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Differential Rates of Delayed/ Non-Union In Management of Tibia Fractures With and Without Associated Fibula Fracture

KEYWORDS: dynamization, fracture tibia, intact fibula, non union

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ABSTRACT *BACKGROUND: In this clinical study, 20 cases of tibial shaft fracture with an average age group of 31 years were included. All were treated by closed reduction with internal fixation using intramedullary interlocking nail, in the Department of Orthopedics at Sanjay Gandhi Institute of Orthopedics And Trauma, Bangalore, Karnataka, the outcome and follow up were evaluated.*

Materials & Methods: 20 cases of fracture shaft tibia ,which included 10 cases(7 males, 3 females) of both bone leg fracture and other 10 cases(8 males, 2 females) of isolated tibia fracture with intact tibia were selected and treated using intramedullary interlocking nail. History of 16 motor vehicle accidents, 1 sport accident, 2 home falls was present and another 3 cases was associated with femoral shaft fractures. Using AO classification the tibial fracture was Type A in 13 cases, Type B in 7 cases. Nails of diameter 9-12mm were used after reaming 1 more.

Results: Postoperative period following 6 months, consolidation was achieved in 11 patients by first intension treatment, after dynamisation in 7 and nonunion in 2 patients. All patients were in the age group of 18 to 45 years with mean average age of 40 years. Two non- union in cases was managed successfully with dynamization and later bone grafting.

Conclusions: Fracture of tibia with intact fibula is prone to delayed union and non union.

INTRODUCTION

Comminution, soft-tissue injury, and fracture displacement are often cited as the factors best correlated with complications following tibial fracture[1].Clinical observations corroborated by biomechanical studies on an experimental model suggested that when the fibula remains intact, a tibio-fibular length discrepancy develops and causes altered strain patterns in the tibia and fibula. These may lead to delayed union, non-union, or malunion of the tibia with the sequelae of joint disturbances. The lower incidence of complications in patients less than twenty years old may be due to the greater compliance of their fibulae and soft tissues. Certain tibial fractures are often associated with delayed union, non-union, and malunion. These fractures are usually characterized by marked soft-tissue injury, comminution, and displacement. Nicoll, Hoaglund and States, and others[1,2,3], have stated that a minimally displaced tibial fracture in the presence of an intact fibula has a good prognosis. Charnley noted that although the initial force may be great enough to break the tibia and tear local soft tissues, the fibula is protected from fracture by its innate flexibility and the significant compliance of its proximal and distal ligaments. He further stated that roentgenograms often do not reveal the true magnitude of the dis-placement sustained at the moment of violence and that therefore this fracture pattern can indeed be subject to complications [4,14].

In this comparative study we analyzed differential rates of delayed/ non-union in management of tibia fractures with and without associated fracture fibula.

MATERIALS AND METHODS:

This prospective study was conducted in the Department of Orthopedics, Sanjay Gandhi Institute of Orthopedics and Trauma, Bangalore. Total 20 cases of tibial shaft fractures were included after obtaining their consent.

INCLUSION CRITERIA-

- patients who were diagnosed as fracture shaft of tibia
- age group of more than 20 years of either sex
- surgically fit patients

EXCLUSION CRITERIA-

- skeletally immature individuals
- open fractures of shaft of tibia- Type III(Gustilo-Anderson classification)
- neurovascular injury
- pathological fractures
- and associated metaphyseal or intraarticular fractures.

Patients were selected on the basis of history, clinical examination and radiography. X-ray of full length of tibia antero-posterior and lateral view were taken. All fractures were classified as per Orthopedic Trauma Assosiation (OTA) AO classification of tibial diaphyseal fractures and these were treated with intramedullary interlocking nail. Follow up and assessment were performed using Johner and Wruth's Criteria [13].

Patient was operated under spinal/general anesthesia. Patient was placed in supine position over a radiolucent operating table. The injured leg was positioned freely, with knee flexed in 90^0 over edge of the operating table. Nail length was determined radio graphically.

Vertical patellar tendon splitting incision of about 5cm long was made over the skin extending from centre of inferior pole of patella to tibial tuberosity. Curved bone awl was used to breach the proximal tibial cortex in a curved manner. After widening the medullary canal of proximal third, a ball tipped guide wire was passed into the medullary canal of proximal fragment and fracture fragment reduced under image intensifier. Its containment within the tibia was confirmed in antero-posterior and lateral view. Medullary canal was reamed starting from 8mm reamer size to 0.5 to 1mm larger than the diameter measured using radiographs. Then ball tipped guide wire was exchanged with smooth guide wire using medullary tube. This was followed by passing an assembled nail into the medullary canal over smooth guide wire. Routinely, proximal locking will be done first, but due to

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the gap present at fracture site, we carried out distal locking first, which then enabled the use of rebound technique to prevent diastasis. Patellar tendon was sutured using delayed absorbable sutures using ethylon. Sterile dressing and compression bandage was applied.

Patient was allowed non weight bearing with crutch walking /walker on next postoperative day according to general condition. Sutures were removed on 10th-12th postoperative day. Partial weight bearing and with crutch walking/walker was commenced after 10days, depending on the type of fracture, rigidity of fixation and associated injuries.

Further follow-up was done at 6weeks, 3months and 6months and each patient was assessed clinically and radio-graphically according to the standard performa.

RESULTS:
Data was collected based on detailed patient evaluation with respect to history, clinical examination and radiological evaluation. The post-operative evaluation was done both clinically and radiologically. Out of twenty patients treated in this manner, all cases were available for follow up period of 6 months. Of the 20 cases of fracture shaft tibia ,which included 10 cases (7 males, 3 females) of both bone leg fracture and other 10 cases (8 males, 2females) of isolated tibia fracture with intact tibia were selected and treated using intramedullary interlocking nail. There was history of 16 motor vehicle accidents, 1 sport accident, 2 home falls another 3 cases had associated femur shaft fractures. Using AO classification the tibial fracture was Type A in 13 cases, Type B in 7 cases. Nails of diameter 9-12mm were used after reaming once more.

Among the 10 cases (Group A) of fracture both bone leg, eight of them achieved consolidation at 6months and two of them at 9th month following dynamization, whereas in isolated tibia fracture with intact fibula (Group B), 3 achieved consolidation by first intension treatment, 3 of them achieved consolidation by 9 months, two by 12 months followed by dynamization and two patients went into non union who were later managed successfully by bone grafting.

At end of 6months, according to Johner and Wruh's criteria for evaluation of final results In Group A, 5 had excellent results, 3 had good results and 2 had fair results; whereas in Group B, 2 had excellent outcome, 5 fair and 2 had poor results.

DISCUSSION: Comminution, soft-tissue injury, and fracture displacement are often cited as the factors best correlated with complications following tibial fracture[3,4]. In our series, however, a tibial fracture with an intact fibula seems to be a cause for delayed union and non union. In fact, our study indicates that an intact fibula, particularly in patients aged more than twenty years old are frequently associated with delayed tibial union, non-union and secondary pain.

As in our study, we can see that 6 patients in group A have shown consolidation by primary intention at 6months and rest 4 of them my 9 months following dynamization. The interlocking nail restores length, alignment, controls rotation, preserves periosteal blood supply, some amount of endosteal blood supply, biological osteosynthesis, reduce the rate of infections and malunion. The advantage of locking screws over conventional methods is that, it reduces the rate of malunion, prevents loss of allignment, angulation and shortening which are commonly found in plaster cast or functional brace[5].

In our series the anatomical location of the fracture was in the middle third of shaft of tibia in 14 cases, followed by lower third in rest 6 cases which is comparable to Lawrence B.Bone et al (1986) series, where 53.5% were middle -third fractures[6]. Similarly Court Brown et al (1995), showed 44% were middle third fractures[7]. The middle third fractures are more frequent because of rigidity of the bone and its subcutaneous nature makes the bone more vulnerable to the injuring force.

Fracture union was considered when patient was full weight bearing without pain, fracture site was non tender on palpation. Group B fractures united with an average of 36 weeks with 2 non unions when compared with group A which took an average of 28weeks to unite which clearly shows that group B fractures (isolated tibia fractures) were more prone to delayed union and non union when compared to Group A.

Various treatments have previously been recommended for tibial fractures with intact fibulae and Bohler and Lottes recommended intramedullary nailing for concurrent tibial and fibular fractures in which the fibula has healed and is preventing the tibia from uniting. Dehne et al and Sakel-larides et al advised fibular osteotomy[8,9]; however, this treatment did not decrease the time for union of the fractured tibia. Indeed, Urist et al. and Sorensen showed that the osteotomized fibula heals more quickly than does the tibia. Few surgeons recommended resection of a 2.5 to 4.0-centimeter segment of the fibula to allow healing of the tibia[10,11]. Sharma's series showed an average time to tibial healing of 12.8 weeks with primary resection of the fibula at the time of fracture, compared with 16.6 weeks after secondary resection of the fibula

Another study , of twenty-three patients more than twenty years old who were treated for a tibial shaft fracture without a concomitant fibular fracture, six (26 %) had delayed union or non-union and six (26 %) had varus malunion of the fractured tibia. Pain and roentgenographic changes developed in the ipsilateral ankle within two years of injury and in two of these six patients had malunion. Of forty-five patients less than twenty years old with similar fractures, one had delayed union and twelve (27 %) had varus malunion. Pain in the ipsilateral ankle was observed in two of these twelve patients with malunion. In addition, a bent fibula was observed in thirteen patients who incurred their fractures when they were less than twenty but in no patients who were more than twenty years old at the time of fracture[12,13,14].This shows that tibial fracture with an intact fibula is an insidiously dangerous fracture pattern, particularly in patients who are more than twenty years old. Because bone and soft tissue are more compliant in children than in adults, the complications in patients less than twenty years old are rarely of clinical significance.

Conclusion
Our study concludes that isolated tibial shaft fractures with intact fibulae are more prone for complications like delayed and nonunion. Non- union cases are managed successfully with dynamization and later by bone grafting or fibulectomy.

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Figure 1: preoperative X- ray showing isolated tibia fracture

Figure 2: postoperative X-ray showing delayed union of tibia fracture 6months later

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