. Treatment goal is directed in reducing the fracture, correcting any rotational deformity, maintaining

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reduction and preventing complications. But to correct the external rotation deformity of the proximal fragment is difficult due to the instability of the fragments and edema of the elbow. In this study, we emphasized that the reduction maneuver could be performed using a Schanz pin as an anterior joystick into the distal part of proximal segment from anterior side by closed means. We measure the radiographic and functional outcomes by the Flynn criteria (1) after close reduction and internal fixation aided by a Schanz pin guided joystick method.

PATIENT AND METHODS

This was a retrospective study that included total of 36 children (mean age: 7.2, range: 3 to 11) with Gartland Type 3 supracondylar fractures of humerus. They were treated by closed reduction using a Schanz pin—as an anterior joystick between July 2015 to June 2017, when the “traditional” closed reduction and percutaneous fixation or satisfactory closed reduction is not obtained under general anesthesia. Inclusion criteria for this study were age between 2 and 12 years old and complete displaced supracondylar fractures of humerus. Patients with open fractures; fractures associated with vascular insufficiency, or compartment syndrome were excluded. Typical Gartland type I and II fractures were not included in this study. Demographic data including age, sex were collected. The mean follow-up was 8.9 months (range 2 to 20). 23 (64%) of the patients were male, 13 (36%) were female. Tourniquet was not used in this procedure.

TREATMENT PROTOCOL

All unstable patients were positioned in the supine position on the operating table under general anesthesia. C-arm image intensifier was used as an operating table placing elbow. 5mm skin incision was made on anterior aspect of elbow and Approach to the anterior cortical bone was done first using drill sleeve. Then 2.5mm, terminally threaded Schanz pin was inserted to anterior cortex of proximal fragment of the humeral shaft. Schanz pin was inserted through both cortices and using as an anterior joystick after attaching T-handle universal chuck. By manipulating the T-handle (turning it inward), rotational malalignment was corrected after correcting sagittal and coronal plane correction by traction. Two K-wires were inserted from the lateral side and rotational stability was achieved. Fracture reduction and fixation stability is assessed in AP, lateral, and oblique views with gentle stress in all direction. A long arm cast with the forearm in neutral and the elbow flexed around 60 to 70 degrees is then placed. The pins are left out through the skin which was removed after 3 weeks if appropriate evidence of fracture healing noted. In the follow-up visit the patient’s elbows range of motion and carrying angle were measured. The system described by Flynn et al was used to assess the clinical results. AP and lateral radiographs at last follow-up were compared with the post-operative ones as well as with normal contralateral elbow radiographs. Baumann and lateral humero capitellar angles of both elbows were recorded. The level of significance was set as $P < 0.05$.



Fig. 1A: Incision for Schanz pin insertion was made within the distal one-third area of humerus.



Fig. 1B: Schanz pin was inserted to both cortex of proximal fragment of humerus and used as joystick after T-handle universal chuck attachment.



Fig 2A: C-arm image before closed reduction. Schanz pin was inserted on proximal fragment of humerus.



Fig 2B: Lateral image before closed reduction, Schanz pin was inserted to both cortex.



Fig 2C: Lateral image after closed reduction using Schanz pin.



Fig 3A: Postoperative elbow A-P view.

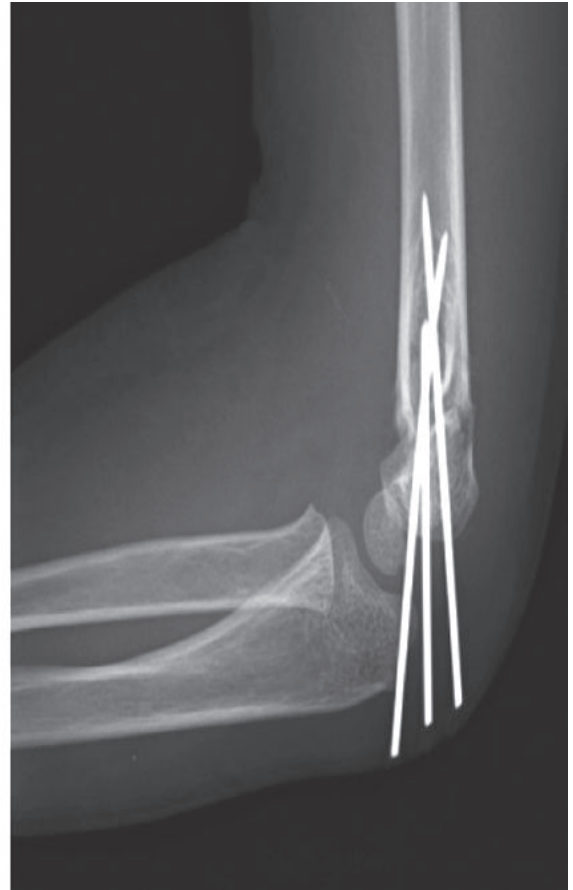


Fig. 3B: Postoperative elbow lateral view.

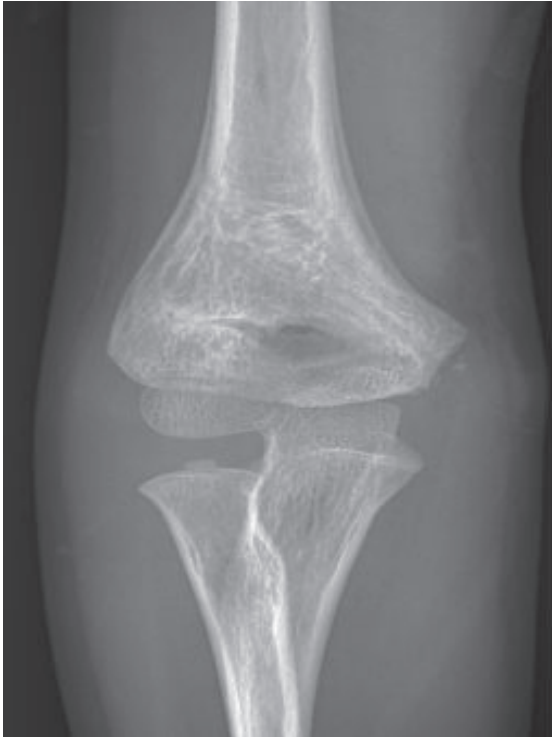


Fig. 4A: A-P radiograph of elbow 2 months after K-wire removal. Union was noticed.



Fig. 4B: Lateral radiograph of elbow 2 months after K-wire removal. Union was noticed



Fig. 5A: Measurement of Baumann's angle.



Fig. 5B: Measurement of carrying angle.



Fig. 5C: Measurement of humero trochlear angle.

RESULTS

There were 23 boys and 13 girls with a mean age of 7.2 years (range, 3 to 11 y). The average follow-up length was 8.9 months (range, 2 to 20 months). In all fractures, the distal fragment was completely unstable and could be manipulated in almost any direction. At the most recent clinical visit, there was no difference between the injured elbow and the contralateral side according to functional, and radiographic evaluation. The mean Bauman's angle was 25.3 degrees (range, 19.2 to 27.2 degrees; 95% confidence interval) immediately after pinning and 27.9 degrees (range, 21.7 to 29.5 degrees; 95% confidence interval) at final follow-up. There was no statistical significant difference between final Bauman angle (P=0.323) and humero capitellar angle (P=0.243) in the operated elbow compared with the contralateral elbow. According to the Flynn criteria 31 patients showed excellent results meaning carrying angle loss between 0-5 degrees and elbow movement loss 5 degrees. At the final examination, mean elbow flexion extension range of motion arc was 156.4° (range: 150.1° to 160.3°). There was no radial nerve palsy as a result of inserting the joystick k-wire.

Table-I
Flynn criteria

	Functional ROM deficit (°)	Number of patients
Perfect	0–5	31
Good	6–10	5
Fair	11–15	0
Fair	>15	0

Table-II
Demographics outcome of 36 children with unstable supracondylar fracture of the distal humerus.

Baseline characteristic	
Age (yr)	7.2 ± 2.1
Sex (male/female)	23/13
Follow-up period (month)	8.9 ± 3.3

Table-III

Radiographic outcome of 36 children with unstable supracondylar fracture of the distal humerus

	Uninjured elbow	Injured elbow (initial)	Injured elbow (postoperative)	Injured elbow (last follow up)	p-value
Baumann's angle (°)	28.2	18.8	25.3	27.9	0.323
Carrying angle (°)	15.8	24.8	16.3	15.8	0.122
Humero trochlear angle (°)	47.9	25.6	41.1	45.6	0.243

Table-IV

Clinical outcome of 36 children with unstable supracondylar fracture of the distal humerus

	Uninjured elbow	Injured elbow (last follow up)	p-value
Elbow flexion (°)	157.2	154.7	0.125
Elbow extension (°)	-3.4	-3.1	0.221

DISCUSSION AND RESULT

Supracondylar fractures are common fractures accounting for 17.9 % of all pediatric fractures². They are the most commonly surgically treated fractures during childhood(4). Closed reduction and percutaneous pinning is the method of choice. However, in soft tissue interposition, severely displaced fractures, very edematous extremities closed reduction may not be achieved⁵⁻⁷. Main advantage of this joystick technique is simple reduction manipulation while

a joystick supplies necessary rotation to proximal fragment. The traditional reduction maneuver for extension-type supracondylar humeral fracture in children is longitudinal traction followed by hyperflexion of the elbow. The forearm can be either in supination or pronation according to the side of displacement. But after correction of varus or valgus angulation and hyperextension deformity, the rotational deformity may persist. Then internal rotation of the arm must be done as the proximal

fragment is external rotated in these cases. Open procedure for such fractures may be required due to inability to correct rotational deformity by internally rotating the arm to achieve reduction.

Various methods in the literature have described the use of K-wire as a joystick to correct rotational deformity. Parmaksizoglu et al. described a method using a K-wire inserted in the proximal humerus as a joystick⁸. Novais et al. described another method in which a K wire was inserted to the distal fragment as a joystick to facilitate reduction⁹ while Yu et al insert the k wire at fracture site to have levering effect to achieve reduction¹⁰. In our study we introduce Schanz pin from anterior side. Basaran et al.¹¹, Herzog et al.¹² and Turgut et al.¹³ use near similar method as parmaksizoglu et al. as they all inserted the joystick in the proximal fragment in different position and direction. While Parmaksizoglu's method had the low risk of iatrogenic nerve injury; but the joystick's is placed far away from the injury side for manipulation (near the deltoid insertion) which is the disadvantages of the method. In Novais et al.'s method the joystick was introduced in the distal fragment for the easy control of the distal fragment but relatively soft metaphyseal bone of the distal fragment makes it difficult for K-wires to be introduced for fixation and also, manipulation of this bone with a K-wire can produce comminution. In our study, we introduced the Schanz pin near the fracture, 1 to 1.5 cm above the fracture line in the anterior surface for easy reduction. Novais et al. described their new technique in a series of 8 patients, Parmaksizoglu et al. works with 23 patient, Basaran et al., Herzog et al., Turgut et al. and Yu et al. works with 13, 53, 19 and 42 patient respectively while in our study the sample size was 36. Kazýmoglu et al.¹⁴ and Kaewpornasawan¹⁵ in their studies compared primary open lateral approach and closed reduction with similar result in Flynn cosmetic and functional criteria. Aktekin et al.¹⁶ found better Flynn score with closed reduction group comparing posterior approach group (that is open method). Ozkoc et al.¹⁷ mentioned better functional results with closed reduction than open methods by primary open posterior approach.

Guse and Ostrum showed that the radial nerve does not pass within 100 mm to the lateral epicondyle¹⁸. Attention must be paid to avoid radial nerve injury in high level fractures. In low level fractures, inserting the fixation wire posterolaterally and passing the far cortex is a safe method. Method of K-wire fixation is controversial. Biomechanical studies imply the most stable fixation as medial and lateral cross K-wire fixation¹⁹. Some authors state the importance of additional medial K-wire after fixation with two lateral

k-wires²⁰⁻²². But there is the risk of ulnar nerve injury with additional medial K-wire fixation. Ulnar nerve injuries are the most common iatrogenic nerve injuries in supracondylar fractures²²⁻²³. To reduce the risk of ulnar nerve injuries we used a mini-incision on medial side and bend the elbow < 90 degree during medial pin placement as stated in previous studies^{20-22,24}. This technique allows placement of the medial pin safely and reduction of fractures does not deteriorate during medial pin placement.

Closed reduction and percutaneous pinning is the first choice of treatment of displaced supracondylar humeral fractures in children as it has got shorter operation time, less infection risk and no opening fracture site. Another advantage of this technique allows better cosmesis due to its minimal incision scar compared to open reduction, however, disadvantages of this technique are; needs more experience, fluoroscopy usage, risk of iatrogenic nerve injuries and not able to visualizing quality of reduction directly^{23,25-27}. Also aggressive and repeated reduction attempts may lead to neuropraxia, elbow stiffness, and myositis ossificans^{6,14}. By using joystick assisted closed reduction and cross K-wire fixation method, the complications related with repeated manipulation and open approaches can be avoided. But the success will depend on achieving acceptable reduction by closed means. At the final examination, all patients and parents were satisfied with the functional and cosmetic results. The simplicity of the method which can be used without any complications if performed properly can be considered the strength of this study.

CONCLUSION

In conclusion, our technique appears to be an effective and simple procedure for the correction of rotational malalignment during closed reduction that can remove the need for open reduction. Weaknesses of our study are short follow-up period, small number of cases and its retrospective nature.

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Evaluation of the Result of Congenital Talipes Equino Varus (CTEV) Treated by the Ponseti Method at An Early Age

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ABSTRACT:

Congenital Talipes Equino Varus (CTEV) is a three dimensional deformity and is one of the most common congenital abnormalities affecting the lower limb and can be challenging to manage. Ponseti method is an established conservative treatment for idiopathic clubfoot in children worldwide. The Ponseti method is a safe and effective treatment for congenital clubfoot and radically decreases the need for extensive corrective surgery. The clinical correction achieved by the Ponseti method has been reported to produce a functional, plantigrade foot in 85 to 90% of cases. To correct all components of the deformity by the Ponseti method, so that the patient has a pain-free, plantigrade foot with good mobility and without callosities. This prospective observational study was conducted in the Dept. of Orthopaedic Surgery, MH Samorita Medical College & Hospital, Dhaka from June 2016 to March 2018. 25 patients (39 clubfeet) less than 6 months of age were selected consecutively on the basis of selection criteria and the mean follow-up period was 10.53 months (range 6-12 months). Diagnosis was confirmed by history and clinical examination. Treatment was done by the Ponseti method. Factors that were evaluated in this study were age at the initiation of the treatment, history of previous treatment, bilaterality, total number of Ponseti casts applied before tenotomy, requirement of tenotomy, compliance with brace and complications. Severity of deformity at presentation, correction of the deformity and outcomes were determined by Pirani scoring. The parents of the infants were explained & convinced to be in regular follow-up to assess the maintenance of the correction of deformity & that their compliance was of utmost importance for a better outcome. All the data was collected in predesigned questionnaire. Of the 25 patients (39 clubfeet), 37 feet had satisfactory correction and responded to the Ponseti treatment initially and 2(5.12%) feet were unresponsive and had unsatisfactory correction. Satisfactory correction was achieved in 37(94.88%) clubfeet and mean follow-up period was 10.53 months. Tenotomy was needed in 38(97.44%) clubfeet. There was statistically significant reduction in the Pirani score as presentation and at final follow-up ($p < 0.001$). The Ponseti method is effective for the treatment of congenital idiopathic clubfoot at an early age.

Keywords: CTEV, Ponseti method, Early age, Pirani score.

INTRODUCTION

Congenital Talipes Equino Varus (CTEV) or clubfoot is a common pediatric congenital foot deformity that occurs about 1 in 1,000 live births^{24,21} and this deformity is

characterized by four components such as hindfoot equinus, midfoot cavus, forefoot adductus, and hindfoot varus¹⁸. In recent years, the “Ponseti method” (conservative treatment method) has been widely accepted

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worldwide to correct the clubfoot deformity. This method involves with manipulation, serial casting, percutaneous tendoachilles tenotomy, and bracing¹¹.

In 1950, Ponseti developed a method of treating clubfoot using manipulation and casting. The clinical correction achieved by this method has been reported to procedure a functional, plantigrade foot without the need for posteromedial release in 85% to 90% of cases³. Currently manipulation and casting according to Ponseti method are the “gold standard”, and this method is endorsed by the American Association of Orthopaedic Surgeons¹². The goal of treatment is to correct all components of the deformity so that the patient has a pain-free, plantigrade foot with good mobility and without callosities⁶.

Clubfoot is a congenital structural defect of several tissues of the foot and ankle, resulting in abnormal positioning of joints. Specifically, the hindfoot is rotated inward, the foot is pointed downward, the midfoot is arched, and the forefoot is turned inward²³. While some cases are associated with neuromuscular disease, different syndromes or extrinsic causes, others occur in otherwise normal infants and are classified as Idiopathic Congenital Talipes Equino Varus (ICTEV)¹⁵. Many of these cases are untreated or poorly treated, leading to neglected clubfoot⁸.

The etiology of clubfoot has not yet been clarified⁷. Pathogenesis of clubfoot remains obscure, but there is increased evidence for a multifactorial etiologic model. Both genetic and environmental factors have been implicated¹¹. The genes responsible for clubfoot deformity are active starting from the 12th to the 20th weeks of foetal life and lasting until 3 to 5 years of age⁸. Muscle growth impairment, primary germ plasm defect in the talus, vascular anomalies, medial retraction fibrosis and intrauterine factors such as oligohydraminos, placental insufficiency, drugs, infective pathogens and amniocentesis prior to the 11th week, have been proposed as potential etiologic factors in the pathogenesis of idiopathic clubfoot¹¹.

Clubfoot can be accurately diagnosed prenatally². Clubfoot is rarely detected with ultrasonography before the 16th week of gestation²².

Many different clubfoot classification system have been proposed, but no single one is universally accepted. Two frequently cited systems, developed by Dimeglio/Bensahel and Caterall/Pirani, are often used for evaluation purposes in the treatment of idiopathic clubfoot⁴. The Pirani scoring system is reliable, quick and easy to use and provides a good forecast about the likely treatment for an individual foot but a low score does not exclude a possibility that a tenotomy may be required⁵.

Historically, treatment of clubfoot is challenging¹⁰. These children undergo extensive corrective surgery, often with disturbing failures and complications.

Revision surgeries are also thus more common. Although the foot looks better after surgery, it is stiff, weak, and often painful. After adolescence, pain increases and often becomes crippling⁸. Current management is moving away from operative towards a more conservative treatment using the Ponseti regime¹⁹.

The Ponseti method is a treatment method for CTEV in babies that stretches the ligament rather than surgery, manipulating the foot in optimum shape by hand, casts and braces. It avoids cutting tight ligaments, joint capsules and tendons and makes use of biomechanics of stress relaxation of collagen⁹. Ponseti method has become famous after the author reported successful correction in 85% to 90% cases of clubfoot²⁰.

The spread of the technique described by Ponseti has been remarkable, both in the developed and the developing world. The paper published in 1995 describing the 30 year follow-up of patients treated using this regimen is responsible for starting the change¹⁹.

The Ponseti method is a safe and effective treatment for congenital idiopathic clubfoot and radically decreases the need for extensive corrective surgery. This technique can be used in children up to 2 years of age even after previous unsuccessful nonsurgical treatment¹⁴.

MATERIALS AND METHODS:

This prospective observational study was carried out in the Dept. of Orthopaedic Surgery, MH Samorita Medical College & Hospital, Dhaka from June 2016 to March 2018. We review the medical records of 25 consecutive child's (39 clubfoot) <6 months of age. Who underwent Ponseti treatment on the basis of selection criteria and mean follow up period was 10.53 months (range 6-12 months). We studied age at presentation, previous treatment, the initial severity of the Pirani scoring system, number of cast applied before tenotomy, need for Achilles tenotomy, compliance with brace and complication. Severity of deformity at presentation, correction of the deformity and outcomes were determined by Pirani scoring. All the data are collected in predesigned questionnaire. The patient for the study were selected on the basis of following inclusion and exclusion criteria.

Inclusion criteria- Age less than 6 months, both sexes, Unilateral and bilateral idiopathic clubfoot.

Exclusion criteria- Patients beyond the age of 6 months, Patients with other congenital anomalies like Spina bifida, neurological disorders, arthrogyrosis, etc., Atypical or secondary clubfoot. The study variables- a. Demographic variables (i. Age, ii. Sex), b. Clinical variables (i. Side of involvement of foot, ii. Pirani score), c. Treatment variables (i. History of previous treatment, ii. Number of plaster casts, iii. Tenotomy, iv. Complications like skin

pressure sore, infection). Outcome categorization-According to Pirani scoring system: i. No correction: Pirani score=6, ii. Unsatisfactory correction: Pirani score=3, iii. Satisfactory correction: Pirani score=0. All this information was collected through specially design proforma.

OBSERVATION AND RESULTS:

This prospective observational study was conducted in the Dept. of Orthopaedic Surgery, MH Samorita Medical College and Hospital, Dhaka from June 2016 to March 2018. 25 patients (39 clubfeet) less than 6 months of age were selected consecutively on the basis of selection criteria and the mean follow-up period was 10.53 months (range 6-12 months). Diagnosis was confirmed by history and clinical examination. Treatment was done by the Ponseti method. Factors that were evaluated in this study were age at the initiation of the treatment, history of previous treatment, bilaterality, total number of Ponseti casts applied before tenotomy, requirement of tenotomy, compliance with brace and complications. Severity of deformity at presentation, correction of the deformity and outcomes were determined by Pirani scoring.

Table-I

Distribution of patients according to age (n=25)

Age (days)	Frequency (n)	Percentage (%)
<60	16	64.0
>60	9	36.0
Total	25	100.0
Mean \pm SD	60.0 \pm 24.0	
Range (min-max)	4 -120	

Table I shows distribution of patients according to age. 16 (64.0%) patients age was <60 days and 9 (36.0%) patients age was >60 days. Mean age was 60.0 \pm 24.0 days within the range of 4 -120 days.

Table-II

Distribution of patients according to history of previous treatment (n=39)

History of previous treatment	Frequency (n)	Percentage (%)
Yes	0	0.0
No	39	100.0
Total	39	100.0

Table-II shows distribution of patients according to history of previous treatment. No foot was treated previously.

Table-III

Distribution of patients according to involvement of foot (n=39)

Involvement of foot	Frequency (n)	Percentage (%)
Right	8	32.0
Left	3	12.0
Bilateral	14	56.0
Total	25	100.0

Table-III shows distribution of patients according to involvement of foot. Out of 25 patients, 14(56.0%) patients had bilateral involvement followed by 8(32.0%) and 3(12.0%) patients had right and left foot involvement respectively.

Table-IV

Distribution of foot according to number of cast applied before tenotomy for correction of the deformity (n=39)

Number of cases	Frequency (n)	Percentage (%)
4	8	20.52
5	22	56.42
6	6	15.38
7	2	5.12
8	1	2.56
Mean \pm SD	5.12 \pm 0.60	
Min – Max	4 – 8	

Table-IV shows distribution of foot according to number of cast applied before tenotomy for correction of the deformity. 22(56.42%) feet required 5 number of cast followed by 8(20.52%), 6(15.38%), 2(5.12%) and 1 (2.56%) feet required 4, 6, 7 and 8 number of cast respectively.

Table-V

Distribution of foot according to requirement of tenotomy (n=39)

Tenotomy needed	Frequency (n)	Percentage (%)
Yes	37	94.88
No	1	2.56
N/A	1	2.56
Total	39	100.0

Table-V shows distribution of foot according to requirement of tenotomy. 37(94.88%) feet needed tenotomy, 1(2.56%) feet did not need tenotomy and 1(2.56%) feet were not applicable (N/A) for tenotomy due to unsatisfactory correction.

Table-VI

Distribution of foot according to application of Steenbeek Foot Abduction Brace properly (n=39)

Application of SFAB properly	Frequency (n)	Percentage (%)
Yes	38	97.44
No	1	2.56
Total	69	100.0

Table VI shows distribution of foot according to application of SFAB properly. SFAB was applied properly in 38(97.44%) feet. Of the 1(2.56%) feet who did not comply with the bracing protocol.

Table-VII

Mean of duration of follow up (n=39)

	Mean ± SD	Min – Max
Follow up (Months)	10.53 ± 3.74	6 – 12

Table 7 shows mean of duration of follow up.

Table-VIII

Distribution of foot according to Pirani score before and at different stages of treatment

	Mean±SD	Min-Max	p value
Before treatment (n= 39)	5.35±0.76	4 – 6	
Before tenotomy (n= 39)	1.74±0.77	1 – 4	<0.001
After tenotomy (n= 39)	0.83±0.60	0 – 3	<0.001
Before application of SFAB (n= 39)	0.50±0.69	0 – 3	<0.001
After 2 weeks of SFAB (n= 39)	0.34±0.69	0 – 3	<0.001
At final follow up (n= 39)	0.33±0.89	0 – 4	<0.001

Case -1



Fig.-1: Initial deformity at presentation and during plaster cast correction.

Wilcoxon Signed Ranks test was done to measure the level of significance.

Table-VIII shows Pirani score before and at different stages of treatment. Pirani score significantly reduced before tenotomy, after tenotomy, before application of SFAB, after 2 weeks of SFAB and at final follow up comparing with before treatment.

Table-IX

Distribution of foot according to outcome (n=39)

Outcome	Frequency (n)	Percentage (%)
Unsatisfactory correction	2	5.12
Satisfactory correction	37	94.88
Total	39	100.0

Table IX shows distribution of foot according to outcome. Maximum 37(94.88%) feet had satisfactory correction, 2(5.12%) feet had unsatisfactory correction.

Table-X

Distribution of foot according to complication (n=39)

Complications	Frequency (n)	Percentage (%)
Skin complications	2	5.12
No	37	94.88
Total	39	100.0

Table-X shows distribution of foot according to complications. 2 patients (2 feet-5.12%) developed skin complications like skin rash, allergy and itching. This healed by simply keeping the casting off. The skin healed by 7 days in all the 2 feet. The corrective manipulation and cast was not applied till the skin condition was normal, but the parents of the child were taught to perform manual stretching of the foot for 7 days. After that, the casting was again commenced from where it was stopped.

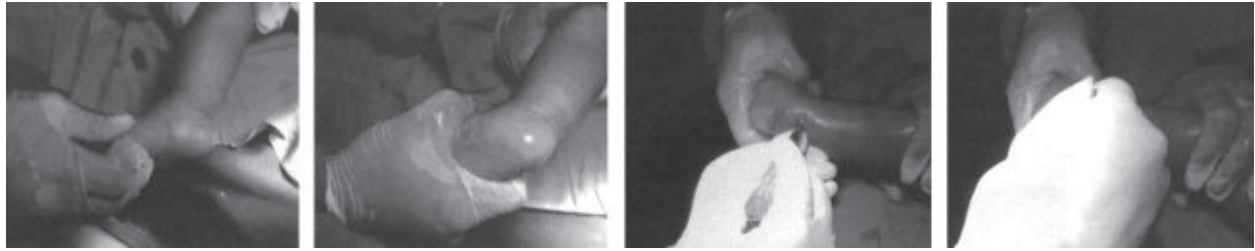


Fig.-2: *During tenotomy*



Fig.-3: *Post-tenotomy plaster cast.*



Fig.-4: *Application of SFAB.*



Fig.-5: *At final follow-up.*

Case - 2

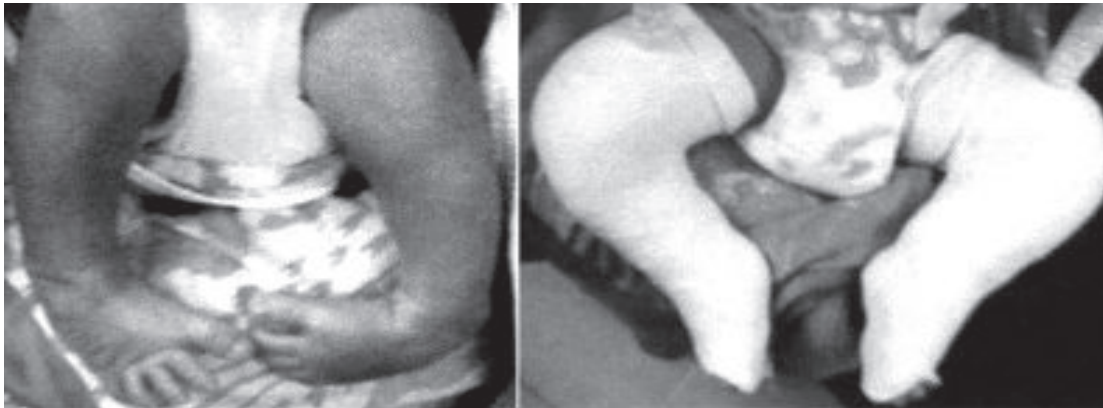


Fig.-1: *Initial deformity at presentation and during plaster cast correction.*

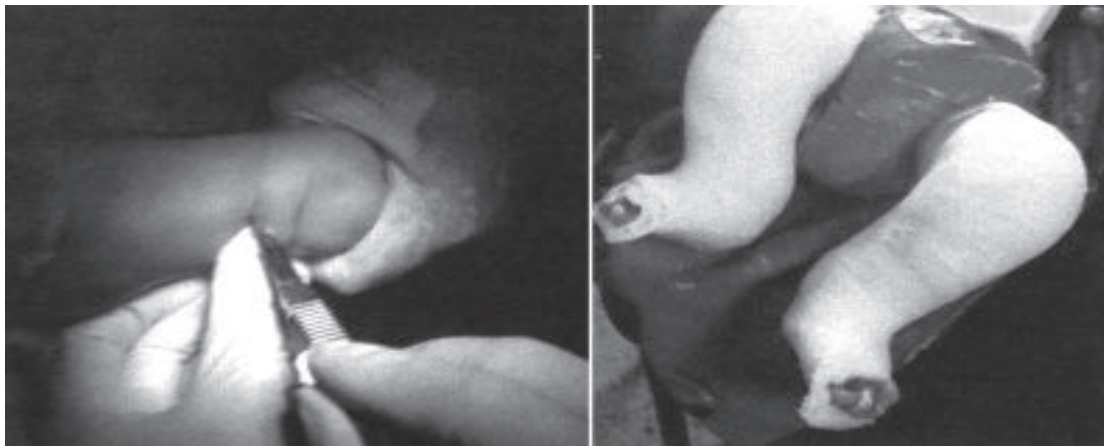


Fig.-2: *During tenotomy and post-tenotomy plaster cast.*

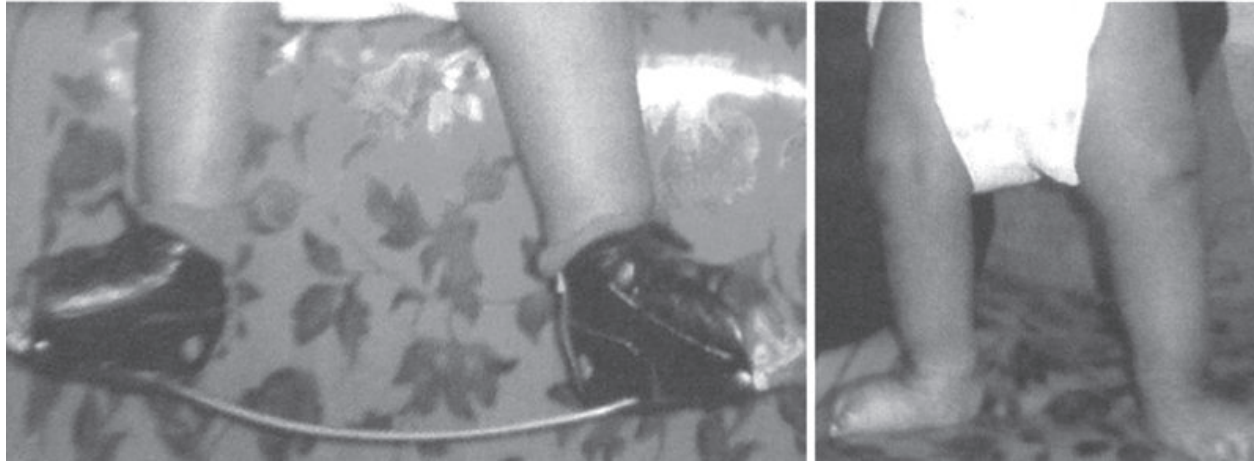


Fig.-3: Application of SFAB and at final follow-up.

Case 3



Fig.-1: Initial deformity at presentation and during plaster cast correction.



Fig.-2: During tenotomy and post-tenotomy plaster cast.

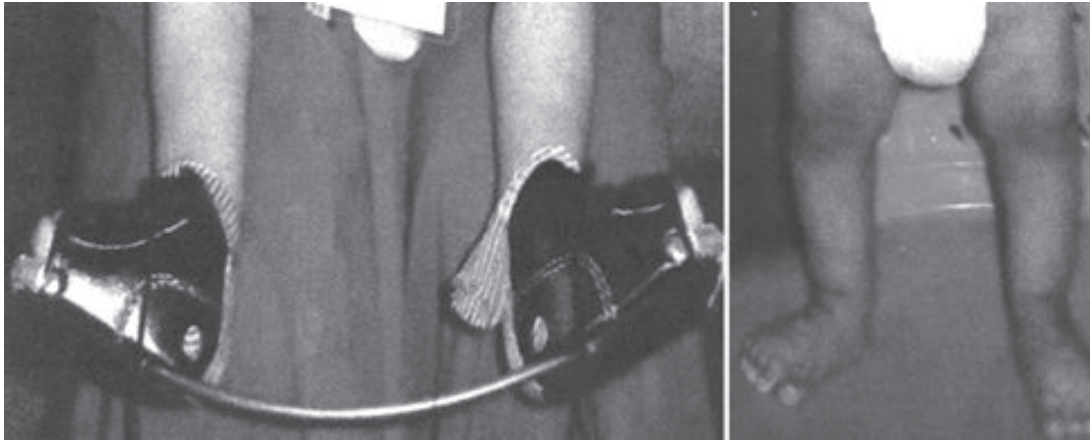


Fig.-3: Application of SFAB and at final follow-up.

DISCUSSION:

CTEV is the commonest congenital deformity of the foot that we encounter in the pediatric age group. Despite this, its treatment remains confusing¹.

Clubfoot or congenital talipes equino varus is a complex deformity of foot that requires meticulous and dedicated efforts on the part of the treating physician and parents for the correction of the deformity⁸. The main objective of treatment for congenital clubfoot is to obtain pain-free, plantigrade foot, with good mobility and without callosities¹².

There is general agreement that initial treatment for congenital clubfoot should be non-surgical¹². Current management is moving away from operative towards a more conservative treatment using the Ponseti regime¹⁹.

The Ponseti technique is based on sound understanding of the pathoanatomy of clubfoot¹. Treatment should be initiated as soon as possible, preferably within the first week of life. The majority of clubfeet can be corrected in infancy in about 6-8 weeks with the proper gentle manipulations and plaster casts followed by Achilles tenotomy. However, the technique requires a lot of training, experience and practice¹². Ponseti technique of serial manipulation and casting is being employed vastly in many of the CTEV treating centers. Many authors have published their experiences²⁰.

This prospective observational study was carried out in the Dept. of Orthopaedic Surgery, MH Samarita Medical College and Hospital, Dhaka from June 2016 to March 2018. A total number of 25 patients (39 clubfeet) of both sexes within the age of 6 months who were established cases of congenital idiopathic clubfoot were included in the study. Diagnosis was confirmed by history and clinical

examination. Treatment was given according to Ponseti technique and maintenance of correction was achieved by application of SFAB. Severity, correction of the deformity and final outcome was assessed by Pirani scoring system.

Mean age was 60.0 ± 24.0 days within the range of 4-120 days. Maximum patients age was less than or equal to 60 days (8 weeks). Pulak & Swamy (2012)¹⁷ found maximum patients to be less than 6 weeks old in their study, which is similar to the present study. In another study by Singh et al., (2011)²⁰, they found the mean age of the patients to be 12 weeks (range 3 to 48 weeks) and maximum patients presented within 3 months of birth.

No foot (or patient) received any previous treatment. Mootha et al., (2011)¹³ found, out of 146 feet in their study, 48 feet had been partially treated elsewhere and the remaining 98 feet were presented to them first. In another study by Singh et al., (2011)²⁰, they found 8 patient had already received 2-3 manipulations and plastering at some other centre.

In this study, 56% patients had bilateral foot involvement, followed by 32% and 12% patients had right and left foot involvement respectively. Similarly, Abbas et al., (2008)¹ found 56% bilateral, 29% right and 15% left sided involvement of foot. In another study by Porecha et al., (2011)¹⁶, they found 36.73% had bilateral involvement, 54.84% had right foot involvement and 45.16% had left foot involvement.

The mean number of cases was 5.12 ± 0.60 with a range of 4-8 casts. Mootha et al., (2011)¹³ found in their study that the mean number of casts required was 5.7 (range 4-13) which is similar to this study. Porecha et al., (2011)¹⁶, in their study, found the mean number of the casts was 6.8

(range 6-8). In another study by Singh et al., (2011)²⁰, they found the mean cast applied was 7 (range 5-9).

92.32% feet required tenotomy. Singh et al., (2011)²⁰ reported 81.31% feet underwent percutaneous tenotomy, which is similar to this study. In the study conducted by Mootha et al., (2011)¹³, tendo Achilles tenotomy was required for 90% of their patients.

Objective measures of compliance with Steenbeek Foot Abduction Brace (SFAB) were not available; therefore, verbal reports of parents about the use of the brace were used as the primary means of assessing compliance. SFAB was applied properly in 97.44% feet and 2.56% feet were non-compliant in this study. Noncompliance occurred despite having advised the parents of the importance of regular long term splintage. Poor brace compliance was a major issue especially in children coming from low socio-economic strata and where the parents' education level was poor. Mootha et al., (2011)¹³ found the incidence of poor brace compliance in their patients was 21.8%, which was quite high. In another study by Porecha et al., (2011)¹⁶, the splint compliance was compromised in all the relapsed cases, which was 28.57%.

The mean duration of follow up period was 10.53 ± 3.74 months (range 6-12 months). Compared to other studies in the literature, the follow-up period was less, due to time constraints. Singh et al., (2011)²⁰ had a mean follow-up time of 15 months (range 6-24 months). In another study by Mootha et al., (2011)¹³, the average period of follow-up of the patients was 4 years (range 2-7 years). In another study by Porecha et al., (2011)¹⁶, the mean follow-up period was 5 years (minimum follow-up period of 3 years).

The mean Pirani score at presentation was 5.35 ± 0.76 and at final follow-up was 0.33 ± 0.89 . The reduction in the Pirani score before treatment and at final follow-up was statistically significant ($p < 0.001$). Mootha et al., (2011)¹³ found the mean initial Pirani score for the responsive patients to be 4.5 and at follow-up for those patients to be 0.5. In another study by Abbas et al., (2008)¹, the mean pre-correction Pirani score was 4.26 and the post-correction mean score was 1.3, the difference between the two was statistically significant.

Few complications were encountered. 2 patients developed skin complications like skin rash, allergy and itching. This healed by simply keeping the casting off. In the study conducted by Porecha et al., (2011)¹⁶, out of 49 patients, 2 patients had a plaster sore on the lateral aspect of the skin overlying the talar head. That healed with local dressing only. The mean time to heal the sore was 7 days.

The corrective manipulation and cast was not applied till the sore healed.

Of the 37 feet (94.88%) feet had a satisfactory correction and responded to the Ponseti treatment whereas 2 (5.12%) feet had unsatisfactory correction.

Similar results were found in the study conducted by Mootha et al., (2011)¹³, where, out of the 146 feet, 87.7% feet responded to the treatment initially whereas 12.3% feet did not respond to casting and needed posteromedial medial soft tissue release, 8 of their feet were atypical feet at presentation and 5 were resistant to their initial treatment. 15.6% feet relapsed after initial success. All relapsed feet had poor compliance with the Dennis Browne splint, which was the most common cause of recurrence of the deformity in their study. Porecha et al., (2011)¹⁶ followed the functional Ponseti Scoring System and got good to excellent results in 86.56% feet at mean five years of follow up. They obtained initial correction in 100% feet with Ponseti method. 28.35% feet had relapse at varying age; out of which 52.63% were corrected by Ponseti casting method, while 47.37% were resistant to Ponseti method. Poor compliance with the Denis Browne splint was thought to be the main cause of failure in those patients. In another study by Sing et al., (2011)²⁰, 90.65% feet responded to initial casting with the mean follow-up time of 15 months. 10 feet failed to respond to the initial treatment regimen and required extensive soft-tissue release. 32.71% had a recurrence after initial success, 19 of which were successfully treated by repeat casting and/or tenotomy and casting. The remaining 16 required extensive soft-tissue release and external fixator application. Poor compliance with the foot-abduction orthoses (Denis Browne splint) was thought to be the main cause of failure in those patients.

The casting technique introduced by Ponseti has had a high success rate with Ponseti reporting a success rate of over 90% with anecdotal or descriptive follow-up of 30 plus years¹⁰.

CONCLUSION:

The Ponseti method is effective for the treatment of congenital idiopathic clubfoot at an early age.

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Evaluation of Proximal Femoral Varus Osteotomy for Treatment of Legg–Calvé–Perthe’s Disease

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Abstract:

There are many methods of treating Legg–Calvé–Perthe’s disease, including operative and nonoperative methods. Femoral varus osteotomy is one of the surgical methods used to treat this disease, and it involves changing the alignment of the proximal femur to improve containment of the femoral epiphysis in the acetabulum. The aims of this study were to evaluate the results of femoral varus osteotomy for the treatment of Perthe’s disease.

Eighteen patients with Legg–Calvé–Perthe’s disease were treated using a proximal femoral varus osteotomy procedure. The mean age of the patients was 7.8 years (range: 6–11.5 years). The average follow-up was 24 months (range: 12–36 months). The patients were classified and graded according to the Catterall and Herring classifications. All of the osteotomies united within 3 months without loss of fixation. According to the results of the present study, proximal femoral varus osteotomy gives good results in children between the ages of 6 and 10 years without any femoral head deformity and flattening, especially with good containment in abduction.

Key words: Proximal Femoral Varus, Osteotomy, Legg-Calve-Perthe’s disease

INTRODUCTION:

Legg–Calvé–Perthe’s disease (LCPD) is defined as an idiopathic osteonecrosis of the femoral head which leads to variable complications with resultant deformity of the femoral head and, later, osteoarthritis. The aim of treating Perthes disease is to reduce the risk of later osteoarthritis by preventing femoral head deformity, which may occur if adequate containment is not achieved. To achieve containment, the femoral head is centered within the acetabulum during the fragmentation and reossification phase. This allows the acetabulum to act as a mold during the healing or revascularization phase. There are many treatment methods for Legg–Calvé–Perthe’s disease, Such methods include spica cast immobilization, bed rest, traction, and walking with a weight-relieving caliper. Surgical methods are femoral varus or valgus osteotomy, other types of pelvic osteotomies such as innominate (Salter) pelvic osteotomy, lateral shelf

osteotomy, and triple osteotomy the present paper was designed to investigate the short-term outcome results of proximal femoral varus osteotomy in the treatment of Catterall grade III (Herring groups B, BC) and IV (Herring group C) Perthes disease.

MATERIALS AND METHODS:

Between July 2015 and July 2017, 18 patients with unilateral Legg–Calvé–Perthe’s disease were treated using a proximal femoral varus osteotomy procedure at NITOR. The right side was affected in 12 patients and the left side in the remaining 6 patients. The mean age of the patients was 7.8 years (range: 6–11.5 years). The average follow-up was 24 months (range: 12–36 months). The patients’ main complaints were hip pain with limping. The clinical complaints and their onset dates were noted, and the flexion, extension, abduction, adduction, and internal and external rotation ranges of the hips and limbs were also

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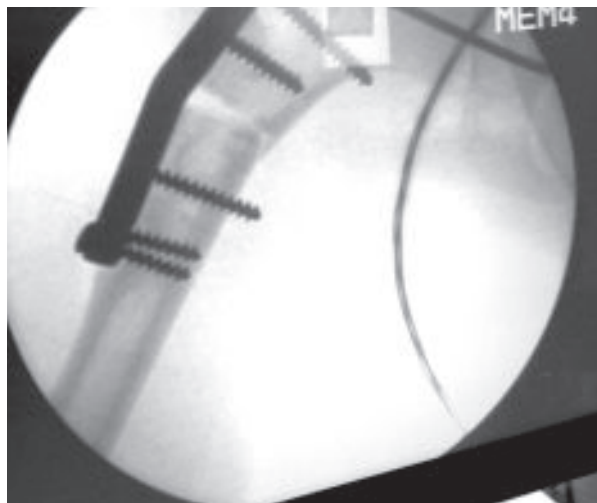
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recorded. Clinical measurements and scanograms were used to measure and detect leg length discrepancies. Anteroposterior pelvic X-rays were obtained in neutral and frog-leg lateral (Lauenstein) views for all of the patients. Femoral head involvement was graded according to the classifications of Catterall and Herring et al. Both the extrusion index and Wiberg’s CE angle were measured and graded, and the risk factors of the patients were also identified.

OPERATIVE TECHNIQUE:

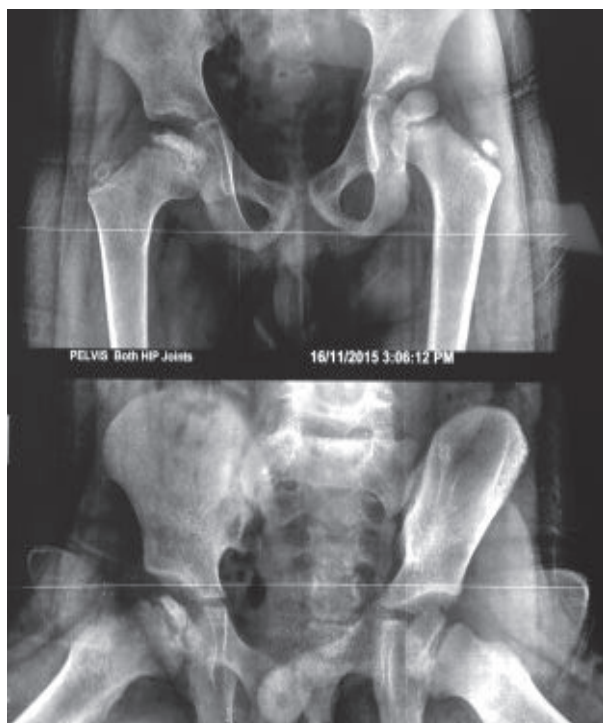
General anesthesia was used for all patients. The patients were positioned in the supine position on a radiolucent orthopedic table. A lateral surgical approach to the proximal femur with an open-wedge subtrochanteric varus osteotomy was used. The osteotomy was fixed with a dynamic compression plate pre-bent from 15° to 20° varus and screws. Immobilization for 6 weeks in a hip spica was employed for children from 6 to 7 years old, and the Abduction Bar to prevent rotation for 3 weeks in patients >7 years old. Weight-bearing was avoided until mature bone was seen. Postoperatively, patients were followed up monthly for 1 year and then every 3 months after 1 year. The results of the treatment were evaluated according to the Iowa hip rating scale, as well as the measured amount of shortening in the extremity. The implants were removed after 12 months.



Peroperative x-ray



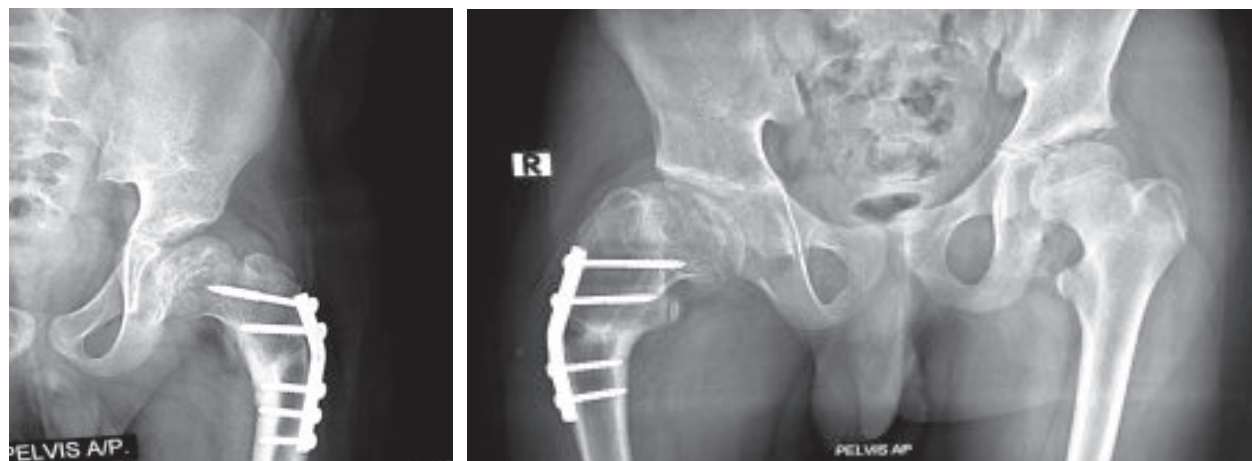
X-ray after 6 wks



Preoperative x-ray of 8 yrs old boy



X-ray after 6 months



X-ray after Iyr shows an enlarged but spherical head

RESULTS

Based on the Catterall and Herring classifications, the 18 patients were categorized as follows: 4 patients were Catterall group III (Herring group B), another 10 patients were Catterall group III (Herring group BC), and the other 4 patients were Catterall group IV (Herring group C).

The preoperative and the postoperative mean Iowa clinical hip score were as follows: group III (B), 52.8 and 88.33, $P = 0.027$; group III (BC), 47.3 and 87.8, $P = 0.005$; group IV (C), 30.43 and 64.29, $P = 0.017$. Mean limb length discrepancy was 0.9 cm (range: 0.0–2 cm) of shortening at the operated side compared to the normal side at the last follow-up after plate removal. We did not see any progressive change in this parameter during the follow-up period, especially after hardware removal and in the younger boys. Limping related to limb length discrepancy and the gluteal weakness was reported for all patients, but this improved gradually over the course of 8 months after the operation. All of the osteotomies united within 3 months without loss of fixation.

DISCUSSION:

The early goal of treatment is to prevent head deformation by weight-related forces during remodeling and ossification, so containment is the widely accepted treatment principle. The main indication for operative containment treatment of Perthes disease is age >6 years along with lateral subluxation and advanced femoral head involvement. The most commonly reported surgical method for the treatment of Legg–Calvé–Perthes disease is proximal femoral varus osteotomy, which was first introduced in 1965 and has since become a popular surgical treatment for LCPD. Femoral varus osteotomy

improves the intraosseous circulation, the mechanics around the proximal femoral head, and subsequently the degree of femoral head sphericity after healing, and it permits the regeneration of the necrotic tissues of the femoral head. It also prevents the subluxation of the femoral head, covering it with the acetabulum. It restores joint congruity and reduces femoroacetabular impingement³⁻⁵.

Recently, many authors have argued against nonoperative treatment, especially in children >6 years old with lateral pillar type B, B/C, or C LCPD. This group benefits more from varus or innominate osteotomy than nonoperative treatment because both pain and hip dysfunction are common in them. One of the surgical methods used when other treatment options are contraindicated is arthrodiastasis of the hip joint with soft-tissue release. Many authors do not recommend arthrodistraction as a primary treatment for the early stages of Legg–Calvé–Perthes disease. Although shelf acetabuloplasty leads to improved femoral head coverage, the available literature does not support the use of this procedure to prevent late osteoarthritis and improve function long term. Triple innominate osteotomy is considered one of the most efficient techniques for femoral head containment in any LCPD case. The main disadvantage of this technique is overcoverage of the femoral head, which can lead to pincer impingement. Limping related to limb length discrepancy or gluteal weakness or both have generally been reported by other authors after a proximal femoral varus osteotomy. In the present study, we also encountered limping, but the limping gradually improved within 8 months after the operation, in agreement with observations reported by

other authors. No complications such as delayed union, nonunion, overgrowth, or elevation of the greater trochanter were encountered in the present study. However, we did face common problems and limitations associated with studies in this field, including the variable nature of Perthes disease (which makes the condition difficult to study) and the use of different classification systems and outcome measures (which leads to confusion).

CONCLUSION:

All recently reported techniques aim to reshape the femoral head in both congruency and size to match the acetabulum and sequentially decrease the impingement, as well as to restore the normal cartilage in the weight-bearing zone of the head.

According to the results of the present study, proximal femoral varus osteotomy gives good results in children between the ages of 6 and 10 years without any femoral head deformity and flattening, especially with good containment in abduction.

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Exchange Nailing with Autogenous Bone Graft for Aseptic Nonunion of Femoral Shaft

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Mohammad Sahajadul Alam⁵, Md. Farukul Islam⁶

ABSTRACT

Exchange nailing refers to the practice of removing an already present medullary implant, reaming the medullary canal to a larger diameter and inserting a larger-diameter nail including interlocking if needed. To evaluate the results of exchange nailing with autogenous bone graft in aseptic non-union of femoral shaft a quasi-experimental study with pre and post procedure design done from July 2013 to December 2015 at Department of Orthopaedic Surgery, DMCH, Dhaka. Sample size was 21. Among them 83.33% were united and mean union time was 26.00±4.5 weeks. Exchange nailing with autogenous bone graft provides a good scope to reinforce the optimum mechanical stability by a larger diameter nail and locked if necessary; as well as biological stimulation by reaming and open bone grafting. Though union time is longer (mean union time 26± 4.5 weeks), union rate (83.33%) is very much comparable. Functional outcome is also substantial.

Key words: Exchange nailing, Femoral shaft nonunion.

INTRODUCTION

Femoral shaft nonunion is a functional and economical challenge for the patient as well as a treatment dilemma for the surgeon.¹ Intramedullary (IM) nailing is the gold standard for the management of femoral shaft fractures.²⁻⁵ As a load sharing implant, it allows earlier weight bearing after surgery⁶⁻⁷ & has lower rates of infection and nonunion than plate fixation.⁸⁻¹⁰ Closed intramedullary interlocking is preferred to open procedures to preserve periosteal blood supply and minimize surgical trauma adjacent to the fracture.¹¹

But recently, the incidence of femoral shaft nonunion after intramedullary interlocking nailing is higher (20% to 50%)¹²⁻¹⁴ in both close and open method than previously reported (0% to 10% in close method;^{2,15-18} 0% to 20% in open interlocking, up to 25% in K-nail fixation of isthmus

fracture¹⁵). This may be due to the greater likelihood of survival of the poly traumatized patient and improved limb salvage techniques. It may also be influenced by the severity of the injury, damage to the surrounding soft tissues, inadequate initial fixation, and demographic characteristics of the patient, advanced age, medical co-morbidities including nicotine and excessive NSAIDs use.¹

Aseptic nonunion treatment should follow three principles:

a. Realignment, b. Stabilization, c. Stimulation.¹⁶

There are several surgical options for treating femoral shaft aseptic nonunion which are initially treated with intramedullary nails:

1. Exchange nailing –Kuntscher's nail to kuntscher's nail or kuntscher's nail to interlocking or interlocking to interlocking with or without autogenous bone grafting according to need for fracture stability.¹

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2. Plate Osteosynthesis.¹
3. Plate augmentation and bone grafting leaving the nail in situ.¹⁷
4. Osteoperiosteal decortications with bone graft and either internal fixation using plates/ intramedullary rods or external skeletal fixation.¹⁸
5. External fixator- Ilizarov technique¹
6. Adjuvant treatment alternatives- Nail dynamization, electrical stimulation, extra cortical cancellous bone graft, bone marrow aspirate and the application of newer biologics such as BMPs (recombinant human BMP-7) etc.

Exchange nailing refers to the practice of removing an already present medullary implant, reaming the medullary canal to a larger diameter and inserting a larger-diameter nail including interlocking if needed. This technique stimulates bone union mechanically and biologically. The biological stimuli that promote union following exchange nailing include the deposition of autogenous bone graft at the nonunion site and the stimulation of a periosteal healing response through the process of femoral canal reaming.¹

Early weight bearing has been reported to be safe and facilitate fracture healing. Exchange nailing can ensure early ambulation and fulfill concept of fast track orthopaedics with excellent functional outcome.¹⁹

Femoral shaft nonunion is a major fracture related problem all over the world and also in our country. Nonunion in fracture shaft femur is significantly related with fracture fixation technique as well as biological environment. Nonunion in intramedullary nailing (Kuntscher's nail) is due to rotational movement and in plating due to excessive periosteal stripping which jeopardize the blood supply.²⁰ To overcome both factors closed interlocking IM nailing is reasonable. But due to economical constrain open interlocking is commonly practiced in developing countries like Bangladesh. Reaming of the medullary canal increases periosteal blood flow and stimulates periosteal new bone formation. The products of reaming, which contain osteoblast and multi potent stem cells, serve as local bone graft that stimulates medullary healing at the non-union site.²¹ Indications for open bone grafting during exchange nailing remain obscure and there is no consensus.²² But it is practiced due to overcome low healing potentiality and low morbidity of bone grafting procedure without hampering functional outcome.²³

OBJECTIVES

To evaluate the results of exchange nailing with autogenous bone graft in aseptic non- union of femoral shaft.

MATERIALS AND METHODS

It was a quasi-experimental study with pre and post procedure design done from July 2013 to December 2015 at Department of Orthopaedic Surgery, DMCH, Dhaka. Calculated required sample size was 112. However in this study 21 patients were recorded due to various constraints. Among them one patient was lost after 14 weeks, before fracture healing. Culture of the fast reaming materials revealed growth in two cases. So, final analysis and test of significance were done with eighteen patients. Purposive sampling was done according to availability of the patients and strictly and strictly considering the inclusion and exclusion criteria. At least one year was targeted to evaluate final functional outcome where union were anticipated within nine months. Data was collected with a pre-tested structured questionnaire. Data sheet was formulated the final outcome according to modified Thoresen's scoring system³ modified Silvia's scoring system²⁴ and Short-form Musculoskeletal assessment survey (SF-MFAS).²⁵ Data was processed and analyzed using computer software program SPSS-version 16. Ethical issues were considered in all steps.

RESULTS

Mean age 41.95 years; SD \pm 13.11; male: female =3.3:1. Among 18 fracture nonunion 15(83.33%) were united and 3(16.67%) were not united after exchange nailing with autogenous bone graft in aseptic condition. Confidence interval at 95% level was 66.08% to 100%. Mean union time was 26.00 \pm 4.5 weeks where 95% of confidence interval was 23.49-28.51 weeks including both static and dynamic mode of fixation.

Among complications unacceptable angle deviation 5.6%, Limb length discrepancy 5.6%, Infection 11.12%, Joint motion restriction 5.6%, Pain-swelling 5.6%, Implant failure 5.6%.

In this study, it was found that smoking and NSAIDs both had significant relation ($p < 0.05$) with fracture union time. Highly strong (+)ve correlation was found between non-union period and union time after exchange nailing.

Final outcome according to modified Thoresen's score was satisfactory 78%; according to modified Silvia's score was 10.83 \pm 2.203. In fracture united cases post-operative SF-MFAS function index was achieved 2.5 \pm 1.7 and Bother index was achieved 1.89 \pm 1.08. There was a highly

significant ($p < 0.001$) difference between pre-operative and post-operative functional outcome after exchange nailing with open bone graft as a whole.

DISCUSSION

One basic work on exchange nailing with autogenous bone graft was done by Wu and Chen from January 1989 to 1993 in china with 19 patients. They compared this open method with close method (16 patients).²⁶ Another basic work was done by Furlong et al, on 1999 in UK with 22 patients where open bone grafting was done in 12 patients.²⁷ On 2006-2007, Dr. Sharkar KM did a study on exchange nailing for femoral shaft nonunion by SING nail in NITOR, Dhaka. Number of cases was 28.²⁸

In this study exchange nailing with autogenous bone graft were done for femoral shaft nonunion in 21 patients. Mean age was 41.95 years; SD \pm 13.11; male: female 3.3:1. Here, a highly strong correlation was found between age and union time. More age more the union time.

In the series of Wu and Chen median age 34 years and male: female was 7:1. In Sharkar's series, mean age was 40.77 years and male female ratio was 3:2.

In present series among 21 patients most were heavy or moderate worker (76%); other was sedentary worker. Almost all fractures initially caused by motor vehicle accident. Among 21 patients femoral fracture involved at right side in 12 patients (57.1%), involved at left side in 9 patients (42.9%). 18 fractures (85.7%) were close and 3 fractures (14.3%) were open. Fractures involving side were 100% close but at right sided fractures about 75% were close and about 25% were open. Initial fracture configuration was mostly Winquist type III (in 12 patients-57.1%). Then Type II in 28.6% (6 patients) and Type I in 9.5% (2 patients). Only one patient (4.8%) had Type IV fracture.

Among 21 fractures 13 fractures (61.9%) were previously fixed by K-nail, another 6 fractures (28.6%) were previously fixed by conventional interlocking nail, SIGN nail and K-nail plate were used in one fractures of remaining two fractures.

Among 21 cases, culture of the 1st riming materials were done in 14 cases (66.7%) and not done in 7 cases (33.3%). Growth was found in 2(9.5%) cases, which were staph. epidermidis where Amoxiclave was sensitive and in 12 cases (57.1%) growth were not found. In growth (+) ve cases antibiotics were given as full dose for 6 weeks then continued as suppressive dose up to union anticipated. One fracture healed within 26 weeks but another fracture not healed and clinically no infection.

In the series of Wu and Chen, some patients under gone as many as four operations, and then onunion periods were as long as 4 years. In the series one patient under gone third operations.²⁶

In this series, among 21 cases, 14 (71.5%) previous implant were intact while 3(14.3%) implant were nail breakage. Among 21 cases, nonunion type of 4 (19%) were hypertropic, 9 (42.9%) cases were oligotropic and 8 (38.15) cases were atrophic.

Among 21 cases, 17 (80.95%) exchanged nail were conventional interlocking, while 2(9.52%) were SIGN nail and remaining 2(9.52%) cases were K-nail.

Out of 21 patients in 11 patients (52.4%) dynamization did not required. Among another 10 patients early dynamization was done in 6 patients (28.6%) and late dynamization done in 4 patients (19%). Mean union time was 26.00 ± 4.5 weeks where 95%. Confidence intervals was 23.49-28.51 weeks including both static and dynamic mode of fixation. In static mode mean union time were 29.33 ± 3.01 weeks where as in early dynamic it was 21.33 ± 1.63 weeks. It was calculated that after late dynamization mean union time was 28.67 ± 2.3 weeks.

Court - Brown et al have stated that locking screws are often unnecessary in exchange nailing. These authors have proposed that locking of the exchange nail is necessary only when there is instability of the construct or a periarticular nonunion with a small distal or proximal fragments.²²

Wu CC, Chen WJ, have found no difference in the healing rates or time to union between patients treated with a statically locked nail and those treated with a dynamically locked nail.²⁶

Hak DJ stated that gradual axial compression at the nonunion site can be attaining with a statically locked exchange nail if it has slotted interlocking holes.¹²

In this study, it was found that smoking and NSAIDs both had significant relation ($p < 0.05$) with fracture union time.

Oleksak et al, 2002 statically shows that there is no significant difference between smokers and non smokers in relation to fracture healing but an increased time to union in the heavy smoker group (>40 cigarettes per day).²⁹

Hak DJ. Lee SS, Goulet JA. on 2000 reported their investigation on success of exchange reamed femoral nailing in the treatment of femoral non-union after intramedullary nailing and analysis on factors those may contribute to failure of exchange reamed femoral nailing.¹²

They work on 23 patients; all were treated by exchange reamed femoral nailing for their femoral shaft non-union or delayed union. Eighteen patients out of twenty three healed without additional procedure (78.3%). Of the five patients whose fractures failed to unite after exchange nailing, all were smokers and had atrophic non-union. They reported that in their series all the eight non-smokers healed after exchange reamed nailing. Only ten of the fifteen smokers (66.7%) achieved union after exchange reamed nailing (95% confidence interval, 43.1 to 90.9%).

P.V.Giannoudis, D.A.MacDonald et al. reported a marked association between non-union and the use of NSAIDS after injury ($p=0.000001$) and delayed healing was noted in patients who took NSAIDS and whose fractures had united.²⁷

Daftari TK stated that nicotine has a detrimental effect on fracture nonunion as it delay and decrease revascularization of the associated bone graft.³⁰

Among complication unacceptable angle deviation 5.6%, limb length discrepancy 5.6%, pain –swelling 5.6% infection 11.12%, joint motion restriction 5.6%.

In the series of Wu and Chen the knee range of motion in all cases did not deteriorate compared with the preoperative status. Furthermore, some cases even improved somewhat after fracture healing. There were no wound infection, leg length discrepancies (>2 cm), or rotational or angular deformities (>15 degrees) noted. The operating time with the closed technique was 36 ± 7 minutes and with the open technique 58 ± 14 minutes ($p<0.01$).²⁶

In the series of Wu and Chen all 19 patients of non-union treated by open method where union time was 5.1 ± 0.8 months. Where as in closed method union rate was 100% but union period was 4.0 ± 0.6 months They concluded that closed bone grafting should be used to treat aseptic nonunion if possible. Otherwise open technique could be used as second choice.²⁶

Final outcome according to modified Thoresen's score satisfactory 78% (Excellent 28%+ good 50%) unsatisfactory 22%(fair 5.6% + poor 16.4%).

In Sharkar's study, rate of fracture healing was around 80%, average union period was 28.09 weeks. Final outcome was 60.71% excellent, 21.43% good, 10.72% fair, 7.14% poor according to Thoresen's score.²⁸

According to modified Silvia's score, final outcome of exchange nailing in this study was 10.83 ± 2.203 where 95% confidence interval was 9.74 – 11.93. So, it is 95% sure that among whole population of femoral nonunion treated

by exchange nailing with extra cortical bone graft minimum Silvia's score will be about 10; a 'Good' outcome.

Wu CC, Chen W J stated that, femoral shaft nonunion is often combined with extension contracture of the ipsilateral knee, which is usually caused by quadriceps adhesion. Because releasing the contracture usually requires extensive soft tissue dissection and forceful manipulation, it can produce additional severe vascular destruction, which has higher infection rate and impedes the fracture healing process. Exchange nailing may preserve the knee range of motion.²⁶

CONCLUSION

Exchange nailing with autogenous bone graft seems to be an effective method of treatment in femoral shaft nonunion after intramedullary nailing. It provides a good scope to reinforce the optimum mechanical stability by a larger diameter nail and locked if necessary; as well as biological stimulation by reaming and open bone grafting. Though union time is longer (mean union time 26 ± 4.5 weeks), union rate (83.33%) is very much comparable. Functional outcome is also substantial. Effects of smoking, NSAIDS and prolonged nonunion period on healing should be reevaluated.

RECOMMENDATIONS

To achieve success in exchange nailing with autogenous bone graft for aseptic nonunion of femoral shaft following measures should be emphasized:

1. Realignment, optimum stable fixation and nail selection should be standard as per requirement.
2. Less soft tissue handling and enough bone grafting.
3. 1st reamed materials should be sent for culture and sensitivity. If (+) ve, sensitive antibiotics as a full dose of 6 weeks then continue as suppressive dose up to fracture healing.
4. Early mobilization and weight bearing according to fracture configuration.
5. Dynamization enhance healing but it is not suitable and essential in all cases.
6. Due to inherent potentiality to nonunion; after exchange nailing union period could be prolonged.
7. Post-operative avoidance of smoking and less use of NSAIDS may accelerate healing.

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Surgical Treatment of the Displaced Proximal Humeral Fractures in Adults with PHILOS Plate

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ABSTRACT

To evaluate the treatment outcome of Philos plate fixation for displaced proximal humeral fractures in 17 patients. This was a prospective study with 17 patients, 11 women, 6 men with average age 62yr having displaced proximal humeral fractures fixed with Philos plate. All the fractures were closed and no associated injuries, classified as 2 part (n=12), 3 part (n=3), 4 part (n=2) according to Neer classification. All patients were evaluated clinically, functionally and radiologically using the Constant Shoulder Score. Patients were followed up for 6 to 24 months. All the fractures healed except one which was four part fracture in 65yr woman. The fracture was in varus position and screw penetration of humeral head at six week. Revision surgery was done and eventually fracture united. Philos plate fixation is a good stable construct with minimal metal work problems and permit early movement.

Key words: Bone plate, screw, humeral fractures.

INTRODUCTION

Proximal humeral fracture may be defined as fractures occurring at proximal to surgical neck of humerus¹. It is the commonest fracture of shoulder girdle in adult². Proximal humeral fractures composed 4% of all fractures and nearly one half of all humeral fractures³.

There are many options for treating proximal humeral fractures. Minimally displaced proximal humeral stable fractures are being treated conservatively with good results⁴.

Displaced and unstable fractures are difficult to manage and have a high morbidity. The ultimate goal of treatment is to have a painless stable functional shoulder. Different methods are described namely Kirshner wire fixation, suture fixation, External fixation, Tension Band Wiring, Rush nail fixation, intramedullary fixation and prosthetic replacement^{5,6,7,9,10,11}.

Locking plate fixation provides angular and axial stability minimizes risks of screw toggle and pull out as well as loss of reduction. Divergent or convergent locked screw improves the pull out resistance of the whole construct¹¹. Locking plate fails at greater load than nonlocking plates¹².

Philos (Proximal Humeral Locking system) plates are preshaped and precontoured. Locking compression plates with an aiming device for insertion of the locking screw and positioning of the plate to prevent impingement. We evaluate the treatment outcome of Philos plate fixation for displaced proximal humeral fractures in adults.

MATERIALS AND METHODS

This was a prospective study carried out at Shaheed Suhrawardy Medical College Hospital, Dhaka from January 2015 to December 2017. There were 17 patients out of which 11 women and 6 men with average age 62yrs. All patients having displaced proximal humeral fractures

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were fixed with Philos plate. Fractures were due to fall on ground (n=10) and road traffic accidents (n=7). All the fractures were closed and have no associated injury. All fractures were classified as 2 part (n=12),

3 part (n=3) and 4 part (n=2) according to Neer classification¹³.

A deltopectoral incision was made with patient in supine position. Fractures were reduced and temporarily fixed with Kirshner wires and sutures. Reduction was checked under image intensifier. Philos plate was applied with at least 4 locking proximal screws and 4 nonlocking distal screws. Passive assisted movement were started on day-1 followed by active assisted exercise after 3 weeks. All the patients were assessed clinically, functionally radiological using the Constant Shoulder Score¹⁴.

Results

Patients were followed up for 6 to 24 months (mean 13 months). All the fractures were united except one in 65 yr woman with a 4 part fracture. There was screw penetration of humeral head at 6 weeks. Eventually she developed nonunion and revision surgery was done. Ultimately fracture united. There was no wound infection. The mean Constant Shoulder Score was 68 with a range of 40 to 85. 7 patients having score more than 75, Seven patients having were between 50 to 75, 3 patients below 50. Constant scores in 2part, 3part and 4part fractures were compared in Table.

Comparism of Constant Scores

Constant Score	No.(%) of patients		
	2-part fracture (n-12)	3-part fracture (n-3)	4-part fracture (n-2)
Mean (range)	75(50-85)	66(40-84)	45(41-49)
>75	6(50)	1(33)	0(0)
50-75	6(50)	1(33)	0(0)
<50	0(0)	1(33)	2(100)

DISCUSSION

Non-operative treatment for displaced proximal humeral fractures is still advocated, patient satisfaction is high, especially in those with 2 part fractures¹⁵, in elderly patients with low functional demand even with poor reduction on radiograph and low Constant score¹⁶. Surgical treatment with minimal soft tissues stripping enables satisfactory reduction, stable fixation and early mobilization but the technical difficulties including poor bone stock, minimum subchondral bone in humeral head

and excessive soft damage. The most common risks include screw cut out back out, penetration of humeral head, loss of reduction, avascular humeral head necrosis and subacromial impingement

Plant Tan plate fixation with 2 cancellous screws resulted in a 100% failure rate in elderly osteoporotic patients¹⁷. Fixation with 2 one-third tubular plates resulted in a complication rate of 12% including loosening of implants, avascular necrosis, subchondral impingement, frozen shoulder and fracture redisplacement¹⁸. Tension band wiring and nonoperative treatment had similar functional results¹⁹. Tension band wiring was superior in 4 part fractures and nonoperative in 3 part fractures¹⁹.

AO plate fixation had also a high complication rate including deep infection (4/32), impingement necessitating implant removal (5/32) and avascular necrosis (4/32)⁵. Cloverleaf plate fixation achieved good results but a hemiarthroplasty was recommended in elderly patients with poor bone stock²⁰. Although hemiarthroplasty achieved good pain relief, its functional results were unpredictable and its strength poor^{21,22}.

Reverse prosthesis fixation achieved better functional outcome²³. Polarus nail fixation yields good results⁸ and used in combine neck and shaft fractures²⁴. But the complication rate was high (proximal screw loosening 3/20, revision surgery 2/20, lateral metaphyseal comminution predisposes to implant failure)²⁵.

Locking proximal humeral plate fixation achieved acceptable results even in osteoporotic bone but nonunion, implant failure, avascular necrosis of humeral head and revision surgery also have been reported^{26,27,28,29,30}. Angle stabilizing plates fixation were not necessarily associated with good functional outcome²⁹. Caution is needed in cases of medial comminution during locking plate fixation³¹.

Our study, Philos plate fixation provided a stable good construct with minimal metal works problems and enabled early range of motion exercises to achieve acceptable functional results. Nonetheless, the choice of treatment should be based on patient age, functional needs, bone quality, fracture personality and surgeon's preference. Prospective randomized trials are needed to compare different methods of fixation.

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Comparative Analysis Between Proximal Femoral Nail And Conventional Interlocking Intramedullary Nail in the Management of Proximal Shaft Femur Fracture

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Abstract:

The present prospective study on comparative analysis between PEN method and conventional interlocking intramedullary nailing in the treatment of femoral shaft fracture. The study was conducted at NITOR, Dhaka over a period of 2 years. Patients with fracture proximal shaft of femur (Winquist any type) was the study population. Patient with age >18 years and <40 years, both sex, fresh injuries and not >3 weeks old, proximal third of the shaft of femur, closed (winquist any type), cause: high velocity trauma/ fall from height were included in the study. Patient age <18 years and >40 years, open fracture, injuries >3 weeks old and pathological fracture cases were excluded. A total of 30 cases full filling the criteria were consecutively concluded in the study.

Key words: Comparative study, PFN vs. Conventional I/M nail, Fx: shaft of femur PFN is better option.

INTRODUCTION:

Fracture of the shaft of the femur is a common factor encountered in Orthopedic practice. Femur is the longest and strongest bone in the body & it is the principal load bearing bone in the lower extremity. So fracture of the femoral shaft can cause prolonged morbidity and disability unless treatment is appropriate (ST . Canale2003).Fracture of the shaft of the femur at the result of high energy trauma and therefore can be both life threatening shortening of the Limb and mal alignment injuries and causes severe permanent disability. Shortening of the limb malalignment, along with contractures of the need you to prolonged immobilization, have traditionally plagues the orthopedist management of patients who have these injuries (Bucholz et al. 1991). Most fractures of the shaft of the femur are described by the location and geometry of the fracture, the degree of comminution, severity of the soft tissue injury, and the presence or absence of associated injuries.

The AO classification coding system defines twenty seven distinct patterns fractures of the femoral shaft. These distinctions are based on the fractures location proximal, mid-shaft, or distal, anatomy and degree of communication (Bucholz et al. 1991).This fractures of femur a difficult both to achieve stabilization and sequent Union. The upper fragment is flexed due to spasm of the iliopsoas an abducted due to abductors. The strong gluteal muscles which are the abductors the hip are attached to the proximal fragment in the region of Greater trochanter, whereas the abductor muscles are inserted below the level of the fracture, so that the proximal fragment is sometimes abducted even as much as 45 degree (Wilson 1992). Several techniques are now available for their treatment, and the Orthopedic surgeon must be aware of the advantage, disadvantages, and limitation of each to select the proper treatment for each patient. the type location of fracture, the degree of communication, the age of the

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patient the patient's social and economical demands and after factors may influence the method of treatment (ST . Canale2003).Intramedullary nailing is one of the frequently used methods, although the degree of rotational stability that is achieved with this technique is usually insufficient for fracture of the proximal and distal part of the shaft. Also comminuted fracture, in all locations, have tendency toward rotational and longitudinal malalignment, which cannot be controlled by the conventional non-locking intramedullary nail. The interlocking intramedullary nail has developed overcome these problems with longitudinal and rotational instability through the use of screws data placed through the bone and into holes in the proximal and distal end of the nail. The method is static nailing (Thoresen, 1985).Short interlocking intramedullary devices such as gamma nail and reconstruction nail have theoretically more load sharing with the medial cortex of the femoral neck then are lateral cortical constructs. The more medial placement of the intramedullary nail compared to the side plate of the compression hip screw, the bending moment at the nail screw Junction is lower than that at the plate screw Junction. Other potential advantages of the intramedullary fixation include as smaller operative exposure and shorter operative time (Lavelle 2003). Moreover, in this system of interlocking only single jig is enough to lock both proximal and distal the eliminate many per operative difficulties.

MATERIALS AND METHODS

Study design: Quasi experimental study

Durations of study: January 2007 to December 2008

Place of study: National Institute of traumatology and Orthopaedic rehabilitation (NITOR), Dhaka

Study population and sampling: Convenience sampling method was used to select 30 (thirty) patients.

Inclusion criteria:

1. Age: Adult patients (>18years & <40years).
2. Sex: Both sex (Male and female).
3. Time of injury: Fresh injuries and not > 3 weeks old.
4. Fracture site: proximal third of the shaft of femur.
5. Fracture type: Closed, Winqvist any type.
6. Cause: High velocity trauma / fall from height.

EXCLUSION CRITERIA:

1. Patient below age of 18 years & above 40 years.
2. Open fracture.
3. Injuries more than 21 days old.
4. Pathological fracture.

DISCUSSION

Proximal shaft femur fracture has always presented a problem in management. Because of muscle force involved, no satisfactory conservative treatment has yet been established for proximal shaft femur fracture because the deforming muscle forces make the closed reduction not only difficult but yield under rewarding result like non union, varus or rotational deformity and shortening of the limb (Schatzker and Waddell 1980). Moreover, conservative treatment requires a prolonged period of debridement with complication of recumbence and this method of treatment can result in a considerable increase in cost. Proximal shaft femur fracture may result both high and low energy trauma. The high energy trauma is the most common in Bangladesh and occurs mostly in young and energetic people who are the earning member of a family. As this group of people are more dynamic, they are prone to suffer high-energy trauma from road traffic accident or fall from height. Hence, timely, proper and economic treatment is valid for their early mobilization, optimum care of the soft tissue and full functional recovery. The great demand of the patient, acute burden on the hospital staff, prolonged hospitalization, unacceptable union, knee stiffness all these things have rendered the conservative treatment of proximal shaft femur fractures not only unrewarding, but unacceptable also(Schatzker and Waddell 1980).

The optimum treatment by internal fixation greatly simplifies the nursing care, allows early mobilization and timely fulfillment of the demand of these young victims for their family and Society. The essential principles of operative treatment are to provide stable fixation, anatomic realignment, and maintenance of length prevention of rotation. Proximal femoral nail can fulfill almost all these criterion proximal shaft femur fracture. Proper placement, accurate size nail and maintenance of anatomic realignment could markedly influence the functional outcome. The present study has been done to find out this fact.Regarding the nature of trauma, all the fractures due to high energy trauma resulting from motor vehicle accident, motorcycle accident, automobile- pedestrian accident and fall from height in both groups of patients. Series of winquist et al.(1978), out of 20 cases, 19 femoral fractures (95%) occurred from high velocity trauma and percent of humeral shaft fractures occurred due to low energy trauma.

Regarding infection in this study, in group-2 (conventional interlocking intramedullary nail) 2 patients (13.33 %) developed superficial surgical wound infection and 1

patient (6.67%) developed deep infection. Both the patients of superficial on infection respond well to antibiotic according to the culture and sensitivity report and healed quickly. But the patient of deep infection developed multidrug-resistant and the ultimate result was infected nonunion. In group-1 PFN method there was no superficial or deep infection. This series had a few problems of malalignment as those reported by others. In this study in group 1 PFN method, one patient (7.14%) developed 20 degree of rotational deformity, in group 2 conventional interlocking intramedullary nail 1 patient (6.67%) develop 20 degree of external rotation deformity and one patient (6.67%) developed 10 degree of varus angulation. Regarding Limb length discrepancy in this study, in group-1 PFN method, 2 patients (14.29%) developed shortening of 1 - 2 cm in group 2 (conventional interlocking intramedullary nail) 2 patients (13.33%) developed shortening of 1-2cm and 1 patient (6.67%) develop shortening >3cm. Thoresen et al. (1985) reported shortening of 1-2 cm in 4 cases (8.33%) and shortening of 2-3 cm into cases (4.17%). Winqvist et al. (1984) reported shortening of 1-2 cm in (7.1%) cases.

Regarding range of knee motion, in group-1 (PFN method) 12 patients (85.71%) had range knee motion >120 degree and 2 patients (14.29%) had range motion up to 120 degree. In group 2 conventional interlocking intramedullary nail 6 patients 40% had range of knee motion 120 degree, 7 patients (46.67%) had range of knee motion up to 120 degree, one patient (6.66%) range of knee motion up to 90 degree and one patient (6.66%) had range of knee motion 90 degree. Rapid recovery of any function is one of advantage of PFN method. In conventional interlocking intramedullary nailing knee motion is hampered because of muscle scarring and adherence to bone (Nichols 1963; Rush 1970; Rascher et al. 1972). Rothwell & Fitzpatrick (1978) reported the same results in their series. In this study In group 1 method 13 patients (92.86%) had union in due time, 1 patient (7.14%) had delayed Union, in group 2 conventional interlocking intramedullary nail 7 patient (46.67%) had Union in due time, 7 patients (46.67%) had delayed union and one patient (6.66%) developed nonunion. Healing time is rapid in PFN nailing in comparison to conventional interlocking intramedullary nailing. Wu et al. (1993) Treated 35 femoral shaft fracture by intramedullary nailing. The union rate was (82.9%) and period of union was 6.1 ± 1.9 months. In the present series, in group- 1 PFN method the results in 10 cases (71.43%) were rated as excellent, 4 (21.43%) were good, 1 (7.14%) was fair, in group- 2 conventional interlocking intramedullary nail the result in 4 cases 26.67% where

rated as excellent, 8 (53.33%) where good, 2 (13.33%) where fair and 1 (6.67%) was poor.

Boldin C. et al (2003), in the prospective study they treated 55 patients having proximal femoral fractures with PFN from 1997 to 2000. The mean age was 73 years and 39 were female. Factors are reduced by closed means and 5 patients reduced by open reduction was necessary. The mean duration of surgery was 68 min (22-205). A cut out of neck screw was seen in two patients.

Simmermacher et al. (1999), within 18191 proximal femoral fracture treated with the PFN. A follow-up period of at least 4 months technical failures (poor reduction, malrotation and wrong choice of screws) were seen in just (4.6%) of the cases. One patients showed a cutout of the implant but there were no mechanical failures (bending, breaking of implant) or ipsilateral fractures of the femoral shaft at the tip of the implant. It is therefore concluded that the results of this new implant compare favorably to the currently available implants for the treatment of the proximal femoral fracture. Lei Shen et al. (2007) in a prospective study they treated 49 patients having subtrochanteric fracture treated with long PFN from January 2003 to December 2004. The average age of the patients was 53 years. Clinical and radiographic analyses were performed when follow-up was made at 6 weeks, 12 weeks, 6 months, 1 year and 2 years. All the 49 traumatic trochanteric fractures healed and eventually except 1 case of delayed union. Walking and squatting ability was completely restored in every case at follow-up examination six months postoperatively. Among them, 32 fractures were successfully reduced with traction on a fracture table under fluoroscopy, but cerclage wiring or cable bandage through a small incision was needed in the other 17 cases. The average operative time was 46 minutes (range, 21 to 98). No complications such as cutout or breakage of the implants were encountered.

This study was done in 29 patients for comparative analysis between PFN method and conventional interlocking intramedullary nailing method for the treatment of proximal shaft femur fracture. The follow-up period was average 11.5 months. In this study it has been evident that proximal femoral nailing results in Rapid return of motion in all joints in comparison to conventional interlocking intramedullary nailing. It has high union rate, low infection rate and low incidence of complications.

CONCLUSION

Femur fracture is the most common fracture of physically active individual due to high energy trauma. Methods of

surgical treatment are available. The PFN is an useful device in the treatment of proximal shaft femur fracture. It creates a biomechanical stable construct then conventional interlocking intramedullary nail due to shorter working length and rigid fixation of proximal screw with the head and neck. For this reason early weight bearing may be allowed after fixation by PFN. There is a low incidence of wound infection probably due to fact that it requires less operating exposure and less operative time than conventional interlocking intramedullary nailing. But the operation is technically demanding. Gradual learning and great patience is required in order to make this method truly minimally invasive.

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Clinical Evaluation of Patients Undergoing Operative Versus Conservative Treatment for Prolapsed Lumbar Intervertebral Disc

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Abstract

Low back pain with sciatica secondary to herniated intervertebral disc represents a major national health problem. This can be managed effectively either conservatively or surgically. Although conservative management is commonly used for people who have Lumbar Disc Herniation with Associated Radiculopathy (LDHR), surgical procedures play an important role. The aim of this study was to compare the clinical results of conservative to operative treatment in the management of prolapsed lumbar intervertebral disc. Main objective was to assess various clinical and radiological findings in these patients during their treatment of Prolapsed Lumbar Intervertebral Disc (PLID). This was a prospective study carried out in the Department of Orthopaedics at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from March 2012 to September 2014. For this study, a total number of 60 patients presented with prolapsed lumbar intervertebral disc age from 14 to 63 years, irrespective of sex with clinical symptoms, signs and radiological evidence suggestive of Prolapsed Lumbar Intervertebral Disc (PLID) treated with either conservatively or surgically in the Department of Orthopaedics at Bangabandhu Sheikh Mujib Medical University (BSMMU) Shahbag, Dhaka. The total number of 60 cases 30 were selected for group-I managed surgically and 30 were selected for group-II managed conservatively and both groups fulfilled the selection criteria. Out of 60 patients in our study 70% cases were male. 71.66% cases had disc prolapsed at L4-L5 level, which being the commonest site of disc prolapsed followed by L5-S1 26.66% and 1.66% at L3-L4 level. In 2 years follow-up, satisfactory outcome was seen in 83.3% surgically (group-I) treated patients with 6.66% complication rate. Conservatively treated (group-II) of patients showed 56.7% satisfactory outcome. The long-term outcomes of surgery and conservative management of prolapsed lumbar intervertebral disc though sometimes considered similar, but in short term, surgery provides the prospect of quicker relief. A period of 2 years outcome of standard discectomy in our study was favorable and comparable to other studies even though the duration was small. Patients undergoing surgery for lumbar disc herniation achieved greater improvement than conservatively treated patients.

Key words: Low back pain, PLID, Conservative Treatment, Operative treatment, Short term result, greater improvement in surgery

INTRODUCTION

Lumbosacral radiculopathy is a condition that results from compression of one or more spinal nerve roots, and is characterized by radiating leg pain and paraesthesia, as well as clinical signs of neurologic

impairment^{12,15}. Lumbar disc herniation, defined as the localized displacement of disc material beyond the margins of the intervertebral disc space, is considered to be the most common cause of lumbosacral radiculopathy²⁰.

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Low back pain is a very common problem, with up to 80% of the population being affected at sometime in their lives³. Of these, about 1% becomes totally disabled, 10% become chronic low back pain sufferers, and the rest recover uneventfully, with 80% returning to work in 8-10 weeks¹³.

The number and variety of non-operative therapies for back and leg pain are diverse and overwhelming. Treatment range from simple rest to expansive traction apparatus. All of these therapies are reported with glowing accounts of miraculous cures⁹.

The presence of disc extrusion has been considered by many to be an indication for prompt surgical treatment¹⁹. Although not documented, the concern that perithecal and perineural fibrosis will develop secondary to disc extrusions has commonly been used as an argument for prompt surgical treatment¹⁹. Moreover, there have been concerns regarding neurologic recovery if nuclear extrusions are left to deform the neural structures over a prolong period¹¹ Patient with lumbar disc herniation with associated radiculopathy (LDHR), greater than 90% of the patients with disc extrusions and radiculopathy had a successful outcome and neurologic deficit did not after the favorable prognosis when prolapsed lumbar discs were treated conservatively¹⁷.

Most people with Lumbar disc herniations and sciatica improve with nonsurgical treatment, some continue to have symptoms that interfere with work, recreation, and enjoyment of life²¹. Sciatica caused by a lumbar herniated disc is the most common cause of radicular leg pain in adult working populations¹⁸. Although most patients improve over several weeks, surgical treatment is frequently considered for patients with symptoms that are persistent or severe¹. Disc excision is a frequently performed operation, although it is done to only a small percentage of those who are afflicted by discogenic pain⁶.

Lumbar discs cushion and tether the vertebrae, providing flexibility and stability. The more gelatinous central portion, the nucleus pulposus, acts as a hydrostatic cushion. The surrounding many-layered ligament, the annulus fibrosus, is a strong and efficient container. Weakness in the annulus can allow fragments of tissue from within the disc space to migrate into the spinal canal. There, displaced nucleus or protrusion of annulus may impinge on nerve. The mere proximity of nucleus or damage annulus to the nerve can cause direct pressure against the nerve, resulting in numbness and weakness of leg muscles¹⁰.

Patients sometimes present with severe sciatica and incapacity due to intervertebral disc herniation, they may show signs of distinct clinical improvement, despite the MRI evidence of particularly large disc herniation of those patients. The surgeon is then faced with the dilemma of intervening in the presence of clinical progress or adopting a conservative policy which, in theory, could prolong the period of suffering, leading to greater nerve damage or even result in cauda equina syndrome⁴. Lumbar discectomy is a common procedure for patients with persistent back and leg pain, particularly if it is unresponsive to non-invasive conventional therapies. Issue with surgery involve shorter and longer term pain persisting, and injury to the disc and endplate of the vertebrae, with accelerated degenerative changes, disc space collapse, and potentially more or worse back and leg pain¹⁴.

The primary rationale of any form of surgery for disc prolapse is to relieve nerve root irritation or compression due to herniated disc material, but the results should be balanced against the likely natural history. Surgical planning should also take account of the anatomic characteristics of the spine and prolapsed the patient's constitutional makeup, and equipment availability⁵. Of the techniques available, open discectomy, performed with or without the use of an operating microscope, is the most common, but there are now a number of other less invasive surgical techniques. Ideally, it would be important to define the optimal type of treatment for specific types of disc prolapsed⁶.

The majority of patients with radicular pain from disc herniation improve within 4-6 weeks without surgery, early operative treatment is needed in certain patients with major muscle weakness, loss of bowel or bladder function and excruciating pain that cannot be controlled by conservative treatment. Some patients with nerve root symptoms lasting more than 6 months develop chronic nerve pain that is not totally relieved by disc excision. The best results from surgery can be expected when performed within this period of 6 weeks to 6 months of radicular pain²¹.

The American Academy of Orthopaedic Surgeons and Alf Nachemson- who was the number one spine researcher in the world¹¹ recommends the following conditions be met before decompressive surgery is offered- (i) Functional incapacitating pain in the leg, extending below the knee with a nerve root distribution. (ii) Nerve root tension signs (positive straight leg raising test) with or without neurologic abnormalities, fitting the radiculopathy. (iii) Failure of clinical improvement after 4-8 weeks of

conservative treatment. (iv) Confirming imaging study: abnormal myelogram, computed tomogram (CT), or magnetic resonance imaging (MRI) correlated to the physical signs and distribution of the pain.

The subsequent narrowing of discs following surgery may cause not only discogenic low back pain, but also spondylotic changes in the facet joints and spur formation in the vertebral body, which may aggravate low back pain further⁷.

Ultimately, the decision to undergo lumbar disc surgery for sciatica is an individual one. Although surgery provides a greater chance for rapid relief of symptoms. Such relief is likely to occur gradually without surgery. Reluctance to undergo surgery might lead patients with sciatica, particularly those with milder symptoms, to defer discectomy².

METHODS

This prospective study was carried out at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka during the period of March 2012 to September 2014 on patients with prolapsed lumbar intervertebral disc undergoing conservative and surgical intervention. A total number of 60 (Sixty) patients with prolapsed lumbar intervertebral disc were included in the study. The patients were simply randomized (Lottery) into two groups. Group-I included 30 patients treated operatively and Group-II included 30 patients treated conservatively. Purposive sampling was followed as per inclusion and exclusion criteria. The diagnosis of prolapsed lumbar intervertebral disc were done from the history, clinical findings and radiological imaging. The patients for the study were selected on the basis of following inclusion and exclusion criteria. **Inclusion criteria of cases-** Dominant leg pain than back pain, Restricted Straight Leg Rising, Signs of root compression– Motor, Sensory, Reflex- change in the lower limb, Positive radiology – MRI of Lumbosacral Spine, PLID at one or two level, unilateral or bilateral and Patients of both sex– male and female. **Exclusion criteria of cases-** PLID due to direct trauma with fracture –dislocation of vertebra, PLID associated with other spinal pathology (e.g.- infection, neoplasm), Repeat lumbar disc surgery due to recurrence of symptoms, PLID more than 2 level, Cauda equina syndrome.

The surgery was a standard open discectomy with examination of the involved nerve root. The conservative protocol was recommended to include active physical therapy, education and counseling with home exercise instruction, non-steroidal anti-inflammatory drugs,

narcotic analgesics, muscle relaxant, ultrasound therapy, pelvic traction and use of lumbar corset. Non operative treatments were individualized for each patient and tracked prospectively. Sixty patients fulfilling the selection criteria were identified. 30 among them were randomly selected for standard open discectomy and 30 were kept solely on conservative treatment. The demographic profile (i.e. age, sex) were noted, clinical examination was performed and x-rays and MRI of lumbosacral spine were taken. Patients who were treated only by conservative method were follow up in outpatient department and pain was rated using VAS and disability were rated by Oswestry Disability Index and clinical outcome was measured by Modified Macnab Criteria. Outcome of the study was evaluated at the end of 6 weeks, 12 weeks, 6 months, 12 months, 18 months and 24 months from the start of treatment or surgery. All this information was collected through specially designed proforma.

OBSERVATION AND RESULTS

In this study the age of the patients ranges from 14-63 years. Maximum age incidence was found in 31-40 years age group. Mean age operative 36.63 ± 10.03 and conservative 39.86 ± 9.58 .

Out of 30 patients 22 (73.3%) were male and 8 (26.7%) were female in Operative group. Out of 30 patients 20 (66.7%) were male and 10 (33.3%) were female in conservative group. Male are more sufferer than female. Maximum patient's side of involvement was right. All patients had motor and sensory involvement.

LEVEL OF LUMBER INTERVERTEBRAL DISC INVOLVEMENT:

Table-I shows the distribution of the patients by level of involvement. Maximum patients' level of involvement was L4 - L5. The difference between these two groups was not statistically significant.

Table-I
Level of involvement of the patients (n=60).

Level of involvement	Group		p value
	Operative (n=30)	Conservative (n=30)	
L3 - L4	1 (3.3)	0 (0.0)	0.529 ^{NS}
L4 - L5	22 (73.4)	21 (70.0)	
L5 - S1	7 (23.3)	9 (30.0)	
Total	30 (100.0)	30 (100.0)	

Table-II shows back pain of the patients after 6 weeks, 12 weeks, 6 months, 12 months, 18 months and 24 months according to VAS. In both groups, pain was decreased gradually but the rate was higher in operative group than the conservative group.

Table II*Back pain according to Visual Analogue Scale (VAS)*

Back pain	Group		p value
	Operative (n=30)	Conservative (n=30)	
Pre operative	7.20±0.71	5.70 ± 0.79	0.001
After 6 weeks	3.16±0.94	3.63 ± 0.61	0.028
After 12 weeks	1.90±0.80	2.86 ± 0.73	0.001
After 6 months	1.20±0.84	1.86 ± 1.04	0.009
After 12 months	0.76±0.50	1.43 ± 0.89	0.001
After 18 months	0.70±0.59	1.26 ± 0.98	0.009
After 24 months	0.70±0.59	1.03 ± 0.96	0.113 ^{NS}

Table-III shows leg pain of the patients after 6 weeks, 12 weeks, 6 months, 12 months, 18 months and 24 months according to VAS. In both groups, leg pain was decreased gradually but the rate was higher in operative group than the conservative group.

Table III*Leg pain according to Visual Analogue Scale (VAS)*

Leg pain	Group		p value
	Operative (n=30)	Conservative (n=30)	
Pre operative	2.96 ± 0.61	3.13 ± 1.33	0.536 ^{NS}
After 6 weeks	1.26 ± 0.58	1.50 ± 0.73	0.177 ^{NS}
After 12 weeks	0.83 ± 0.46	1.06 ± 0.52	0.071 ^{NS}
After 6 months	0.26 ± 0.52	0.53 ± 0.57	0.064 ^{NS}
After 12 months	0.20 ± 0.40	0.33 ± 0.47	0.250 ^{NS}
After 18 months	0.13 ± 0.34	0.33 ± 0.54	0.96 ^{NS}
After 24 months	0.10 ± 0.30	0.36 ± 0.71	0.66 ^{NS}

Table-IV shows disability of the patients after 6 weeks, 12 weeks, 6 months, 12 months, 18 months and 24 months according to ODI. Mean value of ODI in both groups were decreased gradually but improvement rate was higher in operative group than conservative group.

Table IV*Disability according to Oswestry disability index (ODI)*

Disability	Group		p value
	Operative (Mean ± SD) (n=30)	Conservative (Mean ± SD) (n=30)	
Pre operative	61.66 ± 6.12	53.53 ± 3.58	0.001
After 6 weeks	31.13 ± 7.56	37.13 ± 3.81	0.001
After 12 weeks	21.73 ± 4.05	27.66 ± 5.22	0.001
After 6 months	14.13 ± 5.96	21.06 ± 6.27	0.001
After 12 months	11.93 ± 7.83	17.33 ± 6.01	0.004
After 18 months	9.66 ± 3.96	15.40 ± 6.83	0.001
After 24 months	9.26 ± 4.28	14.13 ± 6.4	0.001

Table-V shows clinical outcome of the patients after 6 weeks, 12 weeks, 6 months, 12 months, 18 months and 24 months according to Modified Macnab Criteria. In both groups, clinical outcome was satisfactory but in operative group satisfactory rate was higher than conservative group.

Table V*Disability according to Modified Macnab Criteria (n=60)*

Disability	Group		p value
	Operative (n=30)	Conservative (n=30)	
After 6 weeks			0.002
Satisfactory	8 (26.7)	0 (0.0)	
Unsatisfactory	22 (73.3)	30 (100.0)	
After 12 weeks			0.001
Satisfactory	18 (60.0)	4 (13.3)	
Unsatisfactory	12 (40.0)	26 (86.7)	
After 6 months			0.012
Satisfactory	25 (83.3)	16 (53.3)	
Unsatisfactory	5 (16.7)	14 (46.7)	
After 12 months			0.005
Satisfactory	26 (86.7)	16 (53.3)	
Unsatisfactory	4 (13.3)	14 (46.7)	
After 18 months			0.007
Satisfactory	27 (90.0)	18 (60.0)	
Unsatisfactory	3 (10.0)	12 (40.0)	
After 24 months			0.024
Satisfactory	25 (83.3)	17 (56.7)	
Unsatisfactory	5 (16.7)	13 (43.3)	

Table-VI shows Final outcome of patients after 24 months. In operative group maximum 16 (53.3%) patients outcome was good followed by 9 (30.0%) and 5 (16.7%) were excellent and fair. In conservative group maximum 13 (43.3%) patients outcome was good followed by 8 (26.7%), 5 (16.7%) and 4 (13.3%) were fair, poor and excellent. The difference between these two group was statistically significant ($p < 0.050$)

Table VI
Final outcome of the patients after 24 months

Final outcome	Group		p value
	Operative (n=30)	Conservative (n=30)	
Excellent	9 (30.0)	4 (13.3)	0.048
Good	16 (53.3)	13 (43.3)	
Fair	5 (16.7)	8 (26.7)	
Poor	0 (0.0)	5 (16.7)	
Total	30 (100.0)	30 (100.0)	

Excellent + Good = Satisfactory, Fair + Poor = Unsatisfactory

Case Illustration (Case-1)

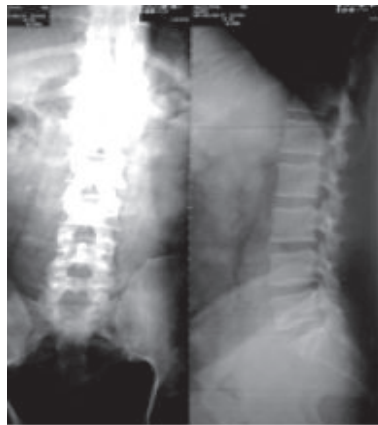


Fig.-1: X-ray lumbosacral spine A/P & Lateral view.

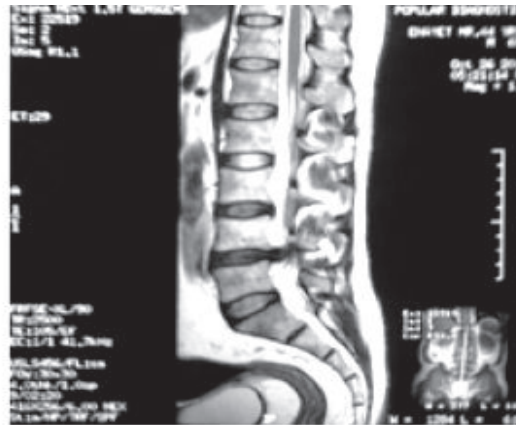


Fig.-2: MRI of lumbosacral spine T2 weighted sagittal view showing disc prolapsed at L4-5.



Fig.-3: Marking X-ray lumbosacral spine A/P view.

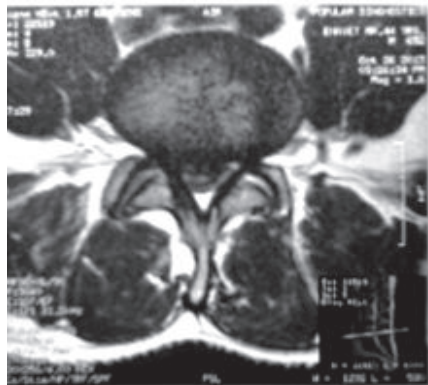


Fig.-4: MRI of lumbar spine T2 weighted axial view at L4-5 level.



Fig.-5: Preoperative posterior view of the patient (Initial).



Fig.-6: Preoperative SLR of left side (Initial).



Fig.-7: Preoperative SLR of right side (Initial).



Fig.-8: Preoperative power of EHL both side (Initial).



Fig.-9: Preoperative power of FHL both side (Initial).

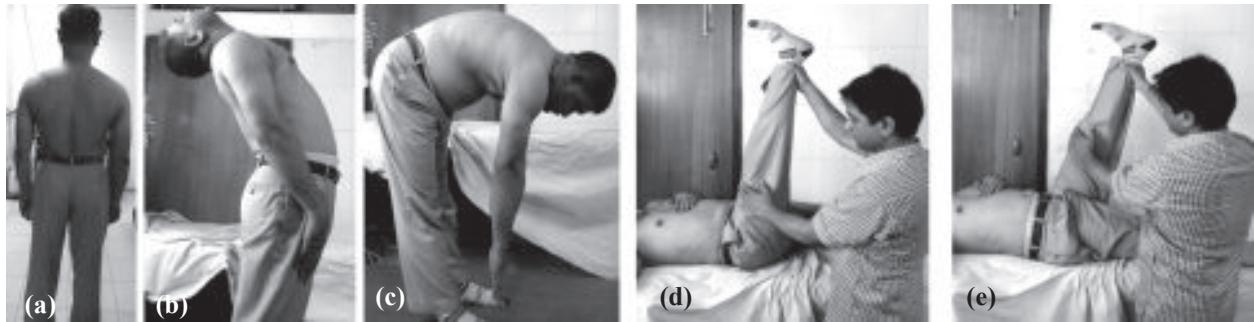


Fig.-10: a- back view, b- extension movement, c- flexion movement, d- SLR on right side & e- SLR of left side (After 6 months follow up).

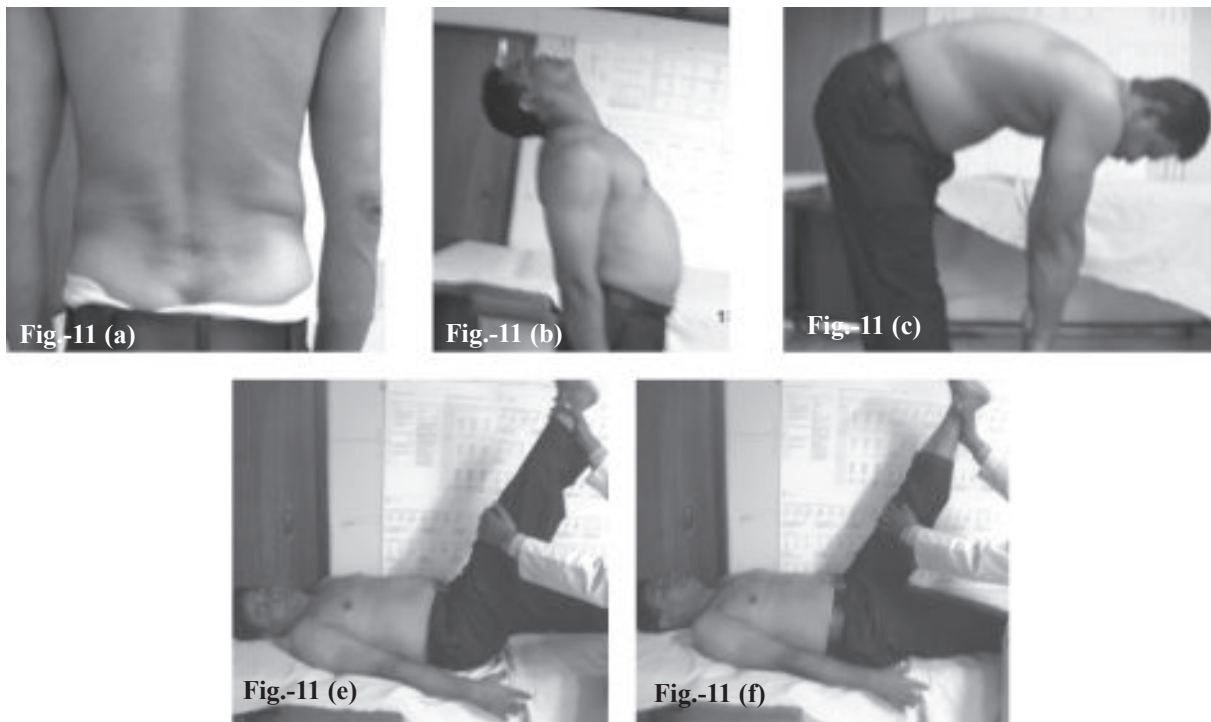


Fig.-11: a- back view, b- extension movement, c- flexion movement, d- SLR on right side & e- SLR of left side (After 24 months follow up).

Case-2

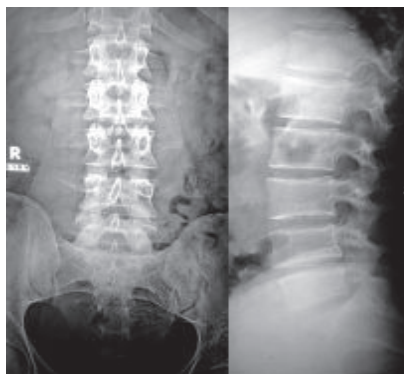


Fig.-1: X-ray lumbosacral spine A/P & Lateral view.



Fig.-2: MRI of lumbosacral spine T2 weighted sagittal view showing disc prolapsed at L4-5.



Fig.-3: MRI of lumbar spine T2 weighted axial view at L4-5 level. Nerve root compression on right side.



Fig.-4: Back extension movement. (Initial)



Fig.-5: Back flexion movement. (Initial)



Fig.-6: a- SLR on left side, b- SLR on right side, c- Power of EHL on both side and d- Power of FHL on both side (After 6 months follow up).



Fig.-7: a- SLR on left side, b- SLR on right side, c- Power of EHL on both side and d- Power of FHL on both side (After 24 months follow up).

DISCUSSION

Low backache is a major public health problem in the rural and urban areas. It causes suffering and distress to patients and their families, and affects a large number of people. Prolapsed intervertebral disc occurs in about 5 – 10% of all low backache patients and is a common cause of sciatica. Disc prolapsed alters disc height and the mechanics of the rest of the spinal column, possibly

adversely affecting the behavior of other spinal structures such as muscles and ligaments. The standard treatment of lumbar disc prolapsed has been surgical excision of the disc or conservative treatment, though the methods vary.

Clinical symptoms and signs, as a rule of a fifth lumbar and/or first sacral root lesion, corresponded to the findings at radiculopathy and almost correlated to the MRI findings. In our study most common level of disc prolapsed at L_{4,5}

(71.6%) followed by L₅-S₁ (26.6%) and 1.88% involved at L₃₋₄ level. In a study done by Spangfort et al, (1972) showed that the common level of disc prolapsed L5-S1 (49%) followed by L4-L5 (48%) and the least common at L3-L4 (3%). In another study carried by Ebeling et al, (1986) showed that most common level of disc prolapsed involve L4-L5 (52.3%), L5-S1 (41.8%) and L3-L4 (3.1%). Though these study shows the commonest disc prolapsed at L5-S1 but the incidence disc prolapsed increase at L4-L5 level.

In our study disc prolapsed on right side is more than the left side. In right side 63.33% disc prolapsed occurred, left side 35% and bilateral involvement 1.6%.

In our study sensory involvement 100% both in conservative and surgical treatment. In a study done by Yorimitsu et al, (2001) shows sensory disturbances 93.7%. In another study done by Godersky et al, (1984) shows sensory disturbances 66.66%.

In our study motor involvement 100% both in conservative and operative treatment. In a study done by Yorimitsu et al. (2001) shows motor disturbances 93.6%. In another study done by Godersky et al. (1984) 100% motor involve present both male and female patients.

In our study initial visual analogue scale for back pain were 7.20 and 5.70 in operative and conservatively treated patient respectively which gradually decrease and after 24 months which were 0.7 and 1.03. In a study done by Peul et al, (2007) showed that initial back pain 6.1 and 5.8 respectively in surgical and conservatively treated patient and pain intensity was gradually decreased and two years after which were 1.6 and 1.8 respectively. Leg pain rapidly decrease operative patients than conservatively treated patients but sustain improvement of leg pain in conservative managed patients and after two years there is no significant difference in both groups. In our study initial visual analogue for leg pain were 2.96 and 3.13 respectively in operative and conservatively treated patient which gradually decrease and two years after which were 0.10 and 0.36.

In another study done by Peul et al, (2007) showed that initial VAS for leg pain was 6.7 and 6.4 respectively in surgical and conservatively treated patients and pain intensity gradually decreased in both group but more rapidly decreased in surgical group and finally which were 1.01 and 1.5. Malmivaara et al. (2007) initial VAS for leg pain 6.6 for surgically treated patients which gradually decrease and after 2 years which was 3.6 and in conservative treated patients initial VAS for leg pain was

6.4 which gradually decrease and 2 years after follow up which was 1.7. Osterman et al. (2006) showing no significant differences were found for back and leg pain in operative or conservatively treated patients throughout the 2 years follow up. VAS leg pain scores, however, improve more rapidly in the discectomy group.

In our study ODI in preoperative period in surgically treated patients was 61.66% and after 6 weeks 31.13% then gradually decrease and after 24 months which became 9.26%. In conservatively treated patients ODI was 53.53% and after 6 weeks 37.13% and gradually decrease and after 24 months which was 14.13%. Disability was decrease more rapidly in operatively treated patients than conservatively managed patients.

In a study done by Malmivaara et al, (2007) preoperative ODI was 37.5% and which gradually decrease 2 years after ODI was 9.6% and in conservatively treated patients initial ODI was 33% and after 2 years which was 22.8%. Benson et al, (2010) showed that initial mean ODI was 58% and after 2 years the mean ODI was 15% surgery. In another study done by Osterman et al, (2006) showed that in surgically treated patients initial ODI was 39% and after 2 years the mean ODI was 6%.

In our study 83.3% patients are satisfied with operative treatment after 24 months and 56.7% patients satisfied with conservative treatment after 24 months.

In a study done by Atlas (1995), Seventy one percent of surgically treated patients reported that their predominant symptom (either back or leg pain) was much better or completely gone compared with 43% of non-surgically treated patients.

In a study done by Weber (1983) satisfactory results 36% patients treated with conservatively and 65% patients satisfied with surgical treatment.

A large trial done by Weinstein et al, (2006) showed that both the surgery as well as the conservative treatment group improved substantially over time but improvement was significantly greater for those patients who underwent surgery. The benefit of surgery was seen as early as 6 weeks and was maintained for at least 2 years. Peul et al. (2011) shows that both surgery and conservatively treated patients improved substantially over time, but surgery showed significantly better results for pain and function as compared with conservative treatment.

Both surgically and conservatively treated groups improved substantially on all outcomes over 2 years of follow up and statistically significant. In contrast, as treated analysis based on treatment received showed strong,

statistically significant advantages for surgery on all outcomes at all follow up times. Patients undergoing surgery for lumbar disc herniation achieved greater improvement than conservative treated patients.

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Evaluation of Results of Arthroscopic Partial Meniscectomy for Medial Meniscal Tear of Knee

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Abstract

Knee is the largest and one of the weight bearing joints of the body. Knee injury can be Crippling. Meniscal tears are one of the commonest intra-articular injuries involving young or middle-aged people. Proper management is an important issue regarding the future effective movements. To find out the results of arthroscopic partial meniscectomy for medial meniscal tear of the knee. This was a prospective interventional study carried out in the Department of Orthopaedics at BSMMU, Dhaka from January 2013 to December 2014. Thirty patients with meniscal tears were selected as per inclusion and exclusion criteria. After proper evaluation and clinical examination of these patients arthroscopic examination and partial meniscectomy was done under spinal anaesthesia. All patients were evaluated at follow up on 3th month using Tapper-Hoover criteria for clinical assessment. A total number of 30 patients were recruited in this study. Twenty seven (90%) patients were male and only 3 (10%) were female. Mean \pm SD of age was 26.16 ± 5.17 and range was 16 – 40 years. Out of 30 patients 21 (70.0%) had right knee affected and the rest 9 (30.0%) had left knee affected. Over 56.7% received injuries from sports activities and the rest 43.3% received them while they were working. Mean \pm SD of duration of suffering was 7.23 ± 2.93 months and range was 4–15 months. According to Tapper-Hoover classification result of arthroscopic partial meniscectomy was excellent 53.3%, good 26.7%, fair 10%, and poor 10%. This study permits to conclude that arthroscopic partial meniscectomy may be the effective method of treatment for the management of medial meniscal tear.

Keywords: Arthroscopic partial meniscectomy, Medial meniscal tear

INTRODUCTION

The knee is the largest and complex joint of the body. Injuries to the knee are one of the commonest injuries, pertaining to the joints in the body, especially amongst sports professionals. The incidence of permanent and progressive residual disability following knee injury is higher than any other trauma sustained in sports (Karachalios *et al.* 2005).

Meniscal tears are the most common injury of the knee, with an incidence of meniscal injury resulting in meniscectomy of 61 per 100 000 population per year. They may occur in acute knee injuries in younger patients, or as part of a degenerative process in older individuals. Medial meniscal tears occur more frequently than tears of the lateral meniscus. (McDermott and Amis, 2006).

The first Arthroscopic Meniscectomy was performed by Masaki Watanabe² in Japan in 1962 and was introduced

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in North America by O'Connor³ in 1977 including an operating arthroscope. Dandy⁴, Jackson⁵, Gillquist⁶ and Metcalf⁷ have been among the early pioneers 'contributing to the development of arthroscopic surgical techniques, operating micro-instruments and power tools. The morbidity of arthroscopic meniscectomy of the knee is so low and return to normal function and sports activities so rapid that this technique has become very popular among the patients. Endoscopic surgery has virtually replaced open meniscus surgery wherever expertise in endoscopic surgery of the knee is available. (Umar, 1997). Since introduction of the therapeutic arthroscopy, by O'Connor, arthroscopic partial meniscectomy or meniscal repair become the treatment of choice of the meniscus tear whenever possible, which allows some preservation of normal meniscal function to avoid or reduce the risk of osteoarthritis that might develop after total meniscectomy. The major disadvantage of closed meniscus surgery is its technical difficulty while being learnt. (Alzubady, 2011).

The knee is the most frequently injured joint because of its anatomical structure, its exposure to external forces and the functional demands placed on it. Articular surface of the femur and tibia are not congruent and tibial condyles are too small and shallow to hold the large, convex femoral condyles in place. All though much emphasis has been placed on the ligaments of the knee, without the supporting action of the associated muscles and tendons, the ligaments are not enough to maintain knee stability. The structures around the knee have been classified into three broad categories : Osseous structures, extra-articular structures and intra articular structures. The intra-articular structure comprises of medial and lateral menisci; anterior and posterior cruciate ligament (Robert *et al.* 2008). The menisci of the knee have an important role in load-bearing and shock absorption within the joint. They may also function as secondary stabilizers, have a proprioceptive role, and aid the lubrication and nutrition of the articular cartilage. Complete or partial loss of a meniscus can have damaging effects on a knee, leading to serious long-term sequelae. (McDermott and Amis, 2006). Medial and lateral menisci are composed of fibro-cartilage, forms an incomplete partition and intervenes between the condyles of femur and Tibia. Medial meniscus is semilunar in shape and longer anteroposteriorly. It is convex and attached to the capsular ligament and tibial co-lateral ligament. Lateral meniscus forms four-fifth of a circle. Lateral margin is convex and attached to the fibrous capsule. In addition post horn provides, the attachment of menisco-femoral ligaments and few fibre of popliteus. Medial meniscal tear is more easier than lateral as lateral meniscus is thicker

and more-mobile. (Jason and Carne, 2007). Traumatic menisci lesions are more common in rotation or forceful twisting, deep squatting and suddenly stopping of knee. The most common location for injury of menisci are the posterior horn and longitudinal tears are most common. The other types are horizontal, oblique tears, a combination of longitudinal and horizontal tears, tears associated with cystic menisci and tears associated with discoid menisci (Robert *et al.* 2008).

The medial meniscus may be trapped between the condyles of the femur and tibia and it may torn at its periphery due to tear of the medial structures, thus producing 'The unhappy triad of O'Donoghue'. (Robert *et al.* 2008). Miller, Warner and Earner classified meniscal tears on the basis of their location in three zones of vascularity – red (Fully within vascular area), red-white (at the border of the vascular area) and white (within the avascular area). Four mechanisms have been described as capable of disrupting the menisci- (I) Abduction, flexion and Internal rotation of the femur on tibia, (II) Adduction, flexion and external rotation of femur on the tibia, (III) Hyperextension and (IV) Anterior-posterior displacement. Arthroscopy play an important role, it has both diagnostic as well therapeutic role. Nevertheless no clinical assessment or advanced investigations such as MRI diagnose medial meniscal tears in all patients. Medial meniscal tears will clinically diagnosed by joint line tenderness, positive Mc Murray test, Apley's grinding test, Duck waddle test and The thessaly test (Mohon, 2007). Arthroscopy is now well established as a method of diagnosing meniscal lesions, and its advantages have been pointed out in several reports. Arthroscopic surgery, however, is difficult to master, so that for meniscectomy open methods remain commoner. By taking advantage of the new instruments and equipment developed for arthroscopic operations, a modified technique of open meniscectomy, designed to improve the postoperative course, has been developed (Hamberg *et al.* 1984).

Carefully performed clinical examination can give equal or better diagnosis of meniscal tear in comparison to MRI scan. When clinical diagnosis is the favour of meniscal tear, performed an MRI Scan prior to arthroscopic examination is un-likely to be significance, MRI scanning is not the primary diagnostic tool in meniscal injuries, in context of our country, most patients are from poor socio-economic conditions, MRI bears an extra financial burden to the patient (Rayan, 2009). With better knowledge of meniscal function in load transmission across the knee and the introduction of new methods of treatment, meniscal tears are now usually managed arthroscopically with

preservation of much of the meniscus. The short term results have been good, allowing early weight bearing, return of function, significantly reduced morbidity and reduction of the cost of care (Hulet *et al.* 2001.)

The vascular supply to the menisci are provided by the lateral and medial geniculate arteries which form a perimeniscal capillary plexus with radial branches directed towards the centre of joint. In the adult, the degree of vascular penetration from the periphery is 10-30% into the medial meniscus and 10-25% into the lateral meniscus. The anterior and posterior horns of the menisci are more vascularised than their bodies. The nerve supply of the meniscus is at present, debatable. Innervation arises mainly from the posterior articular nerve but branch of the medial articular nerve provide part of the innervations of the medial meniscus. No neural elements have been observed in the inner third of the meniscus (Messner, 1998). Meniscal tears usually result from a single, acute rotational force is applied to the weight-bearing knee, overloading the meniscus. Traumatic menisci lesions are more common in rotation or forceful twisting, deep squatting and suddenly stopping of knee. The meniscus consists mainly of circumferential fibres held by a few radial strands. It is, therefore, more likely to tear along its length than across its width. The most common location for injury of menisci are the posterior horn and longitudinal tears are most common. The other types are horizontal tears, oblique tears, a combination of longitudinal and horizontal tears, tears associated with cystic menisci and tears associated with discoid menisci. If in the vertical tear the separated fragment remains attached in front and back, the lesion is called bucket-handle tear. Horizontal tears are usually degenerative or due to repetitive minor trauma. Some are associated with meniscal cyst (Miller and Azar, 2008). Tapper and Hoover's criteria of grading each knee as excellent, good, fair or poor. Excellent, a normal knee; good, the knee was functional in all activities including vigorous sports, but with some aching or swelling afterwards; fair, a knee giving definite symptoms and some disability, preventing vigorous sports; poor, a knee giving symptoms which interfered with routine daily activities. Gentle and automatic technique is required because it is easy to injure and damage the delicate articular cartilage with careless and clumsy use of instruments during endoscopic surgery. (Umar, 1997). All patients had a limited medial meniscectomy with the concept of preserving the meniscus and using standard techniques. Postoperatively, patients were allowed full weight-bearing and were advised to carry out isometric quadriceps contractions. Early return to work and sport was

encouraged. So meniscal tears are now usually managed arthroscopically with preservation of much of the meniscus. The short term results have been good, allowing early weight bearing, return of function, significantly reduced morbidity and reduction of the cost of care.

MATERIAL AND METHODS

Study Design:

Prospective interventional study.

Duration of Study :

From January 2013 to December 2014.

Place of Study :

Orthopaedic Surgery department, BSMMU.

Ethical Issue :

This protocol was approved by institutional review board (IRB) of Bangabandhu Sheikh Mujib Medical University, Shahabag, Dhaka.

Study Population:

The patients who were clinically positive for medial meniscus injury due to trauma visited to the Orthopaedic Outpatient Department of BSMMU and fulfilled the inclusion and exclusion criteria were my study population.

Sampling technique:

Sample was collected by non randomized purposive sampling technique.

Inclusion Criteria :

- Patient with history of knee injury and clinically positive meniscal tear who underwent arthroscopy.
- Patient who failed to show clinical improvement after 3 months of conservative treatment, and those who had no additional injury to the knee between the time of clinical diagnosis and Arthroscopy.

Exclusion Criteria :

- Patients with degenerative changes or evidence of loose bodies in plain radiography.
- Any previous surgery for the index diagnosis.
- Patients treated non-operatively.
- Where clinical findings are equivocal.
- Patients with intra-articular fracture.

DISCUSSION

The present single centered, interventional study was conducted between the periods of January 2013 to

December 2014 for duration of two years in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka. The present study assesses the fruitfulness of arthroscopic partial meniscectomy of meniscal tear of knee. All patients admitted in the Department of Orthopaedic Surgery, BSMMU, Dhaka, aged 16 to 40 years with both sexes diagnosed clinically as meniscal tear were the study population. Total 30 patients with meniscal tear were included in the study. The analysis of age distribution in this study showed that age range was 16-40 years and mean age was 26.16 years. Nearly similar result was shown by Munshi et al.(2000). In their study the age range was 15-45 years. In another study of Jha et al. (2005) showed the mean age was 27.9 years. In most of the cases young people are the victim of meniscal tear due to their aggressive mobility and participation in sports activity. The majority of patients of our study were male 90% and female were 10%. Similar result was shown by Rayan et al. (2009). In their study 88% patients were male and 12% were female. The reason of male predominance may be due to their more involvement in manual activities, sports and random mobility for work. Out of 30 patients 70% had injury at right knee and 30% had injury at left knee. Similar result was shown by Butt et al.(2007). In their study they got predominant right knee injury (63.6%) but dissimilar result was shown by Jha et al.(2005). They got predominantly left knee injury (57.1%). This dissimilarity may be due to variation in patient selection.

Causes of injury are important and vital factors for meniscal tear. In our study it was found that sports were the major cause of injury apart from other activities. Similar result was showed by Sharma et al. (2011) and Jha et al. (2005). In their study sports was the major cause. Duration of sufferings was ranged from 4 to 15 months. In most of the cases the range was 4 – 6 months. This result was nearly similar to Butt et al. (2007) where the range was 5-6 months. Clinical findings showed that pain, giving way, intermittent swelling and quadriceps wasting were the predominant complaints. Karachalios et al.(2010) reported that pain and locking were the major complaints.

Maximum patients had McMurray test and Thessaly test positive followed by joint line tenderness, Appley's Grinding test are also positive. Varyani et al.(2013) showed that maximum patient had joint line tenderness. This signifies that findings of clinical examination may vary in different subjects. In our study showed that isolated MM injury was 86.6%. The study of Rahman et al. (2010) and Sharma et al.(2011) showed that MM injury was common (69.4% and 75% respectively).

We used Hoover classification to evaluate the result postoperatively because it's simple and easy to apply on our patients. When we go through the literatures to compare our results with other results that use the same Hoover classification to evaluate the results.

Briol Gulman, et al. (1992) reported excellent-good result in 73.8% after partial meniscectomy done in 128 patients operated by him. Camanho et al. (2006) reported excellent-good result in 179 patients out of 194 patients (92.2%), with traumatic meniscus injury, poor result in 14 patients (7.73%).

Martin MA et al. (1986) reported excellent results in 41.5%, good results in 43%, fair results in 12% and poor results in 3.5%, on short term after partial arthroscopic meniscectomy done in 116 patients. BK Tay et al. (2008) reported excellent-good result in 39 patients out of 51 patients operated by arthroscopic partial meniscectomy, (76.5%). Fair result in 10 patients (19.6%). Poor result in 2 patients only (3.9%).

We found that, our results is comparable with those results, we reported our excellent result in 16 patients (53.3%), good result in 8 patients (26.7%) that mean(excellent-good 80%), fair result in 3 patients (10%) and poor result in 3 patients (10%) that mean (fair and poor 20%), although our sample of patients was smaller than there study.

Conclusion

From this prospective interventional study satisfactory functional outcome was found by using Tapper-Hoover grading system. So it may be concluded that result of arthroscopic partial meniscectomy is a good treatment option for medial meniscal tear.

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Evaluation of Surgical Bipolar Release of Sternocleidomastoid Muscle in Patients with Congenital Muscular Torticollis

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ABSTRACT:

The congenital muscular torticollis (CMT) is a neck deformity which occurred shortly after birth due to unilateral shortening of sternocleidomastoid muscle (SCM). Generally, male with right side deformity rate is higher. Although there are various options of operation, bipolar release technique is most suitable having less risk of recurrence than other available techniques with good cosmetic outcome when conservative treatment fails. This prospective interventional study was conducted in the department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh from Jan 2015 to Dec 2017. Twenty patients of congenital muscular torticollis was selected and intervention was done by bipolar release of sternocleidomastoid muscle. This study had potential risk, so signed informed written consent was taken from the authorized legal guardian with written statement. The objective of this study was to evaluate the functional and cosmetic outcomes of bipolar release of sternocleidomastoid muscle in congenital muscular torticollis. Out of 20 patients, 12 were male (60%) and 08 were female (40%), Right side involvement were 15 cases (75%) and left side 05 cases (25%). The mean cervical rotation was improved from 45.3⁰ to 78.5⁰, tilt was reduced from 14.8⁰ to 2.3⁰ and lateral flexion was reduced from 24.5⁰ to 4.1⁰ comparing pre-operative state to final follow up at 6 months. The mean modified Lee's score was improved from 4.4 (24.2%) to 16.3 (90.3%) from pre operative condition to the final follow-up at 6 months postoperatively. Therefore, the overall modified Lee's score was improved 66.1% by the bipolar release operation, as well as the functional and cosmetic outcome was also significantly improved.

Keywords: Congenital Muscular Torticollis, Bipolar Release

INTRODUCTION:

Congenital muscular torticollis (CMT) is the third most common congenital musculoskeletal anomaly after dislocation of the hip and clubfoot with a reported

incidence of 0.3-1.9 percent and there seems to be slight male predominance with a relative ratio of approximately 3:2¹. The right side is most frequently affected². Although various theories have been proposed to explain its

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aetiology, such as birth trauma, intrauterine malposition, infectious myositis and venous occlusion, difficult delivery, hereditary and compartment syndrome, the actual cause of CMT has not been identified³. The basic pathology of CMT is endomysial fibrosis with deposition of collagen and aggregation of fibroblast around individual muscle fibres, which then undergo atrophy⁴.

Prompt diagnosis and early treatment with concise physical therapy causes over 95 percent patients to achieve acceptable passive cervical rotation, but when physical therapy is not successful after the age of one year, some authors advocate surgical correction to improve cervical motion and cosmetic deformity³. Surgery is also recommended in patients with residual head tilt, passive rotation deficit or lateral bending deficit of more than 15 degree⁵. The timing of surgery is controversial. Some authors have advocated that an earlier operation improves head tilt and prevents craniofacial asymmetry, which appears to result from restricted growth on the affected side⁶, others have reported that waiting until one year of age has the advantages of allowing the growth of neck structures and simplifying surgery. Some have concluded that the optimal age of surgery is between one and four years⁷.

But complete restoration of facial asymmetry is difficult in patients older than four years⁸. Chen and Ko, 2000 also described excellent results in patients over six years of age, and latter suggested that the degree of correction was affected by adequate surgical release and postoperative rehabilitation rather than age. Coventry and Harris, 1959 reported that operation upto 12 years of age produced good results and indicates good modified Lee's scores⁹.

Although there are various surgical procedures for CMT, unipolar and bipolar release technique are the most popular¹⁰. But with open unipolar tenotomy of sternocleidomastoid muscle could be followed by tethering of scar to the deep structures, loss of contour of the muscle, failure to correct the tilt of the head, or failure of facial asymmetry to correct and recurrence rates are high (7%). But surgical correction with bipolar release and Z-plasty of sternal end of sternocleidomastoid or attachment of clavicular head to sternal head lessens the sunken or hollow appearance of the distal end of sternocleidomastoid and giving the patient a better cosmetic result as well as markedly reduce the recurrence rate⁸. It is clear that surgery in late cases improves neck motion and corrects head tilt,

and therefore improves quality of life. Bipolar release is an adequate and complication free method and must be considered in neglected cases¹¹.

Recently, to hide incision scars an endoscopic technique through an incision placed within the hair bearing scalp at the level of superior helical rim or anterior axillary line was introduced¹² (Sasaki et al., 2000). However, the retroauricular endoscopic approach places spinal accessory and greater auricular nerve at risk. Furthermore this method involves expensive equipment and additional costs due to the requirement for a dispensable endoscopic ports¹³.

A retrospective study of 11 patients, age was 4-18 yrs were operated by bipolar release and Z-lengthening of sternocleidomastoid with an average follow up of 4.4 years (2-8.6 years) shown significant improvement of neck motion, head tilt, chin deviation and cosmesis with excellent results in 8 patients 72.7 percent and good in 3 patients 27.2 percent. Results were evaluated by the scoring system of Lee et al. There were no recurrence and no surgery related complications¹⁴.

In our study we will find out the functional and cosmetic outcome of bipolar release of sternocleidomastoid and Z-lengthening in congenital muscular torticollis.

MATERIALS AND METHODS:

Twenty patients (8 males & 12 females) mean age 5 ± 3.75 years who have undergone bipolar release and Z-plasty of sternal head of sternocleidomastoid muscle for congenital muscular torticollis in the Hand and Reconstructive Surgery Wing, Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh from Jan 2015 to Dec 2017. The patient had been scheduled for surgery on the basis of clinical and radiological finding including cervical rotation, tilt, lateral flexion. Other than congenital muscular torticollis was excluded from this prospective interventional study. Postoperatively intensive physical therapy included cervical traction for 3-6 weeks, application of soft neck collar with neck mobilization exercises were ensured for 3-6 months. Finally results were evaluated at 6 months with modified Lee's scoring score. The results were compared using student or ANOVA's t-test as appropriate. All statistical analyses were performed using SPSS statistics. P value of less than 0.05 was considered as statistically significant.

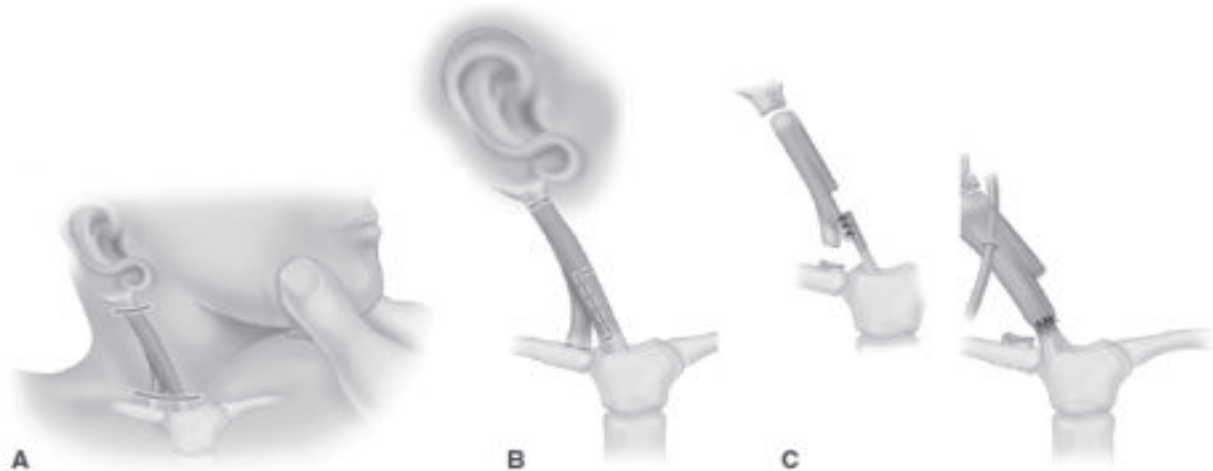


Fig 1. Bipolar Z-plasty operation of Torticollis (Source: Campbell 12 ed.)

RESULTS:

This prospective interventional study was carried out at Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, and Dhaka from January 2015 to December 2017 to assess the outcome of the open bipolar release of SCM in CMT. 20 cases of congenital muscular torticollis were included in this study. After proper evaluation of patient's intervention was done by open surgical bipolar release of sternocleidomastoid with lengthening of sterna head. Follow up were taken every 03 weekly for 03 months then 06 weekly upto at least 06 months.

Maximum 9(45%) patients were in age group 3-6 followed by 6 (30%) and 5(25%) patients were in age group of 6-9 years and 9-12 years respectively. Mean (SD) age was 5.0 (± 3.75) with the range of 1-12 years. Male female ratio was 3:2. 15 (75%) patients were in the right side and rest 5(25%) patients were CMT in the left side. 16(80%) patients had the history of normal vaginal delivery (NVD) and 4(20%) had caesarean section delivery.

Pre operatively thirteen (65%) patients had moderate facial asymmetry, 5(25%) patients had slight facial asymmetry and 2 (10%) patients had severe facial asymmetry, on the other hand lateral flexion deficit was found 53.3% and 54.8% with the lateral rotation deficit was 85.0% and 82.9% on the left and right CMT patients respectively. 11 (55%) patients had moderate head tilt and 9(45%) patients had severe head tilt.

At 6 months follow up seventeen (85%) patients had none of facial asymmetry and 3 (15%) patients had the mild facial asymmetry. The lateral flexion deficit was found 8.0% and 9.0% with the lateral rotation deficit was 2.5% and 2.1% on the left and right CMT patients respectively. 11(55%) patients had none of head tilt, 8(40%) patients had mild head tilt and 1 (5%) patients had moderate head tilt. Regarding post-operative complications one (5%) patient had the superficial wound infection 19(95%) and two(10%) patients had the disfiguring scar. The loss of Sternocleidomastoid muscle contour (SMC) was found in 1(5%) patient.



Fig.-2: Pre operative

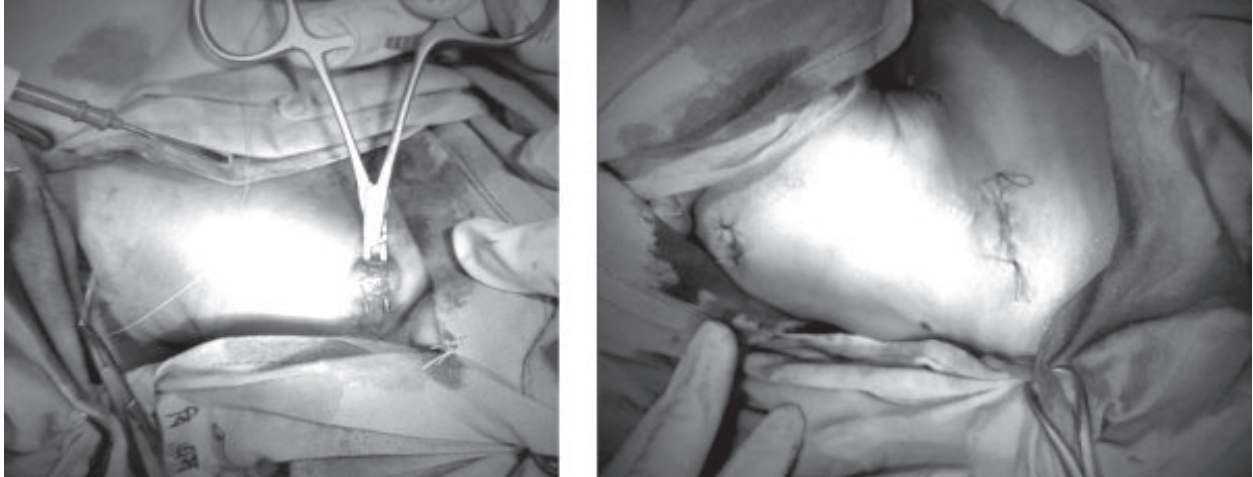


Fig.-3: *Per operative*



Fig.-4: *Post operative halter traction*

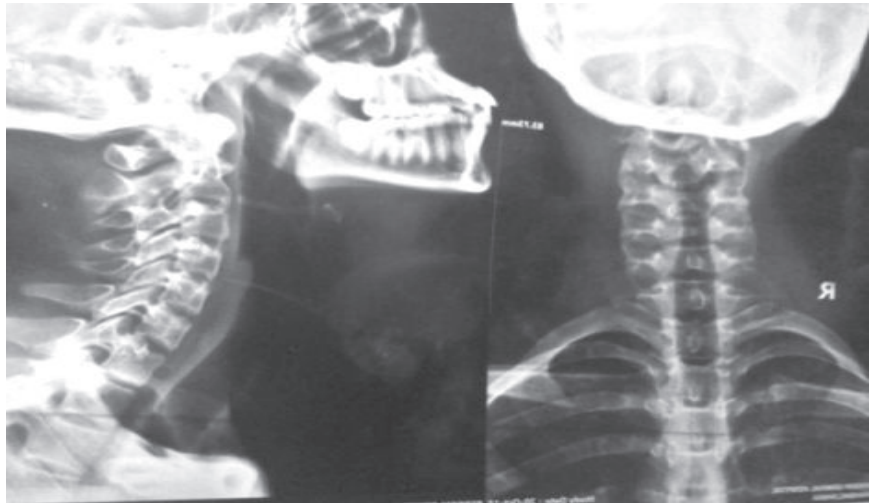


Fig.-5: *X-ray of Cervical Spine at Final Follow-up to measure the residual head tilt traction*

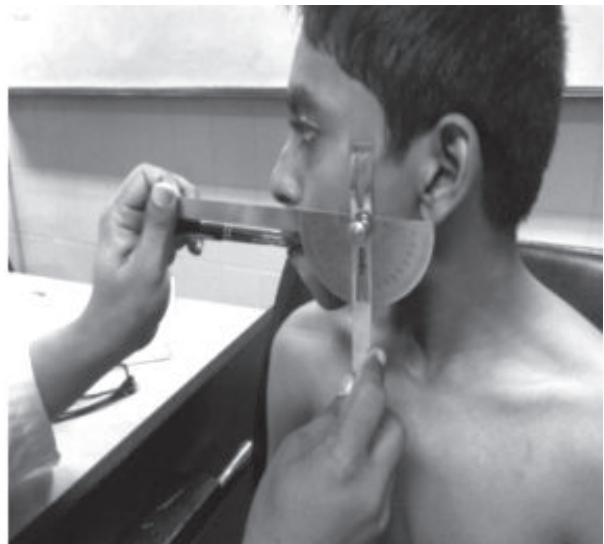


Fig.-6: *Lateral Rotation at Final Follow-up*



Fig.-7: Final Follow-up at 6 months

Table 1
Patients Clinical Information's

Case	Name	Age (yrs)	Sex	Side	Surgical Procedure	Duration of F/U, Months	Results
1	Samia	07	F	R	Bipolar R	24	Excellent
2	Sarimrahman	11	M	R	Bipolar R	22	Good
3	Akbar hossain	3.5	M	R	Bipolar R	21	Excellent
4	Abir	04	M	R	Bipolar R	18	Excellent
5	Shifa	3.5	F	R	Bipolar R	18	Excellent
6	Shohana	07	F	R	Bipolar R	16	Good
7	Sumayia	08	F	R	Bipolar R	15	Good
8	Parul	05	F	L	Bipolar R	15	Excellent
9	Aman	07	M	R	Bipolar R	12	Excellent
10	Munni	12	F	R	Bipolar R	12	Fair
11	Asif	05	M	R	Bipolar R	11	Excellent
12	Nilima	6.5	F	L	Bipolar R	11	Excellent
13	Rajib	04	M	R	Bipolar R	10	Excellent
14	Farhana	09	F	L	Bipolar R	10	Excellent
15	Momin	5.5	M	R	Bipolar R	09	Excellent
16	Ruma	05	F	R	Bipolar R	09	Excellent
17	Umme Hani	12	F	R	Bipolar R	08	Good
18	Fahim	11	M	R	Bipolar R	07	Excellent
19	Nusrat	11.5	F	L	Bipolar R	06	Good
20	Anu	5.5	F	R	Bipolar R	06	Excellent

Table II
Comparisons of pre and post operative modified Lee's score (n=20)³

Value	Rotational deficit		Side flexion deficit		Craniofacial asymmetry		Residual band		Head tilt		Cosmetic and Functional	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Minimum	0.000	2.000	0.000	2.000	0.000	2.000	0.000	2.000	0.000	1.000	0.000	1.000
Maximum	1.000	3.000	1.000	3.000	1.000	3.000	2.000	3.000	1.000	3.000	1.000	3.000
Mean	0.900	2.900	0.900	2.900	0.900	2.850	0.750	2.700	0.550	2.500	0.400	2.300
Std. deviation	0.308	0.308	0.308	0.308	0.308	0.366	0.550	0.470	0.510	0.607	0.503	0.657
p-value	0.0001*		0.0001*		0.0001*		0.0001*		0.0001*		0.0001*	

Table –II, Statistical analysis was conducted using student t-distribution with 95% confidence interval where a p-value <0.05 indicates the statistically significant. The student t-distribution was considered between the pre and post operative modified Lee's scores where the theoretical mean value was set for statistical analysis (3). In case of rotational deficit, side flexion deficit, craniofacial asymmetry, residual band, head tilt and cosmetic function the statistically significant difference (p-value <0.0001) was observed in between the pre-operative and post operative modified Lee's score at 6 months follow up. (Table XI).

Table III

Distribution of patients by final outcome (n=20)

Final outcome	Frequency	Percentage
Satisfactory (Excellent+Good)	19	95%
Unsatisfactory (Fair+poor)	01	05%
Total	20	100%

Table III was shown the final outcome assessment by the modified Lee's scores. Nineteen patients (95%) were found the satisfactory, on the other hand only one patient (5%) was found unsatisfactory result due to post operative complications.

DISCUSSION

In our study 14 patient (70%) had the excellent result with modified Lee's scores³ from 16 to 18, 5(25%) patients had the modified Lee's score was 12 to 15 that was coincide with good result and 1(5%) patient had the fair modified Lee's score. Our one patient developed superficial wound infection, later unsightly disfiguring scar

and subsequently loss of SCM contour and had got fair outcome and another one patient develop slightly disfiguring scar but modified lee's score was good and outcome was satisfactory.

In Ferkel et al.1983 original series with the described operation showed 92% excellent to good outcome with one fair due to unsightly scar. Kashani et al 2008 showed 86% excellent to good results by bipolar release in skeletally mature patient with CMT.

Sudesh et al. 2010 operated 14 patients with patients age more than 10 years showed 71% excellent to good results. Patwardhan et al 2011 reported 67% excellent to good results in a study with patient age ranging from 17-31 by modified Ferkel's method. Seyhan et al 2012 showed marked improvement of head tilt and neck movement by the same technique with patient age between 06 to 23 years. In another study by Bhuyan 2014 of 11 patients showed excellent result in 08 patients (72%) and good in 3(27.2%) cases with patients age between 4-18 years, who followed similar operative technique, post operative rehabilitation and scoring system, which is almost similar to our study.

In our study, the lateral flexion deficit were found 54.8% in right side and 53.3% in left side with the lateral rotation deficit was 82.90% and 85.00% respectively in preoperative group but the lateral flexion deficit were found 8.0% and 9.0% with the lateral rotation deficit 2.5% and 2.1 on the right and left CMT patients in post operative group at final follow up. In a study on 12 adult patient by used the similar operative technique and scoring system.

Regarding distribution of patients by gender. Male were predominant by female. Male female ratio was 1.5:1.0 and male was 60% and female was 40%. In a similar study by out of 12 patients 9 (75%) cases were male and 03(25%) cases were female, which is similar to our study. In a study

by Bhuyan 2014 on 11 patient male patient 7(63%) and female 4(37%) which is similar to our study.

Regarding patients by common pre-operative symptoms of facial asymmetry. Thirteen (65%) patients had moderate facial asymmetry, 5(25%) patients had slight facial asymmetry and 2(10%) patients had the severe facial asymmetry. On the other hand 11(55%) patients had moderate head tilt and 9(45%) patients had severe head tilt, in preoperative group. On post-operatively 17(85%) patients had none of facial asymmetry and 3(15%) patients had the mild facial asymmetry and eleven (55%) patients had none of head tilt, 8(40%) patients had mild head tilt and 1 (5%) patients had moderate head tilt at final follow up. Another study done by Lim et al 42 neglected torticollis case where the mean preoperative cervico mandibular angle was 17.8° (range, $5.1^{\circ} - 37.1^{\circ}$) which was postoperatively reduced to 6.58° (range $0.2^{\circ} - 32.9^{\circ}$). In study by Bhuyan 2014, 7(63.5%) had none and 3(27.4%) had slight and 01(9.1%) had moderate facial asymmetry, which is almost similar to our study.

Regarding post-operative complications 1(5%) patients had superficial wound Infection and 2(10%) patients had disfiguring scar. On the other hand, 18(90%) patients had none of disfiguring scar. Sternocleidomastoid Muscle contour (SMC) was lost in 1(5%) patients and contour was maintained in 19(95%) patients. No significant complication in our study which is almost similar to other study conducted by Lim et al. 2014 and Patwardhan et al. 2011.

CONCLUSION

We found that CMT with bipolar release and sternal head lengthening achieved almost full range of cervical motion and good cosmetic outcome. It also restored the V shape configuration of the base of the neck which also ensures the cosmesis of the patient.

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Evaluation of the Management of Closed Olecranon Fracture (Mayo type IIB) by Pre contoured Olecranon Locking Plate

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ABSTRACT

Olecranon fractures are commonly seen in slip or fall onto the arm as well as in high energy trauma. In comminuted fractures, pre contoured olecranon locking plating provides a stable and long term reliable fixation. This prospective observational study was conducted to evaluate the functional outcome of open reduction and internal fixation of closed olecranon fractures (Mayo Type IIB) by a pre contoured olecranon locking plate at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka, Bangladesh over a period of 24 months. A total of 16 patients were included in this study. The follow up period was for 12 months. Patients of 15-60 years, of both sexes, with Mayo type IIB closed olecranon fractures of less than 3 weeks were included in this study. Mean age of the patients were 31.40 ± 12.08 years. Males were predominant 14(87.5%), females were 2(12.5%). 12(75%) of the injuries were caused fall from height and the rest 4(25%) were due to road traffic accident. The left and right sided distributions were 11 and 5 respectively. The average time interval between injury and operation was 8.1 ± 3.6 days. The mean operation time was 63 ± 9.8 minutes. The patients were followed up at 2nd, 6th, 12th, 24th weeks and at 12 months after surgery. Complete healing was achieved in all cases. The mean fracture healing time was 9.5 ± 1.6 weeks. According to the Mayo Elbow Performance score 8(50%) were considered excellent; 5(31.25%), good; and 3(18.75%), fair. In the present study it was observed that the satisfactory outcome was 81.25% and unsatisfactory was 18.75%. However, superficial infection occurred in 1 patient (6.25%) and elbow stiffness developed in 1(6.25%) patient. No deep infection, implant failure and non-union were found. Pre contoured Olecranon Locking Plate osteosynthesis is an effective and safe treatment option for comminuted olecranon fractures, allowing early joint motion and yielding satisfactory radiologic and clinical results.

Key Words : Olecranon fracture, pre-contoured locking plate.

INTRODUCTION

The olecranon process of the ulna enhances the stability and strength of the elbow. Because of its unique subcutaneous position, olecranon fractures are relatively common in adults. The incidence of the olecranon fracture is increasing and it accounts for 7% of fractures in adult patients and 38% of all elbow fractures.¹ Fracture of the olecranon can be caused either by direct trauma, such as

fall on the tip of elbow, or by indirect trauma, such as fall on a partially flexed elbow with indirect forces generated by triceps muscle avulsing the olecranon.²

Olecranon fractures are all intraarticular fractures and the primary goals in surgical treatment are anatomic reconstruction of joint surface, stable fixation to allow early mobilization, and achieving painless and functional elbow range of motion. Fractures due to direct trauma are

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usually comminuted fractures that impact into the interior of the distal humerus.³ They are treated operatively. Several operative options have been introduced. Weber and Vasey (1963) used 'traction absorbing wiring' technique irrespective of fracture configuration. This technique was further modified by AO group by placing two Kirchner wires obliquely to engage the anterior cortex of ulna in order to increase the stability of the fracture fixation and to prevent the wires from backing out. The tension band wiring has a significant rate of complication, like hardware prominence, wire backing out as well as decrease range of motion. Moreover, tension band principle does not work in comminuted fracture because of presence of comminuted fragment in anterior cortex of olecranon.

At present plating is considered as gold standard for comminuted olecranon fractures. In 1951, Zuelzer first used a hook plate in one patient with a comminuted olecranon fracture. Since then several plating techniques were used for fixation of olecranon fractures, such as one-third tubular plate, dynamic compression plate, pelvic reconstruction plate, etc. But they do not provide sufficient strength leading to hardware fatigue failure. Locking plating increase the stiffness of the fixation construct compared with traditional non-locking plating. Recently, investigators have observed that stiffer implants may result in mechanical successes.⁴

Following the AO principles of fracture management and internal fixation, a contoured 3.5 mm locking compression plate (LCP) with a proximal cortical lag screw and bicortical screw fixation is advised for multifragmentary articular fractures of the olecranon. The application of a contoured LCP in combination with an intramedullary screw has shown both biomechanically and clinically good results for comminuted olecranon fractures. As alternative fixation device to treat comminuted fractures of the olecranon, the AO group recommends the 3.5-mm LCP olecranon plate.⁵ Considering these facts, this study was carried out to evaluate the functional outcome of the treatment of closed comminuted olecranon fractures (Mayo type IIB) by precontoured olecranon locking plate.

Features of Precontoured Olecranon Locking Plate :

Plates are precontoured for anatomical fit, available for left & right side, proximal portion of the plate with 8 locking holes, combi hole accept 3.5 mm locking, 3.5 mm cortex bone screws, and proximal and distal holes are for 1.6mm or 2.0mm Kirschner wires.

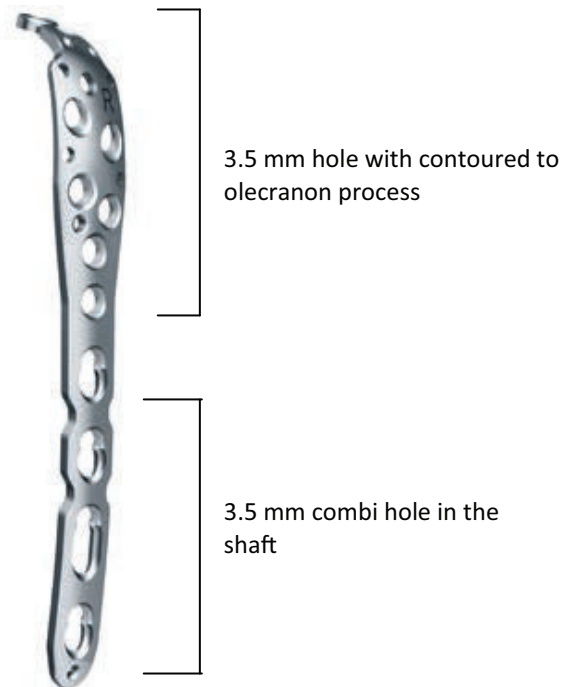


Fig.-1: Precontoured Olecranon Locking Plate (Synthes).

MATERIALS AND METHODS

This prospective observational study was carried out at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-e-Bangla Nagar, Dhaka; from July, 2014 to June, 2016. Sample size was 16. Radiologically proven cases of closed comminuted olecranon fractures of ulna (Mayo type IIB) admitted in NITOR were the study population.

Inclusion criteria were, closed comminuted olecranon fractures (Mayo type II-B) of less than 3 weeks, age 15 to 60 years, and both sexes. Open fractures with distal neurovascular deficit, elbow dislocation and polytrauma cases were excluded from the study.

OPERATIVE PROCEDURE

All the cases were operated under brachial plexus block. With the patient in a lateral decubitus position on the operating table, with the injured arm in a nonsterile tourniquet strapped to an arm holder to allow a full range of flexion and extension, after scrubbing, painting and drapping, a dorsal midline incision gently curving around the lateral aspect of the olecranon tip was made, extending from 2 to 3 cm proximal to the olecranon, distally upto about 6 to 7.5 cm, close to the lateral border of the shaft of the ulna. After incising the deep fascia, the ulna was exposed between the flexor and extensor carpi ulnaris muscles. Following irrigation and debridement of the

fracture hematoma, fracture fragments, specially the intermediate fragments were disimpacted under direct view. Reduction was performed by using clamp, and was held by 2 Kirschner wires drilled antegrade from the medial and lateral margins of the proximal fragment. The precontoured locking plate was then applied to the dorsal surface of the olecranon with the proximal portion of the plate being applied deep to the triceps tendon. The incision wound was closed in 3 layers keeping a drain tube in situ. A well-padded plaster slab was applied.

POST-OPERATIVE CARE :

Post operatively, the limb was elevated. Active fingers and shoulder movements were started on day 1. Drain was

removed on day 2. Sutures and posterior slab were removed after 2 weeks. Then passive and assisted active elbow motion was started, and elbow was supported in a elbow bag between the exercise periods for 7 days. After 3 weeks, elbow bag was discontinued and active movement was advised.

Patients were repeatedly taught about the rehabilitation program. All patients were evaluated both clinically and radiologically at the scheduled follow up sessions at 2nd, 6th, 12th, 24th weeks and at 12 months, and were managed accordingly.



Fig.-1: Positioning of the patient



Fig.-2: A dorsal midline incision curving around the lateral aspect of the olecranon tip



Fig.-3: Reduction held by 2 K-wires



Fig.-4: Placement of olecranon plate



Fig.-5: After closure

RESULTS :

A total of 16 patients with closed comminuted olecranon fractures (Mayo type II-B) were included in the study (n=16).

The mean age was 31.40 (± 12.08) years, ranging from 20 – 43 years; out of 16 patients 9(56.25%) were of 20 to 29 years. 14 (87.5%) patients were male and 2(12.5%) patients were female with the male female ratio 7:1. 11(68.75%) patients had left side involvement and 5(31.25%) patients had right side involvement.

12(75%) cases were caused by fall from height and the rest 4(25%) were due to road traffic accident. Regarding occupation, 7(43.75%) patients were students, 5(31.25%) were service holders, 2(12.5%) were businessmen, 1(6.25%) was farmer and 1(6.25%) was housewife.

10(62.5%) patients were operated within 07 days of injury, 4(25%) were operated within 14 days and rest 2(12.5%) within 21 days of injury. The mean injury-surgery interval time was 8.1 (±3.6) days. The duration of most of the patients’ operation was 61-90 minutes; the mean operative time was 63 (±9.8) minutes.

Table 1
Duration of radiological union (weeks)

Union (weeks)	No. of cases (n=16)	Percentage
8-10 weeks	12	75
10-12 weeks	4	25
12-14 weeks	0	0
Delayed union	0	0
Non-union	0	0
Total	16	100.00

Table 1 shows the duration of radiological union. Most of the fractures 12(75%) were united within 8-10 weeks time. Mean duration of radiological union was 9.8 (± 1.6) weeks.

Table-II
Range of movement of elbow

Motion	Frequency	Percentage
Arc > 100 f	12	75
Arc 50 f - 100 f	4	25
Arc <50 f	0	0
Total	16	100.0

According to the Mayo Elbow Performance Scoring criteria the arc of motion of the elbow was >100 f in 12(75%) patients, arc 500 to 100 f in 4(25%) patients.

Regarding complications, 1 (6.25%) patient had superficial surgical site infection, 1 (6.25%) developed elbow stiffness and the rest 14(87.5%) had no complication.

Table-III
Functional outcome assessment by Mayo Elbow Performance Score

Grading	Number of cases	Percentage
Excellent (>90)	8	50
Good (75 to 89)	5	31.25
Fair (60 to 74)	3	18.75
Poor (< 60)	-	-
Total	16	100.0

Table-III shows 8(50%) patients had excellent outcome, 5(31.25%) had good outcome and 3(18.75%) had fair outcome.

According to Mayo Elbow Performance Score, excellent and good outcome are considered as satisfactory & fair and poor outcome are considered as unsatisfactory. So, in this study, 13 (81.25%) had satisfactory, and 3 (18.75%) had unsatisfactory outcome.

DISCUSSION:

The objectives of the operative treatment of comminuted olecranon fractures are realignment of the longitudinal axis, restoration of joint stability, articular congruity and a pain free functional arc of motion of the elbow. This prospective study was carried out with an aim to evaluate the treatment of closed comminuted olecranon fracture (Mayo type II-B) by precontoured olecranon locking plate.

The mean age of the patients in the study was 31.40 (±12.08) years; 9(56.25%) of them were in the age group 20-29. Agrahari, et al.(2015) reported that most of the patients were in age group 21-30 (53.33%) with mean age of 31 years.⁶ So, it is evident that the closed comminuted olecranon fractures occur commonly in young active people.

In this series, majority 87.5% of the patients were male, which indicates that male are more affected than female working outside and being more prone to injury.

In the current study, 75% of injuries were caused by fall from height and 25% were due to road traffic accident.

Christopher et al (2001) reported the mechanism of the injury were fall from height in 80% cases.⁷ David et al (2000) stated that most common cause of comminuted olecranon fractures included falls, motor vehicle injuries and assaults.⁸

In this study 10(62.5%) patients were operated upon within 07 days of injury. Mean injury surgical interval time was 8.1 (\pm 3.6) days. In a series by Buijze, et al. the time interval between the injury and operation was less than 1 week which is consistent with the present study.⁹

In this study, 12(75%) fractures were united between 8-10 weeks time and 4(25%) between 10-12 weeks time. There were no delayed union or nonunion. Mean duration of radiological union was 9.8 (\pm 1.6) weeks. 1(6.25%) patient developed superficial surgical site infection was managed by empirical oral antibiotics, 1(6.25%) patient developed elbow stiffness due to lack of proper physiotherapy and also for noncompliance. In a series of nineteen patients by Buijze & Kloe, the mean time of union was 4 months, the rate of superficial infection was 10.52% that was resolved after debridement and systemic antibiotic.⁹ These results are closely resemble to the current study.

In the current series, final outcome of all patients were assessed by using Mayo Elbow Performance Index (MEPI), which measured arc of motion, status of pain, stability and some specific functions. In this study, 8(50%) were excellent, 5(31.25%) were good and 3(18.75%) were fair. In a series of fourteen patients, Siebenlist et al., (2010) reported that the results were excellent in 12(63.15%) and good in 2(12.5%) according to MEPI.⁵

According to MEPI scoring system satisfactory result (excellent and good) were 81.25% and unsatisfactory (fair and poor) were 18.75%. The outcome of comminuted olecranon fracture (Mayo type IIB) treated with pre contoured olecranon locking plate demonstrated satisfactory results in majority of case.

The locking compression plate (LCP) is part of a new plate generation requiring an adapted surgical technique and new thinking about commonly used concepts of internal fixation using plates. Understanding of the mechanical background for choosing the proper implant

length and the type and number of screws is essential to obtain a sound fixation.

CONCLUSION :

Large scale studies with longer follow-up are essential requirement for an optimum outcome comparison.

Open reduction and internal fixation of closed comminuted olecranon fractures with pre contoured olecranon locking plate can be strongly recommended in an attempt to provide enough stability to allow for the early postoperative rehabilitation with predictably high rate of fracture union.

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Outcome of Uncemented Primary Total Hip Arthroplasty in 20-50 Years Age Group with Secondary Osteoarthritis due to Avascular Necrosis of Femoral Head

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ABSTRACT

Uncemented primary total hip arthroplasty (THA) is an effective method to treat the younger patients with secondary osteoarthritis due to avascular necrosis of femoral head, being more durable. This prospective observational study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka over a period of 24 months, on 20 diagnosed cases of secondary osteoarthritis due to avascular necrosis (AVN) of femoral head, in 20-50 years age group. The mean age of the patients were $36(\pm 1.85)$ years ranging from 25 to 50 years. 16 (80%) were males and 4 (20%) were females with a male and female ratio 4:1. 14 (70%) were on right hip and 6 (30%) were on left hip. 14(70%) cases were idiopathic, 4 (20%) were corticosteroid induced, 1 (5%) with non united fractured neck of femur and 1 (5%) was a sequelle of Perthe's disease. All cases were treated by uncemented THA. The average duration of hospital stay after operation was $9.6(\pm 0.57)$ days ranging from 7 to 15 days. 2 (10%) patients developed surgical site infection in early post operative period. 1 (5%) developed anterior and 1 (5%) developed posterior hip dislocation. The mean follow-up was 8 months ranging 3 to 18 months. Functional outcome was observed according to Harris Hip Score. The mean preoperative Harris hip score was 35.95, which improved significantly to 76.45 after operation ($p < 0.05$). 5(25%) cases had excellent, 3(15%) good, 8(40%) fair and 4(20%) cases had poor outcome. The functional outcome of primary uncemented THA using modern second generation uncemented stems with circumferential porous HA-coating was found satisfactory in this study during this short term follow up period.

Key words : Secondary osteoarthritis, avascular necrosis, uncemented primary total hip arthroplasty.

INTRODUCTION

Total hip arthroplasty (THA) is the most commonly performed adult reconstructive hip procedure for the hip diseases like Avascular Necrosis, Rheumatoid arthritis, Ankylosing spondylitis, Perthe's diseases, Developmental dysplasia of hip, etc.¹

History of THA is dynamic and research continues to improve the outcome especially in young patients. Considerable laboratory and clinical investigations are being carried out in an effort to eliminate the use of cement and provide for biological fixation of femoral component.¹

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Modern total hip arthroplasty is a very useful procedure with fewer complications.² With longer follow-up on larger group of patients, important problem of loosening especially of acetabular component, mal-alignment induced instability and dislocation, proximal femoral osteopenia, complication with bone cement, etc. have come into sharp focus. In case of younger patients recent advancement is various types of noncemented fixation, computer assisted design and isoelastic materials.

The basic concept of low frictional torque arthroplasty has become established and the metal on polyethylene articulation is now standard in the total hip arthroplasty.³

Because of excessive wear and tissue reaction polytetrafluoroethylene was replaced by high-density polyethylene (HDPE) and later by ultra high molecular weight polyethylene (UHMWPE) for acetabular component.

Modern second-generation uncemented stems, with proximal circumferential porous or Hydroxy apatite (HA) coating, seems to be a good choice for young patients in secondary osteoarthritis (OA). Similarly, modern press-fit porous and HA-coated cups appear to have good invention against loosening in young patients. A good long term outcome has been recorded for patients under 50 years of age with modern uncemented (porous and/or HA-coated) femoral and acetabular components.⁴

The popularity of uncemented THR has ebbed and flowed with surgical fashion. The revival of interest in the uncemented articulation appears due to increase awareness of the long term problems like loosening the bond between implant and bone, migration of component due to loss of bone stock, fatigue of the femoral part of the articulation, fractures of the stem of the prosthesis, the cement or occasionally the bone around the implant and late onset of infection. In some patients revision surgery is necessary, possibly on more than one occasion and the problems of revising on cemented implant remain considerable.⁵

Cementless total hip replacement has been introduced after experimental and clinical studies by Albrektsson from Sweden proved that titanium implants are capable of osteointegrating without cement. The porosity of the prosthetic surface, bone friendly properties of the implant materials and reduced friction and wear & tear of prosthetic surfaces in contemporary designs using titanium as a frame of prosthetic components and alumina ceramic as a prosthetic bearing, are decisive factors for firm and long-lasting bonding between the implant the host bone.

The outcome of uncemented primary total hip arthroplasty depends on many factors including component design, patient selection and surgical technique. Particulate debris from polyethylene wear and osteolysis remain the primary factors limiting the longevity of hip prostheses.⁶

Early overall assessments are usually carried out with clinical scoring systems based on relief of pain and improvement in function and movement. Harris hip score is most common and popular for evaluation of functional outcome in hip scoring system.⁷

The purpose of the study is to evaluate the early results of primary uncemented total hip arthroplasty in our country and assessing factors influencing its outcome.

MATERIALS & METHODS

This prospective observational study was carried out at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), and some other hospitals in Dhaka on 20 patients. The study period was 24 months ; from January 1, 2013 to December 31, 2014. Patients of 20-50 years age group, of both sexes due to avascular necrosis (AVN) of femoral head were included in this study.

Purposive sampling was done according to availability of the patients. All patients were subjected to a thorough clinical examination and radiological investigation in order to reach a correct diagnosis. All cases were treated by total hip arthroplasty using uncemented modular porous coated prostheses.

Patients were followed up at the outpatient department, as follows-

1st follow-up - 6 weeks after operation

2nd follow-up - 3 months after operation

3rd follow-up - 6 months after operation

4th follow-up - 1 year after operation

Every patient was evaluated radiologically, and clinically by modified Harris Hip Score. The functional status of the hip was then graded as excellent, good, fair or poor on the basis of points obtained in the final Harris Hip Score out of total score 100. Excellent and good results were considered as satisfactory, fair and poor results were considered as unsatisfactory.

Data was collected with a pre-tested structured questionnaire containing history, clinical examination & radiological findings, peri-operative and post operative follow-up findings in a formulated sheet.

Data were processed and analyzed using SPSS software. Final outcome was evaluated by 't' test. For all analytical tests, the level of significance was set at 95% CI and $p < 0.05$ was considered as significant.

Surgical procedure

Under epidural/spinal anaesthesia, after surgical scrubbing, painting and draping in lateral position, majority of the cases were exposed by the posterior (Moore) approach. The operating surgeons were not same in all cases.

After the skin incision, the deep fascia was incised in line with skin incision. Then fascia over gluteus maximus was divided and the muscle was split bluntly along the oblique course of its fibers and the margins were retracted to reveal the short external rotators. These muscles and if necessary, part of the piriformis and quadratus femoris were divided close to the insertion and reflected backward to protect the sciatic nerve. The posterior aspect of the joint capsule was then exposed and opened by an inverted 'T'-incision. The thigh and knee were flexed 90° rotated internally and hip was dislocated posteriorly. Level and angle of the proposed osteotomy were marked and osteotomy of the femoral neck was done with electric saw.

Then bony preparation of the acetabulum was achieved by gradual, sequential reaming. Osteophytes were nibbled and removed with osteotome. Reaming was completed when all cartilages had been removed. True lateral position was maintained before inserting acetabular component. The size of the implant was determined by the diameter of the last reamer used. The optimal degree of anteversion was maintained between 10° & 20° degree, with inclination between 40° & 45° degree. Fixation was augmented with screws, in the postero-superior quadrant.

Then the bony preparation of femur was achieved by broaching and sequential reaming with progressively larger reamer until firm cortical reaming was felt. Appropriate sized femoral component were inserted after trial reduction.

After reduction of the hip, capsule was closed by 2 or 3 interrupted absorbable sutures. The short external rotators were sutured. A close suction drain was inserted deep to the gluteus maximus muscle. Then the wound was closed in layers.

Results

Total 20 patients (20 hips) were selected for this study. Data were collected with the help of open ended structured questionnaire. All the patients were followed up from 3 to 18 months.

The mean age of the studied patients were 36 ± 1.85 years ranging from 25 to 50 years. In this study most of the patients 7(35%) belong to the age group 21-30 and 41-50 years, followed by age group 31-40 6(30%).

Out of 20 patients 16 (80%) were males and 4 (20%) were females with a male and female ratio 4:1. 14 (70%) were on right hip and 6 (30%) were on left hip

Regarding aetiology, 14(70%) cases were idiopathic, 4 (20%) were corticosteroid induced, 1 (5%) was post traumatic with non united fractured neck of femur and rest 1 (5%) was a sequelle of Perthe's disease.

The average duration of hospital stay after operation was 9.6 ± 0.57 days ranging from 7 to 15 days.

Regarding complications, 2 (10%) patients developed surgical site infection in early post operative period. 1 (5%) developed anterior and 1 (5%) developed posterior hip dislocation.

The severity of the pain significantly decreased following operation. After operation, no pain was observed in 13(65%) patients, 6(30%) patients had slight pain and 1(5%) had mild pain.

Before operation, 5(25%) patients had moderate limping and 12(60%) had severe limping. Following operation, 14(70%) had no limping and 6(30%) had slight limping ; so limping significantly decreased following operation ($p < 0.05$).

Pre operatively 3 (15%) patients were unable to walk and 10(50%) used crutch or cane. After operation 12(60%) patients could walk without support. The difference was statistically significant ($p < 0.05$).

The distance of walking significantly increased following operation ($p < 0.05$). Before operation, 7 (35%) patients could manage to move from bed and chair and 6 (30%) could move in the indoor only. After operation the distance of walking improved in all patients and 13 (65%) patients could walk unlimited.

8(40%) patients were unable to climb stairs and 4(20%) were able to climb using railing before operation. Following operation, 9(45.0%) patients were able to climb stairs independently, 9(45%) with using railing and 2(10%) were unable during the last follow up.

Ability of wearing shoes increased significantly after operation ($p < 0.05$). Pre-operatively, 16(80%) patients were unable to wear shoes and 3(15%) were able with difficulty. Following operation, 14(70%) patients were able to wear shoes with difficulty and 4(20%) patients with ease.

11(55%) patients were unable to sit on chair and 7(35%) patients could manage to sit on high chair before operation. The post operative capacity to sit on chair increased significantly ($p < 0.05$). All the patients could sit on chair after operation, where 12(60%) could use ordinary chair.

Before operation 15(75%) patients were unable to use public transport whereas 16(80%) patients were able to use public transport after operation which is statistically significant ($p<0.05$).

In this study, preoperative Harris hip score was 15 to 51 (mean 35.95), which improved significantly to 44 to 96 (mean 76.45) after operation ($p<0.05$). The following table shows the final outcome.

Table-I

Distribution of patients by pre- and post- operative functional outcome

Functional outcome	Pre-operative ($n=20$)		Post-operative ($n=20$)		Paired "t" statistics
	No	%	No	%	
Poor	20	100	4	20	Mean of differences 40.4±2.94 $t=13.74$ P value<0.05
Fair	0	0	8	40	
Good	0	0	3	15	statistically significant
Excellent	0	0	5	25	
Total	20	100	20	100	



Fig.-1 : Pre operative x-rays



Fig.-2: Post operative x-rays



Fig.-3: 6 Months Follow up pictures : sitting on ordinary chair & climbing stairs

Discussion

Evaluation of total hip arthroplasty is dynamic and research continues to improve the result especially for young patients.⁸ The Charnley prosthesis most successful long lasting. It became a “gold standard” for hip replacement and is still used in modified versions.⁹

The success of THA depends on careful patient selection, evaluation of the patient as well as meticulous attention to operative technique and asepsis.

In this study, 20 hips of 20 patients suffering from avascular necrosis were included, who were treated by uncemented modular porous coated prostheses.

The mean age of the patients was 36 ± 1.85 years ranging from 25 to 50 years. 16(80%) patients were male and 4(20%) were female. All patients were operated unilaterally, 14(70%) on right side and 6(30%) on left side.

Poor outcome observed in 4 patients and fair in 8 patients. Causes of poor and fair outcome were due to persistence of hip pain and short follow-up period.

Average duration of hospital stay was 9.6 ± 0.57 days ranging from 7 to 15 days. Considering the Per-operative complication, 1(5%) patient had difficulty in preparing acetabular component which was found deficient during reaming and finally ended up with mild protrusion of the acetabulum. 1(5%) patient developed anterior thigh pain and another 2 (10%) had superficial infection which resolved with dressings and antibiotics, No late deep infections were noted. 1(5%) developed anterior hip dislocation 5 days after operation due to more anterior offset which was corrected next day by maintaining appropriate anterior offset. Another 1 (5%) developed posterior hip dislocation 2 months later due to accidental fall during walking without walker, which was managed by close reduction under general anaesthesia. In a study on 241 hips with an average follow up of 5 years, Kim et al found 3% superficial wound infections and 11% intra-operative fractures.¹⁰

In this study, pain and limping were decreased significantly after operation ($p < 0.05$). Distance walked by the patient increased significantly after operation ($p < 0.05$). Also, the activity in stairs and capacity to wear shoes improved significantly after operation ($p < 0.05$). The proportion of using public transport increased significantly even during this short follow-up period.

Preoperative mean Harris Hip Score was $35.95 (\pm 8.45)$, ranging from 15 to 51. After operation the mean Harris Hip Score increased to $76.45 (\pm 10.91)$ ranging from 44 to

96 and the difference was statistically significant ($p < 0.05$). In the the study carried out by Kim et al, the mean Harris Hip Score had improved from 44 to 98.¹⁰

Excellent outcome was observed in 5(25%), Good in 3(15%), fair in 8(40%) and poor in 4(20%) patients, giving a total of 8(40%) satisfactory outcome which is nearly similar to the result of the study by Kim et al, where excellent result was obtained in 19% patients, good in 40% and fair in 6% patients after 2 years follow up.¹⁰

Mont et al have reported excellent early results with the porous coated anatomic hip in patients less than 45 years of age where only 12% had clinical or radiological failure.¹¹ This is considerably better than the results of cemented arthroplasty for young patients.¹²

In this study, no postoperative major complication like DVT, ARDS and deep seated infection were found. 2 patients were in risk of DVT, so they were treated by low molecular weight heparin.

The result of total hip arthroplasty have longest track record. As our study period was only 2 years which is not sufficient for overall assessment and comment. The limitations of this study are as follows :

Small sample size.

Non-randomized sampling.

Non homogenous group of patients

Shorter follow up period.

CONCLUSION

Modern second generation uncemented stems with circumferential porous HA-coating is an excellent and promising method to improve the quality of life in young patients with secondary osteoarthritis due to avascular necrosis of femoral head. Large scale studies with longer follow up are essential for an optimum outcome evaluation.¹³

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Analgesic Effect of Ketorolac as an Adjuvant to Intravenous Regional Anaesthesia (IVRA) Bier's Block for Hand and Forearm Surgery

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ABSTRACT:

Tourniquet pain and lack of postoperative analgesia are the main disadvantage of intravenous regional anaesthesia (Bier's block). To compare the analgesic effects of combination of 0.5% lidocaine plus ketorolac in intravenous regional anaesthesia (IVRA) with those of lidocaine 0.5% alone to prevent tourniquet pain and postoperative pain after IVRA. Randomized control trial. The study was carried out at the department of Anaesthesia, NITOR from July 2015 to June 2016. 60 adult patients undergoing hand and forearm surgery were included in this study. Patients were randomly assigned into two groups (30 patients in each). Control group -C received IVRA with lidocaine in a dose of 200mg of 40 ml of 0.5% solution only. Ketorolac group -K received lidocaine in dose of 200mg 40ml of 0.5% solution plus Ketorolac 30mg. The onset time for sensory and motor block, recovery time of sensory and motor block, the onset time of tourniquet pain after cuff inflation at 5 min, 10 min, 15 min, 20 min, 30 min, and post operative pain intensity was measured by visual analog scale (VAS) at operation time and postoperatively after cuff deflation at 0.5 hr, 1hr, 1.5 hr, and 2hr, respectively. The analgesic efficacy recorded on the basis of VAS of the two groups was compared using Student 't' test. P value of <0.05 was considered statistically significant. In group -C 16(53.33%) males and 14(46.6%) females were enrolled for this study while in group-K there were 17(56.66%) males and 13(43.33%) females. The mean ages of the patient in group -C was (34.03±8.02) years while in group-K was (34.73 ± 6.07) years. Patients were also classified according to ASA classification in which 40 patients were classified as ASA-I and 20 patients as ASA-II. Group -K which received Ketorolac in addition to lidocaine for Bier's block had low visual analog score as compared to group-C which received lidocaine only for Bier's block. P value obtained after the comparison of the mean VAS of the two groups at 5min, 10min, 15min, 20min, 30min, peroperative was insignificant and 0.5 hr, 1hr, 1.5hr, 2hr, postoperatively mean VAS was significantly higher in group-C as compared to group-K (p<0.001). Ketorolac as an adjuvant improves the tourniquet pain and the postoperative analgesia markedly when used with lidocaine in intravenous regional anaesthesia (IVRA) Bier's block.

Key words: Intravenous regional anaesthesia, Ketorolac, lidocaine, Visual analog scale, Postoperative pain.

INTRODUCTION:

In 1908, August K.G. Bier presented intravenous regional anaesthesia (IVRA) as a method to produce analgesia in an extremity especially for hand and forearm surgery¹. Bier block is a simple, safe, cost effective and trustable technique of regional anaesthesia for operations performed on extremities but it has some obstacles such as pain of

tourniquet, poor postoperative analgesia and local anesthetic toxicity². Now-a-days lidocaine 0.5% is a drug of choice for intravenous regional anaesthesia in united states of America³.

If we compare it with general anaesthesia, intravenous regional anaesthesia lacks the complications associated with general anaesthesia⁴.

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In an attempt to improve intra operative and postoperative quality of the IVRA, several adjuvant can be added i.e opioids⁵ Ketamin⁶ muscles relaxant⁷, Non-steroidal anti inflammatory drug⁸, Clonidine⁹ and dexmedetomidine¹⁰ and neostigmine¹¹.

In order to overcome tourniquet pain and postoperative pain associated with intravenous regional anaesthesia, intravenous Ketorolac (toradoline) an NSAID, is very useful addition to 0.5% lidocaine¹². It has been recommended that ketorolac (30mg) when added with lidocaine (0.5%) results in significant postoperative pain relief¹³. Recent researches has shown that for adequate postoperative pain relief Ketorolac when combined with 0.5% lidocaine improve postoperative analgesia¹⁴. The aim of the study was to compare analgesic effects of adding Ketorolac to the local anesthetic for IVRA on the quality of intraoperative (tourniquet pain), postoperative analgesia during forearm and hand surgery.

PATIENT & METHOD:

After obtaining informed written consent from all patients, 60 patients of both sexes, aged 18-60 years, ASA I-II, scheduled for forearm and hand surgery were included in this study. The study was carried out in the department of anesthesia, NITOR from July 2015 to June 2016. Exclusion criteria from this study were, allergy to any study drugs, Sickle cell anemia, peripheral vascular diseases, post traumatic injuries, nonco-operative patients, history of epilepsy and operation time longer than one hour. Patients were divided into two equal groups by random number method (Group-C and group-K). The number of patients in each group was 30. Preanaesthetic assessment was carried out preoperatively.

An intravenous cannula 22G was established in the arm to be operated as distally as possible preferably on the dorsum of the hand for injecting the local anesthetics, a second one 20G was inserted in contralateral one for injection of drugs (sedatives for resuscitative drug) if an emergency situation arise. The operating upper extremity was lifted to 90° for 3 minutes then vein was emptied from the distal to proximal by using bandage of Esmarch, after protection of the skin of upper arm by soft role bandage, double cuff Pneumatic tourniquet was applied. The proximal cuff was inflated to a pressure of 250mm Hg. then the Esmarch bandage was removed. Then local anaesthetic solution was injected over 90sec. The sensory block was assessed every 30 seconds in all dermatomes innervated by median, ulnar and radial nerves by using pinprick test with 22G needle. The motor block was evaluated by asking the patients to flex and extend their fingers and wrist. Complete motor block was achieved when patient can not flex and extend their fingers and wrist. After complete sensory and motor block were achieved, distal cuff was inflated to 250 mmHg and the proximal cuff tourniquet was deflated. During surgery mean arterial pressure (MAP) and Heart rate (HR), SPO₂ were recorded

every 5 minute, tourniquet pain assessed by using VAS (visual analog scale) recorded 5min, 10min, 15min, 20min, 30min after tourniquet inflation. At the end of surgery, deflection of tourniquet at least 30min was passed after tourniquet inflation before starting to deflect the tourniquet. After end of surgery, patients were transferred to the PACU (post anesthetic car unit) for 2hours and pain intensity was measured by VAS on 30min (0.5hr), 1 hr, 1.5hr and at 2 hours after deflection of the cuff, and completions (side effects) if arose was to be documented.

All equipment and drugs to deal with a case of local anesthetic toxicity were kept in mind. General anesthesia was to be taken it needed. The data was analyzed by computer using SPSS version 15.0. Descriptive statistics such as mean and SD (standard deviation) was calculated for age and frequency were calculated for gender. The analgesic efficacy recorded on the basis of VAS of two groups, was compared using student 't'-test, P value of less than 0.05 was considered statistically significant.

RESULT:

Table-I

Demographic profile (age, gender, weight) of the patients in to groups was compared as well as duration of tourniquet (min.), duration of surgery,

Variables	Groups-C	Group-K	p-value
Age (years)	34.03±8.02	34.73±6.07	0.34
Gender (m/f)	16/14	17/13	1.00
Body weight	47.26±10.58	53.23±12.25	0.095
Duration of tourniquet	49.7±9.9	47.8±11.90	0.5 74
Duration of surgery	40.13±3.82	42.47±7.82	0.122

Demographic data between the groups (mean ± SD)

Table II

Types of Cases	Group-C	Group-K	p-value
CTS (Carpal Tunnel Syndrome)	12	10	
Ganglion cyst.	6	5	
Trigger finger	3	5	0.982
Tendon release	3	3	
Colle's fracture	4	3	
Excision biopsy	2	4	

Values were expressed as mean ± SD between groups. Analysis were done by student 't' test. Values were expressed as significant if p<0.05. There was no significant differences between the two groups as regards demographic data, duration of surgery, duration of tourniquet, types of cases (Table I and Table II).

Table-III
Intra operative and postoperative criteria for two groups (mean ± SD)

	Cases	Group-C	Group-K	p-value
After inflation of tourniquet	Onset time of sensory block(min.)	5.64±0.76	4.65±0.8	<0.001
	Onset time of motor block	6.91±1.04	5.19±0.8	<0.001
After deflation of tourniquet	Sensory recovery time	13.26±0.7	27.35±78	<0.001
	Motor recovery time	18.04±7.76	33.03±7.9	<0.001

The onset time for sensory & motor block was faster in Ketorolac group (5.64±0.76 min and 5.19 ±0.81) as compared with Control group (P<0.001).

Table-IV
Tourniquet pain (VAS) after inflation of tourniquet between two group compared.

Time	Group-C (n=30)	Group-K (n=30)	p-value
5 min	1±0.41	0.5±0	>0.05
10 min	1±0.5	0.5±0	>0.05
15 min	2±0.6	1.6±0.4	>0.05
20 min	3±0.9	1.4±0.5	<0.001
30 min	36 ±0.94	1.6±0.5	<0.001

As regards VAS there was insignificant difference between the two groups peroperatively at 5 min, 10 min, 15min, after tourniquet inflection (p<0.05). At 20 min and 30 min after tourniquet inflation VAS was significantly higher in control group-c as compared to the Ketorolac group-k.

Table-V
Postoperative pain (VAS) in two group after tourniquet-deflation.

Time	Group-C	Group-K	p-value
0.5hr	2.1±0.4	1.2±0.04	<0.001*
1.hr	2.6±1.2	1.0±0.4	<0.001*
1.5 hr	2.8±1.3	1.6±0.5	<0.001*
2 hr	3.8±1.3	1.8±0.6	<0.001*

Data expressed as mean ± SD, P<0.05 is considered significant.

As regards, VAS there was significant difference between two group, at 0.5hr, 1hr, 1.5hr and 2hr postoperatively after deflation of tourniquet. VAS was significantly higher in Control group as compared to the Ketorolac groups (P<0.001).

DISCUSSION

The mechanism of action of Bier's block is unclear, but may include; compression by the tourniquet, ischemia, drug action on nerve trunks and on peripheral nerve

endings¹⁵. Tourniquet pain and lack of postoperative analgesia are the main disadvantage of IVRA. In several studies it was tried to find a local anesthetic mixture that allows prolonged duration of analgesia after tourniquet release. In this context NSAID' drugs, opioids, nitroglycerine, magnesium, ketamine, muscle relaxants have been used as an adjuvant¹⁶⁻²². Ketorolac is a non steroidal anti inflammatory drug that inhibits the synthesis of pain and inflammatory mediators at the site of surgical trauma by inhabiting the action of cyclooxygenase (COX) enzymes and thus interferes with the arachidonic acid pathway. At the site of surgical trauma, there is increase of the level of prostaglandin E&I₂ that causes sensitization of nociceptors. Ketorolac suppresses the production of those mediators through inhibition of COX-1 and COX-2.

Vanoset et al were the first to used Ketorolac in IVRA in patient with reflex sympathetic dystrophy and they concluded that Ketorolac IVRA produced prolonged analgesia in most of the patient of reflex sympathetic dystrophy without serious side effects²³. Steinberg R et al studied the effect of adding different doses of Ketorolac (0,5,10,15,20,30 and 60mg) to lidocaine 0.5% in IVRA. The documented that Ketorolac is useful addition to lidocaine in IVRA and 20mg Ketorolac is effective as 60mg²⁴.

Rueben S et al, studied the effects of adding 60mg Ketorolac to lidocaine in IVRA in patients undergoing hand surgery. They concluded that the use of Ketorolac as an adjuvant to lidocaine IVRA produced more effective control of postoperative pain²⁵.

In our study combination of lidocaine 0.5% and Ketorolac 30mg has been used and we compared between lidocaine alone, lidocaine with Ketorolac for tourniquet pain and postoperative pain relief. Our result support the previously performed studies and concluded that Ketorolac improved tourniquet pain tolerance and postoperative analgesia markedly when used with lidocaine in IVRA. Advantages of IVRA with Ketorolac and lidocaine, especially in our country is that less expensive, cost effective, cheap, reduced hospital stay, avoids side effects of general anesthesia.

In conclusion, the addition of Ketorolac to lidocaine for IVRA improved the quality of intraoperative and postoperative analgesia without side effects. Ketorolac was superior in delaying the onset of tourniquet pain and postoperative analgesia.

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“Study of Management of Closed Tibial Shaft Fractures with Interlocking Nail under C-arm Guidance” Our experience in 250 Bedded General Hospital

Narayan Chandra Karmakar¹, Md. Mokhlesur Rahman²

Abstract

Tibia is the most commonly fractured long bone in the body with an annual incidence of tibial shaft fractures is 2 per 1000 individuals. It is very important for weight bearing long bone in the lower limb. Most important thing is the management of fracture of shaft of Tibia which is usually responsible for nonunion and is challenging for the orthopaedic surgeon. So operative treatment for the fracture of shaft of Tibia is close interlocking intramedullary nailing under C-ARM guidance is preferable.

Key words: Key words: Tibial Shaft, Closed Shaft Fractures, Interlocking Nail, C-arm Guidance Our experience

INTRODUCTION

Tibia is the most commonly fractured long bone in the body with an annual incidence of tibial shaft fractures is 2 per 1000 individuals. Since the tibia is the large bone of the body and one of the principal load bearing bones in lower extremity, fractures can cause prolonged morbidity, extensive disability unless treatment is appropriate. Since the tibia is the large bone of the body and one of the principal load bearing bones in lower extremity, fractures can cause prolonged morbidity, extensive disability unless treatment is appropriate. Various techniques are now available for treatment of diaphyseal fractures of tibia where Orthopaedic surgeon must be aware of the advantages, disadvantages and limitation of each to select the proper treatment for each patient. The type, location, degree of comminution, age, patients social and economic demands may influence the use of non-operative treatment of tibial fractures that are widely displaced or that are the result high-energy forces is associated with a high prevalence of mal union, stiffness of the joint, and poor functional outcome. Its medial surface being subcutaneous, it often suffers from fractures. Furthermore, the blood supply to the tibia is already precarious and it is guarded by the presence of hinge joints at the knee and the ankle which allow no adjustment for the rotatory deformity. Sisk (1983) noted treatment of diaphyseal fractures by techniques that require prolonged immobilization of the

extremity has obvious - disadvantages. Hospitalization or convalescence or both are prolonged, limitation of joint movement common, and malunion and nonunion may occur. The perfect method of fracture treatment would safely fix the fracture so firmly that soft tissues and joints could be mobilized early and continuously during healing and when applicable, ambulation and weight bearing could be permitted. A method closely approaching this is medullary fixation”.

The traditional treatment of tibial shaft fractures has been long term immobilization in plaster of paris cast and functional cast brace this is in itself an invitation to the well known “Fracture - disease”. The Sarmiento type PTB functional brace, which is so popularly practiced results an average shortening of 6.4mm, an average angulation 8° and an average union time 5.7 months. (Austin RT-Sarmiento Plaster 1981).

How can a method of treatment be acceptable if it gives stiff joints in a shortened, deformed limb? These constraints have to a large extent been overcome by the intramedullary interlocking nail revolution. The sheet anchor for its use remaining, its ability to prevent axial collapse, rotational and angulation deformities and the most important of all being earliest possible ambulation, keeping this treatment modality on the top priority.

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Nicoll⁶⁷ as early as 1974 pointed out that with conservative treatment the probability of delayed union with the difficulties that may arise in the treatment of fractures of shaft of tibia include -

(1) A tendency of redisplacement of the fragments when swelling subsides, particularly in oblique and spiral fractures; (2) cosmetics and sometimes functional disability if the alignment or rotational position of the fragment is imperfect because the knee and ankle joint normally move in the same parallel axis; (3) Conspicuous disfigurement if apposition of the fragments is imperfect because the tibia lies subsequently; (4) slow union as a result of severity of the fracture, poor blood supply to one fragment and sometime distraction of the bone fragments; (5) the occasional limitations of joint movement in the knee, ankle and foot, usually caused by associated joint, soft tissue or vascular injury (Watson Jones,⁸⁶ 1982). (6) slow union as a result of severity of the fracture, poor blood supply to one fragment and sometime distraction of the bone fragments; (7) the occasional limitations of joint movement in the knee, ankle and foot, usually caused by associated joint, soft tissue or vascular injury (Watson Jones,⁸⁶ 1982).

It is these difficulties that have given rise to so much controversy between surgeons as to the best method of managing tibial fractures.

Later, as a result of ability to lock the nail proximally and distally, closed intramedullary nailing became an accepted treatment for closed shaft fractures during the ninth decade (Kuntscher,⁵⁴ 1962; Hoentzsch et al, 1989). However side effects of conventional reaming- technique had been noted probably due to mechanical, thermal injury. Good results had been shown by using locking nails under C-arm guidance, although the intramedullary vascular supply was obliterated through this technique, the periosteum and surrounding tissues would promote adequate bone formation for healing.

The conventional method used in our hospitals in India is towards closed reduction of displaced tibial fractures and then application of groin-to-toe cast for the full period of clinical and radiological healing. This results in patients lying on bed without weight bearing for many months leading to complications like joint stiffness, muscle atrophy, osteoporosis and prolonged recumbence and its side effects (Cast syndrome).

The method of closed nailing without reaming followed by early ambulation and weight-bearing has positive advantages over all existing methods, significantly lower complication rate and has comparable results. Compared with A.O. technique it has the advantages of (1) not requiring specialized technique as complications following treatment with A.O. methods have been explained as due

to insufficient expertise (Thunold et al, 1975); (2) not requiring special equipment and (3) being more suitable for high energy fractures (Bauer et al,⁸ 1962; Edwards,³⁴ 1965). Interlocking nailing has proven to be the method of choice for fixation of these fractures. The intramedullary nailing under image intensifier fulfills the objective of stable fixation with minimal tissue damage resulting in better and quicker fracture union.

The present study has been taken to review the results of diaphyseal fractures of tibia treated with Intramedullary Interlocking nailing.

AIMS & OBJECTIVES

1. To study the period of union and union rate on radiological evidence.
2. To study and evaluate the results of Interlocking intramedullary nailing In diaphyseal fractures of tibia.
3. To Study the range of movements of knee and ankle joints.

MATERIAL AND METHOD

This is a prospective study conducted during the period of January 2016 to December 2016 in 250 Bedded General Hospital, Tangail. This will include patients of both sex and age group between 25-40 year admitted in the orthopaedic wards with diaphyseal fracture of tibia. All cases will be followed for a period of 5 months to 1 year.

Source Material

The source material comprised of all patients who were 25 years and older with fracture of the tibia mainly of the middle third.

The management of the injury was based on the following protocol.

Initial Management and Resuscitation

1. The patient was received in the emergency and his vital parameters were monitored.
2. Associated limb, chest, abdomen and head injury were ruled.
3. IV channel was opened and long leg back slab was given.
4. Then patient was transferred to orthopaedic dept.

Surgical Anatomy

(Williams & Warwick - Gray's anatomy 36^m Ed. Osteology of tibia 397-404).

The tibia is the medial and much stronger of the two bones of the leg. It is the second largest bone of the body. It is prismoid in section in the shaft and is expanded more from side and forms two large condyles which overhang the

posterior surface of the shaft. The upper end of tibia includes the medial and lateral condyles, non-articular area and the tuberosity of tibia.

Blood Supply of Tibia

(Joseph Trueta, 1974; F W Rhinelander, 1974; Ian Mac nab, 1974).

The blood supply of tibia is derived from three main systems:

(1) Nutrient Artery:

The nutrient artery of tibia arises from the posterior tibial artery and enters through the posterolateral cortex of the bone at the origin of soleus muscle, just below the oblique line of tibia posteriorly. The nutrient artery provides afferent supply to all areas of endosteal surface and inner two third of diaphyseal cortex. (2) *Epiphyseal - Metaphyseal vessels:*

The **periosteal vessels** are derived from the main vessels of the limb and run transversely to the long axis of the bone. With fracture, the nutrient vessels are obviously disrupted and as periosteal vessels runs transversely to the long axis of bone, blood supply to periosteum is maintained on both sides of fracture line, thus sustaining adequate vascularity for periosteal callus. Following fractures, however, the vessels penetrate the cortex and thereby help to reestablish the blood supply.

Preoperative Assessment and Planning

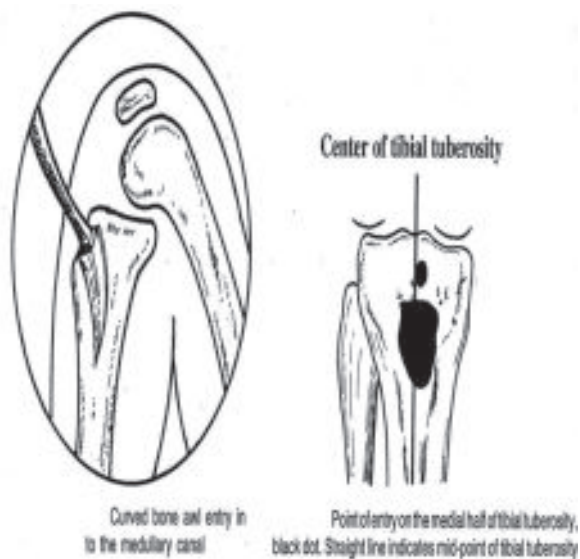
On admission in the ward, detailed history was taken, noting mode and severity of the injury, extent and type of the trauma to the tissues and detailed examinations of the affected extremity. Skia grams were studied in details.

Method of collection of Data

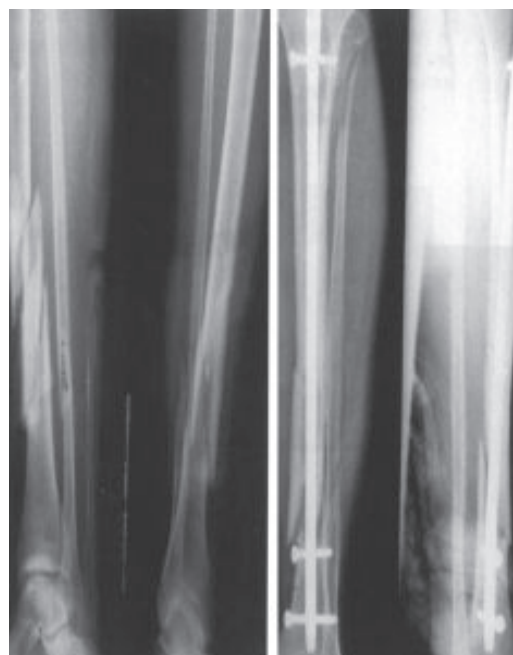
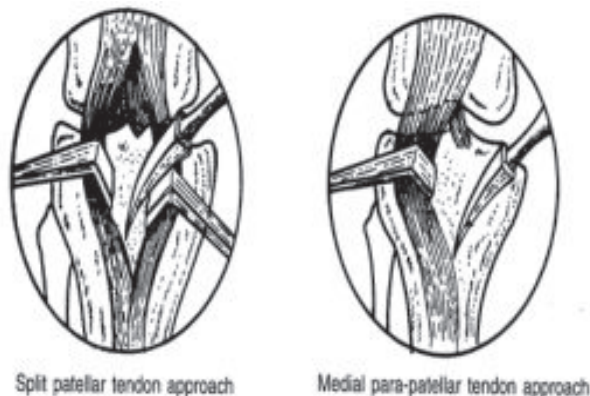
All cases of both sexes belonging to adult age group with closed diaphyseal fractures of Tibia.

Operative Procedure :

With all aseptic precaution under spinal anaesthesia draping and painting was done. Tourniquet was given in the thigh. Knee was flexed at 90 degree with pad beneath the knee. A longitudinal incision was given in midline from tibial tuberosity to lower pole of patella Keeping the knee



flexed, with the help of a curved awl, the window is tunneled to the medullary canal. Reaming is done after inserting guide wire by flexible reamer. The distal locking of the nail is done as under the IL nail is introduced over guide wire with its eye anteriorly and the slot kept posteriorly. The fracture is reduced under C-arm and the nail is negotiated into the distal fragment with the gentle taps of the hammer over the nail head, keeping the nail dead parallel to the axis of the limb. An appropriate length of 4,5mm cortical screw is used for locking. After suturing the ligamentum patellae with Vicryl, skin closure is done. Compression bandage is applied and the tourniquet is removed and long leg back slab applied. Cephalosporin antibiotics are continued till suture removed.



Post Operative Follow-up:

The limb is kept elevated at all times and active toe movements are encouraged. The patient is watched for excessive swelling, pain and distal circulation. The first dressing is done after 5 days of the operation. If suture line is clean, suture removal done after 10 to 12 days under full asepsis. The compression bandage and GT slab is removed a crepe bandage is applied from knee to the ankle. Active knee and ankle mobilization is started immediately after the dressing. Partial weight bearing with 2 axillary crutches started. Gait training on the parallel bars if possible, can also be done review after 1 month. Advice regarding full weight-bearing is given on the basis of pain and the stability of the fracture fixation.

Follow-up and Evaluation:

The patient is usually followed up at 4 weeks, 8 weeks, 16 weeks, 20 weeks, 6 months. Check X-rays are assessed on the basis of Alho⁴ and Ekeland³⁶ criterias (Clinical Orthopaedic 231; 205 take The results; 1988). This, criteria considers six aspects:

1. Tibial mal-alignment and shortening
2. Range of knee motion and extensor lag
3. Range of ankle motion
4. Foot Motion
5. Pain in limb
6. Swelling

OBSERVATIONS

20 patients of fractures tibia were studied until the final follow up.

• Age and Sex

The study included patients 17 years and above in age.

Table-I
Age distribution of the participants (n = 20)

Age (yrs)	Frequency	Percentage
≤30	04	20.0
31 – 40	06	30.0
> 40	10	50.0

Mean age = (40 ± 12.1) years; range = (20 – 70) years.

Out of 20 patients, half (50 %) was > 40 years, 20% 30 or < 30 years and 30 % 30 - 40 years old. The mean age of the patients was 40 ± 12.1 years and the lowest and highest ages were 20 and 70 years respectively.

Table-II
Level of Fracture (n=20)

S.No.	Level of Fracture	No. of patients	Percentage
1.	Proximal third	4	20%
2.	Middle third	12	60%
3.	Distal third	4	20%

Out of 20 patients proximal third fracture 4(20%), middle third 12(60%), distal third 4(20%).

Affected limb:

Table III
Distribution of the limb affected (n = 20)

Side	Frequency	Percentage
Right	17	85.0
Left	03	15.0

Out of 20 patients, 17 (85%) presented with right tibial fracture and only 3 (15%) with left tibial fracture.

Duration of hospital stay.

Table IV
Duration of hospital stay (n = 20)

Duration (wks)	Frequency	Percentage
2 – 3 weeks	14	70.0
>3–4 weeks	06	30.0

Out of 20 patients, two-third (14) of the patients stayed in the hospital for 2–3 weeks and the rest > 3–4 weeks .

Evaluation of outcome:

Range of knee motion:

Table V
Outcome of patients based on range of knee motion (n = 20)

Range of knee motion (degree)	Frequency	Percentage
> 130 ⁰	08	40
110 ⁰ – 130 ⁰	09	45
90 ⁰ – 110 ⁰	02	10
<90 ⁰	01	5

Objective evaluation of outcome revealed that 8(40%) patients exhibited wide range of knee motion (> 130⁰), 9(45%) patients slightly restricted knee motion (110–130⁰), 2(10%) moderately restricted knee motion (90–110⁰) and 1(05%) extremely restricted.

Table VI*Distribution of patients by status of union (n = 20)*

Status of union	Frequency	Percentage
United	16	80.0
Delayed union	04	20.0

Radiological evaluation of fracture site showed that 80% united and 20% had delayed union .

DISCUSSION

The aim of the study was to evaluate the results of closed dynamic interlocking nailing in close tibial diaphyseal fractures.

The treatment programme should ensure a low incidence of complications; it should require minimum possible interventions, short hospitalization and convalescence, and the end result should be comparable with the more complicated methods . Fractures of the tibia are the commonest among the major long bones fractures. Very often, they are open owing to the subcutaneous location of the tibia. The commonest cause of the fracture being high velocity road traffic accidents. in our series, 73% of the fractures groups were due to high velo These days there is a trend towards more use of AO compression osteosynthesis. This has the advantage of perfect anatomic reduction and early movement of the affected limb, but need expertise. Complications following treatment with the AO - compression methods have been explained as due to insufficient experience (Thunold et al 1975). Also open reduction and internal fixation is not tolerated by high energy fractures which are common in the tibia by road traffic accident (Onnerflat, 1973).

(Bauer et al^{7,8} 1962). The possibilities of open reduction and internal fixation, it converts a closed fracture into open, the stay in hospital is longer, delayed union is more frequent as weight bearing with a plate fixed on the bone leads to complications like fracture of plate and re-fracture of bone after removal of plate (Van-der-Linden and Larsson, 1979).

Another method of treatment is a compromise between closed and open methods (semi open) where closed nailing of tibia is done without exposing the fracture site, thus avoiding complications of opening the fracture. Perfect anatomic reduction and rigid fixation may be achieved by reaming the medullary cavity and inserting a nail with wide caliber, but it may not be applicable to fractures in proximal and distal third of tibia where the nail has no hold over fracture in the wide medullary canal.

Besides, rigid nailing with reaming leads to a higher incidence of infection as dead bone produced due to reaming (debris/endosteal necrosis) acts as a good culture medium for bacteria (Bintcliffe, et al⁹ 1984). Merle D, Aubigne et al (1974) first used the method of closed nailing without reaming in fracture of tibial shaft. This was followed by groin-to-toe cast 4 week, after which patellar tendon bearing cast was given and patient was allowed weight bearing. They concluded that though it was not a mechanically sound way of bone stabilization, but when associated with a plaster cast, simplicity of technique, nearly complete elimination of infection, the security it provides in reduction and immobilization and the superiority of results determines its use in preference to all other methods of treatment of fracture of tibial shaft.

The present method of closed tibial nailing omits the disadvantages of other methods while including their advantages. It is advantageous over the method of AO technique *vis a vis*, operating time and complications; over, and over conventional conservative treatment by groin-to-toe cast in terms of avoiding joint stiffness, muscle atrophy, osteoporosis and ill effects of prolonged recumbency, and malalignment. The regimen tested in this study is applicable to majority of cases of fractures of tibia in adults. Primary medullary nailing by closed method without exposing the fractures site was done in close fracture and early weight bearing without cast was done after 2-4 weeks. The results of this investigation were compared here with. The other method of treatment of fracture of shaft of tibia.

Interlocking was done by putting locking screws proximally & distally in all of the cases.

We encountered 2 cases of delayed union in which, after waiting for about 16 weeks when abundant callus was not visible in the x-ray. The reason in the cases was probably was a small diameter nail (8 m.m) which was used. This nail because of its small diameter could not prevent locking of the nail. This indicates that a proper diameter, well-fitting nail should be used in all cases. Most of the authors had used reamed tibial nail and showed earlier union than the present series

CONCLUSION

The present study was undertaken to investigate the outcome of closed interlocking nailing of diaphyseal fractures of tibia, done with the help of image intensifier. 20 cases of closed tibial diaphyseal fractures were fixed with intramedullary interlocking nail. The cases were followed up minimum for a period of six months. The fractures in

our study united in an average of about 17 weeks. Interlocked intramedullary nailing done under image intensifier has proved to be a one-time procedure leading to union in almost all the cases. This procedure allows earlier weight-bearing lead inter locking tibial

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Anatomic Single Bundle ACL Reconstruction Preserving the ACL Remnant Achieves Good Clinical Outcomes

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Abstract

Preservation of the ACL remnant may have a beneficial biological and biomechanical function. Although anterior cruciate ligament (ACL) reconstruction techniques that preserve remnant tissues have been described, complete preservation may be difficult, with little known about its clinical advantages. To evaluate clinical outcomes in patients undergoing ACL reconstruction with ACL remnant preservation. Prospective clinical trial. This clinical study has been carried out in Sharkari Karmochari Hospital. Total 15 patients underwent surgical treatment of an ACL injury between June 2017 and June 2018. Attempts were made to preserve the ACL remnant as much as possible among all the 15 patients. Patients were followed for at least 13 months. Outcomes were observed for the same duration. Time from injury to surgery was significantly shorter (4.3 ± 3.3 months; $P < .05$) and the pre injury activity was significantly higher (34.3 ± 1.3 ; $P < .05$). The postoperative negative ratio of anterior drawer test and Lachman test 87%. Anterior stability of the knee was significantly good. Regression analysis showed that preservation of the remnant decreased the likelihood of graft rupture. These findings confirmed that preserving the remnant tissue of the ACL may facilitate recovery of function and decrease graft rupture after primary reconstruction.

Keywords: Anterior Cruciate Ligaments (ACL); Posterior Cruciate Ligament (PCL); Remnant preservation; Hamstring autograft; Bio absorbable Screw

INTRODUCTION

Successful anterior cruciate ligament (ACL) reconstruction depends on multiple factors, including anatomic graft placement with secure fixation, graft incorporation, graft revascularization, and ligamentization.^{2,5,7} In addition to stability, a high quality of proprioception is needed after ACL reconstruction.^{6,16,24} The presence of remnant tissues in the ruptured ACL, containing mechanoreceptors and free neural ends is of paramount importance to help

reinnervation of the ACL autograft.^{11,14,28} Histologic examination reveals that human ACL remnants have their healing potential, especially that due to intact vascular support by the synovial sheath.^{4,12} Thus, preservation of the mechanoreceptors and vascular supply in an ACL remnant may improve recovery of joint positioning and enhance early revascularization of the graft. The clinical results of ACL reconstruction techniques with preservation of the remnant tissues have been described.^{1,3,8,20-}

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22,25,27,35,37 As reported by Crain et al¹⁰, most of them, termed as “tissue-preserving surgeries,” were performed with type 1, 2, or 3 ACL remnant tissue. However, complete preservation of the remnant may be difficult because little is known about the quantity and quality of the remnant before and after surgery. Remnant preservation, however, should involve minimally invasive procedures on most tissues in the joint. Despite continuous improvements in ACL reconstruction techniques, these patients remain at risk for repeated ACL injury, which has devastating outcomes for many athletes.^{9,30,32,36}

Table-I

Patient Demographic and Clinical Characteristics

		P value
Total patients, n	15	
Lost to follow-up, n	01	
Patients reviewed, n	14	
Follow-up rate, %	94.4%	
Age at surgery, mean ± SD	24.3 ± 8.4	
Time from injury to surgery, mean ± SD	4.3 ± 3.3 months;	< .05
Mechanism of injury, contact/noncontact	4/10	NS
Preinjury activity level, mean ± SD	34.3 ± 1.3;	< .05
Follow-up period, mo, mean ± SD	10.5±4.5	

Patients in whom the ACL remnant could be preserved; ACL, anterior cruciate ligament; SD, standard deviation; NS, not significant; mo, months.

Improvements in ACL reconstruction procedures may restore normal function and prevent future injuries. The finding that remnant tissues enhance mechanical stability and proprioceptive function suggests that preservation of these tissues may decrease the likelihood of repeat ACL injury.³⁰ It has been hypothesized that preserving remnant tissues during ACL reconstruction with a hamstring autograft reduces the risks of autograft ruptures. Accordingly, we performed this study to test this hypothesis.

MATERIAL AND METHODS:

Patients

Between June 2017 and June 2018, a total of 15 patients underwent surgical treatment of an isolated unilateral ACL injury and met the following criteria: (1) closed femoral and tibial physes, (2) no history of surgery on either knee, (3) no or minimal osteochondral degeneration on radiographic examination (stage 0 or 1 in the Kellgren and Lawrence staging system 18, and (4) were scheduled to undergo single-bundle ACL reconstruction using a hamstring autograft. This procedure was performed in 15

patients who had ACL remnant tissue of type 1 (scarring to the posterior cruciate ligament [PCL]), type 2 (healed to the roof of the notch), or type 3 (healed to the lateral wall), as classified by Crain et al.¹⁰ During surgery, we tried to preserve the remnant as much as possible. After insertion of the graft, preservation of the remnant was considered possible if the following conditions were met: (1) the graft was covered with synovial tissues and had abundant blood vessels, (2) coverage of more than 75% of the graft from the tibial attachment, and (3) presence of a bridge between the femur and tibia. Of the 15 patients, 01 was lost to follow-up for unknown reasons. Thus, 14 patients were followed for a minimum of 10 months (10.5 ± 4.5 months). The 14 patients consisted of 10 males and 4 females (mean age, 25 years; range, 14-48 years). There were no statistically significant differences for mean age and follow-up period (Table 1).

SURGICAL TECHNIQUE

Four surgeons (MA Hossain, G Verma, MA Haque, K Ehtesham A) performed or supervised (made all important surgical decisions) operations on all patients. All patients were examined under spinal anesthesia (Lachman test, Anterior drawer test). Before ACL reconstruction, routine diagnostic arthroscopy was performed through the anterolateral (AL) and accessory anteromedial (AAM) portal with a 30° oblique arthroscope. The status of each ACL remnant was assessed, and the surgeons decided whether ACL reconstruction could be performed using a remnant-preserving technique using previously described criteria.¹⁰ Patients without a remnant were excluded. Any meniscal injury or articular cartilage lesion was evaluated. The semitendinosus and gracilis tendons were harvested through a straight 3-cm skin incision over the medial aspect of the proximal tibia, and the muscle tissue of the harvested semitendinosus was removed. The 4 strands were utilized as a graft.



Fig-1: Gross appearance during formation of an Accessory Antero Medial (AAM) portal. Arthroscope is inserted through the Anterolateral (AL) portal, knee flexed at 90 degree

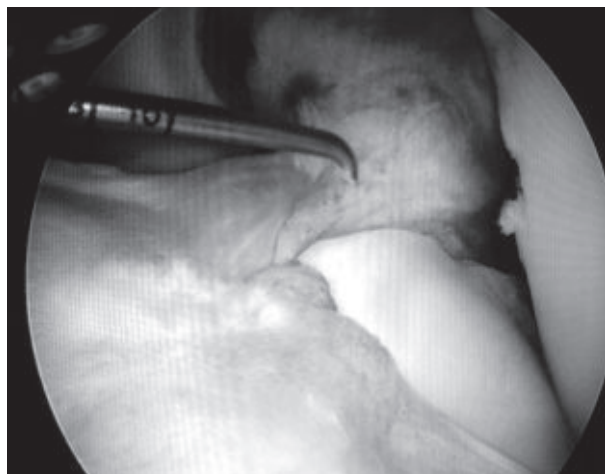


Fig-2: Complete tear of Anterior Cruciate Ligament (ACL), where stump of ACL is attached to the posterior cruciate ligament (PCL) and an empty space at the femoral insertion site in the left knee viewing through the Anterolateral portal (AL)



Fig-3: Non-functional ACL with ACL remnant at the tibial insertion site

A 2.4-mm Kirschner wire (K-wire) was inserted from the AL portal into the femoral footprint behind the ridge while retracting the remnant. While viewing the tibial attachment of the ACL arthroscopically, a 2.4-mm K-wire was inserted using an ACL tibial guide (Linvatec, Largo, Florida, USA), positioned at the central portion of the remnant tissue, and set at a 55° sagittal angle from the tibial long axis.

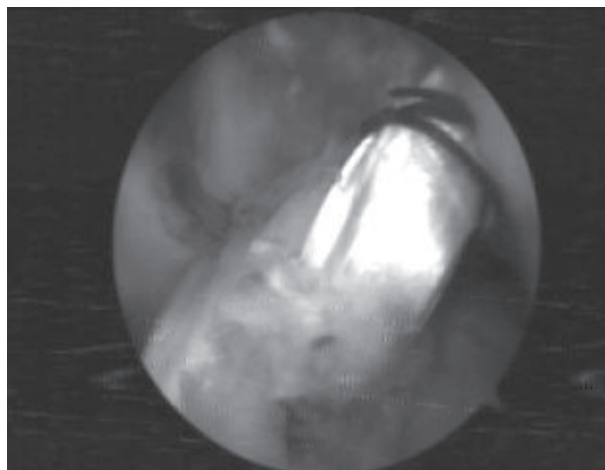


Fig-4: Graft within the femoral tunnel before fixed it with bio-absorbable screw

During these procedures, care was taken to minimize damage to the ACL remnant. The guide wire was advanced into the joint and carefully directed inline with the ACL remnant. From the AL portal, and using this K-wire as a guide. Femoral socket was drilled at a diameter equal to

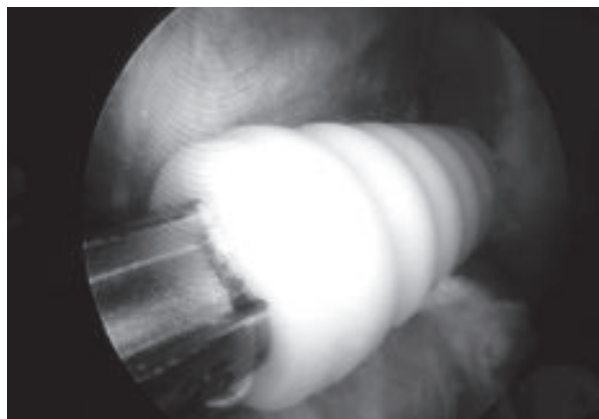


Fig-5: fixation of the graft within the femoral tunnel with bio-absorbable screw.

that of the graft, and a 4.5 mm diameter tunnel was drilled over the guide wire to the lateral aspect of the femur. A tibial bone tunnel was made using an acannulated reamer of the same diameter as that of the distal portion of the graft. During tunnel creation, the reamer was advanced carefully to minimize damage to the remnant. After removing the bony debris in both tunnels, a string to guide the graft was passed from the tibial tunnel, posterolateral to the remnant, to the femur side.

A graft composite was passed through the tibial and femoral tunnels, taking care to prevent damage to the remnant (Figure 1). The graft is then inserted into the knee joint through the tibial tunnel to femoral tunnel and fixed with bio-absorbable screw.

POSTOPERATIVE MANAGEMENT

All patients followed the same postoperative rehabilitation protocol. Postoperative knee braces were used for 2 weeks, and all patients were allowed to bear full weight after 1 week. Range of motion, isometric muscle, and closed kinetic chain exercises were allowed from the first postoperative day. Jogging was encouraged after 2 months, and open kinetic chain exercises were allowed after 3 months. Jumping, landing, twisting, and cutting exercises were allowed at 4 months, and sprinting and other competitive exercises were allowed at 6 months. Subsequently, return to full sports activities was permitted stepwise.

Table-II
Clinical Results

	P Value
Duration from surgery to return to sports activity, mo, mean±SD	9.5 ± 3.5
NS	
Difference in activity, mean ± SD	0.23 ± 0.6
NS	

Patients in whom the ACL remnant could be preserved; ACL, anterior cruciate ligament; SD, standard deviation; NS, not significant.

Postoperative Clinical Evaluation

All objective evaluations were performed by experienced orthopaedic surgeons independently. Joint stability was assessed at final follow-up by performing Lachman test and Anterior drawer test. Pain was assessed by using Lysholm Knee Scoring Scale. Arthrometric measurement was recorded as side-to-side differences between the injured and uninjured knees. Subjective evaluations included time from surgery to return to sports activity and change in pre-injury activity scale³⁵ from before injury to return to sports activity.

RESULTS

The mean interval between ACL injury and reconstruction was significantly shorter (4.3 ± 3.3 months, $P < .05$) and preinjury activity was significantly higher (34.3 ± 1.3 , $P < .05$). There were no differences in the ratio of mechanism of injury (contact/noncontact), or in treatment methods (Table 1). At the time of surgery, an attached ACL remnant was noted in 15 (100%) patients. Although we attempted to preserve the remnant in all patients with identifiable

tissue. None of these patients had acartilage injury requiring supplemental surgical procedures. Postoperatively, there were no significant differences between pre-injury activity score change on return to sport activity. Stability of the knee, as assessed by performing Lachman test and Anterior drawer test. Other variables tested, including sex, age, time from injury to surgery, mechanism of primary ACL injury, and postoperative activity level, were not predictive of graft rupture.

DISCUSSION

ACL reconstruction techniques that preserve an ACL remnant have been found to yield satisfactory results.^{1,3,8,20-22,25,27,34,38} However, the ability to preserve remnant tissues at the time of surgery was not evaluated because little was known about the quantity and quality of the remnant after surgery. A double-bundle ACL reconstruction method with remnant preservation, creating 4 tunnels at the attachment of the remnant, yielded good clinical results,³⁸ as did a double-bundle reconstruction with remnant preservation that avoided impingement of the reconstructed graft against the ACL remnant or the roof of the intercondylar notch.²⁷ This latter method involved the creation of a passage through the ACL remnant using a curved hemostat. However, double-bundle reconstruction requires 4 bone holes, which has been associated with a risk of destroying the site of remnant attachment, the most important site of native ACL.^{27,38} Furthermore, minimal debridement of the residual stump of the ruptured ACL was found to result in earlier revascularization of ACL.¹⁵ We utilized 1 femoral and 1 tibial tunnel to preserve the maximal amount of remnant tissue. Preservation of the ACL tibial stump also significantly reduces the leakage of arthroscopy fluid through the tibial tunnel.¹⁷ Although double-bundle ACL reconstruction yields good clinical results, the creation of many tunnels can more easily result in non-preservation of the remnant. Techniques to preserve the remnant should not only keep the remnant intact but also be minimally invasive, not only of remnant tissue but also of many structures within the joint. Although selective anteromedial bundle (AMB) and posterolateral bundle (PLB) reconstruction techniques have been described,^{25,26,29,33} distinguishing damage to the AMB or PLB selectively is very difficult. Moreover, selective AMB reconstruction without invasion of the anterior fiber does not meet our postoperative definition of preservation. None of our patients experienced extension loss, suggesting that our surgical method of creating only 1 bone tunnel at the tibial insertion to decrease the debris in the remnant and of never

invading the anterior fibers of AMB may reduce the risk of impingement. ACL remnant tissues were reported healed to the PCL, the roof of the notch, or the lateral wall. The previous classification system 10 focuses on the morphology of the remnant but does not consider its volume, tension, or function. In some patients classified as having a remaining remnant, the remnant showed insufficient quality, such as loose tension, poor attachment to the femur, or a small quantity. To clarify the ability to predict preoperatively whether a remnant can be preserved, it is necessary to determine whether the quality and quantity of the remnant are appropriate. Preoperative condition and postoperative outcome have been reported to differ depending on the remnant volume.²³ These findings suggested that remnant volume may be an important preoperative condition and a predictor of operative outcome. A long interval from injury to surgery, even in patients with a preserved remnant, suggests that the morphology and function of the remnant were insufficient and that surgical preservation of a remnant was difficult. We suggest that a larger remnant volume in a preoperative condition may be an important factor for predicting the outcome. Furthermore, a longer interval after initial ACL injury could result in more giving-way, which may negatively affect the remnant volume. We focused not only on the role of mechanoreceptors but also on the vascular and tensional support of the remnant tissue. Using an arthrometer, we found that the anterior stability of the knee was significantly good in patients with a preserved remnant. The loss of proprioception after ligament injury results in changes in gait and deterioration of position sense. Altered biomechanics and neuromuscular function resulting from the initial ACL injury can affect leg kinematics. Patients are greatly dismayed to face repeat surgery and the long process of rehabilitation after having successfully completed this process previously. This study had several limitations. First, the 13 months followup period was insufficient, although Salmon et al³⁰ reported that ACL graft ruptures were found to occur in 39 of 675 patients (6%) at a median 20 months (95% CI, 15-25 months) after the index surgery. A long term follow-up may reveal additional clinical results. Second, several surgeons made intraoperative observations during reconstruction involving remnant preservation. However, all the surgeons in this study had 5 years of experience as a knee surgery specialist at the same hospital. Third, our definition of the ability to preserve the remnant was not completely objective, and there was inherent selection bias in dividing the patients. Future studies should evaluate the quality and quantity of

the remnant before surgery. Fourth, we did not measure functional outcome scores. However, postoperative score changes on return to sport activity was 0.5 points or less. Finally, we did not evaluate proprioception or the graft remodeling process in analyzing the function and morphology of the remnant. Despite these limitations, however, this study has clarified that preserving the ACL remnant tissue has several clinical advantages, such as decreasing graft rupture after primary reconstruction, thereby decreasing the likelihood of repeat injury in athletes.

Conflicts of Interest: None to declare

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Comparison of Fixation of Incomplete Thoracolumbar Spinal Injury by Short Segment and Long Segment by Posterior Stabilization by Pedicular Screw and Rods

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Abstract:

The present prospective interventional study was conducted to compare short segment fixation and long segment fixation in incomplete thoracolumbar spinal injury at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-E-Bangla Nagor, Dhaka, Bangladesh over a period of 24 months. Patients diagnosed as incomplete thoracolumbar spinal injury were the study population. A total of 20 patients aged 15-60 years irrespective of sex were included in the study. 10 patients were treated by fixation with short segment posterior fixation and 10 patients were treated by long segment posterior fixation with pedicular screw and rod. The mean age found in 37.1 ± 13.9 years in group I and 26.8 ± 8.9 years in group II respectively almost identical. Males were predominant in both groups Male was found 9 (90%) in group I and 9 (90%) in group II. Female was found 1 (10%) in group I and 1 (10%) in group II. Patient's occupations were almost identical between the two groups except higher proportion of daily labourer in both groups. In both groups injuries were primarily caused by fall from height fall from height was 8 (80%) and 8 (80%) in group I and group II respectively. Short segment fixation required shorter operation time than that required by long segment fixation group. Mean operative time in short segment fixation was 150 ± 30 and mean operative time in long segment fixation was 210 ± 30 . Mean blood loss in short segment fixation was 480 ± 50 and mean blood loss in long segment fixation was 750 ± 50 . Involvement of bowel and bladder occurred in most of cases. Follow-ups were carried out after 6 weeks, 3 months and 6 months of operation. At final follow-up regarding the pain scale of the study patients. Pain was found grade-1, 5 (50%) in group I and 5 (50%) in group II. Pain was found grade-2, 5 (50%) in group I and 5 (50%) in group II. Regarding the work scale of the study patients. Work scale was found grade-2, 6 (60%) in group I and 5 (50%) in group II. Work scale was found grade-3, 4 (40%) in group I and 5 (50%) in group II. Mean Cobb angle (Pre-operative) was found 7.3 ± 1.33 and 5.85 ± 1.915 in group I and group II respectively. Mean Kyphotic deformation of Vertebral body (Post-operative) was found 15.1 ± 3.32 and 14.4 ± 4.45 in group I and group II respectively. Mean Sagittal index (Post-operative) was found 16.1 ± 4.98 and 17.4 ± 6.53 in group I and group II respectively. Mean Measurement of compression deformity (Post-operative) was found 0.314 ± 0.1023 and 0.27 ± 0.15 in group I and group II respectively. Regarding the modified Macnab criteria of the study patients. Good was found 5 (50%) in group I and 6 (60%) in group II. Fair was found 5 (50%) in group I and 4 (40%) in group II. Poor was not found in both groups.

Key words: Incomplete Thoracolumbar Spinal Injury, Short Segment, Long Segment, Stabilization, Pedicular Screw and Rods

INTRODUCTION:

The thoracolumbar injuries are the commonest spinal injuries worldwide. Approximately 75% to 90% of spinal injuries occur in thoracic and lumbar spine. Most of these

occurring at the thoracolumbar junction (T10-L2). Spine fractures occurs predominantly in young people Despite the high incidence of thoracolumbar fractures, there is there is little consensus regarding injury classification and

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management. These systems are typically based on descriptions of anatomic structures. (eg, Denis three column system), proposed mechanism of injury (eg, Watson-Jones, AO), or a combination.¹

posterior approach is less extensive. Pedicle screw devices allow immediate stable fixation as the screws traverse all the three columns. The pedicle screws are passed one level above and one level below the fractured vertebra via posterior approach in short-segmental (SS) fixation and two level above and two level below in case of long-segmental (LS) fixation. The technique of pedicle screws and plates has been routinely used to stabilize the lumbar spine since 1963.

Thoracolumbar junction is particularly prone to injury because of the transition between the relatively fixed thoracic spine and relatively mobile lumbar spine².

Thoracolumbar fracture dislocation is trauma of high energy which generally treated with long segment stabilization. A few articles have reported on short segment fixation for thoracolumbar fracture-dislocation[3]

Dick et al have developed the SS stabilization for the operative treatment of thoracolumbar and lumbar fracture. There are high rate of failure because of proximal screw pull out, screw breakage and loss of correction.⁴

Satisfactory fusion rates in thoracolumbar fractures treated with first generation short segment posterior pedicle screw instrumentation. The kyphotic deformity was significantly improved immediately post-operatively.⁵

long segment fixation can achieve relatively closer alignment to a normal spinal line and maintain firmer fixation even in a situation when single level of fixation is to fail.⁶

Short-segment posterior fixation (SSPF) is the most common and simple treatment, offering the advantage of incorporating fewer motion segments in the fusion. SSPF alone led to a 9-54% incidence of implant failure and re-kyphosis in the long term and 50% of the patients with implant failure had moderate to severe pain.⁷

Tezeran and Kuru in their study comparing short segment versus long segment fixation in thoracolumbar burst fractures, demonstrated that LS instrumentation is an effective way to manage thoracolumbar burst fractures.⁸

The goal of this study is to compare short segment (SS) instrumentation versus long segment instrumentation (LS) for the treatment of incomplete thoracolumbar injuries.

AIMS AND OBJECTIVES

General

To compare the effect of short segment and long segment fixation in incomplete thoracolumbar spinal injury by posterior stabilization by pedicular screw and rods.

Specific

1. To find out clinical outcome by Frankel grading and ASIA grading
2. To find out radiological outcome measuring Cobb angle, Kyphotic deformity, sagittal index and measurement of anterior body compression.
3. To compare short segment fixation and long segment fixation for duration of surgery and blood loss.
4. To see complication of surgery

DENIS CLASSIFICATION:

- Minor - Fracture of vertebral process
 - Fracture of pars interarticularis
- Major - Compression-most common fracture due to flexion. -Posterior ligament usually remain intact.
 - Although it may damage by distraction.
 - Injury is usually stable.

Burst-Produced by severe axial compression

- Failure of anterior and middle column
 - Fragments of bone may be displaced to spinal canal.
 - Posterior ligament damaged.
 - Injury is usually unstable
- Fracture- dislocation-most dangerous injury:
- Segmental displacement may occur with various combination of flexion, compression rotation and shear.
 - Often associated with neurological damage.
 - There may be varying degree of subluxation or even bilateral facet joint dislocation.

Jack-knife injuries:

- Combined flexion and distraction may cause the midlumber spine to jack-knife around an axis that is placed anterior to the vertebral column.

Most typically in the seatbelt injury

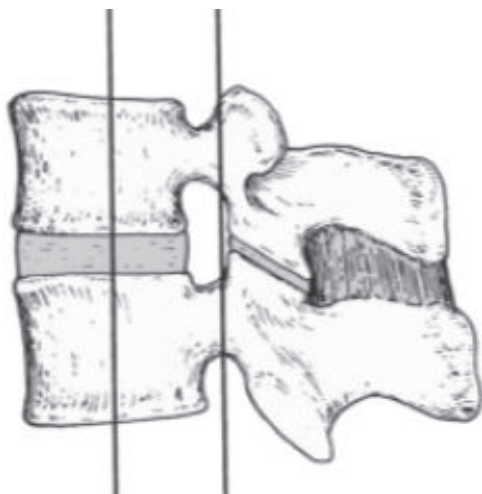


Figure: Structural elements of the spine. The vertical lines show Denis' classification of the structural elements of the spine. The three elements are: the posterior complex, the middle component and the anterior column. This concept is particularly useful in assessing the stability of lumbar injuries¹

MANAGEMENT:

Decompression and Spinal Stabilization:

The two decompressive techniques used most commonly are hemilaminectomy and dorsal laminectomy. The selection of either technique is based on the type of fracture, the lateralization of neurologic signs, and the anticipated method of postoperative stabilization. The technique of hemilaminectomy is in general less destabilizing and spares the dorsal spinous process if they are to be used for subsequent internal fixation.

Posterior internal fixation with pedicle screws:

Pedicle fixation systems are the most commonly used implant type. The large size of the lumbar pedicles minimizes the number of instrumented motion segments required to achieve adequate stabilization. A depth of 50-75% of the AP vertebral body diameter usually is recommended for lumbar fixation, while bicortical screw purchase is recommended for sacral fixation.

MATERIALS AND METHODS

This was an interventional study. The study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sheer-e-Bangla Nagar, Dhaka. The study was carried out during the period from January, 2012 to December, 2014. This was an

interventional study carried out among the patients with incomplete thoracolumbar injuries

LOCAL EXAMINATION:

A detailed local examination was then carried out with particular attention to:

Local examination of spine gives important clues in diagnosis of thoracolumbar injuries. Local tenderness, gibbus, stepping, swelling, skin abrasion, bruise give an important clue to localize the site of injury.

Radiological evaluation:

- Ø Pain-X-ray: Initial radiographic assessment includes antero-posterior (AP) and lateral spine films.
- Ø CT-Scan

Outcome categorization:

The following internationally accepted modified Macnab criteria was used for categorizing the outcome of surgery.

Result (Outcome) Criteria

- Excellent** No pain; no restriction of mobility; return to work and level of activity.
- Good** Occasional non radicular pain; relief of presenting symptoms; able to return to modified work.
- Fair** Some improved functional capacity; still handicapped and unemployed.
- Poor** Continued objective symptoms of root involvement; additional operative intervention needed at the index level irrespective of length of postoperative follow-up.

RESULTS:

Figure-I: Occupation

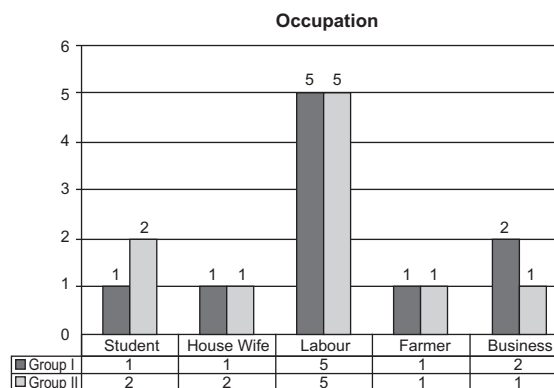


Fig.-2: Bar diagram showing occupational distribution of the patients (n=20).

Table-I

	Group I (n=10)		Group II (n=10)	
	n	%	n	%
Student	1	10%	2	20%
House wife	1	10%	1	10%
Labour	5	50%	5	50%
Farmer	1	10%	1	10%
Business	2	20%	1	10%

Group I=Short segment, Group II=Long segment

Table -II

Mechanism of injury:

Mode of injury	Group I (n=10)		Group II (n=10)	
	n	%	n	%
Fall from height	8	80%	8	80%
Road traffic injury	2	20%	2	20%

Regarding the mode of injury of the study patients. RTA was found 2 (20%) in group I and 2 (20%) in group II. Fall from height was 8 (80%) and 8 (80%) in group I and group II respectively. The difference was not statistically significant (P>0.05).

Table-III

Distribution of the study patients according to level of injury (n=20)

Level of injury	Group I (n=10)		Group II (n=10)	
	n	%	n	%
D ₁₁	1	10%	0	00%
D ₁₂	2	20%	4	40%
L ₁	5	50%	3	30%
L ₂	2	20%	2	20%
L ₃	0	00%	1	10%

Regarding the level of injury of the study patients. D₁₁ injury was found 1 (10%) in group I and 0 (00%) in group II. D₁₂ injury was found 2 (20%) and 4 (40%) in group I and group II respectively. L₁ injury was found 5 (50%) in group I and 3 (30%) in group II. L₂ injury was found 2 (20%) in group I and 2 (20%) in group II. L₃ injury was found 0 (00%) in group I and 1 (10%) in group II. The difference was not statistically significant (P>0.05) between two groups.

Table-IV

Distribution of the study patients according to type of fracture (n=20)

Type of fracture	Group I (n=10)		Group II (n=10)	
	n	%	n	%
Compression	7	70%	5	50%
Burst	3	30%	5	50%

Regarding the type of fracture of the study patients. Compression fracture was found 7 (70%) in group I and 5 (50%) in group II. Burst fracture was found 3 (30%) and 5 (50%) in group I and group II respectively. The difference was not statistically significant (P>0.05) between two groups.

Table-V

Distribution of the study patients according to Post operative Frankel grading (n=20)

Post Operative Frankel	Group I (n=10)		Group II (n=10)	
	n	%	n	%
A	0	00%	0	00%
B	0	00%	0	00%
C	0	00%	0	00%
D	4	40%	5	50%
E	6	60%	5	50%

Regarding the post-operative Frankel grading of the study patients. E operative Frankel was common in both groups, which was 6 (60%) in group I and 5 (50.0%) in group II. The difference was not statistically significant (P>0.05).

Table-VI

Distribution of study patients according to Denis Pain scale during last follow up (n=20)

Denis pain scale Grade	Group I (n=10)		Group II (n=10)	
	n	%	n	%
1	5	50%	5	50%
2	5	50%	5	50%
3	0	00%	0	00%
4	0	00%	0	00%
5	0	00%	0	00%

Regarding the pain scale of the study patients. Pain was found grade-1, 5 (50%) in group I and 5 (50%) in group II. Pain was found grade-2, 5 (50%) in group I and 5 (50%) in group II. The difference was not statistically significant (P>0.05).

Table-VII

Distribution of study patients according to Denis Work scale during last follow up (n=20)

Denis pain scale Grade	Group I (n=10)		Group II (n=10)	
	n	%	n	%
1	0	00%	0	00%
2	6	60%	5	50%
3	4	40%	5	50%
4	0	00%	0	00%
5	0	00%	0	00%

Regarding the pain scale of the study patients. Pain was found grade-2, 6 (60%) in group I and 5 (50%) in group II. Pain was found grade-3, 4 (40%) in group I and 5 (50%) in group II. The difference was not statistically significant (P>0.05).

Table-VIII*Distribution of the study patients according to pre and post operative follow-up (n=20)*

Pre and post operative follow-up	Group I (n=10)	Group II (n=10)	P value
	Mean \pm SD	Mean \pm SD	
Cobb angle (Pre-operative)	19.9 \pm 7.69	22.4 \pm 7.74	
Cobb angle (Post-operative)	7.3 \pm 1.33	5.85 \pm 1.915	1.98 ^{ns}
Kyphotic deformation of Vertebral body (Pre-operative)	23.8 \pm 3.6	23 \pm 5.18	
Kyphotic deformation of Vertebral body (Post-operative)	15.1 \pm 3.32	14.4 \pm 4.45	0.402 ^{ns}
Sagittal index (Pre-operative)	24.8 \pm 5.02	26 \pm 7.6	
Sagittal index (Post-operative)	16.1 \pm 4.98	17.4 \pm 6.53	0.502 ^{ns}
Measurement of compression deformity (Pre-operative)	0.5705 \pm 0.998	0.57 \pm 0.116	
Measurement of compression deformity (Post-operative)	0.314 \pm 0.1023	0.27 \pm 0.15	0.538 ^{ns}

Mean Cobb angle (Pre-operative) was found 7.3 \pm 1.33 and 5.85 \pm 1.915 in group I and group II respectively. Mean Kyphotic deformation of Vertebral body (Post-operative) was found 15.1 \pm 3.32 and 14.4 \pm 4.45 in group I and group II respectively. Mean Sagittal index (Post-operative) was found 16.1 \pm 4.98 and 17.4 \pm 6.53 in group I and group II respectively. Mean Measurement of compression deformity (Post-operative) was found 0.314 \pm 0.1023 and 0.27 \pm 0.15 in group I and group II respectively. The mean difference was not statistically significant ($P > 0.05$) between two groups.

Table-IX*Distribution of the study patients according to modified Macnab criteria.*

Modified Macnab criteria	Group I (n=10)		Group II (n=10)	
	n	%	n	%
Excellent	0	00%	0	00%
Good	5	50%	6	60%
Fair	5	50%	4	40%
Poor	0	00%	0	00%

Regarding the modified Macnab criteria of the study patients. Good was found 5 (50%) in group I and 6 (60%) in group II. Fair was found 5 (50%) in group I and 4 (40%) in group II. Poor was not found in both groups. The difference was not statistically significant ($P > 0.05$) between two groups.

DISCUSSION:

The purpose of treating thoracolumbar fracture are to achieve early neurological decompression, Stabilization for early rehabilitation. The pedicle offers a strong point

of attachment of the posterior elements to the vertebral body. Pedicle screw fixation revolutionized spine surgery. However, the surgical treatment of thoracolumbar fractures remains a controversial issue.

Sasso et al. did clinical comparisons and analysis among Harrington rods, hooks Luque rods, sublaminar wires and pedicle screws with 70 patients and found pedicle screw fixation was a posterior fixation which could be applied to shorter segments than could other posterior fixation tools. Therefore, pedicle screw fixation is a good posterior fixation method suitable for this purpose.¹⁰

In our study, we selected 20 patients randomly admitted in NITOR with incomplete thoracolumbar injury. We have done decompression. Stabilization was done in 10 patients with short segment posterior fixation and in 10 patients with long segment posterior fixation with posterolateral bony fusion.

A total of 20 patients were included in this study. They were divided into three age group. The mean age found in 37.1 \pm 13.9 years in group I and 26.8 \pm 8.9 years in group II. The difference was not statistically significant ($P > 0.05$) between two groups.

Regarding the sex distribution of the study patients. Male was found 9 (90%) in group I and 1 (10%) in group II. Female was found 9 (90%) in group I and 1 (10%) in group II. The male female difference was not statistically significant ($P > 0.05$) between two groups.

Regarding the occupation status of the study patients. Maximum patients were laborer in both groups, which was 5 (50%) in group I and 5 (50%) in group II. The difference was not statistically significant ($P > 0.05$) between two groups.

Regarding the mode of injury of the study patients. RTA was found 2 (20%) in group I and 2 (20%) in group II. Fall from height was 8 (80%) and 8 (80%) in group I and group II respectively. The difference was not statistically significant ($P>0.05$).

Regarding the level of injury of the study patients. D₁₁ injury was found 1 (10%) in group I and 0 (00%) in group II. D₁₂ injury was found 2 (20%) and 4 (40%) in group I and group II respectively. L₁ injury was found 5 (50%) in group I and 3 (30%) in group II. L₂ injury was found 2 (20%) in group I and 2 (20%) in group II. L₃ injury was found 0 (00%) in group I and 1 (10%) in group II. The difference was not statistically significant ($P>0.05$) between two groups.

Regarding the type of fracture of the study patients. Compression fracture was found 7 (70%) in group I and 5 (50%) in group II. Burst fracture was found 3 (30%) and 5 (50%) in group I and group II respectively. The difference was not statistically significant ($P>0.05$) between two groups.

Regarding the pre-operative Frankel grading of the study patients. C-operative Frankel was common in both groups, which was 10 (100%) in group I and 10 (100%) in group II. The difference was not statistically significant ($P>0.05$).

Regarding the post-operative Frankel grading of the study patients. E operative Frankel was common in both groups, which was 6 (60%) in group I and 5 (50.0%) in group II. The difference was not statistically significant ($P>0.05$).

Regarding the pain scale of the study patients. Pain was found grade-1, 5 (50%) in group I and 5 (50%) in group II. Pain was found grade-2, 5 (50%) in group I and 5 (50%) in group II. The difference was not statistically significant ($P>0.05$).

Regarding the work scale of the study patients. Work scale was found grade-2, 6 (60%) in group I and 5 (50%) in group II. Work scale was found grade-3, 4 (40%) in group I and 5 (50%) in group II. The difference was not statistically significant ($P>0.05$).

Mean Cobb angle (Pre-operative) was found 7.3 ± 1.33 and 5.85 ± 1.915 in group I and group II respectively. Mean Kyphotic deformation of Vertebral body (Post-operative) was found 15.1 ± 3.32 and 14.4 ± 4.45 in group I and group II respectively. Mean Sagittal index (Post-operative) was found 16.1 ± 4.98 and 17.4 ± 6.53 in group I and group II respectively. Mean Measurement of compression deformity (Post-operative) was found 0.314 ± 0.1023 and 0.27 ± 0.15 in group I and group II

respectively. The mean difference was not statistically significant ($P>0.05$) between two groups.

Regarding the modified Macnab criteria of the study patients. Good was found 5 (50%) in group I and 6 (60%) in group II. Fair was found 5 (50%) in group I and 4 (40%) in group II. Poor was not found in both groups. The difference was not statistically significant ($P>0.05$) between two groups.

Regarding the post operative complication of study population. Bed sore was found 1 (10%) in group I and 1 (10%) in group II. Urinary tract infection was found 3 (30%) in group I and 2 (20%) in group II. Urethrocuteaneous fistula was found 1 (10%) in group II. The difference was not statistically significant ($P>0.05$) between two groups.

Mean operative time in short segment fixation was 150 ± 30 and mean operative time in long segment fixation was 210 ± 30 . Mean blood loss in short segment fixation was 480 ± 50 and mean blood loss in long segment fixation was 750 ± 50 . Involvement of bowel and bladder occurred in most of cases.

CONCLUSION:

As seen from the result of this study, incomplete thoracolumbar spine injuries can be treated with spinal fixation through posterior approach. Both the short segment and long segment fixation is an effective method of treatment. Both this method enhance neurological recovery, reduce pain and improve working status with early rehabilitation without significant radiological deference

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Management of Infected Non Union of Femoral Shaft Fractures by Ilizarov Ring External Fixator

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Abstract

Management of infected nonunion of femoral shaft fractures has always represented a difficult orthopedic challenge. Ilizarov ring external fixator system has proved potentials to face this challenge effectively. The aim of this prospective study is to evaluate the Ilizarov external fixator system as a method of fixation for infected nonunion of femoral shaft fracture. Eleven patients presenting with infected nonunion of femoral shaft fractures were treated by extensive debridement and external fixation using Ilizarov external fixator from October 2013 to December 2014. Eight were male and three were female with a mean age of 29.7 (18- 45) years. Results were expressed according to ASAMI evaluation system and found that in terms of function, excellent and good were 4(36.8%), fair was 1(9.1%) and poor were 2(18.2%). In conclusion, Ilizarov ring external fixator offered a reliable and successful method for stabilization and satisfactory bone union of infected nonunion of femoral shaft fractures.

Keywords: Infected non union, Fracture femoral shaft, Ilizarv External fixator

INTRODUCTION

Management of infected nonunion of femoral shaft fractures has always represented a difficult orthopedic challenge. In addition to treating the infection, it is necessary to establish bony stability, encourage fracture union and reconstruct the soft-tissue envelope¹. Ilizarov ring external fixator system has proved potentials to face this challenge effectively². The aim of this prospective study is to evaluate the Ilizarov external fixator system as a method of fixation for infected nonunion of femoral shaft fractures.

MATERIALS AND METHODS

Eleven patients presenting with infected nonunion of femoral shaft fractures were treated by extensive debridement and external fixation using Ilizarov external fixator from October 2013 to December 2014. Eight were

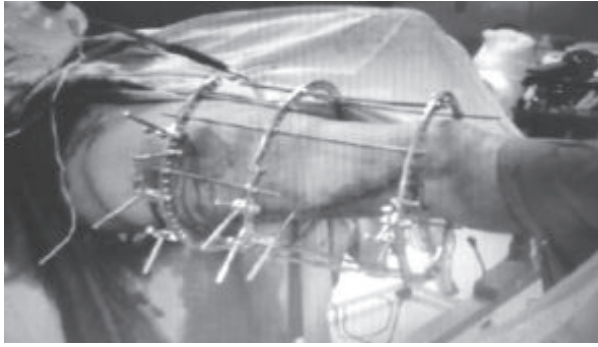
male and three were female with a mean age of 29.7 (18- 45) years. All patients had infected nonunion of femoral shaft fractures with chronic infection persistent for more than 6 months. All cases were initially managed by internal fixation in the form of repeated debridement, revision of fixation and bone grafting. The mean duration of application of the fixator was 7.8 months (6-12). Weight bearing was permitted immediately postoperative. Three patients required iliac crest bone graft to achieve solid union.

Surgical technique

Patients were operated under spinal anesthesia, the patient was positioned supine on the fracture table and the limb was abducted adequately to allow access to the femur medially and laterally.

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Generous exposure was performed using lateral approach. All devitalized and infected tissues were removed and sent for culture and sensitivity testing. Any remaining implants were removed, copious wash by normal saline solution was performed. The edges of bone ends at the fracture site were freshened and the medullary canal was reconstituted. Open reduction of the fragments was

performed trying to achieve the best possible contact between them and the maximum internal stability at the fracture site. The accuracy of reduction and the alignment of the femur were confirmed using image intensifier radiographs in antero-posterior and lateral planes. Then Ilizarov frame was applied and was anchored to the femur using both 1.8mm smooth wires and 6mm Schanz screws. The frame consisted of three or four rings in addition to a proximal semicircular ring or a femoral arch with 2 oblique supports.

RESULTS

Results were assessed and expressed according to ASAMI evaluation system and found that in terms of function, excellent and good were 4(36.8%) each, fair was 1(9.1%) and poor were 2(18.2%). In terms of bone results, excellent were 6(54.5%), Good were 2(18.2%), fair was 1(9.1%) and poor were 2(18.2%) (Table-I).

Table-1

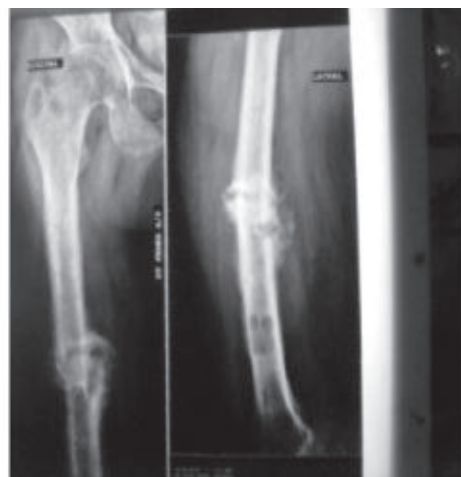
Grade	Bone Results		Functional results	
	Number of Cases	Percentages	Number of Cases	Percentages
Excellent	6	54.5	4	36.4
Good	2	18.2	4	36.4
Fair	1	9.1	1	9.1
Poor	2	18.2	2	18.2

The most common complications were pin tract infection, joint stiffness, delayed union, edema, pain, loosening and fracture malalignment.

Case Illustration



Nonunion shaft of femur with IM nail in situ



After removal of implant



Immediate Postoperative Photo



Immediate Postoperative X-ray

Late Postoperative X-ray

At final follow up with solid union



Extension of knee after removal of Ilizarov External Fixator

Range of Movement of Knee-Medial view

Range of Movement of Knee-Lateral view

DISCUSSION

Results of conventional treatment of infected nonunion of the femur are poor, due to the causative high energy trauma, multiple surgeries, late presentation, bone and soft tissue infection, nonunion, bone loss, osteoporosis, dystrophy, poor vascularity and associated deformities and limb length discrepancy. The use of Ilizarov external fixation helps manage these difficulties. The presence of infection and bone loss that is found in many cases rule out internal fixation, external fixation is the only option left, the use of external fixation for the treatment of infected nonunion of the femur has been previously reported³. In a study, solid union was achieved in 29 out of 34 fractures (85%) without bone grafts⁴. Another study showed, the average time of union was 6.1 months (4 - 19 ms)⁵. As the major concern regarding knee range of motion, different study observed the knee ROM and one study achieved the average knee range of motion was 87.5 degrees (30 - 115 degrees)⁶. The bony results were assessed and expressed as excellent in 24 patients (70.5%), good in 6 (17.7%), fair in 2 (5.9%),

and poor in 2 (5.9%), and the functional results were excellent in 10 (29.4%) patients, good in 14 (41.2%), fair in 6 (17.6%), and poor in 4 (11.8%), and the functional results were excellent in 10 (29.4%) patients, good in 14 (41.2%), fair in 6 (17.6%), and poor in 4 (11.8%) according to ASAMI protocol⁷. The limitation of knee motion was the most disabling complication in many studies, as also reported in our study. There are several factors that cause limitation of knee motion including: type of the fracture (type C3 of OTA classification), severity of the associated soft-tissue injury (type IIIB and type IIIC of Gustilo classification) and incorrect application of external fixator (the knee in extension).⁸

CONCLUSION

We concluded that Ilizarov ring external fixator offered a reliable and successful method for stabilization and satisfactory bone union of infected nonunion of femoral shaft fractures following extensive debridement that helps in the management of such difficult condition.

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Results of Surgical Treatment for Degenerative Cervical Myelopathy by Anterior Cervical Corpectomy, Discectomy and Stabilization

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Abstract

This prospective study involves 26 patients with degenerative cervical myelopathy who were surgically treated by anterior corpectomy, multi level discectomy inter-body fusion by titanium mesh cage (TMC) filled with autogenous cancellous bone or by tri-cortical iliac crest stud graft and stabilize by anterior cervical plate. This study was conducted to determine the indications, efficacy and complication rate associated with performing corpectomy to achieve anterior decompression of neural elements or for removing anterior lesions. Twenty-six patients with degenerative cervical myelopathy who had surgical treatment and average 30 months (range, 24–52 months) follow up were included. The mean age was 64.9 years (range, 55–74 years) and average period between myelopathic symptoms and surgery was 2.8 years (range, 6 months–5 years). Preoperative evaluation of every patient consisted of anterior–posterior, lateral, bilateral oblique, flexion, and extension radiographs, Computed tomography reconstructions and magnetic resonance imaging of the cervical spine, Degree of pre and postoperative myelopathy was determined according to the scoring systems developed by Nurick and Japanese Orthopedic Association (JOA). Eight patients had a mild balance problem and difficulty while walking but were able to perform their daily activities. Two patients had spastic quadriplegia ambulating on either crutches or with the help of others and other sixteen patients had moderate to severe myelopathic syndrome. Surgical treatment in all patients consisted of anterior decompressive corpectomy, and multilevel discectomy anterior plate stabilization. Mean sagittal Cobb angle (C2–C7) was 9° (range 0–23°) before surgery 17.1° (range 11–22°) on the third postoperative month, and 16.9° (range 10–22°) at last follow-up. The difference in sagittal alignment on the third month and last follow up was not statistically significant. Average preoperative Nurick score was 3.5 (range 2–5) and JOA score was 7 (range 1–14). Major and statistically significant neurologic recovery was within the first 3 months, and average Nurick and JOA scores at 3 months were 2 (range 0–3) and 8 (range 8–17) respectively. All patients had improved neurologic status at final follow up. As confirmed by plain radiographs and some-time computed tomography reconstructions, solid fusion was achieved and we had no implant related complication or failure. As major complications 1(3.8%) postoperative CSF leaking developed improved spontaneously. At final follow up all patients were able to ambulate without support and maintain their daily activities. Anterior decompression provides good neurologic recovery in patients with degenerative cervical myelopathy. Tricortical bone graft from iliac crest or titanium cage impregnated with cancellous bone provides good structural support, and solid fusion can be achieved with an anterior plate.

Key words: Cervical spine, cervical myelopathy, anterior cervical corpectomy, and stabilization

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INTRODUCTION

Cervical spondylotic myelopathy (CSM) is the secondary to degenerative changes in the cervical spine often include Prolapse intervertebral disc (PIVD), ossification of posterior longitudinal ligament (OPLL), ligamentum flavum hypertrophy, uncovertebral and facet joint osteophytosis which compress the spinal cord and subsequently lead to its injury and dysfunction. Patients with CSM will generally have these symptoms: neck stiffness; unilateral or bilateral deep aching neck, arm and shoulder pain; motor or sensory changes upper limb and possibly stiffness or clumsiness while walking¹.

The operative treatment of CSM is recommended for patients who have either substantial or progressive impairment of neurological function or failed conservative management². The goal of surgical treatment for CSM is the decompression of the spinal cord and maintenance of spinal stability.

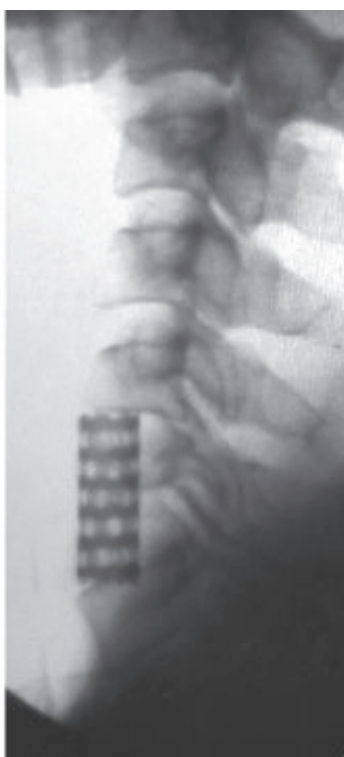
METHODS

A prospective study was conducted at NITOR and private hospital in Dhaka from January 2013 to December 2015. Patients of cervical spondylotic myelopathy were studied

after the consent. In this study Clinical, Radiological and Surgical selection are applied. During the treatment process, we had found the major ten patients included in this study. All patients were preoperatively as well post-operatively graded according to Japanese Orthopaedics Association (JOA). Several surgical methods such as anterior approach, have been addressed for CSM patients, with the choice based on the pathogenesis of the myelopathy. The optimal surgical management of the CSM remains controversial. The main indications for surgery were evidence of myelopathy on physical examinations, a JOA score below 13 points help with spinal cord compression observed on plain X-ray, CT scan, MRI studies. Points in favor patients treated medically show continual progressive neurological deterioration, patients with CSM are at an increased risk of spinal cord injury from relatively mild traumatic events and early surgery can improve prognosis³. X-ray was done to determine the disc height, size of the spinal canal, stability of spine with its curvature and range of motion (ROM). MRI was done to provides a soft tissue overview, demonstrates intrinsic signal changes in the spinal cord, visibility of CSF, MSCS (multisegmental cervical spondylosis) (F-1,2,3).



Pre-Op MRI



Intra -Op



Post-Op Image

In this study 10 patients age 52 ± 7 were selected for laminoplasty, among them 04 were suffering from OPLL and six patients were suffering from more than three segmental disc herniation out of which 5 had developed stenosis, 1 pt. suffered from ossified disc herniation.

Operative Procedure

The indications for surgery were progressive myelopathy with spinal cord compression documented on computerized tomography (CT) myelography or magnetic resonance (MR) imaging. Instability or pain was present in some cases but was not a primary indication for surgery. The preoperative plan was to perform surgery in all patients placed in a specially made halo headring with 5-lb traction.

The surgical procedure was similar to that described by Saunders, et al. 2 case was performed through a longitudinal incision along the anterior border of the sterno cleidomastoid muscle and others cases were performed by transverse incision extending from midline to anterior borders of sterno cleidomastoid muscle. A left-sided approach was used unless there had been extensive previous surgery on that side, in which case the spine was approached from the left side. After obtaining a radiograph to confirm the levels to be removed, the operating loop was brought in and the corpectomies were performed using rongeurs and an air drill. The osteophytes and the posterior vertebral body cortices were removed using a fine curet and/or 1- or 2-mm bone punches.

The corpectomy was at least 15 mm wide (F-2). In all cases of OPLL and in most cases of cervical spondylosis, the posterior longitudinal ligament was removed using sharp dissection. Following decompression, a 5- to 7-mm-deep hole, approximately 1 cm in diameter, was drilled into the upper and lower vertebrae with respect to the corpectomy to accept the bone graft. A piece of tricortical bone graft was fashioned with rounded ends and seated deeply into the upper and lower vertebrae under traction.

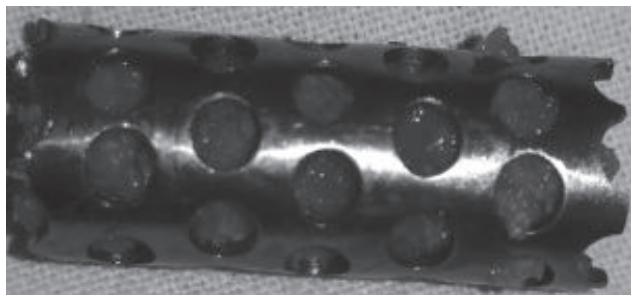
The bonegraft did not project anteriorly, as with some techniques. For the duration of this study, cervical reconstruction plates longer than 55 mm were unavailable. In some cases, an anterior cervical plate was applied spanning the fusion or at the upper and/or lower end of the fusion.

RESULTS

Total 10 underwent discectomy and corpectomy and 16 received discectomy at more than two level. Average follow up period was 3 months. CSF leakage in 1 was due to adhered yellow ligament which was repaired by facial patching. During the follow up no kyphotic change. To prevent postoperative hematoma we used drainage, which was removed after around 35 hours.

Ten patients underwent discectomy and corpectomy. In 8 autogenous anterior iliac crest for bone graft with plating was done. Two patients used titanium mesh cage with cancellous bone from resected vertebral body with plating. There were no infections, neurological or graft-related complications (e.g. extraction, collapse, subsidence or kyphosis) and no hardware failure such as plate fracture, migration of cortical screw or malposition. No pseudarthrosis, hoarseness, adjacent disc degeneration and kyphotic change were found on follow up. Two complained of pain in iliac bone graft donor site during the follow up. Five experienced transient symptoms of mild dysphagia. This dysphagia resolved in all patients within 3 weeks after surgery.

JOA score improved to more than 13 points. Regarding predictors of surgical outcomes, the following factors such as the preoperative transverse area of the spinal cord at the site of maximal compression, the age at the time of surgery, the chronicity of the myelopathic symptoms (preoperative JOA score), the multiplicity of involvement, the high-signal changes on T2-weighted images of the spinal cord before decompression and the sagittal cervical alignment have been considered the key predictors⁷.



Titanium Mesh cage with autogenous cancellous bone and Cervical plate

Japanese Orthopaedics Association Score.

Variable Grade

1. Motor Function

A) Upper Extremity

- Unable to feed one self- 0
- Unable to handle chopsticks; able to eat with a spoon-1
- Handles chopsticks with much difficulty- 2
- Handles chopsticks with slight difficulty- 3
- Normal- 4

B) Lower Extremity

- Unable to stand and walk by any means- 0
- Unable to walk with/out a cane or othersupport on a level- 1
- Walk independently on a level surface butneeds support on stairs- 2
- Capable of fast walking but clumsy- 3
- Normal- 4

2. Sensory Function

A) Upper Extremity

- Apparent sensory loss- 0
- Minimal sensory loss- 1
- Normal- 2

B) Lower Extremity

- Apparent sensory loss- 0
- Minimal sensory loss- 1
- Normal- 2

C) Trunk

- Apparent sensory loss 0
- Minimal sensory loss 1
- Normal 2

3) Bladder Function

- Urinary retention and/or incontinence 0
- Sense of retention and/or dribbling and/or thin stream -1
- Urinary retardation and/or pollakiuria - 2
- Normal -3

Total 17

Recovery rate (by Hirabayashi method)=**Postoperative score-Preoperative Score****17 (full score)-preoperative score x 100(%)****DISCUSSION**

This study shows that the major parameter i.e. the several modifications of laminoplasty were proposed to keep the cervical alignment. Hirabayashi et.al. described two

mechanisms of neural recovery as the result of laminoplasty. The decompression effect of laminoplasty consists of two distinct mechanisms. One is a direct posterior decompression effect and other is an indirect anterior decompression effect obtained by the posterior shift of the spinal cord from the anterior compressive lesions. The dorsal shift of the spinal cord is achieved only in patients with a lordotic cervical spine. The spinal cord of a kyphotic cervical spine moves less posteriorly, and these patients still have some anterior compression after laminoplasty. Several authors described unfavorable results in patients with loss of lordosis that decreases the shift of the spinal cord. The curvature and the range of motion of the cervical spine have been reported to decrease after laminoplasty. The main cause of this change in curvature could be destruction of the facet joint by the lateral gutters formed as part of the laminoplasty, or the change could be the result of damage of the paravertebral muscles and their attachments to the spinous processes. Postoperative weakness of the posterior structure of the cervical spine may also be an etiological factor. Using spacer method of posterior element-preserving laminoplasty may initially seem complicated but can be performed more quickly as surgeons become more familiar with the procedure. Lateral mass spinal fixation is a safe and effective stabilization technique⁸.

The possible causes of axial pain after laminoplasty were disuse atrophy of the nuchal muscles and prolonged bracing and bone graft on the hinged side might increase the risk for axial pain. Postoperative laminoplasty C5 palsy is defined as paresis of the deltoid muscle and/or the biceps brachii muscle after cervical decompression surgery without any deterioration of myelopathy symptoms. Half of affected patients complain of sensory deficits and/or intractable pain in the shoulder region (C5 dermatome area) as well as muscle weakness, whereas the other half manifest only motor weakness in the C5 area. Recurrent stenosis may occur after laminoplasty if laminae are elevated insufficiently to allow for adequate canal expansion or if the laminae are displaced anteriorly in the postoperative period. ROM: On radiological findings, some authors reported that range of motion of the cervical spine was reduced (22-70%) after laminoplasty⁹.

Transient dysphagia results from prolonged traction on the esophagus during anterior surgery. Complications of the decompressive procedure involve vertebral artery injury, dural tear, and iatrogenic spinal cord injury. Injury to the vertebral artery can be avoided by strict orientation to the midline, and preoperative review of a computed tomography scan to rule out an anomalous

vertebral artery. Furthermore, screws may fail to lock to the plate, leading to backing out and possible visceral injury. The injury of laryngeal nerve cause transient hoarseness.

Adjacent-level disease is defined as the development of a new radiculopathy or myelopathy referable to a segment adjacent to a previously fused level in the cervical spine. Pseudo-arthrosis after an anterior cervical discectomy and fusion is a well-known complication.

However, not all pseudoarthrosis are symptomatic or require a subsequent surgical repair. Kyphotic change in patients who undergo cervical corpectomy (CC) results from the axial loading on the graft before it is incorporated into the spine and its subsidence into the adjacent softer medullary bone of the vertebral bodies¹⁰.

The most common site for donor graft harvesting is the iliac crest. Minor complications include superficial infection, superficial seroma, minor hematoma, and pain. Major complications may include herniation of abdominal contents, vascular injuries, deep infections, neural injuries, deep hematomas, and iliac wing fractures. The theoretical advantages of disc arthroplasty include maintenance of range of motion, avoidance of adjacent segment degeneration, reconstitution of the disc height and spinal alignment, maintenance of mechanical characteristics, decreased surgical morbidity compared with fusion, avoidance of complications from instrumentation or postoperative immobilization, and to allow an early return to function. The introduction of inter-body spacers, so-called cages, is the answer to donor site morbidity and optimization of the fusion construct. Two major types of titanium cages: threaded hollow cylinders and rectangular cages¹¹. Complications can generally be categorized as: approach related, decompression-related, graft related, long-term and Patients health condition and habit. Careful patient selection remains the cornerstone of good surgical results. This, combined with high-quality imaging study and meticulous surgical technique, will result in gratifying results with respect to neurologic recovery, function, and pain relief¹².

CONCLUSIONS

Cervical spondylotic myelopathy is a progressive degenerative process that can lead to severe neurological impairment, pain, and disability. Surgical treatment can arrest progression and allow for recovery of neurological function. Currently, there are several anterior cervical decompression techniques that have been demonstrated to be safe and effective in the treatment of CSM. Given

the heterogeneity of the disease process and the number of patient-specific variables that must be considered, the optimal surgical management of multilevel cervical spondylotic myelopathy has to date not been defined. While the current state of the literature does not provide definitive evidence of a superior technique, recent studies suggest that anterior surgeries may be preferable to posterior approaches, in particular in the patient with a kyphotic alignment, when considering health-related quality of life measures and cost effectiveness.

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