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RESEARCH ARTICLE
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COMBINED NAIL AND PLATE FIXATION FOR PROXIMAL TIBIA AND TIBIAL PLATEAU FRACTURES

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ABSTRACT:
Proximal tibia and tibial plateau fractures with meta-diaphyseal comminution commonly have a compromised soft tissue envelope. Combined plate-nail fixation is an emerging technique that utilizes a limited anterolateral approach for plate application. This technique alleviates the need for a separate medial approach to the proximal tibia. We report a series of patients treated with this approach.
METHODS:
we performed prospective cohort study of 3 consecutive patients treated with combination of lateral locked plating and intramedullary nailing at a single academic institution from 2024 to 2025. Two patients had SCHATZKER IV and one had VI type fractures.
RESULTS: Primary outcomes included good alignment of fractures in both sagittal and coronal plane and maintenance of articular congruity, without postoperative infection. There was no radiographic evidence of articular subsidence at latest follow up for any patient**.**
CONCLUSION: The results of our case series, early weight-bearing after nail-plate fixation may be a safe and viable alternative for patients who sustain complex proximal tibia and shaft-plateau combination injuries.

KEYWORDS: Kirschner wire (K-wire), Computed tomography (CT), Intramedullary nailing(IMN).

Introduction:

The incidence of proximal tibia fractures, including those of the tibial plateau, is 13.3 per 100,000 people per year, accounting for 5% to 11% of all tibia fractures[1,2]. These are high velocity injuries causing significant impairment in mobility and function and can have high rates of malunion and malallignment[2,3]. Given the complexity of these injuries, both intramedullary nailing (IMN) and plating are routinely used for internal fixation, depending on injury characteristics and surgeon preference[3]. A nail-plate double construct, which increases the amount of implant fixation, is a novel treatment option for these fractures. There is increased interest but a paucity of literature surrounding the use of nail-plate combinations in this fracture type[4–7]. When treated operatively, patients with proximal tibia fractures are typically prescribed a prolonged period of restricted weight-bearing of up to 8 to 12weeks, as recommended by the Arbeitsgemeinschaft für Osteosynthesefragen guidelines[8].

Surgeons tend to restrict weight-bearing in patients with these injuries to prevent fracture collapse and further articular damage. However, 72.1% of surgeons report recommending weight-bearing earlier than 12weeks and 11.7% recommend immediate weight-bearing after operative fixation[9]. Earlier weight-bearing leads to increased periosteal bone production, energy absorption, and blood flow compared with restricted weight-bearing[10,11]. Patients themselves, particularly the elderly, may experience difficulty restricting weight-bearing for extended periods of time[12]. Additionally, quality of life is quantifiably improved in patients who experience early weight bearing compared with those who remain restricted[13,14]. For these reasons, early weight-bearing has gained popularity in the treatment course of several lower extremity injuries including hip fracture fixation, femoral and tibial IMN, and ankle fracture fixation[15,16]. The technique of using nail-plate combinations in the proximal tibia was first described by Dunbar et al as an adjunct for successful reduction prior to IMN, but has since been demonstrated as a successful definitive treatment modality[17,18,19]. The advantages of this technique include protection of fixation and a more even distribution of energy through the bone and implants. By combining an IMN and a plate, forces may be more smoothly transitioned to accommodate early weight-bearing[20]. In this case series, we provide a technical guide to creating nail plate combination constructs and describe the treatment course of 3 patients with proximal tibia fractures with plateau components that were treated with these constructs and early weight-bearing. Use of these principles in tandem can return these patients to high functioning without adverse effects.

Aims and objectives

To assess the outcome of proximal tibia and tibial plateau fractures with combined nail and plate fixation.

Indications:

- Metaphyseal comminution that would demand dual plate fixation
- Articular injury that can be reduced and stabilized during nail placement
- Proximal tibial segment that will accommodate two tibial nail interlocking bolts

Contraindications:

- Displaced posteromedial plateau fractures which require buttress fixation
- Proximal bicondylar patterns with little metaphyseal extension
- Fractures with condylar widening better treated with dual plates
- Simple metaphyseal pattern better treated with anatomic reduction

Technique:

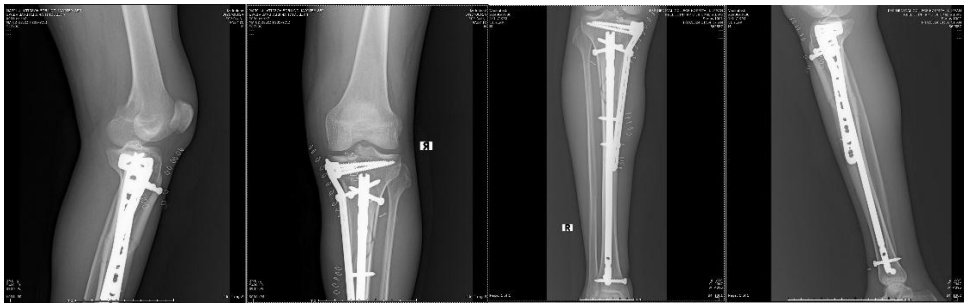
- The order of fixation is case-dependent, but in general, if the plateau or proximal fracture does not enter the nail trajectory on computed tomography scan, the nail is placed first using standard semi-extended technique (author preference: suprapatellar, but parapatellar also possible). This allows the distal portion of the tibia to move as a unit, allowing leverage for the femoral distractor if necessary. If the fracture enters the planned nail trajectory, the articular surface is stabilized first.
- The plateau or proximal tibia component is approached in a standard manner (anterolateral, medial, or both). The anterior compartment musculature is elevated and a sub-meniscal arthrotomy is performed in the anterolateral approach. The articular surface is elevated using a standard combination of wires, osteotomes, bone tamps, and/or bone graft. The surgeon's proximal tibia plate of choice is positioned and provisionally secured with K wires proximally, and, a uni-cortical screw can be used to achieve the same goal. A periarticular clamp can be used to decrease condylar width. Care must be taken to plan screw trajectory away from the nail path, and aim to support the articular surface fragments. Additional rafting screws or mini-plates separate from the primary plate can also be used for this purpose if screw trajectory is suboptimal. Screws can also be made short initially and replaced with bi-cortical or longer screws once the nail is in position.

- The nail component is placed according to surgeon preference, but should be placed as proximally as possible, to maximize proximal tibia surface fixation with the nail locking bolts. Nails with multiple proximal screw options are preferable for this purpose, as screws can be directed into different parts of the plateau, further supporting proximal fragments. Certain nails provide the opportunity for lateral nail/plate linkage.
- In our series, 3 patients were treated with nail plate combinations and early weight bearing for tibial shaft and plateau injuries. The average age was 30 years and all are male patients. All sustained high velocity injuries. The cases were classified according to schatzker classification. All 3 patients were treated initially with combined nail and plate fixation. Average hospital stay is 7-10days.
- 2of 3 patients were prescribed immediate weight-bearing postoperatively, and 1 was prescribed partial weight-bearing of 30 lbs. No patients experienced treatment complications during hospitalization or during their treatment course.

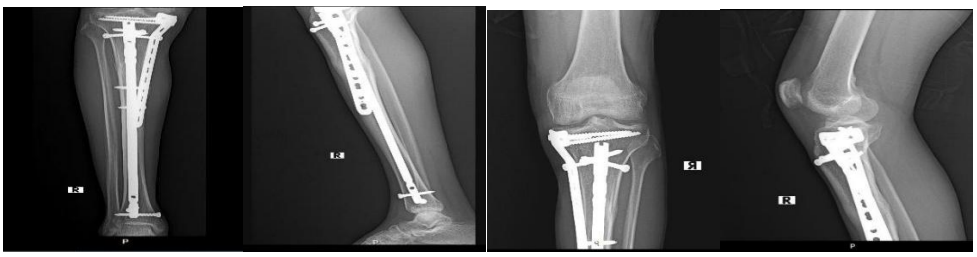
Patient	Age	sex	Mechanism	Additional injuries	Gustillo-Anderson grading	schatzker	fixation	Treatment complications
1	33yrs	M	High velocity injury	Lateral condyle of femur#, patella #, fibular head fracture	-	IV	INTERNAL	-
2	30yrs	M	High velocity injury	Segmental fibula fracture	II	IV	INTERNAL	-
3	33yrs	M	Skid and fall	Lateral condyle of femur#, fibular head fracture	-	VI	INTERNAL	-

CASE 1 PRE OP XRAYS AND CT

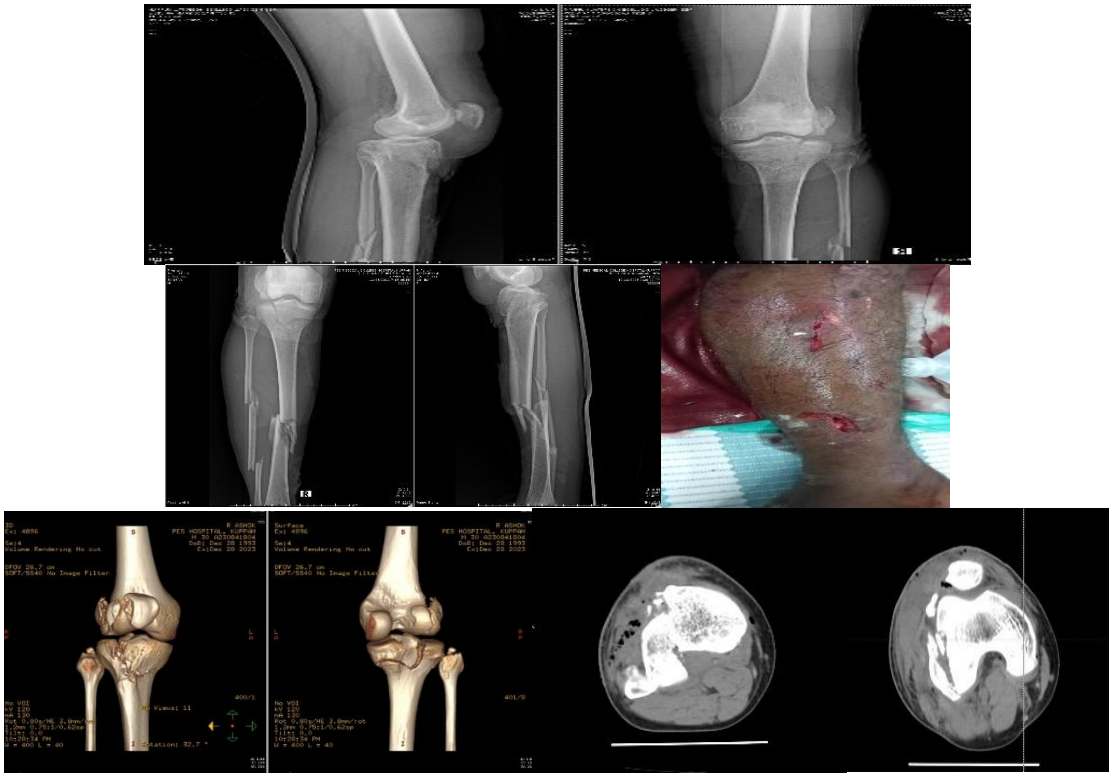
IMMEDIAPOST OP XRAYS



6 MONTHS FOLLOW UP XRAYS

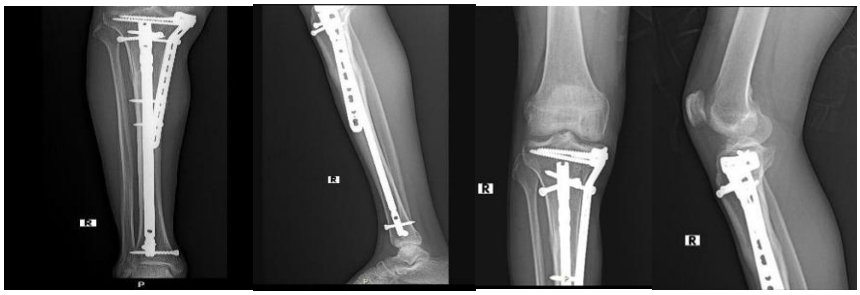


CASE 2
PRE OP XRAYS, CT AND CLINICAL PICTURE OF THE WOUND



IMMEDIATE POST OP XRAYS

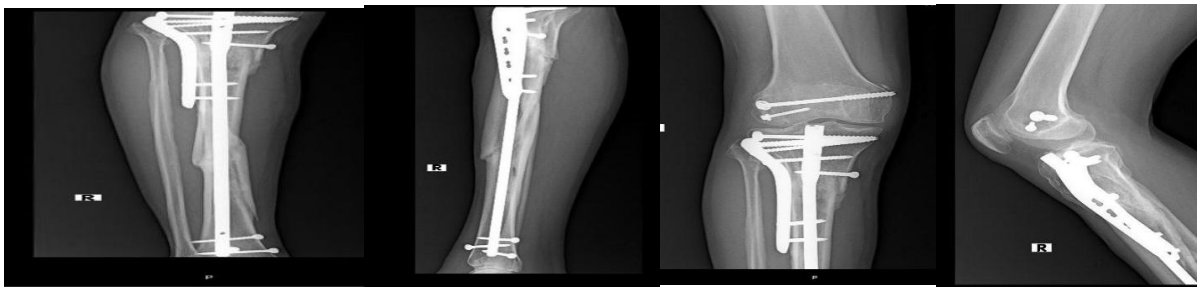
6 MONTHS FOLLOW UP XRAYS



CASE 3
PRE OP XRAYS AND CT

IMMEDIATE POST OP XRAYS

6 MONTHS FOLLOW UP XRAYS



DISCUSSION :

- Nail-plate constructs have gained favour in the treatment of other technically difficult fracture patterns, such as the distal femur. These nail-plate combinations allow for early weightbearing, especially in the elderly, for whom these injuries can be particularly debilitating. Biomechanically, these constructs demonstrate greater resistance to axial and torsional forces than either nail or plate fixation alone. Use of a load-distributing device such as an intramedullary nail holds the reduction of the fracture, while a plate may control further motion at the articular surface, providing greater stability. In the same way, proximal tibia and tibial shaft fractures may benefit from the combination of these principles.
- Use of the nail-plate construct for proximal tibia fractures employs a similar concept as that in the distal femur, support of the articular surface and the shaft using stable fixation for both the articular and axial components. Nail-plate proximal tibia fixation has been previously reported, but not in the context of early weight-bearing. Yoon et al[17] presented an overall union rate of 93% in patients with proximal third tibia fractures that underwent nail-plate fixation and immediate weight-bearing, albeit only in those with extra-articular fractures. They posited that using a combined fixation method may circumvent the higher rates of malalignment seen in tibial nail fixation compared with plating, and reported no malalignment in their cases. In a recent study, Cinats et al[19] reported plate-assisted reduction of proximal tibia fractures as a viable option, particularly in complex and open fractures. However, the analyses of the differences between patients with retained plating and those who had the assistive plate removed (n=13 and 11, respectively) were underpowered, and no commentary was made regarding the postoperative weight-bearing status[19]. Several studies have examined the immediate weight-bearing concept in proximal tibia injuries with similar results. Kalmet et al described no differences in complications with an earlier return to full weight-bearing in patients prescribed permissive weight-bearing after operative fixation of tibial plateau fractures. Haak et al similarly reported no differences between immediate weight-bearing and 6 to 8weeks of non-weight bearing in proximal articular tibia fractures including radiographic metrics, complications, and subjective reports. Immediate weight-bearing, as it gains further favour, can allow patients to have earlier range of motion and return to activities of daily living. Expanding on these studies and the results of our case series, early weight-bearing after nail-plate fixation may be a safe and viable alternative for patients who sustain complex proximal tibia and shaft-plateau combination injuries.

REFERENCES

1. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. Injury 2006; 37:691–697.
2. Lang GJ, Cohen BE, Bosse MJ, et al. Proximal third tibial shaft fractures. Should they be nailed? Clin Orthop Relat Res 1995; 64–74.
3. Tejwani N, Polonet D, Wolinsky PR. Controversies in the intramedullary nailing of proximal and distal tibia fractures. J Am Acad Orthop Surg 2014; 22:665–673.
4. Buehler KC, Green J, Woll TS, et al. A technique for intramedullary nailing of proximal third tibia fractures. J Orthop Trauma 1997; 11:218–223.
5. Nork SE, Barei DP, Schildhauer TA, et al. Intramedullary nailing of proximal quarter tibial fractures. J Orthop Trauma 2006; 20:523–528.
6. Ricci WM, O'Boyle M, Borrelli J, et al. Fractures of the proximal third of the tibial shaft treated with intramedullary nails and blocking screws. J Orthop Trauma 2008; 22:S39–S45.
7. Meena RC, Meena UK, Gupta GL, et al. Intramedullary nailing versus proximal plating in the management of closed extra-articular proximal tibial fracture: a randomized controlled trial. J Orthop Traumatol 2015; 16:203–208.
8. Arnold JB, Tu CG, Phan TM, et al. Characteristics of postoperative weight bearing and management protocols for tibial plateau fractures: findings from a scoping review. Injury 2017; 48:2634–2642.
9. van der Vusse M, Kalmet PHS, Bastiaenen CHG, et al. Is the AO guideline for postoperative treatment of tibial plateau fractures still decisive? A survey among orthopaedic surgeons and trauma surgeons in the Netherlands. Arch Orthop Trauma Surg 2017; 137:10711–10775.
10. O'Sullivan ME, Bronk JT, Chao EY, et al. Experimental study of the effect of weight bearing on fracture healing in the canine tibia. Clin Orthop Relat Res 1994; 273–283.
11. Aro HT, Chao EY. Bone-healing patterns affected by loading, fracture fragment stability, fracture type, and fracture site compression. Clin Orthop Relat Res 1993; 8–17.
12. Hurkmans HL, Bussmann JB, Selles RW, et al. The difference between actual and prescribed weight bearing of total hip patients with a trochanteric osteotomy: long-term vertical force measurements inside and outside the hospital. Arch Phys Med Rehabil 2007; 88:200–206.
13. Lorente A, Palacios P, Lorente R, et al. Orthopedic treatment and early weight-bearing for bimalleolar ankle fractures in elderly patients: quality of life and complications. Injury 2020; 51:548–553.
14. Segal D, Mallik AR, Wetzler MJ, et al. Early weight bearing of lateral tibial plateau fractures. Clin Orthop Relat Res 1993; 232–237.
15. Koval KJ, Friend KD, Aharonoff GB, et al. Weight bearing after hip fracture: a prospective series of 596 geriatric hip fracture patients. J Orthop Trauma 1996; 10:526–530.
16. Dehghan N, McKee MD, Jenkinson RJ, et al. Early weightbearing and range of motion versus non-weightbearing and immobilization after open reduction and internal fixation of unstable ankle fractures: a randomized controlled trial. J Orthop Trauma 2016; 30:345–352.
17. Yoon RS, Bible J, Marcus MS, et al. Outcomes following combined intramedullary nail and plate fixation for complex tibia fractures: a multi-centre study. Injury 2015; 46:1097–1101.
18. Dunbar RP, Nork SE, Barei DP, et al. Provisional plating of Type III open tibia fractures prior to intramedullary nailing. J Orthop Trauma 2005; 19:415–417.
19. Cinats DJ, Perey B, Moola F, et al. Plate-assisted intramedullary nailing of proximal third tibia fractures. J Orthop Trauma 2020; 34:321–326.
20. Liporace FA, Yoon RS. Nail plate combination technique for native and periprosthetic distal femur fractures.J Orthop Trauma 2019; 33:64–68.