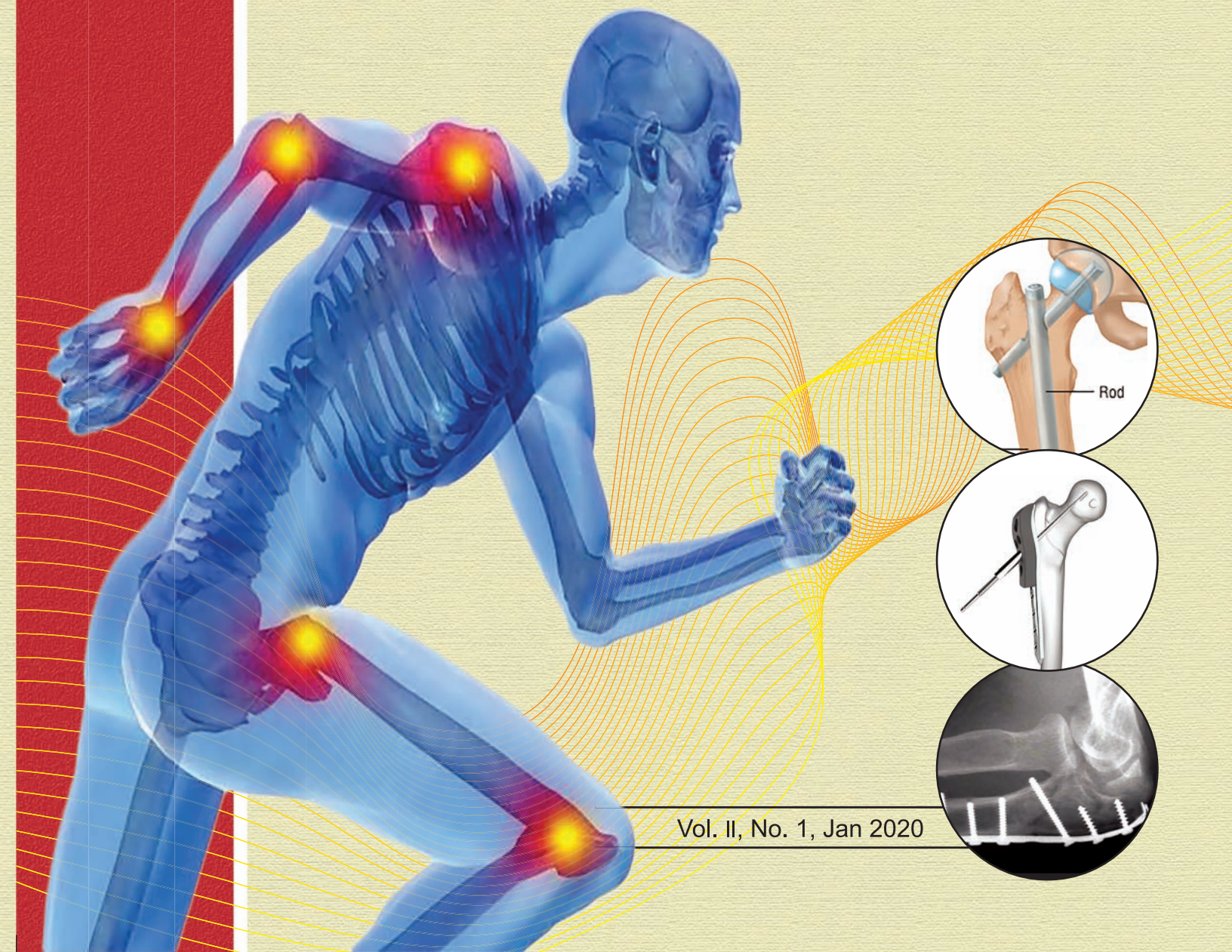
JOURNAL

OF JHARKHAND ORTHOPAEDIC ASSOCIATION

An Official Publication of Jharkhand Orthopaedic Association



Vol. II, No. 1, Jan 2020

CONTENT

FROM THE EDITOR'S DESK

Never stop, one day you will be someone's hope, someone's hero.

First of all, I express my heartfelt thanks to all of you for giving me the responsibility as the editor for our esteemed journal. I am certain that, in this era of emerging orthopaedic technology, the second edition of the Journal of Jharkhand orthopaedic association will enhance the knowledge and will bring the latest developments in the field of orthopaedics closer to the ever young fellow surgeons. This work is focused at imparting a concise picture of the new and upcoming scientific advancements in the world of orthopaedics and trauma surgery. A basic insight into the novel researches is sure to enlighten your minds and encourage most of you to contribute to or gain from them.

The journal has earned credibility amongst all the readers and institution during a short period of time. I will sincerely try my level best to make it as one of the reputed journals in the country.

With the hope of infusing new thoughts and ideas, wish you a memorable JOACON 2020.

Enjoy browsing through the journal.

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FAILURE OF FRACTURE FIXATION USING LOCKING PLATES : IS PREOPERATIVE PLANNING ESSENTIAL REGARDING DEVICE CONFIGURATION?

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ABSTRACT

Most locked plating failures are due to inappropriate device configuration for the fracture pattern. Several studies cite screw positioning variables such as the number and spacing of screws as responsible for occurrences of locking plate breakage, screw loosening, and peri-prosthetic re-fracture. It is also widely accepted that inappropriate device stiffness can inhibit or delay healing. Careful preoperative planning is therefore critical if these failures are to be prevented. This study examines several variables which need to be considered when optimising a locking plate fixation device for fracture treatment including: material selection; screw placement; the effect of the fracture pattern; and the bone-plate offset. We demonstrate that device selection is not straight-forward as many of the variables influence one-another and an identically configured device can perform very differently depending upon the fracture pattern. Finally, we summarise the influence of some of the key parameters and the influence this can have on the fracture healing environment and the stresses within the plate in a flowchart.

INTRODUCTION

Preoperative planning is critical to the success of any fracture fixation surgery. For any fixation device there are three key clinical requirements and consequent mechanical demands arising from them [1]: it must support fracture healing; it must not fail during the healing period; and it should not loosen or cause patient discomfort. It is well recognised that an appropriate amount of interfragmentary motion (IFM) between fractured bone fragments is pivotal to healing; too much or too little can delay or inhibit fracture healing [2]. IFM is determined by the stiffness of the bone-fixator construct with stiffness defined as IFM produced on application of unit load. Moreover, to prevent failure, stresses wit hin the implants should not be too high. Fatigue is normally a more likely cause of failure rather than a single traumatic event and the implant is more prone to fatigue failure if healing has been delayed [3]. Small increases in stress can, therefore, reduce significantly the number of cycles to failure of the fixation device [4]. High strains/stresses at the screw-bone interface are known to cause loosening around screw holes and entail a risk of infection [5,6]. In addition, compromising the integrity of the bone due to screw holes or bone atrophy can lead to periprosthetic fracture during fixation or re-fracture after device removal [7].

In the context of metallic plates for fracture healing, preoperative planning must consider the different plate types available. The benefits of locking plates have been demonstrated clinically and experimentally [8,9]. Several studies show that the use of locking screws can improve construct strength [10–12] and performance in osteoporotic bone compared to conventional screws [13–15]. On the other hand, studies have also shown that the pull-out strength of conventional screws increases with bone density [16,17] which can result in equivalent or even better results than locked plating in healthy bone [14]. These differences arise due to two main factors: (1) The preloads involved in compression screw tightening increase strain levels at the screw–bone interface even before physiological loads are applied, whereas locking screws have negligible screw tightening preload and resulting strains [13,18]; and (2) During physiological loading, compression plating

allows for frictional load transfer at the plate–bone interface; locked plating, on the other hand, transfers all physiological loads via the screw–bone interface [18]. In particular, the localised high tensile strains produced by conventional screws have been shown to be responsible for their poorer performance in osteoporotic bone [18]. Therefore, there should be a very clear distinction made between these two screw types; indeed, locking screws are not really screws in the conventional sense – they are more like bolts [19]. For example, the use of conventional screws can help reduce the fracture during surgery; on the other hand, once a locking screw has been inserted, it prevents further distraction or reduction of the fracture [20].

It is well accepted that the majority of locked plating failures are due to inappropriate device configuration for the fracture pattern [21–25]. Several studies cite screw positioning variables such as the number and spacing of screws as responsible for cases of locking plate breakage, screw loosening, and periprosthetic re-fracture [3,8,26–29]. However, the significance of different variables and manner in which their variation affects mechanical behaviour of fixation constructs (and associated clinical expectations) is poorly understood; many of the findings in this respect are contradictory. To achieve the clinical requirements, a well-planned device selection and configuration is essential, which in turn requires understanding the influence of different variables on the mechanical behaviour of bone-plate construct.

This aim of this study is to examine the role of different variables that influence pre-operative planning with a particular emphasis on device configuration, which is a key determinant for ensuring that the clinical requirements are met.

Philosophy of fixation

The decision whether to aim to for promotion of primary (direct) or secondary (indirect) bone healing needs to be made before any fixation device selection. Delayed fracture healing or non-union is very likely to occur when the fracture environment is not controlled to achieve one of these fixation philosophies [30]. Secondary bone fracture healing is the most common form of healing and the surgery required is less invasive and biologically damaging [2,31]. To stimulate secondary bone healing, the initial post-operative interfragmentary movement (IFM) should be in the region of 10– 40% of the total fracture gap [32,33]. As the interfragmentary strain governs the healing process, the smaller the size of the fracture gap, the smaller the required movement. The appropriate value of IFM and resulting interfragmentary strain changes throughout the course of healing [34]. Primary bone healing is a much slower process requiring so-called 'absolute stability' of the fracture, and therefore aims to completely abolish the fracture gap; consequently, the required IFM tends to zero [34]. If any significant movement occurs in a small fracture gap, this results in very large strains and is disruptive to healing. Conversely, it is almost impossible to abolish relative movement between fracture fragments in a severely comminuted fracture pattern and therefore indirect bone healing should be sought [35]. Clinical studies demonstrate that using a lag screw to abolish movement in this situation conflicts with the goal of indirect healing leading to hardware failure [8]. One of the criticisms of locking plates is that the final bone-plate construct can become overly stiff thereby delaying or preventing healing [20]. Therefore, the stiffness of the device should be carefully controlled.

Implant material selection

The interfragmentary movement (IFM) at the fracture site is largely governed by plate bending [36], and consequently plate stiffness needs to be carefully controlled to avoid it from being too high or too low and thereby detrimental to healing. Material choice is known to influence healing rates in distal femur locking plates, particularly in the period up to 12 weeks post-operative [37]. It is intuitive that titanium, with a lower Young's modulus than steel, produces greater interfragmentary movement (IFM). However, the increase in IFM produced by titanium compared to steel is not proportional to the difference in

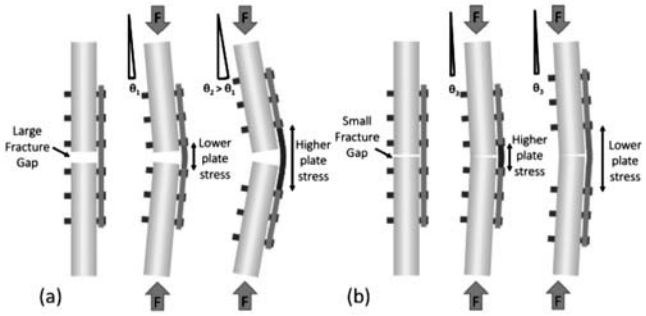
material stiffness as the plate is eccentric to the applied load [38]. The geometry of the plate, particularly the structural bending stiffness, also influences the IFM in a similar manner to the material stiffness. Any implant will alter the natural load distribution within the host bone. Fixation devices are designed to redirect load and shield the bone from undesirable motion to allow the fracture to heal [39].

This redirection of load also results in other unwanted effects: for example, stress-shielding in some regions and strain concentration at the bone-implant interface. In locking plates, it has been shown that a more rigid screw material (e.g. steel with a higher Young's modulus than titanium) reduces the strain concentrations at the screw-bone interface [36] since they deform less in bending. The same applies to the stiffness of the plate itself – higher stiffness plates reduce screw-bone interface strain concentrations [36]. As material failure of bone and consequent loosening of screws is governed by strains, their concentration at the bone-screw interface needs to be limited. The concern of high interfacial strains with titanium in comparison to steel has been previously noted for unilateral fixators [40].

Device configuration: working length

One of the most important parameters regulating the device stiffness is the working length (also known as the bridging span), defined as the distance between the two innermost screws on either side of the fracture. Small working lengths in a simple reduced fracture can cause large plate stresses [4,24,41]; but in comminuted fracture patterns with a fracture gap, it is large working lengths that result in higher plate stresses [9]. This apparent contradiction has led to some confusion in the literature regarding the influence of working length. Bottlang et al. [42], for example, noted that the efficacy of working length, in terms of stiffness reduction, is "inconsistent and is gained at the cost of construct strength". The mechanics for the two cases, one with a fracture gap and the other little or no fracture gap, can be explained as follows: When there is a fracture gap, the entire load is transmitted from one bone fragment to the other via the plate. In this case, upon load bearing, a higher working length results in flexible system leading to increased bending, higher plate stresses, higher interfacial bone strains and higher IFM. However, when there is no fracture gap the loads are shared between the bone and the plate. In this case a more flexible plating system (e.g. due to a larger working length) results in a lower load being transferred via the plate resulting in lower plate stresses and lower interfacial strains.

Unfortunately, the distinction between the performance of load-bearing and load-sharing locked plating systems is not fully understood. For example, some studies have attributed insufficient working length to higher plate stresses even for cases with a fracture gap [13,19,20]. This is explained [19] by applying identical angular deformation to the plate – a scenario in which a smaller working length will result in larger plate stresses.



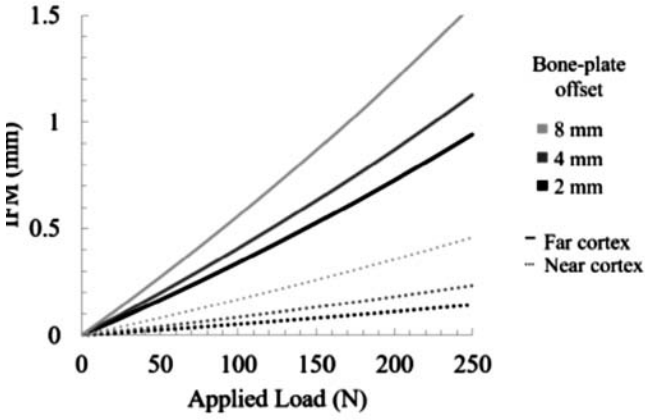
A depiction of the influence of working length on plate stress in a bone plate system under applied axial load where: (a) there is a large fracture gap where no interfragmentary contact can occur (the plate is supporting all applied loads) resulting in larger plate stresses and larger angular deformation for system with larger working length; and (b) there is a small fracture gap which enables load sharing resulting in lower plate stresses with larger working length.

Device configuration: bone-plate offset

Locked plating is structurally similar to unilateral external fixation [1]; however, there is considerable difference in bone plate offset between locking plates and unilateral fixators. As the boneimplant

distance is much smaller for locking plates compared to external fixators, the majority of the fracture gap motion is generated by plate bending [1] which also results in asymmetric fracture gap closure [44]. Ahmad et al. [46] demonstrated that increasing the bone-plate offset can reduce the strength and stiffness of locking plate constructs. Techniques that utilise bending of the locking screws to increase the effective bone-plate distance have been described in a number of studies using: 'far-cortical locking screws' [47], 'dynamic locking screws' [48] and 'near cortical slots' [49]. These techniques have been shown to generate increased motion at the fracture site, however, they also produce larger strains at the screw-bone interface due to the larger lever arm [1,50].

The influence of bone-plate offset in relation to the motion at the fracture site appears to have been overlooked by some studies in the literature.



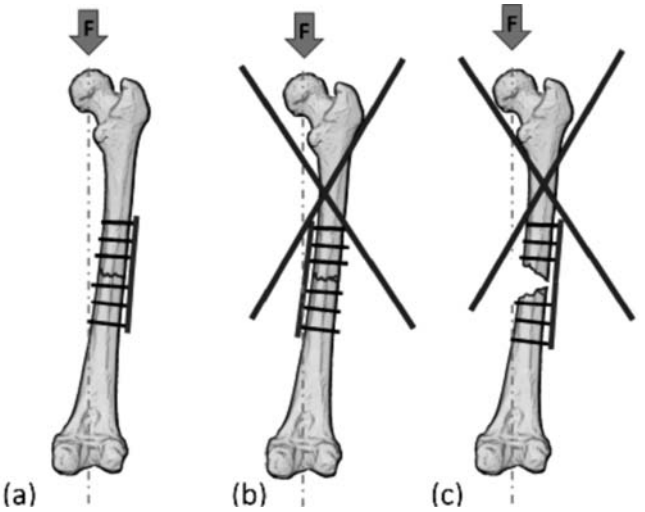
The predicted interfragmentary motion (IFM) for a locked plate construct under axial loading depending upon the bone-plate offset

Anatomical considerations, fracture pattern and boundary conditions

The anatomical location of the fracture can dramatically alter the demands placed upon the plate. In upper limb fractures plates are exposed to considerable torsional loads [55], whereas in the lower limb larger axial forces must also be resisted [56]. Lateral femoral plating causes the plate to be located a considerable distance from the mechanical axis due to the off-set of the femoral head. In a loadbearing situation, this can result in rapid plate breakage [34,57].

It is important to note that a load-bearing environment can also occur in gap-opening situations (the opposite of the 'tension-band' principle), or where a displaced wedge fragment does not allow for load-sharing . Clinical studies, such as Strauss et al. [8], state that longer working lengths can "better distribute stresses" around the fracture site. This statement assumes that there is a load-sharing environment at the fracture site, in the case of a small fracture gap, as discussed earlier.

The loading and boundary conditions can also influence whether bone-plate contact will occur



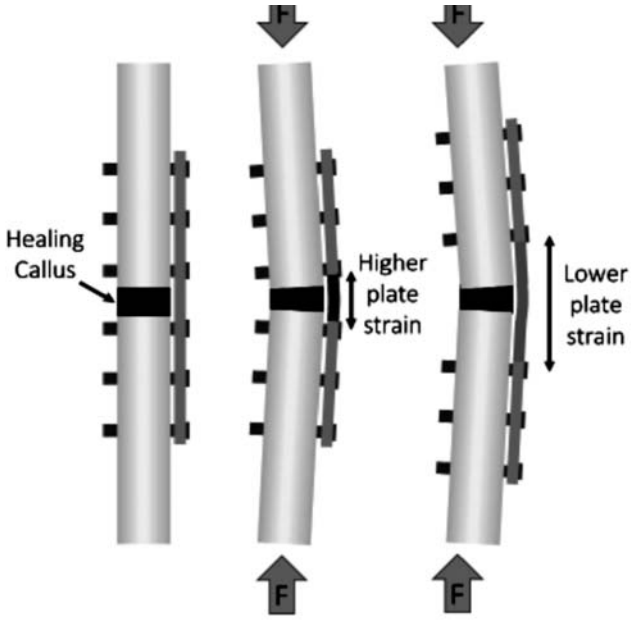
Depiction of (a) the tension band load-sharing principle; (b) a gap-opening loadbearing situation; (c) a displaced wedge fragment load-bearing situation. The tension band situation (a) is safe for patient weight-bearing, however, weight-bearing in the other two situations (b and c) would result in very large stresses within the plate and a high risk of plate breakage

Effects of fracture healing

A load-bearing system can become a load-sharing system with the progression of fracture healing. With increased callus formation, the bone will transmit an increasing proportion of the load [56]. If fracture healing does not occur or is delayed, then the plate must support all applied loading and plate breakage will eventually occur [22]. Previous experimental studies that have considered loadbearing scenarios have found that more rigid

constructs perform better under cyclic loading [41,51,54,59].

On the other hand,clinical studies show that more flexible plates promote faster callus formation; this includes the use of titanium instead of steel [37], but also the use of longer working lengths [60].



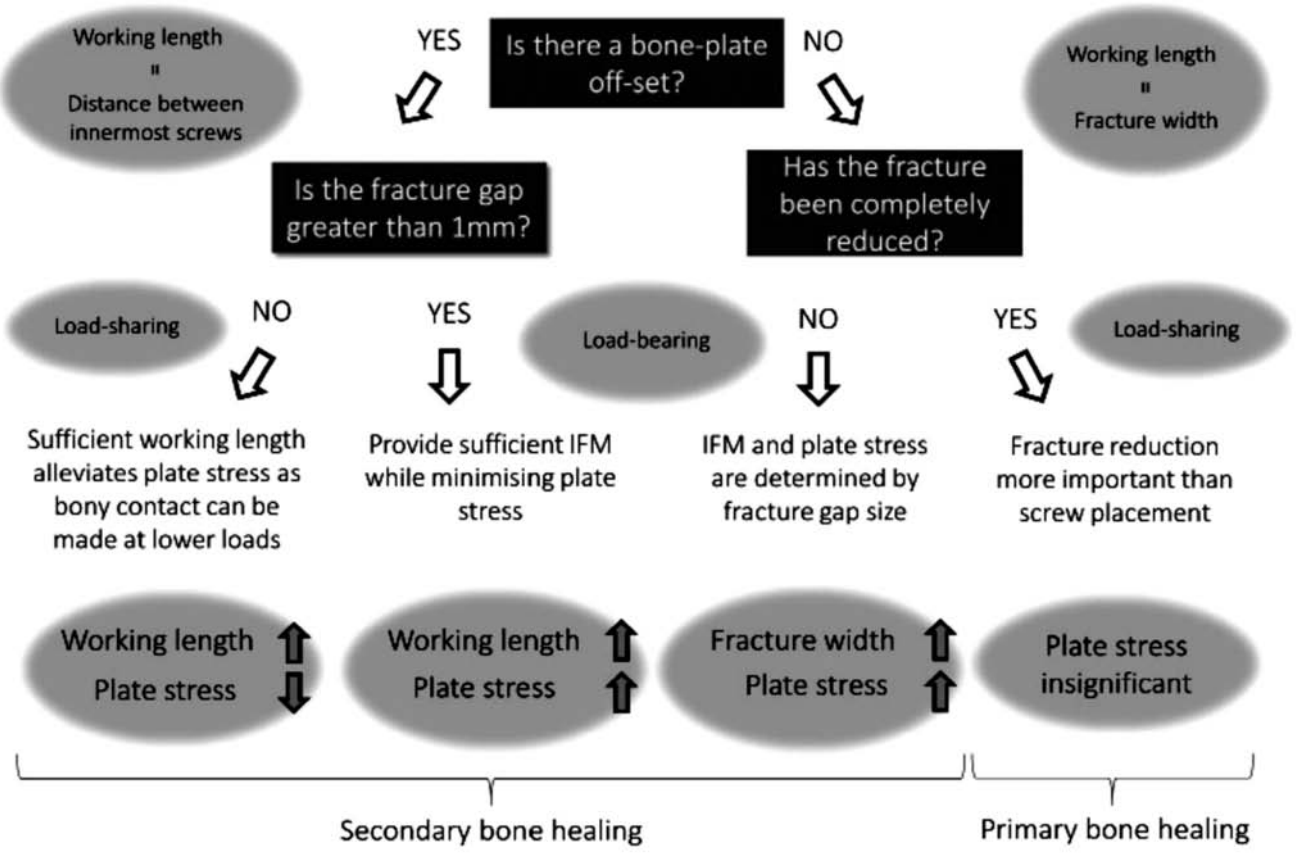
The influence of callus formation at the fracture site on plate strain for different working lengths.

Optimising device configuration

Most plate failures are not due to a single traumatic event but are the result of fatigue failure [4]; minimising stress in the plates and screws should, therefore, be one of the goals of internal fixation [4]. If healing progresses more rapidly, however, the demands upon the fixation are reduced [67]. The most beneficial healing conditions require the correct level of fracture site movement – and this appears to be moderate axial motion and minimal shear movements [68,69]. As discussed, the axial motion produced by locked plating can be altered by many variables: working length, the offset distance between the bone and plate and the material properties of the plate [41,46,59]. Additionally, this review has demonstrated that there is confusion in the literature regarding the influence of some parameters in different fracture scenarios. This indicates that a more rigorous understanding of the mechanics of locked plating is required. Current screw positioning guidance includes the appropriate plate length and the number of screws to use (AO guidelines, [70]). Unfortunately, there are no guidelines regarding working length, which is known to be one of the primary determinants of interfragmentary motion in locking plates [41].

Better guidelines could inform the selection of an appropriate working length for a given fracture, which would reduce the likelihood of mechanical failure or delayed healing. Considering the literature reviewed, the influence of working length, bone-plate offset and fracture gap size, is summarised in the flowchart below. As discussed, the apparent contradictory influence of working length is dependent upon whether load-sharing contact can occur at the fracture site under weight-bearing forces. The flow chart demonstrates that working length is only relevant when there is a bone-plate offset (left hand side of the flowchart in Fig. 8). A fracture gap size of 1 mm was taken as a threshold where fracture gap closure might be expected under weight-bearing. This value is illustrative and will change for different device configurations.

If the plate is in contact with the bone (right hand side of the flowchart), then the effective working length is smaller than the distance between the screws closest to the fracture site. Additionally, in reduced fractures where primary bone healing is the goal, fracture reduction is more important than screw placement [29]. Therefore, if secondary fracture healing is the goal (or complete reduction is not achieved), screw placement can only be used as a method of controlling the healing environment or stresses in the plate if a bone-plate offset exists [4,41]. It should be noted that if fracture healing progresses, the fracture callus will be supporting some of the load and the bone-plate construct will tend toward a load-sharing situation. If healing is delayed, however, the loadbearing situation would remain.



Summary of the influence of different variables on plate stress including: bone-plate offset, fracture gap size and working length. Note: non-locking screws that compress the plate against the surface of the bone will always eliminate the bone-plate offset and, therefore, screw placement will have no significant influence on the plate stress under weight-bearing loads.

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Fig. 8. Summary of the influence of different variables on plate stress including: bone-plate offset, fracture gap size and working length. Note: non-locking screws that compress the plate against the surface of the bone will always eliminate the bone-plate offset and, therefore, screw placement will have no significant influence on the plate stress under weight-bearing loads. S18 A.R. MacLeod and P. Pankaj / Injury, Int. J. Care Injured 49S1 (2018) S12–S18

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PROSPECTIVE STUDY TO ACCESS THE SURGICAL OUTCOME IN TWO- AND THREE- PART FRACTURE OF THE PROXIMAL HUMERUS USING PROXIMAL HUMERUS INTERNAL LOCKING SYSTEM (PHILOS) PLATE

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ABSTRACT

INTRODUCTION:

The displaced two- and three- part proximal humerus fractures remain a major challenge for the treating surgeons. Aims: To access the efficacy, functional outcome and complication of PHILOS plate in management of two parts-and three-part fractures of proximal humerus. Methods: This is a prospective study in which 20 patients of the proximal humerus fractures, between 18 years to 60 years of age group who provided written informed consent to participate in the study were included and treated using PHILOS plate from December 2018 to November 2019. Outcome measured using radiological and clinical parameters; fuctional outcome was access by Constant-Murley scoring system and DASH Score. Result: According to constant score, scores were excellent in 9(45%) patients, good in 5 patients (25%), moderate in 4(20%) patients and poor in 2(10%) patients. Mean constant score was 76(range 40-100).DASH score of 15.0 points was obtained at the final follow up. 25% of the patient's developed complications.

INTRODUCTION

Proximal humerus fractures are the 2nd most common fracture of upper limb after distal radius fracture and accounts for 26% of all humerus fracture[1]. The morphology of fractures depends on the mechanism of injury, numbers of muscular forces on fracture fragments and connection of fragments to periosteum. It has been divided into avulsion and impaction fractures. For impaction fractures the mechanism are fall on the abducted arm with the glenoid consequently depressing the humeral head into the shaft thereby blowing out the minor tubercle ventrally and the greater tuberosity laterally resulting in a valgus-impacted four-part fracture. On the contrary, the avulsion fracture causes disruption of periosteum and subsequently more pronounced dislocation of affected tuberosities as well as rotational and usually varus malpositioning of the humeral head leads to two- and three-parts fractures. The term avulsion may be misleading because it generally refers to isolated avulsion fractures of the greater and lesser tuberosity. It has been observed that two- and three-part fractures often show a comminuted fracture area at the medial calcar induced by compressive forces, while tension forces are seen on the lateral side. So,in adducted arm (or neutral position), an axial forces of the humerus directed cranially to the acromion rather than to the glenoid cavity. The rotary muscles then pull the humeral head mediocaudally and the acromion additionally depresses the central and medial aspect of the humeral head caudally into varus. In contrast, a fall on the abducted arm transfers axial forces to the glenoid depressing the head into valgus. Therefore like femoral neck fractures it is reasonable to distinguish between abduction (valgus) and adduction (varus) fractures of proximal humerus and term avulsion fracture for isolated fractures of the tuberosities[2]. Women are affected more than men in the ratio of 3:1[3]. Proximal humerus fractures occur in a bimodal frequency, either in younger people following high- velocity/energy trauma or in those older than 50 years with lower- energy injuries[3, 4, 5]. In elderly with osteoporotic bone proximal humerus fracture is most common along with hip and radial fractures[6, 7, 8]. Un-displaced or minimally

displaced fracture can be treated conservatively,[9] but for the displaced fracture different opinions including conservative, percutaneous fixation or minimally invasive osteosynthesis, plating, intramedully nails, and hemiarthroplasty[10]. Much controversy and confusion still exist, and no single treatment protocol or algorithm has been proved to be universally effective. areas still in controversy include radiographic diagnosis, operative or non-operative treatment, consideration of patient age in treatment decision making, surgical approach, fracture fixation or hemiarthroplasty, type of internal fixation, and rehabilitation protocol. Non-operative treatment may be preferable for displaced three-part proximal humeral fractures in elderly patients, but pain and loss of function have been reported in high percentages of patients after this treatment approach. Decision of the fracture treatment should take into account of patient's individual needs and characteristics, such as his/her biological age, accompanying illness, bone quality and morphology of the fracture[11]. Excellent outcome have been obtained with advent of locking compression plates technology[12, 13]. It preserves the biological integrity of the humeral head and secures an anatomical reduction with multiple screws and angular stability[14].

MATERIALS AND METHOD

Due approval from the institutional ethical committee and written informed consent of the patient were obtained. All patients with Proximal humerus fractures who came to the department of orthopedics, were admitted between December 2018 to November 2019.They were assessed by antero-posterior, lateral view X-rays and CT-scan with 3D reconstruction of the affected limb. Routine Investigations were done in all patients.

The study was prospective and hospital based. Data collected were analysed using SPSS V.23.

Inclusion Criteria

All adult patients aged 18-60 years with closed displaced proximal humerus fractures. [Neer's: 2- and 3-part fractures].

Exclusion Criteria

1. Patients under 18 years and above 60 years.
2. Patients with Polytrauma and open fractures.
3. Pathological fractures.
4. Patients with distal neurovascular deficit.
5. Concomitant ipsilateral fracture of distal humerus or elbow joint.
6. Medically unfit patients.

Surgical techniques:

All the patients in this study were operated upon under regional or general anesthesia. The patients were positioned supine with affected shoulder elevated. After preparing and draping the limb, the fracture site was approached through the deltopectoral approach. The fracture was reduced carefully and fixed with k-wires temporarily; placement of tagging sutures within the rotator cuff tendons to help gain control of tuberosity fragments. The plate was positioned on the bare spot on the lateral cortex posterior to the bicipital groove, which was then fixed with angle stable screws on the humeral head and shaft. Incision wound was closed in layers with negative suction drain in situ. Pressure bandage was applied. Fixation checked by C-Arm. The operative limb was kept elevated and movement of the fingers was encouraged. During dissection and head penetration with the proximal interlocking screws, care had to be taken to avoid damage of the anterior humeral circumflex artery and the axillary nerve. The screw position has to be checked intraoperatively with image intensification.

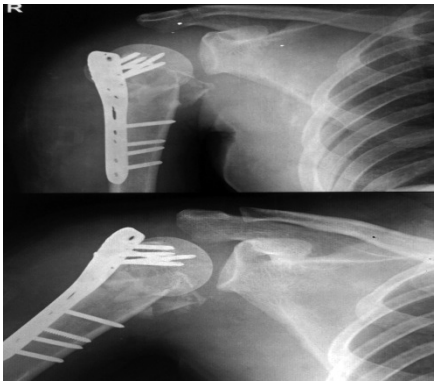
Post-Operative Rehabilitation:

Shoulder and Elbow exercises were encouraged and postoperative check x-rays were taken in both antero-posterior & lateral views on the next day of operation. For the first 3 weeks passive assisted stretching done, followed by active range of motion exercises with terminal stretching exercises until maximum active range was achieved. At 10 weeks resisted strengthening exercises were given. Second check x-ray was taken on follow up at 6th week; the fracture union was assessed clinically by absence of tenderness and radiologically by

bridging callus formation. Patients were followed up at 3 weeks, 6 weeks, 3 months, 6 months, 1 year. At each visit, functional evaluation was done according to Constant-Murley scoring system and DASH score.


Preoperative Xray Postoperative Xray


Preoperative Xray



Post operative xray

RESULTS

In our study 20 patients of proximal humerus fractures were treated with PHILOS plates. Mean age of the patients was 42.8(range 18 years to 60 years). (Table 1) There were 9 male and 11 female. The mean time from injury to operation was 7 days (range from 2 to 10 days). Fractures were classified according to Neers classification, 7 two- part and 13 three- part fractures were operated. The patients were followed up for a period of 1 year at 3 months, 6 months and 12 months. Average union time was 12(11-14) weeks. Clinical evaluation was done using Constant score. According to constant score, scores were excellent in 9(45%) patients, good in 5(25%) patients, moderate in 4(20%) patients and poor in 2(10%) patients. Mean constant score was 76(range 40-100). Excellent to good results were seen in 70% of patients. DASH score of 15.0 points was obtained at the final follow up. 25% of the patient's develops complications. (Table 4)

TABLE 1: Age and sex:

Sl. No.	Sex	Age in years			
		18-30	31-40	41-50	51-60
1	Male	1	3	2	3
2	Female	1	2	4	4

TABLE 2: Types of fracture:

Sl. No.	Sex	2-parts fracture	3-parts fracture
1	Female	4	7
2	Male	3	6

TABLE 4: COMPLICATIONS:

Complications	Number of patients	Percentage (%)
Hypertrophic scar	3	15
Sub-acromian impingement	1	5
Stiffness	2	10
Superficial wound Infection	1	5

DISCUSSION

For the displaced fracture of the proximal humerus conservative treatment leads to poor outcome due to inherent instability of fragments and intra-articular nature of injury.[15, 16] ORIF with conventional plates and screws associated with higher complication rate like AVN, Subacromial impingement, head perforation and screw loosening in osteoporotic bone.[17-20] The biomechanical studies has demonstrate significant benefits of the standard plating by using locked implants which maintain the angular stability in the face of axial loading.[21,22] The locking

compression plates provides high resistance to back out of screws even in patients with poor bone stock due to combination of fixed angular screws plate locking and 3D placement of the screws in the humeral head and provides early mobilization because of good initial stability.[23,24] It has been advised to bring the fragments near anatomical reduction before application of multi directional screws since plate doesn't helps in reduction of proximal fragments.[25] In our study 70 % of the patients had excellent to good outcome. The mean age of the patient is 42.8 with female dominance. Similar findings were reported by Raghavendra raghuvanshi et al.[27] Chandan kumar et al, in their study found that 66% of the patients had excellent to good outcome. G.Kishore et al in their study found 44.6% and Felix Brunel et al reports excellent to good results in 50% of the patient. Parmaksizoglu et al [28] in their study showed 68.7% excellent to good results. In our study the overall mean Constant score was 76(range 40-100). Solberg et al [26] in their retrospective study of neer 3-part and 4-part fractures shows constant scores of 64.7in 4- part fractures. Hypertropic scar was the major complication in 15% of the patients followed by subacromian impingement 5%, stiff shoulder in 10% and superficial wound infection in 5% of the patient. Based on our result we can say that the proximal humerus internal locking system (PHILOS) plate fixation is a suitable choice for two- part and three-part proximal humeral fractures. The only limitation of our study is that we did not compare our results with other treatment modalities.

CONCLUSION

We conclude that proximal humerus internal locking system (PHILOS) plate's fixation for 2-part and 3-part fractures has good functional outcome and is associated with complication rates. Use of this implant needs technical expertise and most of the complications occur because of intraoperative technical errors.

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OUTCOME OF RESECTION-RECONSTRUCTION ARTHROPLASTY FOR GIANT CELL TUMOR OF DISTAL RADIUS

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ABSTRACT

BACKGROUND

Giant cell tumor (GCT) of the distal radius poses problems for reconstruction after resection. Several reconstructive procedures like vascularized and non-vascularized fibular graft, osteo-articular allograft, ceramic prosthesis and megaprosthesis are in use for substitution of the defect in the distal radius following resection. Most authors advocate wrist arthrodesis following resection of distal radius and non vascularized fibular graft. Here we have analyzed the results of aggressive benign GCTs of the distal radius treated by resection and reconstruction arthroplasty using autogenous non-vascularized fibular graft.

MATERIALS AND METHODS:

Ten cases of giant cell tumor of the distal radius (mean age 32 years, mean follow-up 6 months) treated by en-bloc resection and reconstruction arthroplasty using autogenous non-vascularized ipsilateral fibular graft with a minimum followup of two years have been included in this retrospective study. Nineteen cases were of Campanacci grade III .The mean resected length of the radius was 9.5 (8-12) cm. Routine radiographs and clinical assessments regarding pain, instability, recurrence, hand grip strength and functional status were done at regular intervals and functional results were assessed using (musculoskeletal tumor society) MSTS-87 scoring.

RESULTS:

Early radiological union at host-graft junction was achieved at mean 12.5 weeks, (range 12-14 weeks) and solid incorporation with callus formation was observed in mean 18 weeks (range 16-20 weeks) in all the cases. Satisfactory range of motion (mean 63%, range 50-78%) of the wrist was achieved in 8 cases. Grip strength compared to the contralateral hand was found to be 66% (range 58-74%). Functional results were excellent in six cases (60%), good in two cases (20%) and one(10%) cases had fair results. No soft tissue recurrence was seen. The most commonly encountered complication was fibulo-carpal subluxation [4 cases,(2 clinically and 2 radiologically) 40%].

INTRODUCTION

Giant cell tumor (GCT) of bone is a benign but locally aggressive tumor with tendency for local recurrence.[1] Absence of absolute clinical, radiological or histological parameters renders the tendency of any lesion to recur or metastasize. Distal radius is the third most commonly involved site of skeletal GCTs (%10 cases) next to distal femur and proximal tibia.[2,3] Many methods have been advocated for the management of distal radial GCTs. Goals of treatment are to achieve satisfactory removal of the tumor, lessen the chance of local recurrence and to preserve as much wrist function as possible. The treatment consists of either curettage or en-bloc resection of the lesion with subsequent reconstructions.[1,4,5,6] Though curettage and bone grafting can preserve joint functions, it has been associated with high local recurrence rate of %27 to [10–7].%54 Walthar (1911) was the first to describe the use of a free non vascular proximal fibular graft to replace the resected distal radius.[11] Most of the authors have reported various success rates with the procedure. [11–17] The use of free vascularized proximal fibular graft has produced encouraging results.[18–20]

The purpose of this study is to analyze the results of GCT of the distal radius (Campanacci grade III and recurrent grade II) treated by resection and reconstruction arthroplasty using autogenous non-vascularized fibular graft.

MATERIALS AND METHODS

Ten cases of GCT involving the distal radius operated by en-bloc resection of tumor followed by reconstruction of the gap with autogenous non-vascularized fibular graft with 6 months follow-up are included in this prospective study. They were operated in Orthopaedic department RIMS, Ranchi, from January 2018 to January2019. All cases were Campanacci Grade III . Confirmation of diagnosis was by needle aspiration cytology and open biopsy .

The patient were included in this study based on following inclusion/exclusion criteria after Informed consent was obtained from all the patients.

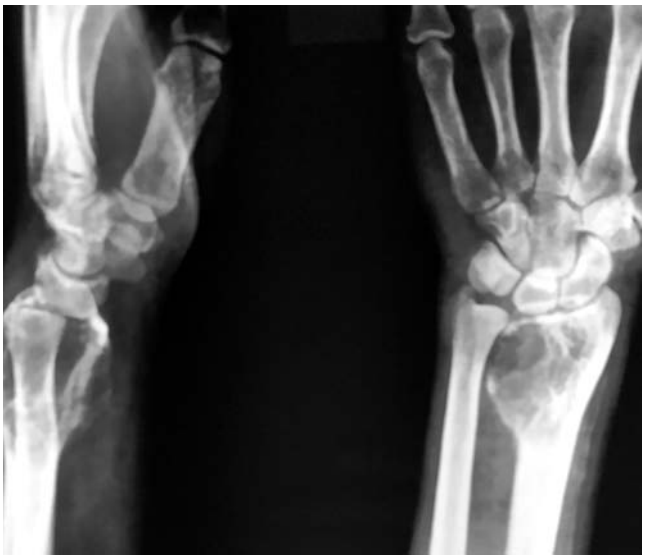
Inclusion criteria

1. Evidence is radiographic features characteristic of GCT on roentgenogram, CT scan or MRI and confirmation by needle aspiration cytology or open biopsy .
2. Age 20 to 60 years
3. ASA grade less than 2.
4. No soft tissue involvement
5. Previously any intervention has not been done.

Exclusion

1. Age less than 20 and more than 60 years.
2. ASA grade more than 2
3. Soft tissue involved
4. Recurrence of lesion
5. Patient refusal

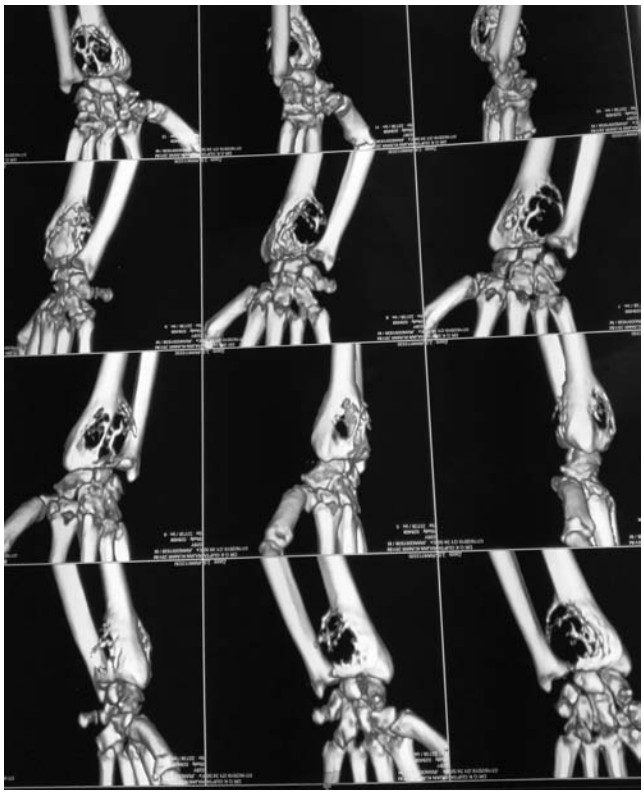
A detailed history including name age sex time of first noticed Using a volar or dorsal approach, depending upon anterior(n=07) or posterior expansion(n=03) of the lesion, the tumor along with biopsy scar was resected. Four to five cm of distal radius was excised along with the tumor with safe margin in all the cases. Clearance biopsies taken from the safe margins were negative in all the cases. The bone defect after excision of the tumor ranged from eight to twelve cm(mean 9.5 cm). Care was taken to preserve the neurovascular bundle while resecting the tumor mass from the surrounding soft tissue. Reconstruction of the bony defect was done using ipsilateral proximal fibular transplant.The articular surface of the head of the fibula was placed over the scapho-lunate articular surface and fixed to the carpals with one or two 1.5 mm K-wires inserted obliquely. The excised end of the radius and the transplant were fixed with a small DCP taking 12 cortices fixation. The lateral ligament of the wrist was created by attaching the part of the fibular collateral ligament. Another K-wire was inserted transversely to



Preopxray

stabilize the newly created fibulo-ulnar joint . Iliac cancellous bone grafting was done routinely at the host-graft junction. The limb was immobilized in a long arm cast for 8-10 weeks and followed by a forearm brace after removing the K-wires for mobilization. Protected brace was continued for another 14-16 weeks until solid union was achievedradiologically .Routine radiographs were taken at two monthly intervals for six months to exclude local recurrence. Clinical assessments regarding pain, instability, recurrence, hand grip strength and functional status were done at regular intervals of three and six months. The range of

movement at wrist joint was measured with a goniometer and grip strength was assessed in comparison with the opposite hand. Functional results were evaluated by using Musculoskeletal Tumor Society (MSTS 87) rating for limb salvage.



Preop ct

Postop X-ray

Followup X-ray at 6 months

RESULT

The mean age of 6 male and 4 female patients included in the study was 32 years (17-56 years). Average operating time was 1.5 hours. The mean resected length of the radius was 9.5 (range 8-12) cm.

Early radiological union at host graft junction was achieved at 12-14 weeks (mean 12.5 weeks) and solid incorporation with callus formation was seen in 16-20 weeks (mean 18) in all the cases

The average range of motion of the involved wrist was 50° dorsiflexion, 38° palmar flexion, 12° radial deviation, 22° ulnar deviation, 52° supination and 46° pronation. They retained 65% of contralateral hand was found to be 60-75% (average 67.5%). Functional results were excellent in six cases, good in 4 cases .

DISCUSSION

Giant cell tumor is a challenge for the surgeons

both for cure and rehabilitation. Most patients with GCT are young with normal life expectancy. The aim of treatment is to remove the tumor, reduce the chances of recurrence and preserve the joint function. The defect created by the excision of the distal radius can be filled by non-vascularized autogenous proximal fibular graft,vascularized fibula, or vascularized pedicle graft of the ulna.

Local recurrence and loss of joint function are still major problems following surgery, resection of the distal radius has been recommended to treat Grade III GCT when the tumor breaks through the cortex on dorsal and volar sides, In our study also, we have followed this recommendation.

The most commonly encountered complication in our series is found to be fibulo-carpal subluxation. Two of our cases developed a subluxated wrist with pain and partial loss of function. Another two cases had radiological subluxation of the wrist and two cases had diastasis of the fibulo-ulnar joint. These patients were clinically asymptomatic and the radiographic findings were found during routine periodic check-up. Wrist function in these patients was good with little limitation in daily activities. A proper length of fibular graft is a must to maintain the radial height and to prevent subluxation of the wrist joint. We ensured this by harvesting the fibula 2-3 mm more than the required length, which is the resected tumor length plus the safe margin. This 2-3 mm allowed us to achieve compression at the host-graft junction during fixation with DCP. A longer fibular graft will lead to subluxation of the wrist. K-wire fixation through the carpals and reconstruction of the lateral ligaments of wrist joint helps in stabilization of the wrist joint. Transverse fixation of the fibula-ulnar joint further helps in stabilization. Wrist stability is assured by fibrosis after 8-10 weeks following K-wire fixation. There is a chance of stiffness of the wrist with relatively longer duration of immobilization and consequently decrease in the hand grip strength.

We had no recurrence. None of our cases had delayed union or nonunion. Twelve cortices' fixation at the host-graft junction with a small DCP permits rigid fixation. In our series, intramedullary nail was not used for fixation of the fibular graft to the radial stump as compression cannot be achieved at the host graft junction, thereby increasing the chance of delayed or failure of union. Routine cancellous bone grafting was done at the host-graft junction, which prevents delayed union. There were no graft fracture. Arthroplasty over arthrodesis was preferred in our study to retain joint mobility. We preserved an average of 62.5% (range 50-75%) of the contralateral range of wrist motion. The grip strength compared to the contralateral hand was found to be 67.5% (range 50-75%).

GCT of the distal radius is best treated with excision of the distal radius and reconstruction by non-vascularized fibula with good functional results.Asavamongkolkul et al. reported good and excellent functional results in all seven patients of non-vascularized autogenous fibular graft reconstruction. Our method of resection and reconstruction with non-vascularized fibular graft, internal fixation with DCP with primary bone grafting, use of stabilizing K-wires across the newly formed wrist joint and ligament reconstruction has been advocated by many other authors.

CONCLUSION

Resection of distal radius and reconstruction with proximal fibular transplant is useful to preserve the functional movement and stability with normal appearance of the wrist. Further, this procedure eliminates the need for microvascular surgery. Our results showing satisfactory range of movements (62.5%) and sufficient grip strength (67.5%) with good functional results justify this procedure of reconstruction arthroplasty in case of Giant cell tumors of distal radius.

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FUNCTIONAL AND RADIOLOGICAL OUTCOME OF EXTRA ARTICULAR DISTAL HUMERUS SHAFT FRACTURES TREATED WITH USE OF PRE CONTOURED EXTRA ARTICULAR DISTAL HUMERUS PLATE

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ABSTRACT

Management of extra-articular distal humerus fractures presents a challenge to the treating surgeon due to the complex anatomy of the distal part of the humerus and complicated fracture morphology. Although surgical treatment has shown to provide a more stable reduction and alignment and predictable return to function, it has been associated with complications like iatrogenic radial nerve palsy, infection, non-union and Implant failure. We in the present series retrospectively analysed10 patients with extra-articular distal humerus shaft fractures surgically treated using the extra-articular distal humeral locking plate approached by the triceps-sparing posterolateral approach. The outcome was assessed using the DASH score, range of motion at the elbow and the time to union. The mean time to radiographic fracture union was 12 weeks.

INTRODUCTION

Extra-articular fractures of the distal humeral shaft are relatively rare injuries and have been in the limelight owing to a higher incidence of radial nerve injuries, as well as the dilemmas surrounding their management [1, 2]. Both conservative and surgical treatment options exist for these fractures, with the ideal treatment still being debatable. Bracing has been an acceptable option for humeral shaft fractures; however, in the distal third of the humerus in adults it can cause problems owing to difficulty in controlling angulation. Sarmiento reported his results of functional bracing for comminuted extra-articular fractures of the distal third humerus. There was varus deformity averaging 9 degrees in 81% of patients, but loss of range of movement was minimal and functional results were good [3]. However, O'Driscoll et al. [4] showed that cubitus varus deformity secondary to supracondylar malunion or congenital deformity of the distal part of the humerus may not always be a benign condition and may have important long-term clinical implications including tardy posterolateral instability. Although surgical treatment seems to provide a more reliable and predictable alignment and potentially quicker return of function, iatrogenic radial nerve palsy is a cause of major concern [5]. If the decision to proceed to surgical intervention has been made, then plate osteosynthesis is the usual standard option [6]. The classical teaching for fixation of a humeral shaft fracture has been with a narrow/ broad 4.5 mm low-contact dynamic compression plate, purchasing a minimum of eight cortices (i.e. 4 screws) on either side of the fracture zone or at least six cortices (3 screws) on either side if a lag screw has been used [6]. This, however, becomes difficult to achieve in distal humeral shaft fractures owing to the limited space available distally, as well as the curved shape of the distal humerus when approaching anteriorly and the presence of the olecranon fossa posteriorly (Fig. 1). Double-column plating using two 3.5mm plates in orthogonal or parallel patterns is another roption [7], but it requires greater soft tissue stripping and exposure, leading to a potentially higher non-union and infection rate and elbow stiffness reported in some series [5, 8]. In the present retrospective case series, we present our clinical experience with use of a single column pre-contoured extra-articular distal humeral locking compression plate for treatment of extra-articular distal humeral fractures. It was a

retrospective study aimed to evaluate the clinical and radiographic results after fixation of fractures of the distal humerus shaft with this single column system

MATERIALS AND METHOD

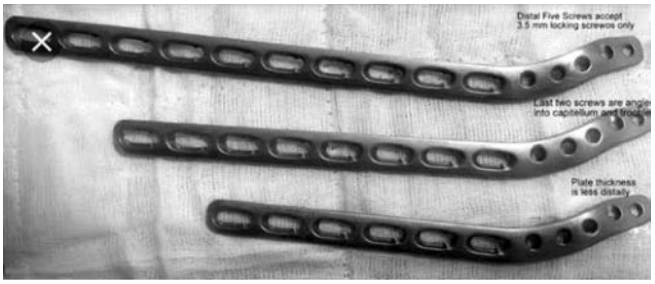
IMPLANT:3.5-mm LCP (Locking Compression Plate) extra-articular distal humerusplate is an anatomically shaped and angular stable fixation system for extra-articular fractures of the distal humerus. Distally, the plate accepts five 3.5-mm locking screws and is tapered to minimize soft tissue irritation and the screw hole density is greater to allow larger number of screws to be placed in the distal fragment (Fig. 2). The two most distal screw holes are angled towards the capitellum and trochlea, which allows longer locking screws to be placed distally. Proximally, the thickness of the plate is based on LCP 4.5/5.0, narrow and has combi-holes. Locking screws create a fixed-angle construct, providing angular stability, whereas the combi-holes can be used to provide inter-fragmentary or dynamic axial compression. As the plates are anatomically contoured, there are different plates for the right and left sides and it is available from 4 hole (122 mm) to 14 (302 mm) hole length.

INCLUSION CRITERIA :

i) fractures of the distal humeral shaft which could not be fixed with conventional LCDCP's
ii) age >18 years
iii) closed fractures of the distal humeral shaft, with or without radial nerve palsy

CLINICAL OUTCOME

Clinical outcome was assessed using Disabilities of the Arm, Shoulder and Hand (DASH) score and the range of motion of the elbow joint for each patient. The union was assessed clinically and radiologically; clinically by absence of pain and tenderness on palpation and range of motion at elbow joint, ability to perform activities of daily living without pain. Anteroposterior and lateral radiographs were done, and the healing progress of the distal humerus fracture was assessed. Union was defined by the absence of fracture line or bridging of the fracture site on at least 3 of the 4 cortices and the absence of implant loosening or failure



SURGICAL TECHNIQUE : Patient is placed in the lateral position under brachial block(BB), with the arm hanging by the side. A tricepsreflecting posterolateral approach of Gerwin et al. [9] is utilized to expose the fracture site. After performing a midline skin incision on the posterior aspect of arm, full thickness flaps are developed on the lateral side (Fig. 3). On the lateral side, using blunt dissection, the lower lateralcutaneous nerve of the arm is identified and its origin traced to the radial nerve (Fig. 4). The triceps is elevated from the lateral inter-muscular septum and the lateral supracondylar ridge, and the radial nerve is then carefully dissected (Fig. 5). After adequate fracture visualization, reduction clamps are used to reduce the fracture fragments. Provisional fixation is achieved with K wires, and lag screws are used wherever possible to increase the strength of the construct and achieve adequate compression in spiral fractures (Fig. 6). Finally, the Synthes TM extra-articular distal humerus plate is applied over the posterior surface of humeral shaft and fixed with locking screws distally and a combination of cortical and locking screws proximally. The plate is positioned so that its shaft portion is located centrally on the posterior aspect of the humerus, while the distal end curved along the posterior aspect of the lateral column (Fig. 7). Plate bending is required in some cases for better seating of the plate to the bone surface. Postoperatively, the patient is placed in a soft dressing and arm pouch sling and early range of motion of the elbow, wrist and shoulder is started.

RESULTS

It was retrospective study of 10 patients with

extra-articular distal humeral shaft fractures who were operated using the EADHP system from october2018 to October 19. Patients age, sex, mode of injury, interval between injury and surgery, status of radial nerve, associated injuries, time to union and elbow range of motion were noted. The final DASH score was measured at 1 year. Additional support in the form of elbow brace/plaster-of-paris cast/slab was not used in any of the patients. The average age of the patients at the time of surgery was 46 years (range 31–62 years) with 7 males and 3 females. The most common mode of injury was fall form height(7 patients)followed by road traffic accidents (3patients),. Onepatients had associated radial nerve palsy, but intra-operatively the nerve was found to be intact in both the cases and nerve function recovered with time (Fig. 8). One patient sustained additional injuries; had an ipsilateral radial fracture, . All patients were operated within 5 days of injury, . The mean time to radiographic fracture union was 12 weeks (range 10–18 weeks) (Fig. 9). ROM and DASH scores are presented in Table 1. At final follow-up, the mean flexion was 125 degree and only one patient had a flexion deformity of 5 degree. The mean DASH score at 1 year was 17.6 ranging from 13.3 to 38.3 points. The normal DASH score in the general population has been reported to be around 10 with a standard deviation of 14.68 [10]. There were no patients with secondary loss of reduction at the fracture site, non-union, ulnar nerve problems, superficial or deep infection. The most common fracture pattern was spiral: AO type 12 A1 (simple spiral): three cases; B1 (wedge spiral): nine cases; C1 (comminuted spiral): three cases. Lag screws (ranging from 1 to 5) were used in all the cases. Eight hole plate length was used in the majority of the cases (8 out of 10), and in the rest ten hole plate was used. A total of 3–4 screws were used for proximal fixation, and 5–6 were used for distal fixation (Fig. 9).

S. No	Age	Sex	Mode of injury	Radial nerve	Time interval b/w injury and surgery in days	Associated injuries	Follow up duration in months	DASH score at 1 year	Time to union in week	Elbow flexion	Elbow pronation supination	AO type	Number of lag screw	Plate lenth combi holes	Proximal fixation	Distal fixation
1	31	F	fall	Intact	4	Nil	12	14.2	12	0-130	85/85	12B2	2	8	3	5
2	42	M	Fall	Intact	4	Nil	6	13.3	16	0-140	80/80	12A2	1	8	3	3
3	38	M	RTA	Intact	3	Nil	8	15	12	0-120	80/75	12C1	1	8	3	5
4	56	M	RTA	Intact	4	Nil	16	18.3	18	0-135	90/85	12c1	1	10	3	5
5	62	M	fall	Intact	4	#Ipsi-lateral radius	12	23.3	15	0-125	80/85	12B1	2	8	4	5
6	50	M	Fall	Neuro-praxia	3	Nil	12	30	16	5-120	75/80	12C1	1	10	3	5
7	44	M	RTA	Intact	4	Nil	14	18.3	12	0-130	75/75	12B	1	8	3	5
8	48	F	RTA	Intact	4	Nil	12	17.5	16	0-135	80/80	12B1	2	8	3	5
9	39	M	Fall	Intact	5	Nil	12	18.3	12	0-120	80/85	12A1	1	8	3	5
10	54	F	Fall	Intact	4	Nil	14	20	12	0-120	85/90	12c1	2	10	3	5

DISCUSSION

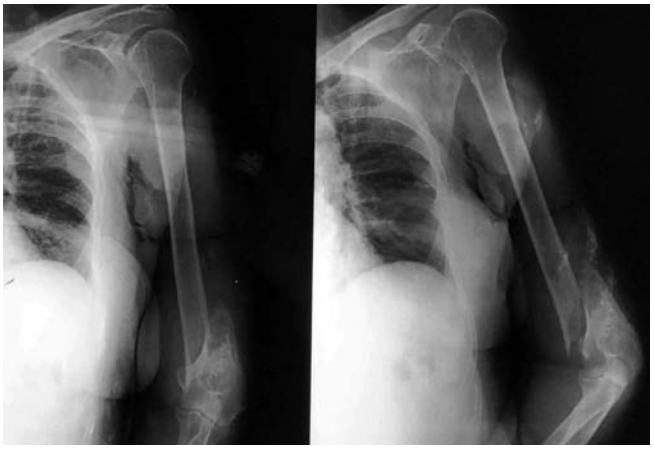
Open reduction and internal fixation of distal humeral shaft fractures is increasingly becoming an acceptable treatment modality. [5, 11–14] Options for internal fixation include intramedullary nailing and plate osteosynthesis either with double-column plating or a single column plate applied onthe posterior or posterolateral side. Biomechanical studies have shown superior bending properties of humeral fractures fixed with a plate and screw system versus intramedullary devices. Also, the distal fragment is short and the medullary canal is narrow, rendering it difficult to perform nail osteosynthesis in distal third fractures [15]. Dual plating although offers a better biomechanical strength [16] does so at the expense of greater soft tissuedissection. It requires almost circumferential exposure of both the medial and lateral column. Such an enormous soft tissue dissection and exposure although justifiable for intraarticular fractures seems unreasonable for extra-articular shaft fractures. Preservation of the soft tissue envelope is an important aspect in fracture healing, and it has led to the change in the earlier concept of anatomic reduction and rigid fixation [17]. This concept is no longer valid for most of the extra-articular fractures with complex fracture patterns, where minimal soft tissue dissection and stable fixation has shown to have better results and is now the standard principle [18]. Although there have been no comparative studies of dual column vs. single column fixation for distal humerus fractures, we believe and suggest that the higher infectionand non-union rates quoted in many series of distal humerus fractures may in part be due to greater soft tissue dissection and a longer operative time required for dual column plating [5, 8]. Yang et al. [18] also suggested that the excessive soft tissue dissection required for dual plating may be responsible for the increased incidence of iatrogenic radial nerve palsy reported in some series. Placement of implant over the distal medial aspect of humerus which has a scant soft tissue cover also leads to a high incidence of implant-related complications such as ulnar neuropathy [19]. To circumvent these problems, single columnplating has been suggested by many to be the answer. Standard single column plating techniques fail to achieve adequate stabilization owing to many factors; the most important being inadequate distal purchase. Levy et al. [20] used modified Synthes Lateral Tibial Head Buttress Plate (Synthes, Paoli,PA) that allowed for a centrally placed posterior plating of the humeral shaft that angled anatomically along the lateral column to treat far distal humeralshaft fractures. The advent of modern locking plates has allowed improved fixation of the peri-articular frastudies have demonstrated and confirmed the increased stability provided by locking plates at the distal femur, proximal tibia, calcaneum, distal radius and proximal humerus [21–25]. This increased strength of fixation has in some cases obviated the need for dual column fixation. Several studies have demonstrated that the mechanical stability and overall stiffness of a laterally placed locked plate in the proximal tibia is equivalent to the control of historical dual plating [26–28]. The extra-articular distal humeral locking plate is based on a similar concept of single column plating. Owing to greater screw hole density distally, it allows the placement of adequate number of screws in the distal fragment and thectures. Numlocking construct increases the stability. Since only the lateral column is exposed, it decreases both the soft tissue dissection and the surgical time. As compared to the trochlea, the posterior aspect of the lateral column is nonarticular and allows for posterior placement of implant without risk of injury to the cartilage or risk of impingement with flexion and extension. We in the present series used the posterolateral approach of Gerwin et al. [9] which has several advantages over the traditional triceps splitting approach. Sparing the triceps muscle limits the formation of intramuscular adhesions and scar formation and theoretically reduces the chances of elbow contracture and improves post-operative triceps function. The exposure canbe extended proximally and distally; proximal extension is by elevating the triceps off the humerus and mobilizing the radial nerve, and distal extension can be accomplished by converting the approach into an olecranon

osteotomy approach, TRAP approach [29] or Bryan and Morrey [30] approach if there is an intra-articular extension of the shaft fracture. Triceps-reflecting anconeus pedicle (TRAP) approach involves complete detachment of triceps from proximal ulna along with anconeus using sharp dissection. The entire flap is then lifted off the posterior aspect of distal humerus. Lewisky, Sheppard and Ruthdescribed how the posterolateral approach can be extended proximally and distally to expose most of the posterior humeral shaft and elbow joint for complex fracture treatment. They described the combined olecranon osteotomy, lateral paratricipital sparing and deltoid insertion

Intraoperative picture

splitting (COLD) approach [31]. Approximately 94% of the humeral diaphysis can be exposed with the posterolateral approach (Fig. 6c) as compared to the triceps splitting approach which provides exposure to only 76% of the shaft [9]. This enhanced exposure also provides complete visualization of the radial nerve on both sides of the intermuscular septum and since it exploits a relatively blood less plane, this approach can be performed without a tourniquet. DASH score was used to assess the functional outcome. This questionnaire asks the patient about symptoms as well as their ability to perform certain activities. The questions are answered based on the condition in the last week. If patient did not have anopportunity to perform an activity in the last week, the best estimate is made. It does not matter which hand or arm is use to perform the activity. The normal DASH score in the general population has been reported to be around 10 with a standard deviation of 14.68 Our study has a few limitations, namely a small sample size, and the lack of a biomechanical study to test and compare the strength of a singlecolumn vs. double-column locking plate. As the plate is pre-contoured, it does not seat equally well in all patients and bending the plate can potentially damage the locking hole screw threads and can also change the screw direction to a certain extent. Improperly lockedscrews can compromise thestability ofthe construct, and the change in screw direction can pose a problem in the distal screws which are directed into the capitellum and trochlea. To circumvent this problem, plate bending should be done after blocking the screw holes with locking sleeves and bending the plate only in between the screw holes. Tejwani et al. [16] in their laboratory study demonstrated that a double plating construct is stiffer than one single-locking plate, especially in varus stress when the mepatients did not encounter any patient with a comminuted medial column; those who had so, also had some intraarticular extension of the fracture and were treated by conventional dual plating system. The increased stress placed on a single (lateral) column fixation in the absence or comminution of the other (medial) column leads to increased strain over the

implant at the fracture site, which can lead to implant failure in absence of union. This can to some extent be negated by using a longer plate with widely spaced screws to increase the working lengthdial column is absent. We, however, in our series of 20 [10].patients did not encounter any patient with a comminuted medial column; those who had so, also had some intraarticular extension of the fracture and were treated by conventional dual plating system. The increased stress placed on a single (lateral) column fixation in the absence or comminution of the other (medial) column leads to increased strain over the implant at the fracture site, which can lead to implant failure in absence of union. This can to some extent be negated by using a longer plate with widely spaced screws to increase the working length



Preop xray

CONCLUSION

The EADHP system using the modified posterior approach to the humerus is a useful treatment option for managing extra-articular distal humerus fractures. The provision of greater screw hole density of the plate distally and using 3.5-mm screws instead of 4.5 mm allows adequate number of screws to be placed in the distal fragment. Bi-columnar fixation of distal humerus provides increased stability, but requires increased soft tissue dissection. EADHP fixation of distal humerus fractures using the modified posterior approach provides stable fracture fixation with adequate exposure of the radial nerve and[90% of posterior humeral shaft surface.

Postop xray

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SEASONAL VARIATIONS IN INCIDENCE OF FRACTURES AMONG ELDERLY PEOPLE:

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ABSTRACT

OBJECTIVE

To investigate seasonal variations in the incidence of fall related fractures among people 50 years and older.

POPULATION AND METHODS

A prospective,population based cohort study was performed on people aged 50 years and older followed up from 2015 to 2019.

RESULTS

There were 4821 fall related fractures. The risk was higher in the colder seasons (October through March) among people aged 50-80 years (relative risk (RR) =1.39, 95% confidence interval (CI) 1.32 to 1.47) and in people aged 50 years and older (RR = 1.17, 95% CI 1.09 to 1.22). For arm fractures, the RR was 1.69 (95% CI 1.56 to 1.83) among people aged 50-80 years and 1.30 (95% CI 1.13 to 1.43) among those aged 50 years and older. The RR for hip fractures was 1.27 (95% CI 1.15 to 1.37) among people aged 50-80 years and 1.08 (95% CI 1.00 to 1.15) for people aged 50 years and older. Slipping on wet and moist surface seems to entirely explain the excessive incidence of hip and arm fractures during winter months.

CONCLUSION

Season affects the incidenceof all types of fractures in elderly people. Slipping on wet and moist surface seems to be a causal mechanism behind the seasonal effect. Preventive measures targeting this causal mechanism are likely to reduce the risk of fracture, but the size of the effect is difficult to estimate with certainity.

Falls are a main cause of injury among elderly people and a major public health problem. The most serious common fall injury is a hip fracture. Numerous studies have investigated risk factors for hip fractures, including the effect of seasonal changes.

Various hypothetical causal mechanisms for these seasonal variations have been observed. Differences in exposure to sunlight in winter and summer have been suggested as one possible explanation. Reduced sunlight may result in poor visual acuity because of shorter daylight periods, low sun on the horizon, reduced synthesis of vitamin D and consequent osteomalacia. Cold weather may also result in decreased activity and concomitant increased bone loss.

Falling temperature in winter may increase risk of slipping. In one study, the risk of hip fracture was related to moist and slippery winter weather conditions among women aged 50-80 years, but not among women aged 75 years and older.[8]

It is unclear which of the proposed pathways accounts for the seasonal variations in hip fracture. Also unknown is whether similar variations occur for other types of fractures among elderly people.

The current study investigates seasonal variations in the incidence of different types of fractures among the elderly, and estimates the contribution of slipping on wet and moist surfaces to the pattern of these injuries.

POPULATION AND METHODS

We conducted a prospective observational population based cohort study in a defined population aged 50 years and older in RIMS RANCHI. The study lasted from 1 January 2015 to 30 Nov 2019. The total number of person years of follow up was divided into exposure during the four colder seasons (from 1 October through 31 March), and during the five milder seasons (from

1 April through 30 September). The same subjects served both as the exposed population (exposure time during the colder seasons) and the control population (exposure time during the milder seasons). New subjects entered the population by reaching the age inclusion limit (50 years) or by moving into the study area. The subjects left the study population by emigrating or by dying.

Outcome was defined as a fall related fracture. Cases were identified through an ongoing prospective registration of admission of patients in the department of orthopedics, RIMS , RANCHI.

Table 1 : Incidence of fractures among elderly people by nature of injury, age, sex, and season of the year

	Women				Men				Both sexes	
	Incidence/ 100 000				Incidence/ 100 000					
	person years		Incidence rate ratio	PAR	person years		Incidence rate ratio	PAR	Incidence rate ratio	PAR
	Winter	Summer	(95% CI)	(%)	Winter	Summer	(95% CI)	(%)	(95% CI)	(%)
50-80 years										
Hip	128	107	1.20 (1.08 to 1.33)	9	65	45	1.42 (1.20 to 1.70)	18	1.27 (1.15 to 1.37)	12
Arm	230	136	1.69 (1.55 to 1.84)	26	55	33	1.69 (1.39 to 2.05)	26	1.69 (1.56 to 1.83)	26
Other	87	74	1.17 (1.04 to 1.33)	8	42	41	1.03 (0.85 to 1.25)	1	1.12 (1.02 to 1.25)	6
Any	446	318	1.40 (1.32 to 1.49)	17	163	119	1.36 (1.22 to 1.52)	15	1.39 (1.32 to 1.47)	16
>80 years										
Hip	506	478	1.06 (0.98 to 1.15)	3	276	245	1.13 (0.96 to 1.32)	6	1.08 (1.00 to 1.15)	4
Arm	241	195	1.24 (1.10 to 1.40)	11	82	54	1.52 (1.10 to 2.09)	21	1.30 (1.13 to 1.43)	13
Other	127	96	1.31 (1.11 to 1.56)	14	81	59	1.38 (1.01 to 1.88)	16	1.34 (1.14 to 1.54)	14
Any	875	770	1.14 (1.07 to 1.21)	6	441	359	1.23 (1.08 to 1.40)	10	1.17 (1.09 to 1.22)	8

CI = confidence interval; PAR = population attributable risk.
Summer: 1 April through 30 September; winter: 1 October through 31 March.

Fractures caused by motor vehicle crashes and occupational injuries are excluded. Multiple fractures from the same injury event were calculated as a single case. Repeated fractures to the same person on different occasions were calculated as separate cases.

We stratified the analysis by age (50-80 years and 80 years and older), sex, and nature of injury. For nature of injury, cases were grouped as follows: hip fracture (InternationalClassification of Diseases, ninth revision(ICD-9) code 820), arm fracture (ICD-9 codes 812±817), other fracture (ICD-9 codes 800±829 excluding hip and arm fractures). In the case of multiple fractures occurring in a single injury event, the following order of preference was followed: hip fracture, arm fracture, other fracture. The seasonal pattern was analyzed by calculating the relative risk for injury during the exposure to colder seasons compared with the exposure to the milder sea-sons. We also analyzed month-by-month changes in incidence rates, but that did not help to better clarify the seasonal patterns, due to smaller samples and larger random variations. Relative risk (RR) was calculated as the incidence rate ratio. Confidence intervals (95% CI) for the RR were calculated for each age, sex, and nature of injury subgroup by applying estimation method used for the person time denominator.[20] The joint incidence rate for both sexes within the same age and nature of injury subgroup was estimated by the Mantel-Haenszel procedure using the relative size of the groups as the weighting factors.[20]

The contribution of wet and slippery condi-tions to the incidence of injuries was analyzed by classifying cases in those caused by slipping on wet and moist surfaceand those due to all other mechanisms. We calculated incidence rates stratifed by each age, sex, and nature of injury.

RESULTS

From 2015-19 , 4821 fall related fractures occurred among people aged 50 years and older in the study population. Of these, 75% were caused by falls on the same level, 14% caused by falls from a level less than 1.5 m high, and fewer than 1% caused by falls from a level higher than 1.5 m. For 8% of the cases this information was missing.

Table 1 shows the incidence rate of injuries by nature of injury, season of the year, age, and sex.

There was a statistically significant difference in incidence rate of injuries occurring during the colder seasons for each sex and age subgroup. The difference was larger among people aged 50-80years (RR = 1.39) than among people aged 80 years and older (RR = 1.17). It was similar for both men and women in the respective age subgroups. Approximately 16% of the cases in the age group 50-80years and 8% of the cases in the older age group could be attributed to effects associated with colder season.

The difference in incidence rate of fractures between the colder and warmer seasons is most pronounced for arm fractures. Among people aged 50-80years, the incidence rate of arm fractures was 69% (95% CI = 56% to 83%) higher during the colder season compared with milder season. The pattern was similar for women and men. Among people aged 80 years and older, the incidence rate of arm fractures was 30% (95% CI = 13% to 43%) higher dur-ing the colder compared with the milder season. The eVect was higher among men (RR = 1.52) than women (RR = 1.24).

Twenty seven per cent (95% CI 15% to 37%) more hip fractures occurred during the colder than the milder season among people aged 50-80years. The effect was somewhat higher among men (RR = 1.42) than women (RR = 1.20). Twelve per cent of all hip fractures occurring among people aged 50-80years were attributed to the season effect. Among people aged 80 years and older, the seasonal pattern in occurrence of hip fractures was moderate (RR = 1.08, 95% CI 1.00 to 1.15). Only 4% of hip fractures were attributed to the effect of season.

Other fractures also showed statistically significant seasonal variation. Among people aged 50-80years, the effect was smaller (RR = 1.12) than among people aged 80 years and older (RR = 1.34).

Table 2 shows the incidence rate of injuries by age, sex, nature of injury, season, and cause of accident. The excess incidence of hip.

Table 2 Incidence rate (per 100 000 person years) of fall fractures by age, sex, nature, season and cause of the accident

	Hip fracture		Arm fracture		Other fracture	
	Wet/moist surface	Other	Wet/moist surface	Other	Wet/moist surface	Other
Men						
50-80 years						
Summer	1	45	1	32	1	40
Winter	17	47	23	32	13	28
>80 years						
Summer	3	243	0	54	0	59
Winter	34	242	22	60	14	67
Women						
50-80years						
Summer	1	106	2	134	1	73
Winter	22	105	95	134	24	63
>80 years						
Summer	1	478	1	193	1	95
Winter	30	475	40	202	18	108

Also, other mechanisms may play a part. From our data it is difficult to estimate how

large the injury prevention effect of the improved wet and moist surface removal and the application of friction increasing materials would be. Intervention studies are required to answer that question.

This study has some limitations. Cases are missed if treated outside the registration system catchment area. This is, however, unlikely to cause major distortion of the end ings. People are probably more likely to travel during the warmer season, leading to a differential underestimation of incidence rates for colder and warmer seasons. Fractures is entirely due to the fractures occurring by slipping on ice and snow. A similar finding is suggested for arm fractures. For other fractures, the excess risk is less clearly related to slipping on ice and snow.

DISCUSSION

Studies investigating seasonal pattern in the incidence of hip fracture are contradictory. In the current study, a seasonal variation in incidence of fall related fractures among elderly people exists for all types of fractures and in all age and sex groups. The seasonal pattern is most pronounced for arm fractures.

Our study strongly suggests that the seasonal effect on the incidence of hip and arm fractures occurs entirely due to slipping On wet and moist Seasonal effects are less likely to occur in areas with mild winter temperatures. This may explain the lack of seasonal variations in some studies. A seasonal effect on hip fractures among the oldest old is small and unlikely to be observed in studies performed on small samples.

Our study suggests that preventive measures

should be targeted to moist and slippery surface conditions. Avoiding walking on moist & slippery Surfaces , increasing friction on the moist surfaces - are preventive measures.

Population attributable fractions suggest a substantial . Information bias may also play a part , People may over-report by wrongly describing injuries as related to slipping on ice and snow, or under-report by failing to describe them correctly. Under-reporting is more likely and cannot be easily ruled out. But it would make our conclusions about the importance of slipping on wet and moist surfaceeven stronger.

Implications for prevention Slipping on wet and moist surface seems to be main factor contributing to the excess seasonal risk of hip, arm, and other fractures among elderly people. Preventive measures targeting these causal mechanisms are likely to result in a reduced risk of fracture, but the size of the effect is difficult to estimate with certainty. A variety of preventive measures could be prevention potential from a more intensive use of these measures. However, caution is required before translating the population attributable fractions calculated in this study into risk reduction estimates. The population attributable fraction is not the same as the preventable fraction.21 The fact that a proportion of injuries can be attributed to slipping on wet and moist surface does not imply that the same proportion of injuries would be avoided if all exposures related to slipping in wet & moist surfaces are removed.

Applied health education, use of safety equipent, removal of ice and snow, or home food delivery services to the elderly during cold periods. Little is known about the costs and effectiveness of such measures, and good evaluation studies are needed to help select them.

MANAGEMENT OF FRACTURE OF DISTAL RADIUS BY EXTERNAL FIXATOR USING THE PRINCIPLE OF LIGAMENTOTAXIS

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ABSTRACT

BACKGROUND AND OBJECTIVES

Fracture of distal end of radius continues to be one of the most common skeletal injuries since thedescription by Poteau in 1783 and by Colle's in 1814. Management of these fractures is still a challenge for orthopaedic surgeon in achieving good functional results. Numerous techniques have been described and developed to treat the fracture in an effort to improve the outcome. A prospective study of management of fracture-distal radius by external fixator using the principle of ligamentotaxis was conducted at our institute to evaluate the clinical efficacy of external fixator with ligamentotaxis in distal radius fracture reduction, fracture healing, functional recovery after surgery and common complications encountered.

METHODS

A prospective study of 10 cases of fracture lower end of radius in age group 20-60 years was done who were treatedwith ligamentotaxis in the department of orthopaedics at our institute from June 2018-November2019. Fracture was anatomically reduced and fixed with Joshi`s external fixator with ligamentotaxis. All patients were monitored for pin tract infection and other complications. Active finger movements were advised by the patient from second post operative day. Regular clinical examination, periodical check X-rays were taken to assess the union of fracture. Patients were followed up to 1yearwith average duration of 9 months.

RESULTS

We found that in all cases there was union of fracture on an average of 6weeks. There was no case of non union; therewere 2 cases of acceptable malunion and 2 cases of joint stiffness and one case of pin tract infection Interpretation and conclusion: With external fixation and ligamentotaxis the result in majority of cases was either excellent orgood. Hence we concluded that external fixator with ligamentotaxis is a good method of treatment in fracture distal end of radius.

INTRODUCTION

Fracture of the distal end of radius is one of the most common fractures. It occurs in middle aged and elderly women commonly. It also occurs in young men with high velocity injury though less in number. With increase in longevity and activity in middle aged to elderly population, there is increase in number of these fractures[1]. Patients with fracture distal end of radius have serious complications more frequently than generally appreciated[2] and failure in management may cause permanent disability[3]. Distal radius fractures crush the mechanical foundation of the man's most elegant tool, the hand. Fit middle aged patients do not expect their wrist to be deformed and do expect a strong mobile hand. Previous policies of benign neglect, is no longer acceptable. Therefore treatment methods are continually improving and best suitable method of management has to be followed in each case [1]. Pain and disability have resulted from subsequent malunion of unstable fracture of distal radius which were managed by conservative method like plaster cast alone[4,5]. With increasing demand in functional recovery previously held dictum of cast

treatment for patients with distal radius fractures are being challenged both by surgeons and society, although some patients still seem to confirm Abraham Colle's famous remark that stated "wrist will at some remote period again enjoy perfect freedom in all of its motion and be completely exempt from pain", an increasing preponderance of published studies support the need for operative intervention in these patients[6]. Recently surgical management has been widely recommended and performed to prevent disability. Several studies has shown convincingly that functional outcome is good when the anatomy is restored by obtaining good reduction of fracture fragments, maintaining the angulations of the articular surface of radius and radial

LENGTH [7,8,9]

Various surgical interventions are available presently, like percutaneous pinning, intra focal pinning, external fixator and plate fixation[10]. External fixator may be performed in a bridging technique and a non bridging technique. Bridging external fixator allows distraction across the radio carpal joint[6]. The moulding of fracture fragments into alignment by traction force applied across the fracture through the surrounding soft tissue is known as ligamentotaxis. Anderson and O Neil were first to maintain fracture reduction with an external fixator using the principle of ligamentotaxis. Multiple studies have documented the Management of fracture of distal radius by external fixator using the principle of ligamentotaxis… efficacy of this technique [11,12, and 13]. The present study "Management of fracture of distal end of radius by external fixator using the principle of ligamentotaxis – a prospective study" was undertaken in department of orthopaedics at our institute to study fracture healing and functional outcome in distal radius fracture following external fixation with ligamentotaxis.

AIMS AND OBJECTIVES

To study the role of external fixation and to determine the importance of anatomical reduction in distal radius fracture. To study, the role of ligamentotaxis in the management of distal radius fracture. To know the advantages, disadvantages and complications by using external fixator with ligamentotaxis and to evaluate the results of fracture distal end of radius managed with external fixator with principle of ligamentotaxis.

MATERIALS AND METHODS

Tenpatients who have sustained fractures of the distal radius admitted in the department of orthopaedics at our institute were studied. The inclusion criteria followed was adults between age group of 20 years to 60 years with fracture lower end of Radius, closed and open fractures (Gustilo – Andersons type I and II), fractures less than 2 weeks old, comminuted fracture lower end radius and intra articular fracture of lower end radius. The patients with pathological fracture, fracture more than 2 weeks old, non-union, fracture with neurovascular complications, fracture associated with other bone fracture in the wrist hand or forearm and complex fractures with depression of articular surface and fracture radial styloid were excluded from study.

METHODS

Patients with distal end radius fractures admitted in our institute after meeting the inclusion and exclusion criteria were taken up. All patients were evaluated preoperatively by clinical and roentgenographic examination. Systemic, haematological investigations, chest X-ray and assessment of cardiac status using ECG were done as a routine with pre anaesthesia evaluation. Preoperatively patients were immobilized with Plaster of Paris or splints. Patients were informed about the operative procedure and consent taken.

Surgical Technique

Under regional block anaesthesia or General Anaesthesia depending upon anaesthesiologist preference, patient was placed supine on the operating table. The forearm and hand were scrubbed with betadine and saline. The tourniquet

was applied over the arm. The forearm and hand were painted with betadine and draped. The operating forearm was placed on a radiolucent arm-board. Closed reduction was done under C-arm. Wound debridement and wound care was given in compound fracture. In our technique, 5mm incision for 4 shanz pins, 2 in the middle third of the radius on the dorso lateral aspect about 10-12cm from distal end of radius and 2-3cm apart. We have done soft tissue dissection using a haemostat, care taken to avoid injury to radial nerve. Another 2 incision over the base of the second metacarpal on dorso lateral aspect about 1-2cm apart were done, 3mm shanz pin were inserted in the radius, and 2.5mm Shanz pins were introduced in second metacarpal, then with fixator pins securely in place, clamps and external fixator rod were mounted to shanz pin. The clamps were loosened and longitudinal traction was given.

The fracture fragments back into a more normal alignment and gentle flexion and ulnar deviation was maintained. The reduction was confirmed through image intensifier and then external fixation device was locked into place. The tension across the wrist generated by the external fixator device which provides enough ligamentotaxis was confirmed by image intensifier wherein, radio carpal articulation was seen to be 1 mm wider than the mid-carpal joint in Antero-posterior projection. The average duration from the date of injury to the date of operation was 4 days ranging from 1st to 14th day.

Postoperative Care and Rehabilitation

The check X-rays were taken in both anteroposterior and Lateral views. The reduction of the fracture was confirmed and amount of distraction was also studied by radio carpal joint space in anteroposterior view, which should be 1 mm wider than the midcarpal joint space. Active exercises of fingers, thumb, elbow, forearm and shoulder were commenced from the day 1 of operation. On the 4thpost operative day the dressing was removed. The pins were cleaned and small dressing around the pins was applied. Patient was discharged on 6th day with an advice to clean the pins alternate days and was followed up after 2 weeks, 4 wks, 6wks, 8 wks and 12 wks. On demonstration of the radiological union, the external fixator was removed after 5-7 weeks (average 6 weeks) and physiotherapy of the wrist was commenced. A removable splint for forearm was applied during night time and was removed during day time for physio-therapy for another 2 weeks and wrist and finger exercises were taught to continue at home. The follow up period was ranging from minimum 3 months to a maximum of 12 months (Average 9 months). During the follow up, all the patients were observed for any possible complications. Each patient was evaluated for functional recovery at the end of three months and also at the latest follow up visit up by clinical and radiological examination.

External Fixator

The Joshi type of External fixator was used in our study. This fixator consists of, distractor bar attachment Management of fracture of distal radius by external fixator using the principle of ligamentotaxis… with the Schanz pins. In our series, the Joshi type of External fixator was applied in all the cases. We have used two 3mm Schanz screws for radius and two 2.5 am schanz screws for the second metacarpal and 4 mm connecting rods.

Instruments used for the Procedure

External fixator set, spanner No 7 & 8, drill-bits, electric drill or hand drill, T handle, scalpel, blade and image intensifier.

RESULTS

The assessment of functional outcome was made according to modified clinical system of Green and O'Brien 1978 and Brad way et al 1989. This modified score includes independent scores for motion, Strength, pain, and activity level, which can be objectively graded as per the Table 2. To achieve an excellent result, full range motion of wrist and forearm, strength, function of hand and comfort must be present.

Table 2: The Modified Green- O'Brein clinical scoring system

Category	Score	Findings
Pain	25	None
	20	Mild
	15	Moderate (medication required)
	00	Severe (requires narcotics)
Function	25	Same job
	20	Different job
	15	Able, no job
	00	Unable
Motion	25	100%
	15	75-99%
	10	50-74% of normal side
	5	25-49%
	00	0-24%
Strength	25	100%
	15	75-99%
	10	50-74% of normal side
	5	25-49%
	00	0-24%

Note: Motion and strength as percent of normal side.

Scoring:

Excellent : 90-100%
Good : 80-89%
Fair : 65-79%
Poor : <65%

Overall results were graded as acceptable (excellent and good), fair or poor. In our study, 2 patients had full range of movements, no pain, returned to previous job and had 100% strength to that of normal side and the results were considered as excellent. One patient had full range of movements as compared to that of opposite side with mild pain not affecting the function of wrist. He also scored more than 90% and the results were considered as excellent.4 patients had limitation of movements of wrist and forearm by 20% and decreased hand strength by 15-20% as compared to that of normal side, but they did not have pain. The function of hand was not affected and they continued their previous profession. They scored 80% and the result was considered. Management of fracture of distal radius by external fixator using the principle of ligamentotaxis… as good. Two patients had limitation of movements of wrist and forearms by 25% as compared to that of normal side, with mild pain, unable to lift heavy weights and their hand grip strength was also decreased by 20 to 25 % as compared to that of normal side. They scored between 65 – 79% and the results were considered as fair. One patient had moderate pain, which was subsiding with analgesics. Shewas unable to do heavy manual work, but could carry out daily activities. She had restriction of wrist movements by 50% as compared to that of normal side. She scored less than 65% and the result was considered as poor. The overall results were estimated according to modified Green- O'Brien clinical scoring system, 1978. The results of management of 10 intra-articular fracture of distal end of the radius were as follows in Table 3.

Table 3: Functional outcome

Outcome	No of cases	Percentage
Excellent	3	30%
Good	4	40%
Fair	2	20%
Poor	1	10%

Pre-op x ray

Post op x ray

3**Follow up x ray**

DISCUSSION

Management of fracture distal end of radius is still a challenge for orthopaedic surgeon and pose therapeutic problem in term of reduction of fracture, maintenance of reduction till the fracture unites mobility of the joint after fracture union. Failure in the management may cause permanent disability[14]. We agree with Green[9] that a good functional result usually accompanies a good anatomical reduction. Failure to identify the unstable fracture by the degree of displacement, severity of the comminution, the involvement of radio carpal or radioulnar joint[9]. Recently surgical management is being preferred over conventional method to prevent disability in unstable fracture[15]. Bridging external fixator with ligament-totaxis for treatment of fracture distal end of radius has given promising results.[16] The efficacy of ligament-totaxis in neutralizing detrimental compression forces, which are likely to cause displacement of unstable fracture with radial shortening, is a significant and increasingly appealing advance in the management of distal radius fracture[6].

In our study we treated 10 cases of fracture distal radius with external fixator using the principle of ligamentotaxis. There were 7(70%) males and 3 (30%) female patients. The increase in number of male patients is because of increase in number of road traffic accident and high energy trauma which was noticed in young adults. We restricted our study group from 20-60yrs, because management and rate of union differ in younger and older age groups. The peak incidence in our study was in age group of 30-40 years and average age was 38 years. There were 2 compound injuries and in all 2 cases wound was on volar side, one of them was type I, and other was type II (Gustilo-Anderson). Surgery was delayed in one case till the wound healed and none of them had post operative infection. It was easier to manage wound after the application of external fixator. In our study, one patient was diabetic and two were hypertensive, there were no medical problems in others. In all 3 cases disease was well under control. There was no systemic complication during preoperative, intraoperative or post operative period. The medical problems did not come in the way of fracture management, fracture healed well in 6-8 weeks. There was one case of pin tract infection despite meticulous wound care and antibiotics, with minimal discharge and pin loosening. We had to remove

the external fixator early at 5 weeks and give a wrist splint, there was mild malunion and restricted movements at wrist, with poor result, but patient did not develop osteomyelitis. Infection subsided after external fixator removal and oral antibiotic treatment.

There were 2 cases of malunion one was dorsal tilt and other with lateral tilt but with minimal restriction of movements and functional disability. These 2 cases were of comminution. There were 2 cases of wrist stiffness probably because of wrist immobilization for 7 weeks and one patient developed feature of RSD (reflex sympathetic dystrophy) because of inadequate physiotherapy. Out of 2 cases one developed reduced range of pronation and supination, because of involvement of distal radioulnar joint. In all the 2 cases there was reduced hand grip strength. We did not come across any case of non union and neurological deficit either because of fracture or because of external fixator.

Table 4: We compared our results of Jenkins N.H. etal [4]

Study	No of cases	Excellent	Good	Fair	Poor
Jenkins et al	32	13	17	1	1
our study	10	3	4	2	1

The functional outcome in our study was 30% excellent, 40% good,20% fair and 10% poor, as compared to 40.6% excellent 53% good 3% fair and 3% poor results of Jenkins et al study[4]. After comparison we noticed that our study had excellent and good result in 70% of all cases.

CONCLUSION

The present study "Management of fracture of distal radius by external fixator using the principle of ligamentotaxis a prospective study" was conducted at our institute from June 2018-November 2019. The study included 10 cases of fracture distal end of radius presenting to our hospital. For all patients a thorough clinical examination was carried out, required X-rays were taken; initial treatment was given and admitted as in-patient. After selection of patients, according to inclusion criteria careful preoperative planning and evaluation was done, patients were operated for fracture distal end of radius with Joshi's external fixator using principal of ligamentotaxis. External fixator was removed after 5-7 weeks. From the present study on 10 patients with distal end radius fractures we conclude the following: Fracture of distal end of radius is more common in age group between 31-40yrs and more common in males, and more commonly seen because of fall on outstretched hand. Right side was affected more than the left side. Restoration of anatomy of distal end of radius, early mobilization and less complication were achieved using external fixator. After meticulous post operative care, patients were followed up for clinical and radiological union, complication and functional recovery observation and results were analyzed using Modified Green-O-Brien clinical scoring system, there were 30% excellent, 40% good, 20% fair and 10% poor result. Result was good in many patients.

Hence we concluded that external fixator with ligamentotaxis is a good method of treatment for fracture of distal end of radius.

Conflict of Interest: None

Source of Support: Nil

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SURGICAL MANAGEMENT OF MEDIAL CONDYLE OF FEMUR FRACTURE IN SAGITTAL PLANE BY CANCELLOUS CANNULATED SCREW AND RECON PLATE

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ABSTRACT

Sagittal shear fracture of the distal femoral condyle is an unusual intra articular injury. Medial condylar fracture is a rare injury and has anecdotally been reported in the literature, which require prompt anatomical reduction and internal fixation.We describe a rare case of medial condylar fracture of left lower limb and its management. We describe a case of a 21-year-old male patient presenting with a 10-day-old medial condylar fracture of left lower limb. Skin condition prevented from conventional open reduction and internal fixation.

INTRODUCTION

A medial condylar fracture is a type of supra-condylar distal femoral fractures with intra-articular extension and is characterized by an associated coronal plane [1]. While they are rare inabsolute numbers, they can account for approximately 40 % of inter-condylar fractures. It is typically seen in adults after higher-energy trauma [2]. Coronal shear fracture of the distal femoral condyle is an unusual injury. While medial condylar fracture is a rare injury and has anecdotally been reported in the literature. We describe a rare case of medial condyle distal femoral fracture with intra-articular extension and its management.

CASE REPORT

A 21-year-old male was referred to us 10 days after injury to left knee after a motorbike accident. On examination in emergency his vitals were found to be within normal limits, on local examinations a small left knee joint effusion was detected. Tenderness was elicited upon palpation along the medial joint line and the medial femoral condyle. An emergency radiograph of the knee revealed a minimally displaced fracture of the medial femoral condyle with intra articular extension. Though medial condylar with intra-articular extension fracture warrants an early anatomical fixation, poor skin condition on the medial side of knee was a challenge. Henceforth, after due informed consent, patient was planned for Open Reduction Internal Fixation.

Preoperative xray

On subsequent investigations we found that patient is fit for surgery and we posted him for elective surgery. Under aseptic and antiseptic precautions patient was given spinal anaesthesia and put on OT table after dripping, knee was maintained in flexed position to relax posterior capsule, gastrocnemius and protects the neurovascular structures. About 15 cm of incision was taken along the medial parapatellar region, skin, superficial facia and surrounding soft tissue were separated and vastus medialis was dissected, finally reached to medial condyle of left femur . Fracture site was properly reduced and fixed with 6.5 mm two CC screw finally recon plate was applied for fixation of medial condyle. After successful procedure, hemostasis secured and skin was closed along with all surrounding soft tissue, drain was placed for removal of local collections. During post operative days patient was kept on IV antibiotics and pain killer along with iv fluids.

Intraoperative c-arm picture

Postoperative Check xray

DISCUSSION

We described a rare case of a medial condylar muller's type- 2B fracture managed successfully by open reduction and internal fixation with good clinical outcome at 6 months of follow-up. We feel that a medial condylar Muller's type-2B fracture occurs when the flexed knee is subjectedto a posterior and upward directed force with varuscomponent and that the proximity of the fracture lineand its obliquity depends upon the degree of kneeflexion at the time of impact. Radiographs helps indefining the exact pattern of injury but also is valuablein the surgical planning.

High grade skin lesion with damage to the extensor mechanism [3] or injury to the vessels and nerve [4,5] are extremely rare in patients with middle condyle of femur fracture.

This case report highlights the fact that an isolated medial condyle femur fracture is quite rare. Therefore these patients are prone to having the diagnosis missed. It is important for every patient and medical provider to maintain a high index of suspicion to ensure that these patients are properly diagnose and treated. When a patient is suffering extremity trauma, it is important for every provider

to examine the entire patient and to be alert to the possibility of an isolated femur in either condyle.

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LATERAL CLOSED WEDGE (MODIFIED FRENCH) OSTEOTOMY FOR POST TRAUMATIC CUBITUS VARUS DEFORMITY.

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ABSTRACT

INTRODUCTION

The cubitus varus is the most common long term complication of the supra-condylar fractures of the humerus in children. Though the deformity is considered to be more of cosmetic in nature, recent studies have also described an associated morbidity .In the past the incidence of the cubitus varus following the supra condylar fractures ranged from 9% to 58%.However with the use of the modern methods of management of the fractures, the incidence has decreased. Several methods of correction of the cubitus varus have been established. They differ mostly in their approach and the methods of fixation.

OBJECTIVE

To evaluate the outcome of Modified French osteotomy technique.

MATERIALS AND METHODS

This prospective non-randomized study was carried out over a period of 2years in a sample size of 20 children at Rajendra Institute of Medical Sciences [RIMS], Ranchi. 20 cases of both sex with cubitus varus deformity following supracondylar fractures of the humerus were operated by Modified French Lateral Closed Wedge osteotomy during August 2017 to August 2019. The mean age of the patients at the time of corrective surgery was 9.45 years (range 5-14 years). The osteotomy was fixed by two screws with figure of eight tension band wire between them. The fixation was supplemented by passing one to two K-wires where ever required from the lateral condyle engaging the proximal medial cortex through the osteotomy site .

RESULTS

Out of 20 cases 12 were male and 8 were female patients, with average duration of union 6.76 weeks, mean pre op varus angle was 20.45^0,mean immediate post op carrying angle and mean carrying angle at the time of union was 14.45^0 . The results were assessed as per Morrey criteria.80% (16cases) showed excellent results 10% (2 cases) showed good results and 10% (2cases) showed fair results.

CONCLUSION

The modified French osteotomy is simple, safest and most stable osteotomy which can be performed by orthopedic surgeons with the basic knowledge of the patho-anatomy and biomechanics of the deformity, with favorable and comparable results.

Key words : cubitus varus ,fixation technique, Modified French lateral close wedge osteotomy.

INTRODUCTION

Cubitus varus is the most common delayed complication that results following supracondylar fracture of humerus in children. Immediate and late causes of cubitus varus deformity are medial angulations, medial rotation, overgrowth of lateral condyle and osteonecrosis or delayed growth of medial condyle.[1] The medial angulation is the major determinant for the deformity[2] while medial rotation contributes to it.

The treatment of the deformity is considered to be more of cosmetics. But other studies have described an associated morbidity for which surgical intervention is necessary. The incidence of the cubitus varus following the supra condylar fractures ranged from 9% to 58%.However with the use of the modern methods of management of

the fractures based on Garland's classification and surgical intervention wherever is necessary, the incidence has decreased. This deformity consists of a permanent adduction of the forearm, which is most apparent when the elbow is in full extension. The most prominent feature is the marked, abrupt, movement made by the forearm towards the ulnar side as the limb approaches full extension, and the unsightly appearance of the limb in this position.[3] The deformity is predominantly cosmetic The functional is found in major degree of cubitus varus while walking in the inability to clear pelvis and pain during lifting weights. Several methods of corrective osteotomies were described which differ both in their approach as well as their fixation techniques. A) The Medial open wedge osteotomy, with bone grafting. Here the disadvantages are a gain in length and ulnar nerve neuropathy.[4] B) oblique osteotomy with derotation fixed with cortical screws attempts to correct a two plane deformity with a single osteotomy.[5] C) Three dimensional osteotomy in which medial and posterior tilt and rotation are corrected[6] D) Lateral closed wedge osteotomy is inherently stable, the easiest and the safest. The methods of fixation included two screws & figure of eight wire, compression plate fixation, crossed kirschner wires and staples. Kirschner wire fixation was the most prevalent method of holding the osteotomy. Loosening of the fixation, pin track infection, skin sloughing and nerve palsies and rarely aneurysm of brachial artery were noted.[7] E) Uni-planar supra condylar closing wedge osteotomy with pre set kirschner wires in post traumatic cubitus varus was reported in 36 patients with good results.[8] F) French and modified French osteotomy: here Lateral closed wedge osteotomy is used to correct the post traumatic cubitus varus. The osteotomy is stabilized using two screws over which wire loop is tightened. Posterior approach is used in the French technique and the triceps is cut from its insertion. In modified French osteotomy the postero lateral approach is used and the lateral one third muscles is slit rather than cut. It is muscle preserving surgery and helps in early rehabilitation.[9]

AIMS AND OBJECTIVES

To evaluate the outcome of Modified French closed wedge Osteotomy in cubitus varus deformity.

MATERIAL AND METHODS

This was a prospective non randomized study conducted in the Department of Orthopaedics at Rajendra Institute of Medical Sciences [RIMS], Ranchi from August 2017 to August 2019.20 cases in the age group 5 to 14 with cubitus varus deformity following supracondylar fracture of the humerus, out of which 12 were male and 8 were females, had been included in this study after taking written, informed and understood consent from the parents/guardians.

The study included 20 patients of cubitus varus deformity and corrected by Modified French Closed Wedge Osteotomy. A detailed history regarding previous fractures and treatment (pop cast) was elicited from the patient and parents/guardians, following which a thorough examination of the patient was carried out and neurovascular injury ruled out.

Standard antero-posterior and lateral view X-rays of the elbow were taken and necessary laboratory investigations done.

The osteotomy was first fixed by two screws and figure of eight tension band wire around them. Supplementation of fixation where ever required according to stability of fixation, one or two K-wires passed through the lateral condyle up to the proximal medial cortex. Clinically carrying angle was measured by angle formed between long axis of arm and forearm. The affected elbow was examined and compared with the contralateral side. Standard true antero-posterior and lateral radiograph of affected and normal elbow in identical position were used to assess the deformity and to do templating in every case. Radiologically, the humero-ulnar angle was taken into account. A varus angle of more than 10 degrees measured on radiograph and cosmetic complaints were considered as an indication for surgery. Preoperative templating has been done in each case.

Operative procedure- After giving appropriate anesthesia. The patient was positioned supine with the arm on a hand table. Posterolateral skin incision was made along the lower arm. The lateral third to half of the triceps muscle was reflected from its insertion. The osteotomy site was marked on the humerus with the help of the template which determines the length of the lateral wedge and angle of osteotomy. The desired correction was calculated by adding the differences of humero-ulnar angle of both elbows and adding normal valgus angle of normal elbow. Supplementation of fixation wherever required, K-wire was inserted parallel to the proposed osteotomy site, one proximally and one distally. After checking the placement of K-wires under the C-arm, two cortical screws, one proximally and the other distally, were inserted parallel to the two K-wires. After removing measured wedge, the fragments were aligned with the help of pre-placed K-wires rather than aligning them by manipulating the forearm which usually does not provide the controlled force at the fracture site and may lead to break in the medial cortical hinge, and in turn to instability of fixation. The fixation had been secured with the help of figure of eight tension band wiring loop around the screws heads after achievement of reduction of osteotomy and comparing it clinically with other elbow in full extension. This fixation was supplemented where ever required by two K-wires inserted from the lateral condyle passing through the osteotomy site and engaging the opposite proximal medial cortex . The wound was closed and the above elbow plaster of paris slab was applied. Stitches were removed after 12 to 14 days of operation.

Patients was followed up at an interval of 2weeks,1month,3months,6months and 1year.

Postoperative radiographs were assessed at 1month, 3months,6months and 1year time to asses the maintenance of correction achieved postoperatively. The assessment of the outcome of the cases was done on the basis of Morrey[10] criteria [Table 1].

Table 1: Morrey's system of functional assessment of outcome

	None	Mild	Moderate	Severe
Pain		If patient had occasional pain during use of the elbow but took no medication	If patient had pain at night occasionally took medication for pain but elbow did not limit the activity of daily living	If the patient took medication for pain regularly and activities of daily living were impaired
Stability		If varus valgus laxity was estimated to be less than 5 degrees and was not associated with any symptoms;	If varus valgus laxity was estimated to be less than 5-10 degrees and was associated with mild symptoms	If varus valgus laxity was estimated to be more than 10 degrees and was associated diffi culty in activity of daily living
Motion	Flexion and extension of the elbow were measured with a hand goniometer held along the lateral aspect of the brachium and forearm. Pronation and supination were measured at the extremes of active motion, with one arm of the goniometer held along or parallel to the brachium and the second arm placed parallel to the dorsum or the volar aspect of the wrist			
Strength	Strength of flexion and extension was measured isometrically in all patients			

RESULTS

The 20 cases were followed up to a period of 2years. 19 cases were fully satisfied with cosmetic results, but one had complaint related to cosmetic appearance. All the cases resumed their normal activity within three to six months of surgery.

The radiological union at the osteotomy site took place in a mean period of 6.76 weeks (range 5.5 to 8 weeks). Preoperative loss of flexion improved approx to normal. The hyperextension improved to normal postoperatively. The supination, pronation of forearm was same pre- and postoperatively. There was no pain in 16, mild pain in 2, moderate pain in two cases and none had severe pain. A total of 19 patients (95%) were satisfied with the cosmetic appearance while one (5%) noticed little difference due to excessive lateral condylar prominence. Of the 20 patients, 18 were able to have full range of motion after a mean of 6.8 weeks (range 5.5 to 8.4 weeks), while two patients regained at 9 and 10 weeks respectively. No case had instability in the coronal plane. 16 (80%) patients showed excellent results, 2 (10%) good and 2(10%) showed fair while none showed poor results in the follow-up. None of our patients had any neurovascular deficit postoperatively. There was superficial pin tract infection in two cases but it responded to local wound care and antibiotics. None reported pin loosening, gross loss of fixation, and loss of correction. Average preoperative varus was 20.45 degrees (range 16-25), immediate postoperative and 12th week postoperative valgus angle measured 14.45 degrees (range 12-17 degrees). The radiological valgus achieved on the operated side was near equal to valgus of normal side . Cosmetically all were satisfied with the outcome. There had been no neurovascular complication, unsightly scar or any residual deformity. Stable fixation had led our most of the cases to achieve >170 degree of supination-pronation,<5-10 degrees of restriction of flexion-extension in the majority of the cases . Most of our patients were able to regain their pre-injury functional status in the ninth week postoperatively with excellent cosmetic correction.

TABLE:2 The clinical details of patients

Case	Age (years)	Sex	Carrying angle (In degree)		Carrying angle (In degree) Immediate post op	Duration of union (In weeks)	Carrying angle (In degree) At the time of union	Results
			Pre op clinical varus angle	Pre op carrying angle of normal elbow				
1.	10	F	25	11	12	8	12	Excellent
2.	14	M	24	13	14	6.5	14	Excellent
3.	12	F	16	13	14	6	14	Excellent
4.	13	M	18	15	14	5.5	14	Excellent
5.	8	M	21	14	17	6	17	Excellent
6.	11	M	22	13	15	7.5	15	Good
7.	6	M	24	14	14	7	14	Excellent
8.	10	F	18	15	15	8	15	Excellent
9.	9	M	19	11	15	6	15	Excellent
10.	7	M	20	14	15	6.5	15	Fair
11.	12	F	18	12	13	5.5	13	Excellent
12.	8	M	21	16	16	7	16	Excellent

Case	Age (years)	Sex	Carrying angle (In degree)		Carrying angle (In degree) Immediate post op	Duration of union (In weeks)	Carrying angle (In degree) At the time of union	Results
			Pre op clinical varus angle	Pre op carrying angle of normal elbow				
13.	9	M	24	14	14	8	14	Good
14.	9	M	19	13	14	7.2	14	Excellent
15.	7	F	19	12	14	6.5	14	Excellent
16.	8	M	21	14	12	7	12	Excellent
17.	10	M	18	12	16	6	16	Excellent
18.	12	M	23	13	14	7	14	Fair
19.	8	F	21	14	12	6	12	Excellent
20.	6	M	18	12	13	8	13	Excellent

CASE-1 KUNDAN KUMAR,12 years old boy with Left sided Cubitus varus deformity with varus angle-15^0

Pre-operative X-ray

Immediate Post-OP X-ray

X-ray at 1year follow up

Clinical photographs showing good correction of Left elbow deformity

Extension

Corrected carrying angle-15^0

Flexion

CASE-2 JUNAID ALAM,10 years old boy with Left sided Cubitus varus deformity,with Varus angle-12^0

Pre-operative X-ray

Immediate Post-OP X-ary

X-ray at 1year follow up

Clinical photographs showing good correction of Left elbow deformity

Extension

Flexion

Corrected Carrying angle-10^0

DISCUSSION

Lateral close wedge (LCW) osteotomy is the easiest, safest and inherently stable method of correction. The type of fixation of osteotomy is a concern to achieve good result. Roach et al.[11] believed that unstable, non-rigid fixation led to slip of the fragments and loss of correction. Various methods of fixation are: use of two screws and figure of eigth tension band wire attached to them, plate fixation, cross K-wire fixation, staples; few authors used no fixation. The fixation by crossed K-wires frequently led to loosening of the fixation with recurrence of deformity,[12] pin tract infection[13] skin slough,[14] nerve palsy[14,15] and rarely brachial artery aneurysm. This modification reported by us to stabilize lateral closed wedge osteotomy for the cubitus varus deformity has certain advantages. We have used two K-wires in addition to two screws with TBW at the osteotomy site which gives us more control on the proximal and distal fragments which avoids the fracture of the medial cortex after closing the osteotomy. In addition, on peroperative clinical evaluation it gives better control of translation, rotation and angulations. Thus this method of fixation reduces the chance of the recurrence of the deformity. We respected the periosteum by not stripping it too much, thus giving the osteotomy more biological

environment for fast healing. Experience has shown that the biological determinants of fracture healing are as important as the mechanical and must be respected.[15] The K-wires were passed across the osteotomy site when the elbow was in position of full extension thus ensuring that there was no mechanical block postoperatively for regaining full elbow movements. In two cases with hyperextension deformity, the K-wires were passed when the elbow was at zero degree of extension; an appropriate anterior wedge was also removed before the fixation of osteotomy.

CONCLUSION

We believe that the modified method of French osteotomy is a simple reliable, acceptable and effective method. By doing the osteotomy through lateral muscle sparing approach, excellent to good results can be obtained. The present method when followed meticulously can achieve satisfactory results even in the hands of a primary care orthopedic surgeon.

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LUMBAR DISC PROLAPSE DIAGNOSIS: FINDING CORRELATION BETWEEN CLINICAL FEATURES AND MRI FINDINGS

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Magnetic Resonance Imaging (MRI) is a noninvasive technique that can effectively demonstrate disc degeneration and prolapse which is a major problem in the working individuals. Patients with suspected intervertebral disc prolapse routinely undergo MRI but relevance of associated clinical findings is not an assurity. Therefore, the MRI findings and the clinical status of the patients suffering with low backache were assessed with reference to sensitivity, Positive Predictive Value(PPV), Negative Predictive Value (NPV), Odd's ratio, p-value and a correlation was made in which presence of centro-lateral disc protrusion and extrusions with gross neural foramen compromise is invariably associated with clinical features. Central disc bulges with thecal sac compromise and without significant neural foramen compromise are clinically not of much significance. The presence of neural foramen compromise is more important in determining the clinical signs and symptoms while the type of disc herniation (disc bulge, disc protrusions) do not correlate well with clinical features. Whenever there are multiple level disc lesions with neural foramen compromise, patients are likely to have objective neurological deficit. Therefore, before asking for MRI, the patients should be thoroughly evaluated and we must have a clinical diagnosis and a specific question in hand. This will greatly help in correlating the MRI and clinical findings and also in further planning and surgical management of the patients.

Keywords: low backache, MRI, lumbar disc prolapse, disc herniation, clinical finding

INTRODUCTION

Low backache constitutes a considerable problem in middle age group, constituting large proportion of working population. Lumbar disc prolapse is responsible for a large number of these cases. True incidence of lumbar disc prolapse causing back pain and radicular symptoms is not known. Magnetic Resonance Imaging (MRI) is a noninvasive technique, which does not involve ionizing radiation, or any of the unpleasant effects of radiculography and it can demonstrate disc degeneration and prolapse. When T-2 weighted spin-echo sequences are employed a high signal is produced by the normal nucleus pulposus, reflecting its high water content. A degenerate or herniated disc shows a reduction in signal intensity from nucleus pulposus. With various imaging sequences, MRI can provide not only anatomical details but also biochemical information regarding changes in the intervertebral disc associated with degeneration and herniation. [1] Magnetic resonance imaging demonstrates degenerative changes and disc herniation that may not be clinically significant because studies in asymptomatic people have shown high levels of disc herniation.[2] Magnetic resonance imaging in symptomatic and matched asymptomatic controls showed similar levels of degeneration and more importantly, a similar prevalence of disc herniation. The main discriminator between the two groups was the presence of nerve root compression.[3] All degree of degeneration are

represented in both groups and no one pattern can be used as an absolute predictor of pain in the symptomatic patients.[4] The clinical findings of MRI are still controversial. Though MRI is done routinely for patients with suspected intervertebral disc prolapse, no one is sure which clinical findings are clinically relevant and have diagnostic and prognostic values. The best way to obtain meaningful clinical information from MRI of spine is to have a specific question before the study. The question is derived from patient's history and a careful physical examination. In present study we have tried to determine the association between abnormalities visible on MRI and patient's clinical features including pain distribution, neurological signs and symptoms in lumbar disc prolapse. The aim is to study clinical profile of patients, presenting with low backache in age group 25-40 years and to correlate findings of MRI with clinical features for diagnostic and prognostic purposes.

MATERIAL AND METHODS

The study was conducted in Central Institute of Orthopaedics and department of Radiodiagnosis at Vardhman Mahavir Medical College & Safdarjung Hospital, New Delhi during period of June 2016 to May 2018 wherein 39 patients between the age group of 25 to 40 years were evaluated. The clinical criteria was low backache with radiation to lower limb, radicular pain along a specific dermatome, nerve root tension signs like Straight leg raising and femoral stretch test, presence of neurological signs and symptoms. Three out of four clinical criteria or patients with two positive clinical criteria with MRI showing lumbar disc prolapse, when other causes have been ruled out will be clinically diagnosed to have lumbar disc prolapse. The exclusion criteria being patients age > 40 years, post discectomy patients, patients having metallic implants in which MRI is contraindicated and uncooperative patient's and those not giving consent for MRI. Patients presenting to outdoor department with clinical features satisfying suspected diagnosis of lumbar disc prolapse will be included in the study. All patients will go MRI evaluation of spine with a 1.5 Tesla MRI scan. Clinical findings were noted under pain distribution, presence of neurological symptoms and signs, dermatomal level of pain distribution and dermatomal level of neurologic signs and symptoms. Pain or neurological level may involve two or more levels. MRI findings will be analyzed as disc degeneration, extent of disc prolapse, status of neural foramen and miscellaneous and then will be correlated with clinical findings.

The classification of disc degeneration as Modified from Pearce (cited by Eyre et al)[5]will be taken into account wherever necessary. Extent of disc prolapse will be classified as A. Normal- no disc extension beyond interspace, B. Disc bulge- circumferential symmetrical disc extension beyond the interspace, C. Disc protrusion- focal or asymmetrical disc extension beyond the interspace, D. Disc extrusion- focal obvious disc extension beyond the interspace with base against the parent disc narrower than the diameter of the extruding material itself, E. Disc sequestration- when a part of disc separates from it and migrates.

Neural foramen status will be evaluated as neural foramen compromise and nerve root compression. Further nerve root compression will be classified as 0) absent - no visible disc material contacting or deforming nerve, 1) minimal- contact with disc material deforming nerve, but displacement <2 mm, 2) moderate- contact with disc material displacing >2 mm, nerve is still visible and not obscured by disc material, 3) severe- contact with disc material completely obscuring nerve

Miscellaneous findings were also analyzed such as lumbar canal stenoses, ligamentum flavum hypertrophy, facet joint arthropathy and spondylolisthesis.

A 39 years old female patient presented with complains of pain in lower back with radiation to left heel and dorsum of foot with absent ankle jerk. Rest clinical findings were with in normal limits. MRI findings are shown in Figure 1 and Figure 2.

Another patient, a 45 years old female presented to us with findings of low backache with radiation to

dorsum of foot (left), numbness was present in L5 region, Extensor Hallucis Longus(EHL) weakness was present . Sensation was decreased in L5 area left side. MRI findings are shown in Figure 3 and Figure 4.

RESULTS

The results were evaluated in total of 39 patients with diagnosis of lumbar disc prolapse satisfying inclusion criteria. The observation of study was documented based on different factors and parameters. The clinical status of each patient was correlated with MRI findings and evaluated with reference to sensitivity, PPV, NPV, Odd's ratio, p-value. All the patients were in the range of 25 to 40 years of age and the mean age being 35.5 years.Maximum number of patients were in the age group 35 to 40 years (25 out of 39 patients) around 64%. Out of the 39 patients there were 24 males (62%) and 15 females.Most common level affected was L4-L5 (32 out of 72 levels around 44.44%). 2nd most common level affected was L5-S1 (29 out of 72 levels around 40.27%). There were 23 patients who had single level involved and 15 patients had two level involvement while only one patient had more than two levels involved. The most common dermatome involved was L5 which was found in 23 patients (59%) followed by S1 in 7 patients (18%) and L4 in 2 patients (5%). Tingling and numbness were present in 8 patients each (27%) while paraesthesia was found in only 1 patient. Both tingling and numbness were found in 8 patients. 2 patients had all the three symptoms that is tingling, numbness and paraesthesia. Out of the 30 patients who had neurological symptoms, 1 (3%) had L4 involvement, 8 (27%) patients had L5 involvement, 12 (40%) patients had S1 involvement while L5+S1 involvement was found in 6 (20%) patients. 21 patients had neurological deficit out of which sensory deficit was most common and was present in 8 (38.09%) patients while motor deficit was present in 5 (23.8%) patients. Combined motor and sensory deficit was present in 8 (38.09%) patients. In patients having neurological deficit, single level involvement was most commonly affected (in 13 out of 21 patients constituting 62 %) and L5 nerve root is most commonly involved (8 out of 21 patients constituting 38 %).S1 nerve root is 2nd most commonly affected (19 %). History of neurogenic claudication was found in 9 (23.08%) patients, 6 males and 3 females. 20 patients were found to have normal ankle jerk while 19 (48.71%) patients had ankle jerk absent. Grade 3 and higher disc degeneration was present in 71 discs and grade 4 degeneration which was most common was found to be present in 43 cases (60.56%). L5-S1 levels were most commonly affected by grade IV degeneration (19 out of 43 levels constituting around 44.18 %). L4-L5 levels were found to be 2nd most commonly affected (37.2%). Disc bulge was most common type of disc herniation affecting around 47 of 72 levels (65.3%). Disc protrusions were 2nd most common type of disc herniation affecting around 29% of patients. Two disc levels were most commonly involved affecting 24 of 39 (61%) patients. Para central disc protrusion was most commonly present in 17 discs (23%) while central disc protrusion was present in 5 discs (23%). Disc extrusion was found to be more common in para central location affecting 2 out of 3 patients (67%).

Out of 39 patients, Ligament Flavum Hypertrophy(LFH) was found in 9 patients, Lumbar canal stenosis(LCS) was found in 14 patients, Facet Joint Hypertrophy(FJH) was found in 5 patients and spondylolisthesis was found in 3 patients.

Disc bulge was found to be symptomatic mostly (75%) when it was associated with nerve root compression. Disc protrusion was associated with nerve root compression in 14 out of 22 levels and 13 of these cases were symptomatic (92.85%). Disc extrusion was associated with nerve root compression in 2 cases, neural foramen compromise in one case and all patients were found to be symptomatic. Patients who were symptomatic but their MRI did not show neural foramen compromise were not having any neurologic deficit. 6 out of 22 patients who had neural foramen compromise on MRI, also had neurologic deficit (27.27 %). 15 out of 24 patients

who had nerve root compression on MRI were also having neurologic deficit (62.5 %). The most common level involved was L5-S1 producing S1radiculopathy and was found in 10 patients. Centro-lateral disc protrusion was found to be more common (77.27%) as well as symptomatic (76.47). Disc extrusion was found to be more common in Centro-lateral position. Out of 25 patients having nerve root compression on their MRI, 11 of these patients (44%) had nerve root compression at single level and 14 of these patients had nerve root compression at more than one level.

Disc extrusions showed sensitivity of only 9.52 for neurological deficit. Multiple level compression and findings related to chronicity showed higher level of sensitivity with neurological deficit. Disc extrusion, multiple level compression and findings related to chronicity shows positive predictive value 66.67, 64.29 and 70.58 sequentially. Disc extrusion shows negative predictive value 48.57 for neurological deficit, while multiple level compression and findings related to chronicity shows higher negative predictive value (52 and 59.09 sequentially). Disc extrusion does not show significant association with neurological deficit (p-value = 0.546) while multiple level compression and findings related to chronicity shows significant association with neurological deficit (p-value 0.008 and 0.05 sequentially). Disc bulge does not show positive association with clinical symptoms (odd's ratio-0.232) while other variables like disc protrusions disc extrusions neural foramen compromise and nerve root compression shows positive association with clinical symptoms. Disc protrusions, neural foramen compromise and nerve root compression shows significant association (p-value <0.05) while disc bulge does not show significant association (p value >0.05).

Nerve root compression shows higher association with neurological deficit than any other finding on MRI and same holds true with disc protrusion and disc extrusion as well. Multiple level foramen compromise and findings related to chronicity also shows positive correlation. Disc protrusions and disc extrusions does not show significant association with neurological deficit (p-value >0.05) while nerve root compression, multiple level foramen compromise and findings related to chronicity all show significant association with neurological deficit (p-value < 0.05). Association of ankle jerk with S1 nerve root (MRI finding) compression was seen. Absent ankle jerk as a screening test for S1 nerve root compression show sensitivity of 58.82 and positive predictive value of 52.63 and higher negative predictive value(65). The association of these two variables was not significant (p-value>0.491). Lumbar canal stenosis was correlated with history of claudication with sensitivity of 55.56, positive predictive value of 35.7 but having a higher negative predictive value (84). The association was not considered significant (p-value>0.05).

DISCUSSION

Prolapsed lumbar intervertebral disc affects a large number of working population. There are very few studies that have correlated clinical findings with MRI findings. These studies also gave contrasting reports and were inconclusive. Milette et al[6] concluded that in patients with chronic low back pain, loss of disc height or abnormal signal intensity is highly predictive of symptomatic tears extending into or beyond the outer annulus. Disc bulges and disc protrusions do not represent discs with significantly different internal architecture, based on findings of discography. They do not have additional significance. Beattie et al[7] suggested that there were no significant association between segmental distribution of symptoms and the presence of anatomic impairment. It has been observed that the disc extrusion and/ or ipsilateral severe nerve compression at single or more than one sites has close relation with distal leg pain. Rankine et al[3] concluded that pain drawings are not a good predictor of nerve compression seen on MRI with a poor correlation. In our study majority of patients were of in the age group 35-40 years (64%). This can be explained by the fact that in later age group degenerative changes in the disc are found in increasing number that are precursor for disc herniation. Majority of patients in our

study were male -24 out of 39 (62 percent). Most common level involved in our patients was L4L5 (32 out of 72 levels; 44.44%) followed by L5-S1 (29 out of 72 levels ;40.27%). These are the regions were disc prolapse is more common in general population also. This can be explained by the fact that physical stress is more in these regions. Single level affection is more common in our study group (23 out of 39 patients) followed by affection at two levels (15 out of 39). This can be explained by the fact that in this population (25-40 years) one or two levels are involved more frequently than in older age group (>40 years) where degenerative changes are more prevalent at multiple levels and disc herniation is also common at multiple levels. L5 dermatome was most commonly involved by pain (59 %) followed by S1 dermatome (18%). This dermatomal involvement can be explained by the involvement of levels (L4-L5 most common followed by L5-S1). Neurological symptoms were assessed and tingling and numbness were found to be present most commonly (27 % each). Similar percent of patients have both tingling and numbness. Only paraesthesia was present in least number of patients (3%). These neurological symptoms were most commonly present in S1 dermatome (40%) followed by L5 dermatome (27%).

Ito, Manuba et al[8](1997) investigated correlation between discogenic lumbar pain and disc morphology by using MRI and discography and concluded that although the lumbar intervertebral discs along with posterior combined annular tears may produce pain, the validity of these signs for predicting discogenic lower back pain is limited.

M.C. Powel et al[9] examined 302 women without symptoms of spinal disease and had their lumbar intervertebral discs examined by MRI and concluded that it must be wiser to consider high prevalence of disc degeneration that is mostly asymptomatic and these cases must be taken into account when MRI is used for assessment of spinal symptoms.

David G Borenstein et al[10] did a 7 year follow up study in which a group of 67 asymptomatic individuals with no history of backache underwent Magnetic Resonance Imaging of the lumbar spine and concluded that clinical correlation is essential to determine the importance of abnormalities on MRI.

Majority of patients show positive correlation between clinical level and MRI level. On keen observation although we have found that clinical level and the MRI level with evidence of nerve root compression were matching, the MRI level may not be the same as the conventional wisdom of L4-L5 causing L5 radiculopathy and so on. The findings observed clearly emphasize the need for accurately assessing at which level neural foramen compromise and nerve root compression are present before considering surgical options .So while the level of disc prolapse correlates well with the clinical level and MRI may not be essential for clinical diagnoses , MRI is definitely essential when surgery is planned.

We also noted that not all MRI lesions have symptoms. Out of 72 levels of discs lesions only 32 levels were symptomatic. It suggests that MRI is a very sensitive test for identifying disc lesions but not a specific test.

For decision making regarding level of surgical intervention which of MRI findings are likely to produce symptoms is an important issue. Disc protrusions without neural foramen compromise were symptomatic only in 33.33 % of cases while in case of neural foramen compromise symptoms were present in 40% cases and in case of nerve root compression around 92.85 % patients were symptomatic. No disc extrusion was without neural foramen compromise and were symptomatic in 100% of cases. MRI findings with neural foramen compromise and nerve root compression are likely to be more symptomatic than those without neural foramen compromise. The position of disc herniation also affects the neural foramen compromise as central disc bulges are less likely to cause neural foramen compromise while centro-lateral lesions in majority of cases produced neural foramen compromise. This means that a patient with a disc bulge with neural foramen compromise

is more likely to have symptoms than a patient with disc bulge when it is central and does not produce neural foramen compromise. In our study, percentage of patients having disc protrusions and extrusion having foraminal compromise is higher compared to those with disc bulge producing foramen compromise. A pure central disc bulge is asymptomatic in most of the cases. We have only three patients with disc extrusions and all of them were symptomatic. In our study we can see that a centro-lateral disc extrusion, centro-lateral disc protrusion and disc bulge with neural foramen compromise are more likely to cause symptoms while central disc protrusions and disc bulges without neural foramen compromise are less likely to produce symptoms. These findings are important when surgical option is considered for example a patient with two level disc bulges, one level with central disc bulge and another with disc bulge with neural foramen compromise. In such a case disc bulge with neural foramen compromise is likely to cause symptoms and after clinical correlation guides for surgical approach. Neurological deficit is well correlated with nerve root compression in our study. Although all root compressions seen in MRI need not have neurological deficit. When a nerve root compression visible on MRI, it is more likely to produce symptoms (89.74% in our study). When only neural foramen compromise is visible, 35.29 % patients were symptomatic. In patients without neural foramen compromise, only 17.64% patients were symptomatic. This clearly shows that MRI evidence of nerve root compression although not specific of neurologic deficit is more likely to produce symptoms. MRI findings like facet joint hypertrophy and ligamentum flavum hypertrophy were more commonly seen in patients with neurological deficit. 8 out of 9 patients having ligamentum flavum hypertrophy were also having neurological deficit. 4 out of 5 patients having facet joint arthropathy were also having neurological deficit. The disc extrusion is strongly associated with pain. However the position of disc extrusion, protrusion is more predictive of symptoms. Disc extrusions and protrusions are associated with neural foramen compromise in most of the cases due to their focal herniation and that may be the reason why disc extrusion can be more likely to be symptomatic. Association of ankle jerk with S1 nerve root (MRI finding) compression was seen. Absent ankle jerk as a screening test for S1 nerve root compression show sensitivity of 58.82 and positive predictive value of 52.63 and higher negative predictive value (65). The association of these two variables was not significant (p-value>0.491). Lumbar canal stenosis was correlated with history of claudication with Sensitivity of 55.56, positive predictive value of 35.7 but having a higher negative predictive value (84). The association was not considered significant (p-value>0.05). So in last it is suggested that patient should be thoroughly enquired about functional and neurological impairments and we must have a question in hand before ordering for MRI and the clinical findings should be properly documented in MRI requisition that will help radiologist about proper evaluation and correlating MRI findings which will help in proper management and also to avoid legal complications.

Outcome of correlation will greatly help in planning and surgical treatment options and regarding its level and definitive mode of treatment.Thus it also improves prognosis of patients.

CONCLUSION

Clinical features correlate well with MRI findings, but all MRI abnormalities need not have a clinical significance. The presence of centro-lateral disc protrusion and extrusions with gross neural foramen compromise is invariably associated with clinical features. Central disc bulges with thecal sac compromise and without significant neural foramen compromise are clinically not of much significance. The presence of neural foramen compromise is more important in determining the clinical signs and symptoms while the type of disc herniation (disc bulge, disc protrusions) do not correlate well with clinical features. Whenever there are multiple level disc lesions with neural foramen compromise, patients are likely to have objective neurological deficit. We concluded that before asking for MRI, the patients should be

thoroughly evaluated and we must have a clinical diagnosis and a specific question in hand. This will greatly help in correlating the MRI and clinical findings and also in further planning and surgical management of the patients.

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Figure 1: Grade IV disc degeneration at L4-L5(long white arrow), grade V disc degeneration at L5-S1(small white arrow) disc herniation at L4-L5 and L5-S1(black arrows).

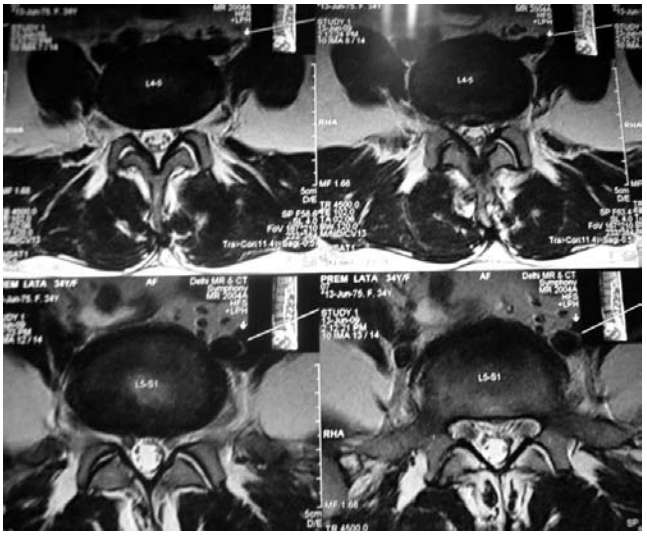

Figure 2: Diffuse disc bulgeL4-L5 (long white arrow) with compression on bilateral exiting

nerve roots (small white arrow). Diffuse disc bulge L5-S1(white arrow) with bilateral descending nerve root compression. So clinical findings are correlating well with MRI findings.

Figure 3: Grade 4 degeneration at L4-L5 and L5-S1(small white arrow). Disc protrusion at L4-L5, disc bulge at L5-S1(long white arrow).

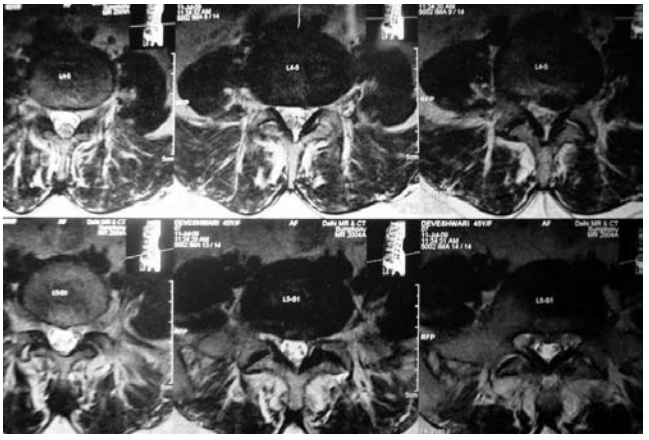

Figure 4: Left para central protrusion at L4-L5(small white arrow) compression at left L5 nerve root (long white arrow). Diffuse disc bulge at L5-S1(small white arrow) with no nerve root compression (long white arrow). MRI findings are well correlating with clinical findings.

RADIOLOGICAL AND FUNCTIONAL OUTCOME OF FEMORAL SUB TROCHANTERIC FRACTURES WITH PROXIMAL FEMORAL LOCKINGPLATES

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ABSTRACT

INTRODUCTION

A large proportion of hospitalization for trauma is due to proximal femoral fractures. This study was conducted to observe the outcome of unstable subtrochanteric femoral fractures treated with proximal femoral locking plate.

The peritrochanteric fracture is one of the most serious causes of mortality and morbidity in the elderly. Sub trochanteric fractures account for approximately 10-34% of all peritrochanteric fractures, and they affect persons of all ages. The peritrochantric fracture have been treated with proximal femoral locking plate.

Radiological and functional outcome is evaluated after fixation of subtrochanteric femur fracture with PFLCP.

Materials &Method:10patients were admitted to our institute with sub- trochanteric fractures and underwent surgical intervention by ORIF with PFLCP. Follow-up taken at 3, 6, 9 months and 1 year. Radiological and functional outcome is evaluatedby X-rays and Harris hip score.

RESULT

Out of the 10 operated cases. 9 patients are regularly followed till thefracture union or revision surgery.1 was lost to follow-up.Union was achieved in 8 patients.1 patient underwent revision surgery for implant failure due to premature weight bearing who eventually achieved union.

CONCLUSION

The greater trochanter fragment and the lateral trochanteric wall play an important role in stability after implant fixation of sub- trochanteric fractures. The PFLCP can be a feasible alternative for the treatment of unstable sub- trochanteric fractures because it provides proper fixation of the lateral fragments and prevents the lateral migration of proximal fragments.

INTRODUCTION

The intertrochanteric fracture is one of the most serious causes of mortality and morbidity in the elderly. Sub- trochanteric fractures account for approximately 12-30% of all intertrochanteric fractures, and they affect persons of all ages. The sub- trochanteric region of the femur is generally recognized to be the area of the femur below the inferior border of the lesser trochanter, extending distally 5 to 7cm.This fracture occurs in young adult with high energy trauma and old due to low energy trauma in elderly patient due to osteoporotic bone. This age group is also susceptible to metastatic disease that can lead to pathologic fractures. Early surgical intervention is advocated in the majority of these patients to reduce the complications associated with long-term immobilization. The aim of the surgery is to achieve initial stability and early mobilization of the patients for to reduced complications, such as deep vein thrombosis, thrombophlebitis, pulmonary embolism, urinary and lung infection and bed sore .The difficulty involved in the treatment of this fracture is partly due to injury pattern is anatomically different from other proximal femoral peritrochanteric fractures and also to the difficult features of femoral shaft fractures. As a result, it must be treated with specially designed implants that can sustain significant muscular forces for prolonged periods of healing. Because of these, this fracture has significantly higher rates of mal-union and non-union than other femoral fractures.

A number of treatment alternatives exist, having its owns complications. However, the main treatment choices of femoral sub- trochanteric fractures can be divided into two groups, the intramedullary nails and the lateral plate-screw system. The use of intramedullary nail fixation in intertrochanteric fractures has been increasing, but some problems exist when treating comminuted intertrochanteric fractureswith Traditional devices, such as dynamic hip screws (DHS) and angular blade plates can only provide limited treatment for peritrochanteric fractures. For example, the reoperation rate of DHS and intramedullary nails is reported to be 8% and 24%, respectively.

The lateral trochanteric wall is believed to be an important factor in stabilizing intertrochantericfractures. Keeping the lateral stable wall can speed up the fracture healing and greatly reduce the rate of malunion or non-union.A proximal femoral locking compression plate (PFLCP) can provide a stress for the lateral trochanteric wall and avoid the lateral movement of proximal fragments. This kind of inner implant may be a choice for sub- trochanteric or transverse intertrochanteric fractures.

We reviewed a prospective the clinical and radiological results of proximalfemoral locking plates used in 10 cases of sub trochanteric fractures. Effectiveness of the PFLCP was weighing its ability to maintain radiographic reduction and its functional outcome with Harris Hip scorein time-course after the operation.

MATERIALS AND METHODS

This is a prospective study conducted in Departmentof Orthopaedics, RIMS, and Ranchi from June 2018 to November 2019. The patients were included in the study based on the following Inclusion/ Exclusion criteria after getting consent of the patient. Inclusion criteria:

1) Age group 18 to 80 years who have given consent for surgery.
2) Seinsheimer classification of sub trochanteric fracture type III-V,
3) Russell-Taylor classification type II,

Exclusion criteria:

1) Pathological fracture,
2) Patients with ipsilateral pelvis fracture (floating hip),
3) Ipsilateral distal femur fracture
4) Patient unfit for surgery
5) Open contaminated fractures

METHODOLOGY

A detailed history including name, age, and sex, date of injury, mechanism of injury, residential address, and occupationwas recorded. Routine x-ray of concerned area in ap and lateral view. Patients underwent routine blood investigations. And after fitness underwent surgery.

Surgical technique

Surgery was performed with the patient in supine position on a fracture table in traction. Closed reduction was performed before surgery under fluoroscopic view in the anterior-posterior and lateral views and subsequently secured in traction. In highly comminuted and unstable fractures that could not be adequately reduced by traction on a fracture table, we preferred open reduction

The proximal femorallocking compression plate (PFLCP) we used was designed for anatomical placement on proximal femur. A lateral longitudinal incision of about 7.0 cm to 10 cm was made starting from top of the greater trochanter along the line of shaft of femur. After the longitudinal incision of the skin and subcutaneous tissue, we split the fascia of the lateral vastus lateralis at its proximal insertion, and the muscle was flipped to visualize the lateral aspect of the proximal femur. After satisfactory reduction of fracture, fragments were provisionally held with k-wire.

Then plate was positioned on the contour of greater trochanter offemur. After placement of plate four locking cancellous crews were placed in the neck region. And at least 4 locking and one cortical screw was applied on distal fragment.

Reduction and fixation was confirmed under fluoroscopy.

Wound was closed in layers over closed suction

drainage. Andaseptic sterile dressing was done.

Postoperatively antibiotic prophylaxis was given according to standard in hospital protocol.

Postoperatively knee bending and bedside mobilisation was started immediate postoperative day. Patient was discharged after wound inspection. Weight bearing was delayed till radiological evidence of union.

Patients were followed up at 4 weeks, 8 weeks, 3months, 6months, 9 months, and one year.

Radiological evaluation was done by Periodic radiographs for union, screw position, any loss of reduction or implant failure was done

Functional evaluation was carried using Harris hip score with aMinimum follow up of 6 months and maximum 13 months.

Preoperative radiograph

Postoperative check xray

RESULTS

Among all patient admissions, 10 patients who underwentsurgery. 9 patients were followed till thefracture union and 1 was lost to follow-up. There was one case of severe infection after operation, which was cured by debridement and intravenous antibiotic. 2 cases of superficial infection were observed and cured with antibiotic therapy and regular dressing. Among the 9 patients who were followed up for more than 6 months, 1 patient had implant failure due to premature weight bearing and required revision surgery. Among the 8 cases, 6 fractures (75%) healed with no loss of position at the 3-month follow up. among the 8cases, 7 fractures (87%) healed without any deformity at the 6-month follow-up, all 8fractures (100%) healed without any deformity at the 13 follow-up, including those with severely comminuted fractures, but the fracture healed after delaying the weight-bearing time. Moreover, there were no cases of screw cutout through the femoral head. And loss of reduction and collapse during healing time. And all patents are restored to normal routineactivity.

DISCUSSION

The important anatomical feature of the proximal femur is neck shaft angle and stress due to muscular forces creates a unique type of fracture in subtrochantric fracture.Maintaining anatomical angle – neck shaft angle, restoration of deformities and minimising soft tissue injury, and osseous fragments reduction with stable internalfixation to avoid non-union. Bone grafting is used in posteromedial commination. If we follow above principal good result occur in subtrochanteric femur fracture. Our main aim is restoring the stability and early mobilization after fixation to reduced morbidity and mortality, non-union,malunion and also to boost up mobility. Subtrochanteric femur fracture requires strong and stable implant for maintaining the stability till the fracture got united.These implants fall into two main categories, intramedullary and extramedullary. Intramedullary fixation is associated with short operative time and minimal

blood loss and has better biomechanical properties when compared with extramedullary fixation. However, they have their own technical difficulties and complications .Although intramedullary has good outcome for subtrochanteric fracture bur newer extra medullary devices play significant role in the fixation of subtrochanteric femur.

There was no significant difference in Harris hip score between intramedullary device group (84.611 ± 7.076) and extramedullary pflcp group (81.785 ± 7.500) at 12 months after operation (t = 1.626, P = 0.109). The early complication rate and late complication rate were 16.7% (6/36) and 5.6% (2/36) in PFNA group and were 9.1% (3/33) and 9.1% (3/33) in LCP group. Showing no significant difference between 2 groups ($\chi 2$ = 0.871, P = 0.481; $\chi 2$ = 0.320, P = 0.665). Both PFNA and LCP have good effectiveness in the, treatment of subtrochanteric fractures with the lateral unsubstantial femoral wall in the elderly patients.

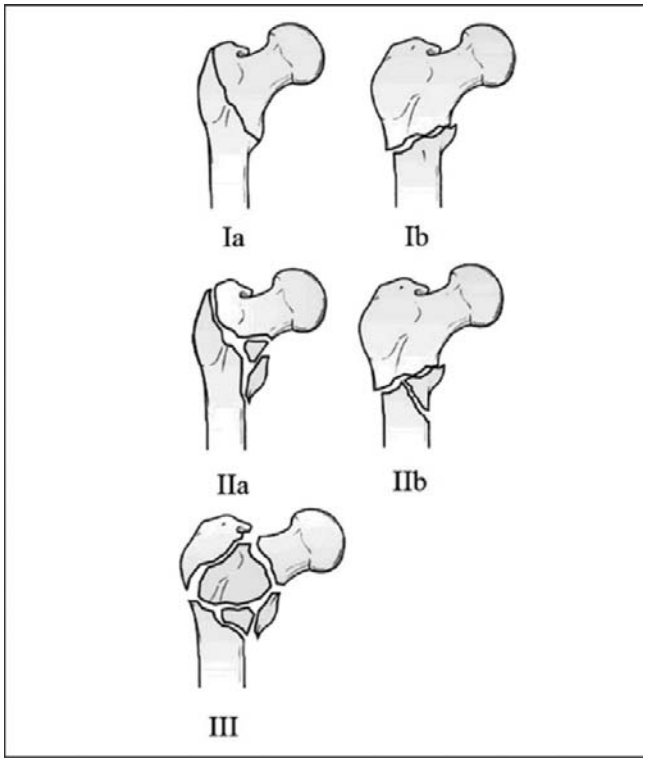

Figure 3 : (Ia, Ib) Lateral wall is intact, the fracture can be fixed with DHS or intramedullary nail. (IIa, IIb) Lateral wall is intact but in danger, and may refracture during operation. (III) Lateral wall is ruptured.

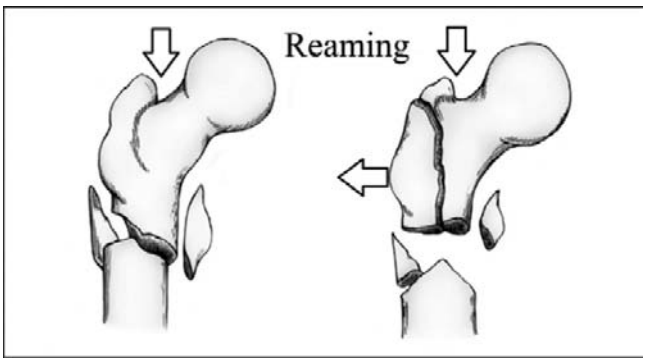

Figure 4 : The lateral wall fragment displaces laterally when reaming the piriformis fossa.

The dynamic compression hip screw (DHS) has been a popular method of internal fixation for sub trochanteric fractures. Provides compression along the femoral neck, and if the reduced fracture is stable, load-sharing between the bone and implant can occur. However, if the fracture is not stable, progressive medial displacement of the femoral shaft can occur, which may result in fixation failure and non-union. Failures increase sevenfold if medicalization of more than 1/3 of the femoral diameter at the fracture site occurs. The most common mode of mechanical failure of the sliding hip screw is the progressive varus collapse of the femoral head with proximal migration and eventual cutting out of the femoral head screw.

CONCLUSION

The greater trochanter fragment and the lateral trochanteric wall play an important role in stability after implant fixation of sub -trochanteric fractures. The PFLCP can be a possible alternative for the treatment of unstable sub- trochanteric fractures because it provides proper fixation of the lateral fragments and prevents the lateral migration of proximal fragments and good results.We conclude that PF-LCP is an effective alternative treatment for sub trochanteric fractures.

- Both PFN and PFLCP are effective treatments for unstable trochanteric femur fractures.
- PFN is superior to PFLCP only in terms of shorter incisions and shorter time to full Weight-bearing
- Both devices have good long-term functional

outcomes.

- Complication rates in unstable trochanteric fractures treated with both implants are comparable
- Larger randomized controlled multicentre studies are needed to further evaluate and compare both implants in displaced unstable trochanteric femur fractures

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Age/ Sex	Side	Operating time in (min)	Blood Transfusion Required (in units	C-Arm Images	Bone Grafting	follow up period (in weeks)	Harris Hip Score	Compli-cation	comor-bidity
52/M	LT.	68min.	1	16	No	48	92		
67/M	RT.	78min.	1	16	No	40	91		DM
54/F	RT.	56min.	1	14	No	32	87	Superficial infection	
47/M	LT.	45min.	1	20	No	36	92		
72/M	LT.	66min.	1	21	No	No			HTN
47/M	LT.	70min.	1	16	yes	24	92	Superficial infection	
75/F	RT.	56min.	1	13	No	38	92		
74/M	RT.	48min.	0	15	No	24	87		DM
67/M	LT.	49min.	0	12	No	22	90		DM
49/F	RT.	102min.	1	32	yes	53	85		

A MORPHOMETRIC STUDY OF NUTRIENT FORAMEN OF TIBIA IN NORTH CHHOTANAGPUR, JHARKHAND

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INTRODUCTION

Nutrient foramen is present on the shaft of long bone responsible for supplying nutrition to the bones through the nutrient artery. Nutrient foramen of long bones is having elevated margins & groove proximal to it.

One or two diaphysial nutrient arteries enter through the nutrient foramina which lead into nutrient canals .Their site of entry and angulation are almost constant and characteristically directed away from the dominant growing epiphysis. In tibia nutrient foramen lies near the soleal line passing the branch of the posterior tibial artery.

Location of the nutrient foramen of the long bones is an essential for the surgeons to perform various surgical operations. Morphometric measurements of the bone and nutrient foramen is useful for determining the whole length of a bone. Preservation of the nutrient blood supply is considered as one of the most important aspects in promoting repair in vascular bone grafting.

MATERIAL & METHOD

The study of 52 washed and dried tibia was done in Patliputra Medical College ,Dhanbad. Deformed bones were excluded from the study. Age & gender of bone were not taken into account and to determine the sides of the bone universally accepted rules were followed. In the present study all the measurements were taken using sliding Vernier caliper and hypodermic needle of 24 gauge.

The following observation were taken-

1. Number of nutrient foramen.
2. Type as Dominant or Secondary foramen.
3. Location as in upper 1/3rd,middle 1/3rd or lower 1/3rd- It was determine by the help of Foramina index (FI) using the formula:

   FI = DNF/TL X100

   DNF- the distance from the proximal end of the bone to the nutrient foramen.

   TL- total length of the bone.

   The position of the Nutrient foramen was grouped into three types according to FI as follows:

   Type 1-FI from 01 to 33.33

   Nutrient foramen is in the upper 1/3rd of the bone

   Type 2- FI from 333.34 to 66.66

   Nutrient foramen is in the middle 1/3rd of the bone

   Type 3 – FI above 66.67

   Nutrient foramen in the lower 1/3rd of the bone
4. Location with respect to soleal line (medial, lateral or upon soleal line) was observed.
5. Size of the nutrient foramen- Nutrient foramen equal or larger than the size of 24 gauge hypodermic needle having the diameter of 0.56 mm were considered as Dominant foramen and less than this as the Secondary nutrient foramen.
6. Direction of the foramen – fine wire were used.

RESULTS

This study was undertaken on 52 dried tibia among which 28 were of right side & 24 left sided. The observations were recorded in the form of tables-

Table 1 : Type of Nutrient foramen and direction of foramen

Type of foramen	Right tibia, direction	Left tibia, direction
Dominant foramen	22, downward	19,downward
Secondary foramen	6,downward	5, downward
Dominant+ Secondary	0	0

Table 2 : Location of the nutrient foramen

Sample size(no.)	Upper 1/3	Middle 1/3	Lower 1/3
Right(28)	20	8	0
Left(24)	20	4	0

Table 3 : Nutrient foramen with respect to soleal line

Sample size & side	Lateral to soleal line	Medial to soleal line	On soleal line
Right (28)	24	0	4
Left (24)	20	0	4

Table 4 : Calculation of the Foramina Index of the right tibia

S. No. of Right tibia	T.L	DNF	Foramina Index
1.	35	19.6	56
2.	36	12.9	35.8
3.	36.3	12.1	33.33
4.	38.2	13.2	34.5
5.	33.9	11.7	34.5
6.	38.5	10.2	26.4
7.	34.9	8.2	23.4
8.	36.5	11.6	31.7
9.	36.6	9.3	25.4
10.	38.2	11.1	29
11.	39	14.9	38.2
12.	33.3	11.4	34.2
13.	35.4	7.4	20.9
14.	37.4	10.4	27.8
15.	37	14.5	39.1
16.	40.1	12.1	30.1
17.	39.4	14	35.5

18.	38.7	10.4	26.8
19.	35.4	10.5	29.6
20.	31,3	8.6	27.4
21.	31.7	9.4	29.6
22.	27.4	7.5	27.3
23.	38.8	10.2	26.2
24.	34.8	11.4	32.7
25.	36	11.3	31.3
26.	32.6	9.8	30
27.	33.8	11	32.5
28.	32.6	9.8	30
S.No. of left tibia	T.L	DNF	Foramina Index
1.	33	13.2	40
2.	36.2	11.4	31.4
3.	37.5	15.3	40.8
4.	38.6	11,4	29.5
5.	35.3	12.8	36.2
6.	40	10.4	26
7.	38.5	11.6	30.1
8.	34.4	10.6	30.8
9.	35.9	10.3	28.6
10.	38.7	11.2	31.3
11.	36.8	12.6	34.4
12.	35.3	10.8	30.5
13.	36.3	11.3	31.1
14	33.2	9.5	28.6
15.	35.6	13.1	36.7
16.	32.7	10.1	30.8
17.	31.5	9.7	30.7
18.	34.8	9.4	27
19.	36.6	10.2	27.8
20.	36.6	10.9	29.7

DISCUSSION

In present study 52 dried tibia 71% of the nutrient foramen of the right side was located in the upper 1/3 of the bone while 83% were located in upper 1/3 of the bone in left side. Rest of the percentage were located in the middle 1/3 of the bone. While nutrient foramen absent in lower 1/3 of the bone.

This study of location of nutrient foramen was in accordance with Longia (1980), Krischner (1998) & Tejwasi H.L(2014) that they got the highest percentage of nutrient foramen in upper 1/3 of bone.

In the present study 85% cases nutrient foramen is lateral to soleal line in right side while in left side the percentage is 83%. Similar finding is of Collipal(2007) & Tejaswi (2014).

CONCLUSION

The present study was in accordance and is confirmatory with the data given by the previous studies done by various researches. It provides useful information pertaining to the nutrient foramen of the tibia and will surely help the surgeons to salvage the nutrient artery while performing important surgical intervention like bone grafting and fracture repair.

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