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Original Research Article

Osteosynthesis distal tibial metadiaphyseal fractures with intramedullary nailing versus plating

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ABSTRACT

Background: The management of the tibial fracture remains controversial despite advances in both non-operative and operative care. Plates and intramedullary nails are two well-accepted and effective methods, but each has been historically related to complications. The present study was conducted to compare the results of displaced extra-articular distal tibia meta-diaphyseal fractures OTA/AO Type 42A- C (distal) and 43-A treated with intramedullary nailing versus plating with respect to union of fracture, early Restoration of function, the axial alignment and Complications, if any.
Methods: In this study 30 patients of extra-articular distal tibia fracture AO type 42 A-C (distal) and 43 A were randomly selected and 15 were operated with intramedullary nailing and remaining 15 with plating. The patients were regularly followed up for a period of 9 months with radiological and clinical examination. Final assessment was done by Tenny and Wiss clinical assessment criteria.
Results: In Interlocking group, average time for union was 20.33 weeks in Interlocking nail group compared to 23.21 weeks in plating group which was significant (p value 0.011). Also, the average time required for partial and full weight bearing in the nailing group was 7.2 weeks and 13.2 weeks respectively which was significantly less as compared to 9.33 weeks and 16.64 weeks in the plating group. Lesser complications in terms of implant irritation, ankle stiffness and infection (superficial and deep) were seen in Interlocking group as compared to plating group.
Conclusions: In present study ILN showed better outcome as it offers advantage in terms of mean operating time, less invasive surgery, hospital stay, partial and full weight bearing time and union time.

Keywords: Distal tibia metadiaphyseal fractures, Expert tibia nailing, Intramedullary nailing, Plating

INTRODUCTION

In the modern world with the increase in the number of fast moving vehicles there is a great increase in number and severity of musculoskeletal trauma. The goal of fracture treatment is to obtain union of the fracture in the most compatible anatomical position which allows maximal and full restoration of the extremity.[1]

Fractures of the distal tibia accounts for less than 10% of all fractures of lower extremities and occur more frequently in men than women aged between 35-40 years.[2] The management of distal tibial fractures remained challenging in orthopaedic traumatology. By its location and subcutaneous position in the leg, tibia is exposed to risk of injury and open fractures. High energy trauma and poor blood supply at lower one third shaft of tibia pose difficulties in bringing out optimal results.[3]

The management of the tibial fracture remains controversial despite advances in both non-operative and operative care. Orthopedic opinion is often cyclic, and in no area of orthopedic endeavor is this better seen than in the management of the fractured tibia. Böhler had

recommended that all major tibial fractures be treated with skeletal traction for 3 weeks followed by a weight-bearing plaster cast until healing was complete.[4] However, Watson-Jones and Coltart clearly showed that traction for tibial shaft fractures had a deleterious effect on the rate of union.[5] In Dehne eliminated the preliminary period of skeletal traction and instituted immediate weight bearing for the patient in a long-leg cast with the knee extended, he and his colleagues reported good functional results with no nonunions.[6,7]

Close treatment requires frequent follow up to check for displacement, so noncompliant patients are less well suited for non-operative treatment. Displaced tibia fractures without fibular fracture are prone to fall into varus with non-operative treatment, so these require caution.[8]

In 1957 the AO group, studying the poor functional results being obtained by non-operative treatment, placed open reduction and stable internal fixation on a firm scientific basis.[9]

Open reduction and plate fixation necessitates extensive soft tissue dissection and devitalisation, creating an environment, less favorable for fracture healing and more prone to infection and postoperative ankle stiffness. As a result, other methods such as intramedullary nailing, percutaneous plating have become the standard treatment for distal tibia fractures. Fracture fixation with intramedullary nails was developed to limit these potential operative complications. The use of intramedullary nails obviates the need for extensive surgical dissection, spares the extraosseous blood supply, and allows the device to function in a load-sharing manner. However, intramedullary management of distal tibia metaphyseal fractures is accompanied by its own complications, including malalignment, hardware failure, and the risk of fracture propagation into the ankle joint.[10]

Plates and intramedullary nails are two well-accepted and effective methods, but each has been historically related to complications. Mal-alignment and knee pain are frequently reported after nailing, whereas infections, wound complications, and implant prominence have been associated with tibial plating in some series.[11]

METHODS

This prospective randomized study was conducted on total of 30 adult patients with displaced distal tibial fractures, admitted in the Department of Orthopaedics, attached to Government Medical College, Patiala, Punjab, India between august 2013 and October 2015.

We included all Close displaced fracture and open fracture of distal tibia gustilo anderson grade I and II, fracture of distal tibia in adult, Distal tibia fracture not complicated by infection, Associated fibula fracture may /may not present. Fracture in paediatric age group, pathological fracture, presence of infection in fracture, patient unfit for operation for medical reason, Gustilo Anderson type III, Associated Fractures of talus, calcaneum, Intra-articular fractures, associated proximal tibia fracture, segmental fracture of tibia were excluded from our study.

The eligible patients were randomly divided into two groups, Group 1 includes 15 patients treated with intramedullary nailing and Group 2 includes 15 patients treated with plating.

Pre-operative broad spectrum antibiotics were given on the day of surgery and antibiotics was continued for three to five days post-operatively. The surgery was performed with the patient in supine position under general or spinal or epidural anaesthesia depending upon choice of anesthesiologist. Whole of the limb was prepared. Pneumatic tourniquet was applied after taking proper precautions and the time of its application and removal was noted.

Surgical technique for intramedullary nailing

A vertical patellar tendon splitting incision over skin extending from centre of the inferior pole of patella to the tibial tuberosity was made about 3cms long. Reduction of the fracture fragments under image intensifier by maintaining longitudinal traction in line of the tibia was done.

If the metaphyseal area does not supply enough stability or if the reduction cannot be achieved, polar screws need to be positioned to narrow the metaphyseal canal and to guide the nail. Polar screws can be used prior to nail insertion as a reduction aid or can be placed after nail insertion to support stability and maintain the reduction. Distal tibial fractures usually require biplanar fixation, so antero-posterior and Lateral Interlocking screws are beneficial.

Surgical technique for plate fixation

The key concept of this approach was to preserve the soft-tissues and blood supply. The incision was carried straight across the subcutaneous fat, preserving the greater saphenous vein and saphenous nerve. The dissection was advanced down onto the periosteum which was completely preserved. In this anatomical space, the tunneling towards the diaphysis was achieved with the blunt tip of the plate. For the insertion of the proximal screws in the diaphysis, separate stab incisions usually were taken. If there was difficulty in reduction of fracture fragments incision was extended proximally and open reduction was done under direct vision.

Post-operative management

Par-enteral antibiotics was given for three to five days followed by oral antibiotics depending upon the condition

of the wound. Limb elevation and active exercises were advised. Post-operative check X-ray was taken to assess the reduction. After 24 hours post operatively wound was examined and neurovascular status noted. Physiotherapy, within the limit of tolerance, was started 48 hours after the operation

On 3rd and 7th postoperative day wound was again dressed. Stitches were removed on 11th day (subject to condition of the wound). Patients were maintained non or toe-touch followed by partial weight bearing until clinical and radiographic signs of healing were seen after which full weight bearing was allowed. Secondary surgeries like bone grafting, dynamization, wound wash and secondary suturing were performed as determined by the surgeon for failure of progression of healing, loss of fracture fixation or infection. Patients were followed up at 6 weeks, 12 weeks, then monthly for next 3 months and then finally at 9 months after surgery with radiological and clinical examination.

RESULTS

In present study total 30 patients of distal tibial metadiaphyseal fractures were treated by intermedullary nail (15 patients) and plating (15 patients). We included all patients between 21 to 74 years' age. The mean age was 36.6 years and 43.47 years for Interlocking nail and plating group, respectively. Males were predominantly affected in our study accounting for 83.3% as compared to females (16.7%). Commonest mode of injury was road traffic accidents (73.33%). Most common fracture pattern seen in our study was type 43-A1 (30%) and type 42-A3 (16.66%) and 43-A2 (16.66%) (Table 1).

Table 1: Classification of fracture: OTA/AO type.

AO type fracture	Study groups		Total
	Interlocking nail	Plating	
42 A1	1	2	3
42 A2	2	1	3
42 A3	5	0	5
42 B2	0	1	1
42 C1	1	2	3
43 A1	4	5	9
43 A2	2	3	5
43 A3	0	1	1
Total	15	15	30
P value	0.344		

The right side was more commonly involved i.e. 63.33%, as compared to left side (36.66%). There was significant predilection for the fibular involvement (86.66% had associated fibula fracture). The mean time for delay in surgery was 3.16 days. The minimum time was 1 day and the maximum was 10 days. The mean time of duration of surgery was 77.33 mins in Interlocking nail group and 94.67 mins in plating group. The mean time of hospital stay was 6.6 days in Interlocking nail group and 9.20 days in plating group. The mean time for Partial weight bearing was 7.2 weeks in Interlocking group (range 3-12 weeks) which was significantly less than in plating group i.e. 9.33 weeks (range 6-14 weeks). The mean time for Full weight bearing was 13.2 weeks in Interlocking group (range 8-20 weeks) that was significantly less than in plating group i.e. 16.64 weeks (range 14-20 weeks). The mean time for radiological union was 20.33 weeks in Interlocking nail group that was significantly less than in plating group i.e. 23.21 weeks (Table 2).

Table 2: Duration of surgery.

Duration (in minutes)	ILN	%	Plating	%
70-80	12	80	2	13.33
81-90	2	13.33	6	40
91-100	1	6.67	3	20
>100	0	0	4	26.67

Four cases from Interlocking nail group and one patient from plating group had significant valgus (6º -10º). Other patients either had no varus/valgus or had acceptable 5º varus /valgus. One patient from Interlocking nail group had anteversion of 6º-10º. Other patients either had no angulation or had ≤5º anteversion /recurvation. Complications encountered in Interlocking nail group were superficial infection in 1 patient (6.66%), delayed union in 2 patients (13.33%) and anterior knee pain in 3 patients (20%), Whereas in plating groups were superficial infections in 3 patients (20%), deep infection and wound dehiscence in 2 (13.33%) patients, delayed union in 3 (20%) patients and non-union in one (6.66%) patient.

Table 3: Bone union.

Duration (in weeks)	ILN	%	Plating	%
16-20	9	60	2	14.28
20-24	5	33.33	9	64.28
>24	2	13.33	3	21.4
Total	15		14	

In present study, the secondary procedures in Interlocking nail group were dynamisation in 3 patients (20%), bone graft in 2 patients (13.33%). whereas in plating group secondary suturing in 2 (13.33%) patients, wound wash in 3 (20%) patients and bone grafting in 3 (20%) patients were done. In our study, excellent results were more common in Interlocking nail groups (53.33%), compared to plating group (46.66%) (Table 4).

The poor results according to tenny and wiss clinical assessment criteria were more common in plating group (13.33%) as compared to (6.66%) the Interlocking nail group (Table 5).

Table 4: Complications.

Complications	Study groups			
	Interlocking nail	Percentage	Plating	Percentage
Superficial infection	1	6.66	3	20
Deep infection	-	0	2	13.33
Delayed union	2	13.33	3	20
Non-union	-	-	1	6.66
Mal-alignment				
Varus/valgus	4	26.66	1	6.66
Anteversion/recurvation	1	6.66	-	-
Anterior knee pain	3	20	-	-
Wound dehiscence	-	-	2	13.33

Table 5: Tenny and Wiss clinical assessment criteria.

Tenny and Wiss clinical assessment criteria	Study groups			
	Interlocking nail	%	Plating	%
Excellent	8	53.33	7	46.66
Good	4	26.66	5	33.33
Fair	2	13.33	1	6.66
Poor	1	6.66	2	13.33
Total	15		15	
Chi square	0.844			
Degrees of Freedom	3			
P value	0.839			

DISCUSSION

Fractures of the distal tibia accounts for less than 10% of all fractures of lower extremities and occur more frequently in men than women aged between 35-40 years. The management of these fractures remains challenging. These kinds of fractures are treated either conservatively or operatively by Interlocking nail or plating.

In the present study, the average duration of surgery was 77.33 minutes in Interlocking group and 94.67 minutes in plating group. Which was comparable to studies done by Li Y et al and Guo et al.[12,13] In the present study the average time to partial weight bearing was 7.33 weeks in Interlocking group and 9.33 weeks in plating group. Which was comparable to studies done by Pawar ED et al and Vaza JV et al.[1,14] In the present study the average Full weight bearing was 13.2 weeks in Interlocking group and 16.64 weeks in plating group. Which was comparable to studies done by Li Y et al, by Pawar ED et al and Vaza JV et al.[1,12,14]

Bony union was defined clinically as ability to walk without any support and pain and radiologically as solid callus bridging the fracture fragments taking mean time of 20.33 weeks in Interlocking nail group and 23.21 weeks in plating group (ranging from 16 weeks to 28 weeks). One patients of plating group show no signs of union either clinically and radiologically at 9 months of durations, This duration was similar to studies done by Li Y et al, Vaza JV et al and Pawar ED et al.[1,12,14]

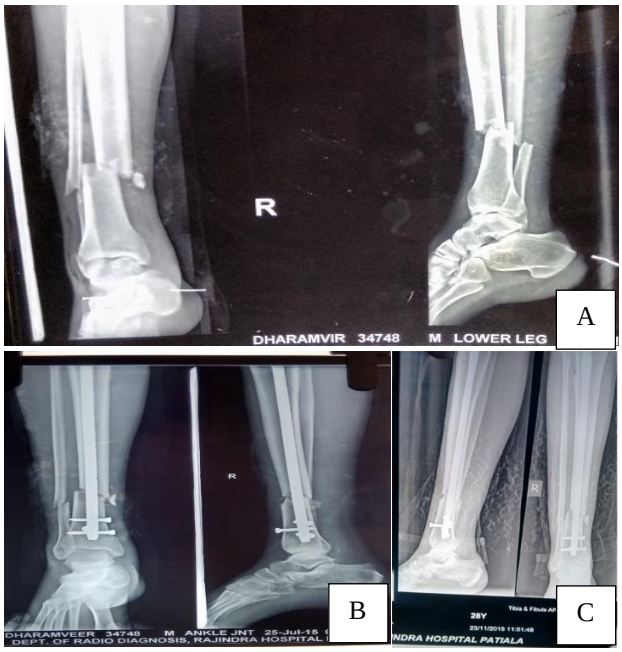

Figure 1: Interlocking nail; (case 1): A) Pre-OP; B) post OP; C) at 6 weeks follow up.

Complications encountered in Interlocking nail group were superficial infections in 1 patients, delayed union in

2 patient and anterior knee pain in 3 patients. Whereas in plating groups there were 3 delayed union, 1 non-union, superficial infections in 3 patients, deep infections and wound dehiscence in 2 patients (in which wound wash and secondary suturing was required). Superficial infections were treated with extra course of i.v. and oral antibiotics as per culture and sensitivity.

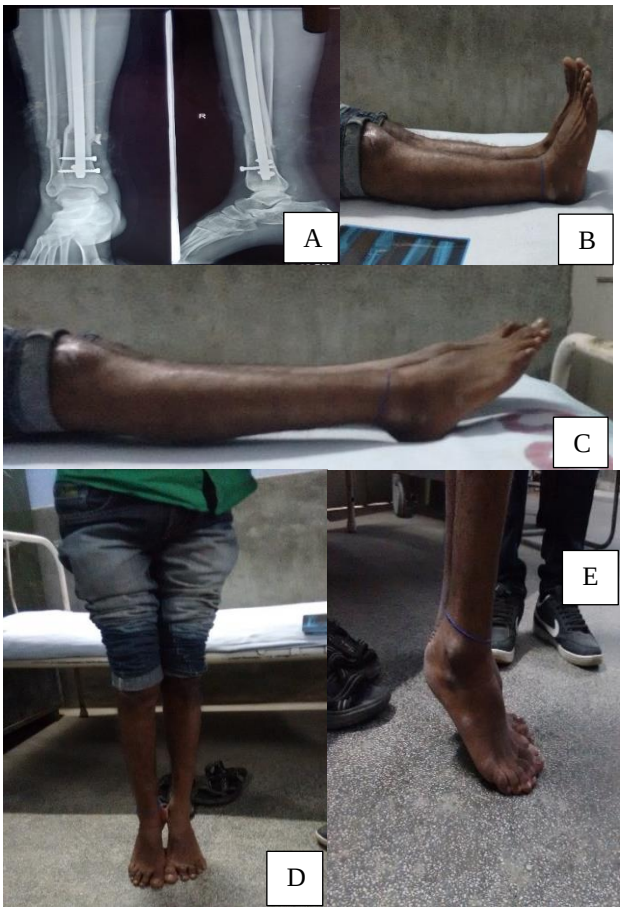

Figure 2: (case 2); A) After union; B-E) rom at follow up.

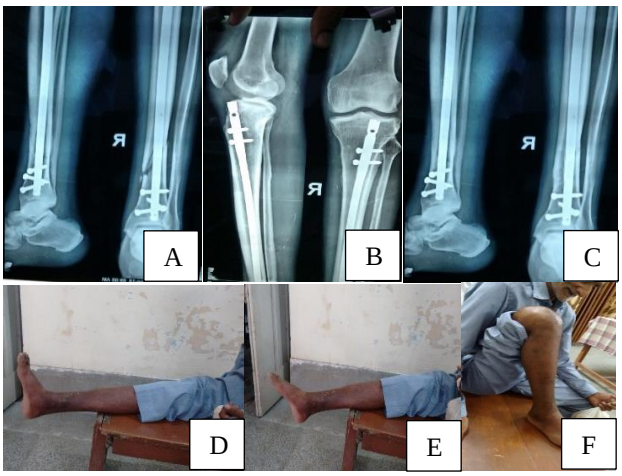

Figure 3: A, B) Post OP; C) Union; D-F) range of motion at follow up.

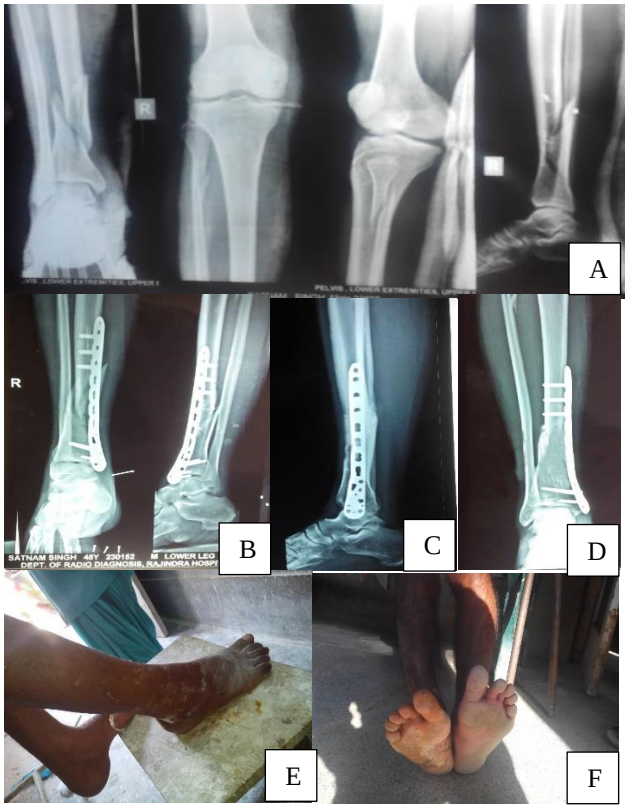

Figure 4: Plating 1st case; A) pre-OP; B) post-OP C, D) after union E, F) Range of motion at follow up.

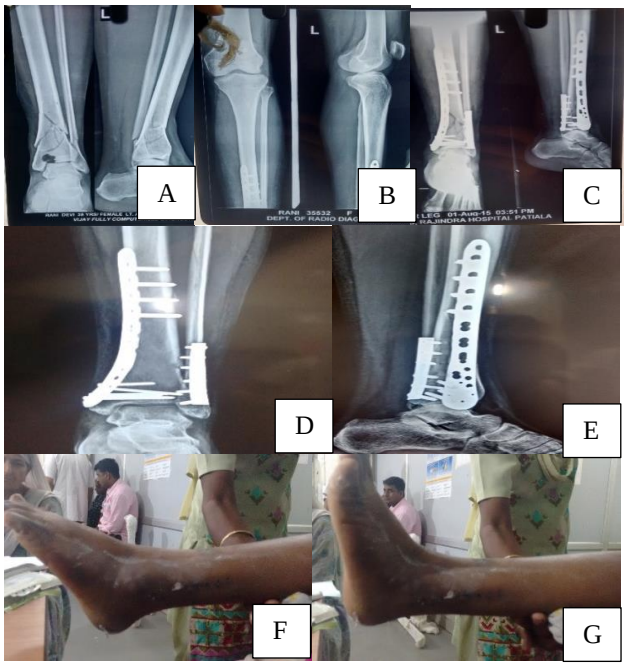

Figure 5: 2nd case; A) pre OP; B) post OP; C, D) union; F, G) Range of motion at follow up.

These patients did not show any further signs of infections once treated. Similar results were reported by Vallier HA et al and Vallier HA et al.[11,15] In present study, the results were evaluated according to the tenny

and wiss criteria. There were 80% good to excellent results in both the groups treated with plating and Interlocking intramedullary nailing. Comparable results were found in the studies conducted by Obulapathy D et al, Yip WH et al and Hegazy G et al.[3,16-18]

CONCLUSION

In osteosynthesis of displaced extra-articular distal tibia meta-diaphyseal fractures OTA/AO Type 42A- C (distal) and 43-A both modalities ILN as well as plating deserve a place. However, in our study ILN showed better outcome as it offers advantage in terms of mean operating time, less invasive surgery, hospital stay, partial and full weight bearing time and union time.

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REFERENCES

1. Pawar ED, Agrawal SR, Patil AW, Choudhary S, Asadi G. A Comparative Study of Intramedullary Interlocking Nail and Locking Plate Fixation in the Management of Extra Articular Distal Tibial Fractures. J Evol Medical Dental Sci. 2014;3(24):6812-26.
2. Court-Brown CM, McBirnie J. The epidemiology of tibial fractures. J Bone Joint Surg Br. 1995;77(3):417-21.
3. Obulapathy D, Reddy S. Management of distal third fractures of tibia by plating or interlocking nailing: a comparative study. Inter J Recent Scie Res. 2015;6(6):4918-20.
4. Matejčić A, Mihovil I, Tomljenović M, Krolo I. Forearm shaft fractures: results of ten-year follow-up. Acta Clinica Croatica. 2000;39(3):147-53.
5. Watson-Jones R, Coltart WD. Slow union of fractures: with a study of 804 fractures of the shafts of the tibia and femur. Br J Surg. 1943;130:260-76.
6. Dehne E, Metz CW, Deffer P, Hall R. Nonoperative treatment of the fractured tibia by immediate weight bearing. J Trauma Acute Care Surg. 1961;1(5):514-35.
7. Schatzker J, Tile M, Axelrod TS. The rationale of operative fracture care. Springer; 2005:477.
8. Rockwood CA, Green DP. Fractures in adults, Philadelphia. J.B. Lippincott Co., Ed. 8, Vol.2: 2428.
9. Allgower M. A healing of clinical fractures of the tibia and rigid internal fixation. Reprint from "The healing of osseous tissue. Natl Acad Sci, Natl Res Council. 1967:81-9.
10. Duda GN, Mandruzzato F, Heller M, Goldhahn J, Moser R, Hehli M, et al. Mechanical boundary condition of fracture healing: borderline indications in the treatment of undreamed tibia nailing. J Biomech. 2001;34:639-50.
11. Vallier HA, Cureton BA, Patterson BM. Randomized, prospective comparison of plate versus intramedullary nail fixation for distal tibia shaft fractures. J Orthop Trauma. 2011;25(12):736-41.
12. Li Y, Liu L, Tang X, Pei F, Wang G, Fang Y et al. Comparison of low, multidirectional locked nailing and plating in the treatment of distal tibial metadiaphyseal fractures. Int Orthop. 2012;36(7):1457-62.
13. Guo JJ, Tang N, Yang HL, Tang TS. A prospective, randomised trial comparing closed intramedullary nailing with percutaneous plating in the treatment of distal metaphyseal fractures of the tibia. J Bone Joint Surg Br. 2010;92(7):984-8.
14. Li B, Yang Y, Jiang LS. Plate fixation versus intramedullary nailing for displaced extra-articular distal tibia fractures: a system review. Eur J OrthopSurgTraumatol. 2015;25(1):53-63.
15. Vallier HA, Le TT, Bedi A. Radiographic and Clinical Comparisons of Distal Tibia Shaft Fractures (4 to 11 cm Proximal to the Plafond): Plating Versus Intramedullary Nailing. J Orthopaedic Trauma: May/June 2008;22(5):307-11.
16. Yip WH, Lee KB, Shen WY. Early Experience of Metaphyseal Plating by the Minimally Invasive Plate Osteosynthesis Technique for Closed Distal Tibial Fractures. Hong Kong J Orthop Surg. 2006;10(1):22-7.
17. Hegazy G; Rashed R E ; Elfatah Al-sha E A, Hassan A E. Biological fixation of Distal Tibial Fractures by locking compression plate. J Am Sci. 2015;11(5):179-84.
18. Neer CS. Injuries to the acromioclavicular joint. In: Rockwood CA Jr, Green DP, eds. Fractures in Adults. Vol 1. 2 nd ed. Philadelphia, PA: JB Lippincott; 1984:895.

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