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Sociodemographic Profile, Risk Factors, and Mechanisms of Traumatic Extensor Mechanism Tendon Ruptures of the Knee: A 10-Year Multi-Centre Cohort in Cameroon

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Abstract

Background: Traumatic rupture of the knee extensor mechanism—quadriceps tendon, patella, and patellar tendon—is uncommon, with an annual incidence of approximately 1.37 per 100,000 for isolated quadriceps tendon injury. Epidemiological data from sub-Saharan Africa remain sparse. **Purpose:** To describe the sociodemographic profile, behavioural risk factors, mechanisms of injury, and anatomic pattern of traumatic knee extensor mechanism ruptures in a Cameroonian multi-centre cohort. **Methods:** A 10-year hospital-based cohort (1 January 2013-31 December 2022) was conducted across three hospitals in Yaoundé and one in Douala. Of 43 files screened, 32 met inclusion criteria. Recorded variables included age, sex, profession, comorbidities, toxicological habits, sporting activity level, mechanism of injury, tendon involved, extent of tear, laterality, and associated injuries. Analyses used Epi Info v7, SPSS v23, and Microsoft Excel. **Results:** Mean age was 45.3 ± 16.9 years (range 13 - 72), with a male predominance (sex ratio 5.4:1). Businessmen accounted for 22.6% of cases with recorded occupation (7/31). Chronic comorbidities were present in 40.6%; 25% were smokers; 18.75% consumed alcohol. Falls were the most frequent mechanism of injury (13/32, 40.63%), predominantly in patients over 50 years, followed by road traffic accidents—all motorcycle-related (10/32, 31.25%)—and sporting activity (9/32, 28.13%). The left knee was affected in 54.8%, and the patellar tendon was more frequently affected than the quadriceps tendon (ratio 1.4:1). Associated injuries were present in 31.25% of patients. **Conclusion:**

In Cameroon, extensor ruptures predominantly affect working-age men. Low-energy falls were the leading mechanism overall, while motorcycle-related RTAs not involving sport were the leading high-energy mechanism, particularly among patients aged 30 - 45 years. These findings differ from North American and European series, in which sport is dominant, and emphasise the need for targeted road-safety interventions in sub-Saharan Africa.

Keywords

Quadriceps Tendon, Patellar Tendon, Rupture, Epidemiology, Road Traffic Accident, Cameroon

1. Introduction

Traumatic ruptures of the knee extensor mechanism quadriceps tendon, patella, and patellar tendon are uncommon injuries that, if untreated, result in permanent loss of active knee extension. Although classically described in elderly Caucasian populations following low-energy falls, recent African series suggest a distinct pattern: younger, working-age men exposed to high-energy trauma, particularly RTAs [1] [2]. The comprehensive systematic review of quadriceps tendon ruptures reports an annual incidence of 1.37 per 100,000, with a male predominance (M:F = 4.2:1, mean age 51.1 years) [3]. Reito *et al.* observed a steadily rising incidence of surgically treated quadriceps tendon ruptures in Finland [4]. In sub-Saharan Africa, injury burden exceeds that of HIV, tuberculosis, and malaria combined, with RTAs being the largest contributor [5]-[8]. RTAs are overwhelmingly motorcycle-related in West and Central Africa and dominate orthopaedic trauma admissions and RTA-driven extremity injuries in comparable regional centres [5]-[9]. The Yaoundé cohort by Muluem *et al.* showed a median age of 36 years among patellar tendon ruptures [2], while a Gabonese preliminary series by Mba Angoué *et al.* described 11 quadriceps tendon ruptures with male predominance and a mean age of 55 years [1]. These contrasts highlight the need for region-specific epidemiological profiling. This article, the first of a three-part series, focuses on the sociodemographic profile, behavioural risk factors, mechanisms of injury, and anatomic pattern of these ruptures in Cameroon.

2. Methods

2.1. Design and Setting

We conducted a retrospective cohort study including patients operated for traumatic extensor tendon rupture over the past 10 years, from January 2013 to December 2022, in reference hospitals in Douala and Yaoundé (the Yaoundé Teaching Hospital, the Yaoundé Emergency Centre, and the Douala General Hospital). Our study population was obtained from patients operated in these hospitals with records from theatre records and admission files. Data were recorded on a standardised case report form.

2.2. Participants

Patients of all ages treated for traumatic rupture of quadriceps, and patellar tendons between 1st January 2013 and 31st December 2022 were eligible for inclusion. Inclusion criteria were: 1) patients with clinical diagnosis of an extensor mechanism based on clinical and radiological evidence, which had occurred within 0 - 14 days; 2) patients who were managed by surgically; 3) data were obtained from hospital files and post-operative records. Exclusion criteria were incomplete records, absence of written informed consent (prospective participants), and death before data collection. Of 43 files identified, 32 patients met inclusion criteria; eleven were excluded, seven for incomplete records, three for absent informed consent, and one for patient death.

2.3. Variables

Documented variables included age, sex, profession, chronic disease history, smoking/alcohol use, lifestyle sporting activity (sedentary, low, medium-high), mechanism of injury, laterality, tendon involved, tear extent (50% - 79%, 80% - 95%, 100%), and associated injuries.

2.4. Study Composition and Missing Data

Of the 32 included patients, all were enrolled retrospectively (2013-2021) and these same patients were re-contacted prospectively (2023); the retrospective and prospective phases thus covered the same sample of the cohort. Missing data were handled as follows: behavioural exposures (smoking, alcohol, sporting activity) and comorbidities, as well as the mechanism of injury, were abstracted from the medical record and, for prospective aspect, verified by patient interview; values not recorded were treated as unknown and analyses were conducted using a complete-case approach. Records judged to lack a complete minimum dataset were excluded at screening (n = 7).

2.5. Statistical Analysis

Descriptive statistics were generated using Epi Info v7, IBM SPSS v23, and Microsoft Excel.

2.6. Ethical Considerations

Ethics approval was obtained from each institutional review board. Prospectively enrolled patients provided written informed consent. Retrospective data extraction was approved with a waiver of individual consent on the basis of anonymised chart review, in accordance with the Declaration of Helsinki.

3. Results

3.1. Enrolment

Exclusion rate was 42.2% (11/43), yielding 32 participants.

3.2. Sociodemographic Profile

Observed on Table 1, mean age of 45.3 years sits between the European mean of 51 - 57 years [3] [10] and the African mean of 33 - 36 years reported elsewhere [1] [2], reflecting the bimodal injury pattern in our setting.

Table 1. Sociodemographic profile.

Variable	Value
Mean age	45.3 ± 16.9 years (range 13 - 72)
Male:female	27:5 (5.4:1)
Commonest profession	Businessmen (7/32, 21.9%)
Second tier	Retirees 15.6%; students 15.6%

3.3. Past Medical History and Behavioural Risk Factors

Thirteen patients (40.6%) had chronic comorbidities. Eight (25%) were smokers and six (18.75%) consumed alcohol—both habits non-mutually-exclusive. Lifestyle analysis showed 47% were sedentary, 34% engaged in medium-to-high sporting activity, and 19% reported low sporting levels. No patient had undergone prior surgery on the affected limb.

3.4. Mechanism of Trauma

Falls were therefore the most frequent mechanism overall (40.63%), followed by motorcycle-related RTAs (31.25%) and sporting activity (28.13%). RTAs disproportionately affected patients aged 30 - 45 years. Sport-related ruptures occurred predominantly in active athletes, footballers and basketball players. A pattern is consistent with the sports-driven profile reported in large North American patellar tendon series [11] [12]. Low-energy falls dominated in patients over 50 years, paralleling the predominance of low-energy extensor ruptures in older patients in European series [10] [13]. The RTA pattern is highly consistent with the broader sub-Saharan orthopaedic trauma burden, where RTAs account for 48.6% - 63.7% of orthopaedic admissions and motorcycles are the dominant vector in Tanzania [6] [14]. In a Guinean series, 65.52% of RTA victims were motorcycle users [9], and in Sierra Leone, falls accounted for over 40% of non-fatal injuries while motor vehicle incidents were the leading cause of injury-related death [7].

3.5. Anatomic Distribution and Tear Extent

- Left knee: 54.8%.
- Patellar tendon involved more frequently than quadriceps tendon: 19 patellar (59.4%) vs. 13 quadriceps (40.6%), ratio 1.4:1.
- Extent of tear: Complete (100%) in 13; 80% - 95% in 11; 50% - 79% in 8.
- Associated injuries in 10/32 (31.25%): Ipsilateral femoral fracture (3, 9.38%); articular wound (3, 9.38%); ipsilateral tibial or patellar fracture (1 each, 3.13%); miscellaneous (2, 6.25%).

The patellar-tendon predominance at 1.4:1 differs from the European literature, in which quadriceps tendon ruptures account for the majority of extensor ruptures in elderly patients [10] [11]; possible explanations are considered in the Discussion. The 31.25% associated-injury rate is in line with comparable West African trauma series.

4. Discussion

To our knowledge, this is the largest multi-centre Cameroonian cohort of surgically managed traumatic extensor mechanism ruptures reported to date.

4.1. Intermediate Mean Age

The mean age of 45.3 years sits between European and African published figures [1]-[3] [10] and reflects a bimodal pattern: high-energy RTA trauma in working-age adults alongside low-energy falls in older patients. The secular rising incidence described by Reito *et al.* in Finland is likely mirrored and probably outpaced in African settings [4], particularly as motorisation expands [7] [9].

4.2. Sex Distribution and Profession-Related Risks

The male predominance of 5.4:1 is consistent with the RTA-driven mechanism. European spontaneous-rupture literature has historically emphasised female predominance due to obesity, type 2 diabetes, and chronic kidney disease. In contrast, businessmen were the modal profession in our cohort (7/31, 22.6%). Although every road traffic accident in this series was motorcycle-related, the recorded occupation data identify businessmen and do not establish that patients were themselves motorcycle riders or used motorcycles for work, since occupation as a rider was not recorded. The broader profile of male predominance with motorcycle-related trauma is nonetheless documented in West and Central African urban mobility studies [2] [6] [8].

4.3. Mechanisms: Predominance of Low-Energy Falls and the Motorcycle-RTA Pattern

A key finding is the bimodal mechanism profile. Low-energy falls were the most frequent mechanism overall (13/32, 40.63%), predominantly in patients over 50 years, while motorcycle-related RTAs (10/32, 31.25%) were the leading mechanism among working-age adults aged 30 - 45 years; sport accounted for 28.13% (9/32), as seen in **Table 2**. The RTA proportion exclusively motorcycle-related closely mirrors the patterns reported by Zirkle [8] and Premkumar *et al.* [6] in East African orthopaedic populations, with motorcycles involved in 52.8% of RTAs in Tanzania [14]. The WHO Global Status Report estimates that 90% of global road traffic fatalities occur in low- and middle-income countries, despite these countries holding only half the world's vehicles. This is probably because most bike riders on Cameroonian streets don't have their driver licences and thus do not master road safety. The pattern observed here working-age men, motorcycle-related, lower-ex-

tremity-dominant is therefore consistent with broader regional epidemiology rather than an institution-specific artefact.

Table 2. Distribution with respect to the mechanism of injury.

Mechanism	Proportion
Falls (predominantly patients over 50 years)	13/32 (40.63%)
RTAs (all motorcycle-related)	10/32 (31.25%)
Sporting activity	9/32 (28.13%)

4.4. Implications for Prevention

The profile documented here carries direct implications for prevention strategy: targeted road-safety measures, particularly motorcycle regulation, helmet enforcement, and rider training, are likely to be higher-yield than sport-targeted interventions in this setting [5] [7] [9].

4.5. Hypotheses Requiring Patient-Level Confirmation

Causal interpretations of these associations remain plausible but were not tested in this study. No patient-level data were collected on riding behaviour, helmet use, road conditions, or employment as a commercial motorcycle rider, so a specific contribution of poor riding standards or road infrastructure to the concentration of RTAs in patients aged 30 - 45 years cannot be assessed. Similarly, the patellar-tendon predominance (ratio 1.4:1) has been hypothesised to reflect the eccentric loading sustained during motorcycle trauma, as seen in **Table 2**, but no biomechanical or patient-level evidence was collected to support this. Finally, the predominance of low-energy falls in patients over 50 years among whom chronic comorbidities were common (40.6%) is consistent with age-related tendon degeneration, but tendon quality was not assessed, so tendon fragility remains a proposed rather than demonstrated contributor. These hypotheses should be tested in dedicated prospective studies.

4.6. Limitations

The study is limited by retrospective data quality (approximately 80% of cases), modest sample size (n = 32), and absence of multivariate modelling. Occupational data were unavailable for one patient (percentages computed on a denominator of 31), and behavioural exposures and comorbidities in retrospective participants could not be independently verified. Multi-centre prospective cohorts with larger samples, standardised imaging, and patient-level exposure data are warranted.

5. Conclusion

Traumatic ruptures of the knee extensor mechanism in Cameroon predominantly affect young, economically active men. Low-energy falls were the leading mechanism overall, while motorcycle-related RTAs not involving sport were the leading

high-energy mechanism (Table 2) and dominated among patients aged 30 - 45 years. The clinical and demographic profile differs substantially from European and North American series and carries direct implications for prevention. Targeted road-safety interventions are urgently required, and larger multi-centre African studies are needed to confirm the trends observed here.

Ethics Approval

Institutional review board approval was obtained in each participating centre.

Informed Consent

Written informed consent was obtained from prospectively enrolled patients. Retrospective data extraction was approved with a waiver of individual consent.

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Author Contributions

Armand Collins Ewole Ella conducted the research. Marc Leroy Guifo and Pius Fokam supervised the procedure, and the write-up was conducted by Armand Collins Ewole Ella, Stephane Eric Eya Mvondo, and Adrien Mounchili Yongho, who completed the final editing. All the authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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