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Original Article

Tibioplasty, a new technique in the management of tibial plateau fracture: A multicentric experience review

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ABSTRACT

Introduction: The traditional methods in displaced tibial plateau fractures use metallic instrumentation. "Balloon-tibioplasty" is a novel minimally invasive technique.
Purpose: Use of the balloon-tibioplasty show an improvement of the reduction compared to traditional methods.
Patients and methods: We enrolled 28 patients who presented with a depression fracture of external tibial plateau divided into two treatment groups: balloon-tibioplasty (group I) and "traditional" reduction technique (group II).
Results: Balloon-tibioplasty is a minimally invasive treatment for tibial plateau fracture.
Discussion: Balloon-tibioplasty appears to have several advantages over traditional reduction techniques.
Conclusion: Balloon-tibioplasty represents an improved and accurate modality for restoration of articular congruence.

1. Introduction

Depressed external tibial plateau fractures can be difficult to treat and current reduction techniques often lead to poor results. The commonly encountered fracture patterns are split with depression and pure lateral depression fractures, the later seen predominantly in older patient with osteoporotic bone.[1] With increasing osteoporosis, low energy falls are resulting in more fractures especially in the weak metaphyseal location of long bones. Tibial plateau fractures constitute 1% of all fractures and 8% of fractures in the elderly.[2] The mechanism usually involves a varus or valgus load with an axial force. Soft tissue injury is very common especially in high energy open fractures. Surgical treatment is usually halted until soft tissue swelling subsides and local skin conditions improve. Surgical incisions made through injured and damaged soft tissues about the knee have high complication rates. Non-operative treatment is indicated for non-displaced or minimally displaced fractures in patients with osteoporosis. This requires partial weight bearing in either a cast or hinged fracture brace. Operative indications include depressed fragments greater than 10 mm or instability $>10^{\circ}$ in a fully extended knee.[2] Open fractures with an associated compartment syndrome is another indication for surgery. The treatment of choice for this type of fractures is considered to be open reduction and internal fixation.[3] Restoration of the joint surface and tibial alignment is the goals of surgery. This is usually accomplished with buttress plating with subchondral rafting screws. Many authors suggest to avoid the use of cannulated screws without plate especially in comminuted fractures with important articular defect.[4] Depressed articular fragments can be elevated using a metal tamp and filling the defect with bone graft filler. Other authors have also incorporated knee arthroscopy to aid in the reduction of the articular fragment. Surgery of tibial plateau fractures is not without complications in patients who are older with multiple co-morbidities. This may result in worsening the defect and even articular penetration as the surface of the impact is small and the force applied is uneven. Borrowing from the successful vertebral kyphoplasty technique, we used an inflatable balloon as a tamp, to reduce a depressed tibial plateau fracture. This gave us the advantage of reducing the bone window to a drill hole while simultaneously increasing the

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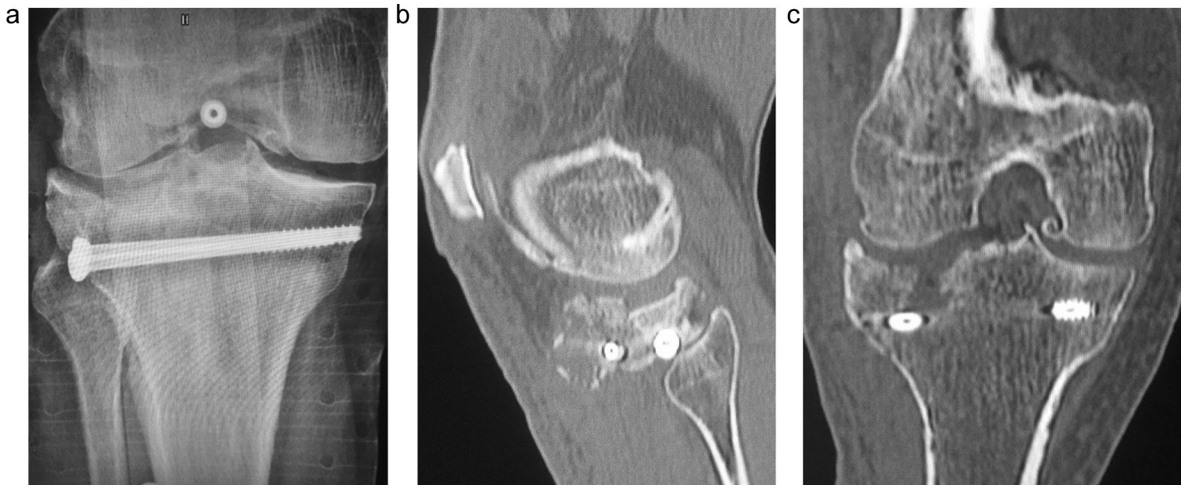

Fig. 1. Anteroposterior postoperative radiograph showing depressed external tibial plateau fixed by two cannulated screws (a). Postoperative CT scans on sagittal (b) and coronal (c) views showing lateral split with important articular defect.

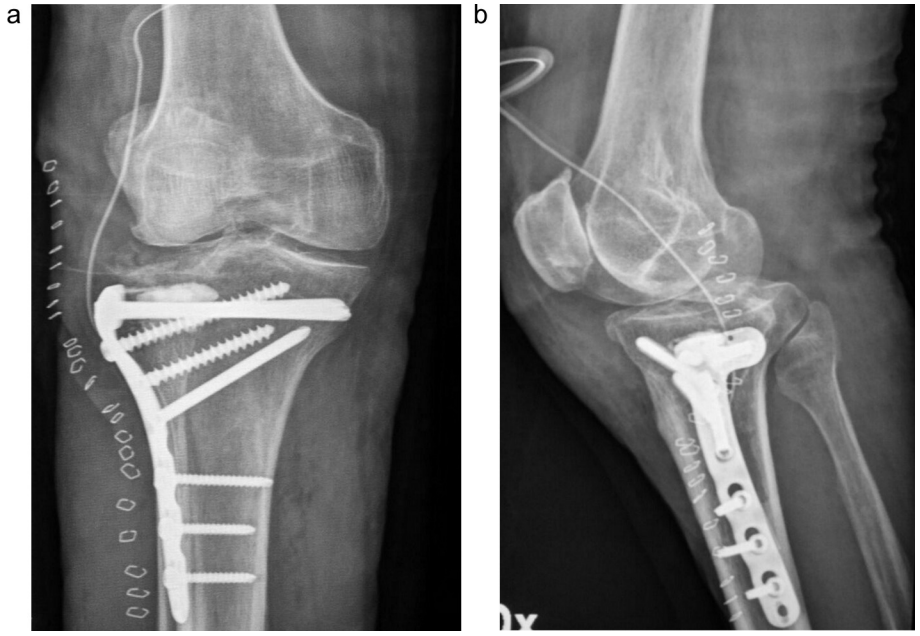

Fig. 2. Anteroposterior (a) and lateral (b) postoperative radiographs after fracture reduction by balloon-guided inflation tibioplasty and plating.

area of force transmission, resulting in easy and satisfactory fracture reduction and minimal trauma, minimizing wound complications to the tenuous skin around the knee.

2. Methods

We reported clinical and radiological results of randomized multicentric trial performed 3 year ago at Orthopedic Department of Sassari, Orthopedic Department of Schio and Orthopedic Department of Oristano. Between June 2011 and January 2013, 28 patients (21 males and 7 females) with post-traumatic external tibial plateau fractures were randomized to fracture reduction using balloon tibioplasty (group I) or "traditional" surgical techniques (group II). In order to pilot this study, the investigators have decided to recruit 14 patients into each arm of the trial. The diagnosis of external tibial plateau fracture was made on AP and lateral X-rays, according to the current guidelines. CT scan was used to localize the injury and assess the topography of the fracture, classify it, and quantify it. According to the Schatzker classification, patients were classified into type II ($n = 3$) and type III ($n = 25$). Inclusion criteria were isolated, depressed or split depressed fracture of the external tibial condyle where the decision for operative fixation has been made by the on call team; patients aged 18–80 years; patients willing to give informed consent. The patient and trial statistician were blinded from the treatment method received. 14 patients (9 males and 5 females) with average age of 67.3 years (23.4–74.7 years) underwent surgical treatment using a minimally invasive technique consisting of an inflatable bone tamp for the reduction of the depression (KyphX® Inflatable Bone Tamp Kyphon, Sunnyvale, CA); 13 patients with a contained depressed fracture with no involvement of the lateral cortex underwent tibioplasty alone without any fixation device; one patient, previously underwent surgery with two cannulated screws, showed persistent comminuted fracture of the external tibial condyle (Fig. 1); in this case cannulated screws were removed and tibioplasty with lateral proximal tibial buttress plate fixation (Synthes, Paoli, Pennsylvania) was performed immediately below the compressed tibial