

Augmented Wagner's External Fixator in Proximal Tibial Fractures

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Key Words

Tibial plateau fractures - Intraarticular fractures closed reduction. Percutaneous 'K' wires. Ligamentotaxis. Early function.

❖ Abstract ❖

Tibial plateau fracture are complex and pose management problems. There is tremendous soft tissue damage, displaced intraarticular fragments & fracture comminution.

Between 1997 to 2002. 63 proximal tibial fractures were treated with Augmented Wagner's External fixator. Average follow up was 2 yrs (range 1 to 4 yrs). Union occurred in all cases. Using IOWA

knee score 89% had good or excellent results. 6% fair & 5% poor results. Poor results were in those cases associated with either ipsilateral intercondylar or shaft fractures.

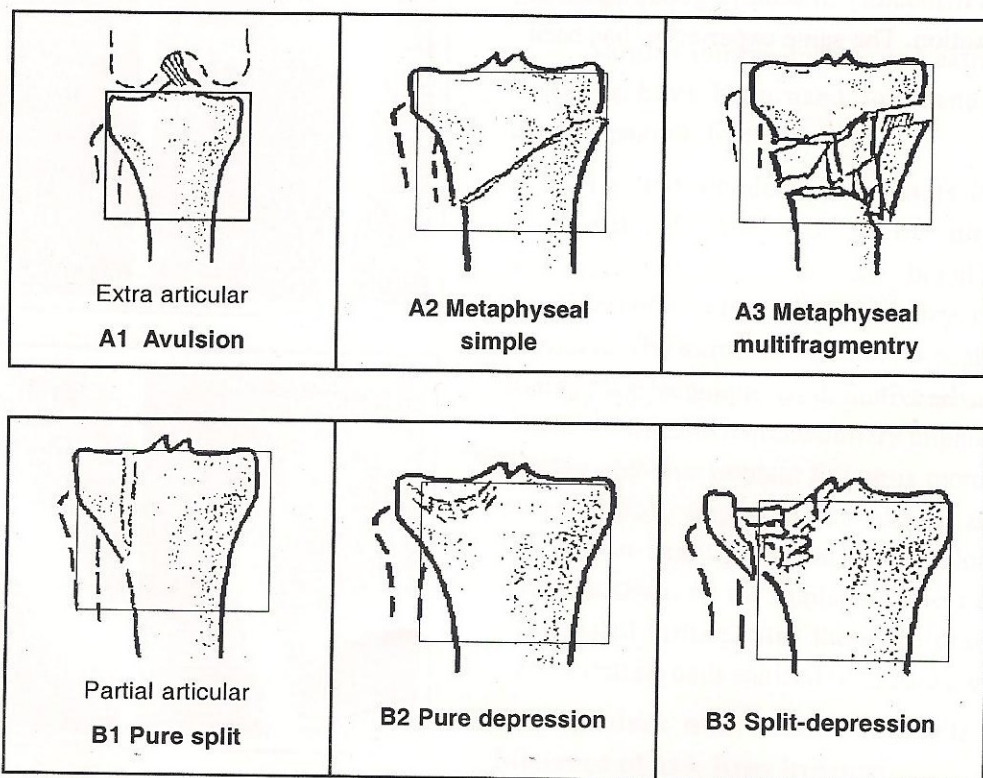
Material and Methods

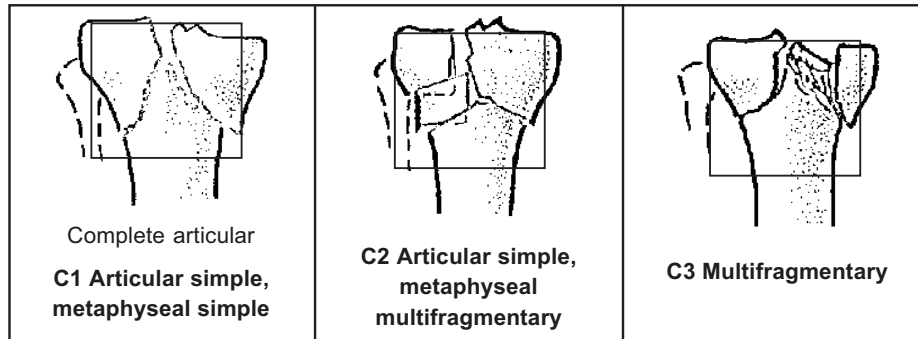
63 proximal tibial fractures were treated with Augmented Wagner's External Fixator between 1997 to 2002.

57 were male & 6 female. Age distribution was between 18-87 yrs and average follow up of 2.5 yrs (1-4 yrs).

All the fractures were classified using OTA Classification.

Proximal Tibial Fractures OTA Classification



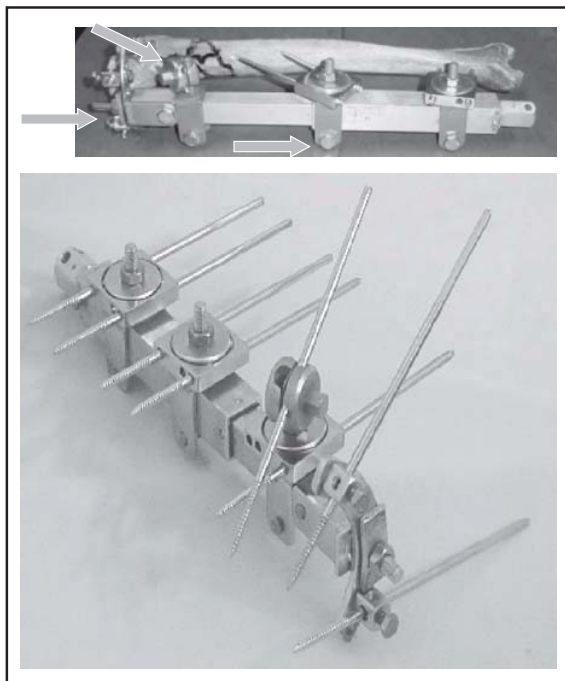


Augmented Wagner's External Fixator

The augmentations are :

1. 4 clamps instead of 2, 1 clamp with Ilizarov quarter mounted with 3 Rancho cubes placed at right angles to the other 3.

2. Stud of clamp is 8 mm in diameter & 32 mm in length instead of 6 mm & 20 mm respectively to accommodate an Aesculap clamp.



Technique

- * Pre op assessment of X-rays & 3-D scans
- * Ligamentotaxis - fracture table.
- * Closed reduction of condyles with tenaculum forceps under image control.

- * Percutaneous & intra-articular K wires used to manipulate fragments.
- * If necessary limited incision to elevate depressed fragments & limited internal fixation of meta/diaphyseal fracture.
- * Maintaining tenaculum forceps AWEF positioned parallel to medial tibial surface.
- * Initially the proximal & distal most Schanz introduced 90° to tibia.
- * 1st proximal Schanz is through posteromedial tibia 1 cm from joint.
- * 2nd proximal Schanz is through anteromedial tibia.
- * 3rd proximal Schanz is anteroposterior through medial condyle.
- * The rest of Schanz are appropriately directed to hold the meta / diaphyseal fracture.
- * All nuts of clamps and bolts of Rancho cubes fastened.
- * Gentle compression to bring bone on bone contact at metaphysis is carried out.
- * The apparatus is finally locked.

Post Op Regimen

- Motion of knee initiated from 2nd post op day (*achievement of larger ROM not emphasized in early weeks to minimize drainage from proximal pins*)
- Toe touch weight bearing : 6 weeks. Progressive weight bearing based on fracture pattern and X-ray evidence of healing.

Other Measures :

- Standard pin care.
- Fixator compression if required.
- When no pain at fracture site & clinically / radiologically fracture is healed then fixator is removed in OPD.

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100 point scale with 5 categories of knee functions assessed

ADL : 35 points

Pain : 35 points (no pain) & 0 points - (severe pain)

Gait : 10 points

ROM : 10 points (1 point for each 15° motion)

Absence of deformity, ligament laxity : 10 points

Score of 90 to 100 = excellent

80 to 89 = good

70 to 79 = fair

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Our Results - IOWA Score

- Follow-up: average 2 years (range 1 to 4 years).
- Mean time of union (as determined by removal

of external fixator) 7months (range 4 to 11 months).

- 89% good or excellent, 6% fair and 5% poor. Average IOWA Score - 92.
- Poor results of 5% were in those cases associated either with ipsilateral intercondylar / shaft femoral fractures.

Complications - Instability

- No patient had functional instability
- 7 patients had clinical instability of which 4 were posterior and 3 were medial.

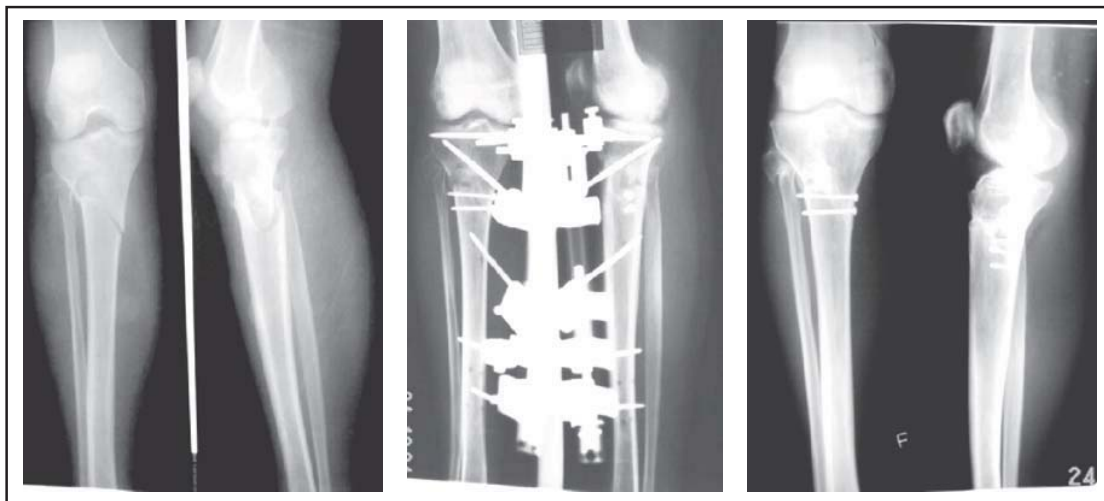
3 of the 4 posterior and all 3 medial instabilities were Gr 1+ (< 5 mm)

The remaining 1 case of posterior instability was of Gr. 2+ (5-9 mm).

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- Articular surface and metaphyseal / diaphyseal fractures can be well maintained.
- Construct can be compressed, allows deformity correction as consolidation progresses.
- Fixator is mechanically stable with no cantilever loading.
- Low incidence of infection.
- Permits plastic / vascular repairs.
- Excellent patient compliance.

Proximal Tibial C1 Fracture : 30 yr M, Closed, Fix Off 6 Months



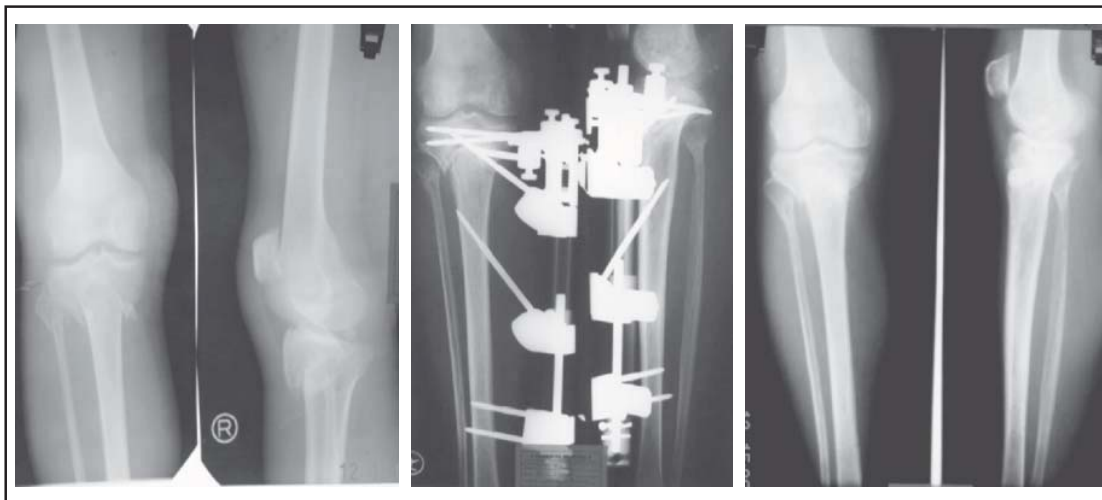
Proximal Tibial C1 Fracture : 32 yr M, Comp Gr. II, Fix Off 4 Months



Proximal Tibial C2 Fracture : 37 yr M, Comp Gr. I, Fix Off 8 Months



Proximal Tibial C2 Fracture : 65 yr M, Closed Gr. I, Fix Off 8 Months



Proximal Tibial C3 Fracture : 52 yr M, Closed, Fix Off 5 Months



Proximal Tibial C3 Fracture : 50 yr M, Closed, Fix Off 6 Months



Proximal Tibial C3 Fracture : 38 yr M, Closed, Fresh, Fix Off 5 Months





- Ability to recognise & repair meniscal / ligament injuries / articular surface restoration not as accurate as open reduction and plate fixation.
- But Marsh JL et. al. mentioned that it is unlikely that a more intensive approach would improve outcome.
- Watson JT et. al. warned that in face of tremendous soft tissue disruption, repairs would be ill advised.

Discussion

The proximal tibial fracture is one of the commonest injuries in road accidents and pose management problems due to tremendous soft tissue disruption, displacement of articular fragments and comminution of fracture fragments.

Closed reduction and immobilisation is ineffective and maintaining the reduction and joint congruency is difficult.

Open reduction and plate and screw fixation is suitable in split and split depression fractures, it has advantage of direct visualisation of articular surface but is not indicated in high energy trauma leading to comminution and wounds.

So external fixation with or without internal fixation is preferable as seen by the results using Augmented Wager's External Fixator.

Reference :

1. Apley AG: Fractures of the lateral tibial condyle treated by skeletal traction and early mobilization. A review of sixty cases with special reference to the long-term results. JBJS, 38-B(3): 699-708, 1956.
2. Benirschke SK, Agnew SG, Mayo KA, et al: Immediate internal fixation of open complex tibial plateau fractures. Treatment by a standard protocol. J Orthop Trauma 6: 78-86, 1992.
3. Burri C, Bartzke G, Coldewey J and Muggler E: Fractures of the tibial plateau. CORR 138: 84-93, 1979.
4. Bolhofner BR: Indirect reduction and composite fixation of extra articular proximal tibial fractures. CORR 315: 75-83, 1995.

5. Bastiani GDE: Treatment of fractures with dynamic axial fixator. JBJS: 538-545 1984.
6. Bach AW, Hansen ST Jr: Plates versus external fixation in severe open tibial shaft fractures: A randomized trial. CORR 241: 89-94, 1989.
7. Burny F, Rasquin C: The papineau technique to replace bone defects with Hoffmann External Fixation. The Severely Injured Limb 214, 1983.
8. Bonneville P, Fouque E, Cariven P, Bertin R, Asencio G, Mansat M : Value of external fixation in proximal tibial fractures, Revue de Chirurgie Orthopedique et Reparatrice de l Appareil Moteur 83 (7): 602 -12, 1997.
9. Bal GK, Kuo RS, Chapman JR, Bradford H, Benirschke SK, and Claudi BF: "The anterior T-frame external fixator for high-energy proximal tibial fractures" CORR 380: 234-240, 2000
10. Claudi BF, Oedekoven G: Biologische osteosynthesen. Der Chirurg 62: 367-377, 1991.
11. Drennan DB, Locher FG, Maylajn DJ: Fractures of the tibial plateau. Treatment by closed reduction and spica cast. JBJS 61-A: 989-995, 1979.
12. Duwelijs PJ, Connolly JF: Closed reduction of tibial plateau fractures: A comparison of functional and radiological results. CORR 230:116-125, 1988.
13. DeCoster TA, Nepola JV: Cast Brace treatment of proximal tibial fractures: Ten Year Follow up study. CORR 231: 196-204,1998.
14. Denham RA: Principles and use of Portsmouth External Fixator. The Severely Injured Limb. 97-100, 1983.
15. External Fixator, manual of Internal Fixation, ME Muller, M Allgower, R Schneider, H Willenegger, 2nd edition, 1979.
16. External fixation, Campbell's Operative Orthopaedics VIITH edition.
17. Evans M Kenwright J, Harris JD: External Skeletal Fixator for Tibial Fracture, JBJS, 62-B: 525, 1980.
18. Edge AJ, Denham RA: External Fixation for complicated fracture of Tibia, JBJS 63-B: 92-97, 1981.
19. Evans M, Kenwright J: The Oxford External Skeletal Fixator system. The severely injured limb. 129-143, 1983.
20. Fernandez DL: Anterior approach to the knee with osteotomy of the tibial tubercle for bicondylar tibial fractures. JBJS 70-A: 208-219, 1988.
21. Gustilo RB, Anderson JT: Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones. Retrospective and prospective analyses JBJS 58A: 453 - 458, 1976.
22. Giordano CP, Koval KJ : Treatment of fracture blister : a perspective study of 53 cases.
23. Gustilo RB, Mendoza RM, Williams DN: Problems in the management of type III (Severe) Open Fractures. A new classification of type III open fractures. J Trauma 24: 742 - 746, 1984.

24. Gausewitz S, and Hohl M: The significance of early motion in the treatment of tibial fractures. *CORR* 202: 135-138, 1986.
25. Jensen DB, Rude C, Duus B and Bjerg-Nielsen A: Tibial plateau fractures. A comparison of conservative and surgical treatment. *JBJS* 72-B (1): 49-52, 1990.
26. Jones H F, Stovall S L: External Fixator in Fracture, *JBJS* 32-A: 466-467, 1950.
27. Karlstrom G, and Olerud S: Stable External Fixation of open Tibial Fracture, a report of 5 year of experience with Vidal – Adrey Double Frame Method, *Ortho Reve* 6:25, Aug 1977.
28. Karlstrom G, Olerud S: Percutaneous Pin Fixation of open Tibial Fracture, *JBJS* 57-A: 115-124, 1975.
29. Koval KJ, Sanders R, Borrelli J, Helfet D, DiPasquale T, Mast JW: Indirect reduction and percutaneous screw fixation of displaced tibial fractures. *J Orthop Trauma* 6: 340-346, 1992.
30. Lang GJ, Cohen BE, Bosse MJ, Kellam JF. Proximal Third tibial shaft fractures. Should they be nailed? *CORR* (315): 64-74, 1995.
31. Lansinger O, Bergman B, Korner L: Tibial condylar fractures. A twenty-year follow-up. *JBJS* 68-A: 13-9, 1986.
32. Lundy DW, Albert MJ, Hutton WC: Biomechanical comparison of hybrid external fixators. *Journal of Orthopaedic Trauma*. 12(7): 496-503, 1998.
33. Marsh JL, Smith ST: External fixation and limited internal fixation for complex tibial fractures of the tibial plateau. *JBJS* 77-A: 661-73, 1995 .
34. Murphy CP, D'Ambrosia R, Dabezies EJ: The small pin circular fixator for proximal tibial fractures with soft tissue compromise. *Orthopaedics* (Thorofare, NJ). 14(3): 273-80, 1991.
35. Mikulak SA, Gold SM, Zinar DM: small wire external fixation of high energy tibial plateau fractures. *CORR* 356: 230-238, 1998.
36. Moore TM, Patzakis MJ, Harvey JP: Tibial plateau fractures: Definitions, demographics, treatment rationale, and long-term results of closed traction management or operative reduction. *J Trauma* 1: 97-119, 1987.
37. Mallik AR, Covalt DJ, Whitelaw GP: Internal versus external fixation of bicondylar tibial plateau fractures. *Orthop Rev* 21: 1433-1436, 1992.
38. Merchant TC, and Dietz FR.: Long term follow-up after fractures of the tibial and fibular shafts. *JBJS* 71-A: 599-606, 1989.
39. Orthopaedic trauma Association Committees for Coding and Classification: Fractures and Dislocations compendium. *J Orthop Trauma* 10 (Suppl 1): 1-154, 1996
40. Principles of Fracture and Dislocations, Rockwood and Green's Fractures in Adults, Charles A. Rockwood, Jr. David P. Green, Robert W. Bucholz, 3rd edition, Vol. 1.
41. Reid JS, Vanslyke M, Moulton MJR, et al: Safe placement of proximal tibial trans fixation wires with respect to intra capsular penetration. In *Orthopedic Transactions*. Presented at the 10th annual meeting of the Orthopedic Trauma Association. Tampa, 1995.
42. Russell RCG: Recent Advances in Surgery, No 12, Churchill- Livingstone, 205-207, 1986.
43. Ries MD and Meinhard BP: Medial external fixation with lateral plate internal fixation in metaphyseal tibial fractures. A report of 8 cases associated with severe soft tissue injury. *CORR* 256: 215 – 223, 1990.
44. Schatzker J: Fractures of the Tibial Plateau. In Schatzker J, Tile m (eds). *Rationale of Operative Fracture Care*. Berlin, Springer-Verlag 279-295, 1988.
45. Stamer DT, Schenk R, Staggers B, et al: Bicondylar tibial plateau fractures treated with a hybrid ring external fixator: A preliminary study, *J Orthop Trauma* 8: 455-461, 1994
46. Tytherleigh Strong GM, Keating JF, Court Brown CM: Extraarticular fractures of the proximal tibial diaphysis; their epidemiology, management and outcome. *Journal of the Royal College Of Surgeons of Edinburgh*. 42(5); 334-8, 1997, Oct.
47. Watson JT, Coufal C: Treatment of complex lateral tibial plateau fractures using Ilizarov techniques. *CORR* 353: 97-106, 1998.
48. Weiner LS, Kelley M, yang E, et al: The use of combination internal fixation and hybrid external fixation in severe proximal tibia fractures. *J Orthop Trauma* 9: 244-250, 1995.
49. Watson JT: High energy fractures of the Tibia. *Orthop Clin North Am* 25: 723-752, 1994.
50. Williams EA, Rand JA, An KN, Chao EYS, Kelly, PJ: The Early Healing of Tibial Osteotomies Stabilized By One-Plane or Two-Plane External Fixation. *VOL. 69-A, NO. 3, 355-365* Copyright 1987 by JBJS, Incorporated, March 1987.
51. Wagner Heinz: Orthopedic Lengthening of the Femur. *CORR* No. 136, Oct 1978.
52. Yang EC, Weiner L, Strauss E: Metaphyseal dislocation fractures of the proximal tibia. An analysis of treatment and complication. *American Journal of Orthopaedics* (Chatham, NJ). 24(9): 695-704, 1995 Sep.
53. Young MJ, Barrack RL: Complications of internal fixation of tibial plateau fractures. *Orthop Rev* 23:149-154, 1994
54. Zecher SB, Danziger MB et al: Treatment of high-energy proximal tibial fractures using Monticelli-Spinelli fixator. *American Journal of Orthopaedics* (Chathan, NJ). 25(1): 49-54, 1996 Jan.

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