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Editorial

Road Traffic Accident (RTA)

A road traffic collision (motor vehicle collision, motor vehicle accident), car accident is when a road vehicle collide with each other. Usually they are unintended resulting in injuries, death and/or loss of property. RTAs kill 45,000/year in USA & 60% are less age 35 & account for 5,00,000 hospitalization. It account for 20,000 annual spinal cord injuries at a cost of $75 billion/year. According to the latest WHO data published in April 2011, road traffic accidents deaths in Bangladesh reached 21,218 or 2.22% of total deaths. The age adjusted death rate is 16.40 per 100,000 of population,Bangladesh ranking 90 in the world.

Causes of RTA includes : Bad weather where due to bad visibility or flash flooding lead to vehicles colliding with each other,drivers are intoxicated by alcohol/drugs,driver error is the largest cause of RTA currently, these ranges from follow willing cars too closely, falling asleep at the wheel, driving too fast, unsafe over taking, carelessness, ignorance & lack of adequate training, bad road design, vehicle defect includes brake failure to a tire bursting or defective air bags, distractions: violence of traffic rules & laws.

In 1990, about 5 million people died worldwide as a result of injury & estimated that by the year 2020, 8.4 million people will die every year from injury. It is also postulated that RTA will be the 3rd most common cause of disability & the 2nd most common cause of death in the developing world.

In RTA,injury pattern can be divided into collisions between patient & external environment where accelerate or deceleration forces acting on the patients internal organs. In frontal collision initial impact point is the lower extremities, resulting fracture /dislocation of ankle; knee, hip, femoral fractures. As the body continuous to moving, the head, cervical spine may injure.

In the lateral impact the victim may accelerated away from the side of the vehicle causing compressive pelvic injury, pulmonary contusion, intra -abdominal solid organ injury, diaphragmatic ruptures .

Deceleration /acceleration injuries occur when differential movement occurs between adjacent structures causing aortic rupture, renal pedicles injury.

Motor cyclist experience a death rate 35 times greater than the occupants of car. In such cases injuries includes head injury, spinal injury, cervical vascular injury, thoracic injuries includes aortic injury, blunt cardiac injury, tracheo-bronchial tree injury, diaphragmatic injury. Abdominal injury includes hollow viscous injury, pelvic & extremities injury.

RTA causes both tangible & intangible costs to the economy includes: damage to the vehicles require repair cost, administration costs, medical treatment, reduction in output due to injury & death also insurance costs.

Intangible cost includes pain, grief & sufferings. Economical loss decreases national GDP. RTA causes direct impact on the social & physical environment, the person involved in an accident, the whole family will have to sustained the medical burden or in event of death, the whole family may become financially vulnerable , leads the circumstances, the family will be forced to look for an alternative income earner to alleviate poverty, may end up exposing them to AIDS or children may become destitute.

There is no recent data in our country. But according to JDMC, a total of 400 RTA patients attended during their data collection period at Dhaka Medical College and Sir Salimullah Medical College (SSMC) & Mitford Hospitals from July 2007 to June 2008 reveals that,23.8% patients due to accidents were related to truck accidents, followed by bus (20.3%) and CNG Taxi (11.3%) respectively. It has been revealed that frequency of accidents caused by new vehicles and old vehicles were almost equal (36.5%) and 13.5% vehicle were overloaded when accidents happened. Fast speeds of the vehicles (62%) were responsible for accidents. About 31% stated that even with normal speed accident was happened. About 44.8% accidents were caused due to collision with other vehicles. Majority of the patients (52.8%) stated that drivers were looked healthy, 17.8% drunker and 5.5% looked drowsy when they drove vehicles during accident. Majority (55%) of them drove in wrong side of the road. In 78.3% cases, there was no traffic signal, 39.1% driver did not follow traffic signal. About 25% patients stated that defective road is the factor of causation of accidents. Majority (76.75%) of the patients opined that accident was

happened during day time and in sufficient light (66%). Weather was foggy stated by 16% patients. Only 6.75% victims used protective measure during accidents.

Therefore, plan should be taken to reduce RTA by taking certain measure includes: speed limitation, good high way patrols, good road design, improving driver skill & good governance.

Recently communications minister asked the concerned authorities to remove unauthorized vehicles like Nosimon, Korimon (small vehicles having no brakes and other essentials) and Easy Bikes from the highways within three months to prevent road accidents from happening on Jan 2013. The order came from a meeting of the Transport Advisory Council held at the conference room of the Communications Ministry.

He also said that the Divisional Commissioners would coordinate the operations in cooperation with local political leaders and the civil society.

In that meeting, the council decided to remove unauthorized infrastructures like shops and markets from the highways and the Sayedabad bus stand area within three months.

The chairman also informed that the council has decided that the City Corporation would remove wastes from the roads in the city to ease vehicle and pedestrian movement

The first human fatality associated with a motor vehicle was a pedestrian killed in 1899 , since then the patterns of injury from man's interaction with the motor car may have been somewhat modified by crash protection devices, such as helmets, seat belts and air bags, but injuries due to road traffic related trauma are worsening each year. Injury is the leading cause of death among young adults in the western world and trauma is imposing an increasingly severe burden on the health infrastructure of the developing world. The use of motor vehicles is growing worldwide; a particular concern in emerging nations where increasing urbanization, overcrowding and scant regard for the 'rules of the road' are the norm.

Nevertheless, it is not feasible to draw a concrete conclusion. But on the basis of the study findings, it may be stated that a greater part of Road Traffic Accidents (RTA) can be prevented by specific preventive measures and also taking personal precautions. It is also to be concluded that countrywide wide mass scale study should be carried out in this specific emerging field to combat road traffic accidents as a major public health issue.

A recognition of the typical patterns of injury coupled with a logical sequence for the initial assessment and management of trauma patients will contribute to reductions in mortality and morbidity; however, the most significant impact on reducing the worldwide burden of motor vehicle-related trauma will come from injury prevention programmed organized at societal and governmental levels.

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Original Article

Results of one stage reconstruction in old injured flexor tendons on fingers of the hand at zone II

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ABSTRACT

Hand is the most important effective organ of a person. Intactness of tendons (both flexor and extensor) are essential for proper functioning of hand. Injury of tendons in hand produces deformity and nonfunctioning hand. Flexor tendon injuries in the hand are the most common hand injuries and may involve multiple digits and locations. Deformity is more when Flexor tendon injury occurs at zone II of hand. Late presentations are frequent where early repair is not feasible. Such late cases surgeons are advised to reconstruct the FDP tendon at zone II by free tendon graft rather than repair. Although late cases are frequent, few studies of single stage reconstruction of flexor tendon (FDP) at zone II of hand have reported good functional outcome.

To regain the hand function as early as possible by single stage reconstruction of flexor tendon (FDP) at zone II of hand by free tendon graft.

This study was conducted at the NITOR, Sere Bangla Nagar, Dhaka from 1st January 2008 to 31st December 2009.Old injured flexor tendons (FDP and FDS) of fingers at zone II of hand, single stage reconstruction was done by using Palmaris Longus free tendon graft. In this study 17 patients were operated and continuous followed up for 4 to 12 months duration. In all patients, injured fingers were exposed by Brunner's zigzag incision. Proximal end of tendons was exposed at zone III. Palmaris Longus tendon graft collected from distal forearm by two incisions. Proximal cut end of FDP tendon pulled distally and cut. Distal 1 cm of FDP of distal cut was preserved for later juncture with graft. Graft was placed through the pulleys in the sheath. Distal juncture was made by modified Kessler's technique. For core suture non absorbable monofilament 4-0 atraumatic prolene and 5-0 prolene for epitendinous suture was used. Proximal juncture of the graft with FDP was made after measuring adequate tension at zone III by Pulvertuft technique. The wound was closed with interrupted non-absorbable suture. A dorsal splint extending elbow to the fingertips was used with wrist joint at 30°, MP joint 60° & IP joint 5-10° flexion.

Passive movements of fingers were started from first post operative day. From second week by intermittent removal of cast, controlled active flexion of fingers thrice daily. After three weeks complete removal of cast and active flexion of fingers continues. Outcome parameters of hand function like grip strength, key pinch and return to work status was assed according to the Buck-Gramco (1983) evaluation criteria.

Out of 17 patients functional results were excellent in 5(25%) of patients, good in 7(35%) of patients, fair in 4(20%) of patients, poor in 4(20%) of patients. No tendon ruptures or tenolysis occurred in my series. 12 patient returned to their previous occupation.

One stage tendon reconstruction is better choice of treatment in old injured flexor tendons on fingers of hand at zone II .

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INTRODUCTION

The Hand is a highly sophisticated organ of communication, as it has three basic functions: Sensory perception, precise manipulation and power grip, carried out by musculotendinous units. It can give information about the position, size and shape of an object by its highly developed sensory mechanism and described as third-eye (Davies , 1985). Hand function will be grossly impaired if flexor tendon is injured as muscle activity is finally carried out by intact tendon attached to the bone. For injured flexor tendon in the hand, the goal of treatment is recovery of functionally acceptable digital motion with intact tendon (Strickland, 1998).

Flexor tendon injury is one of the most common hand injuries. Surgical repair of flexor tendon requires an exact knowledge of anatomy, careful adherence to some basic surgical principles, sound clinical judgment, strict atraumatic surgical technique and a well planned post operative programme. (Ahmad , 2007).

Flexor tendon surgery at zone II is particularly difficult as fibro osseous sheath with pulley systems are there to prevent bow-stringing (Holm, 1959) The zone II is also important as two tendons (Flexor Digitorum Superficialis and Flexor Digitorum Profundus), pass through the fibro osseous sheath system (Williams , 1989). The two tendons maintain fairly constant relationship and maintenance of this anatomical relationship is important to prevent malfunctioning of tendons (Wehbe, 1985).Hand function will be grossly impaired if flexor tendon is injured as muscle activity is finally carried out by intact tendon attached to the bone. For injured flexor tendon in the hand, the goal of treatment is recovery of functionally acceptable digital motion with intact tendon (Strickland, 1998)

Indications permitting primary repair of lacerated flexor tendons in Bunnells 'no man's land' included clean lacerations caused by sharp instruments with minimum tissue damage, no contamination or open fracture.(Kleinert,1957) Tendon adhesions are the most common problem following tendon repair if not properly handled and repaired. Tendon and tendon sheath laceration during injury or during operation, tendon ischemia, sheath diminution, immobilization and suture gap formation all favors' adhesion formation (Galanakis.2003).

Because of better techniques, improved suture materials and the availability of trained people interested in hand surgery; direct early repair in zone II has proved its superiority (Chow, 1988). But while crushing injures with division of flexor tendons, skin damage or open fracture at zone II, primary repair is not certainly indicated. Wound should be allowed to heal and repair by means of a tendon graft (Mason,1959)

Though direct early repair of injured flexor tendons at zone II are superior, yet there are a group of patients in whom a free tendon graft is indicated. These groups include patients in whom the wound or general condition did not allow the direct repair. Grafting may also be required during late referral from peripheral centers or the tendon injury was missed at the time of initial care. Unfortunately, the experienced hand surgeons also are not involved in the primary care of hand injury in primary centers in our country.

Tendon grafts should be of adequate size, yet small enough in caliber to avoid massive necrosis from taking place before the new tendon is nourished. Tendons to be used as grafts are better if of small in diameter and have a smooth gliding surface, so that they can be easily nourished by the surrounding tissues.

The Palmaris Longus tendon is the most common source of tendon for use in the hand. It is 12 or 15 cm in length and adequate in caliber. It is present an about 80 percent of the population. It can be withdrawn readily from its bed distally with its smooth epitenon layer intact through two small incisions in the forearm (Boyes, 1950.1955)

Graft must be handled with extreme care and placed in a bed of good tissue. Junctions of graft with tendon should be accurately made and selected to avoid becoming adherent to adjacent raw surfaces of ligaments of fascial planes. Proper tension of a graft is somewhat less than that used for direct tendon transfer. If a graft is to be used and placed in a scarred bed, it is better to include paratenon with the graft (Boyes, 1970).

One stage tendon grafting for isolated profundus injury can be accomplished successfully without interfere sublimis tendon function (Versaci, 1970). Injury of the tendons in more than one digit was not important but the condition of the individual digit determined the outcome. Pulley reconstruction was done if needed at the same time as the tendon grafting does not compromised the result (Boyes, 1970)

A study of technique of tendon grafts for flexor tendon injures in the fingers of ninety cases. The results obtained, replacement of a divided FDP in presence of an intact FDS tendon restored a useful range of movement in 80 percent of cases. The particular tendon used for the graft did not materially influence the result (Pulvertaft, 1956)

A study of factors influencing results in 1000 cases in the zone commonly called no man's land was done. Significant detrimental factors are if total loss of extension of the interphalangeal joints exceeds 40 degrees in index or long

and 60 degrees in the ring or little fingers. Other thing being equal patients over forty years of age did not obtain as much motion from tendon grafts as did the patients in younger age groups (Boyes, 1970).

The late management of a divided profundus tendon with intact sublimis tendon, a study result of thirty patients' average age was 28.5 years. After complete mobilization of the distal insertion and the proximal portion of the profundus tendon at the lumbrical lebel, reconstruction was done by free tendon graft. In thirty three patients donor tendon was Palmaris Longus and the Planteris in seven patients .A modification of White's end result classification for tendon graft assessment was used. Excellent results were 20 per cent,37 per cent good results, 37 per cent fair and 6 per cent poor results(Jaffe,1966)..

Hand injury is common in our country but the exact incidence is not known. There is no national statistical data in this aspect. But our hospital statistics shows that the hand injury with flexor tendons injury are increasing day by day due to increased social, political violence and mechanization all over the country.

Musculoskeletal trauma is increasing rapidly and they require prolonged bed-occupancy. Hand injury patients are neglected most of the times due to failure to have a chance for admission in hospital; it prolongs the treatment. As the patients are treated on the outdoor basis, they need no bed for admission which is a major problem in the hospital. It lessens the bed occupancy. There is no specialized centre except few tertiary hospitals in our country for hand injury patient. Operation of the hand can easily and safely be done by improved regional anesthesia. Due to scarcity of hospital bed, improved anesthetic facility, availability of physiotherapist, interest has developed to treat the tendon injury patients as day case at NITOR.

As specialized centre for musculoskeletal system and lack of expertise in this specialty in the peripheral centers, many patients are referred to the National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, with a prolonged gap since injury, when repair is not feasible.

In our study the cases were collected from the outpatient department. After fulfilling all the preoperative criteria operation was done in hand Operation Theater. Subsequent postoperative management and follow up was done in hand clinic.

Operation of the hand can easily and safely be done by improved regional anesthesia. Do to scarcity of hospital bed and on the other hand improved anesthesia facility, interest has developed to treat tendon injury patients as indoor patient as well as outdoor patient in National Institute of Traumatology and Orthopeadic Rehabilitation (NITOR), Dhaka.

MATERIALS AND METHODS

Type of Study

This was a prospective interventional study.

Period of Study

From 1st January 2008 to 31st December 2009.

Place of study

Study was carried out at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka.

Study population

One stage reconstruction of old flexor tendons on fingers of hand at zone II of 12 to 60 years old and of either sex.

Sample Size

A total number of 24 injured fingers of 20 patients with injury of both long flexor tendons (FDP and FDS) at zone II of hand were selected for the study. Selection was done on the basis of history and clinical examination at the outpatient department (OPD). Three patients with four injured digital flexor tendons were lost from the follow-up because of various reasons and therefore excluded from the study. The remaining 17 patients were available for follow-up for a period of 4 to 12 months.

Inclusion Criteria

a) Sharp cut injury with minimum scar along with FDP and FDS tendon injury of fingers at zone II of hand
b) Age of patient 12 to 50 years
c) Age of injury from 4 weeks to 6 months
d) Normal or near-normal passive range of motion of joints of fingers
e) Good digital circulation - at least one intact digital vessel confirmed by Alien test (Wright, 1998)
f) both sex
g) Well-motivated and well-informed patients

Exclusion Criteria

- Lacerated injury with extensive scar
- Injury more than 6 months
- Stiffness of joints of fingers
- Malunited fracture of small bones of the hand
- Uncooperative patients
- Medical problems, like Epilepsy, Reynaud's disease, Arthritic hand, Paralyzed hand etc.

Measures of Outcome Variables

After enrolment of the patients, the following variables were measured:

1) Demographic variables
   - Age
   - Sex
   - Occupation

2) Clinical variables
   a) History
      - Date of injury
      - Mode of injury
      - History of initial care
      - Involvement of side
      - Involvement of digit
      - Time interval between injury and operation

   b) Clinical Examinations
      - Condition of scar
      - Digital circulation
      - Neurological injury
      - Presence of Palmaris Longus tendon
      - Passive range of motion of joints of finger
      - Condition of bone and joints

3) Diagnostic variables
   - Radiological examination of hand
   - Pre and postoperative photographs

4) Laboratory investigations
   - Total Blood count
   - Blood sugar
   - Urine routine examination
   - Blood urea
   - Chest X-ray

5) Surgical features
   - Condition of pulleys
   - Adhesion
   - Gliding bed

6) Complications
   - Neurological deficit
   - Ugly scar
   - Graft rupture
   - Adhesion formation

Ethical consideration:

Written informed consent was obtained from the patients and the relevant authorities

Data collection

Data was obtained using the patients information sheet comprises of structured questionnaire ,laboratory investigations, pre and postoperative data. Data was collected by pre designed Proforma, Patients information, operative observation and follow up of patients.

Data processing

Data was processed, edited and analyzed by SPSS (statistical package for social science) facilities

Data analysis

Findings of the study to be complied and calculated. Quantitative data was described accordingly.

Criteria For Evaluation of Functional Outcome

The evaluation of functional criteria were studied according to Buck- Gramco(1983). -

Table-I

Criteria for evaluation of functional outcome

	Parameters	Degree	Points
A.	Composite flexion	>200	6
		>180	4
		>150	2
		<150	0
B.	Extension deficit	0-30	3
		31-50	2
		51-70	1
		>70	0
C.	Total active motion	>160	6
		>140	4
		>120	2
		<120	0

Total active motion (TAM) means active motion done at the joints of the finger. It can be calculated by subtracting the total extension deficit of joints from composite flexion of finger.

TAM = Composite flexion-extension deficit at joints of fingers
Composite flexion means sum of angles formed by metacarpo-phalangeal, proximal and distal interphalangeal joints.

Score

Score = A+ B + C

A : Composite flexion
B : Extension deficit
C : Total active motion

Categorization of results

Excellent : When score is 14-15
Good : When score is 11-13
Fair : When score is 7-10
Poor : When score is 6 or below 6

Shortly the result was categorized into satisfactory and unsatisfactory.

Satisfactory : When score is 11 to 15. So, excellent and good results are categorized as satisfactory.

Unsatisfactory : When score is below 10. So, fair and poor results are categorized as unsatisfactory.

Data Collection and Analysis

Data were collected, compiled arid tabulated according to key variables and biostatistical analysis was done by scientific calculator. Both qualitative and quantitative data generated during study were collected and recorded. Qualitative data were collected using predesigned structured questionnaire and then described (Appendix-II). Quantitative data were presented in tables. Test of significance of differences were done using 'Z' test. A 'P value of < 0.05 was considered as statistically significant.

OBSERVATIONS AND RESULTS

The present prospective study was carried out between January 2008 to December 2009 at NITOR, Dhaka. Total 20 patients were selected for this study, but of out of these, 3 patients were lost from total postoperative programme for various reasons. So, remaining 17 patients with 20 injured tendons were followed up for at least 4 months and a maximum of up to 12 months. In these series, following observations were noted.

Age Incidence

Table-II shows the age incidence of patients. Age of the patients ranged from a minimum of 12 years to a maximum of 45 years, mean age being 26.65 years. Maximum number of patients, 10 (59%) belonged to age group 21-30 years, followed by 4 (23,3%) in age group 11-20 years, 2 (11.8%) in age group 31-40 and 1 (5.9%) patient in age group 41-50 years. The highest incidence was found in age group 21-30 years (Table-II)

Table II

Distribution of patients in different age groups (n= 17)

Age group (years)	Number of patients	Percentage
11-20	4	23.3
21-30	10	59.0
31-40	2	18.8
41-50	1	5.9

*Z=1.59,P<0.05

So, difference is significantly higher in age group 21-30 years than 41-50 years.

Sex Distribution

Table-III shows that out of 17 patients, 14 (82.35 %) were male and the rest 3 (17.65%) were female. Incidence of tendon injury was higher in male than female due to their outdoor activities and protected lifestyle in female. The male-female ratio was 4.67:1 (Table-Ill).

Table-Ill

Distribution of patients according to sex (n= 17)

Sex	Number of patients	Percentage
Male	14	82.35*
Female	3	17.65

*Z=1.97,P<0.001

So, the sex incidence is significantly higher in male than female.

Occupation

Table-IV shows distribution of patients by occupation. All the patients who were treated in this series belonged to different occupation. Among them, 5 (29.40%) were student, 4 (23.53%) businessman, 4 (23.53%) service holders, 2(11.77%) taxi driver and 2(11.77%) housewife. Highest number of patients were student, followed by businessman and service holders, least number of patients were housewife and taxi driver (Table-IV).

Table-IV

Distribution of patients by occupation (n= 17)

Occupation	Number of patients	Percentage
Student	5	29.40*
Service holder	4	23.53
Businessman	4	23.53
Taxi-driver	2	11.77
Housewife	2	11.77

*z = 0.52, P > 0.05

So, there is significant difference between the occupation of higher and lower incidence.

Incidence of Involved Digit

Table-V shows that index finger was involved in 7 (35%) cases, middle finger in 6 (25 %), ring finger in 4 (20 %) and little finger in 3 (15 %) cases. Highest number involvement was found in index finger and lowest number was in little finger. (Table-V).

Table-V

Distribution of involvement of digits (n=20)

Digits involved	Number of digits	Percentage
Index	7	35.0*
Middle	6	30.0
Ring	4	20,0
Little	3	15.0

*Z = 0.65, P>0.05

So, there is no significant difference between involvement of higher and lower incidence.

Incidence of Mode of Injury

Table-VII shows that mode of injury of tendons 13 (76.47%). Patients suffered injury by sharp weapon, such as knife or blade, whereas 4(23.53 %) had injury by broken glass (Table-VII).

Table-VII

Incidence of mode of injury (n= 17)

Mode of injury	Number of patients	Percentage
Sharp cut	13	76.47*
Broken glass	4	23.53

*Z= 1.61, P< 0.001

So, there is significant difference between sharp cut and broken glass cut injury.

Side Involvement

Table-VIII shows that right dominating side was involved in 12 (70.6%) and left non dominating side involvement was in 5 (29.4%) patients. Highest number of patients had right side involvement. In the right side, 10 patients were male and 2 were female, whereas in the left side, 4 patients were male and 1 was female (Table-VIII).

Table-VIII

Distribution of side of involvement of the patients (n-17)

Side involved	Number of patients	Percentage
Right	12	70,6*
Left	5	29.4

Z=1.26, P<0.05

So, there is significant difference between involvement of right and left sides.

Time interval between injury and operation

Table-IX shows the time interval between injury and operation.

Table-IX

Distribution of patients by time interval between injury and operation (n= 17)

Time interval (weeks)	Number of patients	Percentage
5-8	2	11.76
9-12	3	17.65
13-16	5	29.40
17-20	4	23.54
21-24	3	17.65

In this series, none of the patients were treated within the first 4 weeks of injury, 2 (11.76 %) patients were operated within 5-8 weeks interval, 3 (17.65 %) between 9-12 weeks, 5 (29.4 %) between 13-16 weeks, 4 (23.54 %) between 17-20 weeks and 3 (17.65 %) between 21-24 weeks. About fifty three percent of the patients were treated between 13-20 weeks interval since injury. The mean duration of delay was 15.7 weeks (Table-IX).

DURATION OF FOLLOW-UP PERIODS

Table-X

Shows the Distribution of time of follow-up (n= 17)

Time of follow-up (months)	Number of patients	Percentage
4-6	4	23.5
7-8	6	35.3
9-10	4	23.5
11-12	3	17.7

Total follow-up period ranged from 4 to 12 months, with an average of 7.94 months. Out of 17 patients, 4 (23.5 %) were followed up for a 4-6 months, 6(35.3 %) for 7-8 months, 4 (23.5%) for 9-10 months and 3 (17.7%) for 11-12 months.

One patient gained full range of motion with excellent result in 4 months and he was advised to come only if any complication develops. But he did not came further (Table-X).

Incidence of Complications

Table-XI

Distribution of incidence of complication (n=20)

Complications	Number of fingers	Percentage
Neurological deficit	2	11.75
Infection	1	5.88
Ugly scar	1	5.88
Swan-neck deformity	1	5.88
Adhesion formation	3	17.65

Of all the 17 patients with 20 injured digits, 2(11.75 %) patients developed neurological deficit, 1(5.88 %) developed wound infection, 1(5.88 %) developed ugly scar and 1(5.88 %) patient developed swan-neck deformity. Later 3 patients developed postoperative adhesion (Table-XI).

Final Functional Outcome

By Buck-Gramco (1983) evaluation criteria.

Table -XII

Shows that distribution of patients by functional outcome (n=20)

Result	Number of Digits	Percentage
Excellent	5	25.00
Good	7	35.00
Fair	4	20.00
Poor	4	20.00
Satisfactory(Excellent plus Good)	12	60.00*
Unsatisfactory(Fair plus Poor)	8	40.00

Total 17 patients with 20 digits, was 60 percent satisfactory (excellent plus good) and 40 percent unsatisfactory (fair plus poor) (Table - XII).

DISCUSSION

Flexor tendon injuries continue to be disabling diseases. Flexor tendon Injury at zone II of hand has always presented as a problem in the management. There is no conservative treatment of this injury, but sometimes can be ignored when only flexor digitorum profundus is injured in a less important finger of non dominant hand with intact flexor digitorum superficialis. But most of the times, the injury involves both tendons that causes significant morbidity to the patients due to loss of grip and other fine activities. In Bangladesh, the injury is mainly due to sharp cut and earning members of the family mostly are affected in a lot of cases. They need proper management with early return to their activities. But the procedure and aftercare is lengthy to achieve a full functional recovery. As there is no conservative treatment available, either repair or reconstruction is the method of choice depending upon the necessity of the individual patient involved. In this series, only one-stage grafting was selected . The various aspects of the tendon reconstructions has been evaluated.

In this series, a little bit early mobilization programme was used which have many advantages. Early mobilization programme that attempt to allow tendon healing by decreased surrounding adhesion formation. Researchers have demonstrated that repaired tendon stressed through a early mobilization programme heal faster, gain tensile strength faster and have less adhesion and better excursion than unstressed repair. Some type of early mobilization programme is currently the accepted postoperative treatment after flexor tendon repair (Gulp and Taras, 2000).

In this series, age of the patients varied from minimum 12 to maximum 45 years. Among them, 4 (23.3%) patients were within 11-20 years of age group, 10 (59 %) in between 21-30 years and 2 (11.8 %) above 31 years. The mean age of the patients was 26.65 years, which corresponds with other series where mean age was 23.3 years (Tang and Song, 1993). Ten patients (59 %) in the age group 21-30 years correspond to similar age group of series by Kunzle *et al* (1984).

Age of patients is an important factor in achieving full functional recovery. Most of the poor results (20%) were found in the age group above 30 years Which corresponds with the series of Kunzle *et al.* (1984).

There were 14 male (82.35%) and 3 female (17.65%) patients, which corresponds to the series of Hunter and Salisbury (1971), but does not correspond with the series of Chacka (1974), where male-female ratio was 51:12 and 12: 1, respectively. Male predominated far more than females in all other series. In this series, male-female ratio was 14:3.

Flexor tendon injury in this series was more in right dominating hand, 12(70.6%) versus 5(29.4%) in left non-dominating hand. This corresponds to the series of Jaffe and Weckesser (1967) and Naam (1997), who found 56.66 and 63.63 percent in dominating hands, respectively, and 43.33 and 36.63 percent non-dominating hands respectively.

Incidence of involved digits shows that 7 (35%) patients had involvement of index, 6(30%) middle, 4 (20%) ring and 3 (15%) little fingers in this series. The results of this study

nearly corresponds to the study by Goldner and Coonard (1969) who showed 27.27, 18.18, 31.81 and 22.72 percent, respectively, with slight variation.

In this series, associated digital nerve injuries were in 3 (15%) digits. This result corresponds to the series to Chacka (1974), who found 23.07 percent. Better results were observed in 3 (75%) patients with repair during tendon grafting.

Thirteen patients (76.47%) out of total 17 patients had sharp cut injury and 4 (23.53%) lacerated injury by glass, This result is approximately corresponds to the series of Chacka (1974), in which the result was 81.61 and 15.38 percent, respectively. Sharp cut injury is mainly by knife of a hijacker. Tang and Song (1993) showed that 60 percent patients had sharp cut Injury, 26.66 percent machine saw injury and 13.33 percent compression cut injuries, which does not correspond to our series. It may be due to their industrializations and social security.

In this series 5 patients (29.4%) were students, 4(23.53%) businessmen, 4 (23.53%) service holder, 2 (11.77%) taxi-driver and 2 (11.77%) housewife (Table-IV).Two patients (11.76%) were operated between 5-8 weeks after injury, 3 (17.65%) between 9-12 weeks, 5 (29.40%) between 13-16 weeks, 4 (23.54%) between 17-20 weeks and 3 (17.65%) between 21-24. This result does not correspond with the results of Kunzle *et al* (1984), where 40 percent patients were operated within 4 weeks of injury, 24 percent within 5-12 weeks, 20 percent within 13-24 weeks, 12 percent within 25-60 weeks and four percent after 1 year. It is due to ignorance and negligence of our patients and lack of expertise in the tendon surgery at the peripheral hospitals in our country and also delayed diagnosis and delayed referral. It may be also due to long waiting list of hand injury patient and lack of regular operation schedule of hand surgery. In a series of Kunzle *et al.* (1984), the length of time from injury to operation seemed to have little effect on the results. It also corresponds with this series where time interval between injury and operation was not a factor.

The range of postoperative follow-up was from 4 to 12 months, which is also exactly similar to that of Aziz (1988), but in this series average follow-up was 7.94 months versus 6.14 months.

In my study ,functional outcome was satisfactory (excellent plus good) in 60 percent of fingers; excellent in 5 digits (25%) and good in 7 digits (35%).

In a series by Kunzle *et al* (1984), the excellent result was 20 percent and good 36 percent digits. In their study, combined excellent and good result was 56 percent, which is slightly less than this series. Because in this series, early active motion was started by actively contracting the flexor muscles with the fingers in full flexion. The unsatisfactory (fair plus poor) result was observed in 40 percent digits in this series compared to 44 percent in the grafted digits of Kunzle *et al* (1984). Chow *et al.* (1988) showed 98 percent satisfactory (excellent plus good) results in a series of 78 fingers with long, flexor tendon injury at zone II following repair of the tendons which is much more than the present series.

In their series, unsatisfactory (fair only) result was only 2 percent digits and there was no poor result. The results of two-stage reconstruction of flexor tendons were satisfactory in 79.62 percent digits in a series of Paneva-Holevich (1982) with 20.38 percent unsatisfactory results, which is much more than that of current series of one-stage graft. It may be due to highly developed technology of the tendon surgery in that particular centre.

In this series, one (6, 25%) patient developed infection of mixed organism *(S.aureus, Pseudomonas, Proteus* and *E.coli)*. The organisms were resistant to most of the antibiotics, but sensitive to amikacin which was given for 5 days. But the patient developed adhesion formation. In most of the published series, there was no infection, but one patient (2.63%) developed infection in a series by Grobbelaar and Hudson (1994) out of 38 children.

In a series by Aydin, (2004), Infection at the incision site occurred in 3 cases but regressed with proper antibiotics.

In this series, 1 patient (5.88%) developed ugly scar over the fingers and palm. It impaired the function of gliding of the flexor tendons with a fair result Neurological deficit was observed in 2 patients (11.75%), one on the radial side of little and one the ulnar side of the little finger. There were two-point discrimination of > 10 mm. Swan-neck deformity was observed in 1 patient (5.88%) with 20" hyperextension of the proximal interphalangeal joint. The patient had tendon injury by sharp cut. He had also injury to the capsule of the proximal interphalangeal joint and there was also injury to the Flexor Digitorum Superficialis over the proximal interphalangeal joint. The patient had poor result. There was adhesion formation in 3 (17.65%) patients, which is a very common problem when injured tendon is repaired end-to-end with repair of sheath (Wright, 1998).

Surgical release of non-gliding adhesions that form along the surface of a tendon after injury or repair is a useful procedure in the salvage of tendon function. Tendon adhesion occur whenever the surface of a tendon is

damaged either through the injury itself, be it lacerated or crushed or by surgical manipulation.

At any point on the surface of the tendon where violation occurs, an adhesion would likely to form in the healing period (Potenza, 1963). Whenever these adhesions cannot be mobilized by therapy techniques, tenolysis should be considered. Tenolysis was performed in 2 cases of Aydin *et al* (2004) which tendon adhesion occurred and pully reconstruction was performed when pully insufficiency occurs. This procedure is demanding as tendon repair and itself cannot be Undertaken lightly. It represents another onslaught in an area of previous trauma and surgery.

Tenolysis may be required in 18.25 percent patients after repair versus 15 percent in this series. It is usually done after 5-6 months of repair and may improve the ringer function as much as 50 percent (Wright, 1998).

In this series, I tried to do the procedure on the patients those who developed adhesion but none of the patients were willing to do the second operation.

SUMMARY:

Total number of 20 patients with 24 injured flexor tendons were selected for this study, but out of these, 3 patients with 4 injured digits were lost at follow-up. All patients were treated with one-stage tendon graft and followed up for a period of at least 4 months with an average of 7.94 months.

The mean age of the patients was 26.65 years (range 12-45 years). Males were 14 (82.35%) and females 3 (17.65%). There was a preponderance of injury to the dominating right side (70.6%) than the non-dominating left side (29.4%) Highest number of patients (29.4 %) belonged to student, followed by businessman 4 (23.53%), service holder 4 (23.53%) taxi driver 2 (11.77%) and housewife 2(11.77%).

Index finger injury (35%) was maximum Followed by middle and ring (30% and 20%, respectively). Little finger involvement was least (15%). Associated digital nerve injury was present in 15 percent of fingers and mode of injury was sharp cut injury by knife in 76.47 percent of cases and glass cut injury in 23,53 percent of patients.

All the patients were operated by volar zig-zag incision, maximum of them within 13-20 weeks of injury (53%) and about 60 percent of them followed up for 4-8 months and rest 40 percent for a period of 9-12 months. Functional outcome was evaluated by Buck-Gramco criteria and were excellent in 5 (25%), good in 7 (35%), fair in 4 (20%) and poor in 4 (20%) of fingers. Regarding complications, 2 patients (11.75%) developed neurological deficit, infection in 1 (5.88%), ugly scar hi 1 (5.88%) and swan-neck deformity in 1 (5.88%) of patients.

CONCLUSION

Management of flexor tendon injury at zone II of hand constitutes a therapeutic dilemma; the problems are primarily related to basic anatomic structure and biomechanical stress of this region. There is no conservative treatment of flexor tendon injury. So, the establishment of anatomic integrity is the treatment of choice. Among many of the options of treatment of old flexor tendon Injuries of hand at zone II, one-stage tendon reconstruction was used in this series. The result of the present study suggests that one-stage reconstruction seems to be an appropriate choice of treatment, in old flexor tendon injury at zone II of hand where early repair is not feasible.

Further large-scale Studies for longer follow-up may yield a better result.

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Original Article

A prospective study of association of osteoporetic spinal fracture with hip fracture (neck #, trochanteric #)

Abul Kalam Azad[1], Md. Wahidur Rahmam[2], Golam Sarwar[2], Quazi Abul Azad[3], Siddika Sultana[3]

ABSTRACT

More than ten years study at district level hospital starting from December 2000 to January 2011 among 100 patients unrelated with sex. Age between 50-90 years, average 70 years, 81% trochanteric fracture, 19% fracture neck of femur. Among them L1 compression fracture was 80%, total 80 and D12 compression fracture was 20%, total 20. All of the pelvic fractures were found associated with Compression # L1 or, D12. Causes of fractures were fall due to slippery floor, or due to fall from standing height. All of them had fragility fracture of trochanter or fracture neck of femur associated with spinal fracture. 90% of the patient was referred to the specialized centre Dhaka for ORIF, 10% of the trochanteric fracture were treated only conservatively by skeletal traction and with bed rest associated with spinal and thigh muscle building exercise. All of them healed up within six months including spinal fractures. Post treatment follow up was 2 to 3 years and average 2 and a half years. Patient was treated associated with vitamin D3, calcium, Bisphosphonate, Estrogen, Decadurabolin, Strontium Ranelate for at least six months

INTRODUCTION:

Osteoporosis ("Porous Bones" from Greek OOTEOV/ Osteon Meaning "Bone" and Ropoc/Porous meaning "Pore") is a disease of bone that lead to an increased risk of fracture. In osteoporosis the bone's mineral density (B.M.D) is reduced, the bone micro architecture is deteriorating and the amount and Varity of proteins in bone is altered. W.H.O. define osteoporosis as B.M.D 2.5 standard deviation or more below the mean peak bone mass. Established osteoporosis includes the presence of a fragility fracture. Osteporosis may be type1, type2, (Senile osteporosis) and secondary osteoporosis.

In my study most of the patients are primary osteoporosis. A few are primary type2, osteoporosis fractures are called fragility fractures. Typically these fractures occur in vertebral column, hip, rib and wrist. Patients were treated in govt. hospitals and private clinics. Diagnosis was done simply by clinical examination and plain x-ray pelvis A/P and lateral view with associated check x-ray of the D/L spine A/P and lateral views. No expensive investigations like, B.M.D, Dual energy x-ray absorptiometry (DXA, DEXA), C.T, M.R.I, Serum Calcium, PTH, VitD3 and diagnosis of secondary causes of osteoporosis were done as a routine test.

PATIENTS AND METHODS

Among all the patients 100 patients in both sexes were studied in my practice for last ten years. Age ranges were 50-90 years. Average age was 70 years. Maximum patients were female, 90% were due to simple falls on the slippery floor and other 10% were due to falls from standing height. R.T.A patients were excluded in this study. 90% of the patients were sent to Dhaka for ORIF. 10% were followed up for at least 3 years. Those patients who were interested to treat by conservative means were included in my study. My aim and objective were to find out the associated spinal fracture (Vertebral compression fracture that either fail to detect by taking associated x-ray of D/L spine or due to failure of proper history given by the patients or attendants, patients with vertebral compression fracture associated with neurological deficit were excluded in this study. All the patients were admitted in the hospital by taking x-ray pelvis with hip A/P and lateral view associated

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x-ray of D/L spine A/P and lateral view with investigation of blood sugar to exclude D.M. All the patients were given skeletal traction with Steinman pin by local anesthesia with traction by 5-6 kg weight. Patients usually were kept in a normal bed with hard mattress with a pelvic corsette insitu to protect the spine. Patients foot end were elevated and indwelling foly's catheter with urobag connection were done for evacuation of bladder, bedpan were used for evacuation of bowel. Common antibiotics were given for prevention of pin tract infection and for UTI. Finger movements, care of prevention of bad sores, quadriceps exercise, spinal exercise, chest breathing exercise were given to prevent associated complications. All patients were given calcium, VitD3, NSAIDS and H2 blocker routinely. After two and half months of traction pin were removed and patients were discharged with rest for further one and half months with radiological checkup to check the healing progress. Patients were advised to use crutch for walking after 3-4 months of treatment. Fracture neck femurs were treated by replacement hemiarthoplasty, usually done after one and half months of fracture due to allowing healing of the spinal fracture and to reduce pain so that after replacement hemiarthoplasty mobilization can easily be done. No thomboembolic complications were seen among the study group patients.

RESULT:

Data recorded on 100 patients were evaluated for study. There were 90 females and 10 males in this series. Mean age of the patients was 70 years.

Table-I

Age distribution of patients (N=100, Age Range=50-90 years)

Age group in yrs	Frequency	Percentage
50 – 70	60	60%
71 – 90	40	40%
Grand Total	100	100%

Table-II

Sex distribution of the patients (N=100)

Sex	Frequency	Percentage
Female	90	90%
Male	10	10%
Grand Total	100	100%

Table-III

Showing associated spinal fracture (N=100)

Name of the Fracture with %	Associated partial spinal fracture	Neurological deficit
Trochanteric fracture 81%	L1=61, D12=20 Total = 81.	Absent
# neck of femur 19%	L1=15, D12=4 Total = 19	Absent
Grand Total	100	

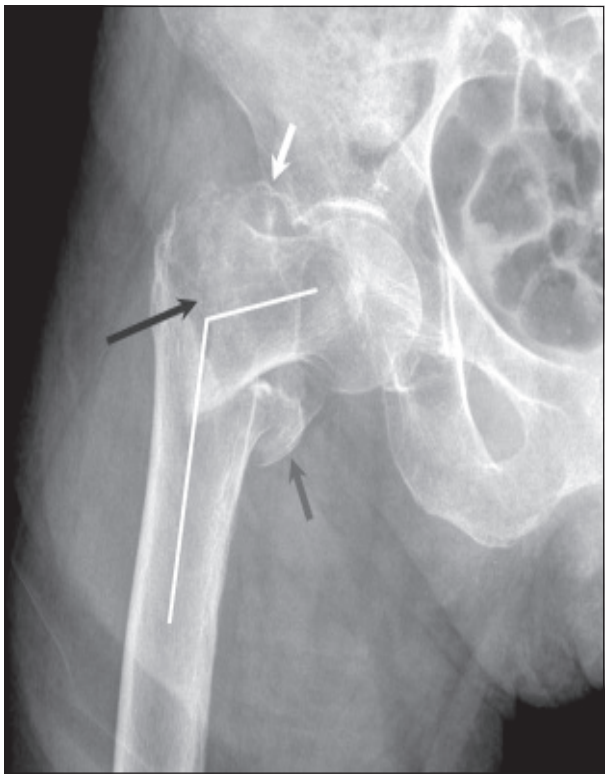

Fig.-1 *is showing osteoporetic trochanteric fracture*

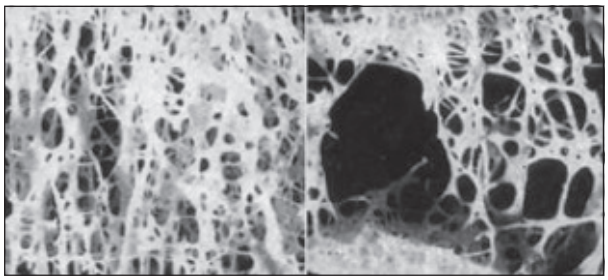

Fig.-2 *is showing normal bone(left) and osteopopretic bone(right)*

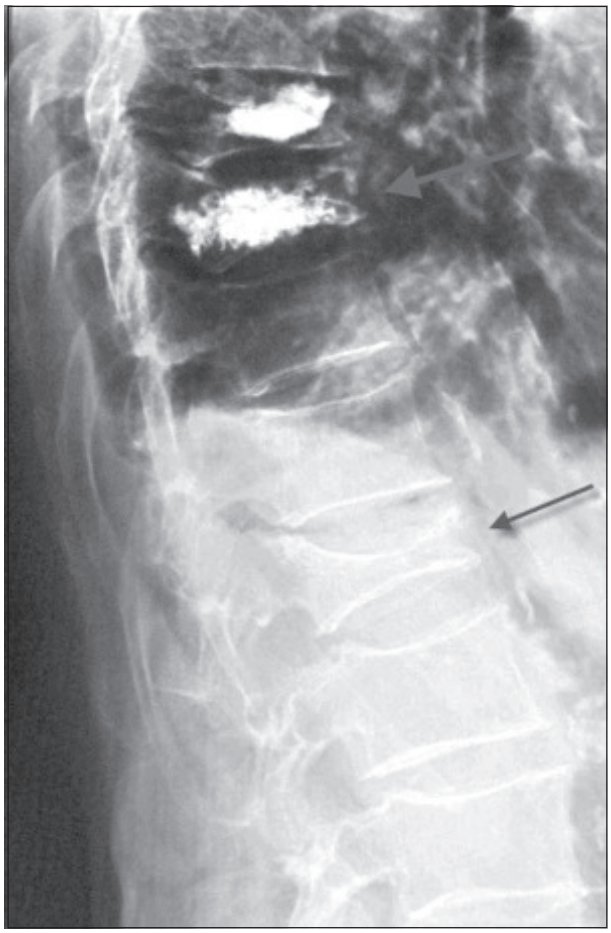

Fig.-3 *is showing associated vertebral compression fracture L1 of the same patient.*

DISCUSSION:

Our aim and objective of the study was to find out the associated spinal injuries that usually mistaken by the orthopaedic surgeons either due to busyness of emergency management of the fracture neck of femur and trochanter which is very much painful. This mistake may be due to patient's failure to give proper history due to severe pain at the hip area or may be due to improper history taken by the orthopaedic surgeon and improper examination of patient either due to pain or negligence or due to not thinking about the associated spinal injury, exclusion by spinal radiography. Tribal trauma may cause osteoporotic fracture associated with hip fracture. It may be that simple vertebral fracture with no neurological deficit usually no need of operative treatment and omitted by orthopaedic surgeon. It is seen that even after operative treatment of the trochanteric fracture and fracture neck of femur patients complain persist due to spinal compression fracture which usually not treated at the time of hip fracture. Even simply advice of the spinal injury helps the patient to early recovery, mobilization and rehabilitation can prevent thromboembolic manifestations.

CONCLUSION:

Simple conventional radiography, proper history of patient and clinical examination can diagnose the associated spinal partial compression fracture and can help early recovery of the patients.

Man came out into this world (Birth) through pelvis and goes out of the world (Death) through pelvis. So associated spinal fracture may linger the post operative (Hip fracture) period and may ultimately lead to death.

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Original Article

"Results of open reduction and internal fixation of rotationally and vertically unstable pelvic ring fractures by reconstruction plate and screws"

Mohammad Serajus Saleheen[1], Wahidur Rahman[2], Qamrul Alam Saleh[3], MA Samad[4], Md. Iqbal Qavi[5], Md. Shah Alam[6], Afia Akhter[7]

ABSTRACT:

The present prospective study was conducted to evaluate the results of open reduction and internal fixation of rotationally and vertically unstable pelvic ring fractures by reconstruction plate and screws. A total of 12 patients aged more than 18 years presenting within 3 weeks of injury were included in the study. The mean age of the patients was 35.8 ± 10.5 years and the youngest and the oldest one were 22 and 52 years respectively. Majority of the patients were male and workers, service holders or housewives by occupation. Ten patients (83.3%) presented with Tile type C1 fractures, and the rest (16.7%) were C3 fractures. The mean interval between injury and operation was 13.4 ± 3.4 days and minimum and maximum interval was 9 and 18 days respectively. Mean hospital stay was 23.3 ± 7.4 days .Majority (75%) of the injury was caused by road traffic accident. SI joint was fixed in 11(91.7%), ORIF of pubic symphysis in 10(83.3%), ORIF of superior pubic rami in 4(33.3%), acetabular reconstruction in 2(16.7%) and ileal blade fixation in only one patient. Evaluation of the outcome at 6 months showed that 41.7 percent of patients had excellent outcome, 41.7 percent patients had good outcome and 16.6 percent had fair outcome. Mean Majeed score was 78.0 11.0. Four complications were seen during the follow up period. Complications included wound infection in three(25%) patients and erectile dysfunction in one (8.3%) patient. No reoperation was required in any patient. The result of the study demonstrates that open reduction and internal fixation of rotationally and vertically unstable pelvic ring fractures by reconstruction plate and screws provides sufficient stabilization to allow early mobilization and thereby good functional outcome.

INTRODUCTION:

Pelvic ring disruptions are uncommon injuries occurring in 3% - 8.2% of all trauma patients. Of all pelvic injuries, 46% are unstable which result from high energy trauma and occur almost only in severely injured patients usually with associated other skeletal injuries[1]. Tile modified the Pennal system involving three groups based on the concept of pelvic stability: A, stable; B, rotationally unstable but vertically stable; C, rotationally and vertically unstable [2]. Therapeutic intervention to stabilize the pelvic ring can be tailored to the degree of instability[3].Unstable pelvic ring fracture can be treated by external and internal fixation. However biomechanical studies have shown that of all forms of fixation, internal fixation of both the posterior

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and anterior portion of the pelvic ring provides the greatest stability [4]. Type C fractures of the pelvis are unstable both rotationally and vertically. Fractures of pelvic ring that includes disruption of SI joint, require healing of the SI joint for a satisfactory outcome[5]. Many types of internal fixation have been promoted in recent years. These include sacral bar, cobra plate, reconstruction plate or ileo-sacral screw for posterior disruption[6].

The possible complication of the open reduction and internal fixation are substantial, however, exposure is often difficult. With good operative technique and post operative follow up these problems could be overcome[3]. Open reduction and internal fixation of the unstable pelvic fractures has been suggested to provide the best stability of fixation and the best clinical outcome[7].

Objectives:

To evaluate the results of the treatment of rotationally and vertically unstable pelvic ring fractures fixed by reconstruction plate and screws.

Methodology

This study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-e-Bangla Nagar, Dhaka. The study was carried out during the period from July 2009 to June 2011. Patients of diagnosed rotationally and vertically unstable pelvic ring fractures (According to Tile classification of pelvic ring fractures, Tile type-C) of both sexes admitted in NITOR during the above mentioned period were the study population. Patients above 18 years of age and presenting within 3 weeks of injury were included in the study. Patients with open fracture, spinal injury, head injury and with co morbidities like heart disease, diabetes mellitus were excluded from the study.

RESULTS:

The patients, after proper resuscitation and investigation, were treated by open reduction and internal fixation by reconstruction plate and screws and followed up from 1 month to 18 months. After an average of 6th month follow up the following findings were compiled.

Table I

Age distribution of the study patients (n=12)

Age (in year)	Number of patients	Percentage
20-30	5	41.7
31-40	2	16.6
>40	5	41.7
Mean± SD	35.8	±10.5
Range (Min-Max)	(22	-52)

Among the study population male was found 9(75.0%) and female was 3(25.0%). In this series out of 12 patients 3(25.0%) were worker, 3(25.0%) service holder, 3(25.0%) housewife, 2(16.7%) businessman and 1(8.3%) driver. Three fourth (75.0%) of fractures were caused by RTA and the rest (25.0%) were due to fall from height. Majority (83.3%) of the fractures was Tile type C_1 and 2(16.7%) was Tile type C_3.

Regarding the associated injury it was observed that 2(16.7%) patients present with hip dislocation, 2(16.7%) with lacerated wound, 1(8.3%) with fracture shaft of femur, 1(8.3%) with Colles' fracture and 1(8.3%) with bladder tear.

Table-II

Type of fixation of the study patients (n=12).

Type of fixation	Number of patients	Percentage
SI joint fixation	11	91.7
ORIF pubic symphysis	10	83.3
ORIF superior pubic rami	4	33.3
Acetabular reconstruction	2	16.7
Ileal blade fixation	1	8.3

Regarding the time interval between injury & operation it was observed that 4(33.3%) patients were operated within 10 days of injury and the rest of the patients 8(66.7%) was operated between 11-20 days of injury. One fourth 3(25.0%) of the patients had wound infection and only 1(8.3%) had erectile dysfunction. Functional outcome of the patients were measured using Majeed functional Outcome score[8].

Table III

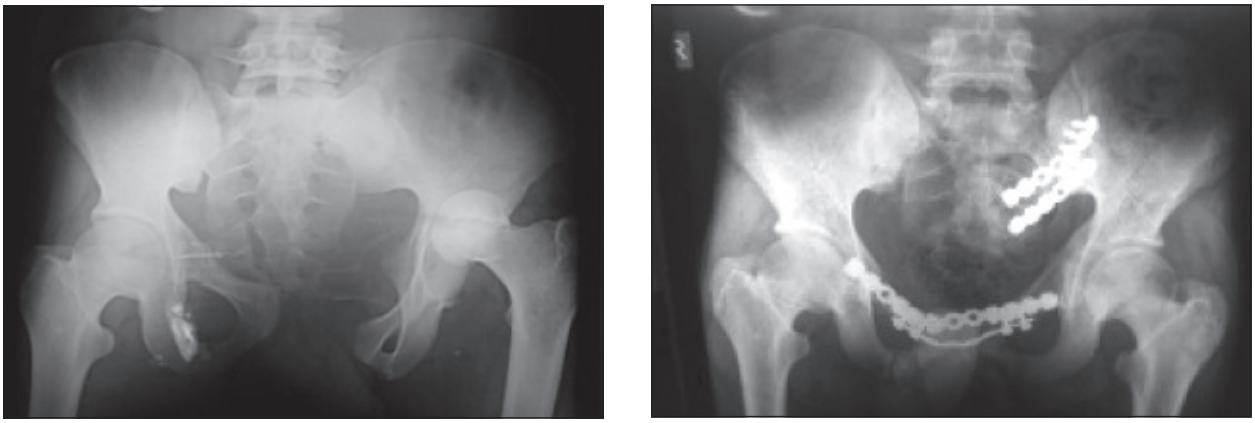
Distribution of the study patients according to Majeed score (n=12)

Majeed score	Number of patients	Percentage
>85	5	41.7
70-84	5	41.7
55-69	2	16.7
<55	0	0.0
Mean ±SD	78.0 ±11.0	
Range (min - max)	(55 -92)	

Table IV

Distribution of the study patients according to score grading (n=12)

Score grading	Number of patients	Percentage
Excellent	5	41.7
Good	5	41.7
Fair	2	16.6



Preoperative and postoperative X-ray at 12th weeks

DISCUSSION:

Disruption of the pelvic ring is a serious injury with a significant mortality and morbidity. Stabilization is only required for rotationally and vertically unstable pelvic ring fractures (Tile type –C)[3]. This prospective study was carried out with an aim to evaluate functional outcomes of open reduction and internal fixation of rotationally and vertically unstable pelvic ring fractures by reconstruction plate and screws. The present study findings were discussed and compared with previously published relevant studies.

In this current study it was observed that highest number 10(83.4%) of patient was in 3rd and 5th decade and lowest number 2(16.6%) patients was in 4th decade. The mean age was 35.8±10.5 years with range from 22 to 52 years. Matta and Saucedo[9] observed the mean age was 34 years with age ranging from 16 to 75 years, which is closely resembled with the current study. In this present series it was observed that three fourth (75.0%) of fractures were caused by RTA and the rest (25.0%) were due to fall from height. Miranda et al.[10] found that 78.9% of the fractures are due to motor vehicle accident, 10.5% due to pedestrian versus car and 10.8% due to fall from height. Maru et al.[7] reported that road traffic accidents were the cause of pelvic fracture in 82.4% patients followed by fall from a height in 17.6% patients and injury from a failing object in one patient. The findings of the above authors regarding the cause of fractures are consistent with the present series.

In this study it was observed that most (83.3%) of the fractures was Tile type C_1 and 16.7% was Tile type C_3. Cole et al.[11] observed in their study that fracture types included Tile Type C_1 75.0%, C_2 8.0%, and C_3 17%. In another series, Pelvandi and Hasankhani[5] found 80.0% type C_1, 10% type C_2 and 10% type C_3. The findings of the above authors regarding the type of fracture are comparable with the present study findings.

Type of fixation of the current study patients was observed that 91.7% underwent SI joint fixation, 83.3% ORIF of pubic symphysis, 33.3% ORIF of superior pubic rami, 16.7% patients needed acetabular reconstruction and 8.3% ileal blade fixation. Zamzam[1] reported in their study that SI joint fixation was needed for all patients and anterior plate fixation for symphyseal disruption was needed in 60.5% patients. The results obtained in present study and above authors findings indicates that both anterior and posterior fixation is necessary for satisfactory stabilization as well as good mobilization postoperatively.

Regarding the functional assessment of pain by Majeed scoring system[8], it was observed in this current series that most (41.7%) of the patients had pain with moderate activity, relieved by rest, 33.3% had mild, intermittent pain with normal activity, 16.7% had slight, occasional or no pain, 8.3% had pain which was tolerable, but limits activity and intense, continuous at rest and intense with activity pain was not observed. Tornetta and Matta[12] have showed 63.0% patients had no pain or pain only on strenuous activity. In another study, Tile found that 36.0% patients had no pain, 52.0% had moderate pain and 62.0% had severe pain. The above studies had long time duration of follow-up but the present study was 6 to 18 months follow-up, therefore the pain was higher in the present study.

According to functional assessment of work, it was observed in the present study, a half (50.0%) of the patients involved with same job with reduced performance, 33.3% had to change the job, 16.7% patients can do only light work and none was found not to do regular work and same job with same performance. Similarly, Tornetta and Matta[12] found in their study that two thirds of the patients

returned to their original jobs and 16.0% changed jobs because of an associated injury.

In this series it was observed the mean Majeed score was 78.0±11.0 with range from 55 to 92. According to score grading it was found that 41.7% excellent, 41.7% good and 16.7% fair. According to functional assessment almost similar findings obtained by Zamzam[1], where the investigators found 29% excellent, 42.0% good, 18.0% fair and 11.0% poor.

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Original Article

Internal fixation of Monteggia fracture dislocation by small DCP

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ABSTRACT

From July 2004 to June 2006, twenty five patients having Monteggia fracture-dislocation were treated with small DCP (dynamic compression plates) at the NITOR (National Institute of Traumatology and Orthopaedic Rehabilitation) with average follow up of at least six months. This study includes those patients who reported to the NITOR within three weeks of injuries. Our target was to accelerate the union in normal anatomical position by addition of the compression device and thus reducing stiffness of the adjacent joints. In all cases, full functional recovery was gained. So, internal fixation of Monteggia fracture-dislocation by the small DCP is a good option of treatment.

The fracture of the proximal third of the ulna with dislocation of the head of the radius was commonly known as Monteggia fracture dislocation. The head of the radius was dislocated both from the proximal radio ulnar joint and radio-capitellar joint. More recently the definition has been extended to embrace almost any fracture of the ulna associated with dislocation of the radio-capetellar joint including transolecranon fracture in which the proximal radio-ulnar joint remains intact (Solomon, Warwick & Nayagam 2001).

It constitute 0.7% of all elbow fractures and dislocations and 7% of fractures of radius and ulna (Bruce et al. 1974).

Giovanni Battista Monteggi first described two cases of fracture of the ulna in association with dislocation of the radial head in 1814. It is a comparatively rare injury. Despite its rarity, the injury has been a popular subject for discussion because the mechanical pathogenesis is very obscure (Tompkins 1971).

The eponym Monteggia fracture has connoted the frustration expressed by Watson Jones who stated in his classic 1943 text that "No fracture presents so many problems; no injury is beset with greater difficulty; no treatment is characterized by more general failure" (Bruce et al. 1974).

Regarding the mechanism various theories were postulated. Direct force theory of speed and Boyd in 1940. Hyperpronation theory of Mervyn Evan in 1947 and Hyperextension theory of Tompkins in 1971 (Tomkins 1971).

Bado described 4 types of Monteggia fracture-dislocations depending on the angulation of the ulna and location of the radial head which is now accepted widely (Bado 1967).

Type-I : Fracture of the middle or proximal third of the ulna with anterior dislocation of the radial head and characteristic apex anterior angulation of the ulna.

Type-II : Fracture of the middle or proximal third of the ulna (the apex usually is posteriorly angulated) with posterior dislocation of the radial head and often a fracture of the radial head.

Type- III **:** Fracture of the ulna just distal to the coronoid process with laternal dislocation of the radial head. This type occurs mainly in children.

Type-IV : Fracture of the proximal or middle third of the ulna, anterior dislocation of the radial head and fracture of the proximal third of the radius below the bicipital tuberosity. The mechanism of injury is similar to type-I.

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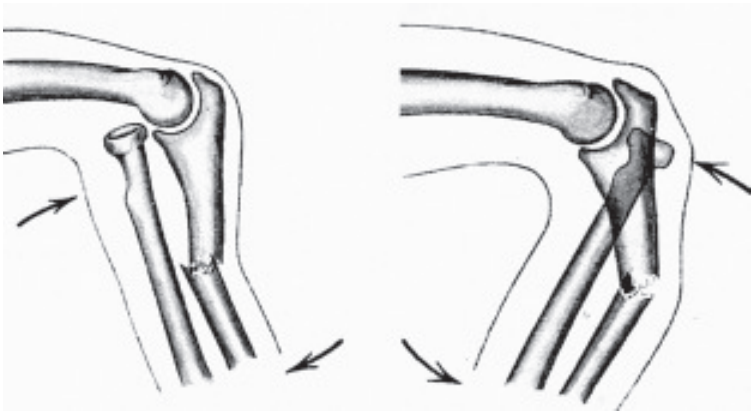

Bado's type- I or Extension type

Bado's type- II or Flexion type

BADO'S TYPE- III

All cases were diagnosed as Monteggia fracture-dislocation by case histories as well as clinical and radiological findings. All the early cases (i.e. cases within 3 weeks of injuries) were treated immediately by open reduction and internal fixation of the ulna by small DCP. When the ulna got appropriate length after internal fixation the radial head automatically took its reduced position by minimum manipulation.

Patients and Method

Study place: This study was undertaken at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-e-Bangla Nagar, Dhaka- 1207.

Study duration: Two years (from July 2004 to June 2006).

Study subjects: 25 patients: (21 male, 4 female) aged from 21-55 years.

Sample size: 25

Sampling technique:

- Non-randomized purposive sampling technique was used as per inclusion & exclusion criteria.

Inclusion criteria:

- Cases in which at least 2 screws can be fixed in each side of the fracture.
- At or above 20 years of age
- Any sex
- Closed fracture
- All cases within 3 weeks of the injury

Exclusion criteria :

- Open fracture
- Fracture in children
- Active or latent infection

RADIOLOGICAL EXAMINATION :

Antero-posterior and lateral view x-rays of the affected forearm including the elbow were taken. Fracture of the ulna and dislocation of the radial head were confidently assessed.

Other Investigations :

Blood- TC, DC, Hb%, ESR, RBS

Urea & S. Creatinine

Urine- Routine and microscopic examinations

X-ray of the chest P/A view

ECG (if the age of the patient > 35 years)

Pre-operative Procedure :

An well informed consent form was filled by the patient or a 1st degree relative.

An anxiolytic drug was advised at the previous night.

A soap bath in the morning on the day of operation was advised.

Nothing was advised per oral for at least 6 hours before anaesthesia.

Surgical procedure :

Anaesthesia – Brachial block

Position of the patient : the patient lay supine with the forearm across the chest

The splint was removed and the limb was thoroughly cleaned with Hexiscrub and operation site was shaved. Prophylactic antibiotic was administered through the IV channel. After 10 minutes a tourniquet was applied just below the axilla.

The limb below the tourniquet was painted with Povidone Iodine solution. The limb was draped separately from the trunk.

Approach : Posterior subcutaneous approach to the ulna.

Incision :

The incision was given along the subcutaneous postero-medial border of the ulna of required distance. The incision was cut straight down to the bone and the periosteum was elevated, carrying the origins of flexor carpi ulnaris medially and extensor carpi ulnaris laterally. Deep to the attachment of the extensor carpi ulnaris lies the origins of extensor policis longus and extensor indices. Deep to the flexor carpi ulnaris is the flexor digitorum profundus. These muscles were safely seperated by sub-periosteal dissection.

Surgical technique (Campbell 2003):

The fracture ends were cleaned, apposed and fixed by a dynamic compression plate (small DCP) & 3.5 mm cortical screws. A 6 or 7 hole plate was placed over the postero-medial surface of the ulna after periosteal elevation and removal of soft tissue interposition. After holding the plate with a Luman's clamp drill holes were made, first most distal hole, then towards the fracture site and the screws were fixed. Compression was given to the fracture site. The muscles were allowed to fall. Haemostasis was ensured and the wound was closed in layers. Long arm cast was applied for two weeks at 90^0 flexion of the elbow with the forearm supinated.

After care :

Active movements of the fingers were started in the evening after the patient recovered from anaesthesia. The limb was elevated and checked for early signs of compartment syndrome frequently. Adequate analgesic was administered at regular intervals. The antibiotic was continued for 2 weeks. The wound was checked on the 5^{th} post operative day.

OBSERVATIONS AND RESULTS

This was a clinical trial carried out at NITOR from July 2004 to June 2006 involving 25 patients with Monteggia Fracture-dislocation. Every patient was treated after initial resuscitation. All were adults and the procedures were done within 3 weeks of injuries. Of all the 25 patients underwent operations, males were predominant; the left side was affected more than the right side and direct trauma was the cause in more than 50% cases. All the cases were Bado's type 1 lesions (100%). Age incidence was maximum in between 20 and 40 years.

In this series final results were based on the range of active motion of the wrist, forearm and elbow, and each result was rated only after recovery was thought to be maximum and no further treatment was anticipated. Other evaluations, such as those of activities of daily living, work status, and pain correlated well with the extent of limitation of motion. An excellent result was found in four cases where full range of motion was achieved. A good result was one in which there was less then 10 degrees of loss of motion in the elbow and forearm. In a fair result there was more than 10 degrees but less than 30 degrees of loss of motion in any one of two sites, while in a poor result there was more than 30 degrees of loss of motion. These criteria are objective measurements that allow comparisons of this series with others. (Reckling 1982).

The end results according to criteria mentioned above:

Out of 25 patients 4(16%) were excellent, 14 (56%) – good, 5 (20%)- fair and 2 (8%) – Poor.

The assessment of the union was determined on both clinical and radiological findings. In the series average radiological union of most of the patients occurred between 6 weeks – 12 weeks.

At follow up, the range of motion of the elbow and radio-ulnar joints were measured and compared with the normal side. Majority of cases regained good results of the elbow movement within 10 weeks and radio-ulnar joint within 6 months. Most of the patients complained of pain in the superior radio-ulnar joint for several months especially when forcefully attempted to move the joint but pain did not interfere their normal daily activities. After active and assisted movements and analgesics, the pain decreased. The fixation devices were taken out from 10 cases after radiological union.

Two cases (No. 12, 16) developed post operative infection. Both were superficial and treated with antibiotics. Both of them healed uneventfully. There was no mortality or significant morbidity.

DISCUSSION

There is little doubt that open reduction and internal fixation is the treatment of choice in Monteggia fracture-dislocation in adults. There is every chance of failure of conservative treatment due to angulation and radial deviation of the ulna with consequent mal-union of the ulna which acts as a fulcrum for the persistent dislocation of the radial head (Ring et al. 1998).

The advent of modern methods of internal fixation (AO/ASIF) has had a dramatic effect on the results of operative treatment of Monteggia fracture in adults. The existing literature on which the pessimistic prognosis for this injury has been based discusses adult patients treated with either closed reduction and cast immobilisation or operative fixation with intramedullary rods or small plates. Intramedullary rods are inadequate for maintaining anatomic alignment of the forearm bones in adults and cannot prevent shortening of the ulna in the presence of comminution.

The small pre AO/ASIF-era plates used in these earlier series improved the ability to maintain ulnar alignment somewhat, but were still inadequate. Moreover, nonunion was commonplace. Most recent investigations have found that when ulnar length and alignment are restored in a timely and stable fashion with the use of modern techniques of internal fixation, early mobilisation is possible, and good results can be expected (Ring et al.1998).

Boyd and Boals in 1969 reported 159 Monteggia lesions with recommendation for rigid internal fixation by plate and screws (Reckling 1982).

Between 1960 and 1970, 244 patients with 333 acute diaphyseal fractures of the radius and ulna were treated with the AO/ASIF compression plate with an overall union rate of 97.9% for the radius and 96.3% for the ulna. Excellent functional results were also achieved (Anderson et al. 1975).

In this study 25 adults with extension type of Monteggia fracture dislocation treated by open reduction and internal fixation with small DCP as shown in table II.

Choice of small DCP and screws in internal fixation of the ulna had the advantages over the intramedullary nail fixation in that it was reliable and rigid. No rotation took place between the fragments. Early movements could be allowed. Thus the chances of postoperative stiffness and other complications diminished.

Postoperatively limb was immobilized in a long arm back slab with the forearm in supination and the elbow at 110^0-120^0 flexion. After two weeks stitches were removed and again the long arm back slab was applied. Immobilisation continued not more than a further period of 2 weeks. Then the slab was discarded and gentle active exercises of the elbow, forearm and wrist were begun. Movements of fingers and the shoulder were started from the first postoperative day.

By the end of 6 weeks majority of the patients regained most of their normal range motion of the elbow and radio-ulnar joints. For further ranges of motion of the elbow and radio-ulnar joints, active exercises like flexion-extension of the elbow and supination-pronation of the forearm were advised. Maximum patients regained muscle power and the range of motion and returned to their jobs within 3 months with slight degree of restriction of movements.

In this series all patients were advised to have their implants removed after radiological union usually after 9-12 months. Twenty five of the patients where sufficient follow-up was done were included in this study. In all cases, full functional recovery was gained. Results of 4 (16%) cases were excellent, 14 (56%) cases were good, 5 (20%) were fair and 2 (8%) were poor. Most of the patients returned to their jobs within 3 months.

The complications in this study were stiffness, tourniquet palsy, infection, muscle wasting, osteoporosis, pain etc. Four cases (Nos. 1, 4, 7, 18) were excellent with full range of motion. Fourteen cases (Nos. 6, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 22, 23 & 24) were found to have mild stiffness less than 10 of the elbow and radio-ulnar joints. Five cases (Nos. 2, 3, 5, 13, 21) cases were fair. Stiffness of the elbow and/or radio-ulnar joints were in between 10^0 to 30^0. Two cases (Nos. 8, 25) had poor results. They developed severe stiffness ($>30^0$). Two cases (12, 16) developed stitch infection. All healed with antibiotics and sterile dressings. Three cases (No. 10, 14 & 24) developed tourniquet palsy from which the patients ultimately recovered after appropriate measures. A few cases developed mild muscle wasting and weakness of the grip. All recovered after a short period of exercise. Those who developed osteoporosis and pain recovered after patient exercise, intake of nutritious diet and appropriate vitamins and minerals.

SUMMARY AND CONCLUSION :

This was a clinical study carried out at NITOR between July- 2004 to June 2006 involving 25 patients with Monteggia fracture-dislocations. All patients were managed by initial resuscitation, splintage and elevation followed by open reduction and internal fixation by small

DCP. All procedures were done within 3 weeks of the injuries. The aim of this study was to establish the effectiveness of the small DCP in the management of Monteggia Fracture-dislocations. Randomised sampling technique using all sources was followed as per inclusion and exclusion criteria.

In this study the results of operative management of Monteggia fracture-dislocations in adults had been evaluated and a conclusion had been drawn that open reduction and internal fixation of the ulna with small DCP and closed reduction of radial head might prove to be a good alternative and effective method. To achieve the desired result post operative frequent checkup was carried out and appropriate physiotherapy was given when need arose.

The following things could be achieved from operative management of Monteggia fracture-dislocations :

a. Perfect anatomical alignment was only possible by open reduction and internal fixation which prevented re-dislocation of the radial head.
b. Early mobilization and short period of hospital stay were possible.
c. No mal-union as the plate was prebended to the normal curvature of the ulna.
d. There was least chance of non-union as every case was rigidly fixed with compression.
e. Patient could return to the job early.
f. This was a cost effective method of treatment.

The long term result is beyond the scope of this study. Long term follow up is needed to evaluate the final outcome of these patients.

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Original Article

Evaluation of the results of open reduction and internal fixation of posterior wall and posterior column fracture of acetabulum by reconstruction plate and screw by Kocher-Langenbeck approach

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ABSTRACT:

This prospective study was carried out at National Institute of Traumatology and Rehabilitation (NITOR) Dhaka, between January 2012 to December 2012. 15 registered patients of posterior wall and/ or posterior column of acetabular fracture were selected on clinical and radiological basis . All the patients underwent open reduction and internal fixation by reconstruction plate and screw by Kocher-Langenbeck approach.Each patient was followed up for at least six months. During each follow up visit patients were evaluated both clinically and radiologically. Functional outcome was assessed using Merle d' Aubigne scoring system. Regarding clinical outcome of the patients after surgery considering Merle d' Aubigne grading score , about 4(26.66%) patients were rated as excellent and 7 (46.66%) patients as good. Radiologically 6(40%) patients were rated as excellent and 8 (53.33%) patients as good. Overall clinical outcome of the study population revealed that most of the patients belonged to satisfactory (Excellent + Good) outcome (73.33%).

INTRODUCTION:

Historically, Acetabular fractures were an enormous orthopaedic problem in which the treatment was grossly inadequate and many patients were left with incapacitating pain[1] . It usually occurs as a result of high velocity injury and often affect the young and economically productive portion of the population[2]. Though Acetabular fractures are rare: of approximately 37 per 100,000 pelvic fractures in the USA annually, only 10% involve the acetabulum with an estimated 4000 per year among the elderly[3].

These intra-articular fractures, if not correctly treated can lead to intra-articular mal-union and joint incongruity that can cause rapid destruction of the articular cartilage and ultimately hip arthrosis .[4]

In the early part of this century , acetabular fractures were often feared and treated with much pessimism because of the poor outcome in many patients treated non-operatively[1]. In the 1960s , Judet and Letournel [6], recommended surgery for all acetabular fractures , because close reduction failed to reduce the fracture fragments in many cases. However , many authors continued to report good results with conservative treatment and problem of operative treatment such as heterotrophic ossification and inadequate reduction were highlightened [1].

But recently , it has become obvious that accurate reduction of the fracture is an important factor in achieving satisfactory outcome and open reduction is better than close reduction in achieving this aim. Many centres which reported high percentage of good and excellent results are mostly well equipped tertiary referral centers or trauma centers with vast experience in treating such fracture [1].

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KY Tan, et al. conducted a study among 15 consecutive cases of acetabular fractures , where a good to excellent result was attained in 80% of the patients which confirms that open reduction and internal fixation is the treatment of choice for acetabular fractures [7].

Matta reported 40% excellent and 36% good outcome in 262 displaced fractures [8]. Ruesch, et al. found 81% acceptable outcome in 102 fractures treated operatively [9], and Mayo also reported 75% good to excellent outcome in 163 operatively treated fractures [10].

These results , together with the findings from 30 years of work by Judet and Letornel confirmed the place of operatively management of acetabular fracture as the standard of care [7].

Acetabular fracture is one of the more difficult fractures in orthopaedics not only because of the complex nature of the fracture but also it is often associated with severe trauma [1].The incidence of multiple injuries is high and Hofmann, et al. reported a mortality rate of 20% [11].

As road traffic accident is one of the most important etiological factors of acetabular fracture, and the victims are usually the young generation, so proper management including best surgical care should be given, specially in our set-up where people are ignorant and economically unsound . As NITOR is the prime referral center, a good number of patients with acetabular injury attend this institute. The purpose of this study was to assess the outcome of surgically managed posterior wall and posterior column fracture of acetabulum at our set-up .

MATERIALS AND METHODS:

A prospective study was carried out at NITOR from 1st January 2012 to 31st December 2012. 15 registered patients of posterior wall and/or posterior column of acetabular fracture were selected for the study. Cases were diagnosed on clinical and radiological basis at the emergency and out-patient department of NITOR . In all cases, plain Antero-posterior and oblique x-rays were done. 3D CT reconstruction of acetabulum was performed in all patients.At emergency all the patients were managed according to ATLS protocol. All the patients were kept on skeletal traction till surgery. 4 patients had dislocation of hip which were managed on emergency basis. All the patients underwent open reduction and internal fixation by reconstruction plate and screw by Kocher-Langenbeck approach. Mean operation time was 1 hour and 40 minutes. Average hospital stay was 21 days. During discharge each patient was advised Indomethacin as prophylaxis against heterotrophic ossification.

Each patient was followed up for at least six months. During each follow up visit patients were evaluated both clinically and radiologically. Functional outcome was assessed using Merle d' Aubigne scoring system.

Merle D'Aubigne Grading Score:

Pain	Points
None	6
Slight/Intermittent	5
After walking but resolves	4
Moderately severe but patient can walk	3
Severe, prevents walking	2
Walking/Gait	
Normal	6
No cane but slight limp	5
Long distance with cane or crutch	4
Limited even with support	3
Very limited	2
Unable to walk	1
Range of movement (ROM)	
95-100%	6
80-94%	5
70-79%	4
60-69%	3
50-59%	2
<50%	1
Clinical Score	
Excellent	18
Good	15-17
Fair	13-14
Poor	<13

RESULTS:

The commonest age group was 29-40 years (53.33%).And there was a male predominance (86.66%).Majority of the sufferers belonged to service holders(46.66%).

Regarding mode of injury the commonest cause was RTA(86.66%) .Most of the patients came with left sided acetabular injury(66.66%). Among all the cases the number of posterior wall acetabular fracture were more(53.33%), then combined posterior column and

posterior wall fracture(33.33%), next to isolated posterior wall fracture. Majority of the patients underwent surgery during the 2nd week of injury(60%).

About 66% patients had other associated injury of which pelvic injury was most common (20%).

Regarding clinical outcome of the patients after surgery considering Merle d' Aubigne grading score about 4(26.66%) patients were rated as excellent and 7 (46.66%) patients as good. Radiologically 6(40%) patients were rated as excellent and8 (53.33%) patients as good.

About 20% patients were rated as fair clinically and 6.66% radiologically . 1(6.66%) patient was found having poor physical outcome whereas no one belonged to poor radiological outcome.

Regarding relationship between outcome and age of the study population , it was found that , among the age group of 29-40 years, the result was mostly satisfactory.

Overall clinical outcome of the study population revealed that most of the patients belonged to satisfactory (Excellent + Good) outcome (73.33%).

Among all the cases after surgery 3 patients(20%) were developed superficial wound infection and 2 patients(13.33%) became the sufferers of transient neuropraxia of sciatic nerve.

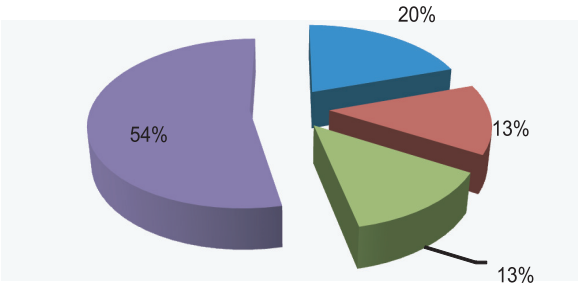

Fig.-1: *Distribution of patients according to associated injury(n=15)*

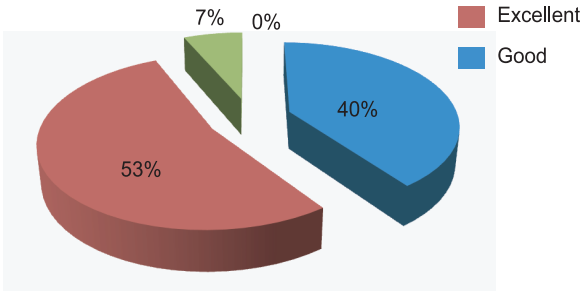

Fig.-2: *Distribution of the patients according to radiological outcome(n=15)*

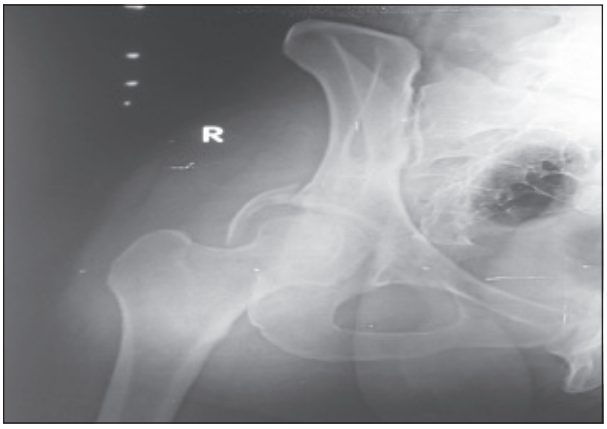

FIg.-3: *x-ray Showing Posterior wall fracture of acetabulum*

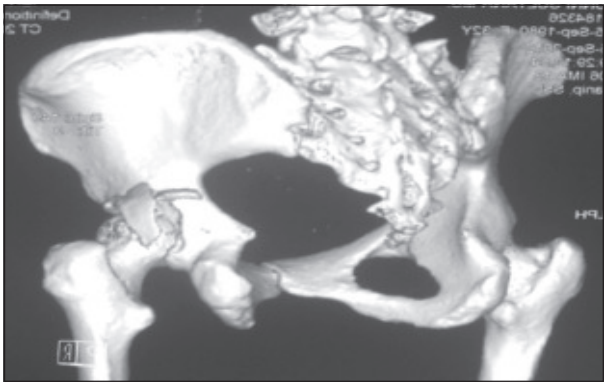

FIg.-4: *CT reconstruction showing posterior wall fracture*

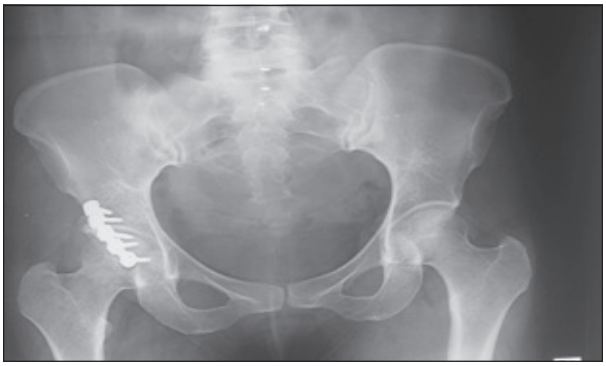

FIg.-5: *Fixation of the posterior wall with reconstruction plate*

Pic 6 : *posterior wall and posterior column fracture.*

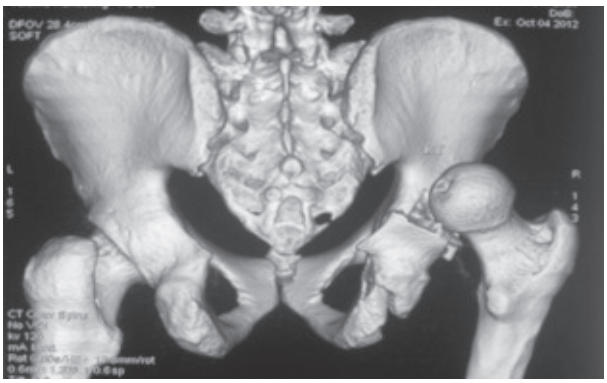

Fig.- 7 : *CT reconstruction showing posterior wall and column fracture.*

Pic 8 : *posterior wall and column fracture after fixation.*

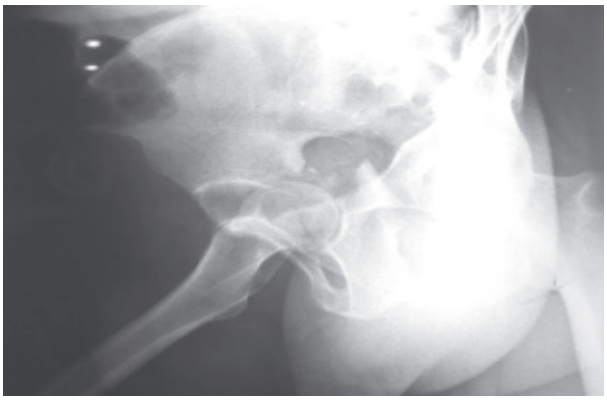

Fig.-9 : *Posterior column fracture of acetabulum.*

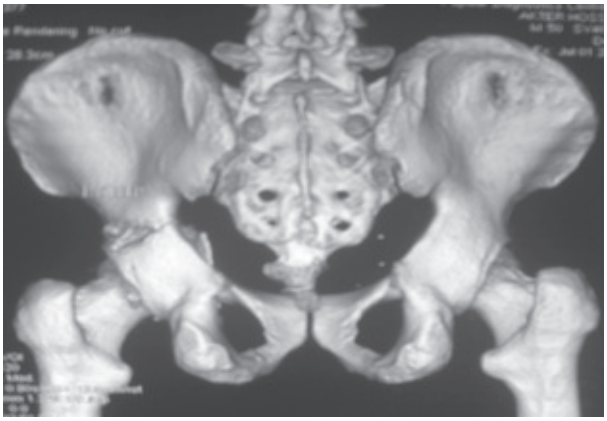

Fig.-10: *CT reconstruction showing posterior column fracture*

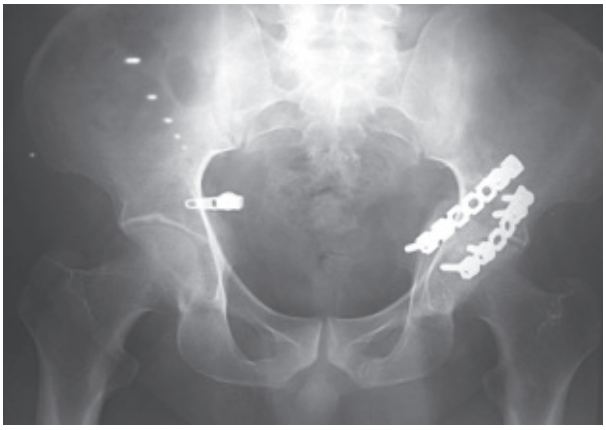

Fig.-11: *Posterior column fracture fter fixation.*

DISCUSSION:

The commonest age group in our study was 29-40 years (53.33%) Patients , which is similar to a study where the average age of the majority of the patients was 35 years[1].

Among the 15 patients about 66% had other associated injury which supports other study which has revealed that three-quarter of the patients had injuries to another system[5].

In this study most of the patients belonged to satisfactory (Excellent + Good) outcome both clinically and radiologically which is similar to another study where good and excellent results were achieved by two-third of the patients[5].

Among all the cases after surgery about 5 (33.33%) patients developed post - operative complications which goes against another study where this incidence was less in number[1].

CONCLUSION:

Finally, it can be concluded that open reduction and internal fixation of the posterior wall and posterior column fracture of acetabulum using reconstruction plate and screw is a satisfactory method of treatment.

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Original Article

Management of diabetic foot infections in orthopaedic wards – Bangladesh perspective

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ABSTRACT :

Diabetic foot infections are most common complications of diabetic patients and are associated with high morbidity and risk of amputations of the lower extremities. The major predisposing factor to diabetic foot infection is foot ulceration which is related to peripheral neuropathy and secondarily – peripheral vascular disease caused by atherosclerosis and arteriolosclerosis. Aerobic gram-positive cocci are the predominant organisms. Wound infections must be diagnosed clinically. Laboratory investigations are of limited use for diagnosing infections except in cases of osteomyelitis. Early recognition, proper assessment, prompt diagnosis and management are necessary to prevent morbidity and amputation. Acombination of surgery and antibiotics is almost mendatory in virtually all foot infections as the patients usually come lately. The aim of surgery is to control the infection and to salvage the limb aiming to preserve a functional limb. The outcome of surgery mainly depends on the skill, care and experience of the surgeon. The best result can be achieved in a multidisciplinary hospital.

INTRODUCTION:

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia due to absolute or relative deficiency of insulin secretion or insulin action resulting in some devastating complications like retinopathy, nephropathy, angiopathy, neuropathy and diabetic foot infections and ulcers. Among these, diabetic foot infections are more common.

In Bangladesh, due to increasing urbanization, rapidly changing lifestyle, dietary changes, reduced physical activities along with population aging, the prevalence of type-2 diabetes mellitus (non-insulin dependent diabetes mellitus) is increasing day by day. 15% of these patients develop foot infections in their life time and among them, 50% - 80% account for non-traumatic amputations of the lower extremities. Due to lack of proper knowledge, consciousness and awareness, most of the patients come to the hospitals lately when, in maximum instances, the infections have been spreaded and cost the lower limbs to be amputed.

The severity of diabetic foot infections range from superficial infection like paronychia to deep infection which even involves the bone leading to osteomyelitis. The types of the infections include cellulitis, abscess, septic arthritis, osteomyelitis etc. These are the common causes for hospitalization of the diabetic patients and cost a lot every year creating a burden to the patient, the family, the society and to the health-care system of the country as well.

AETIOLOGY AND PATHOPHYSIOLOGY:

The aetiological factors contributing to the development of diabetic foot infections are as below:

Peripheral neuropathy:

It has a central role in the development of foot infection in diabetic patients and it accounts for about 30 – 50% of the diabetic patients. The neuropathy can be sensory (glove and stocking distribution), motor or autonomic.

In sensory neuropathy, the patients lose their normal "pain and trauma" sensations resulting in impairing the awareness of temperature, pain and trauma such as abrasions, blisters or penetrating foreign bodies.

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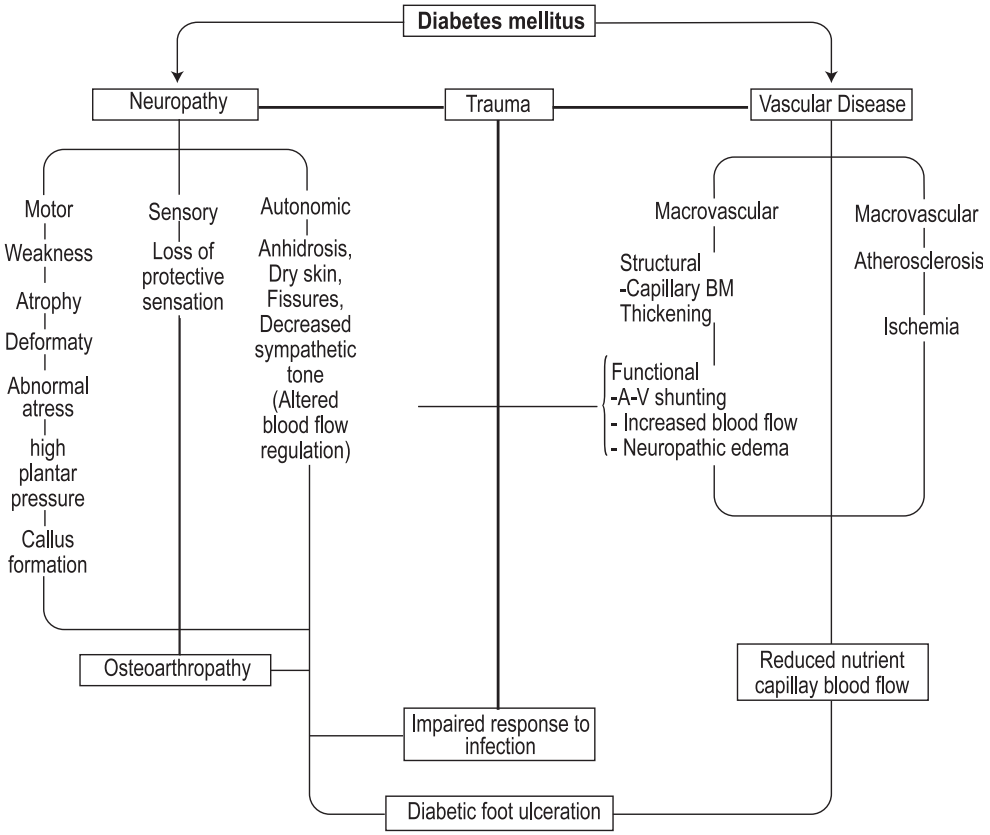

Fig.-1: *Pathophysiologic pathways in development of diabetic foot infection and ulceration*

In motor neuropathy, the patients may develop foot deformities (e.g.- claw toes, hallux valgus, pes planus, prominent metatarsal heads etc.) that may contribute to the development of pressure from foot wears leading to skin breakdown and ulcerations.

Vascular insufficiency:

This can be both micro or macro angiopathy. Atherosclerosis of distal vessels may result in ischaemia and impaired healing of foot infections .

Infection:

Due to impaired body defense mechanisms caused by deficiency in the phagocytic activities of leucocytes, defect in normal chemotactic mechanisms and diminished bacterial killing by leucocytes, the infection can spread to the contagious subcutaneous tissue and even to the deeper structures leading to ischaemia, necrosis and progressive gangrene.

Other aetiological factors:

- Hyperglycemia and other metabolic derangements
- Patient disabilities
- Mal adaptive patient behaviors
- Health care system failure

MICROBIOLOGY:

In case of acute, superficial and previously untreated infected wounds, the most important pathogens are aerobic gram positive bacteria, particularly staphylococcus aureus and Beta- haemolytic streptococci (group A, B and others).

Deep infections are usually caused by a mixture of aerobic gram positive and gram negative (e.g. - E. Coli, Proteus, Klebsiella etc) and also anaerobic organisms(e.g.- clostridia, bacteroides, peptococcus, peptostreptococcus etc.).

CLINICAL FEATUERES:

Diabetic foot infections may be neuropathic or ischaemic among which, neuropathic ulcers are more common.

Neuropathic ulcers are mostly painless. These occurs at the tip of the toes, plantar aspects of the metatarsal heads. Infections may lead to cellulites, abscesses, osteomyelitis and even sepsis leading to gangrene. Pulses are present and the limb is warm.

In ischaemic foot infections, there is absent of pulse, cold extremities and tropic changes may observed.

DIAGNOSIS:

Diabetic foot infections must be diagnosed clinically rather than bacteriologically.

The diagnosis of foot infection is based on the presence of purulent discharge from an ulcer or the classic signs of inflammation (e.g.- pain, warmth, erythema or induration). Other features include foul odor, presence of necrosis and failure of wound healing despite an optimal management.

Most patients with diabetic foot infections do not have systemic features like fever or chill. The presence of systemic features indicate a severe deep infection.

Extent of the infection:

Grading of the foot infection is important to determine the extent of the infection and to plan treatment. The grading system is based on the depth of the lesion, presence of deep infections and presence or absence of gangrene. Wagner's grading of diabetic foot infection is very effective and widely used worldwide to determine the extent of diabetic foot infections.

Grade 0 skin intact but bony deformities produce a "foot at risk"

Grade 1	localized, superficial ulcer
Grade 2	deep ulcer to tendon, bone, ligament, or joint
Grade 3	deep abscess, osteomyelitis
Grade 4	gangrene of toes or forefoot
Grade 5	gangrene of entire foot

Fig.2: *Wagner's Grading of Diabetic Foot Infection*

The International Consensus on the classification of diabetic foot infection introduces the new grading system which is now being familiar. This is as below:

Grade-1 No symptom, no sign of infection

Grade-2 Lesion only involving the skin (without involvement of deeper tissues nor systemic signs) with at least two of the following signs:

- Local warmth
- Erythema >0.5 - 2 cm around the ulcer
- Local tenderness or pain
- Local swelling or induration
- Purulent discharge (thick, opaque to white or sanguineous secretion)
- Other causes of inflammation of the skin must be eliminated (for example, trauma, gout, acute Charcot foot, fracture, thrombosis, venous stasis etc.)

Grade 3 Erythema > 2 cm and one of the findings described above

or -

- Infection involving structures deeper than skin and subcutaneous tissue such as deep abscess, osteomyelitis, septic arthritis or fascitis.
- There must not be any systemic inflamatory response (see grade 4).

Grade 4 Any foot infection, in the presence of a systemic inflammatory response manifested by at least two of the following characteristics:

- temperature > 38°C or <36°C
- pulse > 90 bpm
- respiratory rate > 20 per min
- PaCO2 < 32 mmHg
- leukocytes > 12,000 or < 4000 per mm3
- 10% of immune (band) forms

Diabetic foot infection and osteomylitis:

Osteomylitis is common and serious complication of diabetic foot infection. The risk factors associated with osteomyelitis are as follows:

- Appearance of swollen or deformed red toes
- Visible or palpable bones on probing
- Infected ulcer with an ESR> 70mm in 1st hour
- Non-healing ulcer after a few weeks of appropriate management
- Radiologically evident bone destruction beneath the ulcer
- Ulcer area greater than 2cm^2 or more than 3mm deep
- Ulceration presents over bony prominences for more than 2 weeks
- Ulceration with leukocytosis.

Bone biopsy is recommended if the diagnosis of osteomylitis remains in doubt after having an X-ray.

Severity of the infection:

The severity of infection determines the appropriate antibiotic regimen and the route of administration. The determination is important for consideration for hospitalization and for surgical intervention.

Clinical classification of diabetic foot infection

Clinical manifestations of infection	Infection severity
Wound lacking purulence or any manifestations of inflammation	
Uninfected Presence of > manifestations of inflammation (purulence, or erythema, pain, tenderness, warmth, or induration), but any cellulitis/erythema extends < 2 cm around the ulcer, and infection is limited to the skin or superficial subcu-taneous tissues; no other local complications or systemic illness.	Mild
Infection (as above) in a patient who is systemically well and metabolically stable but which has >1 of the following characteristics: cellulitis extending >2 cm, lymphangitic streaking, spread beneath the superficial fascia, deep-tissue abscess, gangrene, and involvement of muscle, tendon, joint or bone	Moderate
Infection in a patient with systemic toxicity or metabolic instability (e.g., fever, chills, tachycardia, hypotension, confusion, vomiting, leukocytosis, acidosis, severe hyperglycemia, or azotemia)	Severe

Assessment of the vascular status:

Assessment of vascular status in a diabetic foot infection is important for planning the treatment. It can be done clinically by feeling the distal pulses, e.g.- anterior tibial artery, posterior tibial artery, arteia dorsalis pedis.

Duplex ultrasonography is useful for assessing the patency of the vascular tree and the location and nature of the blockage if any.

Venous insuffiency can be detected by evaluating oedema and skin changes like erythema. It can be confirmed by duplex ultrasonography.

Assessment of neuropathy:

Neuropathy can be assessed routinely by assessing touch, vibration and pressure sensation by using cotton wool, tuning fork and 10g nylon monofilament (Semmes-Weinstein nylon monofilament).

Diagnostic imaging:

It is not necessary to all cases of diabetic foot infections. Plain X-ray of the involved foot is useful for detecting osteomyelitis, foreign bodies or soft tissue gase.

If plain X-ray is doubtful in a case of suspected osteomyelitis, MRI OR Radionuclide Scan can be performed.

Ultrasonogram and CT scan are less commonly used. They may give guidelines for diagnosis and aspiration or drainage or tissue biopsy.

TREATMENT:

An efficient and timely applied treatment can cause diabetic foot infections to heal without costing a devastation to the affected limb.

Treatment comprises :

Antibiotic therapy
Surgical drainage and debridement
Adequate wound care and dressing
Correction of metabolic derangements.

Factors suggesting the need for hospitalization:

- Severe infection
- Poor patient compliance and limb-threatening infection
- Deep wound with suspected bone and joint involvement
- Rapidly unfavorable condition of the wound
- Metabolic disorders
- Severe ischeamia or gangrene
- Need for IV antibiotic that can not be administered at home
- Need a surgery
- When patient follow-up at home is impossible
- When appropriate care at home is impossible.

Antibiotic therapy:

Selection of appropriate antibiotic is necessary for the treatment of diabetic foot infections.

Antibiotics should be used in clinically indicated infections and it should be broad spectrum.

Usually in practice, during initial assessment, a swab is obtained from the base of wound and sent for culture and sensitivity. At the same time a broad-spectrum antibiotic is started.

Initial empiric therapy is based on –

- Severity of the infection
- History of recent antibiotic treatment
- Previous infection with resistant organisms
- Recent culture result if available
- Patient factor (e.g.- drug allergy)

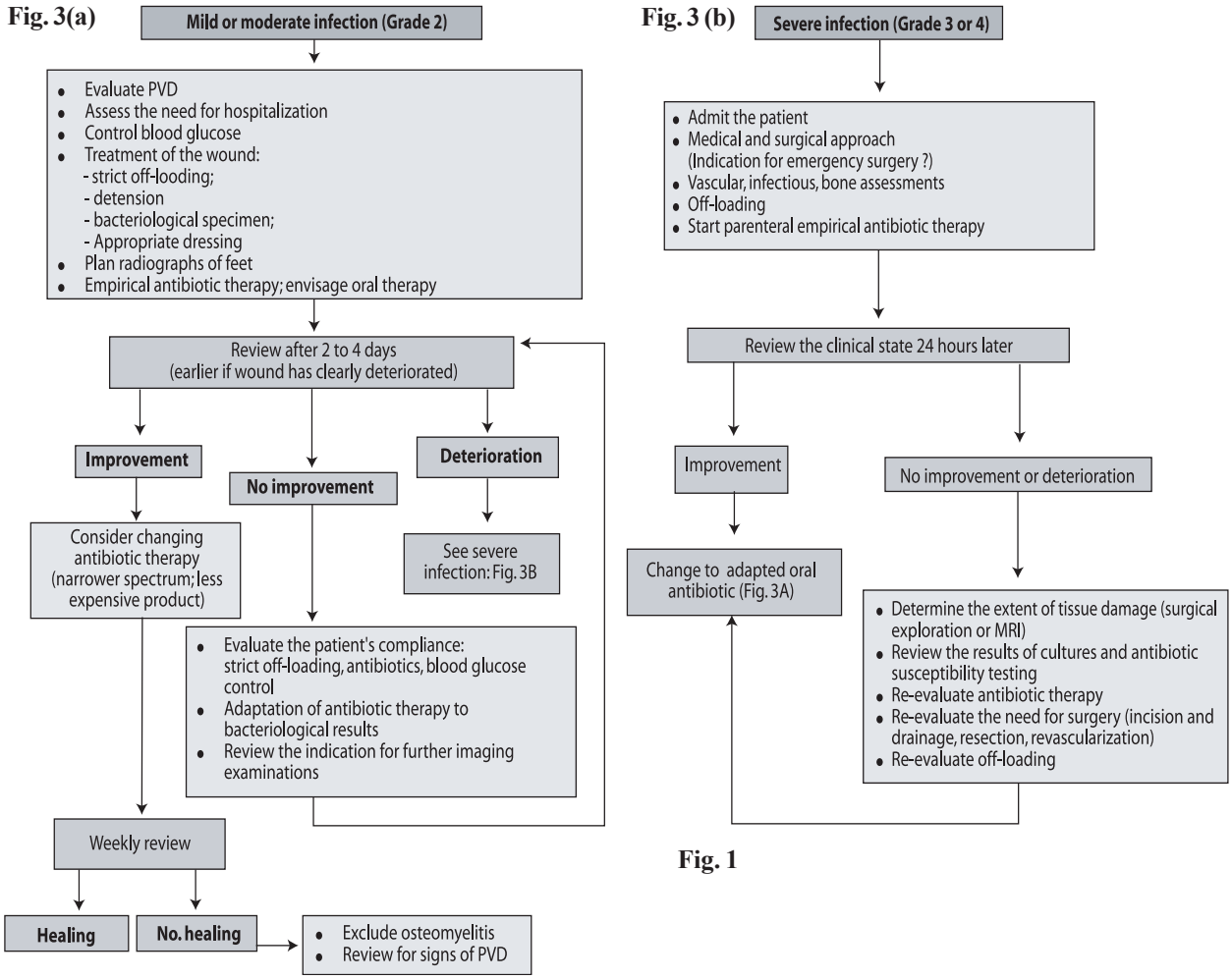

Fig. 1

Fig.-3 (a & b) : *Approaches to diabetic foot infections.*

Necrotic, gangrenous and foul-smelling wounds usually require anti anaerobic therapy e.g.- metronidazole.

Initial empiric antibiotic therapy should be modified on the basis of clinical response and the report of culture of the swab sent.

Oral antibiotics are useful in mild to moderate infection. For switching from parenteral antibiotics – antibiotics of appropriate spectrum and good bio-availability are strongly recommended.

Parenteral antibiotics are indicated for severely infected systemically ill patients or for the patients who are infected with organisms that are not susceptible to oral drugs.

Topical antibiotics are of limited use.

Some systemic factors such as renal failure, cardiac failure, gastroparesis, PVD, drug allergy etc. should be taken into account while prescribing antibiotics.

Antibiotic therapy is discontinued when all the signs and symptoms of infections have been resolved, even if the wound is not healed completely.

Sometimes, antibiotics can be continued to prevent secondary or nosocomial infections.

Cost should be considered in selecting the antibiotic therapy.

Surgical treatment:

Surgery is thought to be the "Cornerstone" of the treatment for deep diabetic foot infections. Surgical procedures range from simple incision and drainage to extensive and multiple surgical debridements and, if needed – amputation. Surgery should not be delayed and in many instances, it should be performed on emergency basis in cases of necrotizing fascitis, gangrene, ischaemic limb or in an infection associated with compartment syndrome.

Timely and aggressive surgical debridement should be performed. This, and limited resection or amputation if

needed, can reduce the necessity for more extensive amputations.

Necrotic, devitalized and contaminated tissues along with slough should be excised thoroughly up to the healthy tissue to promote wound healing.

In case of neuropathic foot ulcers, debridement should be done till the healthy tissues have reached.

In case of ischaemic ulcers, debridement should be performed very cautiously and it should be performed after or during revascularization and before that, only simple drainage can be done.

Amputation sometimes is the only option in case of severe deep foot infection or in case of ischaemic limb. The choice of the level of amputation depends on vascular status. No amputation should be performed before having any vascular assessment - either clinically or by duplex ultrasonography.

Criteria for amputation:

In patients without Peripheral vascular disease – amputation should be performed in case of necrotic or gangrenous limb.

In patients without peripheral vascular disease – amputation is delayed for the revascularization procedure. When revascularization is impossible, amputation is performed in extensive and gangrenous limb.

Absence of healing of a chronic foot infection is a systemic indication for amputation.

Emergency below-knee or above-knee amputation is considered in case of life threatening infection or extensive gangrene.

In case of osteomylitis, if the infection involves the adjacent joint and the joint is exposed and the infection over the joint is not healed, then amputation can be considered.

Wound management and dressing:

The principle of daily wound management is to monitor the infected wound closely and to evaluate its progress. Dressing is done with antiseptic solutions that are non-toxic to the soft tissues and do not hamper to the granulation tissue formation as well. Usually povidone iodine solution diluted with normal saline, EUSOL, vinegar etc are used in dressing and these can be selected according to wound's condition and the culture report. For example – if the culture report shows pseudomonas, the dressing should be done with vinegar.

According to the severity of the infection, initially daily dressing is performed and during dressing, new dead and necrotic tissues are excised. When the wound appears to be healthy, dressing can be done in 1 or 2 days interval.

Wound closure:

Wound closure is awaited till the control of infection and appearance of sufficient healthy granulation tissue on the wound have seen.

The wound can be closed either by secondary closure or by skin graft or with a flap.

Correction of metabolic derangements:

Correction of hyperglycemia, fluid and electrolyte, acidosis are essential in management of diabetic foot infection.

All patients should be monitored regarding blood glucose level and HbA1c during admission or in 1st instance then at regular intervals. Frequent monitoring is done initially. Appropriate selection of anti hyperglycemic agents or insulin must be made aiming to have a good glycemic control.

PREVENTION OF DIABETIC FOOT INFECTION:

Prevention of diabetic foot infections begins with screening of '**High Risk**' feet. All patients should be assessed for anatomic deformities e.g.- bunion, charcot foot, skin breaks, nail disorders, loss of sensation, diminished arterial pulse etc. Screening should be done at initial visit and then at least once a year. High risk feet are followed up at 3-6 months intervals.

Criteria for a "High Risk" foot:

1. Loss of protective sensation
2. Absent pedal pulse
3. Severe foot deformity
4. Limited joint mobility
5. History of foot ulcer
6. Previous amputation

A foot is marked as "**High Risk**" if one or more of the above 6 factors are present in a patient.

Foot deformities that can make a foot "High Risk" are –

- Claw toes
- Prominent heads of metatarsals
- Callus
- Bunion
- Bunionnette
- Charcot joints
- Bony prominence.

Above all, patient education and awareness are more effective in preventing diabetic foot infections. The patients are advised to take care of their feet with same attention as they give to their faces.

Selection of proper shoes is very much important for the diabetic patients to prevent foot infections. The diabetic persons are advised never to walk barefoot. The shoes should be of adequate size and soft and always dry and comfortable from the moment they are purchased.

Advises for shoes:

- Buy shoes preferably at evening and choose them after wearing with comfortable socks with which, they are likely to be worn.
- Buy soft shoes.
- Buy such kind of shoes that allow the toes to be moved inside.
- Check the shoes before wearing for any sharp object, plastic or other object that could cause injury to the feet.
- Discard old and hard shoes.
- Soft and seamless shocks are encouraged to wear and the should not have any wrinkle when are worn

REHABILITATION:

It is important for the patients, who have undergone for amputation. They need suitable prostheses and orthoses for their ambulation in most cases. A good stump is necessary for a proper prosthetic fitting. The patients are taught to ambulate with amputed limbs. They are also taught to be habituated with the new circumstances they are going to face.

CONCLUSION:

Management of diabetic foot infection is still in development stage in Bangladesh. A large number of the population are diabetic and they are prone to foot infections. Adequate knowledge regarding the management of diabetic foot is necessary.

A successful management of diabetic foot infection can only come from a multi-disciplinary approach including orthopaedic surgeon, endocrinologist, podiatrist, nurses educated in management of diabetis, vascular surgeon, radiologist, physical therapist, occupational therapist etc. Above all, patient education and motivation, preventive measures, vigilance for risk factors adopting the appropriate therapeutic measures can limit the diabetic foot infections and their devastating complications.

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Original Article

Correction of adolescent idiopathic scoliosis using pedicle screw - ROD system : surgical technique and results

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ABSTRACT:

The treatment of adolescent idiopathic scoliosis has evolved substantially over the last few decades. The Cotrel-Duboussete spinal system has demonstrated excellent results in coronal and sagittal deformity correction but remains inferior in rotational deformity control. The evolution of pedicle screws in the modern spinal instrument system allows 3-column fixation and allows true rotational correction of the vertebral body by direct manipulation. However, sometime the screws can cut into the spinal canal. Since 1990, the pedicle screw-rod system has been in the process of development and has been used for the treatment of adolescent idiopathic scoliosis. With our technique, indirect manipulation of the spinal deformity results in gradual curve correction and in apical vertebral derotation as well. Our results have been comparable to those of the direct derotation techniques reported previously. In this article, the surgical planning and surgical technique applied to our pedicle screws-rod system are demonstrated, and clinical results are presented.

INTRODUCTION

Adolescent idiopathic scoliosis (AIS) is a 3- dimensional deformity of the spine, which consists of lateral curvature plus rotation of the vertebral bodies. Nonoperative treatment is a widely accepted approach to control the progression of spinal curvature with deformity at the early stage of the disease. However, there is still lack of scientific evidence supporting the effectiveness of such treatment, and surgical correction is often necessary in several patients[1]. The primary objectives of surgical treatment in AIS are as follows: (1) to arrest progression; (2) to achieve maximum permanent correction of the deformity in 3 dimensions; (3) to improve appearance by balancing the trunk; and (4) to minimize short-term and long-term complications.

The revolutionary design and capability of spinal instruments have drastically changed the principle of scoliosis surgical correction over the past 2 decades. The first announcement of the 90-degree rod rotation maneuver espoused by Cotrel and Dubousset in the early 1980s was an excellent technique for coronal and sagittal realignment. However, whereas vertebral translation was essential, because the rotation took place by hooks rather than by vertebral bodies[2-3] . This is of clinical interest, as vertebral rotation is a major concern in scoliotic deformity correction.

Pedicle screw system was introduced at the beginning of the 1990s, followed by the report of superior outcome of

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deformity correction over the hook system in lumbar and thoracolumbar regions. These successes have led a number of scoliosis surgeons to develop techniques for using pedicle screws in the thoracic region for deformity correction with similarly promising results[4-5]. The advantages offered by screw fixation include a secured 3-column fixation, superior control of the upper and lower instrumentated vertebrae and the ability to manage large scoliosis deformities[5-7]. These advantages provide the possibility of true apical derotation for the first time in modern spinal deformity surgery.

Many techniques have been described to accomplish periapical derotation using pedicle screws. The derotation maneuvers consist of either manipulating concave apical screws by pushing in a lateral direction or by pushing convex periapical screws in a medial direction or by bilateral screw rotation through a so-called "quadrilateral frame" described recently by Chang and Lenke[8]. However from a safety perspective, the direct derotation through either maneuver carries important considerations such as screws cutting into the spinal canal or screws displacing out of the vertebral body, which can possibly cause disastrous consequences. In terms of the length of fusion the acceptable endpoints of fusions are the nutral vertebraewhich usually need longer fusion beyond the end vertebra (EV) and may jeopardize the lower spinal motion segments[6-9].

Our technique for scoliosis correction has been developed for its effectiveness and versatility and for the simplicity of the operation. Indirect manipulation of the spinal deformity from gradual curve correction, so-called "dynamic derotation" can be effectively performed, as results from our series have shown that the degree of spinal deformity correction is up to 70%. Further, regarding the degree of apical vertebral derotation, 44% of apical vertebral rotation has been demonstrated in our results[10], which are comparable to the direct derotation technique reported by Lee et al[6]. More recently, the short fusion less than EV to EV technique has been developed and can be applied in some particular curve patterns[11]. This strategy can save 1 or 2 lumbar motion segments, one of the major concerns in scoliosis surgical correction. In this study, our surgical planning and the surgical technique applied to our pedicular screws rod system are demonstrated and clinical results are presented.

Surgical Technique And Deformity Correction With The Pedicular Screws – Rods System

Selection of fusion segments

Our strategic approach for deformity correction in scoliosis is to minimize the extent of fusion as much as possible. In general, the guideline introduced by Lenke at al[12] has been used for the selection of the proper fusion segments

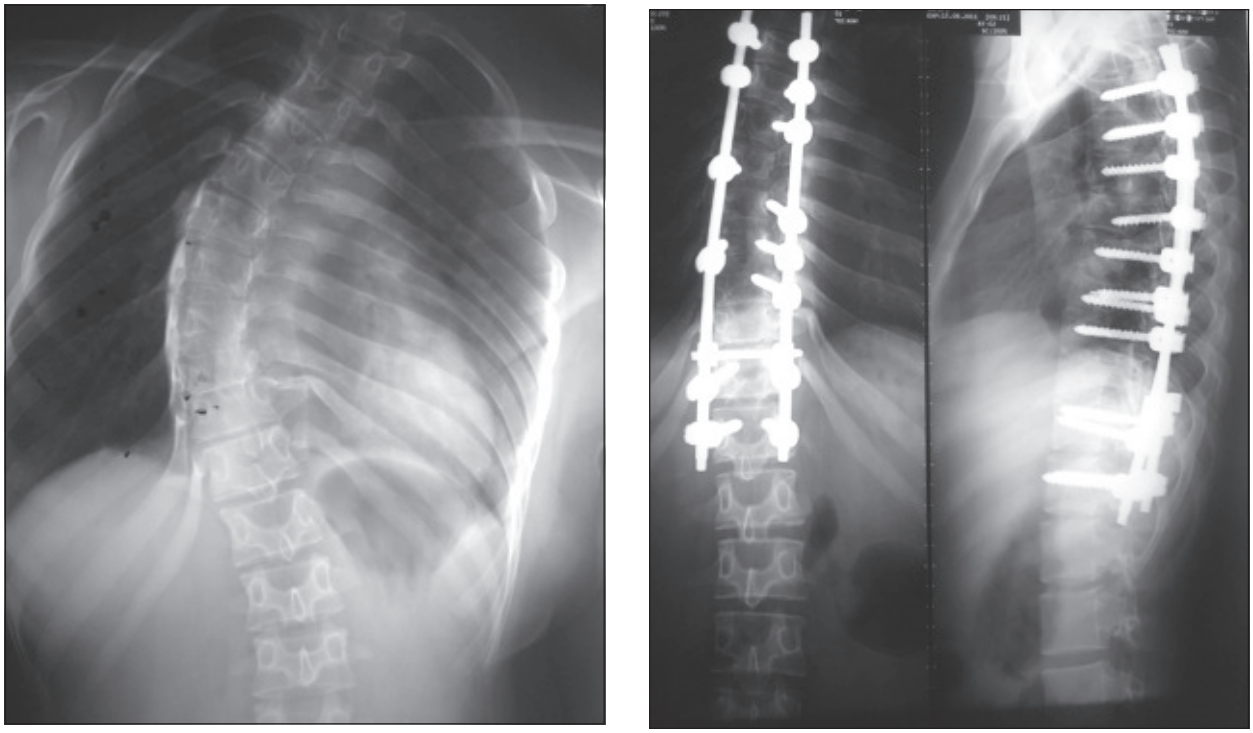

Fig.-1: *A radiographic illustration of 20- year old girl in antero-posterior (AP-pre-operative) view (A) with adolescent idiopathic scoliosis, 70 degree thoracic curve. She underwent a posterior derotation and spinal fusion from T4 to L1 with pedicle screws rod system. The follow-up X-ray 6 months after surgery, in AP & lateral view (B) revealed a well balanced spine, however, 10 degree curve remained.*

in pedicular screws rod system, with some modification. The principles are as follows: (1) the major curve and the structural minor curve are included in the instrumentation and fusion; (2) nonstructural minor curves are not considered in instrumented fusion; (3) in lumbar modifier C curve pattern, the instrumented fusion will be considered only if the magnitude of the curve has a considerable effect on the coronal balance

Surgical Techniques

Positioning

Patients position was prone on 2 dome-shaped pillow positioners to support the chest and pelvis over the radiolucent operating table. The abdomen should be hung free to prevent any compression to the vena cava. We use the strap for pulling the apical chest wall to reduce the deformity. The tape strap should run under the patient across the surgical table to the opposite side to keep the surgical area free of obstacles.

Surgical Exposure

Through the posterior midline incision, the spines are subperiosteally exposed, keeping all the ligament and cartilaginous tissue attached with retracted paraspinal muscles. Exposure is extended carefully until the proximal part of the transverse process is visualized. Generally, both EV are incorporated in the fixation.

Placement of the Pedicle Screws

On the concave side, 7 or 8 screws are placed into the pedicle of the adjacent apical vertebrae, with 1 optional screw in the lower EV (T12 or L1 in the common thoracic curve). On the convex side, 5 or 6 screws are placed in the upper adjacent vertebrae and 2 in the lower EV (Fig-2). If the curve is flexible, an optional apical screw is also used. The position of all pedicle screws should be checked for any missing position by using an image intensifier. At this step the spinal navigation system is very helpful to place the screws in the precise position.

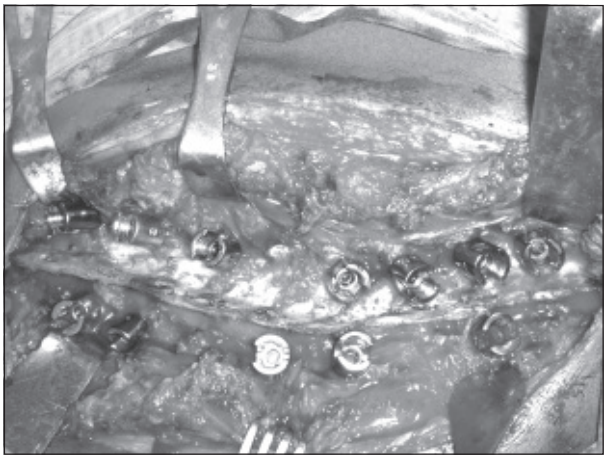

Fig.-2: *The illustrative figure of AIS correction revealed that placement of more screws (7) in concave side and less screws (5) on convex sid*

Assembly of the Rods

As the screws are aligned according to the anatomic axis of the pedicle, rods are contoured. On the concave side, first thread in the 2 proximal screws, and then gradually lever the adjacent distal screws one by one into the rod. Both ends of the rods are guided stay on the same side of the curve and push down the rod until it comes in contact with the lamina.

This maneuver needs to repeat both levering and twisting of the rods. Once all the screws are incorporated into the rods, some degree of rotational deformity correction is achieved (Fig-3).

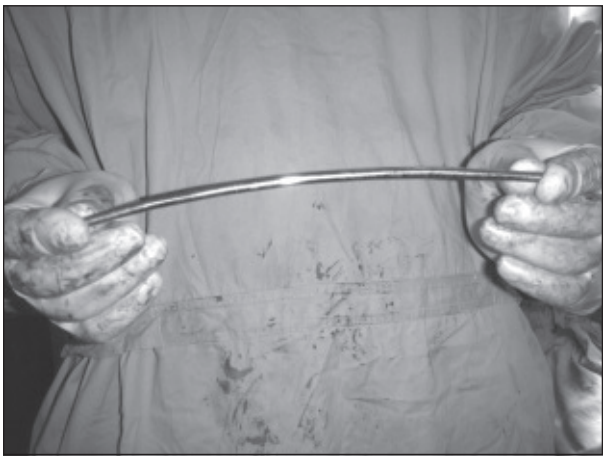

Fig.-3: *Illustrated the assemble of the rod prior put to the screws*

Deformity Correction

After incorporation of rod into all screws the cap of the screws are loosely tighten, than both rods are gradually rotated with the help of vice grip on the concave side till the maximum correction of deformity is achieved. Distraction of the end vertebrae away from the center in the concave side and derotates the apical vertebrae. On the contrary, compression of the end vertebrae on convex side reduce the hump and also correction of curveture. Thereafter, all the cap of the screws are tightened very scuretly.

In patients with severe rigid deformity, discectomy, partial vertebral resection, or pars resection may be performed on periapical vertebrae to reduce stiffness of the curve before assembling of the rod and deformity correction maneuver. Our aim of treatment in such patients is maximum correction of deformity, setting the balance of the spine and impeding the progression of deformity (Fig-4).

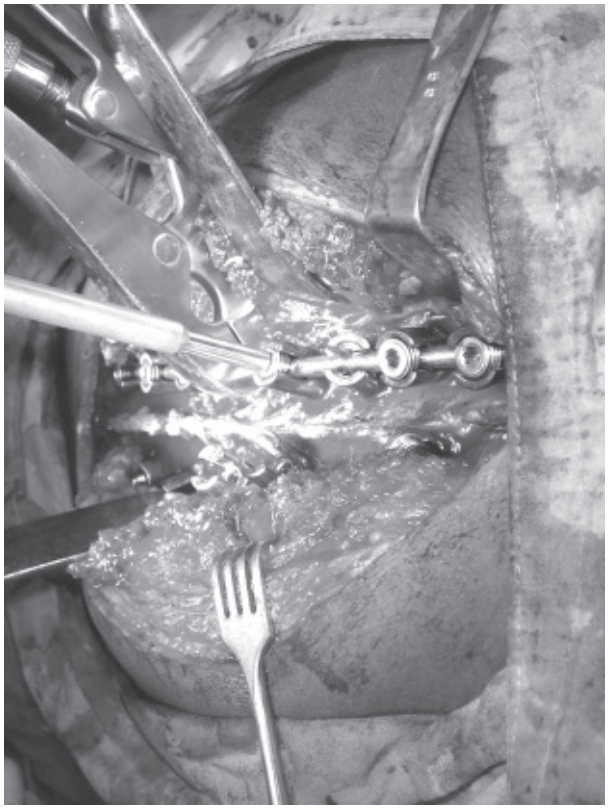

Fig.-4. *The illustrative figure shows the correction of deformity by derotation of the vertebral bodies, rotating the screws & rod with the help of vice grip.*

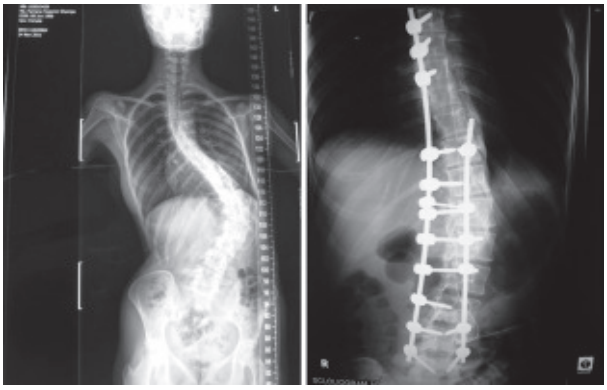

Fig. 5(a) **Fig. 5(b)**

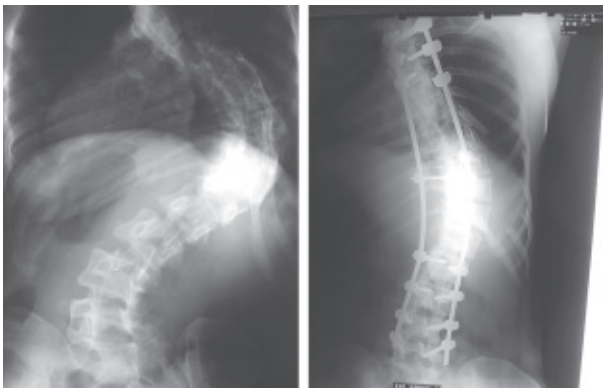

Fig. 5(c) **Fig. 5(d)**

Fig-5: *Pre-operative plain X-ray AP view (5A) of a 19 years old girl illustrated Cobb's angle was 95°, Post-operative plain X-ray AP view (5B) illustrated that Cobb's angle remain about 25° and Pre-operative X-ray AP view (5C) of 25 years of old lady illustrated that Cobb's angle was 120°, Post-operative X-ray AP view (5D) shows that Cobb's angle remain about 55°.*

RESULTS

The clinical results of our surgical technique on idiopathic scoliosis (AIS) deformity correction using the pedicular screws rods system were analyzed.

There were 30 patients (22 female and 8 male) with diagnosis of AIS included in this study. Minimum age was 13 years and maximum was 40 years with mean age 19 years (SD 4.25) as shown in table I. With Lenke's classification thoracic scoliosis were 16(53.33%), lumbar 6 (20%), thoracolumbar 4 (13.33%), double thoracic 2 (6.66%), and double major 2 (6.66%). The minimum preoperative Cobb's angle was 45°, maximum 120° and average 70° (Table II). The minimum postoperative Cobb's angle was 5° maximum

Table-I

Overall Data

	Age of Patients	Pre Operative Angulation in degrees	Post Operative Angulation in degrees	Total Correctnessin degrees
n	30	30	30	30
Mean	16.56	69.72	20.56	49.17
Standered error of Mean	1.00	5.92	4.62	2.69
Median	16.00	65.00	15.00	45.00
Mode	16	50	5	45
Std. Deviation	4.25	25.12	19.62	11.41
Range	19	75	60	45
Minimum	13	45	5	25
Maximum	40	120	65	70

65° and average 20° (Table III). Total correctness of Cobb's angle achieved was minimum 25°, maximum 70° and average 50° (Table IV). The radiographs of two patients are shown in figures-5. Pre-instrumentation anterior release was done in 1 case. Complications included temporary spinal neurological deficit in one case where anterior release was done. In one patient screws were in miss position which was underwent revision surgery for correction of screws after a few days of operation.

Table-II

Pre operative Angulations in Degrees operative Angulations in Degrees

Cobb's Angle	Frequency	Frequency	Cumulative Percent
45	4	13.33	11.1
50	12	40	38.9
55	4	13.33	44.4
65	4	13.33	66.7
80	2	6.66	77.8
90	1	3.33	83.3
115	2	6.66	94.4
120	1	3.33	100.0
Total	30	100.0	100.0

DISCUSSION

This study was done to quantify the magnitude and variability of the correction achieved in AIS. The results are variable due to the degree of normal and/or pathologic anatomic variations. Bahairy et al included eleven patient in their study in which there were 10 females and one male, with a mean age at the time of surgery of 17 years (range 12-30). The median preoperative Cobb angle was 60°±14° (range 48-90°), which was corrected to a median of 26°±22°(10-80°) on preoperative supine right bend film. The postoperative angle was

Table-III

Post operative Angulations in Degrees

Cobb's Angle	Frequency	Percent	Cumulative Percent
5	4	13.33	27.8
10	12	40	44.4
15	4	13.33	61.1
20	4	13.33	77.8
30	2	6.66	83.3
50	2	6.66	88.9
65	2	6.66	100.
Total	30	100.0	

Table-IV

Total Correctness in Degrees

Cobb's Angle	Frequency	Percent	Cumulative Percent
25	4	13.33	5.6
30	3	10	11.1
45	12	40	55.6
50	2	6.66	66.7
55	2	6.66	78.7
60	2	6.66	83.3
65	2	6.66	94.4
70	1	3.33	100
Total	30	100	

40°±14°(9-56°). Pre-instrumentation release contributed a median 42%±25% to the overall correction[11]. Luk KD et al[12] studied idiopathic thoracic scoliosis in which they pointed out that the Cobb's angle was decreased from 34° to 21° post- operatively with total correctness of 13° (average) in 45 patients and remained unchanged in 28 patients, while in our study the Cobb's angle was decreased from 70° to 21° postoperative with total correctness of 50° (average). In his review article Yalda et al analyzed the data of 3299 patients.13 In this study the average major curve correction was 26.6° (for 2188 patients). The mean total Oswestry Disability Index (ODI) was 41.2 (for 1289 patients), and the mean postoperative reduction in ODI was 15.7 (for 911 patients). The mean SRS-30 equivalent score was 97.1 (for 1700patients) with a mean postoperative decrease oIn Quan GM et al 14 study the preoperative main thoracic curve of 60.0° +13.4° was corrected to 17.4° + 6.9° (69.9% correction) on the postoperative radiographs. The preoperative thoracic kyphosis of 20.0° + 10.2° decreased to 11.6° + 4.9° after surgery. There was a significant correlation between decrease in sagittal kyphosis and magnitude of coronal Cobb angle correction (P 0.002). All the above studies are comparable to the present study which showed that the treatment of adolescent idiopathic scoliosis with posterior instrumentation by using rods and pedicle screw fixation along with autologous bone graft is the most effective method for treating AIS.

CONCLUSIONS:

The pedicular screws rod system is one of the most effective implants that can be used to correct spinal deformity in AIS. In this technique, the spinal deformity of AIS can be successfully corrected in 3 dimensions,

coronal, sagittal and axial rotation, as demonstated in our results. Posterior fusion with instrumentation for the surgical treatment for scoliosis with pedicle screw constructs can result in better correction and less frequent implant failures in thoracic idiopathic scoliosis, however, this can be at the expense of sagittal contour.

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Original Article

Evaluation of results of operative treatment of symptomatic Spondylolisthesis

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ABSTRACT

A clinical trial was conducted on 10 patients of symptomatic spondylolisthesis at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, from Jan 2007 to Dec 2008. A predesigned proforma was used to collect the data to evaluate the effectiveness of decompression and posterior stabilization by pedicle screw for symptomatic spondylolisthesis. Mean age of patients was 42.8 years and male to female ratio was 3:7. There were spondylolisthesis L4 over L5 were 7 (70%) and L5 over S1 were 3 (30%). In this study, 04 (40%) cases were sensory deficit and 4 (40%) cases were motor deficit and 02 (20%) were normal. Regarding postoperative hospital stay, 7 patients (70%) were discharged within 2 weeks and remainder 3 patients (30%) stayed up to 3 weeks. In this study, preoperative and postoperative complication developed in 2 patients (20%) in each. Regarding outcome, 5 patients (50%) obtained excellent result; 4 patients (40%) obtained good result and 1 patient (10%) ended up with poor result. We can conclude that decompression and posterior stabilization by pedicle screw is effective measure for symptomatic spondylolisthesis

INTRODUCTION

Spondylolisthesis is defined as forward translation of a vertebral body with respect to the vertebra below. This condition was first recognized in 1782 by the Belgian obstetrician Herbiniaux, and it was Rokitansky who was credited for describing the lesion as pathological entity.[1] The condition is most common in the low lumbar spine (85% to 89% at L5; 10% to 11% at L4; 5% at all other vertebral levels), though it may occur at any segment of the spine. Patients with spondylolisthesis usually present with low back pain, which is dull and aching, radiating down to the posterolateral side of the lower limb, increasing with activity and decreasing with rest. Initial treatment of lumbar spondylolisthesis is usually non-operative and consists of non-steroidal anti-inflammatory drug (NSAID), brace, refraining from strenuous activities, and avoiding heavy labor. Most patients who have spondylolysis or Grade-1 Spondylolisthesis do not need surgical treatment.[2, 3]

Surgical treatment is indicated if there is persistence or recurrent symptoms for at least 1 year with conservative treatment, symptoms are persistent and progressive, if the condition is disabling and interferes with work, and if there is a significance neurological deficit.[4,5] The goals of surgery include: a) Relieve pressure or compression on the affected nerves. b) Stabilize the vertebrae by fusion to prevent further slippage, thus preventing further nerve pressure. c) Restore spinal alignment.

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Operative procedure leads to early pain free active life of the patient.[6,7] Patients with degenerative spondylolisthesis and spinal stenosis treated surgically showed substantially greater improvement in pain and function during a period of 2 years.[8] This study was under taken to evaluate the effectiveness of the operative procedure decompression and posterior stabilization by in situ fixation by pedicle screws of symptomatic spondylolisthesis.

MATERIALS AND METHOD

This study was conducted on 10 randomly selected patients of symptomatic spondylolisthesis who fulfilled the following inclusion and exclusion criteria.

Inclusion criteria

1. Spondylolisthesis with symptoms.
2. Age 18 years or more.
3. Failed conservative treatment
   i. Persistence or reoccurrence of symptoms for at least 1 year.
   ii. Progressive symptom with neurological deficit.

Exclusion Criteria

1. Spondylolisthesis without symptoms
2. Symptom improving with conservative means
3. Pathological fractures
4. Fracture dislocation with complete paralysis.

Ethical consideration

Informed written consent was taken from the patient after detailed explanation of the procedure. Other associated injuries were to get due importance and were managed accordingly. No financial benefit was given to or obtained from any of the patient. Strict privacy of the patients was maintained during study and presentation.

Data analysis

Once data collection was completed, data were compiled manually according to key variables. Analysis of different variables was done with SPSS 16.0 program.

Methods

A complete history of the selected case was taken and an assessment to rule out any co-existing disease had been done. This was followed by a thorough general and physical examination.

Local examination

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

1. Attitude of the limbs and trunk.
2. Estimation of neurovascular status:
3. Any associated problems.

Laboratory investigation

- Complete blood count
- FBS (Fasting Blood Sugar) and RBS (Random Blood Sugar)
- Blood urea, Serum creatinine
- Urine for R/E (Routine Examination) and M/E (Microscopic Examination)

Radiological assessment

- X-ray lumbo-sacral spine Anterior-posterior, lateral, oblique views,
- X-ray chest Posterior-anterior view
- ECG, Echocardiogram

Preoperative preparation

Counseling of patients was done regarding the treatment procedure with emphasis on the available treatment options along with merits and demerits of each. Patients were informed about the possible postoperative sequele. Informed written consent was taken from each case. All issues regarding the patients' welfare were approved by the local ethical committee.

- Pre anesthetic check-up
- 6 hours NPO before operation
- Antibiotics: All patients received prophylactic antibiotic, a third generation cephalosporin (ceftriaxone), one gram i.v was given at the time of induction of anesthesia, then daily up to 3 days. After 3 days oral cephalosporin was given for further 2 weeks according to dose.
- Post operative ambulatory programmed with orthosis for 6 weeks and gradual return to daily activities in another 6 weeks.

Surgical Procedure: Any associated illness such as hypertension, diabetes, pulmonary problem and concomitant injuries were treated. As soon as the general condition of the patients was settled, plan for operation was done; Antibiotic prophylaxis: A third generation cephalosporin (ceftriaxone), one gram i.v. was given at the time of induction of anesthesia; Anesthesia: Under general anesthesia; Position of the patient: Prone, special knee elbow position; Approach: Posterior mid line incision.

Procedure

The skin was prepared with antiseptic solution. Then lumber spine to be instrumented and iliac crest were draped.

An incision was made from one spinious process above the area to be instrumented to one spinious process below the area to be instrumented. Subcuteneous tissue and muscles were infiltrated with epinephrine 1:500,000. Dissection was continued with electrocautery to fascia. Fascia was delineated for later closer. Dissection was continued through the fascia. Perispinal muscles were dissected from the spinous process with cobb elevators and electro cautery. Nerve roots were cleared off all the tissue that pressing on them. Now we continued to widen dissection to the tips of the transverse process.

Fig-1: *Peroperative position of the patient*

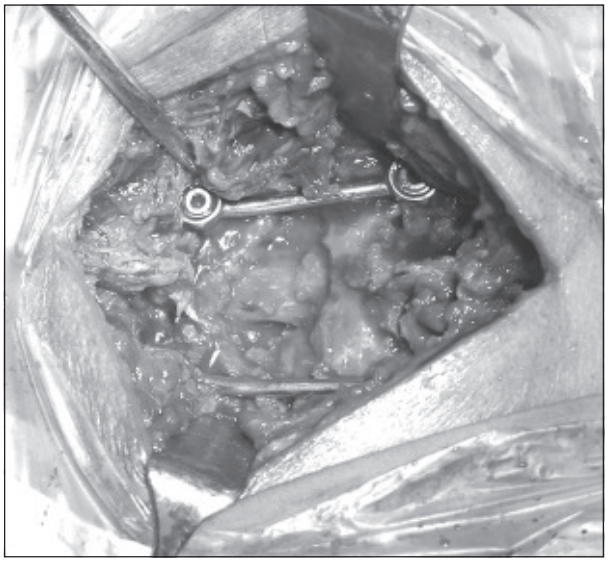

Fig-2: *Per operative pedicle screw rods fixation*

Pedicle screws placements in the pedicles

- Technique: We usually used intersection technique. (All technique are described below)
- X-ray / image intensification was used to identify operative level.
- A blunt awl was inserted into the pedicle and advances it through the pedicle; path of the probe was monitored by C-arm image or checked by x-ray.
- Continuity of pedicle wall was confirmed with a ball tipped probe.
- Pedicle and vertebral body was tapped to at least one half of the depth of vertebral body using a tap for screw driver chosen from preoperative pedicle measurements.
- Pedicle screw with a ploy axial head was inserted. The screws were placed in additional segments in same fashion. When the screws had been placed in all segments to be instrumented, rod was inserted one side and another side and adjust it accordingly and then checked by C-arm image intensification or by x-ray.
- Bone grafts were harvested from iliac crest (if needed).
- Then wound closed in layers after proper haemostasis with a drain in situ.

Techniques for the localizations of the pedicle

We use three techniques for localization of the pedicles:

(1) the intersection technique (2) the pars interarticualris technique and (3) the mamillary process technique.

It is important in preoperative planning to assess individual spinal anatomy with the use of high quality anteroposterior and latral radiographs of the lumbar and thoracic spine and axial CT scanning at the level of the pedicle. In the lumbar spine, Robertson et al. showed that coaxial fluoroscopy images are reliable guide to the true bony cortex of the pedicle. The intersection technique is perhaps the most commonly used method of localizing the pedicle. It involves dropping a line from the lateral aspect of the facet joint, which intersects a line that bisects the trabseverse process at a spot overlying the pedicle. The pars interarticularis is the area of bone where the pedicle connects to the lamina. Because the laminae and the pars interarticularis can be identified easily a t surgery, they provide landmarks by which a pedicle drill starting point can be made. The mammillary process technique is based on a small prominence of bone at the base of the transeverse process. This mammillary process can be used as starting point for transpedicle drilling. Usually the mammillary

process is more lateral than the intersection technique statrting point, which also is more lateral than the pars interarticualris statrting point. With this is in mind, different angles must be used when drilling from these sites. With the help of preoperative CT scanning at the level of the pedicle and intraoperative radiographs, the angle of the pedicle to the sagittal and horizontal planes can be determined.

Materials: Pedicle screw (35, 40 mm), Rods and Metallic Cage (Flip Cage, Bean Cage)

Post operative care: All patients after operation were kept under observation in the post operative ward for next 24 hours. Proper analgesic and sedation were ensured by injection of pethedine and diclofen I/M as needed.

First post operative day: The patients were not allowed sit on bed, passive and assisted active exercise of the upper and lower limbs were begun. Breathing exercise started.

Second post operative day: Active exercise of upper and lower limbs started within limit of pain. (Static Quadriceps, Active Flexion, Active Extension etc.)

Third post operative day to onwards: The drain in the wound was removed on third post operative day. Patients were allowed to sit on bed with thoracolumbo sacral support (i.e Taylor brace). When pain permitted patient was advised to stand with support of walker and physical support from attendants. Patients were trained to walk before discharge. Stitches were cut on 13th post operative day. On discharge all patients were advised physiotherapy for back and limbs and to come again for follow up.

Follow up schedule

1st follow up: After 4 weeks, 2nd follow up: After 8 weeks, 3rd follow up: After 12 weeks, 4th follow up: After 16 weeks, 5th follow up: After 24 weeks

All patients were evaluated clinically and radiologically and according to modified owestry low back disability index (After Inamder et al 2006)

Complications

a. Pre operative: Foot drop, Cauda equana syndrome, Sensory loss, Motor loss

b. Per operative: Dural tear, Partial root injury, Complete root injury

c. Postoperative: Wound infection, CSF leak, Decubitus ulcer, Osteomyelitis, Implant failure (non- union).

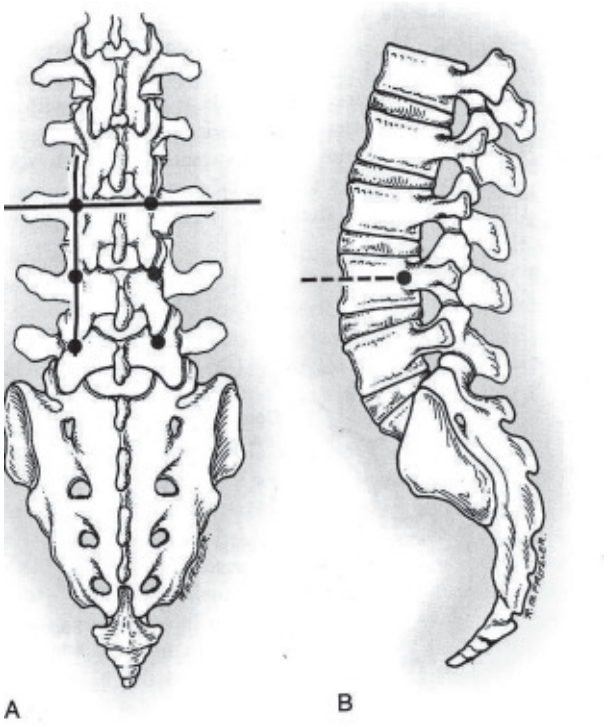

Fig: 3: *Pedicle entrance point in lumbar spine at intersection of two lines. On typical bony crest, it is 1 mm below particular joint. A, Anteroposterior view. B, Lateral view edrawn from Roy-Camille R, Saillant G, Mazel CH: Plating thoracic, thoracolumbar, and lumbar injuries with pedicle view plates, (Orthop Clin North Am 17:147, 1986)*

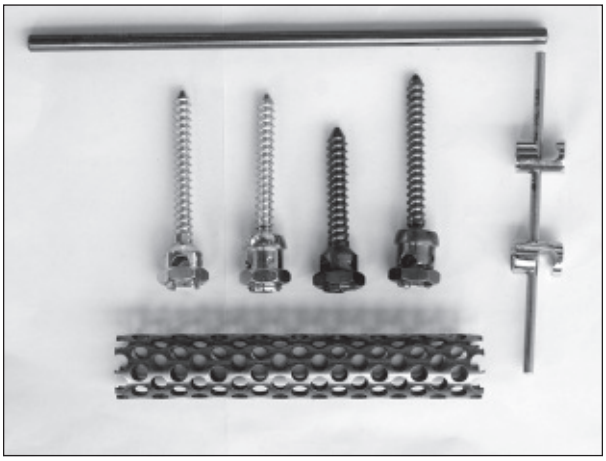

Fig.-4: *Picture: Pedicle Screw, Rods, Cage*

RESULTS:

A clinical study was conducted during the period from Jan 2007 to Dec 2008 in National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka. The study was included ten patients irrespective of sex, religion

social status, or race with symptomatic spondylolisthesis. Random sampling method followed as per inclusion and exclusion criteria.

In this study, the age ranges from 22 to 64 years and mean age was 42.8 yrs. Out of 10 patients, 3 (30%) were male, 7 (70%) was female (Ratio-3:7).Occupation of the subjects demonstrates that housewife was 07 (70%) & farmer was 03 (30%), showed in Table I. Table II observed that among the patients there were spondylolisthesis L4 over L5 were 7 (70%), L5 over S1 were 3 (30%). In this study, 4 (40%) cases were sensory deficit and 4 (40%) cases were motor deficit and 02 (20%) were normal. Among the 10 patients, ankle jerk status was normal in 6 (60%) cases and grade-I was 3 (30%); grade-II was 6 (60%); grade-III was 1 (10%). Table III showed that regarding postoperative hospital stay in this study, 7 patients (70%) were discharged within 2weeks and remainder 3 patients (30%) stayed up to 3weeks. In this study, peroperative complication (root injury) developed in 2 patient (20%) and postoperative complication (foot drop) developed in 1 patient (10%). One patient (10%) developed bowel and bladder complications. (urinary retension). In this study, out come of treatment was classified as excellent, good, fair, & poor. Excellent & good result was considered as satisfactory and the rest as unsatisfactory. Out of 10 patients 5 patients (50%) obtained excellent result; 4 patients (30%) obtained good result and 1patient (10%) ended up with poor result.

Table-I

Distribution of patients according to epidemiological profile (n = 10)

Epidemiological profile	Frequency
Age(in years)	
21-30	3 (30%)
31-40	0 (0%)
41-50	2 (20%)
51-60	4 (40%)
61-70	1 (10%)
Sex	
Male	3 (30%)
Female	7 (70%)
Occupation	
Farmer	3 (30%)
Housewife	7 (70%)

Table-II

Distribution of patients according to clinical profile (n = 10).

Clinical profile	Frequency
Level of spondylolisthesis	
L4 over L5	7 (70%)
L5 over S1	3 (30%)
Neurological Deficit	
Sensory	4 (40%)
Motor	4 (40%)
Normal	2 (20%)
Ankle jerk status	
Normal	6 (60%)
Abnormal	4 (40%)
Grading	
Grade I	3 (30%)
Grade II	6 (60%)
Grade III	1 (10%)

Table-III

Distribution of patients according to duration of complications. (n = 10).

Complications	Frequency
Duration of hospital stay	
0-2 weeks	7 (70%)
2-3 weeks	3 (30%)
Per-operative complications	
Absent	8 (80%)
Present	2 (20%)
Post operative complications	
Absent	9 (90%)
Present	1(10%)
Post operative bowel and bladder complications	
Complication	1 (10%)
Non-complication.	9 (90%)

Table- IV

Distribution of patients according to final outcome of treatment. (n = 10)

Outcome of Treatment		Frequency	%	%
Excellent	Satisfactory	5	50	90
Good		4	40	
Fair	Unsatisfactory	0	0	10
Poor		1	10	
Total		10		100

DISCUSSION:

Goal of treatment was restoration of patient to his or her preoperative status in the earliest possible time with low morbidity and mortality with least cost to the patients and hospital. Conservative measures treatment was successful in the majority of cases, with surgical intervention being reserved for those in whom symptoms were refractory to these measures. In those with symptoms, surgical intervention can be successful in alleviating symptoms. So careful correlation of the clinical picture with neuroimaging data will allow for an accurate understanding of the structural issues and will help in the surgery-related decision-making process [3].

Once it is established that conservative treatment has failed, the next step is to determine a surgical plan. Surgical options include posterior arthodesis, in situ with or without decompression, posterior interbody arthodesis, anterior arthodesis in situ, and reduction of the spondylolisthesis, with associated arthrodesis and also fusion with cage. In adults in whom only radicular symptoms are present, neural decompressive surgery can be performed. Its drawback is the potential for increasing the subluxation postoperatively [3]. In one study, 23% incidence of postoperative subluxation was reported[13]. In this study decompression and bone grafts were done in each of the 10 patients and none developed sublaxation. So this study is not similar to that study. Typically, immobilization of the involved segment leads to resolution of the neural symptoms [14, 9]. Reported results for in situ (intertransverse) fusion indicate that relief of pain can be achieved in both adolescent and adult patients. In a series of eight adult patients with isthmic spondylolisthesis with a follow-up period of 2 to 14 years, excellent relief of both radiculopathy and low back pain was demonstrated in all patients. In addition, all eight patients returned to their previous occupations [15]. In this study, 9 (90%) were cured from the low back pain and returned to their previous occupation.

Spinal instrumentation is typically used to improve arthrodesis rates, to repair a pars defect directly, or to reduce the dislocation in high-grade spondylolisthesis. Specifically, pedicle screw fixation devices have been shown to be mechanically superior to other stabilization systems in the lumbar spine. Compared with other devices, they allow for the selective segmental application of force to the spinal cord without the need for extension to adjacent levels [17]. The benefit of the direct repair procedure is that it preserves motion of the involved motion segment, decreasing stress placed on adjacent levels [3]. In this series, all patients, under gone selective segment stabilization and they cure. So this series is similar to his study.

Women past the fifth decade are predisposed to degenerative spondylolisthesis [16]. In this series 7 (70%) patients were female. Most of the female at this age in our country is poor, anaemic and osteopathic, so degenerative change comes earlier. This series is almost similar to his description. Bone grafting of the defect is performed in conjunction with the repair[18]. Interbody fusion is preferred for high grade spondylolisthesis which requires reduction or if the disc space is still high and when the slip grade is low, or the disc space is narrow, posterolateral fusion is preferred[19]. All the patient undergone interbody fusion after decompression in this study and bone graft and augmentation with cage was used in 7 case.

In this study, level of involvements at L4/L5 was 7 and L5/S1 was 3. The condition is most common in the low lumbar spine (85% to 89% at L5; 10% to 11% at L4; 5% at all other vertebral levels), though it rarely occurs in any segment of the spine [4]. So this study is not similar to that study.

Degenerative spondylolisthesis occurs most often at the L4-5 level, infrequently at L3-4, and rarely at the lumbosacral level [16]. Outcome measures included the Oswestry Disability Index. There was significant improvement in respect to Oswestry Disability score. In this study, clinical outcome was satisfactory in 9 (90%) patient and unsatisfactory in 1 (10%). 1 (10%) patient had peroperative complication. 1 (10%) patient developed postoperative complication. Patient was discharged after operation within 9 to 18 days.

Cloward, 1953 presented 93 cases treated by PLIF, with 98% satisfactory result [6]. Lin, 1983 presented 465 cases treated by PLIF with 82% satisfactory result. Ramani, 1996 presented an analysis of 450 cases treated by PLIF with 83.6% satisfactory result. In another series of 64 cases of spondylolisthesis, treated by PLIF where satisfactory result achieved in 94% cases (Excellent-80%, good 14%).

Molinari present an analysis of consecutive 37 patients treated surgically for high grade spondylolisthesis with and without anterior column structural support with emphasis on fusion rates, segmental Kyphosis & functional outcomes. Among the 37 cases, 31 cases were Meyeding grade III or IV. Incidence of pseudoarthosis was 39% and outcome regarding pain after treatment, function, and satisfaction were high in those patients who achieved solid fusion regardless of surgical procedure [20].

Giovanni and Alfredo presented 35 consecutive patients underwent pedicle screw fixation for isthmic spondylolisthesis. In 18 patients, posterior lumbar fusion was performed and in 17 patients, PLIF added. The author's

findings support the view that an interbody fusion confers superior mechanical strength to the spinal construct when posterolateral fusion is the sole intervention, progressive loss of the extreme correction can be expected [21]. Dennis et al present 42 patients who had undergone uni-or bilateral TLIF (Transforaminal Lumbar Interbody fusion) are effective treatment options in patients of spondylolisthesis. The result gives acceptable rates of fusion and clinical success and a minimal incidence of morbidity when performed by an experienced surgeon [22].

Inamdar presented 47 cases of spondylolisthesis with single level symptomatic spinal stenosis. Patients were treated with posterior decompression and bilateral posterolateral arthrodesis with autogenous bone graft. Solid fusion provides long term clinical benefits [5]. Hensinger et al. presented 34 patients with grade-1 spondylolisthesis and symptomatic lumbar spinal stenosis. Surgery substantially improved 1 year outcomes based on established outcomes instruments in patients with grade-1 spondylolisthesis and stenosis. Fusion was associated with greater functional improvement [9].

There was some limitation of the study. The study sample was small, total 10 cases. The cost of the implant was also a constraint. Patients were well informed with these problems but their follow-up was un-satisfactory. Patients did not followed the postoperative physiotherapy protocol strictly.

CONCLUSION:

The postoperative outcome was satisfactory. We can conclude that symptomatic spondylolisthesis treated by decompression in situ, posterior stabilization with pedicle screw and rods and interbody fusion with bone graft results in- (i) preservation of the anatomical spine, (ii) shortening hospital stay, (iii) minimizing economical burden of prolong conservative procedure, (iv) early mobilization and early return to job.

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Original Article

Results of fixation of femoral shaft non-union with implant failure by SIGN interlocking nail

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ABSTRACT

This prospective study of " Results of fixation of femoral shaft nonunion with implant failure by SIGN interlocking intramedullary nail" was carried out during the period of 2009 to 2012 at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh. Mean age of the patient was 38 years majority of the patients were male. In most of the cases, injury was high-energy trauma due to motor vehicle accident and there was a preponderance of fracture on the right side. Removal of the previous implant, refreshening of the fracture ends, open reduction and fixation either antegrade or retrograde SIGN interlocking intramedullary nail depend on the site of involvement.The mean union time was 16 weeks. Reaming materials was used as internal bone graft and one patient developed deep infection with poor union status.The final outcome satisfactory result was found in 21(84%) cases and unsatisfactory result in 4(16%) cases.

INTRODUCTION

In spite of increased understanding of biomechanics and implant design, nonunion of femoral shaft fractures continues to hinder the treatment of these injuries. This complication presents a difficult treatment challenge for the surgeon and a formidable personal and economic hardship for the patient. Femoral fractures may fail to unite because of the severity of the injury, damage to the surrounding soft tissues, inadequate initial fixation, and demographic characteristics of the patient. The treatment of long bone fracture nonunion has been extensively discussed in the orthopaedic literature. The evolution of treatment began with traction and prolonged immobilization as described by Watson-Jones. This was later surpassed by the concept of bony apposition to stimulate primary healing by removing fibrous tissue interposed between the fracture fragments . In contrast, Harkins and Phemister contended that this fibrous tissue was necessary for nonunion healing and advocated the use of onlay bone grafts. Other adjuvant methods to stimulate healing have included conventional bone grafting as well as electrical stimulation of osteogenes is in various forms. In the 1950s, the application of internal fixation in the form of compression plating as described by Danis and others gained popularity . A few years later, the use of external fixation was introduced as a therapeutic alternative for the treatment of nonunions .Whereas the treatment of femoral shaft fractures has been extensively described in the orthopaedic literature, the data regarding treatment of femoral shaft fracture nonunion are sparse and conflicting. Most of the discussion on long bone nonunions is centered around tibial injuries. The accepted standard of therapy for femoral shaft fracture nonunion invariably includes surgical intervention in the form of

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closed intramedullary nailing with reaming. More specifically, several authors recommend removing the present intramedullary nail, reaming the intramedullary canal, and inserting a larger diameter nail. Open autogenous bone grafting in addition to intramedullary reaming hasbeen recommended only in cases of synovial pseudarthrosis or in nonunions with bony defects at the site of injury.

The advent of improved implant design has helped achieve excellent results treating non-unions.

Intramedullary nailing recently received increased attention for the treatment of femoral shaft fractures. These devices obtain more biological fixation because they are load sharing rather then load spearing implants and successfully controlling the axial and rotational deforming forces. Intramedullary SIGN (Surgical Implant Generation Network) nail fixation in implant failure and nonunion of femoral fractures in an effective method of treatment. The antegrade femoral nail allows for better control of proximal shaft fracture, while retrograde formal nail is reliable in controlling distal fractures (Leggon and feldmann, 2001). Whider proximal portion of the nail occupy proximal and distal capacious areas in case of antegrade and retrograde inserted nails respectively and resist angulations and rotation.

In NITOR (National Institute of Traumatology and Orthopaedic Rehabilitation) we are performing "SIGN" (Surgical Implant Generation Network) nailing for fixation of femoral shaft nonunion with implant failure. With support from Surgical Implant Generation Network (SIGN) expertise as grown up in NITOR to perform both antegrade and retrograde SIGN nailing for fixation of femoral shaft nonunion with implant failure.

This study is to report the outcome of SIGN nailing for fixation of femoral shaft nonunion with implant failure will be evaluated.

MATERIALS AND METHODS

Between 2009 and 2012, 26 patients with nonunion of the shaft of the femur with implant failure were evaluated and cared for at our institution National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka.

For the purposes of this study, nonunion is defined as absence of clinical or radiographic healing 9 months postinjury. The shaft of the femur is defined as the area 5 cm distal to the lesser trochanter proximally and 5 cm proximal to the epicondylar axis distally.

This prospective study was undertaken to evaluate the results of fixation of Femoral shaft nonunion with implant failure by SIGN interlocking I.M. nail.

Purposive sampling method was followed as per inclusion and exclusion criteria. Selection was done on the basis of history, clinical examination and radiological evaluation at the out patient department (OPD) of NITOR.

A complete history of the selected cases was taken with particular emphasis to the time and mechanism of injury, past treatment, and was assessed to rule out any co-existing diseases (Diabetes mellitus, Hypertension, collagen tissue disorder). This was followed by a through general and physical examination to exclude any associated injuries. Available roentgenograms were evaluated to determine bone stock, type of nonunion(hypertrophic, oligotrophic, or atrophic), and fracture alignment in the anteroposterior (AP) and lateral planes, fracture configuration, status of the previous implant, status of union was assessed

Preoperatively lateral X-Ray view of the patient's femur was done to estimate the length and diameter of the required intrameduallary nail. The diameter of the nail was estimated by measuring the diameter of the intramedullary canal of the diaphysis at the narrowest point. Magnification should not exceed 10 percent. In general, the exact nail length and diameter are determined during surgery.

Ante grade Nailing – for proximal and middle third fracture

Retrograde Nailing – for distal third fracture

All the 25 patients were operated under spinal anaesthesia.

At operation patients were placed in the lateral position with the affected side uppermost for antegrade nailing and patients were placed in the supine position with flexion of the knee 60 to 90 degree for retrograde nailing Fracture ends were exposed through lateral incision (an imaginary line from the tip of the greater trochanter to lateral femoral condyle) over the fracture site. All the previously used implants were removed and refreshening of the fracture ends was done.Reduction of fracture was done with manual traction. Rotational alignment was obtained by aligning the iliac spine, centre of the patella and first web space of the foot. Reduced fracture ends were held in position by bone holding forceps.

For antegrade nailing-Incision from just distal to the flare of the greater trochanter extending proximally 9-10cm in the line with the fibres of the gluteus maximus.

For retrograde nailing-A medical parapatellar capsular incision was made beginning at the medical border of the quadriceps tendon 5cm proximal to the patel

Using a femoral awl the entry portal for antegrade nailing was made at the greater trochanter, and for retrograde nailing; the entry portal was made just anterior to the femoral attachment of the posterior cruciate ligament.

After the creation of the entry portal the awl was removed. The reaming of the medullary cavity was done with "SIGN" reamer after attaching with T-handle. Then progressively reaming was done in 1mm increments to 1mm larger then the diameter of the selected nail.

The nail was inserted with the help of "T-Handel" then the nail was advanced across the fracture site keeping the fracture ends in proper alignment to avoid further comminution.

After the fracture was fixed by the SIGN nail and interlocking screws, the jig from the L-handle and L-handle from the nail were removed. Irrigation of the wound was done with normal saline and the wound were closed in layers. Postoperatively limb was elevated on a pillow keeping the knee in slight flexion. The patients started isometric quadriceps exercises 24 hours after operation. After 48 hours, drain was removed. The patients were allowed to move out of the bed when pain permitted, using crutches without bearing weight on operated limb. Stitches were removed on 14th postoperative day. Postoperatively prophylactic antibiotics were given routinely for two weeks in all cases. Patients were discharged with the advice to move the hip and knee joints actively from third week. They were also advised to walk on crutches, bearing no weight on the affected side for six weeks and then to attend the outpatient department of NITOR for follow up. All patients were evaluated both clinically and radiologically at six weeks. If there was radiological evidence of healing (callus), the patient was allowed to touch the toe and gradually bear some weight, but never more than half. After twelve weeks further review was done. A check X-ray was done and full weight bearing was permitted if radiological evidence of consolidation was present on the operated limb.

This prospective study was carried between 2009-2012 at the NITOR. Total 26 patients were selected for this study. One patient was lost during follow up. So, remaining 25 cases were finally available for evaluation. All patients, after proper resuscitation and investigation, were treated with removal of previous implant and fixation by SIGN Nail either antegrade or retrograde nailing, and followed up from 3 months to 18 months. All the relevant findings have been presented in tables and figures.

Table - I

Number of patients (n=25)

Number of patients	25
Number of male patients	16
Number of female patients	9
Mean age of patients	32 year

Table - II

Age distribution of patients

Age group (years)	Number of patients	Percentage
20-30	5	20%
31-40	7	28%
41-50	6	24%
51-60	0	0%
61-70	2	8%
71-80	0	0%
81-90	0	0%

Table II: Shows that the age range of patients was 20-90 years (mean 38 years). Majority of the patients belongs to age group 21-.40

Sex distribution of the study patients (n=25)

Among the 25 patients, out of which 16 (64%) were male and 9 (36%) were female. The sex incidence of the patients is shown in pie diagram.

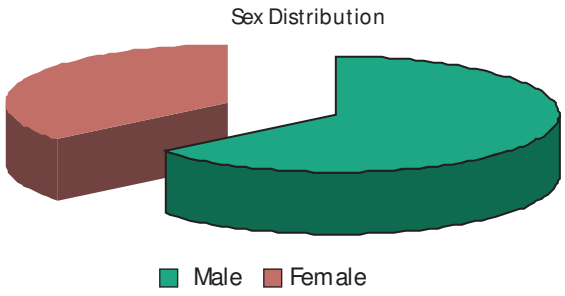

Fig.-1: *Pie diagram showing the sex distribution of the study patients (n=25).*

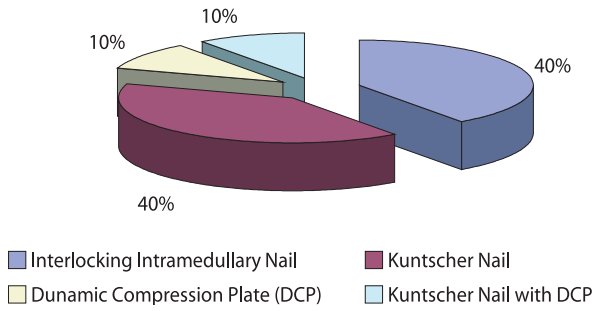

Fig.-2 : *Pie diagram showing the type of implant used*

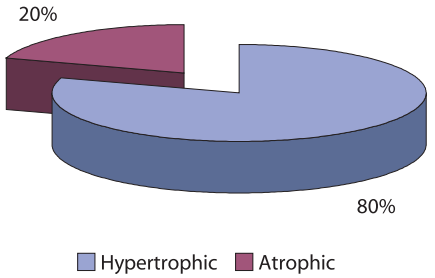

Fig.-3: *Pie diagram showing the types of non-union.*

All the 25 patients were followed – up for 3 to 20 months average 9 months.

Evaluation of results:

According to the Thoresen classification system which includes - malalignment of femur, shortening of femur, knee motion and pain/swelling. An excellent result meant that the patient had full, pain-free function of the extremity. In an excellent result the malalignment and shortening was minimum, the motion of the knee was normal, and there was no pain or swelling. In a good result shortening was 1-2 cm, 5-10 degree malalignment and had moderate pain without objective findings. A fair result meant 2-3 cm shortening, 10-15 degree malalignment, 90-120 degree knee movement, and patient had pain that limited his recreational activities. In poor result shortening more than 3 cm, malalignment more than 15 degree, knee movement less than 90 degree and patient had severe pain.

An excellent result was if the patient was active, able to accomplish his/her daily activities and the other three criteria were absent. A good result was if the patient was active but one or two of the other criteria were present. A fair result was if the patient was active with two or three of the other criteria present. A poor result was if the patient inactive, regardless of the presence of other criteria.

The results in 14 (56%) cases were rated as excellent, 7 (28%) good, 3 (12%) fair and 1(4%) poor. Considering the excellent, good, fair and poor results as Satisfactory and unsatisfactory the data can be tabulated as:

Table - III

Result	Number of cases	Percentage
Satisfactory	21	84%
Unsatisfactory	4	16%
Total	25	100

Overall final satisfactory result of fixation by SIGN nail was 84%.So, SIGN interlocking intramedullary nailing is a better method for the treatment of femoral shaft nonunion with implant failure.

RESULTS

Total number of patients was 25. Mean age was 38 years (range 20-84). Male female ratio was 2.33: 1. Right sided involvement was 15 (60%) and left sided involvement was 10 (40%). 20cases sustained high-energy trauma and 5 cases sustained low energy trauma. Initially most of the patients were treated by intramedullary nail. Most of the nonunion were treated 1-2 years after the initial injury .2 patients developed superficial infection ands 2 patient developed deep infection. Out of 25 patients, 23 patients were united, 2 patient developed delayed union.

20% patients had 2-3 cm femoral shortening, 20% patient had deformity, 20% patient had restricted knee movement. 30% patient had mild pain, 20% patient had moderate pain and 10% patient had severe pain.

In the final follow-up the results were evaluated by classification system described by Theresen *et al* (1985), 14 (56%) patients were rated as excellent, 7(28%) good, 3 (12%) fair and 1(4%) poor. At the end Satisfactory result was 84%.

Table - IV

Results of the Present Series (n=25)

Grading	Number of Patients	Percentage
Excellent	14	56
Good	7	28
Fair	3	12
Poor	1	4
Satisfactory Result (Excellent plus Good)	21	84
Unsatisfactory Result (Fair plus Poor)	4	16

DISCUSSION

A nonunion is traditionally classified into either a hypertrophic or atrophic type for the convenience of treatment. The former is usually due to loss of fracture stability and the latter, loss of osteogenic power. The principle of treatment should depend on the type of nonunion to provide either stability or osteogenic power. During the past several years, methods for nonunion treatment have continuously developed.[21-27] Various nonoperative or operative techniques are available. However, maintenance of sufficient stability with supplementation of cancellous bone grafts has been the most convincing and has achieved the highest success rate. According to reports in the literature, exchange nailing that provides internal bone grafts have been reported to be superior to open bone grafting.[28-30] The reported success rate of exchange nailing to treat femoral shaft delayed unions or nonunions is 53~100%.[12,19,20,28] The advantages of exchange nailing have been advocated. Due to the small incision wound for nail inlet and no exploration of the nonunion site, operating time can be shortened and decrease the complication rate. However, the maximal size of bone defects suited for this technique has not yet been clarified. Clinically, it seems to be impossible to use patients for testing. Factors favoring fracture healing are minimal gap, adequate stability, and sufficient nutrient supply.[21] The size of bone defects can affect the union rate. Therefore, if there is any doubt, open bone grafting should be performed.

The mechanism of initial injury included 80% due to high – energy trauma. Among 80% patients, 50% sustained injury from motor vehicle accident, 20% from motorcycle accidents and 10% due to autopedestrain accidents.

Only 10% of femoral shaft fracture occurs due to low energy trauma as a result of fall on the ground. Bredjikhan *et al* (1999) reported in his study 65% were due to high-energy trauma. In this study 15 (60%) nonunion involved the right femur and 10 (40%) involved the left femur . Involvement of proximal third of the femur 20% (n = 5) , middle third 50% (n = 13) and distal third 30% (n = 7).

Initial treatment of the femoral fracture included , Interlocking Intramedullary nail 40% (n =10) , Kuntscher nail 40% (n = 10) , DCP 16% (n =4) and Kuntscher nail augmented by DCP 4% (n = 1).

In this study the average follow up of the patient was 16 months (range 14-22 months). In Arefin (2002) it was 11 months (range 7-19 months) and Barbarossa and branka (2001) it was 24-126 months and in Dandrions *et al.* (1995) it was 26-55 months.

Short duration of the study period was the limitation of shorter follow-up. In this study no bone graft was done in 9 cases out of 10 patients, only one patients needed iliac crest bone graft due to more comminution at the fracture site. But reaming materials were used in all the cases as internal bone greft.

In final follow-up, the satisfactory result (excellent and good) of this series was 84%. In conclusion, the treatment of femoral shaft non-union with implant failure by SIGN interlocking nail is useful.

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Original Article

Knee assessment score after anterior cruciate ligament reconstruction reflects the activity level for active personals

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ABSTRACT:

Knee injury is a common problem; among them Anterior Cruciate Ligament injury is commonest sports injury which frequently requires reconstruction especially for the young and active patient. Post operative assessment is mandatory for the demanding patients. There are different types of assessment scoring system, of which Lysholm & Gillquest Knee Scoring System (LGKSS) is mostly following. Here we used Lysholm & Gillquest Knee Scoring System. In our study we include only 10 patients because we got total documentations for those patients only; we got normal function (95-100) in one case, near normal (84-94) in 9 cases and none of those fall in abnormal (< 84) category. We observed that the person achieved knee score above 84 can do every ADL smoothly and in some extent also can take part in sporting activity.

INTRODUCTION:

Anterior cruciate ligament injury is a common knee injury in young & sportsperson. Arthroscopy assisted ACL reconstruction with various grafts is the most popular knee surgery & also technically demanding. Following surgical anterior cruciate ligament reconstruction, deficits of proprioception and strength have been widely reported[1-6]. The major goals of ACL surgery and rehabilitation are to restore normal joint anatomy, to provide static and dynamic knee stability and return to the pre-injury level of activity (young sportsmen) as soon as possible. It is very important that the patient should involve actively in the rehabilitation, both before and after the operation.

ACL surgery and rehabilitation have undergone dramatic changes over the past decade due to extensive clinical experience, improved surgical techniques and better understanding of rehabilitation.

Post operative rehabilitation unlike in other procedures is very exhausting for six months to one year with need of patient compliance.

Post operative (6 months to 1 year later) assessment is mandatory to declare when return to demanding functional activities or a sport is safe or not. There are different types of knee scoring system, among them Lysholm & Gillquest Knee Score is widely used; score more than 84 reveals smooth daily activity.

Many Rehabilitation protocols are followed, among them few are as follows[7]:

- Campbell Clinic Protocol
- Shelbourne & Nitz Protocol(Accelerated)
- Kerlan-Jobe Clinic Protocol
- Paulos and Stern Protocol
- Others

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PROTOCOL AFTER ACL RECONSTRUCTION:[7]

Traditional Restrictive (graft protection) Protocol (6M-12M)

Accelerated Rehabilitation Protocol (6M-12M)

Goal:

1. Return to pre-injury level, which requires restoration of:
   - Normal Range of motion
   - Normal Muscle Strength
   - Stable Knee
2. In Athletes: further requirements are:
   - Agility
   - Skill
   - Speed

ACL reconstruction protocol has been changed significantly in the past from traditional or earlier restrictive (graft protective) protocol to recent more aggressive or accelerated protocol.

Traditional Restrictive (graft protection) Protocol:

Exercise protocols commonly combine uniplanar, non-weight bearing, open kinetic chain exercises and more functional, multiplanar, closed kinetic chain exercises.[8-10]

- Knee splinting in slight flexion
- Non weight bearing crutch walking (6 Months)
- Delayed agility training (7 to 8 Months)

Poor result and non compliance:

- Adhesions/ joint stiffness
- Flexion contracture
- PF pain/ Crepitus
- Profound Quadriceps weakness and atrophy (about 40% atrophy)
- Inability to return to pre-injury level even by 1 yr

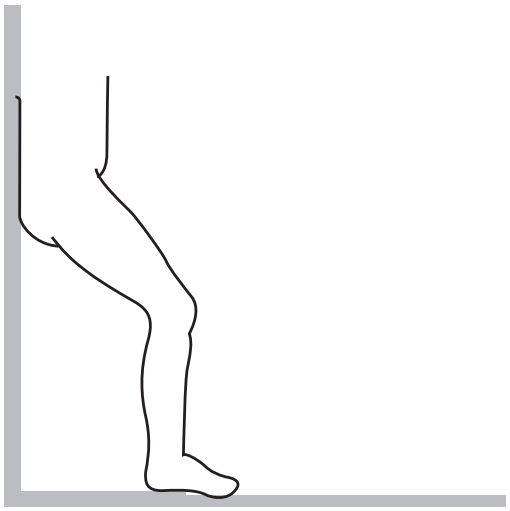
Accelerated Rehabilitation Protocol:

This protocol provides better result.

- Knee splinted in full extension
- CPM & Weight bearing in day 1 (i.e. early ROM & WB)
- Early CKC exercises (Mini squat,/ cycling)& only selective OKC exercises (Isometric Quad Exercise / SLR Exercise)
- Return to light sports activities by 2 months
- Return to full sports activities by 4m – 6 month late

CKC Exercise:

- Motion at knee accompanied by motion at hip and ankle
- Foot in contact with pedal, platform, or ground surface.
- Involves simultaneous contraction and contraction (concentric and eccentric) of quadriceps and hamstrings
- Increase joint compressive forces (physiological)
- Decrease or no shearing forces or strain on ACL
- Hence incorporated early in rehabilitation program.



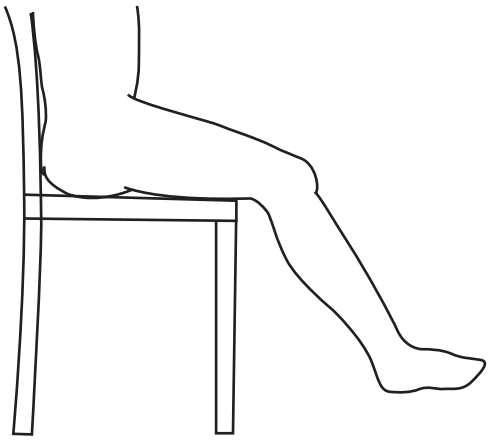
CKC Exercise

- **As for example:**
  - Mini squat
  - Cycling
  - Leg press
  - Step up/ down

OKC EXERCISE:

- Motion at knee is independent of motion at hip and ankle
- Foot is free to move, e.g. Leg in extension, Leg curls
- Excessive strain on ACL graft & elongation.
- Hence, avoided during early rehabilitation
- It increase joint mobility
- Early reeducation of proprioceptive receptors
- Stimulates functional and sports related activities
- Increase muscle strength.

As for example: Isometric quadriceps Exercise, SLR exercise, hamstrings curls



OKC Exercise

MATERIAL AND METHODS:

This is a perspective study, includes those patient underwent ACL reconstruction in Different hospital of Dhaka and Kathmandu during the period of 2006 to 2009 and having full documentations.

Number of patient is ten; follow up period was 9 months to 16 months (Mean 11.7 months). Here we assessed the patients by functional hoop test (Agility test), ROM (Range of Motion) and JPS (Joint Position Sense) components and we followed Lysholm & Gillquest Knee Score.

Functional outcome assessments:[11]

There are batteries of assessments to determine when an athlete after ACL reconstruction can safely return to functional activity or sports, which vary slightly according to different rehabilitation protocol, but in general they are:

(1) Timing

(2) Range of motion

(3) Muscle strength (Dynamic Stability)

(4) Stability (Static)

(6) Proprioception

(7) Agility test (Functional test)

(8) Scoring system (Questionnaires)

The aforementioned tests are being performed for evaluation of function following ACL reconstruction.

Serial No.	Post op Time (in months)	Age Yrs (M)	ROM In degree	JPS Normal	JPS Operated	Lysholm score Scale (%)	Single Hop for distance (%)	Triple Hop (%)	Timed Hop for distance (%)	Cross over hop test%	Quadriceps strength	Hamstring strength
1	12	28	135	1	1.6	88	81	93.26	89.5	93.2	93.5	90.32
2	16	24	135	1	0.4	96	84.35	96.64	95.32	94.40	100	92
3	9	30	130	0.4	0.4	87	96	94.40	98.4	96.64	95.20	101.42
4	11	23	135	0.8	0.6	85	94	94.68	98.2	96.29	96.23	94.60
5	10	26	135	1	0.2	89	96	93.26	96.1	94.68	98.1	95.20
6	9	22	134	0.7	0.8	90	92	96.29	98.5	93.26	94.1	93.5
7	10	32	133	0.6	0.1	86	85	90.30	89.4	97.10	98.4	96.8
8	15	21	135	0.8	0.2	88	87	85.25	92.1	90.30	94.5	94.5
9	13	36	128	0.7	0.3	84	82	96.72	94.2	96.72	97.2	100
10	12	27	130	1	1.6	88	80	97.10	90.6	85.25	96.0	92.5
Average	11.7	26.9	133	0.8	0.62	88.1	87.73	93.3	94.2	93.2	96.32	95.08

Total No. : 10	**Anterior Drawer Test**	**Lachman Test**	**ivot shift test**	
Right :-6	Negative:- 3(stable)	Negative:- 2(stable)	Normal:- 3	
Light :-4	+ :- 5 Partially	+ :- 6	partially	Glide :- 7
	++ :- 2 stable	++ :- 2 stable	Clunk :- Nil	
	+++:- Nil	+++ :- Nil		

(1) Timing:

- Usually 6 month – 12 months(Surgeons preference)
  In our study average timing: 11.7 months

(2) Range of Motion (ROM):

- Should be full ($0 – 130^0$ to140^0)
  Our result: 133^0

(3) Swelling (Joint effusion):

- There should be no swelling or joint effusion when the athlete is ready to go back to sports
- Persistent joint effusion produces significant Quad atrophy (neuromuscular inhibition)
  - Isometric Quadriceps setting Ex, ankle pumps, limb elevation , compression bandage help to control or reduce the edema & joint effusion

(4) Muscle strength Tests (Dynamic stability):

- Any standard series measures the isokinetic strength of Quadriceps and hamstrings by the use of special device such as Cybex isokinetic dynamometer or Kim Con dynamometer.
- Most protocol recommend 80 – 90% isokinetic strength of these muscles as compared to uninvolved side as the prerequisite for safe return to sports

IN OUR SET-UP: We have measured the strength of Quadriceps & Hamstrings of both limbs with the use of simple STRAIN GAUGE weighing machine with the patient seated on chair at 900 knee flexion

- Three readings of each muscle strength are taken
- Average is calculated
- Average muscle strength found of involved limb was

Quadriceps —96.32-% of normal side
Hamstring ——95.08-% of normal side

(5) Stability Test (Static):

- Standard series measures the anterior stability of the involved knee joint accurately with a sophisticated device like KT-1000 Arthrometer and grade the laxity.
- We totally rely on clinical tests alone, namely
  - Anterior Drawer Test (ADT) at 900 flexion
  - Lachman Test (LT) at 20-300 flexion
  - Pivot Shift Test (Extension to flexion method)

LT
Normal (No instability) = 2
\+ = 6
++ = 2
+++ = Nil

ADT
Normal (No instability) = 3
\+ = 5
++ = 2
+++ = Nil

Pivot Shift Test:
Negative (Normal) = 3
Glide (nearly normal) = 7
Clunk (abnormal) = Nil

(6) Proprioception or Joint Position Sense (JPS):

- Normal ACL is rich in mechanoreceptors for JPS
- Disrupted ACL is devoid of these receptors impairing JPS
- It is unclear : Whether Reconstructed Acl Can Restore Or Improve Lost Proprioception Or Jps
- Ochi et al (1999) suggested " sensory innervations occurred in reconstructed ACL"
- JPS improves at least 9 months or later after ACL reconstruction
- Prolonged immobilization after ACL reconstruction
  - Impair proprioceptive functions of other intact structures like capsules, ligaments, tendons, and muscles thereby increasing the chance of re-injury
- Accelerated Rehabilitation :
  - Improves JPS by re-educating proprioceptive receptors
  - Early: by ROM , WB and CKC Ex
  - Later: by Agility training
- General Recommendation:
  Proprioception of Reconstructed knee should be almost normal for safe return to sports activities

In our study:

- No of patients: 10 (only documented cases are taken in study)
- Post op period: 9 -16months
- Functional Weight bearing (Flexion) Protocol at 0^0 to 30^0
- Both reconstructed & normal knees compared
- Goniometer taped (fixed) on lateral aspect of the knee with the hinge at the level of lateral femoral epicondyle
- Targeted angle(TA) between $0^0 – 30^0$ flexion attained activity, held for about 5 seconds – knee straightened for about 7 seconds – instructed to reproduce the angle (RA)

- Five repetitions done at different random angles(to avoid learning effect)
- Difference in TA & RA is calculated , averaged, and compared with the normal knee
- Result: No loss of JPS of any patient as compared to the Normal

(7). Functional Hop Tests (AGILITY TESTS):

These tests provide quantitative functional status of the knee

Four most commonly used tests are:-

- One- legged single Hop for distance
- One- legged timed Hop
- One- legged triple Hop for distance
- One- legged cross- over Hop for distance

METHODS & CALCULATION:

Each test is performed three times for each extremity and then averaged.

(i) Single Hop [12, 13]: Person stands on one limb, hops as far as possible, and lands on the same limb. The distance obtained for each extremity is measured and used for comparison.

In other words it is simply one hop for a maximum distance

Limb symmetry = Involved x 100 Non-involved

Result: 87.73%

(ii) Timed Hop [11, 12]: Person stands on one limb and then hops a distance of six meter. The time is measured for each extremity and used to determine the symmetry index.

That is the time required to hop a distance of six meter

$$\text{Limb symmetry} = \frac{\text{Non- involved}}{\text{Involved}} \times 100$$

Result: 94.2%

(iii) Tripple Hop 13: Person stands on one limb and performs three consecutive hops, landing on the same foot. The distance is measured for each extremity and used to determine the symmetry index.

It is the three consecutive hops for a maximum distance on the same extremity

$$\text{Limb symmetry} = \frac{\text{Involved}}{\text{Non involved}} \times 100$$

Result: 93.3%

(iv) Cross- over Hop [13]: Person hops three times on one limb over a 15 cm wide center strip. The distance for each extremity is measured and used for comparison.

Is three consecutive hops for a maximum distance but crossing the midline

$$\text{Limb symmetry} = \frac{\text{Involved}}{\text{Non – involved}} \times 100$$

Result: 93.2%

Interpretation:

Operated leg is compared with the non-operated leg and difference of 15% in each one is considered an abnormal result.

(8). Knee Scoring: (Subjective evaluation) : [14, 15]

Draper and Ladd [16] used the **Lysholm and Gillquist Knee Score** scale to assess knee function and activity levels of patients with ACL reconstructed knees.

- It is a subjective scoring system evaluating
  - Limp 5
  - Supports 5
  - Symptoms of locking 5
  - Instability 25
  - Pain 25
  - Swelling 10
  - Stair climbing 10
  - Squatting 5

Lysholm and Gillquist Knee Scoring System:

Limp

None 5
Slight 3
Severe/constant 0

Support

None 5
Stick/crutch 3
Weight bearing impossible 0

Locking

None 15
Catching but no locking 10
Occasional locking 6
Frequent locking 2
Locked on exam 0

Instability

Never 25
Rarely/severe exertion 20
Frequent with athletics 15
Occasionally with ADLs 10
Often with ADLs 5
Every step 0

Pain

None 25
Slight 20
Marked with exertion 15
Marked walking > 2 km 10
Marked walking < 2 km 5
Constant 0

Swelling

None 10
Severe exertion 6
Ordinary exertion 2
Constant 0

Stair Climbing

No problems 10
Slight impair 6
One step at a time 2
Impossible 0

Squatting

No problem 5
Slight impair 4
Not beyond 90^0
Impossible 0

Total Score————————

Score Evaluation System: [14, 15]

Evaluation Score = 0-100

95-100 = Normal function
84-94 = Symptoms only with vigorous activity, &
< 84 = Symptoms with activity of daily livings (ADLs)

Our results:

We used this system for its simplicity & easy interpretation
Normal function (95-100) = 1
Near normal (84-94) = 9
Abnormal (< 84) = Nil

CONCLUSION:

Accelerated post operative rehabilitation protocol after ACL reconstruction with early involvement of passive mobilization , weight bearing , closed kinetic chain exercises with selected open kinetic chain exercises and later involvement of various agility & sports specific exercises have proved the test of time with the best functional outcome [17].

To declare the safety on return to functional activities, the functional outcome of the surgery needs to be assessed with battery of objective- subjective tools like ROM, Isokinetic muscle strength testing, stability testing, Proprioception, hopping for distance and scoring system in conjuncture to each other .

Like othes [18] in our study we found that the person achieved knee score above 84 can do every ADL smoothly and in some extent also can take part in sporting activity.

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Original Article

Result of gap non union of fracture shaft of humerus by Ilizarov ring fixator

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ABSTRACT

Humeral shaft fracture is not uncommon. Union rate in conservative procedure is good. Following fracture nonunion is a common complication but gap union is most troublersome for management. Our aim to achieve the union with restoration the length of humerus and satisfactory function of elbow and shoulder despite some mechanical hazards of the device for keeping at the arm for long time.

This study is prospective study at NITOR and Bari Ilizarov and Orthopaedic center from January,2007 to December,2008 in 19 patient with both sexes male 15 and female 04, age of the patient ranges from 11-40 yrs, all are with gap nonunion(2-7cm) fracture shaft of humerus. There are safe corridors for introduction the pins at upper, middle and lower third. With all surgical aseptic procedure we introduce the pins and fix the devices and perform the corticotomy. Stable fixation of the device is first rule. Distraction Osteosysthesis should perform in time for reducing the gap. This procedure(Distraction procedure) should systemically trained the patient and also maintenance of the device.

Out of 19 patients age incidence from 11-40yrs.Union time ranges from 4-10 months. We assay the function of the limb with Modified scoring system of Constant and Murley.Functional outcome is Excellent in 31.56%, good in 52.63% , satisfactory in 10.52% and poor in 5.26%

With the procedure the acceptable outcome achieve in 16 patients out of 19 patients (84.16%). So this procedure can acieve the union and reduce the gap at nonunion fracture shaft of humerus and trauma surgeon can safely use this procedure.

INTRODUCTION

Fractures of the humeral shaft are commonly encountered by the Orthopaedic surgeons, accounting for approximately 3% of all fractures. Both younger and elder people suffer from these fractures. The mechanism of injury is mainly direct trauma, motor vehicle accident, fall from height and direct blow causing transverse or comminuted fractures. Indirect trauma due to fall on outstretched hand, twisting injuries or even violent muscle contraction results spiral or oblique fracture. The fracture might open or close. Treatment of these injuries continues to evolve as advances are made in both non-operative and operative management.

Most humeral shaft fractures can be managed non operatively with anticipated good to excellent results i.e. within 6-10 weeks in 95% cases. Appropriate non-operative and operative treatment of patients with humeral shaft fractures, [1]however requires an understanding of humeral anatomy, the fracture pattern, and the patient's activity level and expectations.

In nonoperative method Primary bone healing occurs with conservative methods like hanging casts, u-shaped splint, functional brace and thoracobrachial spica casts and plaster velpeau dressing. Operative treatment is usually indicated for non-union, poly trauma patients, bilateral humeral shaft fractures, floating elbow, fractures with neuro-vascular

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complications, segmented fractures. Non-union infection and radial nerve palsies are the complications of operative treatment .The rate of non-union of humeral shaft fractures ranges from 0%-8% with non-operative treatment and from 0%-13% with operative methods of treatment . Conservative methods have been found to give better result than primary plate fixation in closed injuries.

Non-union of humeral shaft fractures occur most commonly in transverse or comminuted middle third fractures, fractures with distraction or soft tissue interposition, open injuries, infection, smoking and poor patient compliance.

The treatment objectives for patients with a humeral shaft non-union are to establish fracture union, limb alignment and established the function of the limb and also eliminate infection. Treatment options include functional bracing, electrical stimulation, bone grafting, dynamic compression plating & bone grafting, anterior plate and vascularised fibular graft, intra medullary nailing, intramedullary interlocking nailing with bone grafts, and external fixation such as Ilizarov technique. Among all modalities, Ilizarov technique is probably the most effective methods for the treatment of established gap non-union through its bone transport mechanism. Irrespective of either device, the basic principles of non-union treatment must be followed to obtain osseous stability, eliminate non union gaps, maintain or restore osseous vascularity and to eradicate infection.

Since 1951, Ilizarov and his colleagues in the Siberian city Kurgan of Russia developed the method of distraction osteogenesis for treating acute traumatic fractures. Over the years the method proved to be so widely applicable and effective that the association for the study and application of the method of Ilizarov (ASAMI) was established in Lecco,Italy, in 1982. Ilizarov method application of an external circular fixator and correction through distraction osteogenesis, which involve bone transport and the formation of new bone by intramembranous ossification. Distinct advantage of the Ilizarov treatment is active use of the affected limb to improve its physiological function, which consequently minimizes the development of disuse osteoporosis and atrophy of soft tissue. Despite all these advantages, the report on the use of Ilizarov technique after nonunion humeral fractures is scarce.

With the ilizarov method many surgeon of the world worked and with the achievement of the union at the fracture site they also described different limitations and also some complications of the procedure and they also describe the procedure to mimic the limitations and problems and complications. Our work is to work at gap nonunion at humerus with ilizarov ring fixator to achieve the union and to find out union time, mechanism of fixation, the limitations and complications in our context. With this work it will help others to work in the future.

Patients and Methods

This is a prospective Observational study at National Institute of Traumatology and Orthopedic Rehabilitation, and Bari Ilizarov and orthopedic center from January 2007 – December 2008, In 20 patients with gap nonunion of humeral shaft, both sexes, any age above 10 yrs. The patients are irrespective of sex, religion, social status or race with symptomatic on random basis, of gap nonunion of humerus. Pathological fractures were excluded.

Evaluation of result of final functional outcome were base on Modified Constant and Murley Score of functional assessment

Operative technique :

Following anesthesia, general or regional block, the affected arm scrubbed and painted and draped. In case of infected nonunion and chronic osteomyelitis, fracture site opened and all necrotic bone and devitalized tissues thoroughly resected. Then fixation of Ilizarov apparatus is performed by the following technique: First, bayonet pointed k-wire are introducing through the safe zones above and below the fracture site which was described before. Two k-wires were used to fix one full ring. After introduction of k-wires, appropriate sized rings are fixing to the k-wire (1.8mm) and 3-4 threaded rods were connected and wires are tension with tensioner. The corticotomy done if necessary, above or below the fracture site for distraction osteogenesis (for humerus gap more than 5 cm). After fixation of the device the wound closure and dressing given over incision and pin insertion sites. By the help of threaded rod the distraction and compression will done at the corticotomy site everyday at a rate of 1mm/day. Procedure of corticotomy is as follow.

Transection of the cortex around a bone without cutting the bone marrow and periosteum is a delicate procedure, and must be preformed extremely carefully and patiently. The best way to describe it is in stages. The length of the skin and soft tissue incision is only 0.5 to 1.0 cm.Location of the incision must be at the site where the bone is situated closed to the skin. This helps control the direction more precisely. The cortex transection must be preformed with a small osteotome, preferably 0.5 cm wide. This guarantees that is edge does not slip too deeply into the periosteum or bone marrow sides. We can perform corticotomy proximally and distally 4-5cm for the articular surface at metaphysis. Minimal distraction must be maintained for several days before further distraction is started. This gap of 2 to 3 mm cannot damage the vascular net. On the contrary, it contributes to the initiation of local tissue rebuilding.It stays filled with a hematoma, necessary for early development of micro blood at lacunae. Appearing as the early as the third to fifth day. This is exactly the time to start distraction, which brings about tension forces on the walls of the newly formed vessels. And from this regeneration begins.

Postoperative management :

The postoperative management of a patient requires frequent contact and close monitoring by surgeon.

Systemic antibiotics are continued till the wound heal. Local wound care by debridement and dressing. Operated limb is elevated over a pillow in bed for 24 hours, and joint movements are staring as early as pain permitted. Pin or wore sites are evaluated for any bleeding or discharge, and if any, that should clean and dressed regularly. The patient is encouraged to move in every functional need by shoulder & elbow.

If needed after a latency period of 5 to 10 days gradual distraction of the fracture site at the rate of 0.25 mm, 6 hourly (1 mm per day), for to lengthening 1cm it takes about 10 days, check X-ray is doing to see the effect of distraction and evidence of callus formation. The gradual compression is during at the same rhythm until the fracture ends were in proper alignment. Simultaneously, any deformity is correcting by frame adjustment.

Discharge and subsequent follow-up

When wounds are healed completely and after achieving good alignment and signs of callus formation (radiologically), usually after 4 to 6 weeks, the patient is discharging from the hospital. Patients are to be teaching how to take care of the pin tract and fixator. Patients are allowed to take bath and encouraging other movement they tolerated

Safe corridor for insertion of transosseous wires at arm / humerus :

Selection of entry and exit points passing Illizarovs or K-wires at arm/ Humerus.

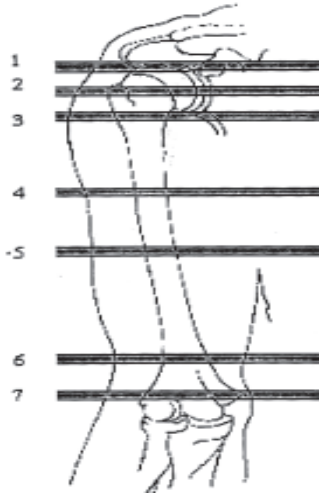

Fig. Level of Pins at arm

1. At the level of acromion process, 2. At the level of greater tubercle, 3. At the level of surgical neck 4. At the level of upper third, 5, At the level of middle Third, 6. At the level of lower third, 7. At the level of supracondylar region

Upper one third:-

Entry and exit points :-

The first wire entries through anterior to posterior from mid point of upper arm circumference. Which passes through biceps. brachialis muscle anteriory just medial to deltopectoral groove and posteriorly it emerge through medial head of triceps & lateral part of long head of triceps.

The second wire passes about 40^0-60^0 away from entry point of first wire just lateral to cephalic vein it pierce the lateral portion of brachialis muscle at anterior compartment and emerge through medial head and long head of triceps posteriorly.

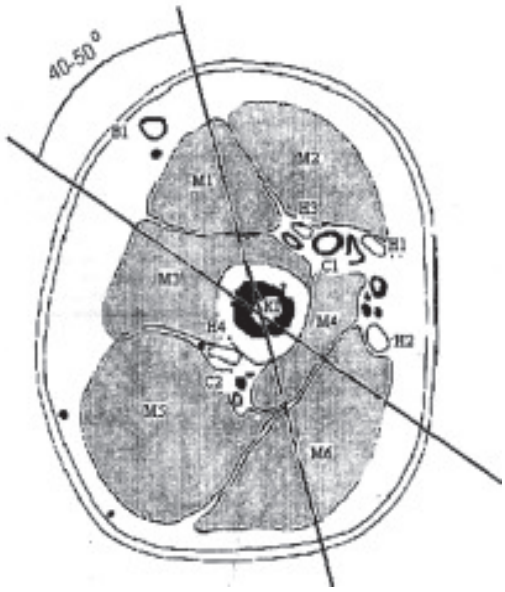

Fig Safe corridor at upper third. (Shevtsov ,2006)

M_1- Biceps	B_1- Cephalic vein
M_2-Coracobrachialis	H_1- Musculocutaneous N
M_3-Brachialis	H_2- Ulnar Nerve
M_4- Medial head of triceps	H_3- Median Nerve
M_5- Lateral head of triceps	H_4- Radial Nerve
M_6- Long head of triceps	C_1- Brachial Artery

Middle third :

Entry and exit points :-

1st pin entering through anterolateral to midline but medial to cephalic vein, piercing biceps, brachialis, posteriorly by piercing triceps it emerges posteriorly.

2nd pin entering through lateral to cephalic vien and pin direction to posteromedially and it pierces anteriorly the biceps brachialis and posteriorly it pierce triceps, emerges medial to 1st pin porteriorly.

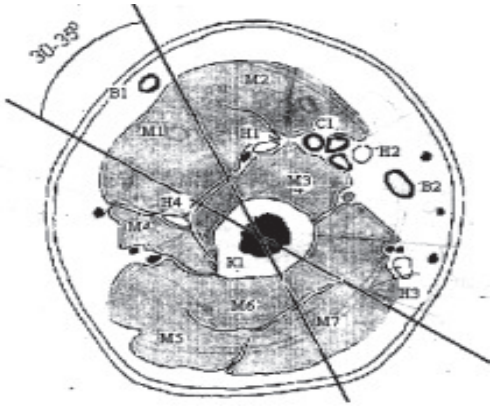

Fig. Safe corridor at middle third. (Shevtsov.,2006)

M_1- Biceps
M_2- Biceps
M_3- Brachialis
M_4- Brachioradialis
M_5- Triceps
M_6- Triceps
M_7- Triceps - Triceps
H_1- Median Nerve
H_2- Ulnar Nerve
H_3- Radial Nerve
B_1- Cephalic Vein
B_2- Basillary Vein

Lower third :

Entry and exit points :-

the first pin entered lateral to cephalic vein anterolateral aspent of lower arm. piercing the brahialis muscle only and emerges through middle of triceps muscle.

The 2nd pin entered 10^0-20^0 lateral (apart) from first pin by piercing same structures as first pin.If we want to fix omega ring or 5/8th ring to elbow then supracondylar points should be known. (Shevtsov,2006)

Fig. . Safe corridor at lower third. (Shevtsov, 2006)

M_1- Biceps
M_2- Brachialis
M_3- Brachioradialis
M_4- Triceps
M_5- Triceps
M_6- Triceps
B_1- Cephalic Vein
B_2- Basillary Vein
H_2- Median Nerve
H_3- Ulnar Nerve
H_4- Radial Nerve
C_1- Brachial artery

Suracondylar/condylar pins:-

Entry and exit points :-

1st pin from lateral epicondyle, at the tip, its dirrection anteromedial aspect of medial epicondyle, we should be very careful that not passes posteriorly & if it does then we will injured the ulnar nerve.

2nd pin also from lateral epicondyle, but its dirrection slight posteriorly behind medial epicondyle, during introducing the pin we should feel the ulnar nerve behind the medial condyle that exiting the not injured the nerve. (Shevtsov,2006)

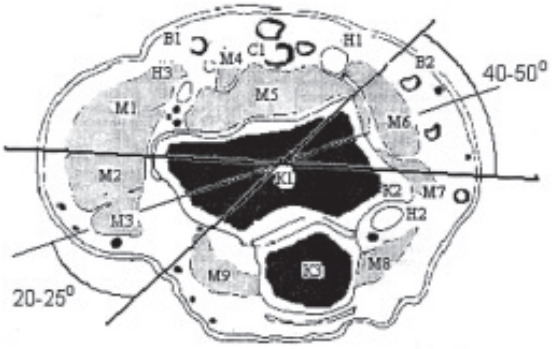

Fig.. Safe corridor at supra condylar region. (Shevtsov,2006)

RESULTS

This prospective study of twenty cases of gap nonunion of Humeral shaft were done with Ilizarov external fixator at NITOR and Bari Ilizarov center, Dhaka.At first 20 cases of nonunion were included in this study, but due to various reasons of one patient was not available for final follow up after removal of fixator. So analysis of result was done with the results of rest of 19 patients. Period of this clinical study was between January 2007 to December 2008.

Out of 19 patients lowest age incidence was 10 years, highest was 40 years average age 27. Highest numbers of patients were in 26-35 years age groups.

Table-I

Showing overall age of victims (n=19)

Years	Frequency	Percentage (%)	Mean	Standard deviation
11-15	1	05.27%	27	8.5
16-20	1	05.26%		
21-25	3	15.78%		
26-30	5	26.31%		
31-35	5	26.31%		
36-40	4	21.05%		

Out of 19 patients 15 were male and 4 female. Sex Distribution of patients:

People of both sexes male and female were victim of nonunion of Humeral shaft.

Table II

Showing sex distribution of victims(n=19)

Sex	Frequency	Percentage (%)
Male	15	78.94%
Female	4	21.05%

People of different occupation were found to be injured in this study. Out of 19 patients 4 farmer, 2 Government service holder, 7 students, 3 businessman, I rickshaw puller, 1 teacher and 1 taxi driver. People from various professions were victims of nonunion of Humeral shaft.

Table III

Showing overall occupations of the victims(n=19)

Occupations	Frequency	Percentage (%)
Farmer	4	21.05%
Govt. Service	2	10.52%
Student	7	36.84%
Businessman	3	15.78%
Rickshaw Puller	1	5.26%
Teacher	1	5.26%
Taxi driver	1	5.26%

In this study road traffic accident was the major cause of the injury. Out of 19 patients 15 injured by road traffic accident, 04 injured by fall from height.

Table IV

Showing overall mode of the injury of the victims(n=19)

Mode of Injury	Frequency	Percentage (%)
RoadTraffic Accident	15	78,9%
Fall from height	4	21.1%

In this study left Humeral facture was more than right side. Out of 19 patients 10 left sided Humeral nonunion and 09 right sided Humeral nonunion.

Table-V

Showing overall side of the injury of the victims(n=19)

Side	Frequency	Percentage
Right	9	47.34%
Left	10	52.6%

Out of 19 patients the minimum hospital stay was 4 weeks and maximum 7 weeks and average 4.89 weeks.

Table VI

Showing overall Hospital stay of the patients.

Hospital stay	Weeks	Mean	Standard deviation
Minimum	4	4.89	1.0
Maximum	7		
Average	4.89		

Out of my 19 patients 2 of them had proximal third Humeral injury, 7 had middle third Humeral injury and 10 of them had distal third Humeral.

Table VII

Showing overall level of fracture of the victims(n=19)

Level of fracture	Frequency	Percentage (%)
Proximal 1/3	2	10.52%
Middle 1/3	7	36.82%
Distal 1/3	10	52.6%

The minimum time for union was 4 months and maximum was 10 months and average 6.42 months.

Table VIII

Showing overall time for Union (months).

Time for Union	Months	Mean	Standard deviation
Minimum	4	6.42	1.6
Maximum	10		
Average	6.42		

Amount of gap between fracture ends in this group was minimum 2 Cm and maximum 7 cm and average 4 Cm.

Table IX

Showing amount of gap between fracture ends.

Amount of gap	Cm	Mean	Standard deviation
Minimum	2	3.6	1.3
Maximum	7		
Average	3.6		

Table-X

Functional outcome by using Modified scoring system of Constant and Murley.

No of pt	Pre operative score(x_2)	Post operative score (x_1)	
1	15	69	Good
2	16	86	Excellent
3	02	59	Fair
4	10	70	Good
5	08	72	Good
6	00	38	Poor
7	14	82	Excellent
8	08	75	Good
9	16	85	Excellent
10	12	83	Excellent
11	10	75	Good
12	08	75	Good
13	22	90	Excellent
14	14	70	Good
15	06	65	Fair
16	08	70	Good
17	14	85	Excellent
18	08	70	Good
19	06	70	Good

Table XI
Showing Result of treatment.

Result	No. of patients	Percentage (%)
Excellent	6	31.56%
Good	10	52.63%
Fair	2	10.52%
Poor	1	5.26%

Discussion

Most of orthopedic and trauma Surgeons will agree that, acceptable treatment goals for gap nonunion humeral shaft include maintaining normal length, alignment and rotation of the extremity, minimizing additional damage to the soft tissues and bone and preserving the remaining circulation and providing a mechanical environment that stimulates periosteal and endosteal responses favorable to bone healing. A simple plan allows functional use of the extremity while been healing. But as there is much difference and variations in individual cases of nonunion of humerus, it is very difficult to manage all the cases by a single treatment method. So, no single treatment regimen, open or closed, operative or non operative, is suitable for the treatment of all the humeral gapnonunion cases. The goal of study was to examine the application of the Ilizarov method and duration of treatment for osteosynthesis and also functional outcome gap humeral nonunion.

Comparing the various methods of stabilization it was noted that cast treatment respect the vascularity of the fracture fragments but does not achieve greatest stability and early functional advice can not be permitted.Some time conservative method also open operative techniques.Open techniques have some complications like soft tissue injury,vascular injury, nerve injury, infection followed by non union.The most ambarrasement to orthopedic surgeon is to manage gap non union in humerus. Many prefers for open technique with revision and stabilizing with plates and bone grafting.This leads to shortening and also fuctional failure of the limb.

In 1971,Ilizarov and his colleagues developed the method of distraction osteosynthesis for treating fracture gap in the Siberian city Kurgan of Russia. This new era of treatment ensure the orthopedic surgeon for treating the gap non union.

Over the years the method proved to be so widely applicable and effective that the association for the study and application of the method of Ilizarov (ASAMI) was established in Lecco, Italy, in 1982. The method, application of an external circular fixator and correction through distraction osteogenesis, which involve bone transport and the formation of new bone by intramembranous ossification. The advantage of the Ilizarov treatment is active use of the affected limb to improve its physiological function, which consequently minimizes the development of disuse osteoporosis and atrophy of soft tissue.

The total procedure include the arrangement of circular rings and associated accessories according to site of involvement, the fitness of the patient for the operation firstly evaluated. The safer zone should selected for pin insertion and for corticotomy,both upper and lower end selected according to gap and proper osteotome should selected.The stable fixation of the total device is very important.For fixation the total use of all accessories must known. In the first post operative day, the movement of proximal and distal joint movement should started as early as possible. The total procedure of compression and distraction procedure and care of pins should learnt by doctor to patient is very essential. When patient is become self trained then patient will discharge. The patient should also advised for regular follow up with regular intervals with radiological evidence.In our study the total number of patient are 19, out of the 15 are men and 04 are women. Age of my patient more than 10 yrs. highest number between 26-35 yrs.10 patients with involvement at left side and 09 patients at right side.Proximal humerus involve in 2 case , middle shaft involve in 7, distal humerus involve in 10 cases.The gap at non union ranges from 2-7cm. The

post operative complication includes pin site infection in 12 patient, which was treated with appropriate care.In 3 patient complained of limited range of motion at elbow, which was treated with physiotherapy. So complications are so minimum to handle. The overall result include excellent result in 6 (31.56%), good in 10(52.63%),Fair in 2(10.52%) and poor in 1 (5.26%) patients.

Finally our aim is to reduce the gap and also to achieve the union with good functional outcome.

CONCLUSION:

The results of the study out of 19 gapnonunion fracture shaft of humerus acceptable bone healing and acceptable functional outcome was found in 16 patients (84.16%) with Ilizarov method. Based on the results shown above it is concluded that Ilizarov external fixator is an effective modality of treatment for the gap nonunion of humeral shaft fracture which gives rigid fixation, painless early post operative motion with the limb and subsequent union with excellent functional outcome. So trauma surgeon can safely use this method.

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Original Article

Comparative study between tricortical and quadricortical syndesmotic screw fixation in ankle injury with diastasis

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ABSTRACT:

Ankle syndesmosis injuries frequently occur with ankle fractures but their treatment remain controversial although specific clinical & radiographic diagnostic measures are generally well accepted. Regardless of fixation technique chosen the most important goal should be anatomical reduction and restoration of the syndesmosis and ankle mortis as this is the only significant predictor of functional outcome.The purpose of this study was to asses short term functional results in two types of syndesmotic fixation comparing the rigid quadricortical syndesmotic screw fixation with a more dynamic tricortical screw fixation.

It was a prospective clinical study conducted in NITOR from 1st January 2008 to 31st December 2009. A total 25 patients were available till the last stage of follow up, 13 were randomly selected & fixed by tricortical Syndesmotic screws (Group-1) and 12 were fixed by Quadricortical Syndesmotic screws (Group-2). No statistical difference was observed in the groups except pain at 3 months follow up. Tricortical screw fixation is safe and improves early function and can be performed in any kind of ankle injuries with diastasis.

INTRODUCTION:

Ankle injuries may involve the distal tibiofibular Syndesmosis and can be associated with a variable degree of trauma to the soft tissue and/or osseous structures that play an important role in ankle joint stability. Syndesmotic injuries may occur solely as a soft tissue injury or in association with ankle fracture. Even though the injury is common, however, diagnosis of syndesmotic injury may not be straightforward, and optimal management remains controversial.[37] Syndesmosis injuries arise in approximately 10% of all patients with ankle fractures or approximately 20% of patients requiring internal fixation. The annual incidence of Syndesmosis injury is approximately 15 per 100,000 in the general population.[33] Fractures at the ankle being articular and in a weight-bearing extremity requires accurate reduction if residual pain and disability are to be avoided and the incidence of arthritis is to be reduced. Classical Diastasis has previously been considered of great importance and consequently diagnosis of the displacement by both clinical and radiographic methods has been emphasized because it was felt that special measures were frequently required for its correction.[8] The stability of the ankle joint is provided by the medial and lateral malleoli and ligaments. Injury to the medial structures of the ankle resulting in lateral subluxation of talus .[32] Although closed method of reduction and immobilization has been tried for years, yet the current opinion increasingly favors primary operative intervention for displaced or unstable malleolar fractures of the ankle.[15]There are three reasons why unstable features should be treated by internal fixation.

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(1) They are difficult to reduce

(2) They are hard to hold reduced while unit and

(3) If treated by conservative method, the mobilization of joints and the treatment of soft tissue is not easy.[13]

The Syndesmotic joint between distal tibia fibula is held together by thick connective ligaments. Determining the integrity of the Syndesmosis is an important surgical consideration because Syndosmotic injuries usually require screw fixation.[31]

Exact method of Syndosmotic fixation remains a matter of debate. Screws, K wires, staples, non absorbable sutures, button sutures and biodegradable implants all have been used with their properties. Technique of screw placement, tricortical or quadricortical fixation and whether or not the screws should be removed remain controversial subjects (Sajid, 2008).

A majority of surgeons (97.4%) prefer the use of only a Syndosmotic screw for Syndesmotic stabilization and most of them prefer to engage three cortices(58.7%) and greater number of them use small fragments 3.5 mm(50.3%) than large fragments(32.3%) screws.[22]

Considering above mentioned facts, this study is designed to compare the effectiveness between tricortical and quadricortical Syndosmotic screw fixation in ankle injury with Diastesis.

MATERIALS AND METHOD:

During the period of January 2008 to December 2009 a randomized comparative study was carried at National institute of Traumatology and Orthopaedic rehabilitation (NITOR), Dhaka to evaluate the management of Ankle Injury with Diastasis by two methods; Tricortical and Quadricortical Syndesmotic Screw Fixation. A total of thirty patients with Diastasis associated with ankle fractures were enrolled by two groups in this study. Five patients were lost during follow up and dropped from the study. The remaining 25 patients were available till the last stage of follow up. 13 were randomly selected & fixed by tricortical Syndesmotic screws (Group-1) and 12 were fixed by Quadricortical Syndesmotic screws (Group-2). The mean age for tricortical group was 34.85 ± 16.56 and quadricortical group was 32.83 ± 12.13. Males were more frequently affected than female. Maximum number of the patients had left side affected in both groups. Road traffic accident was the main cause of injury in both groups.

Operative technique:

Ankle injury with disruption of Syndesmosis or Diastasis was stabilized by one tricortical Syndesmotic screw for group-1 and one quadricortical Syndesmotic screw for group-2. Ankle injuries associated with fractures around ankle were treated accordingly, like for distal fibula $^1/_3$ tubular plate or small DCP and for medial malleolus either Malleolar screw or TBW. We use 4.5 mm Syndesmotic screw (Full threaded cortical screw) for both tri and quardicortical Syndesmosis fixation. The operative diagnosis was confirmed by radiology and associated fractures were detected. If the fracture fibula is part of Syndesmotic disruption of inf. tibiofibular joint, we usually reduce and internally fix the lateral malleolus or fibular fracture before fixing the Syndesmotic screw. Exposed the lateral malleolus and the distal shaft of fibula through an anterolateral longitudinal incision. Protect the Sural & superficial peroneal nerves. Alternatively a posterolateral incision can be used. After proper fixation of fibular fracture either by DCP or $^1/_3$ tubular plate, we inserted Syndesmotic screw through the fibula in to the tibia 2 to 3 cm above and parallel to the ankle joint. This position is selected as to avoid placing the screw across the Syndesmosis. Since the screw is aimed anteriorly at an angle of 20-30°, beginning posterolaterally in the fibula and proceeding anteromedially towards the tibia. Syndesmotic screw is nothing but fully threaded cortical screw 3.5 to 4.5 mm size and use for stabilization of ankle Diastasis. The foot is kept in maximal dorsiflexion during the time of the drilling and tapping. The screw is placed to help bring the wider part of the talus in the mortise prior to reduction of the Syndesmosis and thus prevent over reduction. The Syndesmosis is held manually reduced with firm thumb pressure against the fibula in the direction of the anterior tubercle of the fibula during placement of the screw. The Syndesmotic screw is usually placed separately from the plate but depending on the position of the fibular plate, it may be incorporated in its distal part.

In group-1, three cortices to be engaged (One tibial and two fibular). For 4.5 mm Syndesmotic screw is to be drilled 3 cortices by 3.2 mm drill bit and tapped by same diameter of screw. In group-2, four cortices to be engaged (Two tibial and two fibular). After drilling and tapping four cotises of tibia and fibula, 4.5 mm Syndesmotic screw is inserted than tight up to full and finally ¼ reversal turn. Reversal turn maintains Syndesmosis and prevents synostosis. Lastly wound was closed in layers followed by application of short leg back slab.

Postoperative management:

On 1st postoperative day (POD), check X-ray was done. He was then advised to come on 14th POD for follow-up. During this period he was advised to walk with crutches,

non-weight bearing on left foot but to continue toe movement. First visit (After 2nd week)**:-** Findings :Pain: Mild pain present Infection : Absent X-ray findings :Fracture alignment of lateral & medial malleolus – Intact Position of syndesmotic screw – Intact Status of complications :Absent Stitch off done. Back slab kept in place. Advised for toe movement. Second Visit (After 3rd week) **:-** Pain : Mild pain present Infection : Absent X-ray findings : Fracture alignment of lateral & medial malleolus - Intact Position of syndesmotic screw – Intact Back-slab was removed and crepe bandage was applied after 1 month. Then advised to begin non-weight bearing active movement of ankle. Partial weight bearing was allowed for 25% after 8-10 week. He was asked to visit again after 12th & 24th week with a new X-ray.

Table-I

Assessment o functional outcome by using Olerud and Molander ankle scoring system (After 12th and 24th week)

Categories	Score	Categories	Score
Pain	25	Pain	25
Stiffness	10	Stiffness	10
Swelling	10	Swelling	10
Stair-climbing	10	Stair-climbing	10
Running	0	Running	0
Jumping	5	Jumping	5
Squatting	5	Squatting	5
Supports	10	Supports	10
Work, Activities of daily life	15	Work, Activities of daily life	20
Total	90	Total	95

Fig.-1: *Instruments for fixing ankle diastasis*

Fig.-2: *Fixation of Syndesmotic screw*

Fig.-3: *Preoperative x-ray of ankle Injury with diastasis.*

Fig.-4: *Postoperative x-ray of Tricorticle Syndesmotic screw*

Fig.-5: *Patients squatting after 6 months tricorticle Syndesmotic screw fixation.*

Fig.-6: *Patients standing after 6 months tricorticle Syndesmotic screw fixation.*

RESULTS:

Table-II

Comparison of Total Olerud Molander subjective functional score at three months

Follow up schedule	Tricortical Group (n=13) Mean ± SD	Quadricortical Group (n=12) Mean ± SD	t-value	p value
At 3 months	68.08 ± 18.21	61.25 ± 17.73	.95	>0.05
At 6 months	80.00 ± 12.42	74.17 ± 16.63	.99	>0.05

P > 0.05, indicates non significance

The table-III shows the post operative complications of two groups.

Table-III

Frequency distribution of post operative outcome of different groups of the study subjects

Types	Grouping	
	Tricortical	Quadricortical
	No. (%)	No. (%)
Infection	1(7.7)	2(16.7)
Malreduction	0 (0)	1 (8.3)
Deformity	1 (7.7)	0 (0)
No complication	11(84.6)	9(75.0)

DISCUSSION:

Being the weight bearing joint, maximum thrust of the body passes through the ankle joint. Disability following malleolar fractures may result in serious sequel like early secondary osteoarthritis. Slight variation from normal alignment of a joint is incompatible with proper function of the joint. So it is essential to obtain anatomical reduction and stabilization following such injuries.

Ankle fractures form a large part of workload to the orthopaedic trauma surgeon. The maintenance of reduction in these fractures often requires hardware that may be palpable and uncomfortable for the patient (Lunn, 2003). As there is no muscle coverage around the ankle, it is subjected to extreme temperature changes that can cause pain when screw-heads are lying close to subcutaneous tissues (Charnley, 1999).

Syndesmosis injuries are important to detect because they lend stability to ankle joint. While there are many different

technique available to stabilize the syndesmosis injury, the most important consideration in treating syndesmosis injuries associated with ankle fracture is need for anatomical reduction and restoration of the distal tibiofibular relationship and ankle mortise, as this is the only significant prediction of functional outcome. In the fact of an associated fibula fracture, restoring the fibular length is critical to syndesmosis fixation, as malreduction of the syndesmosis most commonly occurs due to inadequate restoration of the fibular length. (Park, 2009)

As the syndesmosis may be regarded as being part of ankle joint, and as early movement of joints after injury traditionally has been advocated as beneficial, it seems reasonable to apply the same philosophy in the case of a rupture of the syndesmosis joint. (Hoiness, 2004)

In the present study mean age of the patient of tricortical group was 34.85 ± 16.56 and quadricortical group was 32.83 ± 12.13 years, which was found consistent with other series (Alamgir, 2002 & Hoiness, 2004)

Sex distribution was mostly among male, which was however, in- comparable with western series (Moore, 2006 & Hoiness, 2004) where ankle fractures occurred mostly in female due to wearing of high heel shoes and their more outside work and sports in those part of the world. While in our country male are mostly go outside and more at the risk of road traffic accident, a common and daily occurrence in Bangladesh.

Highest group of patients were laborer (23.1%) in tricortical group and others (25%) in quadricotical group.

Side distribution of right and left was almost similar like other series. (Alamgir, 2002 & Hossain, 2008)

All the patients in both groups had diastasis with ankle fracture, none of them had diastasis without associated ankle fracture in our study.

Infection was main post operative complication in both groups. One patient had residual deformity in tricortical group and one patient had malreduction in quadricortical group.

Olerud Molendar ankle scoring was performed to evaluate role of tricortical and quadricortical syndesmosis fixation in our study subjects. It was performed at 3 months and 6 months interval of post operative period. No statistical difference was observed regarding any component of the OMA scoring an both the occasions except pain at three months follow up where statistical significant was observed. Our study reviled that mean values of all the components of OMA scoring in both the occasions were higher in tricortical groups. This findings are in the line with the findings of Hoiness, 2004.

Michelson and Waldman found no changes in coupled motion of the ankle when tricortical syndesmosis screws were used. It is therefore reasonable to assume that tricortical fixation of the syndesmosis acts as a more dynamic type fixation, allowing less constrained motion of the ankle joint until healing of the bony and ligamentous injuries, in particular rotational motion.

The main purpose of the study was to investigate in early joint movement and functional outcome after syndesmosis fixation with two different methods. Secondly we investigate weather tricortical and quadricortical fixation of syndesmosis-without need for early screw removal was adequate or not. Hardware was removed for pre defined indications, which includes screw loosening if it was causing reduced range of ankle dorsiflaxtion, and in case of broken screw if it was painful. In our study removal of early syndesmotic screw in both groups was not necessary due to spontaneous loosening or breakage of screw.h

CONCLUSION:

In our country two types of screw fixation are usually performed in these cases. Though we found no significant different except pain at 3 months follow up between tricortical and quadricortical screw fixation but nature of outcome which was explored by OMA scoring in two follow up sessions the trend of good outcome of fixation is in favors of tricortical Syndesmosis fixation which also supports the previously performed study. It is obvious that in statistical point of view our study could not revealed any superiority of tricortical Syndesmotic fixation over quadricortical fixation but if the sample size were higher and follow up study can be extended statistical significant different could be found.

So it could be concluded that No statistical difference was observed in tri and quadricortical Syndesmotic screw fixation except pain in three months follow up. Tricortical Syndesmotic fixation can be performed in any kind of ankle injury with diastasis.

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Original Article

Evaluation of the results of unstable proximal humeral fractures by proximal humeral locking plate

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ABSTRACT

Our aim was to evaluate the results of unstable proximal humerus fracture by proximal humerul locking plate.

The incidence of proximal humeral fracture is 5% of all fractures. The incidence is slightly greater younger patients in men due to high velocity trauma like MVA and fall from height. In the elderly, however women become much more suspectable due to osteoporosis. Although treatment option varies from surgeon to surgeon. Recently treated fixed angled locked plate that maintained angular stability under load. Proximal humeral locking plate is a new device in our country used for the fixation of unstable proximal humeral fractures.

This was randomized prospective study carried out at Trauma Center, Shyamoli, Dhaka from January 2010 to December 2011. 11 patients were selected for the study irrespective of sex and age range from 32 yrs, to 65 yrs mean age (43.32 yrs). Among them patients were right sided 7 (63.64%) patients were left sided 4 (36.36%) involvement. No patients were bilateral. All the patients were treated by open reduction and internal fixation by proximal humeral locking plate.

In the present series 10 (91.09%) showed union of the fracture and also 1 (9.09%) patients union was delayed. 2 patients (18.18%) developed superficial infection and 1 (9.09%) developed delayed union. Avascular necrosis loosing of the screw 1 (9.09%) varusmalunion 2 (18.18%). In this series proximal humeral locking plate, outcome of the patients were graded according to Constant Murely shoulder score criteria showed satisfactory result 10 (91.01%) and the unsatisfactory group 1 (9.09%).

Unstable fracture of the proximal humerus treated by proximal humeral locking plate is the excellent treatment option.

INTRODUCTION:

Trauma to the upper extremity often presents a difficult challenge for orthopaedic surgeons, whether the problem encountered is a fracture, fracture with dislocation or severe soft tissue injury or neurovascular elements, proximal humerus fracture, which account for approximately 5% of all fractures, are frequently encountered injuries.

In patients less than 40 yrs old the incidence is slightly greater in men and may reflect high energy trauma like MVA or fall from height and displacement is often more sever. In the elderly, however, women become much more suspectable secondary to the effects of osteoporosis to the effects of menopause.

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The majority of proximal humerus fractures fall on an outstretched hand. Most of the fractures are stable and can be treated conservatively however, unstable displaced fractures have high morbidity, especially in older patients. The primary aim of surgical treatment is to obtain good fracture reduction and to maintain is achieved early rehabilitation. Painless shoulder with full function.

Various methods have been used in unstable fracture including hanging cast and abduction cast kirschner wire fixation, suture fixation, external fixation, tension band fixation with cannulated screws, nail fixation, prosthesis and plating. Recently treated fixed angled locked plate that maintained angular stability under load.

The proximal humeral locking plate is a new device in our country used for the fixation of unstable proximal humerus fractures. It has been developed to improve screw fixation in osteoporotic bone and to minimize soft tissue dissection. It combines the principles of fixation with conventional plate with those locking screws. This is an anatomical plate pre contoured for the proximal humerus, which reduce the risk of loss of reduction and preserves blood supply of the bone. Locking the screws in the plate ensures angular as well as axial stability and reduces the risk of loss of reduction. The locked interface also provides fixed stability. Stable also allows early mobilization of the shoulder reducing the dreadful complications of stiff shoulder.

HISTORICAL BACKGROUND:

Hippocrates is credited with documenting the first fracture of the proximal humerus in 460 BC and describing a method of weight traction that aided in bone healing. The Alexandrian school of Medicine (third century BC) mentioned shoulder dislocations complicated with fractures and the author discussed whether the dislocation should be reduced before or after the fracture. Celcus (25 BC-AD 50) distinguished shaft fractures from the proximal and distal humeral fractures. Several illustrations from the sixteenth and seventeenth century surgical texts showed the ancient methods of reduction and bandaging. Long term results of orthopedic treatments were not systematically recorded until the late eighteenth century when pathoanatomic findings from autopsy began to be compared with clinical observations by renown pathologist like Astley Cooper.

Neer classification was the most comprehensive and widely accepted one to classify proximal humeral fractures with integration of fracture anatomy, biomechanics and displacement.

Treatment options include nonoperative (usually a sling with early motion), closed reduction and a sling, closed reduction and percutaneous fixation, external fixation, a variety of open reduction and internal fixation techniques (sutures, intramedullary devices, plates, screws, staples or pins), prosthetic arthoplasty. Whatever the modality, displacement of the fracture fragment remains the major determinant of treatment plan.

MATERIAL AND METHODS:

It was randomized prospective clinical study, done at Trauma Center, Shyamoli, Dhaka January 2010 to December 2011. 11 Patients were selected for the study mean age 43.32 yrs, and the youngest and the oldest patients were 32 to 65 yrs respectively.

Majority of the patients were male 9 (81.82%) and the rest female 2 (18.18%).

Among the 11 patients 7 (63.64%) had right sided and 4 (36.36%) left sided involvement. According to the Neer's classification out of 11 patients, 2 (27.27%) patients on 3 part fracture, 7 (63.64%) patients on 4 part fracture, 1 (9.09%) patients on fracture dislocation category.

Time interval between injury and plate fixation one patients 1 (9.09%) were operated 1st week of injury. 9 (81.82%) cases were operated between 1-2 weeks and 1 (9.09%) patients operated after 3 weeks.

Majority of patients 10(91.01) were caused by high velocity trauma i.e road traffic accident and fall from height and only one 1(9.09%) was of low velocity injury i.e due to simple fall.

At six months follow up only 3 (27.27%) patients complained moderate pain, 4 patients (36.36%), no pain, 4 (36.36%) patients only mild pain.

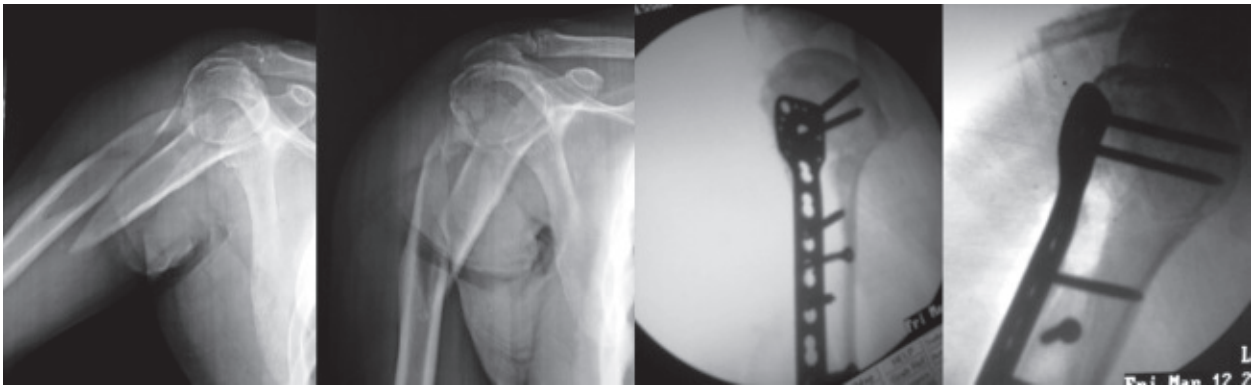
Limitation of daily living out of 11, 3(27.27%) limitation of daily activation, 1 (9.09%) limitation of recreational activities, sleep disturbance 7 (63.64%).

Surgical Procedure:

The patient is placed on a radiolucent table in supine position. A deltopectoral approach is used. The cephalic vein is retracted laterally to protect its many deltoid branches. Blunt dissection through the deltopectoral grove and blunt mobilization of the deltoid muscle is done.

REDUCTION OF THE FRACTURE:

The tendon of the long head of biceps is identified at the upper border of the pectoralis muscle and its course is followed cranially. One fracture line usually passes close



to the intertubercular sulcus; it separates the fragment of the greater tuberosity form that of the lesser tuberosity. The indirect reduction maneuver can easily be done without force by applying longitudinal traction of the arm, with abduction or adduction, rotation and lateralization of the humeral head while pulling simultaneously the sutures.

The pull of the pectorials muscle often medial displacement of the humeral shaft. Its partial reduction is achieved by applying longitudinal traction and lateral pull and the exact reduction is achieved by careful approximation of shaft to the plate.

Fixation of plate to the bone:

The locking plate should be positioned at least 5 to 8 mm distal to the upper end of greater tuberosity and 2 to 4 mm lateral to the bicipital grove. In instances of comminuted fracture the reduction can be provisionally stabilized with threaded K-wires. The insertion of angular stable screws in the humreal head is facilitated with the use of a drill guide. The head is stabilized with four fixed angle screws aligned in different planes. At the shaft a minimum of two bictorial locking screws should be used.

Closure of the wound:

A suction drain is inserted and wound closure in layers is performed.

DISCUSSION:

Proximal humeral fractures is not an uncommon problem encountered in the accident and emergency department in Trauma Center. Previously there was no study in this Trauma Center on the outcome result of unstable proximal humerus fracture fixation for locked plates and screws.

Present series includes 11 patients who all were undergone operative treatment.

Among them patients were 32 yrs-65 yrs mean age 43.32 yrs, showed that relatively older people are affected by the fracture of the proximal humerus 9 (81.82%) male, 2 (18.18%) female.

Range of movement was recorded at find follow up at four planes accurately to Constant Murely scoring criteria. Forwarded flexion 61^0-90^0 in 1 (9.09%) 91^0 -120^0 in 7 (63.64%) and 121^0-150^0 patients 3 (27.27%).

Abduction 61^0 -90^0 in 2 (18.18%) patients
91^0 -120^0 in 7 (63.64%) patients
121^0 -150^0 in 2 (18.18%) patients

External rotation. Hand above head & elbow fracture 7 (63-64%)
Hand behind head and elbow forward 1 (9.09%)
Hand above head and elbow backward 1 (9.09%)
Hand below head and elbow backward 2 (18.18%)

INTERNAL ROTATION

Darsun of the hand reaches

D12	1 (9.09%)
Waist	7 (63.64%)
SiTT	1 (9.09%)
BnHock	1 (9.09%)
Thorn	1 (9.09%)

Power of shoulder measured by spring balance, with an average expression in Kg. 2 (18.18%) not more than 10 kg. 7 (63.64%) patients had a power in between 11 to 15 kg & 2 (18.18%) patients had a power between 16 to 20 kg.

At final follow up 10 patients shoed union of the fracture and in 1 (9.09%) union was delayed. In this series 2 (18.18%) patients developed superficial infection, one patient 1 (9.09%) developed delayed union.

Avascular necrosis, loosing of hand screw in 1 (9.09%)

Varus 2(18.18%)

The outcome of the patient was graded according to Constant Murely score criteria as
Good 7(63.64%)
Fair 3 (27.27%)
Poor 1(9.09%)

Constant Murely score was treated as good & fair are satisfactory group 10 (91.01%) and the poor grade was treated as unsatisfactory group 1 (9.09%).

The younger group is characterized as the trauma group who sustained the fracture usually due to some high energy mechanism of injury. The older patients often has osteoporotic bone and sustained communited fractures even after trivial trauma. High energy trauma following road traffic accident occurs most commonly in young active people who usually the earning members of the family.

In this country, the females are still lagging behind engaging themselves in household activities and males, the principal earning member usually are working outside and more prone to road traffic accident. Of the 3(three) women in this series interestingly two are well educated working women.

In this present series, the basis of diagnosis was clinical examination and radiological evaluation of the affected part in both anteroposterior and lateral views.

Only two patients (18.18%) developed superficial infection and were treated by regular dressing with systemic antibiotic according to the culture and sensitivity report.

Not a single patient developed deep infection in contrast to the Zyto (1997), where it was 10% superficial infection.

CONCLUSION:

By review current literature, displaced three-four part fracture with dislocation of the proximal humerus rarely can be reduced closed and were treated best option by open reduction and internal fixation. Locking plate fixation to be a good option for majority patients with good functional outcome to achieved a satisfactory result.

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Original Article

Results of anterior decompression through posterior transpedicular approach and short segment stabilization of unstable thoracolumbar fractures by pedicle screws and rods

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ABSTRACT:

This was a prospective study. This study was undertaken at NITOR and Ibn Sina Hospital, Dhaka between July 2006 to June 2008. Total 23 patients with thoracolumbar spine injury were selected. All patients were operated in the form of anterior decompression through posterior transpedicular approach and short segment stabilization by pedicle screw and rods. Among the 23 cases, 22 cases (95.65%) were male and 1 case (4.35%) was female. The age range of patient was from 15-55 years. Majority of the patients were between 31 to 40 years (34.78%). Fall from height was the common cause of injury 18 (78.25%). Most commonly level of injury was L1-8 (34.78%). According to neurological deficit incomplete 18 (78.26%) and complete 5 (21.34%) cases. Most common type of injury was burst fracture 17(73.91%). Overall results were classified as excellent, good, fair and poor. No case was in excellent group. 8 (34.78%) cases were in good, fair in 10(43.48) cases & poor in 5 (21.74%). Fewer complications observed, among those preoperatively 2 patients developed bed sore. Peroperatively misplacement 3 screws. Postoperatively 1 patient developed bed sore, 1 patient developed deep wound infection and one screw broken away. Effective decompression of the spinal canal can be performed through a bilateral transpedicular approach. It can be used in different fracture types. It is easy to perform and familiar to most of the surgeons. Although our experience is limited but transpedicular decompression and short segment pedicular instrumentation is considered a safe and effective technique.

INTRODUCTION:

Fracture and dislocations of the spine are serious injuries that most commonly occur in young people. Nearly 43% of patients with spinal cord injuries sustain multiple injuries. Spinal column injuries represent approximately 3% of all trauma cases and 10% of spine injuries are accompanied by injury to the spinal cord. Seventy five percent of all spinal injuries occur with thoracolumbar segment. Epidemiological studies show that these injuries affect mainly younger age groups of patients. Surgical treatment is now offered not only to patients with spinal injuries accompanied with spinal cord lesion,but also to injuries where instability and subsequent deformity is expected.

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The thoracolumbar junction is the most common area of injury to the axial skeleton. Forces along the long stiff kyphotic thoracic spine switch abruptly into the mobile lordotic lumbar spine at the thoracolumbar junction. Biomechanically, this transition zone is susceptible to injury and is the most commonly injured portion of the spine. Primary goals in thoracolumbar trauma patients are prompt recognition and treatment of associated injuries and expeditious stabilization of the spine and protection of the neural elements.

Main goal of a surgical treatment of an unstable fracture is reduction of fracture, correction of deformity, stabilization of fracture, decompression of neural canal and early rehabilitation of the patient.

Short-segment pedicle screw fixation is a common and relatively simple method for treating thoracolumbar burst fractures, and potentially allows for spinal stabilization while preserving as many motion segments as possible. Nevertheless, instrument failure rates and progressive sagittal deformity have been reported in as many as 50% of patients treated with short-segment pedicle screw alone.

Surgical decompression of the spinal canal is presently accepted worldwide as the method of treatment for thoracolumbar burst fractures with neurological deficit in the belief that neurological recovery may be produced or enhanced.

Development of transpedicular screw fixation techniques and instrumentation systems have been brought short-segment instrumentation (fixation of one normal vertebra above and below an injured segment) into general clinical practice.

However, anterior surgery is more complex technically, is associated with increased blood loss and carries the risk of damaging intrathoracic or intra-abdominal organs or vessels. Therefore, posterior instrumentation and fusion still remains the most accepted treatment for thoracolumbar burst fractures in absence of significant neuorological deficit.

Spinal injuries associated with neurological lesions needs decompression along with stabilization. Anterior decompression through pedicles and short segment stabilization is not a very well practiced procedure in Bangladesh. However, the demand for surgery is increasing & needs evaluation.

MATERIALS AND METHODS:

This was a prospective study. This study was undertaken at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-e-Banglanagar, Dhaka and Ibn Sina Hospital, Dhaka between July 2006 to June 2008. A total numbers of twenty three patients with thoracolumbar spine injury were selected. Purposive sampling technique was taken per inclusion and exclusion criteria. We have included the patients **c**omplete or incomplete thoracolumbar spine injury irrespective of age and sex, unstable spine injury, spine injury with neurological involvement**.** We have excluded the patients open spine injury, stable thoracolumbar spine injury, spine injury without neurological deficit.

Collected data were compiled & tabulated according to key variables. All statistical analysis of different variables were analyzed by standard statistical methods using SPSS.

A detailed history of the selected patient was taken with mode of injury, time of injury, other history, then thorough general, local, neurological examination for proper assessment was made.

Plain X-ray both AP & lateral view and MRI of thoracolumbar region for all cases were taken. CT scan done for some cases to see the retropulsion of respective fractured vertebra.

Surgical procedure

After giving general anaesthesia prone position of the patient on a special designed padded operating table for the purpose of abdomen hang free, intravenous pressure is reduced and peroperative blood loss is decreased as a result of collapse of the epidural venous plexus. The incision is in the posterior mid line centered over the involved segment which was pre operatively identified by skin marking on fluoroscopy. A standard subperiosteal dissection was carried out to expose the lamina, facet joints and transverse processes of the vertebra. Self-retaining retractors were used to maintain tension on soft tissues during exposure.

A pre operative CT scan is used to decide on where decompression is required, and to show whether bits of bone have been displaced at the fracture site. Extra soft tissues removed from the spinous process and laminae. Laminectomy done at the involved and vertebrae above the involved one. The bone fragments removed from the spinous processes and the laminae are given to the scrub nurse, who will clean off any fibrous tissue or cartilage to make them into corticocancellous strips which can subsequently be used as bone grafts. When dural tears were encountered, the neural elements were gently returned to the dural sac, and the dural defect was repaired directly

using non-absorbable 4/0 silk with round body needle. When a tear in the dural sac is being rapaired, a patty should be put over the end of the suction tip to prevent damage to nerve roots.

If the bone fragment remained in the spinal canal, decompression followed by posterior pedicle fixation was done. The body of the burst fracture was centered, once access to the vertebral body had been obtained, the medial wall of the pedicle was excised, exposing the lateral aspect of the dural sac. Positions of the remaining pedicle walls were removed as necessary to provide further access for debridement of the burst fracture fragments. Bone anterior to the retropulsed bony fragments was debrided with rongeurs and curettes of varying sizes and angles. The angled instruments facilitated safe undermining of posteriorly displaced bone. These techniques were repeated from side to side until the entire middle column of the injured vertebra had been removed and the canal completely evacuated of retropulsed bone and disc fragments. Sometimes we used blunt instrument such as punch to push the offending fragments forward for the clearance of canal completely.

Then we prepared the pedicles just above and below the involved vertebra. A pedicle awl was then placed into the pedicle & make a hole advanced slowly down the pedicle, the medial inclination and an appropriate degree of cephalad – cauded inclination. Then pedicular screw fitted rigidly with rods. Sometimes additional transeverse link may be used. Chips of corticocancellous bone are placed bilaterally for the posterolateral fusion in future. If bleeding present small neurosponges should be packed liberally into the bleeding sites, taking care to avoid compressing the dural sac. After completion of procedure, wound was closed in layers over a drain.

Technique of safe pedicle-screw application

The locations for screw insertion have been identified and described by Roy-Camille, Saillant, and Mazel and by louis. The respective facet joint space and the middle of the transverse process are the most important reference points.

There are three techniques for localization of the pedicle:

(1) The intersection technique
(2) The pars interarticularis technique
(3) The mamillary process technique.

It is important in preoperative planning to asses individual spinal anatomy with the use of high-quality antero-posterior and lateral X-rays of the lumbar and thoracic spine, as well as with axial CT scanning at the level of the pedicle.

The intersection technique is perhaps the most commonly used method of localizing the pedicle. For lumbar spine dropping a line from the lateral aspect of the facet joint, which intersects a line that bisects the transverse process at a spot overlying the pedicle, incase of thoracic spine intersection of lines drawn through middle of inferior articular facet and middle of insertion of transverse process (1 mm below facet joint).

The pars interarticularis is that area of bone where the pedicles connects to the lamina. Because the laminae and the pars interarticularis can be easily identified at surgery, they provide landmarks by which a pedicular drill starting point can be made.

The mamillary process technique is based on a small prominence of bone at the base of the transverse process. This mamillary process can be used as a starting point for transpedicular drilling. Usually the mamillary process is more lateral than the intersection technique starting point, which is also more lateral than the pars interarticularis starting point.

With this in mind, a different angle must be used when drilling from these sites. With the help of preoperative CT scanning at the level of the pedicle and intraoperative X-Ray, the angle of the pedicle to the sagittal and horizontal planes can be determined.

The sagittal pedicle angle increases in the thoracic spine from an average of 0° at D1 to 10° at D8 and then decreases to 0° at D12. Usually the L4 sagittal pedicle angle is 0° and subsequent rostral and caudal levels are associated with progressively greater sagittal angles. The lordotic curvature of the lumbar spine produces a rostral angulation for upper lumbar screws. The L5 pedicle is 5° to 10° caudally inclined.

The horizontal or coronal plane angulation decreases from the cervical spine to the thoracolumbar region and then increases as the lumbar spine is descended. The coronal plane angulation at D1 is 10° to 15° and D12 is 5°. A 10° medial angulation is satisfactory at L1. The coronal plane angle increases approximately 5° per level from L1 to the sacrum (Benzel et al. 2005). In an average of convergence angle of 10° to 20° is advised for the lumbar segment and 7° to 10° for the thoracic segment respectively.

Fig-1: *Pedicle Entrance Point (A) Thoracic Spine (B) Lumbar Spine*

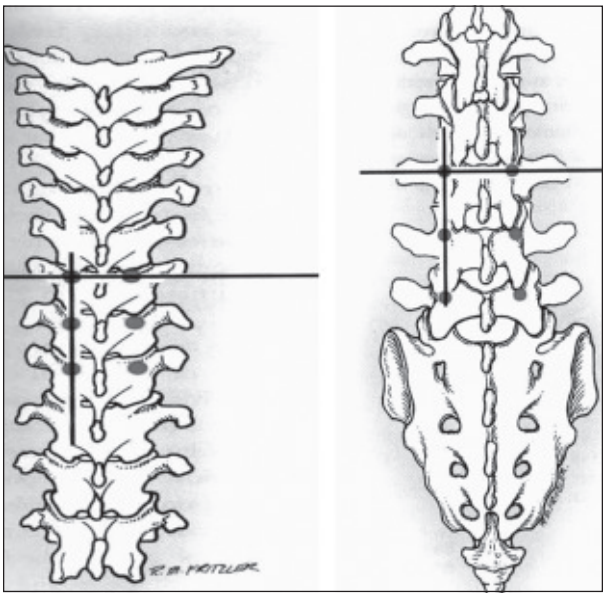


Fig-2: *Pedicle Angle (A) Horizontal or Coronal Angle (B) Sagittal Angle*

Fig-3: *Marking X-ray- Marking given over fractured vertebra (D12)*

Fig-4: *Pre-operative CT Scan- Demonstrating retropulsion of the posterior wall of the vertebral body into the spinal canal*

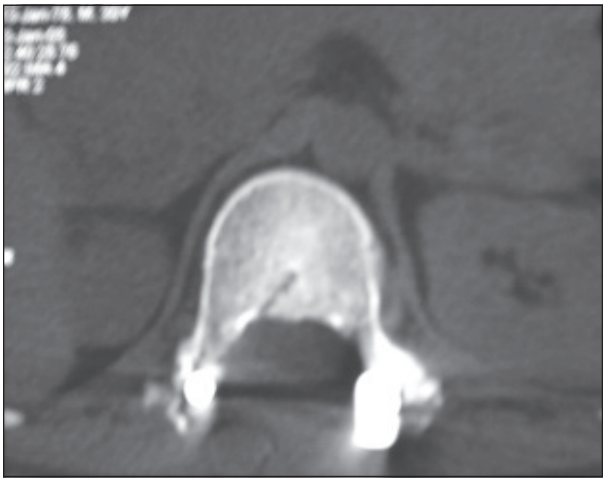


Fig-5: *Post Operative CT Scan- Demonstrating clearance of spinal canal*

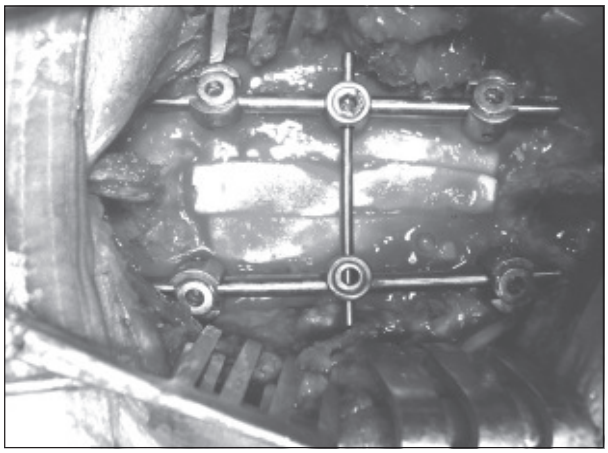


Fig-6: *Reconstruction of pedicle screw & rod*

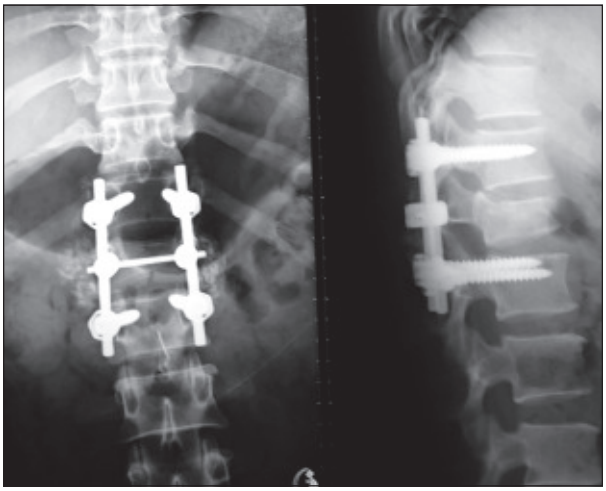


Fig-7: *Post operative X-Ray A/P & Lateral View*

Follow-up

After surgery the patients started using wheel chair and walking aid or without support according to their clinical status and degree of fracture and transposition. After discharge each patient was followed up at OPD initially monthly then three monthly.

On each visit the wound status, motion, presence of any infection, pain at the fracture site, work status or other complications of any was assessed. Radiographs were taken at each visit to follow the fracture healing, position of screw & status of posterolateral fusion.

Neurological status were assessed by Frankel's grading system. Bowel and bladder condition were noted.

During each visit counseling of the patient about his further job, role of physiotherapy, psychological support and rehabilitation.

Patient worn Taylor brace for 3 months then discarded it. Patients were allowed to resume normal activities and employment at 3 months or later (according to his job) or when clinical examination and plain radiographic assessment revealed complete healing of all fractures and a stable fusion.

RESULTS

During this study, total number of 23 patients of thoracolumbar spine injury were selected. All patients were operated in the form of anterior decompression through posterior transpedicular approach and short segment stabilization by pedicle screws & rods.

In this study the age ranged from 15 to 55 years. Maximum patients were found in 31 to 40 years age group 08 (34.78%).

Table-I

Distribution of patients according to age

Age group (Years)	Frequency	%
11-20	3	13.05
21-30	7	30.43
31-40	8	34.78
41-50	3	13.05
51-60	2	8.69
Total	23	100

Out of 23 patients, 22 (95.65%) were male, only one (4.35%) was female. Male & female ratio-22:1.

Occupation of the subjects demonstrates that farmer comprised the main bulk 12 (52.18%). Other occupants were Businessmen 03 (13.05%), Labours 02 (8.69%), Electricians 02 (8.69%), Students 02 (8.69%), Housewife 01 (4.35%) & Tractor Driver 01 (4.35%).

Fall from tree 13 (56.52%) followed by fall from roof of building 05 (21.74%) and then RTA 03 (13.05%) and finally fall of heavy object over back 02 (8.69%).

Table-II

Distribution of patients according to cause of injury

Cause of injury	Frequency	%
Fall from tree	13	56.52
Fall from roof of building	5	21.74
Fall of heavy object over back	2	8.69
RTA	3	13.05
Total	23	100

08 cases (34.78%) had fracture L1, 06 cases (26.09%) had fracture D12, 04 cases (17.40%) fracture L2, 02 cases (8.69%) fracture D11and L3 each and 01 (4.35%) fracture D4 only.

Most common type of injury is burst fracture 17 (73.91%) then fracture dislocation 05 (21.74%) and finally Jack Knife injury 01 (4.35%).

Table-III

Distribution of patients according to type of injury

Type	Frequency	%
Burst Fracture	17	73.91
Fracture dislocation	5	21.74
Jack knife injury	1	4.35
Total	23	100

Most of the cases used Titanium pedicle screw and rod 15 (65.22%) and stainless steel used only 08 (34.78%) cases.

Most of the patients 11 (47.82%) stay in the hospital (31-40) days. Then 4 (17.39%) cases stay (41-50) days. 3 (13.05%) cases stay in the hospital (21-30) days and only 2 (8.69%) cases stay in the hospital maximum (51-60) days.

In this study, 05 (21.74%) cases were complete neurological deficit and 18 (78.26%) cases were incomplete neurological deficit.

Table-IV

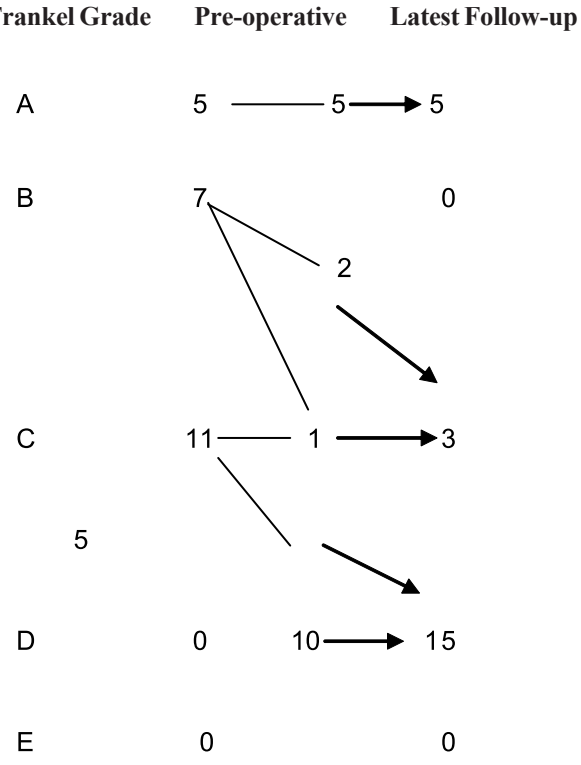
Distribution of patients according to neurological deficit

Neurological deficit	Frequency	%
Complete	5	21.74
Incomplete	18	78.26
Total	23	100

Most of the patients 11 (47.82%) had preoperative Frankel grade C and post operative Frankel D-15(65.21%)

Table-V

Changes in neurological status according to Frankel Classification



In this series misplacement of single screw in 03 cases, UTI developed in 02 cases, bed sore developed in 03 cases. In two cases bed sore developed preoperatively & in one case bed sore developed post operatively. Deep wound infection developed in one case & single screw breakage in one case.

In this study bowel & bladder controlled post operatively in 10 (43.47%) cases & not controlled in 13 (56.53%) cases.

According to Denis et al. pain scale most of the patient is grade-1, 13 (56.53%) then grade-2, 9 (39.13%), then grade-3, one (4.34%) and there is no patient in grade 4 and 5.

According to Denis et al, work scale most of the patient is grade-5, 7 (30.44%) cases followed by Grade-3, 6 (26.08%) Then Grade-2 & Grade-4,5 (21.74%) of each and no patient in Grade-1.

Here, overall results were classified as excellent, good, fair & poor. No case was in excellent group. 8 (34.78%) cases were in good, fair in 10 (43.48%) cases & poor in 5 (21.74%).

Table- VI

Distribution of patients according to overall results

Overall Results	Frequency	%
Excellent	0	0
Good	8	34.78%
Fair	10	43.48%
Poor	5	21.74%

DISCUSSION

The purposes of treating vertebral fractures are to achieve early neurological restoration, overcome damaged spinal segments anatomically and accomplish firm and stable fixation for early rehabilitation. Pedicle screw fixation of spinal fractures is performed as a basic treatment for thoracic and lumbar vertebral fractures and posterior-lateral synostosis in many hospitals.

Pedicle screws can be used both in the lumbar and thoracic vertebrae and are useful in severe fractures such as fracture-dislocation. The main advantages of the dorsal approach in short-segment fixation are that it preserves the motion segment, and is simple and familiar to spine surgeons but a recognized disadvantage is the difficulty in restoring the anterior column.

The immediate goals in the surgical management of severe thoracolumbar fractures are

1. Decompression of the neural elements by removal of impinging bone and disc fragments; and
2. Realignment and acute stabilization of the injured spine.

Posterior fixation has become a popular method in the treatment of thoracolumbar burst fractures, especially after introduction of transpedicular screws. The short-segment fixation, involving one vertebra above and one below the fractures one, offers the advantages of saving motion segments when compared with longer instruments.

In this study, the age range of patients was from 15-55 years, with mean age of 34.21 years. Majority of the patients in this series were in the age group of 31-40 (34.78%), while the next common age group 21-30 (30.43%).

Yue et al. 2002 selected mean age 41.3 years (range 21-76 years). Male population in the study constituted 95.65% of cases, while the female made up the remaining 4.35%. McNamara et al. 1992 observed a male predominance (Male-22 & Female-2).

In all of the series male representation is in majority. Male being the major working force of a society and are thus more consistently exposed to the external environment, which probably accounts for this discrepancy.

In this study, most involved occupational group is farmer (52.18%), then Businessman (13.05%), others electrician, labour & student (all are 8.69% in each group). Most of the occurrence occurred in village area & farmers are engaged in their daily activities such as climbing a tree. Electrician & labour also are an important group.

In this series, fall from height is the commonest cause of injury. It comprises fall from tree (56.52%) and fall from roof of building (21.74%). RTA (13.05%) is another cause of injury. Aebi et al.1987, showed that the common cause of injury is RTA (33.33%). Yue et al. 2002 also found that common cause of injury is high energy trauma such as motor vehicle accidents.

Study in our country showed that most common cause of injury due to fall from height especially fall from tree. But study in western countries showed that common cause of injury is RTA. Difference between these two studies due to socio-economic status of the patient.

In this study, most involved level of spine is L1 (34.78%), next common involved group is D12 (26.08%). Aebi et al (1986) showed most common involved level is L1 (43.3%) & Celebi et al. (2007) also found most common involved level is L1 (37.5%). So in all series L1 is the most common involved spine level.

In current series initial incomplete neurological deficit was found 78.26% & complete neurological deficit was found 21.74%. Among the incomplete neurological deficit incomplete cord injury 8 (34.78%), Conus medullaris syndrome 5 (21.74%) & Cauda equina syndrome 5 (21.74%).

About the type of injury according to Denis classification this series showed that Burst fracture 17 (73.91%), fracture dislocation 5 (21.74%) & Jack-Knife injury only one (4.35%). No patient was found in compression fracture type. Moon et al. (2003) reported Burst fractures 21 (46.67%), 15 (33.33%) were flexion-destruction injuries and 9 (20%) were fracture dislocation.

Here, we used pedicle screw and rod for the all patients. Titanium pedicle screw and rod for 15 (65.22%) patients and stainless steel for 8 (34.78%) patients.

According to Frankel classification in this study preoperatively 5 were Frankel A, 7 were Frankel B, 11 were Frankel C none of Frankel D and E. Post operatively 5 are Frankel A, 3 are Frankel C and most common is Frankel D (15) and none of Frankel B & E.

No patient with complete neurologic deficit (Frankel grade A) demonstrated significant improvement in neurologic function at follow up. Improvement in one or two grades was noted in 17 (94.44%) of the 18 patients presenting with incomplete neurologic deficit. No patient with an incomplete lesion was neurologically worse at the time of follow-up. No further improvement of one patient of grade-C, two patients improved from grade-B to C, 5 from grade B to D, 10 from grade C to D.

Sasso & Cotler (1993) showed that in pedicle screw group all five Frankel E remained E, 10 of 12 incompletes improved, and 5 of 6 complete deficits remained complete.

In this study, No shift of Frankel- 6 (26.08%), shift of Frankel one grade 12 (52.17%), & shift of Frankel two grade 5 (21.75%).

In this study, one patient (4.34%) had a post operative deep wound infection. This infection was successfully treated with debridement and antibiotics. Misplacement of 3 screws in 3 different patients. UTI developed in 2 (8.69%) patients. Bed sore developed in 3 patients. Out of these 2 patients developed sacral sore before operation and unfortunately one patient developed trochanteric sore after discharge from hospital. One pedicle screw of stainless steel type breakage at follow up.

In this study, overall results were classified as excellent, good, fair & poor. No case was in excellent group. 8 (34.78%)

cases were in good, fair in 10 (43.48%) cases & poor in 5 (21.74%) cases.

In Celebi et al (2007) reported that 16 (33.3%) patients had excellent results, 23 (47.9%) had good, 7 (14.58%) had fair & 2 (4.16%) patients had poor results.

In their series preoperative Frankel E was 28 patients. But in our series no patient of Frankel E before operation.

CONCLUSION

Experience gained in the surgical management of thoracolumbar injury in the form of transpedicular decompression and short segment pedicle screw fixation in this series supports the following conclusion:

1. Effective decompression of the spinal canal can be performed through a bilateral transpedicular posterior approach.
2. Fixation is being done only to upper and lower vertebras neighboring the fractured one. Fixation does not involve more than two mobile segments.
3. It can be used in different fracture types.
4. Instruments used for internal fixation are few in number and not complicated.
5. The overall complication rate was low.
6. There were no further neurologic deficit.
7. It is easy to perform and familiar to most of the surgeons.

But this study is limited by the short follow-up period and small study population (23 patients), sampling was not random. So, further prospective study with larger sample and longer period of follow-up are required to delineate the long term outcome.

Although our experience is limited but transpedicular decompression and short segment pedicular instrumentation is considered a safe and effective technique.

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Original Article

The open Latarjet procedure for recurrent anterior dislocation of shoulder

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ABSTRACT

Purpose of the study: This prospective study was carried out to report on recurrent anterior shoulder dislocation, especilly with Hill-Sachs lesion and glenoid bony defect using the open Latarjet procedure.

The open Latarjet procedure makes use of coracoids bone block to extend the anteroposterior glenoid surface by means of a lengthened bone flatform, and a sling effect of the conjoined tendon passing through the subscapularis muscle. From 2009 to 2012, 32 patients with recurrent anterior shoulder dislocation underwent an open Latarjet procedure performed by one chief surgeon and other surgeons. The mean age of the patients were 28 years (range, 19 to 44 years). All of them were available for follow–up examination. There were twenty six men and six women. The study inclusions criteria were three or more previous dislocations and dislocations with humeral head and glenoid bony defect. The mean pre-operative forward elevation was 125.5 (range, 120 to 180) and external rotation in neutral was 45 (range, 25 to 80). The mean number of dislocations before surgery was 6 (range, 3–12).

Shoulder stability and function were restored in all 32 patients at a minimum follow-up 24 months (range, 24 – 40 months). There was no recurrence of instability. The range of motion was minimally reduced; the mean loss of elevation was 6 and the mean loss of external rotation was 5. The mean Constant–Murley score increased from 65 points to 87.15 points post-opratively (pÂ0.05). No significant post operative complications were observed.

There are several open techniques and arthroscopic procedures are available for the treatment of recurrent anterior shoulder dislocations. Both anatomic and non-anatomic repairs for prevention recurrent anterior shoulder dislocation showed good to excellent results with limited restriction of movement and about to normal of daily activities. We operated the shoulders with recurrent anterior instability using the open Latarjet procedure and obtained excellent results in majority cases with good range of movement and daily living activities.

Although recurrent anterior shoulder dislocation with bankart lesion and intac tcapsular material is certainly Bankart operation, we concluded that in almost all types of anterior shoulder instability, especially in patients with Hill-Sachs lesions and Glenoid bone loss, open Latarjet operation is associated with good or excellent results and can make the patient satisfied.

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INTRODUCTION:

The Shoulder is the most mobile joint in human; its wide range of movement and inappropriate constraint predispose to a high susceptibility to dislocation. About 50% of all joint dislocations involve the shoulder, particularly in young people. The incidence of shoulder dislocation is 12 per 1000000 per year, and if recurring dislocations are counted, it is 17 per 100000 per year[1]. Antero–inferior variety of shoulder dislocation is 95%;

posterior dislocations account for 3% and other types 2%. Majority shoulder dislocation is traumatic and it is about 67j ; caused by direct force on the joint or an excessive vectoral force inducing humeral head dislocation. Non-traumatic dislocations may be associated with glenoid dysplasia and labor-capsular insufficiency. 61% recurrent dislocation occurs within second year of the first traumatic dislocation. More than 150 operations including arthroscopic and many open techniques have been described for the treatment recurrent anterior dislocation of shoulder. It is challenging for surgeons when recurrent anterior instability associated with glenoid bone defect and Hill Sachs lesions. The prevalence of a Hill-Sachs lesion occurs in a population with a history of anterior shoulder instability ranges from 40% to 90%[2-5]. For the patient presenting with an initial anterior dislocation, the incidence is 25%[4]. The presence and size of Hill-Sachs lesion, and glenoid defect also increase with recurrent instability episodes as well as total time of symptomatic instability[5,6]. The ideal surgical treatment renders the shoulder stable without compromising strength or range of motion. Transfer of the coracoids process through the subscapularis tendon is one of them. The open Latarjet procedure was first described in 1954 by French Surgeon Latarjet for the treatment of recurrent anterior dislocation of the shoulder.

METHOD:

We have been performing open Latarjet in private clinics with one chief surgeon and associated surgeons since 2009 for patients with recurrent anterior glenohumeral dislocation, especially with glenoid and humeral head bone defect (Hill- Sachs lesion). Available records of patients who underwent this surgical procedure between march 2009 and December 20012 respectively reviewed. Patients bearing incomplete medical records regarding indication for surgery or functional outcome were excluded. Patient data of first dislocation, mechanism of injury, number of recurrent dislocation before and after Latarjet procedure, time of surgery, follow-up period and complications were recorded.

The patient is placed supine on the operating table in lying position in our practice. A small roll or sand bag can be positioned under the medial border of the involved scapula. The shoulder and upper extremity are draped free for some surgeons and only the shoulder for others.

The standard deltopectoral incision began one centimeter proximal to the coracoids process and was extended five to six centimeters distally toward the anterior axillary fold depending on thin and fatty patients. The cephalic vein is protected and retracted laterally. A- self retraiting retractor is inserted into the wound retracting deltoid and pectoralis major. The coracoids process is exposed from its tip to the insertion of the coracoclavicular ligament at the base (genu) of the coracoid. The coracoacromial ligament and the pectoralis minor tendon are released with the electrocautery from the lateral and medial aspect of the coracoid respectively. A curved osteotome or right angled saw is used to perform coracoid osteotomy at its base (genu). The bone block is about 2 to 3 cm long. Periosteum from the posterior surface of the bone block removed and cortex is decorticated to smooth on its shape. Two drilled holes are tapped for 4 mm cancellous screws between cut end and attached conjoined tendon. Subscapularis muscle is splitted transversely at the junction of upper 2/3rd and lower 1/3rd near anterior glenoid rim and retracted with gelpy self retaing retractor. Exposed capsule is incised vertically and Humeral head is retracted laterally with Fukuda retractor. Medial and inferior glenoid neck retractors are placed for soft tissue retraction. After cleaning and decortication of antero inferior glenoid rim, coracoids bone block is fixed with two screws 5 to 6 mm away from glenoid articular cartilage. Sometimes upper and lower subscapularis muscle portions are apposed with one or two stitches. Finally a standard skin closure is performed keeping a drain in situ.

The arm was immobilized in 45 abduction and neutral rotation for 3 weeks and then subject to a 3 week rehabilitation programme. Strengthening exercises on bicep are delayed until 3 months postoperative to permit the coracoid healing.

Contact sports and heavy labour are generally allowed at 3 months after operation. Postoperatively, the range of movements at the glenohumeral joint were measured in all planes. The stability of the shoulder was tested using the apprehension test and sulcus sign. The usual function, range of movement and stability of the shoulder was tested using Constant-Murley Score. Parameters including stability, range of motion, daily function, and pain were evaluated. The final score indicated an excellent outcome if it was 90 to 100 points, good if 75 to 89 points, fair if 51 to 74 oints and, poor if 50 or less points.

Postoperative radiographs of the shoulder in anteroposterior, lateral, and true anteroposterior views; fusion of the transplant, position of the screw, and arthritic degeneration of the glenohumeral joint were assessed.

RESULTS:

The mean follow-up period was 24 months (range, 24 to 40 months). 26 (81.25%) of the patients were male and 6 (18.75%) were female. The mean age of the patients were 28 years. 24 (75%) involved right (dominant) shoulder and 8 (25%) involved left shoulder. First dislocation in all patients was traumatic and the mean number of recurrent dislocation was 6 before surgical stabilisation; one patient had 12 recurrences. No patient had a recurrent dislocation after surgery and their mean postoperative Constant-Murley score was 87.15. Scores of 23 (71.88 %) of the patients were excellent, 5(15.63 %) were good, 3(9.38 %) were fair, and 1(3.13%) was poor. The later patient achieved a Constant-Murley score of 49 points who had pain in abduction and external rotation and a positive subluxation sign despite a negative apprehension test finding.

Range of movement of the operated shoulders was good (Fig: 1a,1b 1c).

There was a slight decrease in mean external rotation and forward elevation in the operated joints compared to the opposite joints (Table-I).

Table-I

Post-operative range of motion compared as percentage of the contralateral good shoulder.

ROM	Operated shoulder	Opposite shoulder	Ratio (%)
Forward elevation	166	172	96.51
Ext. Rotation in neutral	49	54	90.74
Ext. Rotation in 90 abduction	83	88	94.31

However, the difference was not clinically relevant and did not impair activities of daily living. At the follow-up examination, radiography revealed bony fusion (Fig: 3) of the bone block, no screw loosening or migration.

(a) (b) (c)

Fig.-1a, 1b and 1c : *Post-operative follow-up.*

Fig.-3: *Bone block fusion with antero-inferior glenoid rim.*

DISCUSSION :

Both Arthroscopic and many open techniques are available for the treatment of recurrent anterior shoulder dislocation[6]. The ideal surgical treatment renders the shoulder stable without compromising strength or range of motion. The open Latarjet, using coracoid transfer through the subscapularis muscle is one of them.

The coracoid transfer to the antero-inferior glenoid rim does not deal with primary pathology of either traumatic or non-traumatic glenohumeral instability. Although the major aim of surgical repair of shoulder instability is prevention of recurrent dislocations. The open Latarjet procedure has show excellent and reliable results. The natural evolution of this procedure was to reduce the skin incision, nearly 4 to 5 centimeters, not to cut the subscapularis tendon and treating recurrent dislocation

with glenoid and humeral head bone defect. The Bristow–Latarjet procedure and its many modifications are relatively successful in achieving glenohumeral stability with recurrent instability reported as 0% to 5,4% [7,11,26]. Hill et al.[7] reported the result of 107 procedure and, at an average 58 months follow-up, found a rate of redislocation of 3% and a rate of subluxation of 6%. Torg et al.[8] performed a modified procedure in which the coracoid process was secured to the proximal part of the glenoid rim, over the superior margin of the subscapularis. In 212 patients who had been followed for an average of 3.9 years, they found a dislocation rate of 3.8% and a subluxation rate of 4.7%. In the most recent series, Allain et al.[9] reported no recurrent dislocation but subjective subluxation in 1 of 58 shoulders (2%) at a mean follow–up of 14.3 years. Hovelius et al.[10] reported a recurrence rate of 4% for 118 shoulders (113 patients) at 15 years follow-up and a subluxation rate of 9%. Operated Patients of this study had no recurrent dislocations after the open Latarjet procedure, consistent with othe studies[11,12]. Outcomes of the open Latarjet operation are comparable to other open surgical techniques[13,14]. Loss of motion, especially external rotation, has long been a criticisim of the Bristow-Latarjet procedure. Most authors have reported that a mean loss of 9 to 12 of external rotation[11,15-17], and some have reported external rotation losses of up to 20[12,17]. Forward flexion was less consistently evaluated. In our practice, operated patients had good postoperative range of shoulder movement, except for a slight decrease in external rotation probably because we protect the subscapularis tendon during surgery. This reduced external rotation did not impair activities of daily living. All patients could perform their jobs and sports manually. Despite a few cases pain in abductin and external rotation, patient satisfaction was high and no neurovascular irritation and glenohumeral arthritis were encountered. The precise etiology of osteoarthritis is unkown. It is most likely a result of initial traumatic shoulder dislocation. The risk increases with the age of the first dislocation and the number of recurrence[18]. The main factor classically associated with significant degenerative changes after the Latarjet procedure is an overhanging position of the bone block[9,19].

Many authors have studied the bone block position on radiographs. Allain et al.[9] observed 53% too lateral bone blocks and 5% too medial bone blocks. Cassagnaud et al.[19] reported more than 10% of the the bone blocks were found overhanging on the CT scans. Hovelius et al.[20] found 36% malpositined bone blocks above the equator and 6% too medially placed bone blook. Huguet et al.[21] found 45% of the grafts overhanging in the joint. All of these works showed the importance of the graft positin, which is directly related to the final result.

That is, a too lateral or overhanging bone block leads to arthritis in more or less long term[8,19-22]. A too medial bone block result in recurrent instability[20,21,23], and a bone block located above the equator also exposes the joint to recurrent dislocation.

The optimum position is difficult to define but it is recognized that it should be below the equator, neither too medial nor too lateral: less than 10 mm from the cartilage for some[20], less than 2 mm for others[21]. For some, the bone block should really be flush to increase the articular surface of the glenoid, reduced by “crossing lesions”.

For last four years we have been using two 4mm cnnulated cancellous screws to fix the bone block in optimum position and we did not find any screw loosening, migration or pseudoarthrosis.

A Hill – Sachs lesion was present in 40% to 90% of the cases of recurrent anterior dislocation in several studies[2-5]. In our series there were 21(80.77%) small and moderate Hill-Sachs lesions, 3(11.54%) small glenoid bony defect and 2(7.69%) both small glenoid defect and Hill-Sachs lesion observed but none of the lesion caused any post-operative instability.

Arthroscopic techniques are increasingly popular for treatment of shoulder instability[24,25]. Some surgeons try to develop an arthroscopic Latarjet procedure[26,27]. This procedure offers many advantages, including a good exposure of glenoid surface and a secure extra-articular bone block position. Moreover, if the capsule and the labrum are not resected it is possible to reattach them. But arthroscopic Latarjet procedure, as said Boileau et al.[27], is a complex procedure that requires a step learning curve and a certain degree of expertise and technical skill. This technique was developed by this surgeon on cadaveric specimens after 20 years of experience with the open technique.

CONCLUSION:

Anterior stabilization of the glenohumeral joint by means of the open Latarjet procedure continues to be a viable treatment option in selected patients with post-traumatic anterior shoulder instability, especially with glenoid and humeral head bone defect (Hill- Sachs lesion), so long as

the surgeon is familiar with the technique. Although it is a non-anatomic repair, it provides desirable functional results. The results reported in the literatures invariably show an easy rehabilitation, a low rate of reoperation, a low rate of recurrent dislocation, and excellent and good subjective outcomes.

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Original Article

Arthroscopic ACL reconstruction by BPTB graft

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ABSTRACT :

ACL injury is the most common sports injury worldwide. A prospective observational study was carried out in Dhaka Medical College Hospital and other private clinic in Dhaka from July 2009 to December 2010. This study was carried out on 12 ACL deficient knees. All patients were male. Age range was 18-40.Mode of injury were - sports injury 9(75%), RTA 2(16.66%) and fall from height 1(8.33%). All the patients were operated for ACL reconstruction by BPTB graft. Average follow-up period was 12 months. Outcome was evaluated by IKDC rating system. Majority of the patients 10 (83.33%) returned to their normal activities one year after operation. The objective of this study is to find out the outcome of ACL reconstruction by BPTB graft.

INTRODUCTION:

Knee is the most heavily stressed joint in the human frame[1] . It is most commonly injured because of its anatomic structure , its exposure to external forces and the functional demands placed on it. Knee ligament injuries are common in athletes and other young people who are prone to twisting injury of the knee due to sports and other physical activities .The menisci and the ligaments of the knee sustain injury in contact sports like football, volleyball, basketball etc. The commonest damaging force is a combined rotation and impact injury to the weight bearing semi-flexed /flexed knee, though at times a direct trauma to flexed knee is responsible[2] .

ACL is an intra- articular but extra-synovial structure ,along with PCL it is responsible for the normal gliding and rolling movements of the knee . ACL controls the forward motion as well as medial and lateral rotation of the tibia on the femur .Rupture of this ligament impairs the stability of the knee resulting in decreased athletic activity and increased risk of meniscal tear and early degenerative joint diseases.

Lesions of the ACL leads to delinking of this rolling and gliding movements with accompanying damage to menisci and the articular cartilage, leading to accelerated osteoarthritis. Hence the need for surgical stabilization by ACL reconstruction [3].

Middle third of the patellar tendon is the best graft available in comparison with other grafts. There are several methods of graft fixation –Kurosoka's interference screws at the both ends, one end with screw and the other end with endo-button/xo-button ,one end with screw and other end with cancellous screw as tibial post.

ACL injury is the most common ligament injury in the knee joint especially in sportsman, arms personals and following RTA. It is the primary stabilizer against anterior translation of the tibia under the femur and also important factor for rotational and valgus stresses. Greater

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participation in sporting and recreational activities by general population continues to expose more individual to the risk of ACL rupture.[4]

ACL reconstruction has been advocated to improve knee stability and to reduce the incidences of meniscal injury. The controversy for managing this injury now centres more on the choice of graft selection for reconstruction instead of whether surgery is necessary [5,6,7].

The Arthroscopic approach has the advantage of smaller skin and capsular incisions, less extensor mechanism trauma ,improved viewing of the intercondylar notch for placement of the tunnel and attachment sites, less post – operative pain, fewer adhesions, earlier motion and easier rehabilitation [8].

Patient may need either only ACL reconstruction or ACL reconstruction along with treatment of meniscal lesion. The selection of grafts depends on the surgeon's preference and the tissue currently available [9].

Among the autogenous tissues currently available ,the most commonly used are central one third patellar tendon (BPTB) and quadrupled hamstrings [6,10].

Reconstruction of ACL in ACL deficient knee is an well accepted therapy of choice in young adult and sportsman. It provides stability to the knee and prevent further deterioration of the joint. There are numerous methods of ACL reconstruction. Our study was on ACL reconstruction by autogenous Bone –Patellar tendon-Bone graft.

Surgical Procedure:

Arthroscopic Evaluation

MATERIALS AND METHODS:

This study was carried out in Department of Orthopaedics ,Dhaka medical College Hospital, Dhaka and some other private hospitals in Dhaka, Bangladesh from July 2009 to December 2010.Total 12 patients were treated in this prospective observational study.

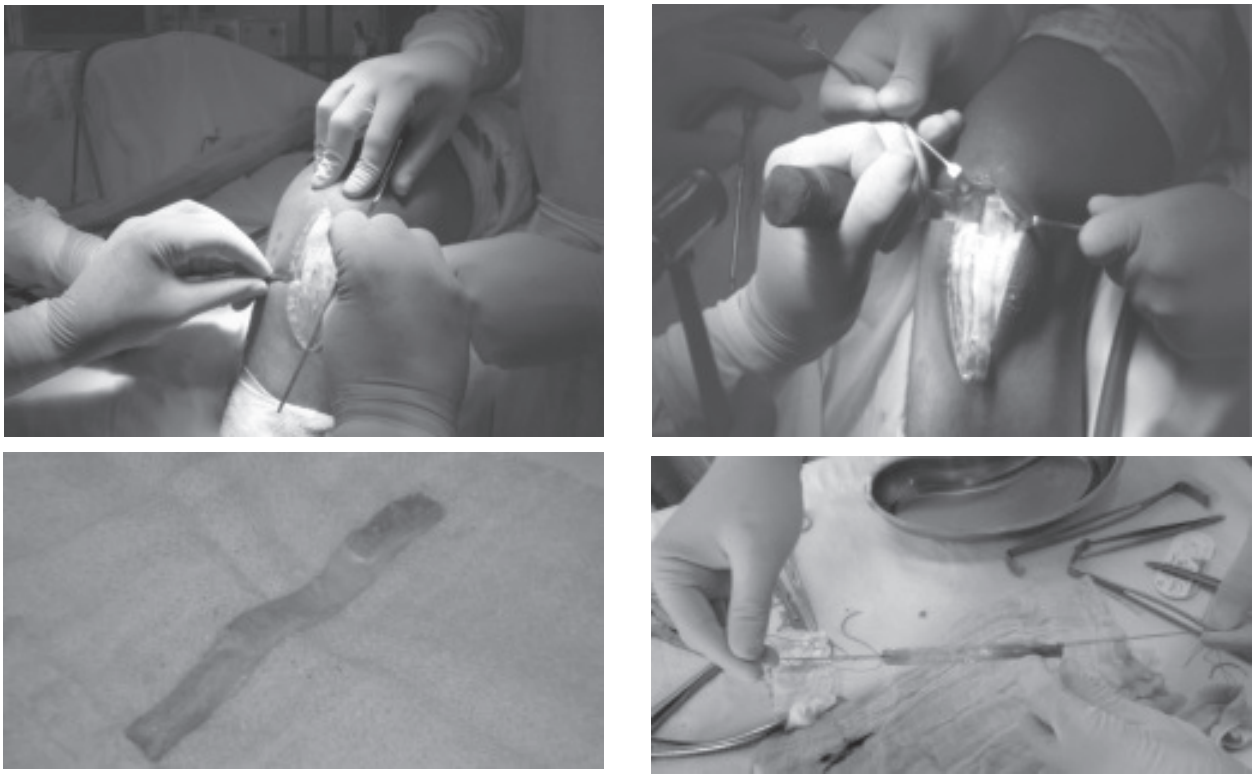
Inclusion criteria:

After epiphyseal closure, no prior knee surgery,no associated PCL injury and no Osteoarthritis.

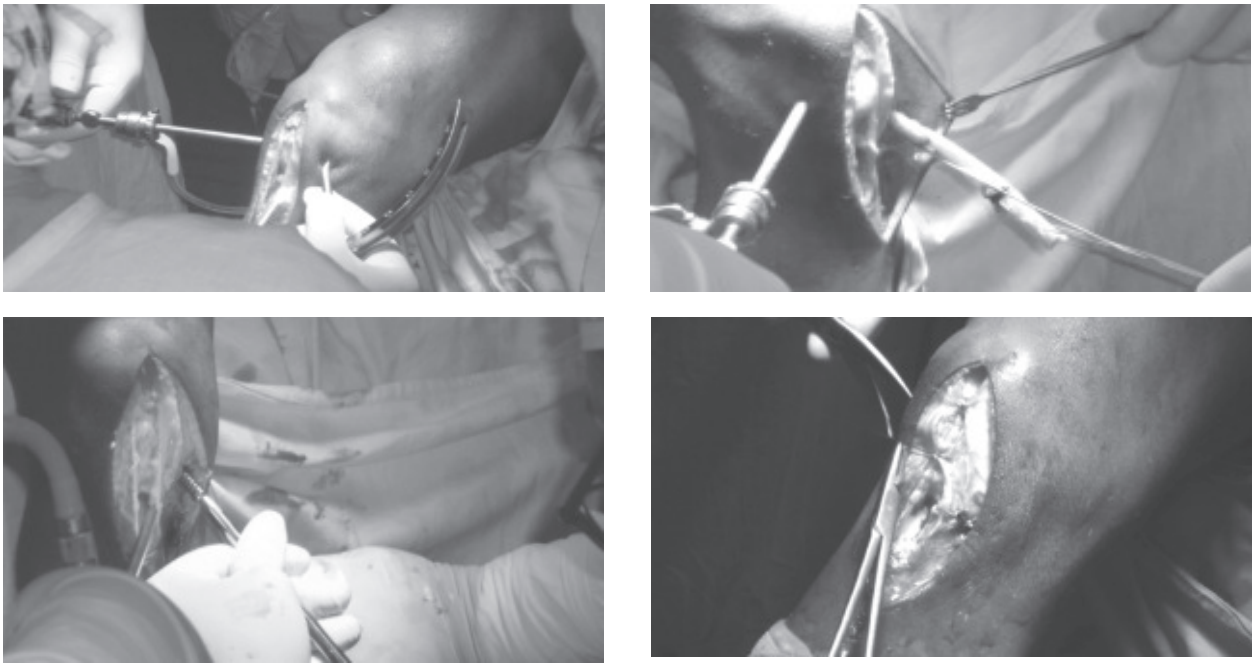
All patients were male of active age group. Age range of the patients-18-40 (average-28 years). Mode of injury were—sports injury 9(75%) which includes sportsman e.g. students , athletes, uniform personals , RTA 2(16.66%) and fall from height 1(8.33%). Out of 12, 10 patients with right knee (83.33%) and 2 (16.66%) with left knee. Out of 12, 7 (58.33%) patients had associated meniscus injury. Time interval between injury and surgery was 3 months to 2years.

All the patients were operated for ACL reconstruction by autogenous Bone-Patellar tendon –Bone graft using metallic interference screw. All the patients assessed pre-operatively and followed up on regular basis with an identical 6 month rehabilitation protocol for all patients. Average follow up period was 12 months .Results of the study were evaluated by using IKDC(International knee documentation committee) rating score. Final evaluation was performed 12 months after surgery.

Skin Incision and Graft harvest



BPTB Graft and graft Preparation



Tunnel Preparation and graft insertion

RESULTS:

Out of 12 , 10 (81.5) returned to normal activity after one year follow up with full ROM, negative Lachman test and Anterior drawer test .2 patients had 25-30 degree lack of full flexion .3 patients had anterior knee pain and 2 patients had loss of sensation on medial aspect of operated knee.3 patients had post –operative knee pain and all are associated with meniscus injury. The effect of menisectomy appears to have a negative impact on the outcome of

reconstruction. One patient had superficial wound infection over graft harvesting site which was improved with a course of antibiotics.

DISCUSSION :

ACL reconstruction, substituting a free tendon graft for the torn ligament is a common surgical procedure for the orthopaedic surgeons.[11] In sports injury there might be ligament injury with or without meniscus injury. Most common are ACL with medial meniscus injury but any ligament or meniscus may injured. Because of associated injury some patient experience instability with some degree of pain. The goal of ACL reconstruction is to restore normal knee stability and prevents further injury to the knee joint.[11,12,13.]The ideal graft is one that restrains strength at least equivalent to that of normal ACL , allows for secure fixation, enables unrestricted rehabilitation and has minimum graft donor site morbidity. Historically patellar tendon is the most popular autogenous graft for ACL reconstruction[11,12,13.]Complications like patellar fracture ,patellar tendon rupture, patello-femoral pain ,patellar tendonitis, quadriceps weakness and flexion contracture are common [11,12.]Anterior knee pain in study with BPTB graft is 17 % to 56 % [11.12.]in our study anterior knee pain is 16.66% which comparable to this study.

In our study success rate of ACL reconstruction is 83.66% which is comparable to other study. In Insall and Norman study, success rate of ACL reconstruction is 75% to 90%

CONCLUSION :

ACL reconstruction with BPTB graft is an excellent reconstruction procedure for most patients except for some donor site morbidity. BPTB graft has good bone mass which helps in anchorage to the tunnel side and tenodesis. But associated meniscus injury correlated with poor outcome. However a long term study and follow-up is needed to demonstrate a significantly good long-term outcome.

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