

Original Research Article

Tibial Plateau Fractures: Epidemiological, Clinical, Therapeutic, and Medico-Legal Aspects in the Department of Orthopaedics and Traumatology at Ignace Deen University Hospital, Conakry

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Abstract: **Introduction:** Tibial plateau fractures (TPFs) are severe articular fractures of the proximal tibia that threaten knee stability and mobility. Their increasing incidence, associated with the rise in road traffic, and their functional impact justify rigorous management and particular attention to their medico-legal implications. **Materials and Methods:** This was a 12-month prospective descriptive study conducted from March 17, 2014, to March 16, 2015, including 18 cases of TPFs treated in the Department of Orthopaedics and Traumatology at Ignace Deen University Hospital, out of 4,215 hospital admissions. Epidemiological, clinical, therapeutic, and outcome data were collected. The Duparc and Ficat classification was used, and outcomes were assessed according to the Merle d'Aubigné and Mazas functional criteria. **Results:** The frequency of TPFs was 0.42% of hospital admissions. The mean age was 35.5 years (range: 11–60 years), with a male predominance (sex ratio = 5). Road traffic accidents accounted for 66.66% of cases. Unicondylar fractures were the most frequent, accounting for 72.22% of cases. Surgical treatment was performed in 72.22% of patients. Functional outcomes were very good in 66.67% of cases and good in 27.78%. Six postoperative complications were observed, representing 33.33% of surgically treated patients. The mean length of hospital stay was one to two weeks in 72.22% of cases. **Conclusion:** TPFs are serious articular injuries for which early surgical management can achieve good functional outcomes. When these fractures occur following road traffic accidents or occupational accidents, they require a structured medico-legal approach, including a comprehensive initial medical certificate, assessment of temporary total incapacity for work (TTIW) and permanent partial impairment (PPI), and thorough documentation of complications.

Keywords: Tibial Plateau Fracture, Articular Fracture, Internal Fixation, Forensic Medicine.

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INTRODUCTION

Tibial plateau fractures (TPFs) are defined as disruptions in the continuity of the cancellous bone of the epiphyseal-metaphyseal region of the proximal tibia, with at least one fracture line extending to the articular cartilage (Trojani *et al.*, 2003). They are a classic example of articular fractures that threaten both knee mobility and stability, thereby compromising long-term functional outcomes (Anger *et al.*, 1968; Mourgues de, 1975).

Once considered rare, TPFs have been increasing steadily in parallel with the development of motorized transportation (Vendeuvre, 2013). They affect two distinct populations: older adults with osteopenia related to menopause or other comorbidities, and younger individuals exposed to high-risk sports and the increasing use of two-wheeled motor vehicles (Savy, 1994).

The morphological diversity of these fractures has led to the development of several classification systems, including the Duparc and Ficat classification (Duparc and Ficat, 1960) and the Schatzker classification

(Schatzker *et al.*, 1979), which are widely used in clinical practice in Africa. Their prognosis depends on the risk of joint stiffness and, particularly, malunion, which may progress to post-traumatic osteoarthritis, the most feared long-term complication (Moore *et al.*, 1987).

Regarding treatment, two approaches coexist in the literature. Most authors advocate anatomical restoration through surgery as an essential prerequisite for favorable functional outcomes, whereas a minority report comparable results with conservative orthopedic treatment for selected fracture types (Huten, 1990). The absence of a fluoroscopy unit in our department necessitated open reduction and internal fixation for all surgically treated fractures, representing a significant technological limitation.

From a medico-legal perspective, TPFs resulting from road traffic accidents or occupational accidents raise important issues concerning compensation and forensic assessment. Systematic documentation of temporary total incapacity for work, residual functional impairment, and any postoperative complications is essential to ensure a fair medico-legal assessment.

In Guinea, epidemiological data remain limited. In 2004, Diallo reported that tibial plateau fractures accounted for 2.75% of hospital admissions over a five-year period (Diallo, 2004). The lack of updated studies and the challenges of managing these fractures, given their diversity and complexity, motivated the present study. Its objective was to analyze the epidemiological, clinical, therapeutic, and medico-legal aspects of TPFs in the Department of Orthopaedics and Traumatology at Ignace Deen University Hospital in Conakry.

MATERIALS AND METHODS

This was a prospective descriptive study conducted over a 12-month period, from March 17, 2018, to March 16, 2020, in the Department of Orthopaedics and Traumatology at Ignace Deen University Hospital in Conakry, the country's main trauma referral center.

All patients admitted, treated, and followed up for tibial plateau fractures during the study period who provided informed consent were included in the study.

Patients who did not accept the proposed treatment (refusal of treatment, absconding, or transfer) were excluded. A total of 18 patients met the inclusion criteria.

Epidemiological variables included frequency, age group, sex, occupational and socioeconomic category, etiology, and injury mechanism. Clinical variables included functional symptoms, associated injuries (skin, meniscal, and ligamentous lesions), and morphological classification according to Duparc and

Ficat. Paraclinical variables included standard radiographs (anteroposterior, lateral, and internal and external oblique views of the knee) and preoperative laboratory investigations. Therapeutic variables included time to surgery, type of anesthesia, surgical technique used, and length of hospital stay.

Surgical Technique

All patients were positioned in the same manner: supine, with the knee flexed at 45°, a tourniquet placed around the mid-thigh, and a cushion under the ipsilateral buttock. In the absence of a fluoroscopy unit, all fracture fixations were performed using open reduction and internal fixation. The surgical approaches used were the medial Gernez approach, the lateral Gernez approach, and the Mercedes approach (for bicondylar fractures).

The fixation constructs used included cancellous screws, an L-shaped plate, a T-shaped plate, and an external fixator. All patients routinely received medical treatment consisting of broad-spectrum antibiotic prophylaxis, thromboprophylaxis, analgesics, and anti-inflammatory drugs.

Functional Assessment

Functional outcomes were assessed after a mean follow-up period of 12 months (range: 9–36 months), using the Merle d'Aubigné and Mazas criteria [10], based on four parameters: pain, walking ability, knee range of motion, and joint stability (Table I — Appendix).

Medico-Legal Aspects

For each patient whose injury resulted from a road traffic accident, an occupational accident, or a fall in the workplace, the following information was collected: circumstances of the accident, time to medical consultation, length of hospital stay, type and severity of postoperative complications, and residual functional impairment assessed according to the Merle d'Aubigné criteria. These data were analyzed for their potential use in medico-legal assessment.

Data were collected using pre-established survey forms and entered into Microsoft Excel 2010. Results were expressed as counts and percentages and presented in tables in the appendix.

The study limitations included the absence of a shared consultation registry, the inability to perform preoperative computed tomography (CT), the poor quality of some radiographs, and limited access to relevant reference articles.

RESULTS

Of the 4,915 consultations recorded, 18 cases of tibial plateau fractures (TPFs) were identified, representing a frequency of 0.36%. Among the 4,215

hospital admissions, the frequency was 0.42% (18/4,215).

The mean age was 35.5 years (range: 11–60 years). The most affected age group was 21–30 years, accounting for 38.89% of cases, followed by the 31–40-year age group (22.22%) (Table IV). There was a clear male predominance, with 15 men (83%) and 3 women (17%), giving a male-to-female ratio of 5:1. Students and

school pupils constituted the largest occupational and socioeconomic group (33.33%), followed by civil servants (22.22%). Road traffic accidents were the leading cause of injury (66.66%), followed by falls (16.67%), sports and recreational accidents (11.11%), and occupational accidents (5.56%). Direct-impact trauma was the predominant injury mechanism, accounting for 89% of cases. These results are presented in Tables I: Sociodemographic characteristics.

Tables I

Characteristic	Number	Percentage
Sex		
Male	15	83
Female	3	17
Mean age	35 ans $\pm$ 14 ans	
Etiology		
RTI	12	66,6
Fall	3	16,67
Sports and recreational accidents	2	11,11
Work related accident	1	5,56
Occupation		
Students	6	33,33
Civil servants	4	22,22
Homemakers	3	16,67
Manual workers	3	16,67
Drivers	2	11,11

The consistent clinical findings at admission were knee hemarthrosis (post-traumatic knee swelling), fracture-related pain, complete functional impairment of the affected lower limb, and axial deformity in valgus or varus, depending on the affected side. Six associated injuries were identified: three open skin injuries, two meniscal lesions (detachments of the lateral meniscus), and one medial collateral ligament injury diagnosed intraoperatively.

According to the Duparc and Ficat classification, unicondylar fractures predominated (72.22%), with type III fractures being the most common (33.33%). Bicondylar fractures accounted for 22.22% of cases, while spinotuberosity fractures represented 16.66%. Closed fractures accounted for 83.33%. Excellent outcomes were observed in 12 patients (66.67%), good outcomes in 5 patients (27.78%), and fair outcomes in 1 patient (5.56%).

Tableau II: Functional outcomes according to the Merle d'Aubigné and Mazas criteria

Outcome	Number	Percentage %
Excellent	12	66,67
Good	5	27,78
Fair	1	5,56
Poor	0	0,00
Total	18	100,00

Surgical treatment was performed in 72.22% of cases, while 27.78% were managed conservatively. The surgical fixation constructs used were T-shaped plates (33.34%), L-shaped plates (11.11%), cancellous screws (11.11%), and external fixators (11.11%). The length of hospital stay was one to two weeks in 72.22%.

Six postoperative complications were recorded, representing 33.33% of surgically treated patients: three cases of exposure of osteosynthesis hardware, two cases of superficial wound infection, and one case of skin necrosis. No deaths were reported.

Tableau II: Medico-legal summary by etiology

Etiology (n)	Estimated TTI	Risk of PPI	Required medico-legal documents
RTI(12)	2–5 month	10–25 % (Stiffness, osteoarthritis)	IMC, insurance claim, picture
Work related accident (1)	3–6 month	15–30 %	Report of work related injury, IMC
Fall (3)	1–3 month	< 10 % if uncomplicated	IMC, specific circumstances
Sports accidents (2)	1–4 month	5–15 %	IMC, report of sport related injury

DISCUSSION

The frequency of tibial plateau fractures (TPFs) in our series (0.42% of hospital admissions) was lower than that reported by Diallo T.S. in Guinea (2.75% over five years) (Diallo, 2004) and that published by Court-Brown and Caesar in Scotland (1.2%) (Court-Brown & Caesar, 2006). It was close to the frequencies reported in other sub-Saharan African series. This lower representation may be explained by the short study period (12 months) and the continued frequent use of traditional medicine before hospital admission, resulting in patients being lost along the healthcare pathway. Chauveaux *et al.*, (2003) also reported an increase in the frequency of TPFs in Western countries, directly correlated with the growth of the motor vehicle fleet. The mean age of our patients (35.5 years) was consistent with findings from African studies and confirms that these fractures predominantly affect the economically active population. In our series, male predominance (male-to-female ratio = 5:1) was more pronounced than in comparable African studies. Diallo (2004) reported that men accounted for 71.15% of cases, whereas Ehlinger *et al.*, (2012) and Trigo Cabral (1982) reported equal proportions of men and women in their European series. Conversely, Keating *et al.*, (2003) observed a marked female predominance (76%) among older patients, attributed to postmenopausal bone fragility. These differences in age and sex profiles are important in medico-legal assessments: in older women, fractures may occur in the setting of pre-existing osteoporosis, which may influence the assessment of causation (Fournier-Charrière & Tourniaire, 2005).

Road traffic accidents (RTAs) were the leading cause of injury in our series (66.66%), a finding consistent with those of several African and European authors, who reported proportions of up to 70% (Savy, 1994; Chauveaux *et al.*, 2003; Carret, 1991). Keating *et al.*, (2003) and Hsu *et al.*, (2001), however, observed a predominance of falls from height among older patients. In our setting, the high frequency of RTAs may be explained by the rapid growth of the motor vehicle fleet, deteriorating road infrastructure, poor vehicle maintenance, and inadequate awareness of traffic regulations. From a medico-legal perspective, the cause of injury determines the applicable compensation scheme (motor vehicle insurance for RTAs and occupational accident insurance for work-related injuries) and helps establish liability.

In our series, direct-impact trauma was the predominant injury mechanism (89%), a finding that

differed from that of Thiam (2004), who observed indirect mechanisms in 87% of cases. This discrepancy may be explained by the predominant type of RTA in our setting, namely vehicle-to-pedestrian collisions, as opposed to sports-related injuries, in which indirect mechanisms such as torsion and forced valgus are more common. Knowledge of the injury mechanism is essential for medico-legal assessment because it determines the plausibility of the causal relationship between the accident and the documented injuries.

Unicondylar fractures predominated in our series (72.22%), in agreement with the findings of Bejui (1985), who reported 58%; Duparc and Ficat (1960), who reported 62.7%; and Chauveaux *et al.*, (2003), who reported 70%. Similar findings have been reported in Africa by Koulali Idrissi *et al.*, (2003), who reported 58%, and Dieye (1993), who reported 50.68%. The predominance of unicondylar fractures is relevant to prognostic assessment because these fractures are generally easier to treat than complex bicondylar fractures, which may influence the assessment of temporary total incapacity for work (TTIW) and permanent partial impairment (PPI).

The Duparc and Ficat classification, used in our study, remains the reference classification in Guinea and in most African centers. The Schatzker classification (Schatzker *et al.*, 1979), which is more widely used in the international literature, complements it by distinguishing six morphological types associated with varying patterns of vascular and ligamentous injuries.

In our series, three cases of open fractures were recorded (16.67%). This rate was comparable to that reported by Thiam (2004) (10%) and higher than that reported by Barei *et al.*, (2004) (13.5%), but lower than the rates reported by Kumar and Whittle (2000) (38.5%) and Stannard *et al.*, (2004) (25.6%). An open fracture is a major severity factor, increasing the risk of infection and worsening the functional prognosis. From a medico-legal perspective, an open fracture generally results in a longer period of TTIW and increases the risk of permanent sequelae that may be assessed as PPI.

One medial collateral ligament injury was identified intraoperatively (16.67% of operated patients), together with two meniscal injuries (33.33% of operated patients). These rates were lower than those reported in the literature. Admi Mohamed (2008) reported ligamentous injuries in 18% of cases, while Thiam (2004) reported collateral ligament injuries in 10.20% and meniscal injuries in 14.28%. Simon *et al.*, (1989)

reported meniscal injuries in up to 40% of cases. The underestimation of associated injuries in our series was probably related to the absence of preoperative CT arthrography and the insufficiently systematic intraoperative exploration of ligamentous structures. An undiagnosed and untreated ligamentous or meniscal injury may seriously compromise functional outcomes and may give rise to medical liability due to inadequate care (Fournier-Charrière & Tourniaire, 2005).

In our series, surgical treatment was performed in 72.22% of cases, consistent with the rate of 68.82% reported by Thiam (2004). The predominance of surgical treatment can be explained by the fact that internal fixation enables anatomical reconstruction of the articular surface and early mobilization, both of which are essential for optimal functional outcomes according to Chauveaux *et al.*, (2003). Nevertheless, Courvoisier (1975) and Jensen *et al.*, (1990) argued that conservative treatment remains a valid alternative for nondisplaced fractures or patients at high operative risk.

Plate fixation, using either T-shaped or L-shaped plates, was the most frequently used technique, in agreement with the recommendations of most authors for displaced fractures. The absence of a fluoroscopy unit in our department represents a significant limitation, necessitating routine open reduction and potentially increasing the risk of soft-tissue complications. From a medico-legal perspective, this technical limitation should be documented in the medical record as a contextual factor explaining the choice of surgical technique.

CONCLUSION

Tibial plateau fractures require early and appropriate management. Road traffic accidents are the leading cause, mainly affecting active males. Surgical treatment achieved favorable functional outcomes in 94.45% of cases. However, the 33.33% postoperative complication rate highlights the need for improved care. Better equipment, professional training, and appropriate medico-legal protocols are essential.

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