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Cable-Assisted Reduction for an Extra-Articular Proximal Tibial Fracture (AO/OTA 41-A2) Treated with Suprapatellar Intramedullary Nailing: A Case Report

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Abstract

Introduction: *Extra-articular proximal tibial fractures, particularly AO/OTA 41-A2 patterns, are associated with a high risk of malalignment when treated with intramedullary nailing. Deforming forces acting on the short proximal fragment, most notably from the quadriceps mechanism, frequently result in sagittal plane malalignment with procurvatum. Although suprapatellar intramedullary nailing and adjunctive reduction techniques such as Poller screws have improved outcomes, maintaining reduction in selected cases remains challenging. The role of circumferential cerclage cables as a reduction-maintaining adjunct in this setting is not well described in the literature.*

Case Report: *We present the case of a 29-year-old male who sustained an isolated AO/OTA 41-A2 extra-articular proximal tibial fracture following a motor vehicle accident. Definitive fixation was performed using a suprapatellar intramedullary tibial nail. Intra-operatively, the proximal fragment repeatedly displaced into extension during guidewire passage and reaming despite appropriate entry point selection and standard reduction manoeuvres. To address persistent sagittal plane instability, a circumferential cerclage cable was applied around the proximal tibial metaphysis and tensioned under fluoroscopic guidance. This successfully neutralized deforming forces and maintained reduction throughout nail insertion. Final imaging confirmed satisfactory alignment in both sagittal and coronal planes.*

Conclusion: *Circumferential cerclage cable application may serve as a useful adjunct for maintaining reduction during suprapatellar intramedullary nailing of selected AO/OTA 41-A2 proximal tibial fractures with persistent proximal fragment extension. When applied judiciously, this technique may help prevent malalignment.*

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List of Abbreviations

AO/OTA: Fracture Classification System

Introduction

Extra-articular fractures of the proximal tibia present a well-recognized challenge in orthopaedic trauma surgery. Compared with diaphyseal tibial fractures, proximal third injuries are associated with higher rates of malalignment when treated with intramedullary nailing, particularly in the sagittal and coronal planes [1-3]. This is attributed to the wide metaphyseal canal, short proximal fragment, and strong deforming forces acting across the knee joint.

The quadriceps mechanism acting through the patellar tendon exerts an anterior force on the proximal fragment, frequently resulting in procurvatum. This deformity is especially problematic in AO/OTA 41-A2 fractures, where the presence of a metaphyseal wedge further compromises stability. Several authors have demonstrated that malalignment rates in proximal tibial fractures treated with intramedullary nails exceed those seen in mid-shaft fractures, even with modern implants and techniques [2,4,5].

To mitigate these challenges, multiple strategies have been described, including optimization of the nail entry point, semi-extended or suprapatellar positioning, blocking (Poller) screws, percutaneous clamps, femoral distractors, provisional plating, and temporary external fixation [6-9]. Among these, the suprapatellar approach has gained increasing acceptance for proximal tibial fractures, as it allows improved control of the proximal fragment, facilitates reduction in a semi-extended position, and improves fluoroscopic visualization during nail insertion [10-12].

Cerclage wires and cables have historically been used with caution in tibial fractures, particularly in the proximal segment, due to concerns regarding periosteal stripping, soft-tissue compromise, and potential neurovascular injury [13]. Consequently, cerclage has not been routinely recommended for AO/OTA 41-A fractures, and reports describing its use in this setting remain scarce.

More recent anatomical, biomechanical, and clinical studies, however, suggest that minimally invasive tibial cerclage techniques can be applied safely and may enhance construct stability when used judiciously as an adjunct to intramedullary nailing [14-18]. These advances warrant reconsideration of cerclage as a selective reduction-maintaining tool in difficult proximal tibial fractures.

Case Report

A 29-year-old male with no known medical comorbidities presented to the emergency department following a motor vehicle accident. He sustained an isolated injury to the right lower limb. There were no associated head, chest, abdominal, or other musculoskeletal injuries.

On examination, the right leg was swollen and tender over the proximal tibia. There were no open wounds, and the skin envelope was intact. Distal pulses were palpable, capillary refill was normal, and neurological examination revealed no deficits.

Plain radiographs demonstrated an extra-articular proximal third tibial fracture with a metaphyseal wedge component, classified as AO/OTA 41-A2. [Figure 1] The tibial plateau articular surface was intact, and no associated fibular fracture was present. Initial immobilization was applied, and the patient was scheduled for definitive fixation with intramedullary nailing.

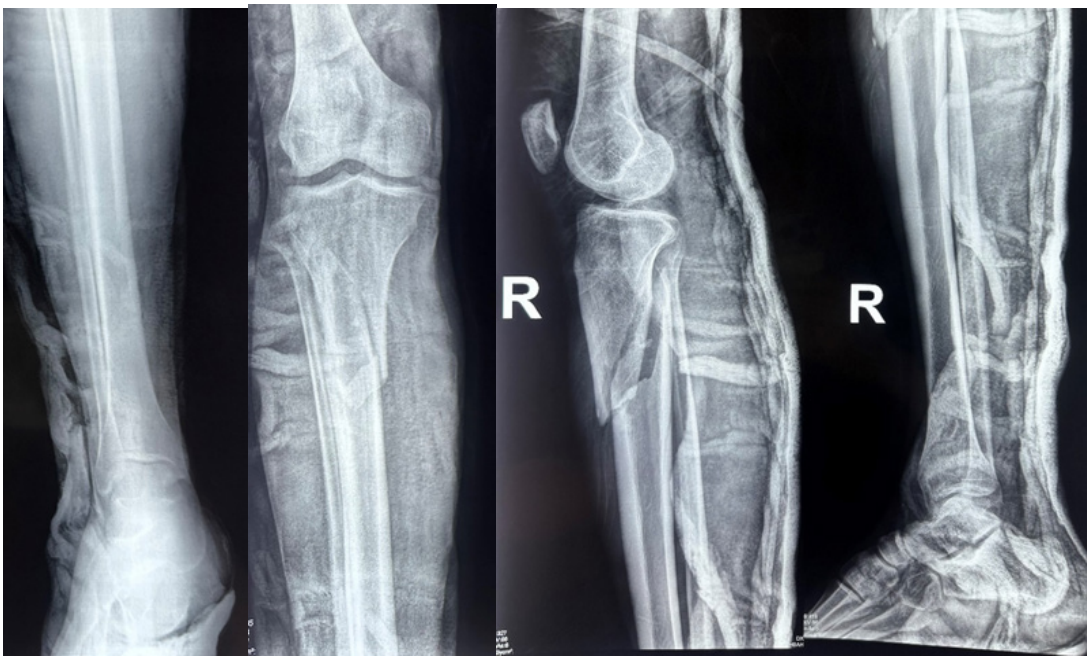

Figure 1: Pre-Operative Anteroposterior and Lateral Radiographs of the Right Tibia Demonstrating an Extra-Articular Proximal Metaphyseal Fracture (AO/OTA 41-A2).

Surgical Technique

The procedure was performed under spinal anaesthesia. The patient was positioned supine on a radiolucent table. A suprapatellar approach was selected to optimize fracture control and alignment, with the knee maintained in a semi-extended position.

Despite appropriate entry point selection and standard reduction manoeuvres, the proximal fragment repeatedly displaced into extension during guidewire advancement and reaming, resulting in unacceptable sagittal plane malalignment.

Given the failure of conventional closed reduction techniques, a circumferential cerclage cable was passed around the proximal tibial metaphysis through a small incision. The cable was tensioned under fluoroscopic guidance, successfully neutralizing the deforming forces and maintaining reduction.

A suprapatellar intramedullary tibial nail was then inserted and statically locked proximally and distally. Final fluoroscopic imaging confirmed satisfactory alignment, length, and rotation. The cerclage cable was retained in situ as a definitive adjunct. [Figure 2]

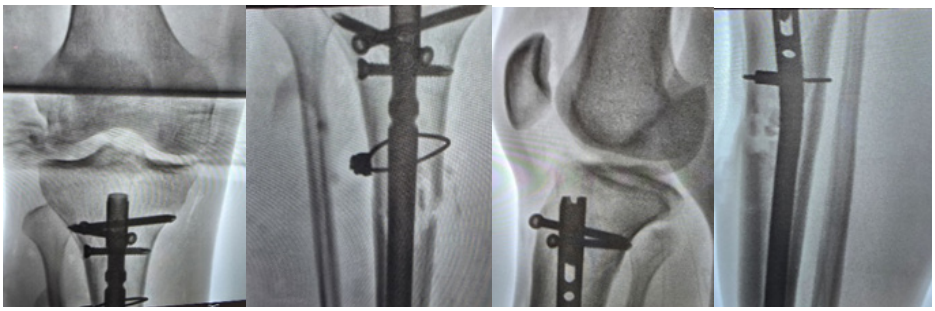

Figure 2: Intra-Operative Fluoroscopic Images Demonstrating Circumferential Cerclage Cable Application to Maintain Reduction of the Proximal Tibial Metaphyseal Fragment during Suprapatellar Intramedullary Nailing.

The post-operative period was uncomplicated. The patient commenced early knee range-of-motion exercises and partial weight-bearing mobilisation with crutches. Serial radiographs demonstrated maintained alignment. [Figure 3] At the three-month post-operative follow up the patient achieved full, painless range of motion of the knee and ankle and returned to normal activities without functional limitation.

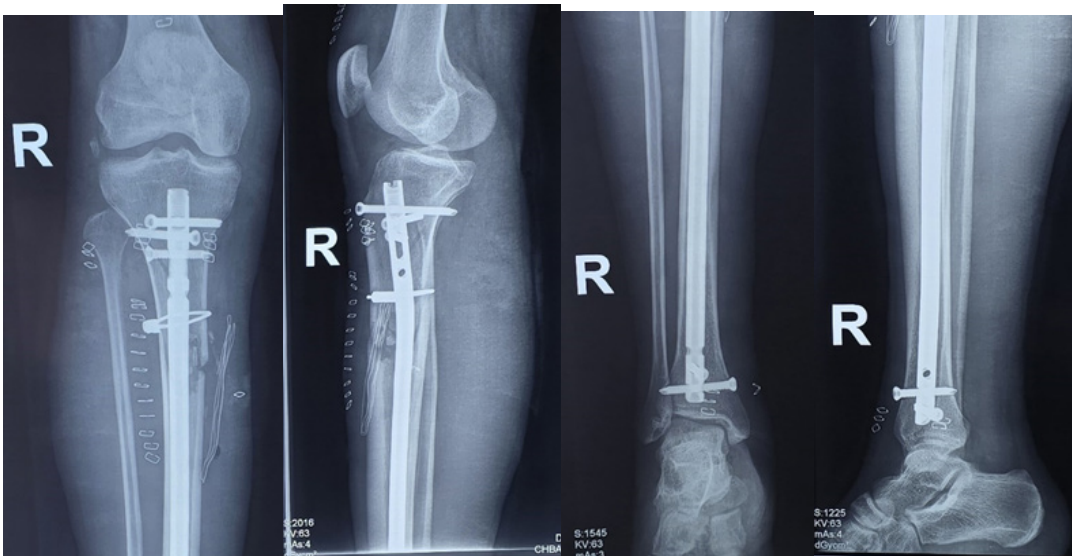

Figure 3: Post-Operative Anteroposterior and Lateral Radiographs Demonstrating Good Reduction and Maintained Coronal and Sagittal Alignment Following Suprapatellar Intramedullary Nailing with the Cerclage Cable Retained in situ.

Discussion

Intramedullary nailing of proximal tibial fractures remains technically demanding despite advances in implant design and surgical technique. AO/OTA 41-A2 fractures are particularly susceptible to malalignment due to metaphyseal geometry and deforming muscular forces, with procurvatum being the most common deformity encountered [1-5].

The suprapatellar approach has been shown to improve fracture alignment and reduce malalignment rates in proximal tibial fractures when compared with infrapatellar techniques [10-12]. However, even with suprapatellar nailing, deforming forces may overwhelm standard reduction manoeuvres.

Blocking (Poller) screws remain the most widely reported adjunct for controlling alignment in proximal tibial nailing and have demonstrated efficacy in reducing malalignment [6-9]. Nevertheless, Poller screws may not adequately address sagittal plane deformity in all cases, particularly when proximal fragment extension is the dominant problem.

Circumferential cerclage cable use in proximal tibial fractures is infrequently reported, largely due to historical concerns regarding soft-tissue injury and fracture biology [13]. Modern minimally invasive cerclage techniques, supported by anatomical studies, suggest that cerclage can be applied safely when meticulous technique is used [14-16]. Biomechanical evidence further indicates that cerclage, when combined with intramedullary nailing, can enhance construct stability without impairing fracture healing [17,18].

In the present case, the cerclage cable provided continuous circumferential control of the proximal metaphyseal fragment, maintaining reduction throughout nail insertion and avoiding the need for open reduction or provisional plating. The favourable clinical and radiographic outcome supports selective use of this technique in carefully chosen AO/OTA 41-A2 fractures when conventional reduction strategies fail.

Conclusion

Although not routinely described for AO/OTA 41-A2 proximal tibial fractures, circumferential cerclage cable application may serve as an effective reduction-maintaining adjunct during suprapatellar intramedullary nailing in selected cases with persistent sagittal plane instability.

Clinical Message

In AO/OTA 41-A2 proximal tibial fractures with difficult control of proximal fragment extension, cerclage cable application can be a valuable adjunct to maintain reduction during intramedullary nailing when standard techniques are insufficient.

Learning Point of the Article

Circumferential cerclage cable fixation can be a practical, reduction-maintaining adjunct during suprapatellar intramedullary nailing of selected AO/OTA 41-A2 proximal tibial fractures, when the short proximal fragment persistently displaces into extension despite optimal entry point and standard closed reduction techniques, helping prevent procurvatum malalignment.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Competing Interests

The author declares no competing interests.

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