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Research Paper

Management of open Fractures of both Bones of Leg Treated by Internal Fixation of Fibula and External Fixation of Tibia

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Abstract
A prospective study of open fractures of both bones of leg in 25 patients managed and stabilized with Internal Fixation of Fibula and External Fixation of Tibia was undertaken at the Department of Orthopaedics, Govt. Medical College, Amritsar from July 2015 - July 2017. Inclusion criteria of study were open grade II, IIIA and IIIB fractures according to modified Gustilo-Anderson classification. Common mode of injury was road traffic accidents in 20 (80%). Age ranged between 5 - 75 years, average 38.2 years. Males were 21 (84%) and 4(16%) females. Split thickness skin graft (12 (48%) out of 25 cases) and rotational fasciocutaneous flap (3 (12%) out of 25 cases) was given to cover the exposed bone. 21 fractures out of 25 united. Average time to union was 19.87 weeks (range, 12-28 weeks). Major complications were pin tract infection in 04 (16%) patients, delayed union in 02 (8%) and non-union in 03 (12%) patients.
Keywords: *Open Fractures, Management, Internal Fixation, External Fixator.*

Introduction

Open fractures of both bones of leg are common presentation at orthopaedic emergency and trauma centres. By its very location the tibia is exposed to frequent injury. The most common site is diaphysis and the most common cause is road traffic accidents.[1,2,3] Because one third of its surface is subcutaneous through most of its length, open fractures are more common in the tibia than in any other major long bone. Furthermore, the blood supply to the tibia is more precarious than any of the bones enclosed by heavy muscles.[4,5] The presence of hinge joints at the knee and ankle allow no adjustment for rotatory deformity after the fracture and thus special care is necessary during reduction to correct such deformity. Also, high-energy injuries like road traffic accidents, blast injuries or crushing type injuries create the problems for bone healing by causing extensive soft tissue damage and contamination. Moreover, the fracture causes disruption of muscular and neurovascular planes of lower limb thus hampering the already precarious blood supply of tibia thereby increasing morbidity of the lower limb distal to the fracture site.[5,6]

The management of open fractures has been a challenging problem for an Orthopaedic surgeon, because he has to combat at two fronts simultaneously i.e. the management of soft tissue injury as well as of the fracture. Soft tissue damages also influence the hospital stay, consolidation time and frequency of osteosynthesis. The more severe the soft tissue trauma is, the more difficult the fracture healing will be. So, the treatment should be so planned so as to get union without deformity and get early mobilization of the patient.[5,6,7]

Earlier treatment options like casting are not recommended because of loss of access to wound and risk of swelling, malunion, non-union and skin necrosis. Prolonged skeletal traction is also discouraged because of prolonged recumbency and increased cost of hospital stay along with risk of malunion and nonunion. The fear of infection has led to the traditionally accepted opinion that immediate internal fixation as for that matter, any internal fixation of open fractures, is contraindicated. But since last decade, the prognosis of internal fixation in open fractures has improved dramatically when the wound is examined properly and thoroughly washed with copious amount of normal saline and early debridement of the wound is done under the cover of broad spectrum antibiotics. The use of external fixator has brought revolutionary changes in the field of Orthopaedic surgery. It provides skeletal stability, and allows early mobilization and thus reduces the hospital stay of the patient.[8,9,10]

The principle of internally fixing the fibula is most useful in the unstable fractures of the tibia. Even in the most catastrophic fractures of the leg, skin over the fibula tends to be intact and one may plate the fibula with impunity. This immediately stores the length of the leg and supplements the stability of external fixator. Achievement of stability means restoration of the fractures to as close as the anatomical position as possible. At the outset, re-establishment of good alignment realigns muscular planes as well as neurovascular planes of lower limb and blood supply to the distal part of the limb is restored immediately which decreases morbidity of the lower limb distal to the fracture site. Also in comminuted fractures, the tibia should not be shortened more than half an inch to achieve good bone apposition because the muscles below the knee do not accommodate well to shortening. Larger segmental defects can be bridged with bone grafts, segment transportation and restoration of the full length provides optimal muscle functions.[11,12,13,14]

Material and Methods

This prospective study conducted from July 2015 to September 2017, included 25 patients (21 males and 4 females) having average age of 38.2 years (range, 5 – 75 years) with open fractures of both bones of leg admitted in our hospital. These were managed and stabilized with Internal Fixation of Fibula and External Fixation of Tibia. Inclusion criteria of study were open grade II, IIIA and IIIB fractures according to modified Gustilo-Anderson classification.

After admission, all the patients were assessed in the casualty department and after the required initial emergency treatment, the patients were wheeled on to the radiology department. Every patient had standard antero-posterior and lateral X-rays of the affected leg and the fracture configuration was recorded along with other associated injuries.

Initially wounds were washed thoroughly with normal saline and hydrogen peroxide, gentle traction was applied and gross deformities reduced. Open wounds were covered with sterile dressings and the extremity was splinted by above-knee back slab. Pain relief was obtained by parentral analgesics. Tetanus prophylaxis and broad-spectrum antibiotics were given to all the patients and later on changed according to c/s report. Associated injuries were treated accordingly.

Operative Technique

As soon as the patient's general and medical condition permitted, under appropriate anaesthesia

wound debridement was done in all cases. Active bleeders were ligated at the time of debridement. The specimens were collected for culture and sensitivity test before the debridement was carried out.

Wound debridement was followed by stabilization of fractures with internal fixation of fibula and external fixation of tibia. The fracture of fibula was fixed internally with small DCP or LC-DCP (3.5 mm) or Kirschner wires of proper size. For reduction with plates, a direct lateral skin incision about 8 to 10 cm was given starting from lateral malleolus and extending proximally. The fracture site was exposed after separating the muscle planes. Fracture was reduced using reduction forceps and appropriate sized plate was fixed across the fracture site with the help of appropriate sized screws. Wound was stitched in layers over the suction drain.

For external fixation of tibia, appropriate sized Schanz pins (4.5 mm or 3.5 mm), depending upon the age of the patient were chosen and applied on anterior border or anteromedial surface of the tibia after drilling with appropriate sized drill bit. Schanz pins were placed at a sufficient distance from the wound. Bars were fixed as close to the bone as possible with additional supportive bars as required. Every effort was made to cover the exposed bone either by split thickness skin graft or rotational fasciocutaneous flap. Aseptic dressing was done. Limb was elevated post-operatively. Reduction and stabilization of the fractures were radiologically assessed on same or first post-operative day. Suction drain was removed after 48 hours post-operatively and sent for bacteriological examination and all the wounds were re-examined. The wound was closed only if there was no sign of infection, oedema or swelling and if closure was possible without any tension. Otherwise the wounds were left open and dressed with swabs soaked in solution povidone-iodine and normal saline.

Active exercises were started from the very next day or when patient could tolerate pain. All patients were allowed non-weight bearing ambulation 2 days after the surgery. Patients were followed up at monthly intervals and were assessed clinically and radiologically. Partial weight bearing was allowed at about 8 weeks and was gradually increased to full weight bearing at about 16 weeks, subject to union criteria. Pin entry sites were cleaned on alternate day and covered with povidone-iodine soaked gauze. Loose clamps tightened whenever required. All patients were trained about the care of external fixator during their stay in hospital. Patients were discharged as wound healed (3-5 weeks) and were called for follow up in the out-patient department at every 3-weekly interval and X-rays were done till fracture united. Fracture was declared united clinically when there was no tenderness and no movement at the fracture site, and radiologically when there was no fracture line visible and good amount of callus. Functional outcome of limb was judged as range of movements. External fixator was removed when fracture was consolidated. The external fixator was replaced by above knee POP cast or a PTB cast for another 02 to 03 weeks.

Observations

In our study, out of 25 patients with open fractures, 4 (16%) were classified as type II and 21 (84%) were classified as grade III (16 (64%) as type IIIA and 5 (20%) as type IIIB) according to Gustilo-Anderson classification. Age of the patients ranged from 05 to 75 years (average 38.2 years). There were 21 (84%) males and 04 (16%) females. Common mode of injury was road traffic accidents 20 (80%), 03 (12%) had fall from height, 2 (8%) had crushing type injuries. Out of the 25 fractures, 5 (20%) were involving upper third of tibia, 10 (40%) were involving lower third and the rest 10 (40%) were in the middle third. 20 (80%) out of 25 patients had fracture on right side and 5 (20%) had on the left. The time lapse between injury and arrival at hospital ranged between 02 to 96 hours (average 24.2 hours). Time between admission in hospital and primary procedure ranged from 02 to 08 hours (average 5.02 hours). Out of 25 patients, for fixation of

fibula, K-wire was used in 4 (16%) cases, LC-DCP (3.5 mm) was used in 8 (32%) cases and SDCP was used in rest of 13 (52%) cases. Wherever possible, split thickness skin graft (12 (48%) out of 25 cases) and rotational fasciocutaneous flap (3 (12%) out of 25 cases) was given to cover the exposed bone.

The mean fixator time was 21.58 weeks (range, 14 to 26 weeks). Out of 25 cases 21 (84%) united. One patient was lost follow up while he was walking in functional cast and fracture was uniting and was taken among the good results. There was delayed union in 02 (8%) patients which eventually united after secondary bone grafting procedure. There was non-union in 03 (12%) patients. Time to union ranged between 12 to 28 weeks (19.87 weeks). There were good results in 19 cases, fair in 3 cases and poor in 3 cases.

Major complications were pin tract infection in 04 (16%) patients, delayed union in 02 (8%) and non-union in 03 (12%) patients. There was no case of implant failure.

Table 1 Distribution As Per Gustilo-Anderson Classification

Gustilo-Anderson Type	No. of Patients	Percentage
Type II	4	16
Type IIIA	16	64
Type IIIB	5	20
Total	25	100

Table 2 Mode of Injury

Mode of Injury	No. of Patients	Percentage
Road traffic accident	20	80
Fall from height	3	12
Crushing type	2	8
Total	25	100

Table 3 – Methods of Wound Coverage

Method of Coverage	No. of Patients	Percentage
Primary closure	4	16
Closure with local release	6	24
Split thickness skin graft	12	48
Rotational fasciocutaneous flap	3	12
Total	25	100

Table 4 – Type of Implant Used For Fibula Fixation

Type of Implant	No. of Patients	Percentage
K-wire	4	16
LC-DCP	8	32
Small DCP	13	52
Total	25	100

Table 5 – Time to Union

Gustilo-Anderson Type	Average Time (weeks)	Range (weeks)
Type II	15.62	12-20
Type IIIA	20.42	18-24
Type IIIB	21.55	20-28
Net Average Time	19.87	12-28

Table 6 – Results

Result	No. of Patients	Percentage
Good	19	76
Fair	3	12
Poor	3	12
Total	25	100

Case Photographs

Pre-Operative X-Ray

Post-Operative X-Ray

At 6 Weeks

At 6 Months (Fixator Removed)

X-Ray Showing Union

Discussion

Open fracture is still a challenge for the treating surgeon and patients. Almost always the fracture is contaminated and the skin and soft tissue overlying the fracture site is severely damaged. The bone is exposed and vascularity of the bone is compromised. Due to comminuted fracture or when there is bone gap, the various neurovascular planes are also disturbed which further compromise the blood supply to the distal fragments. Also, when there is shortening of the lower limb more than half of an inch, the muscles cannot act properly on the distal joints due to laxity. The malunion damages the joints due to improper transmission of body weight. When we apply external fixation to the tibia along with the internal fixation of fibula, we maintain length as well as alignment of the bones of leg. Restoration of the normal length reduces the dead space in which blood can accumulate. Hematoma is avascular and is a problem for infection. Restoration of the normal anatomy improves venous and lymphatic return, thereby reducing soft tissue swelling. At the microscopic level bone stability helps stabilize soft tissue planes. This facilitates capillary proliferation and in growth to revascularization of devitalized bone and soft tissues. Early revascularization of the devitalized structures improves the local tissue resistance to infection. Stabilization and approximation of soft tissue planes also facilitates white blood cell migration. All of these factors contribute to local wound defense against infection. The fragments of the bones are also realigned and chances of avascularity to these decreases. The other benefit of the internal fixation of the fibula is that when there is comminution of the fracture or there is gap in bone due to loss of tibia, we can maintain the length of the leg by fixing fracture of the fibula.

Conclusion

External fixation of tibia and internal fixation of fibula in compound fractures of both bones of leg is one of the many ways of immobilization of fracture and offers many advantages like maintaining the alignment and leg length thus preventing malunion and leg length discrepancy. It also restores anatomical neurovascular planes thereby restoring the blood supply to the distal part of the limb immediately, which decreases morbidity of the lower limb distal to the fracture site and also prevents delayed union and non-union of the fracture thus resulting in decreased duration of hospital stay and early mobilization of the patient.

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