FUNCTIONAL OUTCOME OF INTERTROCHANTERIC FRACTURES AFTER FIXATION WITH PFN OR DHS IN ELDERLY- A COMPARATIVE STUDY

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ABSTRACT

BACKGROUND

Ninety percent of the hip fractures in the elderly result from a simple fall. More than fifty percent of the hip fractures in the elderly are intertrochanteric fractures. The goal of treatment of any intertrochanteric fracture in elderly is to restore mobility at the earliest and minimise the complications of prolonged bed rest. The Dynamic Hip Screw (DHS) has been shown to produce good results, but complications are frequent, particularly in unstable intertrochanteric fractures. Intramedullary fixation is considered to provide a more biomechanically stable construct by reducing the distance between the hip joint and implant.

MATERIALS AND METHODS

The goal of this study is to compare the functional outcome of intertrochanteric fractures in elderly patients treated with Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) by analysing the clinical and radiological results to evaluate the advantages and disadvantages and possible complications associated with fixation of intertrochanteric fractures with PFN and DHS.[1] In our study, we included 106 intertrochanteric fractures, out of which 46 were treated with PFN and 60 with DHS. Ordinary fracture table was used in all cases and were followed up at regular intervals of 4, 8 and 12 weeks, 6 months and one year.

RESULTS

Functional results were assessed with modified Harris hip score. We observed significantly higher excellent results and less poor results in PFN compared to DHS.

CONCLUSION

Unstable intertrochanteric fractures treated with PFN have significantly better outcome than DHS. In unstable fractures, reduction loss, union in varus and limb shortening are significantly higher in DHS. Hence, the advantages of PFN are less surgical trauma, less blood loss and the possibility of early weightbearing even after very complex fractures.

KEYWORDS

Trochanteric Fracture, PFN, DHS, Elderly.

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BACKGROUND

Ninety percent of the hip fractures in elderly result from a simple fall. Elderly people are prone to these fractures mostly because of reduced bone density, visual impairment, malnutrition, neurological impairment, reduced physical activity, reduced muscle power and reduced protective reflexes.[2]

Intertrochanteric fractures account for approximately half of the hip fractures in elderly.[3] Operative treatment has become the treatment of choice for intertrochanteric fractures and consists of fracture reduction and stabilisation, because it permits early mobilisation and minimises many of the complications of prolonged bed rest.

The DHS has gained widespread acceptance in the last decade and is currently considered as the standard device for comparison of outcome.[4] The DHS has been shown to produce good results, but complications are frequent, especially in unstable intertrochanteric fractures. Intramedullary fixation is considered to provide a more biomechanically stable construct by reducing the distance between the hip joint and the implant. The goal of this study is to compare[1] the functional outcome of intertrochanteric fractures in elderly patients treated with PFN and DHS by analysing the clinical and radiological results[5] to evaluate the advantages and disadvantages and possible complications associated with fixation of intertrochanteric fractures with PFN and DHS.

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MATERIALS AND METHODS

106 intertrochanteric fractures, which were surgically treated with PFN and DHS, between January 2014 and December 2016 in our institution. 46 patients treated with

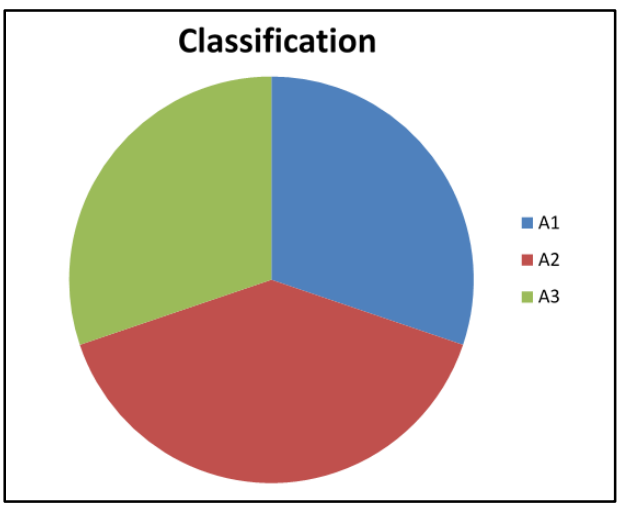
PFN were included in Group A and 60 patients treated with DHS in Group B. Patients were operated on standard fracture table under image intensifier control.

Study Groups	Sex		Average Age	Age Range	Fracture Type 31 A		
	M	F			A1	A2	A3
A PFN	21	25	74.6	61-89	6	18	22
B DHS	22	38	72.4	60-84	26	24	10

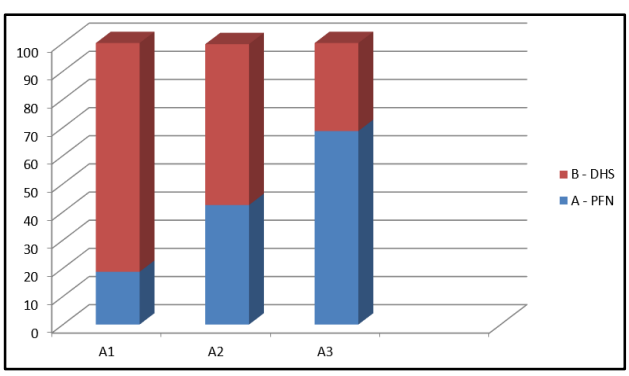
Table 1. Study Groups

Classification

Orthopaedic Trauma Association Alphanumeric classification (OTA/AO) was followed in sorting out the fractures. 32 cases were A1 (30.19%), out of which 6 cases (18.75%) were treated with PFN and 26 cases (81.25%) with DHS. Majority of the cases were A2 type- 42 cases (39.62%), 18 (42.86%) and 24 (57.14%) cases were treated with PFN and DHS, respectively. A3 type comprises 32 cases (30.19%) and PFN was done in 22 (68.75%) and DHS in 10 cases (31.25%).



Graph 1. A1-32 Cases, A2-42 Cases, A3-32 Cases. Total = 106 Cases



Graph 2. Percentage Distribution of Cases

Exclusion Criteria

1. Patients less than 60 years of age.
2. Bilateral fractures.
3. Pathological fractures.
4. Polytrauma cases.
5. Subtrochanteric fractures.

METHODS

All the patients were analysed according to the age of the patient, sex, fracture type, total operating time (from closed reduction to wound closure), time to union and complications.

The decision for the type of operation was based on the fracture pattern, surgeon's preference and availability and cost of the implant. Each patient was thoroughly evaluated and the co-morbid conditions were properly managed prior to surgery. The overall time from injury to surgery averaged 3.6 days (1-7 days). All surgeries were done on standard fracture table under image intensifier.

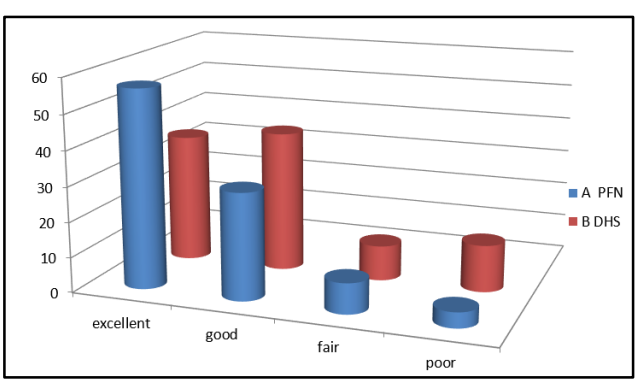
Complications were classified as intraoperative, early (first month after surgery) and late (after first month). Radiographic outcome of each group was analysed with anteroposterior and mediolateral radiographs at immediate postoperative and at each follow up visit. Fractures were considered to be healed if bridging callus was evident on three of four cortices as seen on two views.[6] Patients were followed up at regular intervals of four, eight and twelve weeks, six months and annually thereafter.

Functional outcome was analysed with Modified Harris Score. Harris Hip Score (HHS) was developed for the assessment of the results of hip surgery and is intended to evaluate various hip disabilities.

Maximum 100 Points	
Pain - 44	<70 - Poor
Function - 47	70-79 - Fair
(Activities of daily living – 14; Gait - 33)	
Range of motion - 5	80-89 - Good
Deformity - 4	90 -100 - Excellent
Score Interpretation	

OBSERVATION AND RESULTS

In this study, we had 26 excellent (56.5%), 14 good (30.4%), 4 fair (8.7%) and 2 poor (4.4%) results in Group A; whereas, 22 excellent (36.67%), 24 good (40%), 6 fair (10%) and 8 poor (13.33%) results in Group B.



Graph 3. Functional Results (Percentage)

There were two intraoperative complications in group A. One was splintering of the lateral wall of greater trochanter, which was managed by open reduction and wiring. Another one, fracture of lateral wall of proximal shaft during nail insertion. In Group B, we had one case with loss of fixation in the immediate postoperative period.

Early complications noted were prolonged drainage, haematoma and superficial infection. Reduction loss, nonunion, implant failure and late infection were the late complications noticed. There was no "Z effect" or "reverse Z effect" noted in our study." But, both screws backing out with displacement of the fracture of lateral wall (occurred during surgery) was noted in one case after weight bearing[6] (Figure 1).

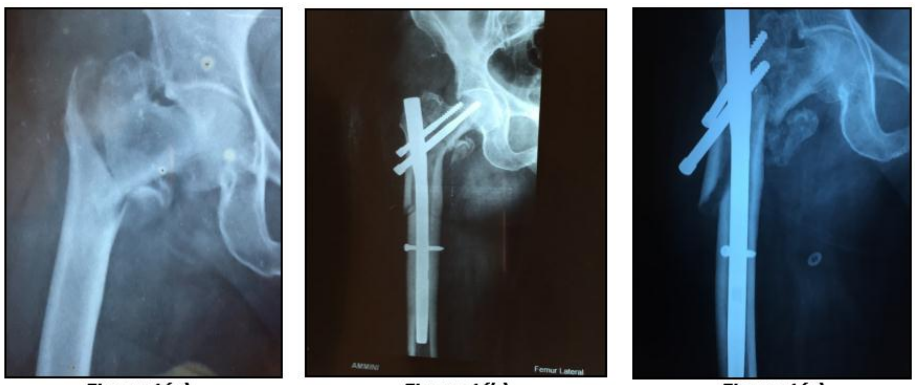


Figure 1(a) *Figure 1(b)* *Figure 1(c)*

Figure 1(a) A2 Fracture, (b) Fixed with PFN, Lateral Wall Fractured during Surgery was Left as Such, (c) Both the Screws Backing Out with Displacement of Lateral Wall Fracture After Weightbearing

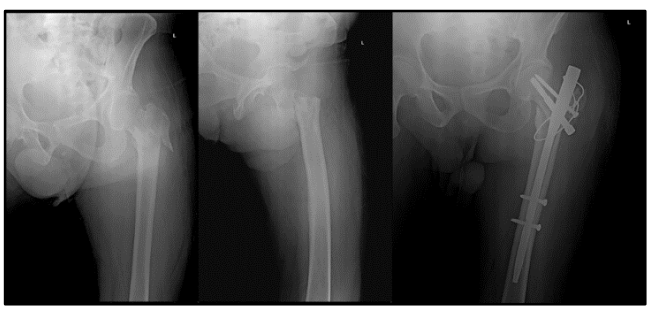


Figure 2. A 3.3 Type Fracture- Splintering of Lateral Wall of Greater Trochanter Managed with Wiring

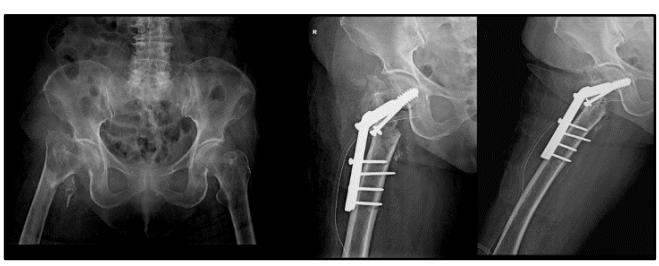


Figure 3. A 2.3 Type Fracture with Loss of Fixation Leading to Medialisation

DISCUSSION

A comparison of intraoperative, early and late complication rates revealed no significant difference between study groups. Duration of hospital stay, infection rate and implant failure rate in stable fractures are similar in both groups. There is also no significant difference in time to union. Smaller incision and significantly lower blood loss are advantages of PFN. Total duration of surgery is similar in both groups. This is in agreement with the findings of similar earlier studies.[7]The outcome of stable fractures treated with either DHS or PFN were similar.

CONCLUSION

Unstable intertrochanteric fractures treated with PFN have significantly better outcome than DHS. In unstable fractures, reduction loss, union in varus and limb shortening are significantly higher in DHS. Hence, the advantages of PFN are less surgical trauma, less blood loss and the possibility of early weightbearing even after very complex fractures.

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Incidence of complications in Ilizarov ring fixator in tibial lengthening

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Abstract
Prof. llizarov was awarded the Lenin prize for medicine in 1978 and International recognition came to him in the 19803, when his work came to be known in Europe, More recently the work came to be known in other countries like USA and Canada. The present status of the affected limb was assessed in terms of length, status of various deformities and function of the muscle and joint and vascularity the limb. General Assessment of the patient profile was done. This was mandatory and its findings were co-related with the clinical observation. Based on this deformity were found and treatment given accordingly. Moreover, this served as a baseline reference for the prospective treatment. Out of the total 28 cases there were 15 excellent 10 cases were good, and 2 cases were fair and 1 case poor results, depending upon the lengthening index, deformity correction, gait, weight bearing and joint and muscle function were analysed.

Keywords: Complications, ilizarov ring fixator, tibial lengthening

Introduction
Many techniques were devised for limb lengthening since the advent of ^{2}0th century. Acute limb lengthening as first performed by Codivilla in 1895 by a sudden and strong pull on an oscalcis pin after oblique femoral osteotomy, Steinmann pin as used first to produce traction on the tibia. Slow distraction using pins above and below was developed by Putti, Later Steinmann pin was replaced by K wire. In 1930 corti cotomy over ostetomy was used for lengthening in 1930 Wagner lengthening apparatus was introduced. It was uniplanar fixator achieved by Schanz screws connected by monolateral tubular lengthening device achieved by a mid disphyseal corticotomy. Later Prof. llizarov devised a circular external fixator using the theory of distraction osteogenesis. The certain case toward, the end of bone lengthening, grafting and plating was done to produce consolidation. The illiteracy of the people and poverty led to disrepute to this system [1].

Dr Gavriil Abramovich llizarov (1921-1992) was born in an economically backward Jewish community of the USSR. Due to dire poverty he had a difficult schooling and medical education. After graduation he was sent by the Government to work in the village of Dolgovoka in the Kurgon district of western Siberia. In 1950 he developed a versatile ring fixator. He worked wonders using the theory of distraction osteogenesis. He struggled to gain recognition among the senior professors even after demonstrating his results: but he was called as the 'Magician from Kurgen' by the patient.

With his successful method of treatment, he showed that the controlled distraction of the bone stimulates osteogenesis. For all the achievements recognition in his own country came late. An Olympic athlete Valery Brumal was treated successfully by Prof. llizarov with his ring fixator. His fame was carried overseas by another patient, an Italian explorer by name Mauri. [2]

He was a guest of honour in many an international conference. He became the Director of VKNC-UTO Russia a sprawling Institute dedicated for research work and treatment based on llizarov Principles, Asami (Association for study and application of methods of llizarov) was constituted with overwhelming international membership [3].

Dr Paley Catagni, Cattaneo, Maocchi, are among his famous disciplines. Prof. llizarov passed away in 1992 at the age of 71 giving the whole world and the suffering millions a new way of hope and new dimensions and directions in treatment [4].

Methodology

The study was conducted in orthopaedic department, Medical College Hospital. Around 28 cases were treated by the Ilizarov ring fixator. Of the 28 cases, 17 cases were with gross bone loss following RTA. 2 cases were shortening following PPRP- 2 case due to Perthes disease and 2 cases due to congenital cause and 5 due to osteomyelitis

H/o: A detailed history was taken, including the bio-data cause of the deformity and the treatment undergone.

The present status of the affected limb was assessed in terms of length, status of various deformities and function of the muscle and joint and vascularity the limb. General Assessment of the patient profile was done.

This was mandatory and its findings were co-related with the clinical observation. Based on this deformity were found and treatment given accordingly. Moreover, this served as a baseline reference for the prospective treatment.

Results

Age Incidence

Age of the patient varied from 7 to 50 years with a mean incidence in its 3rd decade as illustrated in the bar graph.

Sex Incidence

Male preponderance - 24 males and 4 were females

Cause of deformity

Majority of cases were those associated with bone loss which leads to non-union.

Indication for Procedure

It was functional in	21 cases
Cosmetic in	7 cases

Pin tract infection and pain during distraction were universal

Table 1: Complications

Complications	Patient	%
Ring Sequestrum	6	21.43
Axial deviation	3	10.71
Facture	1	3.57
Apparatus instability	2	7.15
Nerve injuries	1	3.57
Behavioural abnormality	9	31.15
Arterial damage	0	
Metal reaction	3	10.71
Refracture	3	10.71

Out of the total 28 cases there were 15 excellent 10 cases were good, and 2 cases were fair and 1 case poor results, depending upon the lengthening index, deformity correction, gait, weight bearing and joint and muscle function were analysed.

Discussion

While the apparatus in being applied to the leg. It is supported by a specially made stand. The rotational alignment of the leg is maintained by a Calcaneal traction or manually by one of the surgeons, as mentioned earlier 1.8mm wires are used. To avoid injury to neuro vascular structures they are inserted in the safe zones of the leg as seen in the Topographic Atlas, showing the cross sections of leg at various levels.

The wires are inserted from the side with the vital structures e.g.: lateral surfaces of the leg. They are pushed normally up to the bone and then drilled through both cortices, power drills are best avoided to reduce heat necrosis of bone and late loosening of wires. After piercing the distal cortex the wire is hammered out to avoid injury to vital structures by a rotating wire that may entangle them.

The muscles have to be stretched to the maximum of all the joints before wire insertion e.g.: The Ankle joint is dorsiflexed before positioning the wire posteriorly and vice versa when the wire is passed anteriorly.

The skin must rest without stretching during lengthening extra skin may be pulled into the area to prevent late sketching of skin.

The ring should be 2 to 3 cm clear of the. Limb all around to accommodate for any post-operative oedema. But the smallest possible ring should be Chosen to increase the stability of the construct. There should be at least two levels of fixation per fragment either with two rings or by adding a drop wire to the ring. The wires are never forced to the ring. If they are offset, they are fixed with washers or posts to the rings or they should be reinserted to a better position on the ring. This method may cause wire loosening in the long run because of two adjacent holes of the bone. The opposing wires should pass through either side of the ring to that the deflection of 5mm (thickness of the ring) will produce additional stability to the construct. The rings of each fragment should be perpendicular to that particular fragment and not to the axis of the limb as a whole. The limb, as a whole should be in the centre of the ring, not the bone. The use of slotted or cannulated wire fixation bolts depend on the position of wire over the hole in the ring [5].

The threaded rods must be parallel and equidistant to each other on the circumference of the ring: Usually four rods are used between the adjacent rings. Use of telescopic rods increase the stability.

In the past, surgeons performing limb lengthening have observed spontaneous new bone formation in the widening distraction. Professor llizarov since 1951 was engaged in clinical, biological engineering and basic science research that has led to the discovery of the law of "Tension stress". Gradual traction on living tissue creates, stresses that can stimulate and maintain the regeneration and active growth of certain structures. The regeneration is characterised by the stimulation of both proliferative and biosynthetic cellular functions and depends upon adequate blood supply and the stimulus of weight bearing [6]. Mechanical forces can produce two separate biological processes.

Distraction Osteogenesis

It is Denovo production of new bone by induction between bony surfaces that are gradually puIled apart. The biological bridge between these bony surfaces arises from local neovascularisation and span the entire cross section of the cut surface. During distraction a fibrovascular interface is aligned parallel to the direction of distraction which new bone columns add length to the gap. When biological and mechanical condition during distraction are ideal bone is formed by pure intra membra neous ossification

Transformation Osteogenesis

It is the mechanical stimulator of a pathological bony interface to regenerate normal bone continuity. Depending on the stability and composition of pathological interface, variation in compression and distraction induce osteogenesis [7]. When a distraction force is applied between a bony interface the forces are equally distributed through-out the tissue between the sectioned fragments. The distraction force is always stronger at

the borders which is called as advance front, gradually grows weaker towards the centre. At the centre of the tissue where the forces oppose each other the two forces tend to cancel each other and a critical quiet zone is formed. It is in this zone of NeuraI forces that the first sign of Osteogenesis is initiated. As this osteogenesis continues this will resemble a special growth plate created within the elongated bone. As soon as the distraction ceases the osteogenesis area invades the entire tissue rapidly. Five distraction zones have been defined within the site of distraction osteogenesis by quantitative complete tomography.

This is a central radiolucent zone persisting throughout the distraction. This zone is formed by parallel bundle of a vascular dense fibrous tissue resembling tendon. This is called the 'Pseudo growth plate"

Immediately adjacent to the radiolucent zone is transitional zone known as primary mineralisation front. This zone is formed by large vascular spaces with immature endothelial cells suggestive of capillary collection. This zone also contains spindle cells oriented longitudinally with matrix showing early calcification. The histology of this region resembles that of Sharpey's fibres. This is the zone of vascularisation and early calcification and is seen on both sides of the central fibrous inter zone [8]. Just proximal and distal to the transitional zone, this is the baseline zone formed by distinct bone columns diameter separated by fibrovascular spaces of equal diameter. These columns slowly increase in size, by opposition of new collagen bundles, Mineralisation occur intimately within the poles between collagen bundles. Histology of this sequence resembles intra membranous ossification.

By the day 14th of distraction new bone is first seen forming at two ends arising from the entire cross section including spongiosa, cortex and periosteum. On the 21 St Day of distraction the new bone has differentiated into micro columns with a maximum diameter of 200 microns. The central region of the osteo genic area remains as fibrous inter zone containing trace amounts of calcium and no crystallised hydroxy apatite. The fibrous inter zone persist throughout the distraction averaging three or four milli meters in length. It follows on undulating course parallel to the margin of the bone ends.

Following distraction, the bone columns bridge across to fibrous inter zone and by post-operative 77th day the osteogenic area has remodelled radio graphically demonstrated early cortex formation. By post-operative day of 119th day the oseogenic area contains lamellar bone and Harversion system and Hematopoietic marrow. The histology is indistinguishable from the host bone with normal cortex, trabecular bone and bone marrow elements. The linear rate of the osteogenesis is calculated as over 200 microns per day.

Conclusion

- Commonest site is tibia, followed by femur
- The most common age group is 3'd decade
- The most important indication is gross bone loss.

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OUTCOME OF RESULTS WITH CONSERVATIVE MANAGEMENT OF ROCKWOOD TYPE III ACROMIOCLAVICULAR DISLOCATION

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ABSTRACT

BACKGROUND

The acromioclavicular joint is commonly involved in traumatic injuries that affect the shoulder. Treatment of these injuries has been controversial and continues to evolve.

The aim of the study is to evaluate clinical outcome in patients with type III acromioclavicular dislocation managed conservatively.

MATERIALS AND METHODS

Clinical outcome in 12 patients with type III acromioclavicular dislocation treated conservatively is evaluated 6-8 months after injury. Functional outcome was done using Constant-Murley score and pain was measured using Visual Analogue Score (VAS).

RESULTS

There is 75% excellent result and 25% good functional outcome as assessed by Constant-Murley score. The average pain as assessed by visual analogue score is 1.7 mm.

CONCLUSION

Conservative management of type III acromioclavicular dislocation gives excellent/good outcome, but the cosmetic appearance is not improved by conservative treatment.

KEYWORDS

Constant-Murley Score, Dislocation, Type III Acromioclavicular, Visual Analogue Score (VAS).

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BACKGROUND

The acromioclavicular joint is commonly involved in traumatic injuries that affect the shoulder. Treatment of these injuries has been controversial and continues to evolve.[1]

According to literature, type I and II injuries are treated by conservative modalities and stage IV, V and VI injuries are advised to undergo surgery.[1] There is no consensus regarding management of type III acromioclavicular dislocation.[2,3]

In this study, classification of acromioclavicular by Tossy-Rockwood is followed. In type III acromioclavicular dislocation, a severe force is applied to the point of the shoulder, which tears the acromioclavicular and coracoclavicular ligaments resulting in a complete acromioclavicular dislocation. The distal clavicle appears to be displaced superiorly as the scapula and shoulder complex drop inferomedially. Radiographic findings include a 25-100% increase in coracoclavicular space in comparison to normal side.[1]

The key to the diagnosis of type III injury is that the acromioclavicular joint can be reduced with upward pressure under the elbow or by having the patient actively shrug and reduce the joint. This is known as "shrug test." A type III reducible injury is thus differentiated from type 4 or 5 injury, which cannot be reduced if the deltopectoral fascia is interposed.[1,4]

MATERIALS AND METHODS

Twelve patients with type III acromioclavicular dislocation who attended the Mount Zion Medical College between September 2014 and November 2016 were included in this study. Patients with previous history of shoulder pathology (periarthritis shoulder), patients with previous history of shoulder injuries and instabilities and associated fractures around the shoulder joint are excluded from this study.

There were 10 male patients and 2 female patients. Age of the patients' ranges from 24 to 58 years and the average age is 37.16 yrs. The dislocation was on nondominant side in 8 patients and on the dominant side in 4 patients. The diagnosis of type III acromioclavicular dislocation was based clinical and radiological examination. Radiological diagnosis of type III acromioclavicular dislocation was confirmed when a complete dislocation of the joint is seen on AP (15 degrees cephalic tilt) view. No stress studies were performed.

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The mechanism of injury includes RTAs, fall on outstretched hands and fall on the side of the shoulder.

All the patients were treated conservatively with arm sling for 3-4 weeks and short course of analgesics. Home exercises and physiotherapy were started early in all patients. Patients were taught scapular squeeze/retraction exercises after 3 days. Active assisted range of movements, Codman's pendular exercises, wall climbs and shoulder isometrics were done in the first week. Active range of movement exercises was done after one week when the pain subsides and resistance band exercises were started after 3 weeks for strengthening. The intensity of the exercises was gradually increased depending upon pain. Normal activity is achieved in 6-12 weeks.

The patients were assessed between 6-8 months after injury for functional outcome using Constant-Murley score and pain was assessed by Visual Analogue Score (VAS).

RESULTS

Functional outcome was evaluated using Constant-Murley score. Grading was done using difference in score between normal and injured side. In this study, 9 patients (75%) had excellent results and 3 patients had good results (25%) as assessed by Constant score. The average pain as assessed by VAS was 1.7 mm. Pain mainly occurred during lifting heavyweights and overhead activities. All the patients have bump/step deformity in the lateral aspect of clavicle. Range of movement was compared with normal shoulder. In two patients, there was terminal restriction of abduction and forward flexion (less than 15^{o}) compared to opposite shoulder, but it did not affect the function of the shoulder, in all other patients, full range of movements was achieved at 6-8 months follow-up.

Patient	Sex	Age	Type of Injury	Difference in CM Score Compared to Opposite Side	Subjective Results
1	Male	42	RTA	6	Excellent
2	Male	24	S	8	Excellent
3	Male	28	RTA	9	Excellent
4	Male	39	Fall	13	Good
5	Female	32	Fall	7	Excellent
6	Male	46	RTA	12	Good
7	Female	41	RTA	6	Excellent
8	Male	58	Fall	4	Excellent
9	Male	33	RTA	12	Good
10	Male	40	RTA	7	Excellent
11	Male	34	RTA	9	Excellent
12	Male	29	RTA	6	Excellent

Table 1. Data of Patients

RTA- Road traffic accident; S- Sports; CM Score- Constant-Murley Score, Grading of the CM shoulder score is done by difference between normal and injured side; difference <11 excellent, 11-20 - Good;, 21-30 - fair; >30 - poor.

DISCUSSION

The main finding in this study was that conservative treatment of type III acromioclavicular dislocation gives excellent to good functional results as assessed by Constant-Murley score.[5,6]

The European Society for Shoulder and Elbow Surgery (ESSES) adopted the scoring system of Constant and Murley.[5,6] The scoring system consists of 4 variables that are used to assess the function of the shoulder. The left and the right sides are assessed separately. The subjective variables are pain and Activities of Daily Living (ADL) (sleep, work, recreation/sport), which give a total of 35 points. The objective variables are range of motion and strength, which give a total of 65 points. The total score is 100. Grading of the Constant shoulder is done by difference between normal and abnormal side. Difference less than 11 is excellent, 11-20 good, 21-30 fair, more than 30 poor.

In this study, 9 patients (75%) had excellent results and 3 patients (25%) had good results as assessed by Constant score. The best treatment for type III acromioclavicular dislocation is still controversial. Surgical management in young active patients is preferred by some surgeons,[7,8] while others recommend conservative treatment because of lower complication rate and recovery time.[9,10] Also, there are studies, which showed no difference in outcome between the conservative and operatively treated patients.[11]

Studies by Galpin et al and Larsen et al indicate that although conservative treatment doesn't restore the anatomy of the joint, it allows for rapid rehabilitation.[12,13] Even if the clinical results are comparable regarding pain relief, range of motion and strength, complications are more in the surgery group than in the conservative group.[14,15,16]

Complications of surgery include early complications like infection, wound breakdown, fixation failure and residual deformity and late complications like hypertrophic scar, traumatic arthritis, calcification of coracoclavicular ligament and requirement for reoperation.

All the patients in our study have persistent step deformity over the lateral aspect of the clavicle. The only potential advantage in surgical treatment is the reduction in residual deformity; however, the degree of deformity does not correlate well with the long-term improvement in pain, motion or strength.[17] The advantages of conservative treatment are shorter period of rehabilitation and avoidance of hospitalisation.[14] All the patients in our study were discharged on the same day and advised review after 3 days.

Physiotherapy and home exercises were started early in all patients and gradual progression was done depending on pain. All the patients in this study returned to work between 3 days to 5 weeks depending upon the side involved (dominant/nondominant) and the type of work. Patients involved in clerical job and nondominant side returned to work early, but in those patients doing manual work with involvement of the dominant side returned to work late.

Limitations of the study include small sample of the study and short-term followup. In this study, no attempt is made to compare conservative treatment with surgical management of type III acromioclavicular dislocations.

CONCLUSION

Conservative treatment gives excellent/good functional outcome in type III acromioclavicular dislocation as assessed by Constant-Murley score. Cosmetic appearance is not improved and there is persistent deformity over the lateral aspect of clavicle following conservative treatment.

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SUPRAPATELLAR VERSUS INFRAPATELLAR TIBIAL NAIL INSERTION- A PROSPECTIVE, RANDOMISED CONTROL PILOT STUDY

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ABSTRACT

BACKGROUND

The standard for treating tibial shaft fractures are by intramedullary nails currently. After the procedure, one of the most frequent complication is knee pain, after consolidation even more chronically. Chronic knee pain can affect more than 50% of the cases, which was said by most authors. Alternative routes of inserting the nail is used, which includes by means of lateral patellar paratendon, medial patellar paratendon or transtendon to avoid the symptom.

The aim of the study is to study the clinical and functional outcomes of suprapatellar versus infrapatellar tibial nail insertion.

MATERIALS AND METHODS

This is a prospective study, which was done from January 2014 to February 2015 and 50 patients who were skeletally mature were selected and randomised into IP and SP nail insertion groups. They were also given informed consent and only after they agreed, they were taken into the study. The technique of nail insertion was revealed to both the surgeon and the patient at that time.

Exclusion Criteria- Pregnant women, patients with intra-articular involvement, periprosthetic fractures, nonunions, ipsilateral injuries, previous knee injuries, history of gout, rheumatoid, osteoarthritis, spinal injury and incarceration. SP insertion was performed percutaneously with the help of a special cannula system.

RESULTS

A total of 50 patients were selected in this study. 31 SP and 19 IP. 10 SP and 2 IP did not show up for follow up examinations, so only 38 patients were present for 12 months. At last, there were 21 SP and 17 IP patients. The time from when the index procedure was done to follow up was 14.6 months, i.e. it ranged from 12-28 months. 12 were males and 9 were females with suprapatellar, 9 were males and 8 were females in infrapatellar. Average age of suprapatellar was 42 and that of infrapatellar was 44. Open fractures were 5 and closed fractures were 33. VAS score was 0.78 in suprapatellar and 1.87 in infrapatellar. Data analysis of external features and extension and flexion were almost equal for both suprapatellar and infrapatellar.

CONCLUSION

Based on the data obtained above, it can be concluded that suprapatellar and infrapatellar approach are equivalent regarding tibial fracture healing and alignment, knee pain and functional disability.

KEYWORDS

Suprapatellar, Infrapatellar, Tibial Nail Insertion.

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BACKGROUND

The standard for treating tibial shaft fractures are by intramedullary nails currently. After the procedure, one of the most frequent complication is knee pain, after consolidation even more chronically. Chronic knee pain can affect more than 50% of the cases, which was said by most authors.[1,2] Alternative routes of inserting the nail is used, which includes by means of lateral patellar paratendon, medial patellar paratendon or transtendon to avoid the symptom. However, these alternatives cause post-treatment pain and even removal of the nail often used does not improve the complication. Because of the intramedullary nail, lesions of tendon are often associated with knee pain after implantation.[3] So, suprapatellar and infrapatellar routes do not injure the tendon. They lead to lower levels of knee pain after implant placement. The advantages of suprapatellar tibial nail insertion are that it can prepare and insert nail with knee extended. It is more simple access to entry point at proximal tibia, avoids patellar tendon, theoretically less anterior knee pain, avoids risk to infrapatellar nerve and avoids insertion trough poor skin if skin at proximal tibia is damaged. The disadvantages are they have to place instruments across the patellofemoral joint potentially damaging joint surface.[4,5] They have higher impact loads across patellofemoral joint. They are not as well studied as infrapatellar insertion. Advantages of infrapatellar

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tibial nail insertion are that this is tried and true method. It has no potential for damage to patellofemoral joint. Disadvantages of infrapatellar tibial nail insertion are that it is very difficult in proximal tibia fractures as knee is required to be flexed during nail insertion and patellar tendon needs to be navigated around or through.

MATERIALS AND METHODS

This is a prospective study, which was done from January 2014 to February 2015 and 50 patients who were skeletally mature were selected and randomised into IP and SP nail insertion groups. They were also given informed consent and only after they agreed, they were taken into the study. The technique of nail insertion was revealed to both the surgeon and patient at that time.

Exclusion Criteria

Pregnant women, patients with intra-articular involvement, periprosthetic fractures, nonunions, ipsilateral injuries, previous knee injuries, history of gout, rheumatoid, osteoarthritis, spinal injury and incarceration. SP insertion was performed percutaneously with the help of a special cannula system. Arthroscopy was undergone by SP patients to obtain a visual clearance of the PF joint. The condition of the articular cartilage was described by out bridge scale. Grade 0 means normal cartilage, grade I- cartilage with softening and swelling, grade II- fragmenting or fissuring <1.5 cm diameter, grade III- fragmenting or fissuring >1.5 cm diameter, grade IV- exposed subchondral bone. Routine follow up with standard tibia and knee radiographs for 6 weeks, 3, 6 and 12 months was done. Visual Analogue Score (VAS), i.e. 0 means excellent and 10 means extreme pain, pain diagram documentation and Range of Motion (ROM) was done.

RESULTS

A total of 50 patients were selected in this study. 31 SP and 19 IP. 10 SP and 2 IP did not show up for follow up examinations, so only 38 patients were present for 12 months. At last, there were 21 SP and 17 IP patients. The time from when the index procedure was done to follow up was 14.6 months, i.e. it ranged from 12-28 months.

Age and Sex Distribution	Suprapatellar	Infrapatellar
Males	12	9
Females	9	8
Average age	42	44
Type of fractures	Open	Closed
	5	33

Table 1. Shows Patient Demographics

	SP	IP
Union	100%	100%
Malalignment	0%	0%
VAS score	0.78	1.87
Pain	26	24

Table 2. Shows 12 Months Outcome Data Analysis

	SP	IP
Physical functioning	45	32
Bodily pain	48	36
General health	50	48
Vitality	42	39
Social functioning	35	40
Mental health	42	40

Table 3. Shows Data Analysis Outcome of other External Features

	IP	SP
Affected extension	0.7	-0.3
Unaffected extension	0.7	0.3
Difference extension	0	0.6
Affected flexion	135	130
Unaffected flexion	132	128
Difference flexion	1	-1.9

Table 4. Shows Data Analysis Outcome of Extension and Flexion

DISCUSSION

Many studies have been reported similar to this study. Gelbke MK et al[6] in their study, they quantified patellofemoral contact pressures and forces during Infrapatellar (IP) and Suprapatellar (SP) intramedullary tibial nail insertion. Fresh-frozen hemicadavers with intact lower extremities and pelvis were used for this study. A standard IP entry portal was used on nine tibiae, whereas an SP entry portal was used in eight tibiae. A digital electronic pressure sensor system was used to dynamically measure peak pressures within the patellofemoral joint during each procedure. Data were continuously recorded from the start to completion of each procedure. Mean pressure and force as well as peak contact pressures recorded were then compared between the two techniques. The results were mean patellofemoral pressures and forces as well as peak contact pressures were higher in the SP group than the IP group. The mean peak contact pressure was 0.90 MPa (range, 0.48-1.26 MPa) during IP nailing. The mean peak contact pressure on the patella and femoral condyles was 1.84 MPa (range, 1.09-2.95 MPa) and 2.13 MPa (range, 1.10-2.86 MPa), respectively, during SP nailing. In this study, it was concluded that structural integrity of articular cartilage is compromised at impact loads exceeding 25 MPa and chondrocyte apoptosis can occur at sustained loads ofs as little as 4.5 MPa in immature bovine cartilage. The results of this study indicate that although the patellofemoral contact pressures are higher with SP nail insertion, they remain below the values reported to be detrimental to articular cartilage. Daniel S. Chan et al[7] conducted a prospective randomised pilot study to compare the clinical and functional outcomes of the knee joint after infrapatellar versus suprapatellar tibial nail insertion. The results were that a total of 41 patients/fractures were enrolled in this study. Of those, only 25 patients/fractures (14 IP, 11 SP) fully complied with and completed 12 months of follow-up. Six of 11 SP presented with articular changes (chondromalacia) in the PF joint during the preinsertion arthroscopy. Three patients displayed a change in the articular cartilage based on postnail insertion arthroscopy. At 12 months, all fractures in both groups had proceeded to

union. There were no differences between the affected and unaffected knee with respect to range of motion. Functional visual analogue score and Lysholm knee scores showed no significant differences between groups (P 0.05). The SF-36v2 comparison also revealed no significant differences in the overall score, all 4 mental components and 3/4 physical components (P 0.05). The bodily pain component score was superior in the SP group (45 vs. 36, P = 0.035). All 11 SP patients obtained MRIs at 1 year. Five of these patients had evidence of chondromalacia on MRI. These findings did not correlate with either the prenail or postnail insertion arthroscopy. Importantly, no patient in the SP group with postnail insertion arthroscopic changes had PF joint pain at 1 year. It concluded that overall there seemed to be no significant differences in pain, disability, or knee range of motion between these 2 tibial intramedullary nail insertion techniques after 12 months of follow-up. Based on this pilot study data, larger prospective trial with long-term follow-up is warranted. Eastman J et al[8] performed a cadaveric and radiographic study utilising 16 limbs. We performed a retropatellar approach via longitudinal quadriceps split, passed a specialised trocar through the patellofemoral joint and onto the superior aspect of the tibia and inserted Kirschner wires into the anatomic safe zone of the tibial plateau at 0, 10, 20, 30, 40 and 50 degrees of knee flexion utilising biplanar fluoroscopy. We recorded knee flexion with a goniometer and the entrance vector of the Kirschner wire in relation to the anterior tibial cortex. The results were that there was a progressive increase in the ability to obtain the correct anatomical start site from 1 of 16 (6.25%) at full extension to 12 of 16 (75%) at 50 degrees of knee flexion (P = 0.00098). A statistically significant decrease in the average sagittal plane entrance vector in relation to the anterior tibial cortex was found from 23.1 degrees at full extension to -0.41 degrees at 50 degrees of knee flexion (P <0.0001). It concluded that the retropatellar technique allows the radiographically defined correct start site to be localised particularly at higher degrees of knee flexion. More favourable intramedullary nail insertion angles were possible with the retropatellar technique particularly with knee flexion angles greater than 20 degrees. The retropatellar technique demands further investigations to further delineate its advantages, limitations and possible risks to local anatomy. Freedman et al[9] in their study, intramedullary nailing of the tibia was performed on 145 tibiae (137 patients) for fracture or nonunion from 1985 to 1992. There were 133 cases available for radiographic analysis of postoperative tibial alignment. Of the 133 nailings, 16 (12%) were malaligned (12 acute fractures and 4 nonunion-malunions). Malalignment was defined as 5 degrees angulatory deformity in any plane. Malalignment was seen in 58% of proximal third fractures, 7% of middle third fractures and 8% of distal third fractures. Of the malaligned fractures, 83% were either segmental or comminuted. Thirteen percent of the reamed tibiae were malaligned as compared with 9% of the unreamed tibiae. There was no relationship between nail insertion site and degree of angulation. The medial entrance angle averaged 9.5 degrees and contributed to a valgus deformity in 4 proximal third tibial fractures. The average anterior bow deformity of 5 proximal third fractures was 7 degrees (range, 5 degrees-12 degrees). Careful attention to operative technique and entrance angle particularly with proximal third or comminuted fractures is recommended to prevent angular deformity and malunion after tibial nailing. Proximal third tibial fractures may require a neutral or slightly lateral entrance angle to ensure a more anatomic reduction and centromedullary nail orientation to offset the tendency for valgus angulation. Tornetta P et al[10] conducted a study to identify the risks to intra-articular structures of the knee during tibial portal creation and to identify the safe zone for tibial nail placement in university trauma center, which was a cadaveric anatomic. Forty fresh frozen cadaveric knees were studied to elaborate the risks of tibial portal creation and nail placement to the intraarticular structures of the knee. Nails were placed through medial and lateral parapatellar approaches, and the distance from the nail portal to the intra-articular structures of the knee was measured. A safe zone for portal placement was determined. The results were that the tibial portal location averaged 4.4 ± 3 millimetres lateral to the midline of the plateau. Actual intra-articular structural damage occurred in 20 percent of the specimens; however, an additional 30 percent demonstrated the nail to be subjacent to one of the menisci. A lateral paratendinous approach placed the lateral articular surface at most risk and a medial paratendinous approach placed the medial meniscus at most risk. The safe zone for nail placement was identified and is located 9.1 ± 5 millimetres lateral to the midline of the plateau and three millimetres lateral to the center of the tibial tubercle. The width of the safe zone averaged 22.9 millimetres and was as narrow as 12.6 millimetres. It concluded that damage to the intraarticular structures of the knee is possible during tibial nailing with a superior portal. The safe zone for nail placement is small and can be exceeded if a reamed nail is used. The safest starting point for tibial nailing should be slightly lateral to the center of the tibial tubercle.

CONCLUSION

Based on the data obtained above, it can be concluded that suprapatellar and infrapatellar approach are equivalent regarding tibial fracture healing and alignment, knee pain and functional disability.

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