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LUPIN PHARMA

LUPIN

For The Management of Osteoporosis

For The Management of Osteoporosis

℞ CORCIUM Fit

Coral calcium, Vitamin D3, Zinc gluconate, Pine bark extract

℞ CORCIUM PLUS

Coral calcium, Folic Acid, Vitamin B6, Vitamin B12 (as Cyanocobalamin) (Cap)

℞ CORCIUM K2

Coral calcium, Calcitriol, Vitamin K2 (Tab)

For the maintenance of joint health

℞ Nutrajoint

℞ MOVNWALK

℞ Lupoxa

Oxaceprol 200 mg (Cap)

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Orthopaedics in Era of Computers and Internet

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Today, computers are a part of our life & have changed the way we live and the way we practice medicine. Their qualities as user friendly, cheap, availability, time saving, multitasking, documentation, and knowledge update has helped in opening up a lot of possibilities for their application in the medical field.

Computers are already being increasingly used in hospitals at the reception, billing, admission, OPD registration, laboratory, radiology, 3-D reconstruction in CT, MRI, in O.T., endoscopies and patient management in wards. Personally, computers are also used by doctors for their practice management-recording patient history, writing prescription, maintaining treatment history, accounts and billing, scheduling appointments and managing correspondence-letters, messages, emails, paper, the forum for the discussion of orthopaedic problems, usually on a case-by-case basis. Now nearly all medical conferences use computer and internet – by having their own website, registration and abstract submission online or by email and conference proceeding and abstracts are provided online or on CD ROM.

There are over two million health websites & nearly thousand are added each month. The health is the second most searched for topic on the net. Health related net usage in India has grown over 10 folds with 40 million users. A survey on internet found that 69% of the patients discuss the information found on net with their health care professionals. 80% doctors found this to be helpful, as it has improved communication, knowledge and saved time in explanation to the patients. While the rest felt, there was risk of patient's self-treatment. The shortcomings to internet usage include lack of time, poor quality of information, unsolicited email, time wasting searches and excessive commercial emphasis.

Though, Orthopaedic surgery has not yet fully grasped the remarkable potential of information technology but surely there has been increasing application of computers in orthopaedics, with special emphasis on the emerging importance of virtual reality in all aspects of orthopedics. Today the computers and technology is used for all aspects of orthopaedics, ranging from pre-operative planning, pre-operative surgical practice on virtual patients, and virtual way finding and navigation; through intra-operative virtual bone structure modeling to enhance accuracy; to, most importantly, post-operative or non-operative rehabilitation of orthopedic conditions using these new computer techniques.

Although the technology has been used in all fields of orthopaedics but it is particularly, been of great help in fields of arthroplasty, deformity correction, documentation and knowledge update.

Computer Assisted Surgery / Computer navigations is been increasing used in replacement surgeries. It has been extensively used for knee, but has also been extended to hip, shoulder and other joint replacements as well. The computer assisted surgery (CAS) is more precise, user friendly, lessor risk, economical and with fewer complications. These are particularly useful for a complex joints and deformed bones were anatomic landmarks are difficult to assess accurately. The robotic surgery is a further advancement, and robots for hip and knee replacement are increasingly used in western world to improve the accuracy and outcomes.

Use of computers in deformity correction is tremendously advantageous. It is extremely useful in assessing the deformity and planning the correction. There are various tools and softwares available for evaluation of the deformities and to guide the correction of the deformities. Computer assisted insertion of

pedicle screws in scoliosis surgery has, increased the precision of the screw placement and decreased the complications of misplacement of the screws or nerve / cord penetration. Today computer assisted hexapods fixators are available for three dimensional deformity corrections. These hexapods like SUV fixator or TSF have made the deformity correction so easy. The surgeon just has to apply the fixator on the patients deformed limb. Then the data needs to be put in the computer software, which then calculates everything and makes a exact model of the limb along fixator in place. The deformity correction can be manipulated and corrected as per the needs, which can be seen on computer software, with days and correction achieved, on screen without been correction actually done on limb. Thus in this way you can access the final correction and can change your rate of correction, if needed. It gives you precision and flexibility in correction. The surgeon can achieve corrections of deformity to 1mm and one degree very precisely with simultaneous correction in all the planes.

Another major step, which technology and computers has helped, is the knowledge update. Today the whole global world is shrinking, with all the knowledge and information available just at a click away from you. There are many website, applications and videos, available which can help you to learn orthopaedics, get knowledge update, see operative technique and read latest articles.

Mobiles, and applications like whatsapp and facebook are very power tools for information sharing not only among general people, but also among orthopods not only to keep contacted with peers but also for opinion, discussion, promotion and for knowledge sharing. Since orthopaedics is a branch which is more dependent on radiological investigation, which can be easily shared and transferred on these social media platforms, these applications have revolutionized the practice of Orthopaedics.

While computer systems are becoming ever more powerful aid to problem-solving but there remains a critical role for intangible human skills such as intuition, experience and imagination. Aging, time and human contact are significant factors. Computer system can never replace human pattern recognition and memory. There is other side of coin also. Patients in search of answers seldom appreciate the difference between obtaining orthopaedic information and an opinion about an individual case. It is manifestly unethical and illegally perilous and downright stupid for an orthopaedic surgeon to offer an orthopaedic opinion on a patient whom he or she has never seen, examined or investigated. Further, Orthopods for their own promotion shows only the best functional outcome of their own case and tend to hide their complications. With the globalization of information, there is also hazard of leaking of secrecy of the patient.

Without a vision and planning, global orthopaedic surgery on the Internet will evolve through chaos and endangered future. It is clear that patients will continue to use the Internet for orthopaedic information and that it is up to us to provide good information and guide them to it. But we should also know the line and limit, for the level of knowledge which should be freely available to the layman, to prevent the misuse of the information. The simple and easy way is, Orthopaedic organizations should focus on networked resources and start website providing valuable public-relations exercise & information about the practice of orthopaedics at several levels such as practical directions for patients, information about orthopaedic conditions, its natural history, options of non-operative and operative treatment, complications and outcomes, scheduling, teaching commitments, case presentations, information about research, and meetings. This requires expert orthopaedic personnel who have the correct skills of knowledge, management and training in organising information in using computers. We as orthopaedic surgeons needs to change existing patterns of behavior with overcoming our inhibitions and has to incorporated the advancing technology into our behavior and orthopaedic practice, because advantages of using computers in orthopaedics are many and the disadvantages can be overruled easily.

The pace with which the Internet and technology has penetrated to an individual level is remarkable but it is not yet integrated into the working patterns of most of us. You won't become an expert overnight, but by starting with the basics and taking online computer training courses whenever possible, can quickly amass an impressive set of marketable skills. Computers are clearly here to stay, so if you want technical training that will help solidify your future, secure the necessary education first. The world has an insatiable appetite for computer technology, and those who have the skills necessary to satisfy that demand are the ones who will be calling the shots in the years to come.

To conclude, the Internet and computer networks may not need promotion but orthopaedic surgery on the Internet assuredly does. Innovations and change in orthopaedic computing and networks are welcomed by some, but are perceived by others as unacceptable system-changing risks, often unrelated to the benefits which they purport to provide, because instinctive opposition to `computer medicine' is inherent. But it is sure than technology and computers as well as the patients urge are to stay here and if we don’t keep ourselves, with the same pace of development as that of technology, we will be left behind.

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Management of Femoral Neck Fractures In Young / Middle Aged Adults

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Abstract

Femoral neck fractures account for nearly half of all hip fractures with the vast majority occurring in elderly patients after simple falls. Currently there is sufficient evidence to support the routine use of hip replacement surgery for low demand elderly patients in all except non-displaced and valgus impacted femoral neck fractures. However, for the physiologically young / middle aged patients (40 to 65 years) preservation of the natural hip anatomy and mechanics is a priority in management because of their high functional demands especially in Indian population. The biomechanical challenges of femoral neck fixation and the vulnerability of the femoral head blood supply lead to a high incidence of non-union and osteonecrosis of the femoral head after internal fixation of displaced femoral neck fractures. Anatomic reduction and stable internal fixation are essentials in achieving the goals of treatment in this relatively young patient population. Furthermore, other management variables such as surgical timing, the role of capsulotomy and the choice of implant for fixation remain controversial. This review will focus both on the demographics and injury profile of middle aged patients with femoral neck fractures and the current methodology and evidence behind the surgical management of these injuries.

Keywords: Femoral neck fracture, Middle aged patient, Capsulotomy, Osteonecrosis.

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Introduction

Femoral neck fractures account for nearly half of all hip fractures with the vast majority occurring in elderly patients after simple falls [1]. Currently there may be sufficient evidence to support the routine use of hip replacement surgery for low demand elderly patients in all but non-displaced and valgus impacted femoral neck fractures. This is based on a multitude of randomized controlled trials documenting improved short and long-term hip function and lower re-operation rates with primary hip arthroplasty as compared to internal fixation in elderly adults [2]. Furthermore, early weight bearing protocols post-arthroplasty minimizes complications of prolonged inactivity [3].

For the non-elderly patient with good bone quality, preservation of the natural hip anatomy and mechanics is a priority as their high functional demands and young age preclude their candidacy for replacement procedures [4]. While only 3%-10% of these fractures occur in younger adults, the major differences in physiology, injury characteristics and activity level necessitate a dedicated treatment pathway [5]. However, the biomechanical challenges of femoral neck fixation and the vulnerability of the femoral head blood supply lead to a high incidence of non-union and osteonecrosis of the femoral head (ONFH) after internal fixation of displaced femoral neck fractures [6]. These complications are highly symptomatic in active patients leading to salvage procedures with significant failure rates.

Undisputedly, anatomic reduction and stable internal fixation are essentials for achieving the goals of treatment in this relatively young population allowing preservation of the femoral head while minimizing rates of non-union and osteonecrosis [7]. Other management variables such as surgical timing, the role of capsulotomy and the choice of implant remain controversial. This review

will focus both on the demographics and injury profile of the young / middle aged patients with femoral neck fractures and the current evidence behind the management of these injuries and their secondary complications.

Consideration of physiological age

The age range describing a young patient is most often between skeletal maturity and the age of fifty [5,6]. More recently, patients up to 65 years have been considered within this definition [3,8]. The majority of surgeons prefer to treat young patients (< 40 years) with internal fixation and elderly patients (>65 years) with arthroplasty / hemiarthroplasty. However, patients between 40 to 65 years constitute a grey area, where the treatment approach is variable. For this "relatively young" population, chronologic age becomes less important and establishing a patient's physiologic age becomes the first step in management [9]. Several variables have been used to characterize the physiologic age of a patient; pre-injury activity level, medical co-morbidities and bone quality. In addition to chronological age these variables dictate the goals of management for this population and have an impact on the outcome of surgical treatments. Bone quality and comminution at fracture site influences the success of internal fixation of femoral neck fractures. Cadaveric studies of femoral neck fixation have shown a positive correlation between bone density and achieved fixation stability [10]. In a review of over one thousand patients with femoral neck fractures, Parker et al. found the incidence of non-union to be age dependent with a rate of 5.9% in patients younger than 40 years compared to 24.9% for patients in their 70s. In addition to non-union, failure of osteoporotic bone around multiple screw fixation leads to increased screw sliding and shortening of the femoral neck. Femoral neck shortening of more than 5 mm has been correlated with decreased functional outcomes and an increased incidence of requiring walking assistance [11].

Although risks of non-union and osteonecrosis are significant in this patient population (40 to 65 years age), arthroplasty is avoided as first line treatment. Highly active patients have increased failure rates of hip prosthetics and less favorable functional outcomes compared to their elderly counterparts [4,12].

Demographics of the middle aged femoral neck fracture patient

The literature suggests that femoral neck fractures in middle aged adults are most often a result of high-energy trauma such as motor vehicle collisions. Patients often present with poly-traumatic injuries such as other fractures or head, chest and abdominal trauma [13]. While this is true for patients with dense bone, more recent work demonstrates that femoral neck fractures in chronologically young patients occur from low energy trauma with a higher than expected frequency [14]. A study conducted by Robinson et al [15] examined ninety-five patients with both intra and extra-capsular hip fractures under the age of 50 years over a five-year period. They identified two demographics within this population; a male predominant group between the ages of 20 and 40 years who sustained high-energy injuries, and a larger group between the ages of 40 and 50 years who sustained fractures after falls. The majority of patients within the latter group had long standing medical conditions and a high prevalence of alcoholism. This demonstrates that there are two main reasons for femoral neck fractures in chronologically young adults, significant trauma in healthy patients or comparatively low energy trauma in patients with predisposing diseases, alcoholism or early age related bone fragility.

Anatomy

Blood supply to the femoral head comes from three main sources, the medial femoral circumflex artery (MFCA), the lateral femoral circumflex artery (LFCA) and the obturator artery. The majority of the blood supply to the femoral head, more specifically to the vital superior-lateral weight-bearing portion, comes from the lateral epiphyseal artery, a branch of the MFCA. This artery courses up the posterior-superior aspect of the femoral neck where it is prone to damage during femoral neck fracture fragment displacement. The

second largest contributor to femoral head blood supply is the LFCA whose ascending branch gives rise to the inferior metaphyseal artery supplying the anterior-inferior aspect of the femoral head. Finally, the smallest and most variable contributor to blood supply in the adult femoral head is via the obturator artery which enters the femoral head via the ligamentum teres [16].

Femoral head vascularity is at risk after femoral neck fractures because the vascular supply is intra-capsular. The most common hypotheses of causes for femoral head ischemia after femoral neck fracture are direct disruption or distortion of the intra-capsular arteries during the initial femoral neck fracture, compression secondary to elevated intra-capsular pressure due to fracture hematoma, pre-operative traction and quality of the surgical reduction and its ability to restore blood flow [17].

Initial Evaluation

The mechanism of injury is important. A large majority of relatively young patients with femoral neck fractures present after high-energy trauma. If a relatively young patient with femoral neck fracture presents after a low-energy trauma or no clear history of trauma, a more in depth history should be carried out. One should inquire specifically about risk factors for osteoporosis, previous pain about the hip both at rest or with activity and constitutional symptoms including fever, weight loss and night sweats. Low-energy fracture can be due to underlying osteoporosis, stress fracture or pathologic bone [14].

In a poly-trauma presentation, Advance Trauma Life Support (ATLS) protocol should be promptly initiated; fixation of the femoral neck fracture be dealt with following the appropriate treatment algorithm based on priority of the injuries. Nevertheless, in isolated or in poly-trauma situations, the patient needs to be medically optimized prior to surgery and evaluated by an anesthesiologist.

Physical examination findings in patients of all ages with femoral neck fractures are similar. Classically, the affected limb is painful, especially with movement, shortened, flexed and externally rotated. However, the diagnosis of femoral neck fracture in young patients can be more elusive. With a significant proportion of patients presenting after high-energy injuries and often in poly-traumatized patients, these fractures can easily be overlooked [13]. In the presence of a femoral shaft fracture, an ipsilateral femoral neck fracture will occur up to 9% of the time [18]. In this clinical setting, the diagnosis is missed approximately 30% of the time [19]. Most of these fractures (between 25% and 60%) are non-displaced at initial presentation [20]. Because of the morbidity associated with osteonecrosis, a high index of suspicion should be entertained when evaluating the poly-traumatized patient. Prompt recognition of femoral neck injuries cannot be underemphasized at timing to surgical intervention which may affect outcomes [3].

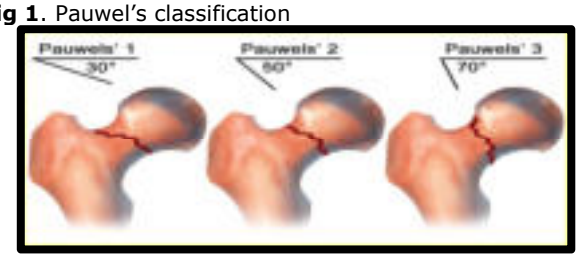
Imaging and classification

Regardless of the mechanism of injury, antero-posterior (AP) pelvis, radiograph of the affected hip and entire femur should be obtained. In addition, traction-internal rotation radiographs may allow for a better interpretation of fracture pattern [21]. Lateral view radiograph is practically difficult to take in ward / ICU setups. Up to 2%-10% of femoral neck fractures may not be clearly visible on standard radiographs and computed tomography (CT) can aid in the diagnosis [22]. In cases of significant trauma where an abdomino-pelvic CT scan is required, it is recommended to extend imaging to the level of the lesser trochanter in order to fully evaluate the femoral neck. Recent studies have found MRI to be as effective as CT scan in detecting these fractures and reducing the chance of a missed injury [22].

Several characteristics identified on imaging have been shown to influence the biomechanical stability of the fracture. First, the verticality of the fracture line in the coronal plane should be assessed. Pauwels

first recognized the significance of high angle fractures in the 1930s. He established a descriptive classification scheme that helps determine fracture stability based on the "Pauwels angle". A femoral neck fracture line < 300 from the horizontal plane is Pauwels Type I, fractures with an angle between 300 and 500 is Pauwels Type II and an angle of > 500 categorizes a Pauwels Type III fracture (fig 1). Increased verticality of the fracture decreases the load shared through the fracture fragments resulting in a biomechanically unstable pattern, susceptible to the development of mal-unions, non-unions and osteonecrosis [3,21].

Fig 1. Pauwel's classification



Another well-known and widely used classification system is that of Garden, originally published in 1961[23] Low inter and intra-rater reliability has led to it being mostly used for femoral neck fractures in the elderly population where the classification can be simplified to non-displaced (Garden I or II) vs displaced (Garden III or IV) in order to dictate appropriate management (fig 2) [24]. Secondly, special consideration should also be given to fractures with posterior neck comminution. Several studies have indicated this to be a poor prognostic factor after internal fixation and correlate the comminution with fracture severity and instability [25].

Fig 2. Garden's classification

Principles of Management

Non-operative treatment of femoral neck fractures in relatively young / middle aged patients has a very limited role and is only reserved for the sickest of patients whose surgical risks negate any benefit of fixation. Moreover, operative management is recommended for non-displaced impacted fractures. In a prospective study of three hundred and twelve patients with impacted femoral neck fractures (Garden I-II), Raaymakers et al [26] found that 5% of healthy patient below age 70 had secondary displacement and 87% of patients in this age group achieved union. Considering the pre-injury activity level of most of these patients, surgical management is recommended, as union rates are higher with operative treatment [25]. Goals of the surgical management of femoral neck fractures in young adult patients are three-fold: (1) Achieve an anatomic reduction of the fracture and preserve the blood supply and effectively prevent ONFH; (2) Provide a stable fixation while preserving bone stock to achieve union; (3) Return to pre-injury level of function.

Preoperative Considerations - Surgical timing of displaced and non-displaced fracture

The consensus for time to surgery following femoral neck fracture in this patient population is still a matter of debate. These fractures are classically treated on an urgent basis with the aim to regain and preserve blood flow to the femoral head but should not be operated in the middle of the night by a junior / less experienced surgeon. Studies have shown that early fixation decreases osteonecrosis and increases functional outcome [27]. In a retrospective study, Jain et al [28] looked at thirty-six young patients with femoral neck fractures. Patients treated within twelve hours of injury had a decreased rate of osteonecrosis as compared to the delayed fixation group. However, there was no difference in functional outcome between the early and delayed fixation group. In contrast, other studies have found no difference in osteonecrosis rates between early and delayed time to fixation [29]. Razik et al [30] retrospectively analyzed ninety-two patients with femoral neck fractures and found no difference in rates of osteonecrosis when comparing treatment within 6 h post-injury,

and delayed treatment 48 h post-injury. They found that the rate of osteonecrosis was related to the type of fixation, which may be indicative of surgeon treatment bias. The conflicting results in the literature are indicative of the wide amount of variance in the studies, which did not uniformly control for cofounding variables such as the quality or the type of reduction and fixation [31]. Given the controversial evidence and considering the impetus to prevent osteonecrosis and improve functional outcome, we recommend treating displaced femoral neck fractures on an urgent basis by an experienced surgeon.

Surgical management

Open vs Closed reduction: The decision between attempting an open or closed approach for fracture reduction is the first step when attempting primary fixation. There is no dispute as far as the management of non-displaced femoral neck fractures (Garden I-II) is concerned, as most of the authors agree on performing a closed reduction and internal fixation [32]. However there is considerable debate between the two strategies for reduction of displaced fractures (Garden III-IV). Obtaining an anatomic reduction is paramount, as a poorly reduced fracture is a major risk factor for non-union and ONFH [25]. Some authors argue that closed reduction can achieve anatomic reduction with intra-operative fluoroscopy; they suggest that this approach decreases cost, is less invasive and saves operating time. Care should be taken while performing the close reduction, as multiples attempts are associated with an increased risk of ONFH [33]. Others support the need for an open reduction to facilitate direct visualization for anatomic reduction, and with the same token, provide relief of a possible intra-capsular tamponade.

Approach: Traditionally, two different surgical approaches for open reduction of femoral neck fractures;

a. Watson-Jones (antero-lateral) [34]: the approach is in between the TFL and Vastus lateralis. With the same incision fracture is fixed and is best suited for basicervical fractures.
b. Smith-Peterson (anterior) [35]. Direct access to fracture between TFL and Sartorius. One needs to take a second incision laterally for fixation of fracture.

There is no gold standard as to proceed with closed or open reduction for displaced femoral neck fractures in this middle aged population as long as anatomic reduction is achieved.

Closed reduction can be attempted by adequate sedation and relaxation of muscle tone. Leadbetter first described in 1939 the maneuver to reduce of femoral neck fractures [36]. The affected leg is flexed to 45° with slight abduction and then extended with internal rotation while longitudinal traction is applied. The quality of reduction can be ascertained clinically by "**Heelpalm" test**: the patient's heel is placed in the palm of the surgeon's outstretched hand. If reduction is complete, the limb will not externally rotate (37). The reduction is verified with fluoroscopy in the AP and lateral view of the hip to verify the anatomic reduction. The quality of reduction can be ascertained using Garden's alignment index, which evaluates the angle of the compressive trabeculae as compared to the femoral shaft on both AP and lateral hip radiographs. Anatomic reduction is achieved with an angle of 160° on the AP, and 180° on the lateral view. Varus angulation of less than 160° on the AP view and posterior angulation of more than 5° on the lateral view indicate an unsatisfactory reduction [25].

Hematoma decompression

Another topic of controversy in treating femoral neck fractures in relatively young patients is the role of capsulotomy for hematoma decompression. The theoretical goal of capsulotomy is to relieve the tamponading effect of the developed intra-capsular hematoma and subsequently increase blood flow to the femoral head. There is good evidence in the literature correlating hemarthrosis following femoral neck fracture and increased intra-articular joint pressure.

In an interventional study, Beck et al [38] injected saline into intact intra-capsular space of eleven patients before having surgical

dislocations and subsequently measured blood flow to the femoral head with laser Doppler flowmetry. The measurable blood flow to the femoral head disappeared with increased pressure (average 58 mmHg) and the blood flow returned once the saline was re-aspirated. In contrast, in a prospective study involving thirty-four patients with femoral neck fractures, Maruenda et al [39] found no correlation between increased intra-capsular pressure and femoral head perfusion. Interestingly they also showed no difference in intra-capsular pressure between non-displaced and displaced fractures. Others have suggested higher pressures are found in non-displaced fractures. Disruption of the hip capsule during facture fragment displacement is thought to be responsible for the decreasing intra-capsular pressures.

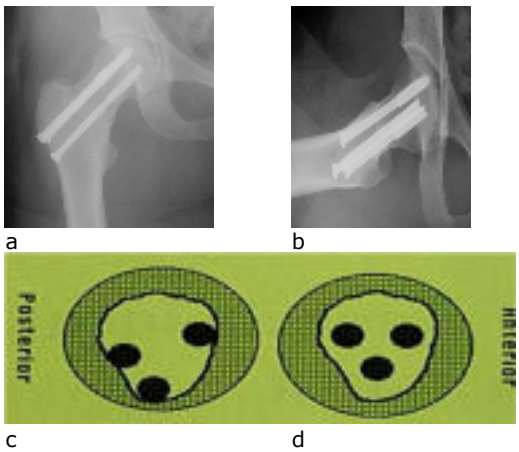
In the study by Maruenda et al [39] five out of the six patients that developed osteonecrosis had pre-operative intra-capsular pressures below diastolic pressure. They concluded what many presently think: high-energy trauma and the initial fracture displacement probably play a more significant role than intra-capsular tamponade in the development of osteonecrosis. Nevertheless, given the current evidence, we do not recommend the routine use of capsulotomy for femoral neck fractures.

Choice of construct

There are several biomechanical constructs available for the fixation of femoral neck fractures and knowing when and how to position the implant is paramount to attain a stable fixation. Compression screws (CS) and fixed-angle dynamic implants, or a combination of both, promote union during weight bearing by allowing the fracture fragments to slide along the implant while being axially loaded [31]. Fixed-angle and length stable implants, such as blade plates, maintain intraoperative reduction by providing a rigid construct [31]. Currently, hemiarthroplasty or total hip arthroplasty are not used as the primary surgery in middle aged patients. Total hip arthroplasty and valgus osteotomy are used as salvage operations in case of failure of fixation. There is still a debate on the optimal method of fixation for promoting union and preventing ONFH in this age group [30]. This is mainly because most opinions on fixation in this population are extrapolated from studies in elderly osteoporotic patients.

Multiples compressive screws: The use of the multiple compressive screws has been advocated for Garden type I-II in attaining union [40]. In a prospective randomized controlled trial of patients allocated to CS or dynamic hip screw (DHS) with non-displaced or minimally displaced femoral neck fracture, Watson et al found no difference in union rate, ONFH or functional outcome between the groups. Numerous studies have looked at biomechanical variations of this construct including the number and placement of the screws or variability in the proprieties of the screws themselves such as the length of the threads [41]. For instance, parallel screws have been shown to be superior construct than convergent screws in maintaining stability reduction [42]. Some authors advocate the use of a fourth screw in cases of fractures with posterior comminution [3]. However, optimal stiffness can be achieved with a three-screw configuration [7]. Three parallel screws placed perpendicular to the fracture line in a inverted triangle with the most inferior screw placed on the medial aspect of the distal femoral neck provides the ideal stability and compression at the fracture site (fig 3) [3].

Fig 3. Placement of cancellous screws in reverse triangle pattern in both AP (a) and lateral (b) views, along with showing screw orientation good (c) and bad (d) in cross section of neck of femur.



a b c d

Fixed angle implants: The dynamic hip screw (DHS) has been advocated as a more stable construct than compressive screws for high shear angle neck fractures (Pauwels type III) [42] . Addition of a derotational screw placed in the cranial part of the femoral neck superior to the dynamic hip screw can improve the rotational stability of the construct (fig 4). In a biomechanical study comparing four commonly used constructs for Pauwels type III fractures, Bonnaire et al [42] found the DHS with derotational screw to be more load stable than compressive screws, a fixed-angle plate or a simple DHS construct. However, for more stable fracture patterns this screw may be of little benefit. Furthermore, in their retrospective study of ninety-two young patients with femoral neck fractures, Razik et al [30] found that DHS alone or DHS supplemented with a derotational screw had significantly less osteonecrosis for Garden III-IV fractures.

Fig 4. Preoperative (a & b) and postoperative (c & d) AP and lateral views of Pauwels' type 3 fracture fixed with DHS and derotation screws.

Siavashi et al [43] in their study of 58 cases concluded that fixation of femoral neck fracture in young adults with the DHS is a better option compared with osteosynthesis with multiple cannulated screws with no fixation failures with DHS; however rate of AVN is same as cannulated screw fixation. In a cadaveric study, Aminian et al [44] compared the stability of DHS, CS, dynamic condylar screw and a proximal femoral locking plate (PFLP) for Pauwels type III femoral neck fractures. PFLP was the most stable for this fracture pattern, followed by the dynamic condylar screw, the DHS and CS. Currently, no clinical studies directly compare proximal femoral locking plate with DHS and/or DHS with derotational screw. We recommend the treatment of Garden I-II fracture with CS and Garden III-IV with a DHS and the addition of a derotational screw for Pauwels type III fractures.

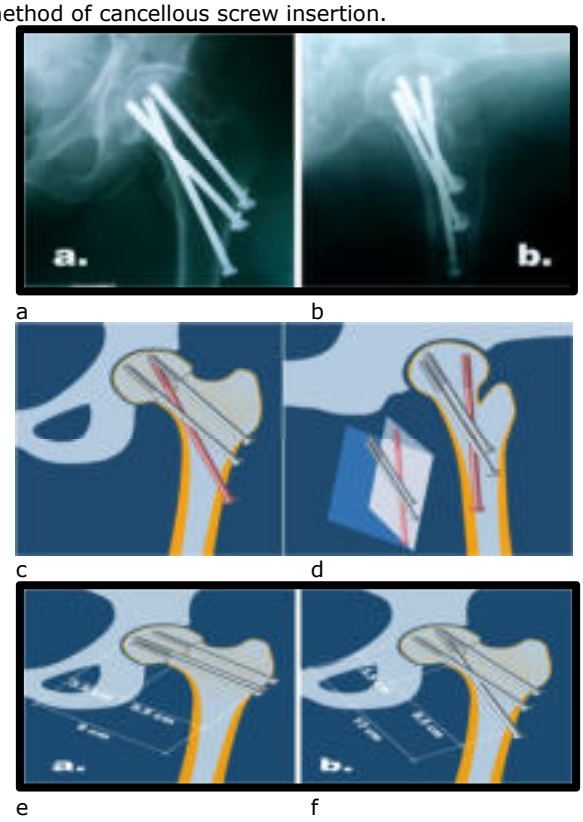
Newer methods of fixation:

Biplane double-supported screw fixation (BDSF): It is method of screw fixation at osteoporotic fractures of the femoral neck. First series published in 2011. BDSF is a new method of internal fixation, designed to improve the internal fixation strength at intracapsular femoral neck fractures in the presence of osteoporosis, according to an original concept of the establishment of two supporting points for the implants and their biplane positioning in the femoral neck and head. The provision of two steady supporting points for the implants and the highly increased (obtuse) angle at which they are positioned, allow the body weight to be transferred successfully from the head fragment onto the diaphysis. The position of the screws allows them to slide under stress with a minimal risk of displacement. This method can be used for Garden types from I to IV and the implant used is 7.3-mm self-tapping cannulated screws.

The BDSF-method has two calcar-buttressed implants. The distal screw (red color) touches on the calcar in the lateral part of the femoral neck, and also in the middle part of the femoral neck this screw has a cortical support on the posterior cortex of the neck. The middle screw (white color) touches on the calcar in the middle part of the neck (Fig. 5). At the method of BDSF, the innovative position of the three screws, laid in two planes (in lateral view), makes it possible for the entry points of two of the implants to be placed much more distally, in the solid cortex of the proximal diaphysis, and also to lean onto the femoral neck distal cortex. Thus it establishes two supporting points. The solid cortex of the calcar acts as a medial

supporting point for the screws. This supporting point works under pressure.

Fig 5. AP (a) & lateral (b) view & illustrations (c & d) of hip showing the configuration of BDSF. Illustrations showing comparison of conventional (e) & BDSF (f) method of cancellous screw insertion.



The entry points of the distal and the middle screws in the solid cortex of the proximal diaphysis, acts as a lateral supporting point for the two screws. This supporting point works under pressure in proximal direction. The position of the distal screw as well as the middle screw thus achieved by the method, in terms of statics, turns them into a simple beam with an overhanging end, loaded with a vertical force. This beam with an overhanging end, bridging the fracture, successfully supports the head fragment, bearing the body weight and transferring it to the diaphysis, resisting to the shearing forces (in a standing position). In the sagittal plane (in lateral view) the distal screw is touched on the posterior cortex of the femoral neck, thus ensuring a posterior supporting point, which works under pressure in posterior direction, in the process of antero-posterior bending of the neck (when rising from a chair). Other advantages of the method are:

1. Due to the biplane placement, enough space for a third screw is provided, unlike the classical methods, where just one or a maximum of two implants are placed at an obtuse angle (Burns 1944 [46], Küntscher 1953 [47], Garden 1961 [23], Von Bahr 1974 [48]).
2. Due to the increase in the distance between the two supporting points, the weight borne by the bone is reduced.
3. The entry points of the screws are positioned wide apart from each other, which ensure that when weight bearing, the tensile forces spread over a greater surface of the lateral cortex and thus the risk of a subtrochanter fracturing decreases significantly.
4. The screw, placed at a highly increased angle, works in a direction close to the direction of the loading force, which guarantees better results for the screw in its role of a beam because of the influence of its sagging decreases.
5. Very important advantage for BDSF is that the distal screw is touched on the posterior cortex, which together with the highly increased angle of this screw, provides improved strength of fixation at antero-posterior bending of the neck. (Walker 2007 [49]).

The popular conventional methods of femoral neck fixation by three cancellous screws, placed parallel to each other and parallel to the femoral neck axis, are associated with poor results in 20–42% [50,51]. The position of the screws with BDSF technique allows them to slide under stress at a minimal risk of displacement. The achieved results with the BDSF method in terms of fracture consolidation are far more successful than the results with conventional fixation methods. The BDSF method ensures reliable fixation, early rehabilitation and excellent long-term outcomes, even in non-cooperative patients. The author stressed the fact that BDSF is mainly addressed to patients, who have contraindications for arthroplasty, as well as for conventional screw fixation [45]. Orlin F et al [45] studied 88 patients with BDSF method and fracture union was registered in 87 patients (98.86%) and failure in 1 patient (1.13%).

Tragon fracture neck femoral system: This is a fixed angle device, combines the dynamic

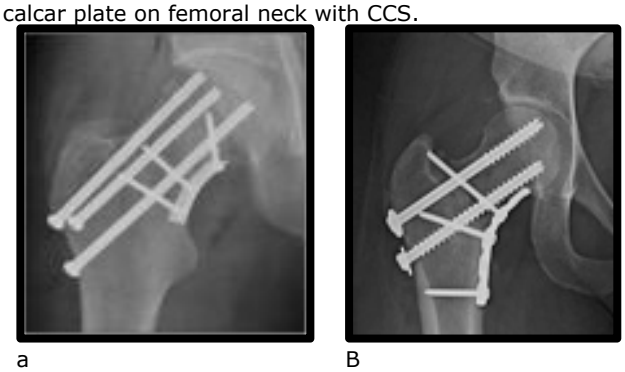
compression of DHS and the anti-rotation advantages of the cannulated screws. It consists of a short 6-hole plate that incorporates 4 proximal dynamic locking cancellous screws with associated sleeves and 2 distal standard locking screws. This allows controlled fracture collapse in line with the axis of the femoral neck, while the fixed angle implant design resists varus displacement (fig 6). This system is developed by Aesculap B-Braun (Germany) and results of large multicenter trials are still awaited although early results are encouraging [52].

Fig 6. Fracture fixed with Tragon system AP (a) & lateral (b) view.

a b

Medial plate on femoral neck: This is a concept by which application of a medial buttress plate which may prevent many treatment failures and varus collapse, particular seen after fixation of vertical femoral neck fractures in relatively young adults (fig 7). Mir H et al [53] has shown in his series that the application of a medial buttress plate may prevent many treatment failures seen after fixation of vertical femoral neck fractures in young adults.

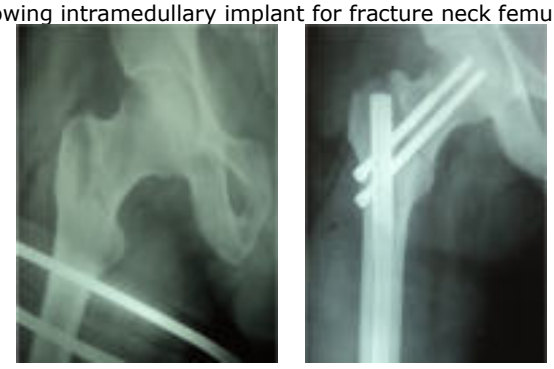
Fig 7. X-rays AP (a) & lateral (b) view showing medial calcar plate on femoral neck with CCS.



a B

Intramedullay implant for fixation of fracture neck femur: Cephallomedullary fixation is usually indicated in ipsilateral fracture shaft femur with neck femur. Mir HR et al [54] in their study of 18 patients with displaced intracapsular femoral neck fractures with a cephalomedullary nail concluded that cephalomedullary nail fixation of displaced intracapsular femoral neck fractures demonstrated mixed results (fig 8). For younger patients with midcervical fractures that were well reduced, the fixation performed well. Displaced subcapital fractures in patients older than 60 years demonstrated a 100% failure rate. As a result, they did not advocate cephalomedullary fixation for displaced intracapsular femoral neck fractures in patients older than 60 years, although in younger patients, these implants may provide an alternative to side-plate based fixation devices.

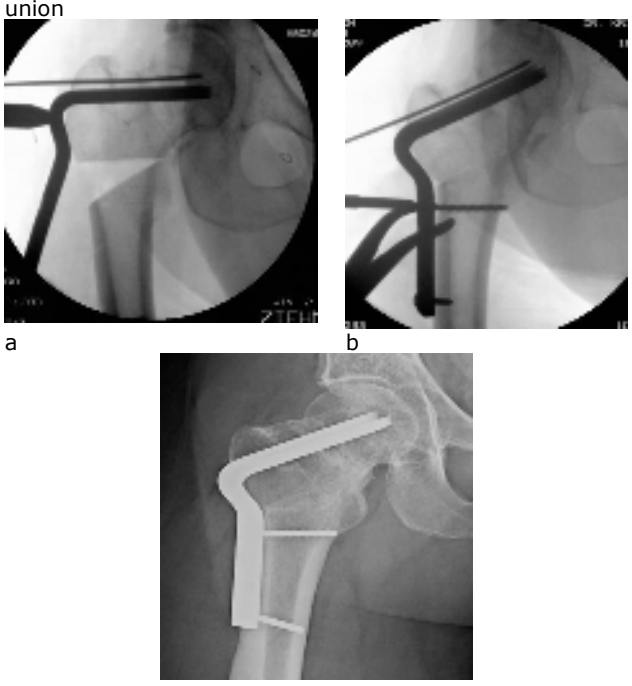
Fig 8. Preoperative (a) & postoperative (b) AP view showing intramedullary implant for fracture neck femur.



a b

Valgus osteotomy: It is a well-established procedure for nonunion and neglected fracture neck femur. This is a kind of intertrochanteric osteotomy which converts the shearing forces into compressive forces to enhance the healing at fracture site, which is usually performed in cases with high Pauwel's angle (fig 9). Both, the fracture neck femur and the osteotomy can be fixed with DHS, fixed angle blade plate or condylar blade plate depending on surgeon's choice. With better understanding of patho-anatomy of fracture neck femur, low threshold for open reduction and availability of good quality implants, the incidence of valgus osteotomy for a fresh fracture has reduced drastically in the recent past.

Fig 9. Intraoperative floroscopic view (a & b) of fracture neck femur fixed with condylar blade plate following a valgus osteotomy. Post-operative x rays (c) showing good union



a b c

Replacement arthroplasty: Replacement arthroplasty is not considered a first line treatment in relatively young patients as bone stock should be preserved and the potential complications of replacement arthroplasty avoided. The major early complications are dislocations for total hip arthroplasty and acetabular erosion for hemiarthroplasty [55]. In the elderly patients, short-term follow up has shown better functional outcome for total hip arthroplasty over hemiarthroplasty [56,57]. Studies have shown that internal fixation has higher re-operation rates and that both hemiarthroplasty and internal fixation have comparable functional outcomes [58]. To this date, there are no levels-I studies comparing arthroplasty to internal fixation in the relatively young adult.

Post-operative considerations

The postoperative recommendations are geared to lower the incidence of wound infection, deep vein thrombosis (DVT), and pulmonary embolism as well as to encourage mobilization. An antibiotic regimen with a first generation cephalosporin is indicated for 24 h [59]. The patients should be placed on DVT prophylaxis for thirty days with a pharmacologic agent such as low molecular weight heparin [60]. Physiotherapy should not be delayed and patients should be encouraged to mobilize with no restriction on range of motion of the hip. The patients are usually subject to toe-touch weight bearing with a walker or crutches for 12 week until the fracture is healed. They are then progressed to full weight bearing as tolerated. The patient should follow-up in 10-14 d post-operatively to assess the wound for infection and to assess the stability of the fixation construct. Follow up visits are indicated at six weeks and three months to assess for clinical and radiologic signs of non-union, osteonecrosis and hardware failure.

Conclusion

The role of conservative management in relatively young patients with femoral neck fracture is limited to patients who are medically unfit; we recommend treating displaced femoral neck fracture on an urgent basis; we do not recommend the routine use of capsulotomy for femoral neck fractures given the lack of evidence to support the development of osteonecrosis from intracapsular hematoma; we recommend the treatment of Garden I-II fracture with compressive screws and Garden III-IV with a dynamic hip screw and the addition of a derotational screw for Pauwels type III fractures.

References

1. Karagas MR, Lu-Yao GL, Barrett JA, Beach ML, Baron JA. Heterogeneity of hip fracture: age, race, sex, and geographic patterns of femoral neck and trochanteric fractures among the US elderly. Am J Epidemiol. 1996;143:677–82.
2. Chammout GK, Mukka SS, Carlsson T, Neander GF, Stark AW, Skoldenberg OG. Total hip replacement versus open reduction and internal fixation of displaced femoral neck fractures: a randomized long-term follow-up study. J Bone Joint Surg Am. 2012;94:1921–8.
3. Ly TV, Swiontkowski MF. Treatment of femoral neck fractures in young adults. J Bone Joint Surg Am. 2008;90:2254–66.

4. Girard J, Glorion C, Bonnomet F, Fron D, Migaud H. Risk factors for revision of hip arthroplasties in patients younger than 30 years. Clin Orthop Relat Res. 2011;469:1141–7.
5. Gerber C, Strehle J, Ganz R. The treatment of fractures of the femoral neck. Clin Orthop Relat Res. 1993; 292:77–86.
6. Askin SR, Bryan RS. Femoral neck fractures in young adults. Clin Orthop Relat Res. 1976;(114):259–64.
7. Yang JJ, Lin LC, Chao KH, Chuang SY, Wu CC, Yeh TT, Lian YT. Risk factors for nonunion in patients with intracapsular femoral neck fractures treated with three cannulated screws placed in either a triangle or an inverted triangle configuration. J Bone Joint Surg Am. 2013;95:61–9.
8. Karantana A, Boulton C, Bouliotis G, Shu KS, Scammell BE, Moran CG. Epidemiology & outcome of fracture of the hip in women aged 65 years & under: a cohort study. J Bone Joint Surg Br. 2011;93:658–64.
9. Talboys R, Pickup L, Chojnowski A. The management of intracapsular hip fractures in the 'young elderly' internal fixation or total hip replacement? Acta Orthop Belg. 2012;78:41–8.
10. Hedstrom M. Are patients with a nonunion after a femoral neck fracture more osteoporotic than others? BMD measurement before the choice of treatment? A pilot study of hip BMD and biochemical bone markers in patients with femoral neck fractures. Acta Orthop Scand. 2004;75:50–2.
11. Zlowodzki M, Brink O, Switzer J, Wingerter S, Woodall J, Petrisor BA, Kregor PJ, Bruinsma DR, Bhandari M. The effect of shortening and varus collapse of the femoral neck on function after fixation of intracapsular fracture of the hip: a multi-centre cohort study. J Bone Joint Surg Br. 2008;90:1487–94.
12. Adelani MA, Keeney JA, Palisch A, Fowler SA, Clohisy JC. Has total hip arthroplasty in patients 30 years or younger improved? A systematic review. Clin Orthop Relat Res. 2013;471:2595–601.
13. Davidovitch RI, Jordan CJ, Egol KA, Vrahas MS. Challenges in the treatment of femoral neck fractures in the nonelderly adult. J Trauma. 2010;68:236–42.
14. Al-Ani AN, Neander G, Samuelsson B, Blomfeldt R, Ekström W, Hedström M. Risk factors for osteoporosis are common in young and middle-aged patients with femoral neck fractures regardless of trauma mechanism. Acta Orthop. 2013;84:54–9.
15. Robinson CM, Court-Brown CM, McQueen MM, Christie J. Hip fractures in adults younger than 50 years of age. Epidemiology and results. Clin Orthop Relat Res. 1995;(312):238–46.
16. Xiao J, Yang XJ, Xiao XS. DSA observation of hemodynamic response of femoral head with femoral neck fracture during traction: a pilot study. J Orthop Trauma. 2012;26:407–13.
17. Sevitt S, Thompson RG. The distribution and anastomoses of arteries supplying the head and neck of the femur. J Bone Joint Surg Br. 1965;47:560–73.
18. Tornetta P, Kain MS, Creevy WR. Diagnosis of femoral neck fractures in patients with a femoral shaft fracture. Improvement with a standard protocol. J Bone Joint Surg Am. 2007;89:39–43.
19. Riemer BL, Butterfield SL, Ray RL, Daffner RH. Clandestine femoral neck fractures with ipsilateral diaphyseal fractures. J Orthop Trauma. 1993;7:443–9.
20. Wolinsky PR, Johnson KD. Ipsilateral femoral neck & shaft fractures. Clin Orthop Relat Res. 1995;(318):81–90.
21. Collinge CA, Mir H, Reddix R. Fracture morphology of high shear angle "vertical" femoral neck fractures in young adult patients. J Orthop Trauma. 2014;28:270–5.
22. Gill SK, Smith J, Fox R, Chesser TJ. Investigation of occult hip fractures: the use of CT and MRI. Scientific World J. 2013;8:303-19.
23. Garden RS. Low-angle fixation in fractures of the femoral neck. J Bone Joint Surg Br. 1961;43:647–63.
24. Van Embden D, Rhemrev SJ, Genelin F, Meylaerts SA, Roukema GR. The reliability of a simplified Garden classification for intracapsular hip fractures. Orthop Traumatol Surg Res. 2012;98:405–8.

25. Upadhyay A, Jain P, Mishra P, Maini L, Gautum VK, Dhaon BK. Delayed internal fixation of fractures of the neck of the femur in young adults. A prospective, randomised study comparing closed and open reduction. J Bone Joint Surg Br. 2004;86:1035–40.
26. Raaymakers EL. The non-operative treatment of impacted femoral neck fractures. Injury. 2002;33 Suppl 3:8–14.
27. Kuner EH, Lorz W, Bonnaire F. Femoral neck fractures in adults: joint sparing operations. I. Results of an AO collective study with 328 patients. Unfallchirurg. 1995;98:251–8.
28. Jain R, Koo M, Kreder HJ, Schemitsch EH, Davey JR, Mahomed NN. Comparison of early & delayed fixation of subcapital hip fractures in 60 years of age or less. J Bone Joint Surg Am. 2002;84:1605–12.
29. Karaeminogullari O, Demirors H, Atabek M, Tuncay C, Tandogan R, Ozalay M. Avascular necrosis and nonunion after osteosynthesis of femoral neck fractures: effect of fracture displacement and time to surgery. Adv Ther. 2004;21:335–42.
30. Razik F, Alexopoulos AS, El-Osta B, Connolly MJ, Brown A, Hassan S, Ravikumar K. Time to internal fixation of femoral neck fractures in patients under sixty years--does this matter in the development of osteonecrosis of femoral head? Int Orthop. 2012;36:2127–32.
31. Lowe JA, Crist BD, Bhandari M, Ferguson TA. Optimal treatment of femoral neck fractures according to patient's physiologic age: an evidence-based review. Orthop Clin North Am. 2010;41:157–66.
32. Petrie J, Sassoon A, Haidukewych GJ. When femoral fracture fixation fails: salvage options. Bone Joint J. 2013;95-B:7–10.
33. Garden RS. Malreduction and avascular necrosis in subcapital fractures of the femur. J Bone Joint Surg Br. 1971;53:183–97.
34. Watson JR. Fracture of the neck of the femur. British J Surg.1936;23:787.
35. Molnar RB, Routt ML. Open reduction of intracapsular hip fractures using a modified Smith-Petersen surgical exposure. J Orthop Trauma. 2007;21:490–4.
36. Leadbetter GW. A treatment for fracture of the neck of the femur. J Bone Joint Surg. 1938;20:108-13.
37. Whittle P. Fractures of lower extremity. In:Cannale T, Beaty JH. Campbell's operative orthopaedics.11th ed. Philadelphia: Mosby Elsevier. 2008. pp 2214.
38. Beck M, Siebenrock KA, Affolter B, Nötzli H, Parvizi J, Ganz R. Increased intraarticular pressure reduces blood flow to the femoral head. Clin Orthop Relat Res. 2004;(424):149–52.
39. Maruenda JI, Barrios C, Gomar-Sancho F. Intracapsular hip pressure after femoral neck fracture. Clin Orthop Relat Res. 1997;(340):172–80.
40. Zhou L, Tan J, Xu B. Treatment of femoral neck fracture with cannulated screw fixation in young adults. Zhongguo Xiufu Chongjian Waike Zazhi. 2007;21:275–7.
41. Watson A, Zhang Y, Beattie S, Page RS. Prospective randomized controlled trial comparing dynamic hip screw & screw fixation for undisplaced subcapital hip fractures. ANZ J Surg. 2013;83:679–83.
42. Bonnaire FA, Weber AT. Analysis of fracture gap changes, dynamic and static stability of different osteosynthetic procedures in the femoral neck. Injury. 2002;33 Suppl 3:C24–32.
43. Babak S, Arash A. A comparative study between multiple cannulated screws and dynamic hip screw for fixation of femoral neck in adults. Intern orthop. 2015;39:2069-71.
44. Aminian A, Gao F, Fedoriw WW, Zhang LQ, Kalainov DM, Merk BR. Vertically oriented femoral neck fractures: mechanical analysis of four fixation techniques. J Orthop Trauma. 2007;21:544–8.
45. Filipov O. Biplane double-supported screw fixation (F-technique): a method of screw fixation at osteoporotic fractures of the femoral neck. Eur J Orthop Surg Traumatol. 2011;21(7):539543.
46. Burns BH, Young RH. Early movement in the treatment of closed fractures. Lancet. 1944;243(6301):723-5.
47. Kuntscher G. Fully automatic nailing of the femoral neck. Z Orthop Ihre Grenzgeb. 1953;84(1):17- 28.

48. Von Bahr V, Syk B, Walheim G. Osteosynthesis of femoral neck fracture using screws. Acta Chir Scand. 1974;140(4):277-82.
49. Walker E, Mukherjee DP, OgdenAL, Sadasivan KK, Albright JA. A biomechanical study of simulated femoral neck fracture fixation by cannulated screws: effects of placement angle and number of screws. Am J Orthop (Belle Mead NJ). 2007;36(12): 680-4.
50. Aisns SE, Wanek-Sgaglione L. Intracapsular fractures of the femoral neck. Results of cannulated screw fixation. J Bone Joint Surg. 1994;76(12):1793–803.
51. Gjertsen JE, Vinje T, Engesaeter LB, Lie SA, Havelin LI, Furnes O, Fevang JM. Internal screw fixation compared with bipolar hemiarthroplasty for treatment of displaced femoral neck fractures in elderly patients. J Bone Joint Surg Am. 2010;92:619–28.
52. Martyn P, Hans WS: Aesculap Orthopaedics Targon® FN September, 2007.
53. Mir H, Collinge C. Application of a medial buttress plate may prevent many treatment failures seen after fixation of vertical femoral neck fractures in young adults. Med Hypotheses. 2015;84(5):429-33.
54. Mir HR, Edwards P, Sanders R, Haidukewych G. Results of cephallomedullary nail fixation for displaced intracapsular femoral neck fractures. J Orthop Trauma. 2011;25(12):714-20.
55. Avery PP, Baker RP, Walton MJ, Rooker JC, Squires B, Gargan MF, Bannister GC. Total hip replacement and hemiarthroplasty in mobile, independent patients with a displaced intracapsular fracture of the femoral neck: a seven- to ten-year follow-up report of a prospective randomised controlled trial. J Bone Joint Surg Br. 2011;93:1045–8.
56. Baker RP, Squires B, Gargan MF, Bannister GC. Total hip arthroplasty and hemiarthroplasty in mobile, independent patients with a displaced intracapsular fracture of the femoral neck. A randomized, controlled trial. J Bone Joint Surg Am. 2006;88:2583–9.
57. Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Randomized comparison of reduction and fixation, bipolar hemiarthroplasty, and total hip arthroplasty. Treatment of displaced intracapsular hip fractures in healthy older patients. J Bone Joint Surg Am. 2006;88:249–60.
58. Parker MJ, Pryor G, Gurusamy K. Hemiarthroplasty versus internal fixation for displaced intracapsular hip fractures: a long-term follow-up of a randomised trial. Injury. 2010;41:370–3.
59. Gillespie WJ, Walenkamp GH. Antibiotic prophylaxis for surgery for proximal femoral and other closed long bone fractures. Cochrane Database Syst Rev. 2010;(3):CD000244.
60. Barrera LM, Perel P, Ker K, Cirocchi R, Farinella E, Morales Uribe CH. Thromboprophylaxis for trauma patients. Cochrane Database Syst Rev. 2013;3:CD008303.

Results Of Single Stage Posterior Instrumentation In Complete Traumatic Spondyloptosis Of Thoracolumbar Spine

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Abstract:

Background: Complete traumatic spinal dislocations above lumbosacral junction are extremely rare injuries. These usually present with complete neural deficit below the level of injury. We present a short series of five patients of such unusual cases of traumatic spondyloptosis who presented to our hospital and were treated with single stage posterior instrumentation.

Material & methods: All patients with traumatic spinal injury with complete fracture dislocation i.e. more than 100% subluxation of one vertebra over the other treated with single stage posterior instrumentation were included in the study. Patients were assessed for the neural and bladder recovery, alignment of spinal column, implant loosening, rehabilitation and presence of bedsore.

Result: Five patients with mean age 31 years (range 22 to 36 years) and mean follow-up 14 months (range 12 to 18 months) were included in the study. All patients had with complete neurological deficit at the time of injury and none of patients neural power improved even at final follow-up. None of the patients had any bed sore present. All patients were mobile with the help of brace and wheel chair doing self- intermittent catheterization themselves. Radiologically, in all the patients the spinal column was well aligned, without any loss of alignment or fixation failure.

Conclusion: Traumatic spondyloptosis is an extremely rare severe form on spinal injury presenting with complete neurological deficit. Surgical management by posterior approach is aimed to realign the vertebral column for proper rehabilitation of patient. Though one cannot expect neurological recovery in these patients but still early restoration of normal spinal cord anatomy should be done to provide proper milieu to the spinal cord and for early rehabilitation to the patient.

Keywords: Traumatic Spondyloptosis, Complete thoracolumbar Dislocation, Rehabilitation

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Introduction

Traumatic spondyloptosis is an extremely rare form of injury, but is among the most severe form on spinal injury. It is defined as 100% or greater subluxation of one vertebral body over another vertebra in coronal or sagittal plane secondary to an injury, usually leading to complete cord transaction [1]. Since it is associated with either cord transaction or there is severe cord damage, it is always associated with neural deficit. Complete paraplegia is usually the rule and is seen in approximately more than 80% of the cases [2]. Due to complete neurodeficit associated with this type of injury, the prognosis is poor and the treatment is aimed for rehabilitation rather than the neural improvement. Complete fracture dislocation, or traumatic spondyloptosis is most commonly seen in L5-S1 lumbosacral region and it is rarely seen in lumbar or thoraco-lumbar region [3-10]. We here present a short series of five cases of traumatic spondyloptosis causing complete

cord / cauda equina injury, which was treated by surgical fixation for early rehabilitation.

Material and methods

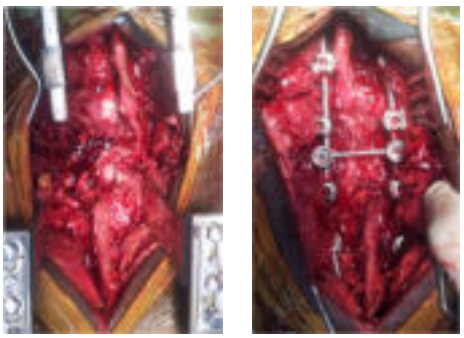
The study is conducted on patients of complete traumatic fracture dislocation presenting to our centre. The study was approved by institutional review committee and written informed consent was taken by all patients. All patients with any age or sex, coming to our center with traumatic spinal injury with complete fracture dislocation i.e. more than 100% subluxation of one vertebra over the other with any neurology were included in the study. Patients with open injury, Nontraumatic spondyloptosis, pathologic spondyloptosis or incomplete dislocation or subluxation of one vertebra over the other were excluded from the study.

All patients presenting with spinal trauma, were first haemodynamically stabilized and then a detailed history and thorough examination was done evaluating pain, tenderness, motor examination, sensory and autonomic examination including assessment of bladder and bowel, etc. Initial ASIA grade was calculated according to American Spinal Injury Association (ASIA) Impairment scale and recorded. All patients underwent a CT scan as well as MRI scan of the affected segment of spine to assess the bony injury pattern and document the cord and neural injury.

After routine investigation and fitness, all patients were operated under general anaesthesia in prone position over bolsters, using posterior midline approach to spine. The spinal column was restored in alignment by open reduction very gentle to avoid the injury of the great vessels. Once the reduction was achieved, the fixation of the spinal column was done with pedicle screws fixation two vertebra above and two levels below (fig 1).

Post operatively all patients were put on air/water mattress. Rehabilitation was started immediately following surgery unless contraindicated by other injuries. Patient were given appropriate nursing care, back care, active and passive physiotherapy, DVT prevention centripetal massage, bowel care (using biological bulk forming agents like isabgol / psyllium husk, laxatives were given if required), skin care, chest physiotherapy and psychological support. Regular bladder irrigation was done with mild antiseptic solution. Urinary catheter was removed and patients were taught method continous intermittent catheterization. Patients were mobilized with the help of anterior spinal hyperextension brace and wheel chair. Regular follow ups were done and at each follow up ASIA grade was analysed and recorded to see for neural recovery in any. Patients were also assessed for the other parameters like bladder recovery, alignment of spinal column, implant loosening and complications associated with long recumbency.

Fig 1. Intraoperative photos of patient with spondyloptosis showing dislocation (a) and reduction with placement of pedicle screw fixation (b).



a b

Result

Five patients were included in the study. The mean age of patients was 31 years (range 22 to 36 years).

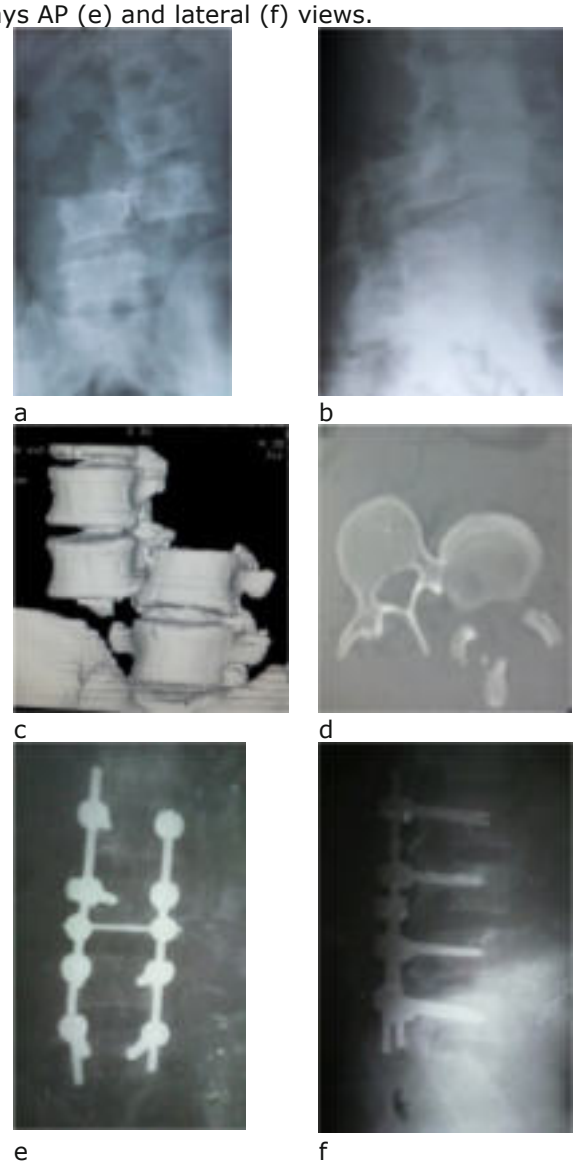
Four cases were male and one was female. Three sustained trauma due high velocity road traffic accident, whereas two sustained injury due to fall from height. One patient had additional fracture in bilateral calcaneum. The mean follow-up period was 14 months (range 12 to 18 months).

The preoperative ASIA score of the all the patients was type A i.e. all had complete neural deficit, with no sensory or motor function preserved below the injury. Bladder and bowel was also involved in all the patients as seen by incontinence. MRI of all the patients confirmed cord transection at the

level of injury. Three patients had spondyloptosis at L3 over L4 level and one at each D12 over L1, and one at L1 over L2. The delay in presentation of the patients was 32 hr (range 8 to 56 hrs) and mean delay in surgery was 36 hrs (range 24 to 72 hrs).

At final follow up, none of the patient have neurological recovery. None of the patients had any bed sore present. All patients were mobile with the help of brace and wheel chair. All patients were doing self- intermittent catheterization themselves without support. Radiologically, in all the patients the spinal column was well aligned, without any loss of alignment or fixation failure (fig 2).

Fig 2. Preoperative X ray AP (a) and lateral (b) views and CT scan transverse (c) and axial (d) views of 35 year patient with spondyloptosis treated by posterior approach with pedicle screw fixation showing good alignment in postoperative X rays AP (e) and lateral (f) views.



Discussion

Spondyloptosis is a form of severe spinal dislocation or advanced spondylolisthesis, in which one spinal segment is dislodged from the other segment [11-13]. Traumatic spondyloptosis is an extremely rare entity, but has severe problems than milder forms of spondylolisthesis [14]. Paraplegia with bowel and badder incontinence occurs in almost all cases of spondyloptosis either thoracic or lumbar.

According to the three column concept describe by Dennis, injury involving all the three columns are unstable injuries [15]. Mechanism of injury described for these injuries is due to high impact trauma causing axial compression and shearing simultaneously leading to fractured facet joints and all ligament rupture leading to complete dislocation of spine. Hence these injuries involve disruption of all the three spinal column, and are inherently severely unstable injuries.

Suggested treatment methods ranges from benign neglect, in situ fusion to decompression and fusion [10,16-24]. In treatment of spinal trauma, only stable fractures can be managed conservatively by bed rest, while unstable fractures require open reduction and stabilisation with rigid instrumentation. Since these injuries are severely unstable, these should not be treated conservatively, because conservative treatment can lead to increased complications related to long bedridden and further, non-surgical treatment may cause future spinal deformity and continuous back pain and delayed rehabilitation [25,26].

Surgical treatment with reduction and rigid stabilization is advisable for such complete dislocation for achieving the alignment and early rehabilitation. The surgery can be done via anterior, posterior or combined approach [4,12-18]. There are very few case reports or series describing complete traumatic spondyloptosis [3-9]. All these reported cases / series has described posterior instrumentation as the standard method of treatment. The posterior approach, is most

commonly used and had shown good success and fewer complications [5,27-35]. The posterior reduction and fixation using pedicle screws for the thoracolumbar spondyloptosis alone is sufficient to provide good alignment and sufficient stable fixation [36,37]. We also treated all our patients via posterior approach for reduction and pedicle screw fixation and were able to achieve reduction, alignment and stable fixation in all the patients. In all cases we manipulated the dislocated spine very gently so as avoid any further damage to the cord and anterior large vessels, a plausible complication which can have futile results.

Since these patients had complete neurodeficit with cord transaction present, the prognosis is poor. It has been shown that rather than fracture severity assessed radiologically, the degree of anatomical injury found at surgery is a better predictor of outcome [2]. Hence it can be said that surgery in these spondyloptosis patients helps to prognosticate the injury in addition to helps to achieve alignment, decreased deformity and provide early rehabilitation. In our series, all patients showed complete cord transaction following a high impact trauma. None of the patient had neurological recovery postoperatively as there was complete cord / cauda equina transaction. The only aim of surgery was to realign the spine to provide better mileu to the cord and stabilize it for proper rehabilitation of the patient, which was achieved by surgical treatment in all our patients.

Conclusion

Traumatic spondyloptosis is an extereme rare condition causing complete neurological deficit. Posterior instrumentation provides satisfactory results as far as realignment and stabilisation is considered. While reduction manipulation should be gentle so as to avoid injury to great vessels this lies immediately anterior to the injured spine. The main aim of surgery is to make injured vertebral column stable to allow for proper reahabilitation, rather than neural recovery.

References:

1. Chandrashekhara SH, Kumar A, Gamanagatti S, Kapoor K, Mukund A, Aggarwal D, Sinha S. Unusual traumatic spondyloptosis causing complete transaction of spinal cord. Int Orthop. 2011;35(11):1671-5.
2. Bellew MP, Bartholomew BJ. Dramatic neurological recovery with delayed correction of traumatic lumbar spondyloptosis. Case report & review of literature. J Neurosurg Spine. 2007;6(6):606-10.
3. Cherian I, Dhawan V. Lateral lumbar spondyloptosis. Int J Emerg Med. 2009;2(1):55-6.
4. Abdel-Fattah H, Rizk AH. Complete fracture-dislocation of the lower lumbar spine with spontaneous neurologic decompression. Clin Orthop Relat Res. 1990;(251):140-3.
5. Chatani K, Yoshioka M, Hase H, Hirasawa Y. Complete anterior fracture-dislocation of the fourth lumbar vertebra. Spine. 1994;15;19(6):726-9.
6. Chavda DV, Brantigan JW. Technique of reduction and internal fixation of thoracolumbar fracture-dislocation using pedicle screws and variable screw placement plates. Orthop Rev. 1994;I:25-31.
7. Chen WC. Complete fracture-dislocation of lumbar spine without paraplegia. Int Orthop. 1999;23:355–7.
8. Stagner JK. Fracture-dislocation of the thoracolumbar spine with special reference to reduction by open and closed operations. J Bone Joint Surg Am. 1947;29(1):107-18.
9. Suomalainen O, Pääkkönen M. Fracture dislocation of the lumbar spine without paraplegia. A case report. Acta Orthop Scand. 1984;55(4):466-8.
10. Wiltse LL, Newman PH, Macnab I. Classification of spondylolisis and spondylolisthesis. Clin Orthop Relat Res. 1976;117:23-9.
11. Curylo LJ, Edwards C, DeWald RW. Radiographic markers in spondyloptosis: implications for spondylolisthesis progression. Spine. 2002;15;27(18):2021-5.

12. Hanna BG, Pill SG, Drummond DS. Irreducible thoracic spondyloptosis in a child with neurofibromatosis: a rationale for treatment. Spine. 2002;15;27(14):E342-7.
13. Rockower S, McKay D, Nason S. Dislocation of the spine in neurofibromatosis. A report of two cases. J Bone Joint Surg Am. 1982;64(8):1240-2.
14. Lehmer SM, Steffee AD, Gaines RW Jr. Treatment of L5-S1 spondyloptosis by staged L5 resection with reduction and fusion of L4 onto S1 (Gaines procedure). Spine. 1994;1;19(17):1916-25.
15. Denis F. The three column spine and its significance in the classification of acute thoracolumbar spinal injuries. Spine. 1983;8(8):817-31.
16. Bosworth DM, Fielding JW, Demarest L, Bonaquist M. Spondylolisthesis; a critical review of a consecutive series of cases treated by arthrodesis. J Bone Joint Surg Am. 1955;37(4):767-86.
17. Boxall D, Bradford DS, Winter RB, Moe JH. Management of severe spondylolisthesis in children and adolescents. J Bone Joint Surg Am. 1979;61(4):479-95.
18. Maurice HD, Morley TR.Cauda equina lesions following fusion in situ and decompressive laminectomy for severe spondylolisthesis. Four case reports. Spine. 1989;14(2):214-6.
19. Peek RD, Wiltse LL, Reynolds JB, Thomas JC, Guyer DW, Widell EH. In situ arthrodesis without decompression for Grade-III or IV isthmic spondylolisthesis in adults who have severe sciatica. J Bone Joint Surg Am. 1989;71(1):62-8.
20. Seitsalo S, Osterman K, Poussa M. Scoliosis associated with lumbar spondylolisthesis. A clinical survey of 190 young patients. Spine. 1988;13(8):899-904.
21. Wiltse LL. Spondylolisthesis in children. Clin Orthop. 1961;21:156-63.
22. Maurice HD, Morley TR. Cauda equina lesions following fusion in situ and decompressive laminectomy for severe spondylolisthesis. Four case reports. Spine. 1989;14(2):214-6.
23. Smith MD, Bohlman HH. Spondylolisthesis treated by a single-stage operation combining decompression with in situ posterolateral and anterior fusion. An analysis of eleven patients who had long-term follow-up. J Bone Joint Surg Am. 1990;72(3):415-21.
24. Verbiest H.The treatment of lumbar spondyloptosis or impending lumbar spondyloptosis accompanied byneurologic deficit and/or neurogenic intermittent claudication. Spine. 1979;4(1):68-77.
25. Hanley EN Jr, Eskay ML. Thoracic spine fractures. Orthopedics. 1989;12(5):689-96.
26. Sapkas GS, Papagelopoulos PJ, Papadakis SA, Themistocleous GS, Stathakopoulos DP et al. Thoracic spinal injuries: operative treatments and neurologic outcomes. Am J Orthop (Belle Mead NJ). 2003;32(2):85-8.
27. Shapiro S, Abel T, Rodgers RB.Traumatic thoracic spinal fracture dislocation with minimal or no cord injury. Report of four cases and review of the literature. J Neurosurg. 2002 Apr;96(3 Suppl):333-7.
28. Fountain SS. A single-stage combined surgical approach for vertebral resections. J Bone Joint Surg Am. 1979;61(7):1011-7.
29. Gräbe RP. Fracture-dislocation of the lumbosacral spine during a grand mal epileptic seizure. A case report. S Afr Med J. 1988 Aug 6;74(3):129-31.
30. Riska EB, Myllynen P, Böstman O.Anterolateral decompression for neural involvement in thoracolumbar fractures. A review of 78 cases. J Bone Joint Surg Br. 1987 Nov;69(5):704-8.
31. Samberg LC.Fracture-dislocation of the lumbosacral spine. A case report. J Bone Joint Surg Am. 1975 Oct;57(7):1007-8.
32. Sapkas G, Pantazopoulos T, Efstathiou P.Anteriorly displaced transverse fracture of the sacrum with fracture-dislocation at the L4-L5 lumbar level. Injury. 1985 Mar;16(5):354-7.
33. Van Savage JG, Dahners LE, Renner JB, Baker CC.Fracture-dislocation of the lumbosacral spine: case report and review of the literature. J Trauma. 1992 Nov;33(5):779-84.
34. Prasad VS, Vidyasagar JV, Purohit AK, Dinakar I.Early surgery for thoracolumbar spinal cord injury: initial experience from a developing spinal cord injury centre in India. Paraplegia. 1995 Jun;33(6):350-3.

35. Silvestro C, Francaviglia N, Bragazzi R, Viale GL. Near-anatomical reduction and stabilization of burst fractures of the lower thoracic or lumbar spine. Acta Neurochir (Wien). 1992;116(1):53-9.
36. Han IH, Song GS. Thoracic pedicle screw fixation and fusion in unstable thoracic spine fractures. J Korean Neurosurg. 2002;32:334–40.
37. Park YK, Lee JK, Lim DJ, Chung HS, Lee HK. Pedicle screw fixation of the thoracic spine. J Korean Neurosurg. 1999;28:190–195.

Outcome Of Proximal Femoral Nail in Management of Pertrochanteric Fracture

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Abstract

Background: Fractures around the trochanteric region of femur are one of the commonest fractures encountered in orthopedics. Better understanding of the biomechanics and the development of better implants have led to radical changes in treatment modalities of pertrochanteric fracture femur. This study was undertaken for evaluating the results of Proximal Femoral Nail in the management of pertrochanteric fractures by analysing the factors which influence the post-operative mobility, associated complications and to evaluate the functional outcome.

Material and Method: This prospective study was done in 50 cases of pertrochanteric fracture treated with Proximal Femoral Nail of age more than 20 years. Open, pathological fractures and age less than 20 years were excluded from the study. Outcome was assessed by modified Harris Hip Score system and radiologically for union

Results: 50 Patients of pertrochanteric fracture with mean age 70.4 year (range 25 to 95 years) were included in study. The mean delay in surgery was 3.8 days (range 2 to 8 days). The mean Harris Hip Score at final follow up was 84.32 ± 5.55. 32 (68%) patients had good outcome, 7 (14%) reported with excellent outcome and 5 (10%) had a fair outcome. Only 4 (8%) patient had poor outcome. Union was achieved in all patients in mean 12.02 weeks (range 10 to 14 weeks). The mean surgical time was 71 min (range 63 to 110 min). The mean blood loss in surgery was 180 ml (range 150 to 300 ml). Most common complications was shortening seen in 4 (8% cases), whereas varus, superficial infection and screw cut out was seen in one patients respectively, while Z effect and abductor lurch was seen in two patients each.

Conclusion: The Proximal Femoral Nail, after proper training and technique is a safe and easy implant option for treatment of complex pertrochanteric fractures which has the unique advantages of closed procedure, minimal invasive, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work and is biomechanical stable.

Keywords: Proximal femoral nail, pertrochanteric femur fractures, intertrochanteric fractures

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Introduction

Fractures around the trochanteric region of femur are one of the commonest fractures encountered in orthopaedics and also the most devastating injuries of the elderly. The incidence of this fracture increases with advancing age. These pertrochanteric femoral fractures especially in elderly have the high postoperative fatality rate and have become a serious health resource issue because of the high cost of care, prolonged morbidity and

extensive disability unless the treatment is appropriate [1].

Better understanding of the biomechanics and the development of better implants have led to radical changes in treatment modalities of pertrochanteric fracture femur which can be treated with either a sliding hip screw or a trochanteric nail. A problem with sliding hip screws is collapse of the femoral neck, leading to loss of hip offset and shortening of the leg. Although some such sliding is expected, too much shortening is detrimental to hip function. Therefore, Proximal Femoral Nail was designed in 1996 which gives a further advantage of minimally invasive surgery [1].

This study was therefore undertaken for evaluating the results of Proximal Femoral Nail in the management of pertrochanteric fractures by analysing the factors which influence the post-operative mobility, associated complications and functional outcome.

Material and Methods

This prospective study was done at our centre in 50 cases of pertrochanteric fracture treated with PFN between 2014 to 2016 after written informed consent and clearance from institutional ethical committee. Patients with pertrochanteric fractures, with age more than 20 years and fit for surgery were included in the study, whereas skeletally immature individual, open or pathological fractures were excluded from the study.

After obtained medical clearance, all patients were operated under the same spinal anesthesia on fracture table. Primarily closed reduction was obtained and under c arm reduction was checked in AP and lateral views on the fracture table. Proximal femoral nailing was done as prescribed by making entry with awl or thick pin at the priformis fossa after 3 cm incision above the tip of greater trochanter. Guide wire was passed from entry in to the canal and checked under C arm for its placement. Reaming of canal was done in patients having narrow medullary canal to fit largest possible diameter nail in the canal. The nail is passed over guide wire. The holes in PFN were aligned in the direction of neck properly just above the calcar. The guide wire sleeve is targeted through the jig into the corresponding holes of PFN and guide wire is passed in to neck and head of femur. The placement of guide wire was checked under c arm in AP and lateral views and later drilled and fixed with corresponding screws. Distal interlocking was done by free hand technique under c-arm control.

The patients were mobilized in-bed and encouraged to sit in bed and perform static exercises from the next day of operation. At around 14th day postoperatively, the stitches were removed. Touchdown weight bearing with the help of a walker or crutches began two weeks after the surgery. Slowly progressive weight bearing and full weight bearing was started as per pain tolerance of the patient. Functional outcome was assessed by modified harris hip score [2] and radiological X rays were assessed for union.

Results

50 Patients of pertrochanteric fracture with mean age 70.4 year (range 25 to 95 years) were included in study, with more than 60% patients were elderly having osteoporosis. There were 24 females and 26 males in the study. Domestic fall and road traffic accident were the mode of injury in all the patients. As per Boyd & Griffin classification, type 1 fracture was seen in 1 (2%) patient, type 2 in 32 patients (64%), type 3 in 11 (22%) and type 4 in 6 patient (12 %). Right to left side involvement was in 28 to 22 patients respectively. The mean delay in surgery was 3.8 days (range 2 to 8 days). In all patients closed reduction was successful to achieve anatomical reduction, except for 5 patients, in which manipulation / elevation or compression with help of the bone spike was done. The mean surgical time was 71 min (range 63 to 110 min). The mean blood loss in surgery was 180 ml (range 150 to 300 ml). Union was achieved in all patients in mean 12.02 weeks (range 10 to 14 weeks).

The mean Harris Hip Score at final follow up of 6 months in 47 patients was 84.32 ± 5.55. 32 (68%) patients had good outcome, 7 (14%)

reported with excellent outcome and 5 (10%) had a fair outcome. Only 4 (8%) patient had poor outcome (fig 1). There was an statistically significant improving trend in the Harris hip score from 1 month, 3 months to 6 months which was 37.68 ± 5.42, 70.83 ± 5.06 and 84.32 ± 5.55 respectively.

Majority of the patients (74.46%) had either no pain or slight pain which did not affect their activities. Only one patient had severe pain and 19.1% (9) of patients had mild to moderate pain which was relieved with analgesics. 41 patients (86 %) had no or slight limp that did not affect their activities. 6 patient (12.8%) had moderate limp which was mainly due to shortening. 51% patients did not require any support for walking and 25.5% of patients used cane for only long walks, whereas only 2 patients was mobilizing with the help of crutch. 87.2% patient was able to walk outdoor. Only 10.6 % patients walk in indoor area. One patient was not able to walk and stay in bed & chair. 38.29% of patients could climb stairs without any support but 46.8% required the support of railing. 3 patients were unable to climb the stairs. Squatting was possible in 29.8% with ease and with difficulty in 48.9%. 10 patients were not able to squat. Cross leg sitting was possible in 78.7% of the patients, but 48.9% of these patients had some difficulty while doing so. 10 elderly patients were unable to sit cross legged. This restriction of motion was primarily due to osteoarthritis.

Of the 47 patients in this series, 1 patient had shortening of more than 2 cm which required shoe raise. 3 patients had less than 2 cm of shortening and it did not require any treatment, whereas rest had no LLD.

3 patients had implant failure and treated by different surgical procedure after PFN implant removal. Most common complications was shortening seen in 4 (8% cases), whereas varus, superficial infection and screw cut out was seen in one patients respectively, while Z effect and abductor lurch was seen in two patients each (table 1).

Fig 1. Pre-operative AP view of pelvis (a) showing pertrochanteric fracture, which was treated by PFN showing good reduction in immediate AP (b) and lateral (c) X rays of hip with thigh. 6 months postoperative AP (d) and lateral (e) X rays of hip with thigh and clinical photographs (f to h) showing excellent outcome.

Table no.1. Complications after PFN

Complication	No. of Patient
Superficial Infection	1 (2%)
Deep Infection	0 (0%)
Screw Cut-out	1 (2%)
"z" Effect	2 (4%)
Reverse "z" Effect	0 (0%)
Varus Deformity	1 (2%)
Abductor Lurch	2 (4%)
Shortening	4 (8%)
Greater trochanteric splintering	3 (6%)
TOTAL	14 (28%)

Discussion

The successful treatment of Pertrochanteric fractures depends on many factors like age of the patient, patient's general health and comorbidities, time from fracture to treatment, adequacy of treatment and stability of the fixation. Current recommendations suggest that all pertrochanteric fractures should be internally fixed to reduce the morbidity and the mortality of the patient. But the appropriate method and the ideal implant

by which to fix the pertrochanteric fracture is still in debate [1].

Several fixation devices have been developed to overcome the difficulties encountered in the treatment of unstable trochanteric fractures. Until recently most of these fractures were treated by sliding hip screw. Since these devices performed less well in unstable trochanteric fractures with high rates of failure, intra medullary devices have become increasingly popular. The proximal femoral nail is an effective load sharing device that incorporates the principles and theoretical advantages of all the intra medullary devices [3]. Biomechanically, PFN is better as it is stiffer; it has a shorter lever arm (i.e. from the tip of the lag screw to the center of the femoral canal) whereas the DHS has a longer lever arm (i.e. from the tip of the lag screw to the lateral cortex). The DHS with a longer lever arm undergoes significant stress on weight bearing and hence higher incidence of lag screw cut out and varus malunion [4]. PFN can be done closed, which provided advantages of minimal blood loss, shorter operative time and early weight. PFN provides a dynamic femoral neck screw and splints whole of the femer [5].

We evaluated the outcome of PFN in 50 patients of pertrochanteric fracture and found excellent to good outcome in 39 (78%) cases, whereas poor outcome in 4 (8%) cases with mean Harris Hip Score at final follow up of 84.32 ± 5.55. The results are comparable with the studies done by Pajarinenet al, Saudanet al, Zhoa et al, kumar al, Bhakatet al and Huang et al [7-12]. Anatomic reduction before nailing is a prior requirement for the excellent outcome of surgery. We also achieved closed reduction in all patients except 10%, in comparison to 9% by Boldinet et al which required additional methods for reduction like elevation with spike [13].

The mean surgical time in our series was 71 min, which was comparable to other studies [6-12]. The surgical time was reduced greatly in the later part of the study, indicating that proximal femoral nailing requires learning curve. The average intra operative blood loss was 180 ml and only 22% of our patients required intra or post-operative transfusion, but this was because many of our patients were anaemic. The average union time was 12.02 weeks in our series. We did not found any case of non-union in our study.

We had "Screw Cut-out" in 2% and "z" effect in 4% of patients which was mostly due to suboptimal placement of the hip screw or cervical screw along with early mobilization of the patients who had severe osteoporosis. Hence these 3 patients required revision surgery. One patient with "z" effect treated with PFN implant removal and fixed was by DHS. Another two patients with "z" effect and screw cut-out required calcar replacing cemented bipolar prosthesis. Only one patient with shortening of more than 2 cms required shoe raise, while none other needed any treatment for shortening. Abductor lurch was seen in two patients in the post-operative period which, improved with progression of time. This has been attributed to Gluteus medius tendon injury in patients treated with IM devices [7]. 6% of our patients had greater trochanter splintering while inserting the nail but no other intervention was required and all the fractures healed well. Infection was present in 2% of the patients which was superficial and was treated with antibiotics and dressing only and none required debridement or revision and healed well.

Pajarinen et al on comparison of PFN with DHS, found that use of the proximal femoral nail may allow a faster postoperative restoration of walking ability [7], whereas Saudan et al concluded no advantage of intramedullary nail over sliding compression hip screw for low-energy pertrochanteric fractures [8].

Kumar et al and Bhakatet et al concluded that DHS was tolerated better by young patients with stable fracture while PFN had a better outcome with osteoporotic patients and weak bone mass and reverse oblique fractures. PFN group has less blood loss and less operating time compared to DHS group. In the long term both the implant had almost similar functional outcomes [10,11]. Whereas Huang et al in his

meta-analysis concluded that PFN fixation shows the same effectiveness as DHS fixation with respect to operation time, blood transfusion, hospital stay, wound complications, number of reoperation, and mortality rate [12].

We found proximal femoral nail to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability. It has shown to be more biomechanically stronger because they can withstand higher static and several fold higher cyclical loading. So the fracture heals without the primary restoration of the medial support. The implant compensates for the function of the medial column. Intramedullary proximal femoral nail also acts as a buttress in preventing the medialization of the shaft. Also, proximal femoral nail is long and it has smaller diameter at the tip which reduces the stress concentration at the tip. Hip screw and the anti-rotation cervical screw of the Proximal femoral nail adequately compress the fracture, leaving between them adequate bone block for further revision, if need arise.

We in our study found success of Proximal femoral nail depends on good surgical technique, proper instrumentation and good C-arm visualization and it had advantages of easy reduction with traction, lesser assistance, easy patient manipulation and better C arm visibility. Proximal femoral nail is costly than the dynamic hip screw, but it provided advantages like less operative time, lower blood loss, lesser hospital stay and lesser medications as minimal invasive, thus reducing the overall cost and early return to daily activities.

Conclusion

Proximal femoral nail can be considered the most judicious and rational method of treating pertrochanteric fractures, especially the unstable and reverse oblique type as it is minimal invasive, with preserves the fracture hematoma, yields early healing and early union. Minimal invasive also confirms quick procedure, small incision, significantly less amount of blood loss, lesser hospital stay and early mobilization. But Proximal femoral nailing requires a higher surgical skill, good fracture table, good instrumentation and good C-arm control. It has a steep learning curve. Proximal Femoral Nail, after proper training and technique a safe and easy implant option for treatment of complex pertrochanteric fractures which has the unique advantages of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work.

References

1. Simmermacher RK, Bosch AM, Van der Werken C. The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures. Injury. 1999;30(5):327-32.
2. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am. 1969;51(4):737-55.
3. Schipper IB, Bresina S, Wahl D, Linke B, Van Vugt AB, Schneider E. Biomechanical evaluation of the proximal femoral nail, Clin Orthop Relat Res. 2002: (405):277-86.
4. Rosenblum SF, Zuckerman JD, Kummer FJ, Tam BS. A biomechanical evaluation of the Gamma nail. J Bone Joint Surg Br. 1992;74(3):352-7.
5. Leung KS, So WS, Shen WY, Hui PW. Gamma nails and dynamic hip screws for peritrochanteric fractures. A randomised prospective study in elderly patients. J Bone Joint Surg Br. 1992;74(3):345-51.
6. Pavelka T, Kortus J, Linhart M. Osteosynthesis of trochanteric fractures using proximal femoral nails. Acta Chir Orthop Traumatol Cech. 2003;70(1):31-8.

7. Pajarinen J, Lindahl J, Michelsson O, Savolainen V, Hirvensalo E. Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A randomised study comparing post-operative rehabilitation. J Bone Joint Surg Br. 2005;87(1):76-81.
8. Saudan M, Lübbeke A, Sadowski C, Riand N, Stern R, Hoffmeyer P. Pertrochanteric fractures: is there an advantage to an intramedullary nail?: a randomized, prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail. J Orthop Trauma. 2002;16(6):386-93.
9. Zhao C, Liu DY, Guo JJ, Li LP, Zheng YF, Yang HB, Sun JH. Comparison of proximal femoral nail and dynamic hip screw for treating intertrochanteric fractures. Zhongguo Gu Shang. 2009;22(7):535-7.
10. Kumar R, Singh RN, Singh BN. Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur. J Clin Orthop Trauma. 2012;3(1):28–36.
11. Bhakat U, Bandyopadhyaya R. Comparative Study between Proximal Femoral Nailing and Dynamic Hip Screw in Intertrochanteric Fracture of Femur. Open J Orthop. 2013;3:291-5.
12. Huang X, Leung F, Xiangh Z, Tan PY, Yang J, Wei DQ, Yu X. Proximal Femoral Nail versus Dynamic Hip Screw Fixation for Trochanteric Fractures: A Meta-Analysis of Randomized Controlled Trials. Scientific World J. 2013;2013:805805.
13. Boldin C, Seibert FJ, Fankhauser F, Peicha G, Grechenig W, Szyszkowitz R. The proximal femoral nail (PFN) - a minimal invasive treatment of unstable proximal femoral fractures: a prospective study of 55 patients with a follow-up of 15 months. Acta Orthop Scand. 2003;74(1):53-8.

Pre-contoured locking plates vs conventional reconstruction plates in AO type C Distal humerus fractures: A prospective randomised study

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Abstract

Background: Reconstruction plates have been used from a long time for fixation of distal humerus fractures. Locking plates are increasingly used now-a-days. The aim of this study is to compare the radiological and functional outcome of AO type C distal humerus fracture treated with pre-contoured locking plates with conventional reconstruction plates.

Material and Methods: A total of 25 patients of AO type C distal humerus fracture were treated using locking plates (n=14) or reconstruction plates (n=11) and compared for radiological union and for functional outcome by Mayo Elbow Performance Score (MEPS).

Results: The mean duration of surgery and hospital stay was similar in both the groups. The mean Range of motion and MEPS score was significantly higher in locking plate group as compared to conventional reconstruction plates at 3 months post operatively. However both of them were similar at 6 months and 12 months post operatively. 93% union rate in locking plate group and 91 % union rate in reconstruction plate group were seen at the end of 12 months follow-up. Excellent and/or good results were obtained in 93% in locking plate group which is significantly higher than reconstruction plate group in which only 82% patients had excellent and/ or good results.

Conclusion: Locking plates has advantage over reconstruction plates in early mobility and greater functional outcome.

Keywords: Distal Humerus fracture, AO Type C, Locking Plate, Reconstruction plates, MEPS Score.

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Introduction

Fractures of distal humerus are relatively uncommon injuries in adults and are very challenging to manage. Approximately 7% of the adult fractures involves the elbow, of which about one-third involve the distal humerus [1,2]. The proximity of neurovascular structures, the frequent occurrence of metaphyseal bone loss and significant articular comminution, and the unforgiving tendency of the elbow toward capsular stiffness and heterotopic ossification make these fractures often difficult to treat [3,4].

Overall incidence of distal humerus fracture is increasing, mimicking the increasing incidence of hip, proximal humerus and wrist fractures [5]. Historically, these injuries were treated by means of closed reduction and slinging (the so called "bag of bones" technique) because the results of open reduction and internal fixation were poor [6]. Advances in the techniques of open reduction and internal fixation and newer implants along with the goal of anatomic

restoration and early mobilization, the standard of care has now shifted to surgical treatment of these injuries by open reduction and internal fixation. The ultimate surgical goals are stable facture fixation and early mobilization of elbow [7]. Depending upon the severity of communition and displacement, open reduction and internal fixation can be done with locking plates, reconstruction plates, cannulated cancellous screws (C.C. screws), kirschner wire or tension band wiring. The introduction of anatomical pre-contoured locking plate technology approximately a decade ago, ushered in the latest advances for the management of distal humerus fractures, offered enhanced biomechanical properties and more robust fixation, thus allowing early rehabilitation. Controversy persists, whether standard non-locking plate screws construct well-placed to maximize subchondral buttressing performs better than locking screws placed through the factory preset trajectories which are often distant from and not parallel to the articulation of the distal humerus. Further long term, clinical benefits of locking plate fixation for distal humerus fractures are not known [8]. The aim of this study was to compare and evaluate the results of pre-contoured locking plates and conventional reconstruction plates in management of AO type C distal humerus fractures in adults with regard to functional outcome using Mayo Elbow Performance Score (MEPS) and radiological outcome in terms of rate of union.

Materials and Methods

This randomized prospective study was done comparing patients with intra-articular distal humerus fractures AO type C treated either by pre-contoured locking plates or conventional reconstruction plates after getting approval from institutional ethical committee and written consent from all patients. Fractures were classified using the AO/OTA classification system on the basis of preoperative X-rays and CT scans. All AO type C distal humerus fractures, with age more than 18 years were included in the study. Open fractures, pathological fractures, fractures with neuro-vascular injury and associated fracture of ipsilateral upper limb were excluded from the study.

All the fractures were treated with definitive open reduction and internal fixation (ORIF) within 3 days. For the surgical procedure, the patients were placed in the lateral position with the involved arm supported and forearm hanging allowing at least 90° flexion. In all patients, posterior approach along with Chevron osteotomy of the olecranon was done. The ulnar nerve was explored routinely; however, transposition was only performed in those patients where mechanical irritation seen by medial plate, was a concern. After temporary reduction and fixation with K-wires, osteosynthesis using either the anatomically pre-contoured locking compression plates or 3.5mm reconstruction plates were used for both the columns. The patients were randomly randomized into these groups. Olecranon osteotomy was fixed with cannulated cancellous screws or tension band wiring (fig 1).

Postoperatively, the elbow was splinted in 90° flexion and the limb was kept elevated to decrease swelling and patient was encouraged to move their fingers. Intravenous antibiotics were continued till post-operative day 2. Suction drain was removed after 48 hours and wound inspection was done at 2nd and 5th post-operative day. Oral antibiotics and analgesics were given to the patient till the time of suture removal. Sutures/staples were removed on the 12th postoperative day. At 2 weeks POP slab was removed and patient was given arm pouch and active elbow and shoulder range of motion exercises were started as per patients pain tolerance. Patients were instructed to carry out physiotherapy in the form of active elbow flexion-extension and pronation-supination. Patients were advised not to lift heavy weight or exert the affected upper limb.

Patients were followed up regularly at 6 weeks, 3 months, 6 months and 12 months post-operatively. At each follow up, patients were assessed subjectively for pain, swelling and restriction of joint motion. The functional assessment of the patient was done according

to Mayo elbow performance score and radiological assessment done for union. The results were statistically analyzed using Mann Whitney U test and a level of $p < 0.05$ was considered significant.

Results

A total of 25 patients (18 men and 7 women) were included in this study. The baseline characteristics of the patients in both groups are given in Table 1. The mean age of patients was 35 years (range 18 to 75 years). The dominant arm was involved in 16 fractures (16/25). AO type C1 (simple intra-articular) fracture was found in 9 patients (9/25), AO type C2 (simple articular fractures with metaphyseal comminution) were seen in 12 cases (12/25) and 4 fractures (4/25) were classified as AO type C3 (multi-fragmentary intra-articular) fractures. Locking plates were used in 14 patients and reconstruction plates were used 11 patients. Mean duration of surgery and mean duration of hospital stay were comparable in both the groups (p value= 0.661 and 0.622 respectively).

Range of motion was statistically higher in locking plate group as compared to reconstruction plates groups at 3 months ($p<0.0001$) while the difference was statistically insignificant at 6 ($p =0.085$) and 12 ($p=0.166$) months follow-up. Similarly, on comparing the mean MEPS score, the difference was found to be statistically higher in locking plate group at 3 months ($p=0.029$) but at 6 ($p=0.066$) and 12 ($p=0.107$) months the difference was statistically insignificant. About 93% patients in locking plate group and 82% patients in reconstruction plate group achieved excellent and/or good results as per MEPS score. Union rate was 93% in locking plate and 91% in reconstruction plate group at the end of 12 months follow-up, with no significant difference between the two groups (table 1).

2 cases had superficial infection, one each in locking and reconstruction plate group which were healed with antibiotics. 3 case of post-operative stiffness were reported, one in locking plate group and two in reconstruction plate group which were managed with physiotherapy and manipulation under anaesthesia. After which, all 3 patients achieved reasonably good to fair range of motion. One case of postoperative ulnar nerve neuropathy was reported in locking plate group which required anterior transposition of ulnar nerve at 4 months post-operatively and subsequently complete recovery occurred at final follow-up. One case of non-union was observed each in locking plate group and reconstruction plate group which further required revision surgery with bone grafting. Interestingly, no case of failure of osteosynthesis of olecranon osteotomy was observed in our series.

Table 1. Results comparing locking plate and reconstruction plate

Parameters	Locking plate group (n=14)	Reconstruction plate group (n=11)	p-value
Age	38.07±18.73	31.81±10.65	0.3337
Gender (M:F)	8:6	10: 1	0.090
Laterality (R:L)	8:6	8:3	0.6766
AO type (C1:C2:C3)	5:7:2	4:5:2	0.9581
Mean surgical duration (min)	139.64± 12.16	137.27 ± 14.55	0.661
Mean hospital stay (days)	8.50 ± 2.74	9.09±3.18	0.622
Range of Motion			
3 months	43.2l±8.22	33.18±6.80	<.0001
6 months	76.42±14.06	71.36±15.98	0.085
12 months	1 11.35± 17.7	102.72±20.90	0.166
Mayo Elbow performance Score			
3 months	53.92±11.l2	42.27±13.84	0.029
6 months	66.42±10.45	59.69±14.96	0.095
12 months	82.85±9.94	76.36±13.24	0.107
Union			
Union rate	93%	91%	0.089
Complications			
Superficial infection	01	01	
Post-operative stiffness	01	02	
Ulnar nerve neuropathy	01	00	
Non-union	01	01	

Fig 1. Pre-operative & post-operative AP (a & c) and lateral (b & d) X rays of a type C1 distal humerus fracture treated with pre-contoured locking plate with intraoperative photo (e).

a b c d e

Discussion

In recent years, the techniques used to treat distal humerus fractures have evolved significantly, from conservative treatment to open reduction using different fixation methods and systems. Inspite of advances, treatment of distal humerus fracture still remains one of the most demanding challenges in elbow surgery. Further type C fractures of distal humerus are most difficult to manage in spite of the advancement in fixation technique [1-3].

The locking plate technology in the management of distal humerus fractures has various biomechanical and theoretical advantages. Despite of these stated advantages, there are scanty clinical data directly comparing its efficacy to non-locking plate fixation for the management of intra-articular distal humerus fractures. Hence we performed this study to determine whether locking plates offered any advantages over non-locking plates in term of functional and radiological outcomes. Our results showed that though at initial 3 months follow-up, the results were statistically higher in locking plate group with regard to mean range of motion and mean MEPS score, there exist's no statistically significant difference between the two groups in term of functional and radiological outcome at final follow-up of one year. The data demonstrate that while non-locking constructs allowed for more ideal screw positioning, the rate of union was equivalent between both groups. The difference between the two groups at initial 3 months follow-up might be due to less rigid fixation provided by reconstruction plates in comparison to locking plates leading to delay in range of motion exercises.

Very few studies have directly compared the functional and radiological outcome between locking and non-locking construct. Berkes et al, retrospectively analyzed 96 patients with intra-articular distal humerus fractures and compared the locking and non-locking construct on the basis of clinical and radiological outcome, fixation failure, complications and cost-effectiveness. They found that though locking construct costs on an average 348% more than the non-locking construct, there exists no statistically significant advantage that locking plates provide with regard to adequacy of fixation, clinical and radiographic outcomes and complications [8].

Komer et al biomechanically compared non-locking and locking plate and found that the stiffness of the construct was not different if arranged in the same configuration [9]. Another study by the same group compared orthogonal constructs using conventional reconstruction plates, locking compression plates, and precontoured distal humerus locking plates in cadaveric specimens of varying bone mineral densities and concluded that fixation with either locking or non-locking plates is acceptable in patients with good bone

mineral density, but locking plates could prove to be more effective in patients with lower bone mineral density [10]. Since there were no large data available comparing the locking and non-locking constructs for AO type C distal humerus fractures, we therefore did this study and compared our results with previous studies and found equivocal rates of non-union, functional outcome, and complication rates [11-13].

The results of this study verify that there has been no statistically significant advantage that locking plates provide with regard to adequacy of fixation, clinical outcomes and complications. Though non-locking plates allow for ideal screw placement but, the impact of this is unknown. The results of this study does not provide enough data to make any recommendations at present but it definitely serves as a critical analysis of locking and non-locking plates fixation that might stimulate future research on this topic.

Conclusion

Locking plates has advantage over reconstruction plates in treatment of distal humerus AO type C fractures in early mobility and greater functional outcome, but long term functional and radiological outcome of both locking plates and reconstruction plates are comparable.

References

1. Anglen J. Distal Humerus fractures. J Am Acad Orthop Surg. 2005;13(5):291-297.
2. Rose Sh, Melton LJ yo, Morrey BF et al. Epidemiologic features of humeral fractures. Clin Orthop Relat Res. 1982;168:24-30.
3. Helfet DL, Schmeling GJ. Bicondylar intraarticular fracture of the distal humerus in adults. Clin Orthop Relat Res. 1993;292:26-36.
4. Wong AS, Baratz ME. Elbow fractures: distal humerus. J Hand Surg Am. 2009;34(1):176-90.
5. Kannus P. Preventing osteoporosis, falls and fractures among elderly people. Promotion of life long physical activity is essential. BMJ 1999;318(7178):205-206.
6. Brown RF, Morgan RG. Intercondylar T-shaped fractures of the humerus. Results in ten cases treated by early mobilization. J Bone Joint Surg Br. 1971;53(3):425-8.
7. Muller WE: Communited fracture of the distal end of the humerus in the adult. AAOS Instructional Coarse Lectures. J Bone Joint Surg 1964;46A:644.
8. Berkes M, Garrigues G et al. Locking and Non-locking Constructs Achieve Similar Radiographic and Clinical Outcomes for Internal Fixation of Intra-articular Distal Humerus Fractures. Hand Surg J. 2011;7:244-50.
9. Korner J, Diederichs G, ArzdorfM et al. A biomechanical evaluation of methods of distal humerus fracture fixation using locking compression plates versus conventional reconstruction plates. J Orthop Trauma. 2004;18(5):286-93.
10. Schuster I, Korner J, Arzdorf M, Schwieger K, Diederichs G, Linke B. Mechanical comparison in cadaver specimens of three different 90-degree double-plate osteosynthesis for simulated C2-type distal humerus fractures with varying bone densities. J Orthop Trauma. 2008;22(2):113-20.
11. Koshimune M, Kamano M, Takamatsu K, Ohashi H: A randomized comparison of locking and non-locking palmar plating for unstable Colles' fractures in the elderly. J Hand Surg Br. 2005;30:499-503.
12. Handschin AE, Cardell M, Contaldo C, Trentz 0, Wanner GA. Functional results of angular-stable plate fixation in displaced proximal humeral fractures. Injury. 2008:39:306-13.
13. Jiang R, Luo CF, Wang MC, Yang TY, Zeng BF. A comparative study of Less Invasive Stabilization System CUSS fixation and two-incision double plating for the treatment of bicondylar tibial plateau fractures. Knee 2008;15:139-43.

The Outcome of Complex Tibial Plateau Fractures (Schatzker type V and VI) Treated with Dual Plates

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Abstract

Background: Isolated lateral locked plating does not provide sufficient fixation to resist collapse of the medial condyle in bicondylar tibial plateau fractures, leading to loss of axial alignment of the limb, producing varus deformity and poor long-term outcomes. Dual locked plating of bicondylar tibial plateau fractures are required to reduce the risk of mal-reduction and loss of reduction and prevents secondary post traumatic osteoarthritis. Hence we evaluated functional and radiological outcome of dual locking plates in proximal tibial plateau fractures Schatzker type V and VI.

Material & Methods: Twenty-two cases of tibial plateau fractures Schatzker type V and VI treated with dual locking plates, antero-lateral and medial buttress plating were evaluated for functional outcome using Knee Society Score and radiological outcome was evaluated for union and alignment by modified Rasmussen radiological assessment score.

Results: A total of 22 patients with mean age 34 years (range 22 to 49 years) were included in the study. 16 were male and 6 were female. The mean delay in surgery was 5.3 days (range 3 to 9 days). All Fractures were united at mean duration of 14.4 weeks, and the mean time to full weight-bearing was 12 weeks. The mean range of knee motion was 121°. The mean knee severity score was 85. 18 patients had excellent results, 2 had good results, 1 had fair result and 1 had poor result as per Knee severity score. As per Rasmussen radiological assessment score 20 had excellent and one each had good and fair results and none of the patient had poor results. Two with superficial infection and one had hardware prominence but none of the patients had non-union, arthritis or secondary loss of reduction.

Conclusion: Schatzker type V and VI fractures require double plate fixation for optimal stability, which prevents secondary loss of reduction and varus/valgus collapse of the fracture and provides excellent radiological and function outcome.

Keywords: Tibial plateau fracture, dual locking plate, Knee severity score

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Introduction

Tibial plateau fractures are high energy fractures and remain challenge to orthopaedic surgeons [1]. Early techniques of osteosynthesis emphasized anatomical reduction and rigid fixation of fractures. Isolated lateral locked plating does not provide sufficient fixation to resist collapse of the medial condyle, leading to loss of axial alignment of the limb, producing varus deformity and poor long-term outcomes. Studies have indicated that dual locked plating of bicondylar tibial plateau fractures reduces the risk of mal-reduction and loss of reduction

and hence prevents secondary post traumatic osteoarthritis [2,3]. The tibial plateau fractures are associated with severe soft tissue injury and application of dual plate by two approaches and two incisions will add to the soft tissue damage already present from the injury [4]. Minimal invasive techniques can decrease this surgeon related morbidity. Thus we evaluated functional and radiological outcome of dual locking plates in proximal tibial plateau fractures Schatzker type V and VI.

Material and Methods:

Twenty-two cases of bicondylar tibial plateau fractures treated with dual locking plates were included in our study after ethical committee clearance and written consent by the patients. Tibial plateau fractures Schatzker type V and VI with age more than 18 years, closed fractures or open Gustilo Anderson type I were included in this study [5,6]. Tibial plateau fracture Schatzker I to IV, pathological fracture, open fracture type II or more, associated with neurovascular injury or age less than 18 years were excluded from the study.

All the patients underwent X-ray of involved limb and 3D CT Scan for detailed study of fracture pattern. At the time of admission, all patients were evaluated for their general condition, routine blood investigations and chest X-ray. Limb was kept elevated and cold fomentation was encouraged to reduce edema and swelling. Surgery was differed in patients with swelling and blisters till wrinkles appeared over the skin.

All tibial plateau schatzker type V and VI fractures were operated under spinal anesthesia under C arm control under tourniquet, only after the swelling was reduced. In all cases the anatomic reduction of the articular surface was achieved and temporary fixed with k wires after confirmation by C arm in both the views. The depressed fragment was elevated in all the cases. Following this in all cases a buttress plate was applied on the medial side or posteromedial side to buttress medial or posteromedial fragment through posteromedial approach. Another locking hockey plate was applied on the over anterolateral side by minimal invasive methods via standard lateral approach, by sliding the plate in the submuscular plane.

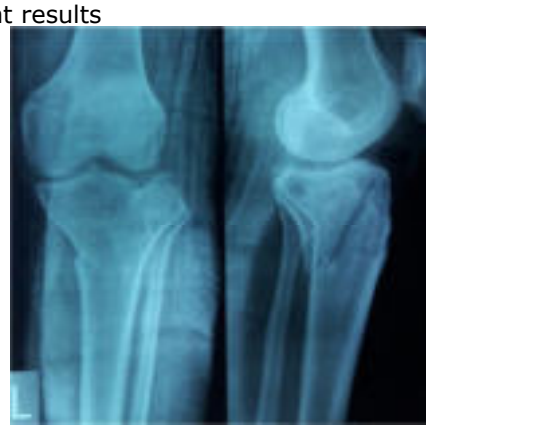
Post-operatively, an above knee slab support was given. Check dress was done after 48 hours of surgery. Sutures and slab support was removed at two weeks. After that active and active assisted physiotherapy and range of motion exercises were encouraged. All patients were followed up for a period ranging from 14 weeks to 40 months. Functional outcome was evaluated using Knee Society Score and radiological outcome was evaluated for union and alignment by modified Rasmussen radiological assessment score and by Paley criteria [7,8]. According to Paley et al. an increase of 5° malalignment or an articular depression of 2 mm compared with the first postoperative radiograph was defined as secondary loss of reduction [8].

Results

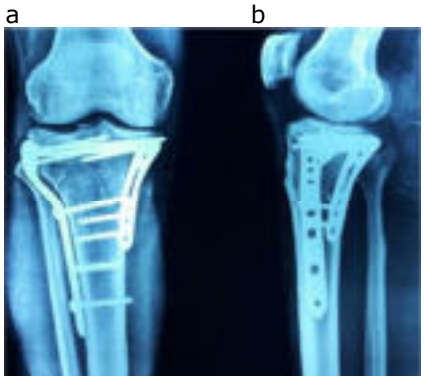
A total of 22 patients of tibial plateau schatzker type V and VI with mean age 34 years (range 22 to 49 years) were included in the study. 16 were male and 6 were female. Right side was involved in 14 case and left side in 8 cases. The mean delay in surgery was 5.3 days (range 3 to 9 days).

All fractures were united at mean duration of 14.4 weeks, and the mean time to full weight-bearing was 12 weeks. At the final follow-up visit, no patients showed knee instability; the mean range of knee motion was 121°. The mean knee severity score of the series was 85. Amongst all patients, 18 patients had excellent results, 2 had good results, 1 had fair result and 1 had poor result as per Knee severity score. As per Rasmussen radiological assessment score 20 had excellent and one each had good and fair results and none of the patient had poor results (fig 1). There was no change in the radiological findings between their immediate postoperative and final follow-up X-rays. All patient had good reduction (articular step <2mm) except one patient with double plates, in whom there was 4 mm articular step.

Fig 1. Pre-operative, immediate post-operative and 6 months followup X rays AP (a, c & e) and lateral (b, d & f) view of 35 year old male patient with Schatzker type VI fracture treated with dual plates. Clinical photographs (g,h & i) at 6 months showing excellent results



a b



c d

e f

g h i

Complications were seen in three cases, two with superficial infection which healed with antibiotics and one had hardware prominence which required removal after union. None of our case had non-union, arthritis or secondary loss of reduction.

Discussion:

In tibial plateau fractures, to preserve normal knee function, treatment must aim to re-establish joint stability, alignment, and articular congruity to ensure a full range of motion. In complex tibial plateau fractures, it is mandatory to anatomically reduce the articular part of the fracture in order to prevent the secondary arthritis and achieve a stable articular and metaphyseal fixation to facilitate the fracture healing regardless which treatment option is selected [1]. Moreover, soft tissue complications can be largely minimized by staging the treatment of the patient. Treatment with hybrid external fixator to treat tibial plateau fractures have shown fewer complications of soft tissues compared with internal fixation, but reports have shown that the use of a hybrid external fixator can cause joint infection [9,10].

The LCP system a new concept in plate osteosynthesis that attempts to combine the advantages of minimally invasive surgical approaches utilizing anatomically pre-shaped plates with the screws that lock into the plate forming the fixed angle device. The locking screws provide a fixed angle device at each screw plate interface [3,4]. The locking plate system combined with indirect reduction technique limits the surgical trauma inflicted while stabilizing the fracture. Studies have shown that a lateral locking plate is not always sufficient to protect the fracture from collapse, and an additional medial plate is necessary to further stabilize the fracture and prevent subsidence of medial fragment [3,11]. Horwitz et al compared the mechanical stability of fixation of an unstable bicondylar tibial plateau fracture with several different fixation techniques in a cadaveric model and found better results with fixation with a lateral buttress plate with an anteromedial antiglide plate [12].

We evaluated the outcome of dual locking plates for Schatzker type V and VI tibial plateau fractures in 22 patients and found that more than 90% patients have excellent functional and radiological outcome.

David Barei et al on treating 41 bicondylar tibial plateau fractures with dual incisions and medial and lateral plates found that accurate reduction could be achieved in only half of the complex fractures [13]. In our study we were able to achieve good reduction almost all the cases which is the reason for excellent results in our series. Jiang et al compared 43 patients of bicondylar fracture tibia with dual plates and 41 patients with LISS plates and found no statistically significant differences in adequate reduction rates of the articular surface, union rate or radiographic healing time, infection, between the Dual Plate (DP) group and the LISS group [4]. LISS plate group showed significantly higher cases of malalignment of the proximal tibia most frequently involving deformity in the sagittal plane compared to DP group. But secondary loss of reduction and loss alignment was comparable in both the groups. But study by Gosling et al in 62 tibial plateau fractures treated with single LISS plate showed 16 patients had substantial loss of reduction [3].

Z Yu et al treated 62 patients of tibial plateau fractures with double plates [14]. At the final follow-up visit, no patients showed knee instability and no statistically significant difference in the functional outcomes was observed between their 6-months and final follow-up visits; or in the radiological findings between their immediate postoperative and final follow-up examinations in terms of alignment. We also, in our study did not found change in the radiological findings between their immediate postoperative and final follow-up X-rays. All patient had good reduction (articular step <2mm) except one patient and this reduction was maintained in the long term follows also.

Dual plate is not without complications, and it has its own complication like infection, hardware related complications, thromboembolism and compartment syndrome, whereas single plate has fewer complication rates like varus collapse [13,14]. But in our study we did not encountered any compartment syndrome or thromboembolism, but two patients had superficial infection which healed with antibiotics and one had hardware prominence which required removal after union.

Our study has several limitations like fewer patients, shorter followup and lack of randomization. Even articular reduction can't be precisely evaluated on plain radiographs; Computed tomography study is required to accurately evaluate articular reduction instead.

Conclusion:

Locking plate fixation is preferred treatment option for complex tibial plateau fractures with excellent radiological and function outcome, especially complex fractures like Schatzker type V and VI fractures which require double plate fixation for optimal stability. This double plate configuration prevents secondary loss of reduction and varus/ valgus collapse of the fracture. Satisfactory surgical restoration of the articular component of these injuries guides the patient outcomes. We concluded that a satisfactory articular reduction with use of the described surgical technique positively affects patient outcome. Satisfactory reduction can be achieved even in the patients with more severe injuries for better radiological and clinical outcome.

References

1. Manidakis N, Dosani A, Dimitriou R, Stengel D, Matthews S, Giannoudis P. Tibial plateau fractures: functional outcome and incidence of osteoarthritis in 125 cases. International Orthop. 2010;34(4):565-70.
2. Jensen DB, Rude C, Duus B. Tibial plateau fractures. A comparison of conservative and surgical treatment. J Bone Joint Surg Br. 1990;72:49-52.
3. Gosling T, Schandelmaier P, Muller M, Hankemeier S, Wagner M, Krettek C. Single lateral locked screw plating of bicondylar tibial plateau fractures. Clin Orthop Relat Res. 2005 Oct;439:207-14.

4. Jiang R, Luo CF, Wang MC, Yang TY, Zeng BF. A comparative study of Less Invasive Stabilization System (LISS) fixation and two-incision double plating for the treatment of bicondylar tibial plateau fractures. Knee. 2008 Mar;15(2):139-43.
5. Schatzker J, McBroom R, Bruce D. The tibial plateau fracture. The Toronto experience 1968–1975. Clin Orthop Relat Res. 1979;138:94-104.
6. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: retrospective and prospective analyses. J Bone Joint Surg Am. 1976;58:453–458.
7. Rasmussen DS. Tibial condylar fractures, Impairment of knee joint stability as an indica-tion of surgical treatment. J Bone Joint Surg Am. 1973;55(7):1331–50.
8. Paley D, Pfeil J. Principles of deformity correction around the knee. Orthopade. 2000;29(1):18–38.
9. Gaudinez RF, Mallik AR, Szporn M. Hybrid external fixation of comminuted tibial plateau fractures. Clin Orthop Relat Res. 1996;203-210.
10. Kumar A, Whittle AP. Treatment of complex (Schatzker type VI) fractures of the tibial plateau with circular wire external fixation: retrospective case review. J Orthop Trauma. 2000; 14:339-344.
11. Rasmussen PS. Tibial condylar fractures. Impairment of knee joint stability as an indication for surgical treatment. J Bone Joint Surg Am. 1973;55:1331-1350.
12. Horwitz DS, Bachus KN, Craig MA, Peters CL. A biomechanical analysis of internal fixation of complex tibial plateau fractures. J Orthop Trauma. 1999 Nov;13(8):545-9.
13. Barei DP, Nork SE, Mills WJ. Functional outcomes of severe bicondylar tibial plateau fractures treated with dual incisions and medial and lateral plates. J Bone Joint Surg Am. 2006; 88:1713-1721.
14. Yu Z, Zheng L, Zhang Y, Li J, Ma B. Functional and radiological evaluations of high energy tibial plateau fractures treated with double-buttress plate fixation. Eur J Med Res. 2009;14(5):200–05.
15. Papagelopoulos PJ, Partsinevelos A, Themistocleous GS, Mavrogenis AF, Korres DS, Soucacos PN. Complications after tibia plateau fracture surgery. Injury. 2006;37(6):475–84.
16. Berkson EM, Virkus WW. High-energy tibial plateau fractures. J Am Acad Orthop Surg. 2006;14(1):20–31.

Congenital Hallux Varus; a rare entity

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Abstract

Case report: Congenital hallux varus is a extremely rare deformity, leading to cosmetically unacceptable foot and difficulty in wearing footwear and trousers. The deformity varies in severity, cause, associated anomalies, patho-anatomy and treatment. We thus report such a rare case of congenital hallux varus associated with polydactyl and syndactyl in an infant which was treated by soft tissue procedure. The aim of this report is create awareness regarding this rare entity and to review the available literature on it

Keywords: Hallux varus, Polydactyl with syndactyl, Foot deformity

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Introduction

Congenital hallux varus is a rare deformity, which can be associated with other deformities [1]. The child has difficulty in wearing footwear and trousers and is not cosmetically accepted to the parents. There is lack in clear definition of the deformity; the deformity also varies in severity, associated features, patho-mechanisms and the choice of surgical treatment bony or soft tissue corrections [2]. We thus report such a rare case of congenital hallux varus associated with polydactyl and syndactyl in an infant which was treated by soft tissue procedure. The aim of this report is create awareness regarding this rare entity and to review the available literature on it.

Case report

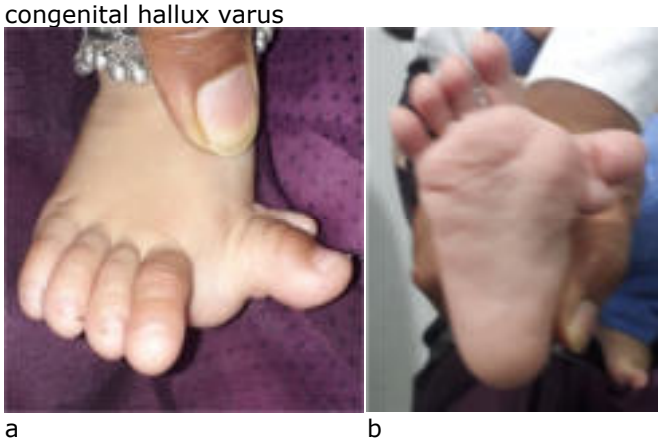
An eight months old male child presented to us with deformity present at right foot since birth. The deformity was double hallux i.e. duplication of great toe with hallux varus deformity of both the great toes (fig 1). The child's parents were concerned, about the bad cosmetic appearance of the foot deformity and they were unable to put regular footwear into the child's foot. They also complain of difficulty in pulling up the trousers/pants for the child. Apart from the foot deformity, there was no any other deformity present in the body. The child was born full term normal vaginal delivery and the neonatal period was uneventful. There was no history of trauma, surgery or any treatment taken.

On examination, the child had right foot deformity, with polydactyl having total of six toes in right foot, with syndactyl of great toe. The two great toes were abnormally placed in severe varus position, projecting almost medially from the inner border of the foot toward medial side rather than distally (fig 1). The fused great toes were perpendicular to the long axis of the first metatarsal. The proximal toe was slightly smaller than the distal toe, and it lacked proper nail plate, which was well developed in distal larger great toe. The first web space was significantly increased and the first metatarsal head was palpable in the web space. Movements dorsiflexion and plantar flexion was present at the both the toes, but movement of the deformed toes to the lateral

side towards the metatarsal head was not possible. Neurovascular examination of the foot and toes was normal.

Radiological, X-rays of the right foot AP and oblique view were done which showed, duplication of the great toes with only proximal phalanx in smaller toe and both the distal and proximal phalanges in the bigger toe. Both the toes were placed together side by side, articulating abnormally on the inner side of deformed first metatarsal head. The first metatarsal was short and thick and head was deformed.

Fig 1. Pre-operative clinical photograph (a & b) of congenital hallux varus

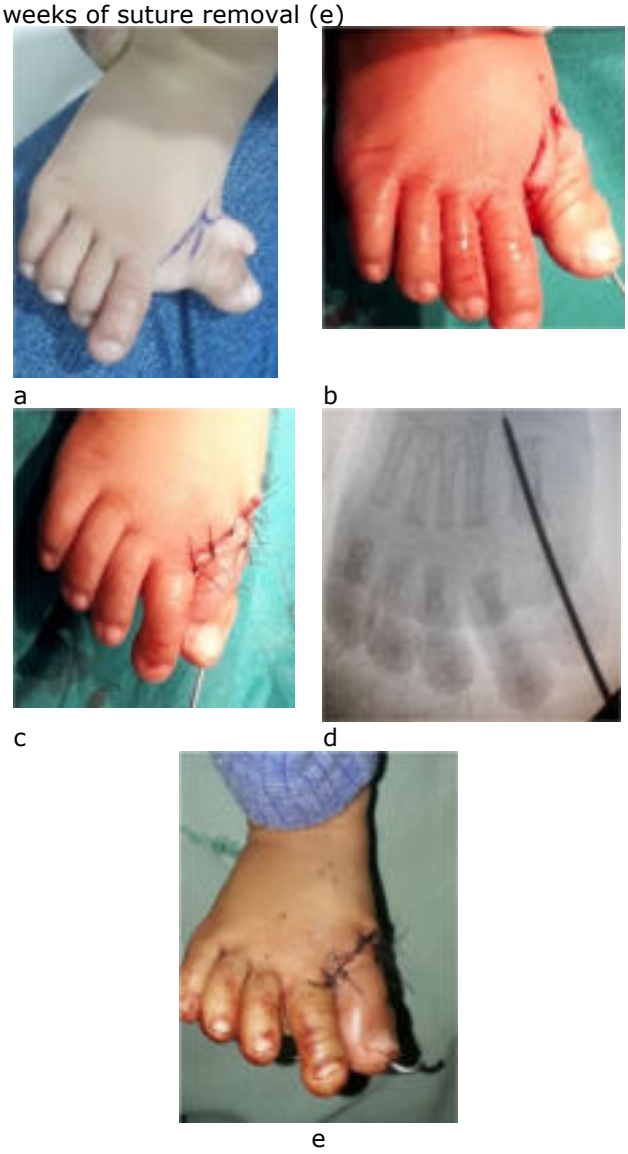


a b

We planned the surgical treatment of the patients, with excision of the supernumerary toe and alignment to the toe with the metatarsal head. The child was operated under general anesthesia under tourniquet in supine position. A 'Y' shaped incision was given with the vertical limb towards the web space (fig 2). Following this, the deep Y-shaped flaps were elevated and the proximal smaller accessary great toe was excised. The bigger toe with proper nail was displaced laterally and temporary fixed with a k-wire (fig 2).

Post operatively, a below knee slab was given and was removed at 2 weeks at the time suture removal. The k wire was removed at 4 week. At final follow up of 4 months, child has cosmetically acceptable foot and is comfortably able to wear normal footwear and trousers. There is slight shortening of great toe.

Fig 2. Intraoperative clinical photo (a to c) and intraoperative AP fluoroscopic vie (d) showing incision planned, the excision of the accessary toe & closure and k wire fixation. Clinical photo at 2 weeks of suture removal (e)



a b

c d

e

Discussion

Hallux varus is a very rare deformity as compared to hallux valgus [1]. Among the ethological types, the congenital variety of hallux varus is further rare variety as compared to other caused of varus deformity like surgical overcorrection of hallux valgus, idiopathic, spontaneous, inflammatory arthropathy or post-traumatic type [3]. Congenital hallux varus has multifactorial causes like thickened medial cords, medial slopes to the first metatarsocuneiform joints, first metatarsal longitudinal epiphyseal bracket (LEB; delta phalanx), shortened block first metatarsals, space occupying extra metatarsals with the first web spaces and

ineffective abductor halluces and adductor hallucis insertions [2,4-7].

Since the deformity is present since birth, these patients present early. But, our case presented to us only at the age of eight month, when the child started mobilization and parents tried to put regular footwear to the child, which they were unable to do, due to the deformity. Dumbre reported a case of congenital hallux varus presenting at age of 23 year, which was complicated with soft tissue contracture, bony deformities and arthritis of joints [3].

Presentation and diagnosis is quiet obvious on clinical examination. Three types of congenital hallux varus are describes by Alfred [8].

a. 1^0 (primary) - not associated with any other deformity
b. 2^0 (secondary) – associated with polydactyly, syndatyly, metatarsal adductus, CTEV, LEX (longitudinal epiphyseal bracket / delta phalanx)
c. 3^0 (tertiary) – with severe deformities like diastrophic dwarfism

Our case was a secondary type, which was associated with both polydactyl and syndactyl. The deformity can range from mild (few degrees) to severe (to 90^0), ours was a severe type who had deformity almost 90^0.

Treatment of the deformity is by surgical correction and various techniques have been described. For mild to moderated deformity only soft tissue procedure are sufficient like, Farmer described a Y rotational skin flap and syndactylization of the first and second toes [2,9]. For very severe deformity and short metatarsal, bony procedures are needed like, Kelikian described reverse osteotomy [2,10]. McElvenny, described the removal of accessory bones, medial sesamoidectomy and capsulotomy, release of the medial fibrous band, reinforcement of the lateral capsule, transfixing of the metatarsophalangeal joint with a Kirschner wire and a partial syndactylization of the first and second toes [11]. Mills and Menelaus compared surgical outcomes of various procedure and found results of soft tissue procedures, such as McElvenny or Farmer technique, and those of arthrodesis were satisfactory, but the metatarsal osteotomy produced unsatisfactory results [12].

Recurrence of deformity after the surgical correction has been described if soft tissue correction alone for congenital hallux varus with LEX is done, due to persistent abnormal growth of the aberrant epiphysis of first metatarsal [2]. Hence to prevent recurrence, the combination of the two procedures, like farmers procedure combined with open wedge osteotomy are described as by shim et al [2]. Other procedures like resection or tenotomy of abductor hallucis muscle and tendon, arthrodesis and even amputation of toes have been described [2,13]. The choice of surgery depends on the type of deformity, associated features and the severity. Since our case was severe type we performed Farmers procedure alone with good results. At last follow, our patient was fine with cosmetically acceptable foot and able to wear normal footwear, without recurrence.

Conclusion

Congenital hallux varus is very rare deformity, which causes gross cosmetic and inability to wear normal footwear. Treatment is by surgical correction which gives excellent results and amputation is reserved as a salvage procedure.

References

1. Handelson, J.E. Congenital disorders of the toes. In: Gould JS. The Foot Book. 1st ed, Baltimore;Williams & Wilkins, 1988, p.107-8.
2. Shim JS, Lim TK, Koh KH, Lee DK. Surgical correction of congenital hallux varus. Clin Orthop Surg. 2014;6:216-22.
3. Dumbre Patil S , Parekh H, Dumbre Patil V, Joshi K. Congenital Hallux Varus with Polydactyly and Syndactyly- Correction in an Adult - A Case Report. J Orthop Case Report. 2014;4(2): 64-8.

4. Masada K, Tsuyuguchi Y, Kawabata H, Ono K. Treatment of preaxial polydactyly of the foot. Plast Reconstr Surg. 1987;79(2):251-8.
5. Mills JA, Menelaus MB. Hallux varus. J Bone Joint Surg Br. 1989;71(3):437-40.
6. Mubarak SJ, O'Brien TJ, Davids JR. Metatarsal epiphyseal bracket: treatment by central physiolysis. J Pediatr Orthop. 1993;13(1):5-8.
7. Phelps DA, Grogan DP. Polydactyly of the foot. J Pediatr Orthop. 1985;5(4):446-51.
8. Alfred J. Phillips, Hallux Varus: Congenital vs. Acquired, available at http://www.podiatryinstitute.com/pdfs/update_1997/1997_10.pdf
9. Farmer AW. Congenital hallux varus. Am J Surg. 1958;95(2):274-8.
10. Kelikian, H. Surgical complications. In: Hallux Valgus, allied deformities of the forefoot and metatarsalgia. 1st ed. Philadelphia:W.B.Saunders. 1965, p.433-5.
11. McElvenny RT. Hallux varus. Q Bull Northwest Univ Med Sch. 1941;15:277-80.
12. Mills JA, Menelaus MB. Hallux varus. J Bone Joint Surg Br. 1989;71(3):437-40.
13. Stanifer E, Hodor D, Wertheimer S. Congenital hallux varus: case presentation and review of the literature. J Foot Surg. 1991;30(5):509-12.

A rare case of Posterior Subtalar Dislocation

Jamoria R, Pathak A

Investigation performed at Gandhi Medical College, Bhopal (M.P.)

Abstract

Case report: Posterior subtalar dislocations are extremely rare injuries which are caused by high energy trauma, which is generally managed by closed reduction, if present early. We present such a rare case of neglected posterior subtalar dislocation, which was successfully treated with open reduction. For satisfactory outcome, early diagnosis, anatomical reduction, stable fixation of peritalar joint, and the resection of small, free osteochondral fragments for the prevention of early posttraumatic arthrosis, is necessary.

Keywords: Posterior subtalar dislocation, Talocalcanealnavicular dislocation, peritalar dislocation

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Introduction

Subtalar joint dislocations are rare injuries, which were first described by Judey in 1811 [1]. In 1853, Broca classified these subtalar joint dislocations into three types according to the direction of displacement of the foot in relation to the talus: medial, lateral, and posterior [2]. Later, in 1855, Malgaine and Burger added subgroup of anterior subtalar dislocation to it [3]. Among all these type of dislocations, posterior subtalar dislocation is a very rare kind of injury which is also known as talocalcaneal navicular (TCN) dislocation or peritalar dislocation and is characterized by simultaneous dislocation of talocalcaneal and talonavicular joints while tibiotalar and calcaneocuboid articulations remain intact [4,5]. These types of dislocations are caused by high energy trauma such as a fall from height or road traffic accident. Prompt diagnosis followed by closed reduction and immobilization in plaster cast is the recommended treatment but when closed reduction is failed or in cases of neglected dislocations, open reduction and internal fixation may be required to minimize further soft tissue and neurovascular compromise [4,5]. We report such a rare case of neglected posterior subtalar dislocation with associated fracture of posterior process of talus which was successfully managed by open reduction with k- wire fixation followed by immobization in plaster slab for 6 weeks.

Case report

A 40-year male laborer injured his left ankle due to fall while painting over roof. The mode of injury of injury was fall from height of around 10 feet, with patient landing on the left foot, with contact of the dorsum of the foot to the ground, with the position of the foot to be inversion and plantar-flexion during strike on floor. Except of foot injury, he had no other injury. Immediately patient went to local quack for treatment where suspected ankle dislocation without being investigation was tried to reduce by manipulation and massage. Following this massage by bonesetter, patient went back to home without splinting. Since pain, swelling and deformity persisted, along with the patient's inability to bear weight on affected limb, patient presented to our center

for consultation and management, 3 weeks after the injury.

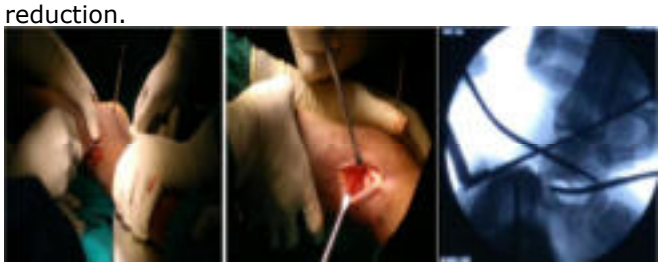
On physical examination, the foot was in plantar flexion with deformity and swelling over anterior aspect of ankle and foot. Sensation and vascularity was intact with saturation of toes to 98%. The ankle range of dorsiflexion and plantarflexion were grossly restricted and severely painful with associated stiffness. But all the toes movements were normal (fig 1).

Radiograph of the ankle demonstrated talocalcaneal and navicular joint dislocation with posterior displacement, which was further confirmed by doing 3D CT reconstruction. The CT scan showed talocalcaneal-navicular dislocation in which the calcaneus was displaced posteriorly, perching of the head of the talus on the dorsal margin of the navicular, and the impingement of the posterior process of talus on the posterior subtalar facet of calcaneus and multiple fragments of posterior process of talus on the top of calcaneus (Fig. 1). MRI of left ankle additionally demonstrated joint effusion, partial tear in talo-fibular and deep fibers of deltoid ligament and marrow edema in subtalar articular surfaces.

As the dislocation was 3 weeks old, any attempt of closed reduction was supposed to be unsuccessful and the patient was planned for open reduction after pre-anesthetic fitness. Under anesthesia, initial attempt of closed reduction was made with help of calcaneal skeletal traction and another counter traction pin inserted from posterior facet into talus to lift the body of talus. This maneuver of closed reduction with application of longitudinal manual traction and counter traction along with application of digital pressure over head of talus anteriorly failed, following with open reduction with dorsal approach was done. Talus was explored through incision of approx. 1.5 cm made over anterior aspect of left ankle and a blunt long bone spike passed under talus to lift the impacted body of talus from posterior facet of calcaneum (fig 2). The reduction was successful by lifting the body of talus, with help of traction and counter-traction of previously passed skeletal pins which was confirmed under C-arm. One the reduction was achieved; it was stabilized in position by inserting a 2.5mm Kirschner wire from the navicular bone into the talus to hold the reduction (fig 3). After primary closure and sterile dressing, below knee slab was applied. After ankle immobilization of about 6 weeks, slab and k-wire were removed and gradual range of motion exercises started. Some ankle stiffness and minimal limitation of dorsiflexion and plantar flexion were found at final follow up but patient was able to weight bearing and was satisfied with the result.

Fig 1. Pre-operative clinical photo (a & b), AP (c) and lateral (d) x rays and CT scan sagittal view (e) showing posterior subtalar dislocation.

Fig 2. Intraoperative photograph (a & b) and fluoroscopic lateral view (c) showing open reduction of posterior subtalar dislocation with exposure and reduction.



a b c

Fig 3. Immediate post-operative clinical photo (a) and AP (b) and oblique (c) x rays of patient showing reduced posterior subtalar dislocation and fixed with k wire.

a b c

Discussion

Subtalar dislocations are a rare form of dislocation and accounts for less than 1% of all traumatic dislocations [1-3]. According to available literature, medial dislocation is the most common type accounting for 72%-80% followed by lateral dislocation (17%-22%) and anterior dislocation (1%). Posterior dislocations, in particular, are extremely rare, and amount to a mere 0.8 % of all subtalar dislocations [2,3].

Owing to gross deformity, pain and severe limitation of motion and functional impairment, along with awareness for treatment these case present early for treatment. But in developed country like our, it is common that these case present late because of either primary treatment by bone setters/quacks, not seeking treatment at all or inability to identify injury. Our case was also a case of 3 week old neglected case, which was due to the primary treatment done by bonesetter.

Subtalar dislocations mostly occur in young adults after a high energy trauma such as a fall from height or road traffic accidents [4,5]. Various reports hypothesize mechanism of injury of posterior subtalar joint dislocation as forced hyper-plantar flexion of foot which leads to a progressive subtalar ligament weakening resulting in a complete tear of ligament if the plantar flexion force is prolonged [4-8]. Our case was also an active middle aged male with no comorbid condition sustaining injury due to fall from height with landing on dorsum of inverted and plantarflexed foot.

Diagnosis of posterior subtalar joint dislocation is easy with anterior-posterior and lateral radiographs. Inokuchi et al, defined the posterior subtalar dislocation on a lateral radiograph, when the head of the talus is seen perched on the posterior margin of the navicular and the posterior portion of the talus resting in the posterior subtalar facet of the calcaneum in the absence of any significant displacement or rotation of the foot in frontal view radiograph [5,9].

Recommended treatment to avoid further damage to skin, soft tissue, neurovascular structures and to reduce the chances of avascular necrosis of the talus, is prompt closed reduction as soon as possible under sedation or general anesthesia with constant counter-traction and flexion at knee so the gastrocnemius muscle is relaxed [6-9]. For reduction initially, the force is applied in the same direction as the existing deformity, then traction is applied, and at the same time a force in opposite direction of the dislocation is applied by a firm digital pressure over the head of the talus from anterior to posterior, passing through plantar flexion to dorsiflexion. The reduction is usually associated with an audible clunk [4,5,6-9]. Post reduction immobilization is done in non-weight bearing cast but the period of immobilization is controversial [10,11].

A delayed presentation, soft tissue interposition, interposed bony fragments, severe swelling or capsulo-ligamentous retraction renders the closed reduction difficult and which requires open reduction, which is required in 10 to 20% cases [12]. Since our case was also a 3 weeks neglected case with

history of maltreatment and massage present, the closed reduction attempt failed and we could reduce it only after open reduction.

Conclusion

Posterior subtalar dislocations are extremely rare injuries which require early diagnosis, anatomical reduction, stable fixation of peritalar joint fractures, and the resection of small, free osteochondral fragments for the prevention of early posttraumatic arthrosis which, in turn, may cause pain, joint stiffness, and an unsatisfactory final result.

References

1. Judey P. Observation dune luxation metatarsienne. Bull Fac Med Paris. 1811;11:81–6.
2. Broca P. Memories sur les luxations sous-astragaliennes. Mem Soc Chir 1853;3:566–656.
3. Malgaigne JF, Buerger CG. Die Knochenbrüche und Verrekungen. Rieger, Stuttgart, 1853. pp 820.
4. Prada-Cañizares A, Auñón-Martín I, Vilá Y Rico J, Pretell-Mazzini J. Subtalar dislocation: management and prognosis for an uncommon orthopaedic condition. Int Orthop. 2016;40(5):999-1007.
5. Inokuchi S, Hashimoto T, Usami N. Posterior subtalar dislocation: case report. J Trauma 1997;42(2):310–13.
6. Bibbo C, Anderson RB, Davis WH. Injury characteristics and the clinical outcome of subtalar dislocations: a clinical and radiographic analysis of 25 cases. Foot Ankle Int. 2003;24(2):158–63.
7. Fortin PT, Kou JX. Commonly missed peritalar injuries. J Am Acad Orthop Surg. 2009;17(12):775–86.
8. Garofalo R, Moretti B, Ortolano V, Cariola P, Solarino G, Wettstein M, Mouhsine E. Peritalar dislocations: a retrospective study of 18 cases. J Foot Ankle Surg 2004;43(3):166–72.
9. Siddiqui YS, Zahid M, Bin Sabir A et al. Neglected peritalar dislocation: a case report with review of literature. J Clin Diagn Res. 2011;5(4):849–52.
10. Bali K, Kumar V, Bhagwat K et al. Closed posterior subtalar dislocation without any associated fracture: a case report and review of the literature. Foot Ankle Surg. 2011;17(3):40–2.
11. Camarda L, Martorana U, D'Arienzo M. Posterior subtalar dislocation. Orthop. 2009;32(7):530.
12. Budd H, Wimhurst J, Davis B et al. Irreducible posterior subtalar dislocation with incarceration of a fracture of the anterior process of the calcaneum. J Bone Joint Surg Br. 2010;92(7):1025–7.

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