ORIGINAL ARTICLE

A Novel Reduction Technique in the Bridge Plating in Management of Femoral metaphyseo-Diaphyseal Fractures

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ABSTRACT

The objective of this study was to evaluate the result of a new reduction technique for bridge plating of femoral fractures. 43 adult patients with fracture of distal diaphyseo-metaphyseal region of femur, presenting in the Accident and Emergency department of Mayo Hospital, Lahore were operated. Bridge plating was done and the fracture fragments were reduced using a novel reduction technique proposed by the author. Postoperative analysis revealed that 93% of the fractures were reduced in an acceptable position in sagittal, coronal and axial plane. The average operative time was less and the average number of persons taking part in surgery was only 3. The authors concluded that this new reduction technique was as good as the conventional methods of reduction of such fractures with the added benefit of being simple and not involving traction table or distractor.

INTRODUCTION

Femoral diaphyseal fractures can be managed efficiently with bridge plating. It promotes secondary bone healing by allowing interfragmentary motion for callus formation.[1]Bridge plating uses the plate as an extramedullary splint, fixed to the proximal and distal main fracture fragments and allowing minimal handling of the soft tissue attached with the intermediate fracture fragments. Anatomical reduction of these intermediate fragments is not necessary. Preservation of the attached soft tissue enhances healing of the fracture once the fragments are properly aligned.

The femur is the largest bone of the body surrounded by protective muscles. Once a diaphyseal or a metaphyseal fracture occurs, this same protective musculature usually is the cause of displacement.[2] Traction applied in the long axis of the limb is the most important mechanism to reduce fracture. Traction may be applied manually, by means of a fracture table, or by applying a distractor.

It is important to restore axial alignment, length, and rotation.The preferred method depends on the fracture and soft-tissue injury pattern, the availability of stabilization device (traction table / fracture distractor) and the experience and skills of the surgeon.

In certain situations where the limited available resources are coupled with increasing work load, like what is seen in the Accident and Emergency department of Mayo Hospital Lahore, there arises a need for alternative method of fracture reduction in bridge plating which would be simple as well as effective. The author perceived this requirement and developed a simple manual reduction technique and the present study proved its simplicity and efficacy.

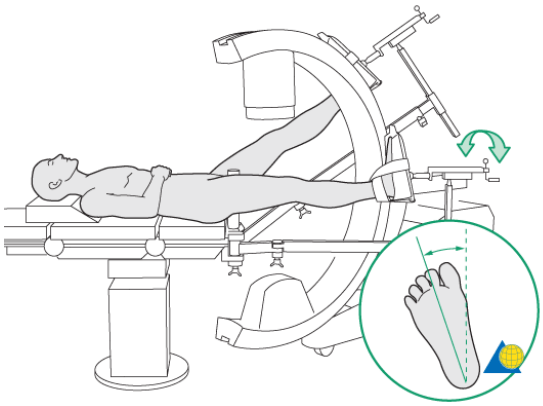

Fig.1: Reduction by using a traction table

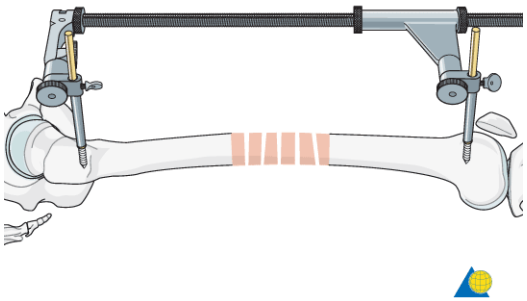

Fig.2: Reduction by external fixator or distractor

MATERIAL AND METHOD

Objectives: To prospectively evaluate the results of a new reduction technique in bridge plating of femoral shaft fractures.

Design: Prospective, consecutive series.

Patients and Settings: 43 patients with comminuted femoral diapyseo-metaphyseal fracture presenting in Accident and Emergency department of Mayo Hospital, Lahore from November 2011 to October 2012, were treated with bridge plating using a new, unconventional and novel reduction technique within two weeks of injury.

Methods: We applied a different reduction technique on 43 patients with femoral fractures presenting in Accident and Emergency department of Mayo Hospital, Lahore. All adult patients with diaphyseo-metaphyseal comminuted fractures were included in the study. Patients having ipsilateral proximal femoral fracture or with distal intra-articular fractures were excluded from the study. Patients presenting after two weeks of injury and having Gustilo[3] type II or III wounds were also excluded from the study.

Fig.3: The reduction technique used in study

Fig.4: Plate fixation after reduction of the fragments

For bridge plating, fracture was reduced by positioning patient on operating table in such a way that the knee joint of the affected side was placed about four finger breadths proximal to the edge of the table and the foot and the leg of affected side hanging down & the proximal tibia at the edge of the table. A bolster made up of draping sheet was placed beneath the thigh. Incisions were made proximal and distal to the fracture and the plate was applied over the fracture zone. The proximal and distal major fragments were aligned by holding the ankle of the affected limb and gently pushing it towards ground, the edge of the table acting as the lever through which this downward force is transmitted to the distal fragment of the fracture where the force in the longitudinal axis of the limb aligned both the fragments. In this way the angulation in coronal and sagittal planes is corrected. The rotational angulation can easily be corrected by correcting the position of the foot. The assistant holds the limb in this position till the surgeon stabilizes the fracture fragments proximally and distally with plate and screws.

RESULT

43 patients meeting the inclusion criteria were operated. Post operative analysis revealed that 40 patients (93%) had their fractures reduced in an acceptable position. Only 5 patients (11.6%) had limb length discrepancy of 2.5cm and the average LLD was 0.9cm. The average operative time was 45 minutes with 3 persons involved in the operation.

DISCUSSION

Over the past few years many evolutionary changes have been seen in the field of fracture management. The concept of rigid fixation has been taken over by the concept of biological fixation. Bridge plating is an example of biological fixation where compression is typically not sought or obtained. Biological fixation of comminuted fractures with bridge plates relies on secondary fracture-healing by callus formation.[4,5] The fracture site is not opened in order to preserve the blood supply of the fragments. The fracture fragments are therefore reduced indirectly using different techniques. This study was conducted to analyze the efficacy of a novel reduction technique when the fracture site is not opened.

In the presence of documented and practiced reduction techniques, the author perceived the

need for a new technique because of the following reasons:

1. The muscular attachment causes the fracture fragments to displace in a femoral fracture. The gastrocnemius pull causes the distal fragment to go into flexion. When longitudinal force is applied through the traction table or the distracting external fixator, the gastrocnemius pull is potentiated causing increase in the deforming force on the distal fragment.
2. The femur is a curved bone and there is an inherent tendency for curved bones to straighten during the distraction procedure. The eccentric force produced by the unilaterally mounted distractor may produce additional deformity.[6]
3. The fracture table has the disadvantage that traction is usually applied across at least one joint. The limb cannot be moved by the surgeons and the surgical approach is frequently compromised.
4. The application of the distractor, applied directly to the main fragments, is demanding and requires tension; angular or rotational corrections are difficult and the construction may be cumbersome.

In spite of the above mentioned hurdles faced by the residents and inexperienced surgeons working in a busy Accident and Emergency department (like the one in Mayo Hospital, Lahore) it is still of paramount importance to restore the biomechanical axis of the lower limb. Our technique has proved its simplicity and has by-passed the above mentioned hurdles faced in the reduction of the femoral diaphyseo-metaphyseal fractures.

Bridge plating after reduction of fragments with our technique can be done in a shorter period of time and with less number of persons involved in the surgery. The time consumed in mounting the patient on traction table or application of the distractor is eliminated and therefore the theoretical risk of surgical site infection is reduced. A number of times there arises a situation where the available resources fail to meet the high number of causalities presenting in the accident and emergency department. The dependency on the traction table in the operating room is eliminated by this technique and so is the dependency on the availability of the distractor.

The downward force applied on the foot of the fractured limb as a reduction maneuver causes the gastrocnemius to relax and the pull on the distal fragment is decreased. The upward force produced by the table edge beneath the proximal tibia acts as a lever and longitudinal force is applied on the distal fracture fragment making the fragments aligned in acceptable position. By this maneuver done by the assistant it also becomes easy to correct the rotational deformity as sustained force is applied on the foot of the fractured side downwards with second toe aligned with the mechanical axis of the lower limb i.e. center of the patella. At this corrected position, confirmed by the C-arm, the plate is applied over the fracture zone by two incisions made proximal and distally. When the plate is anchored distally with screws, the length of the bone can be achieved by application of Hohman retractor at the proximal hole of the plate and retraction of the muscles proximally (Fig. 5). Proximal retraction of the muscles cause the plate to slide downwards and the desired length is achieved and plate is then anchored with the bone.

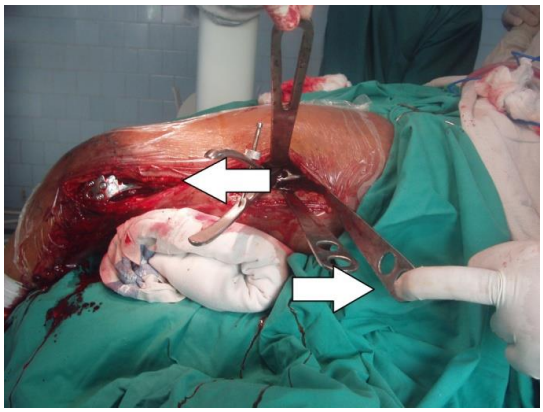

Fig.5: Achieving the length of the bone

This method has produced no angular deformity in 40 out of 43 fractures. Among the rest of the three patients, had varus angulation of about 10 to 15 degrees. When analyzed radiolologically, it was revealed that those three fractures had deficient medial cortices due to suvire comminution and the angulation produced maybe attributed to the misjudgment on the surgeons part, rather than failure of the reduction technique. The limb length discrepancy was also observed in a few cases with severe comminution of the fragments. This minor discrepancy maybe managed with shoe raise.

CONCLUSION

No angular deformity was found after this reduction technique in majority (93%) of the patients. Only 5

patients had limb length discrepancy of 2.5cm which was dealt with shoe raise. The lesser operative time and minimal number of surgeons of the operating team reduced the potential risk of SSI (Surgical Site Infection). This technique should be given serious consideration as an alternative to cumbersome technique of reduction with traction table and depending on the availability of the distractor.

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