ORIGINAL ARTICLE

Treatment of close tibial diaphyseal fracture by dynamic compression plate

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Abstract

Objective: The purpose of this study is to evaluate the results of dynamic compression plate (DCP) for the treatment of close tibial shaft fracture.

Material and method: This study was conducted on 35 patients from January 2007 to November 2010 in orthopedic unit of Hayatabad Medical Complex Peshawar. Adults with type A or B close diaphysial fracture of tibia were included while open and pathological fractures were excluded from the study. Frequency distribution was analyzed with the help SPSS version 10 and presented in tables.

Results: Minimum age was 20 years, maximum was 62 and median age was 33. Male patients were 26(74.3%) while female were 9(25.7%). At second follow up the callus was noted in 29(82.9%) patients radiographs, at third follow up callus was noted in 31 (88.6%) patents, at final follow up in 32(91.4%) patients. Only three patients have no radiological signs of union in which we put autologous cancellous bone graft. Two patients (5.7%) became infected. In one patient the plate became loose and unstable which was removed after six months and NA fixator with bone graft was applied. At final follow up 34(97.15%) patients have healed with 1(2.85%) nonunion.

Conclusion: Dynamic compression plate for the close tibial shaft fracture is one of the favorite methods of treatment in our part of the world because it gives stable fixation within minimal hospital recourses and the union rate is good.

Key Words: Dynamic Compression Plate, Tibia, Diaphysial Fracture.

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Introduction:

Diaphysial fractures of tibia are the most common. Minor trauma can lead to fractures of tibia because the tibia by its location is exposed to frequent injuries as one third of its surface is subcutaneous.[1] Open diaphysial fractures of tibia are more common and require rigorous management. Minor trauma can lead to fractures of tibia because one third of its surface is subcutaneous, low to high energy trauma can lead to open fractures and furthermore complications can occur if the fracture is associated with neurovascular damage or compartment syndrome.[2] More over the blood supply of tibia is more precarious than the other axial bones which are embedded in heavy muscles. The knee and ankle joints are of hinge variety, so rotational deformity is difficult to compensate.[3] Infection, delayed union, malunion and nonunion are the leading complications of open fractures of tibial diaphysis. Therefore these fractures require good techniques and special care in their management.[4]

There are different operative and non operative methods of treatment for the close fractures of tibia. The non operative methods are cast splintage / Plaster of Paris (P.O.P) and functional bracing. It is an effective method of treating the close tibial diaphysial fractures that avoids operative complications but it has higher incidence of ankle stiffness.[5]

The operative method includes a variety of procedures like external fixation, open reduction in-

ternal fixation using dynamic compression plate (DCP) and screws and intramedullary (IM) nailing. The external fixation resulted in pin tract infection and sometime osteomylitis of the bone.[6] To avoid these problems close tibial interlock nailing was developed that was claimed to minimize the chances of postoperative complication but statistically it was not significant.[6] The use of plates and screws has been discouraged by many authors due to the potential damage to the periosteal blood supply during soft tissue stripping, and the increased risk for septic complications.[7] The development of new biological techniques and implants has again revived the interest towards open reduction and plate fixation.[7] However the exact role of plate fixation in the treatment of open tibial shaft fracture still remains obscure, as the literature is lacking in randomized control trials (RCTs) comparing plate fixation with the other established methods of treatment. This method of treatment has big advantage that it can be done without any hazards of radiation and without fluoroscopic control which has a high cost and not available in most of the hospitals.[8] The purpose of this study is to evaluate the results of dynamic compression plate (DCP) for the treatment of close tibial shaft fracture.

Material and methods:

The study was conducted in Orthopedic Department of Hayatabad Medical Complex Peshawar from January 2007 to November 2010 on 35 consecutive patients. The patients were selected according to following criteria.

Inclusion criteria:

1. Close diaphysial fracture of tibia.
2. Adults (after the closure of epiphysis)
3. Types of fracture (Orthopedic Trauma Association (OTA) classification type A and type B fracture).

Exclusion criteria:

1. Open fracture.
2. Pathological fracture.

After fitting in the inclusion criteria, a thorough history were elucidated, complete physical examination performed and investigations carried out. All the patients were counseled about their conditions which necessitated an urgency of the surgical procedure they had to undergo. Informed consent was taken from all patients. Preoperative Cefuroxime 1.5 gram was given on induction and locally made DCP and screws were used. Antibiotics were continued for three days.

Patients were mobilized on first postoperative day and knee and ankle exercises were started. Patients were allowed for touch weight bearing on first post operative day, half weight bearing after six weeks when callus was seen on X-rays and full weight bearing after fracture heals. Stitches were removed on fourteenth post operative day. Patients were followed up for fortnight for first visit, then at one month, at three month, at six months and subsequently at nine months. In each visit the progress of healing of fracture site was examined clinically and radiologically. After collection of the data, it was analyzed with the help SPSS version 10 and presented in tables.

Results:

Minimum age was 20 years, maximum was 62 and median age was 33. Male patients were 26(74.3%) while female were 9(25.7%) (Table 1). Upper third was involved in 4(11.4%) patients, middle third in 16(45.7%) while lower third was involved in 15(42.9%) patients. There were 8(22.9%) fractures due to fall while 27(77.1%) were due to road traffic accidents (RTA) (Table 2). Right tibia was involved in 14(40%) patients while left tibia in 21(60%) patients. There were 20 (57.1%) orthopedic trauma association (OTA) type A Fracture while 15(42.9%) were type B (Table 3).

At second follow up the callus was noted in 29(82.9%) patients radiographs, at third follow up callus was noted in 31 (88.6%) patents, at forth follow up 32(91.4%). Only three patients have no radiological signs of union in which we put autologous cancellous bone graft. There were two (5.7%) patients that became infected (Table 4). In one case the plate became loose and unstable which was removed after six months and

Table 1: *Gender of patients (n=35)*

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Female	9	25.7	25.7	25.7
Male	26	74.3	74.3	100.0

Table 2: *Mechanism of injury (n=35)*

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Fall	8	22.9	22.9	22.9
RTA	27	77.1	77.1	100.0

Table 3: *Type of fracture (n=35)*

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Type A(OTA)	20	57.1	57.1	57.1
Type B(OTA)	15	42.9	42.9	100.0

Table 4: *Infection (n=35)*

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
No infection	33	94.3	94.3	94.3
Present	2	5.7	5.7	100.0

Table 5: *Union seen at Last Follow up (n=35)*

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Union present	33	94.3	94.3	94.3
No	2	5.7	5.7	100.0

NA fixator with bone graft was applied (Figure 2) (Table 5). At final follow up 34(97.15%) patients have healed with 1(2.85%) nonunion.

Discussion:

The closed interlocking nail technique of tibial shaft fracture is said to have fewer complications and the treatment of choice.[6] But it needs expertise and facilities like use of fluoroscope, instrumentation and the cost of nails has not made it a universal treatment in our country as compare to developed world.[8] There is also no difference in complication rate like infection in both these method.[9] There is constant knee pain in more than eighty percent of patient treated with interlocking nail.[10] That is why DCP is still the treatment of choice in our part of the world.

In one study implant failure occurred in 5/105(5%) cases after conventional plate fixation while in our study there was no failure of implant.[10] In another study out of 172 case there were 3 (1.74%) delayed union and 8(4.65%) nonunion while in our study there was delayed union in 2(5.7%) cases and non union in 1(2.85%) case.[11]

In Rommens et al study the infection rate was 1.2% and nonunion developed in 1.2%.[12] In his study 88.1% of the patients had a good end result12 while in our study the infection rate was (5.7%), non union was (2.85%) and (91.4%) has good healing. He concluded that plate osteosynthesis of closed tibial shaft fractures proved to be a reliable treatment procedure.[12] In Bilat C et al study infection was observed in 1.7 per cent and delayed union in 6.8 per cent. More than 94 per cent of the closed fractures had an excellent or good late result while in our study the infection rate was (5.7%), delayed union in (5.7%) and good healing in (91.4%) of patients.[13] Kristensen et al skin necrosis over the osteosynthesis material in 5.2 per cent, osteitis in 1.3 per cent, delayed osseous healing in 2.6 per cent of patient.[14] Janssen et al study showed that the mean time to radiographic union was 19 weeks (range 14–32 weeks) for the DCP group versus 21 weeks (range 13–28 weeks) for the IM nailing group (p=0.44). Delayed union occurred in 2(16.7%) patients managed with DCP and in 3(25%) patients who had IM nailing.[15] Control of alignment in all directions is difficult with a nail alone. [15] In view of this it is interesting to note that some authors advise performing an open reduction and plate stabilization of the fibula to increase the rotational control.[15] Mal alignment of the tibia can cause degenerative changes in the knee and ankle joint. Janssen et al study showed that anterior knee pain is still an important complication of IM nailing.[15] Furthermore; they have found no difference with regard to time to union, nonunion, hardware failure or deep infections between DCP and IM nailing. [15] Janssen et al favored considering the use of DCP for closed fractures in the shaft of the tibia.[11] All these studies are comparable to our study. Rüedi T et al study also proved that dynamic compression plate is very satisfactory for internal fixation

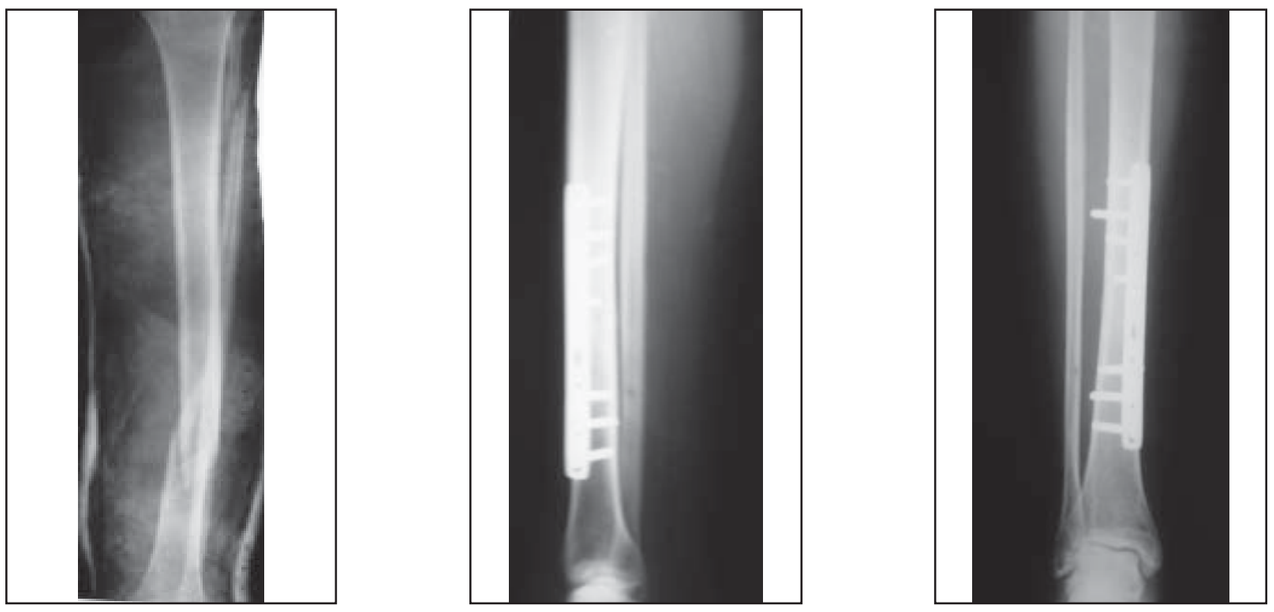

Figure 1: *Fracture Union at six month*

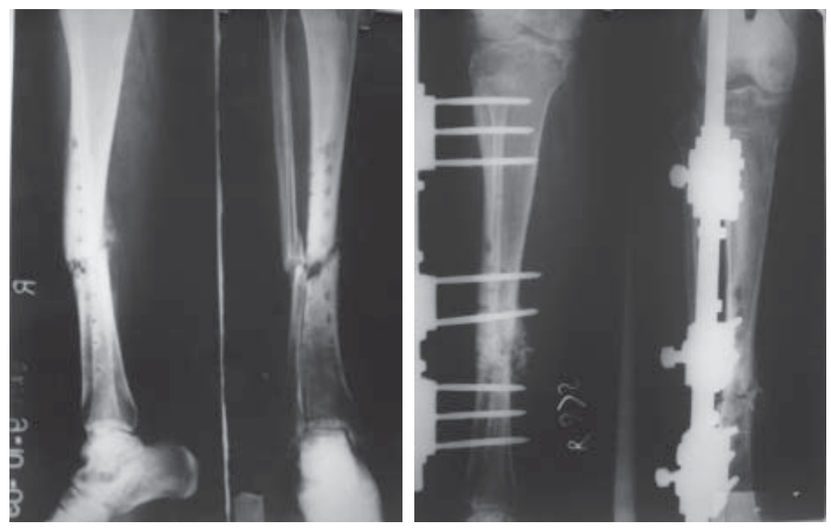

Figure 2: *Non union (last follow up). Removal of DCP, application of NA fixator with bone graft.*

of fractures of the tibia.[16]

Conclusion:

There is no mal alignment with DCP as compare to Interlocking nail of tibia.[16] It gives stable fixation vertically as well as rotationally. The fracture heals quickly with low or negligible infection rate. This method of treatment has big advantage that it can be done without any hazards of radiation and without fluoroscopic control which has a high cost and not available in most of the hospitals.

References:

1. Miller NC, Askew AE. Tibia fractures. An overview of evaluation and treatment. Orthop Nurs 2007; 26:216-23.
2. Myers SH, Spiegel D, Flynn JM. External fixation of high-energy tibia fractures. J Pediatr Orthop 2007; 27:537-9.
3. Janssen KW, Biert J, van Kampen A. Treatment of distal tibial fractures: plate versus nail: A retrospective outcome analysis of matched pairs of patients. Int Orthop 2007; 31:709-14.
4. Bombaci H, Güneri B, Görgeç M, Kafadar A. A comparison between locked intramedullary nailing and plate-screw fixation in the treatment of tibial diaphysis fractures. Acta Orthop Traumatol Turc 2004; 38:104-9.
5. Inam M, Arif M, Shabir M. Treatment of close tibial diaphyseal fracture by close interlocking nail. J Postgrad Med Inst. 2008; 22:47-51.
6. Whittle PA, George WW. Fractures of Lower Extremity. In: Canale ST. Campbell's Operative Orthopaedics. 11th edition New York: Mosby; 2008. 2725-872.
7. Taylor JC. Delayed union and non-union of fractures. In: Canale ST. Campbell's Operative Orthopaedics. 11th edition New York: Mosby; 2008. 1287-90.
8. M Zubair Javaid, M Abdul Mateen, Gul Nawaz. Tibial Shaft Fractures - Treatment evaluation with Interlocking nail and Dynamic Compression Plating. J Surg 2000;19-20:33-5.
9. Lefaivre KA, Guy P, Chan H, Blachut PA. Long-term follow-up of tibial shaft fractures treated with intramedullary nailing. J Orthop Trauma. Sep 2008;22(8):525-9.
10. Jensen JS, Hansen FW, Johansen J. Tibial shaft fractures. A comparison of conservative treatment and internal fixation with conventional plates or AO compression plates. Acta Orthop Scand. 1977; 48(2):204-12.
11. Burwell HN. Plate fixation of tibial shaft fractures: A survery or 181 injuries. J Bone J Surg.1971;53(2): 258-71.
12. Rommens P, Broos P, Gruwez JA.Follow-up results of 102 tibial shaft fractures stabilized by dynamic compression plate osteosynthesis Unfallchirurgie. 1986 Dec; 12(6):320-6.
13. Bilat C, Leutenegger A, Rüedi T. Osteosynthesis of 245 tibial shaft fractures: early and late complications. Injury. 1994;25(6):349-58.
14. Kristensen KD. Tibial shaft fractures. The frequency of local complications in tibial shaft fractures treated by internal compression osteosynthesis. Acta Orthop Scand. 1979 Oct;50(5):593-8.
15. Janssen KW , Biert J, van Kampen A.Treatment of distal tibial fractures: plate versus nail. A retrospective outcome analysis of matched pairs of patients. International Orthopaedics (SICOT). 2007;31:709–14.
16. Rüedi T, Webb JK, Allgöwer M. Experience with the dynamic compression plate (DCP) in 418 recent fractures of the tibial shaft. Injury. 1976;7(4):252-7.