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Interprosthetic femoral fractures: proposed new classification system and treatment algorithm

Robinson Esteves Santos Pires[a,*], Paulo Roberto Barbosa de Toledo Lourenço[b], Pedro José Labronici[c], Leonardo Rosa da Rocha[d], Daniel Balbachevsky[e], Francisco Ramiro Cavalcante[f], Marco Antônio Percope de Andrade[a]

[a] Federal University of Minas Gerais, Belo Horizonte - MG, Brazil
[b] Quinta D'Or Hospital, Rio de Janeiro – RJ, Brazil
[c] Fluminense Federal University, Niterói – RJ, Brazil
[d] National Institute of Orthopaedics and Traumatology (INTO), Rio de Janeiro – RJ, Brazil
[e] Federal University of São Paulo, São Paulo – SP, Brazil
[f] Orthopaedic Institute of Goiânia, Goiânia – GO, Brazil.

KEYWORDS

Fracture
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Hip prosthesis
Knee prosthesis
Knee replacement
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ABSTRACT

Interprosthetic femoral fracture is a rare and challenging fragility fracture issue. Due to aging of the population, the incidence of this type of fracture is gradually and constantly increasing. There is no complete and specific interprosthetic femoral fracture classification system that indicates treatment and prognosis in the literature. The aim of the present study was to describe a new classification system for interprosthetic femoral fractures, and to present a case series and a treatment algorithm derived from the current evidence in the literature.

Introduction

Interprosthetic femoral fractures are rare, occurring in 1.25% of patients who undergo hip and knee replacements [1]. By comparison, periprosthetic fracture incidence is 2.5% in the knee and 2% in the hip [2].

Several issues contribute to the challenging treatment of interprosthetic femoral fractures: poor bone quality, small interprosthetic fragment, prostheses instability, patient age, and clinical comorbidities [3-8].

Mortality and revision surgery rates associated with the treatment of interprosthetic femoral fractures have been reported to reach 50% in an observational study by Zuurmond et al [9].

There are several classifications in current use for knee and hip periprosthetic fractures; however, there is no complete and specific classification system for interprosthetic femoral fractures [10-13].

The aim of the present study was to describe a specific classification system for interprosthetic femoral fracture and to present a treatment algorithm for this important fragility fracture issue. The authors also demonstrated an interprosthetic femoral fracture case series.

The study was approved by the Institutional Ethics Committee and performed according to the standards of the Declaration of Helsinki.

Patients and methods

The following is a new classification system for interprosthetic femoral fractures based on fracture site, viability of interprosthetic bone fragment, and prostheses stability.

I. Interprosthetic fracture surrounding hip (Figure 1)

IA: Stable prostheses
IB: Unstable hip prosthesis; stable knee prosthesis
IC: Stable hip prosthesis; unstable knee prosthesis
ID: Unstable hip and knee prostheses

II. Interprosthetic fracture surrounding knee (Figure 2)

IIA: Stable prostheses
IIB: Unstable hip prosthesis; stable knee prosthesis
IIC: Stable hip prosthesis; unstable knee prosthesis
IID: Unstable hip and knee prostheses

* Corresponding author at: Department of Orthopaedic Surgery, Federal University of Minas Gerais, Belo Horizonte – MG, Brazil. Tel.: +55 31 3409-9757.
E-mail address: robinsonestevespires@gmail.com (R. Esteves Santos Pires).

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III. Interprosthetic fracture with femoral extension stem (Figure 3)

IIIA: Stable prostheses with viable bone between the prostheses
IIIB: Stable prostheses with unviable fragment due to lack of bone interval between prostheses ends
IIIC: Unstable prostheses (hip, knee or both) with viable bone between the prostheses
IIID: Unstable prostheses (hip, knee or both) with unviable fragment due to lack of bone interval between prostheses ends

A literature review of current issues surrounding interprosthetic femoral fracture, a treatment algorithm and a case series were also presented.

The authors reviewed the database of three general hospitals and found six interprosthetic femoral fractures in six patients.

The data collected included sex and age of patients, classification system, injury mechanism, treatment method, healing time and complications.

Results

Table 1 presents epidemiological data, treatment options and complications that occurred in the patients with interprosthetic femoral fracture.

All patients were female and the average age was 75.8 years (range 71-86 years). The average healing time was 4.9 months (range 4-7.9 months).

Treatment options included bridge-plating technique with soft tissue preservation, acetabular component revision plus percutaneous plate osteosynthesis, Ilizarov external fixation, and retrograde intramedullary nailing.

There was only one complication reported: a pin tract infection in the patient who underwent Ilizarov external fixation. The patient was treated with local debridement and oral antibiotics and these were sufficient for infection control.

Figure 4 shows an 86-year-old female who presented with interprosthetic femoral fracture surrounding the knee with stable hip and knee prostheses (IIA).

The patient underwent minimally-invasive percutaneous plate osteosynthesis with distal femoral locked plate (less invasive stabilisation system [LISS®], DePuy Synthes). The fracture healed 6 months post-surgery, and the patient recovered to their pre-injury function level.

Discussion

Interprosthetic femoral fracture is a rare and challenging fragility fracture issue. Due to aging of the population, and the increasing number of arthroplasties, there is a trend towards increased incidence of interprosthetic femoral fracture [1,3-9].

There are several articles in the literature that discuss periprosthetic femoral fractures, but interprosthetic femoral fracture is only now just beginning to be addressed and few authors have described their experiences with this type of fracture [10-16].

Treatment options for interprosthetic femoral fracture include fixation using flat or precontoured plates, cerclage wires, autologous bone grafts with or without bone morphogenetic protein (BMP), and revision with stemmed prosthesis [14].

Hou et al [10] reported the outcomes of a case series of 13 patients with interprosthetic femoral fracture. Four fractures were treated with long-stemmed revisions because of loose prostheses. Two patients died prior to fracture healing. The remaining patients were treated with locked plates. The average fracture healing time was 4.7 ± 0.3 months. Average follow-up was 28 ± 4 months. All patients returned to preoperative functional status except for one patient who presented with a loose hip prosthesis three years after fracture healing.

Mamczak et al [11] described a case series of 26 patients with interprosthetic femoral fracture who were all treated with plate fixation that spanned the interprosthetic zone, applied using soft tissue preserving techniques without adjuvant bone

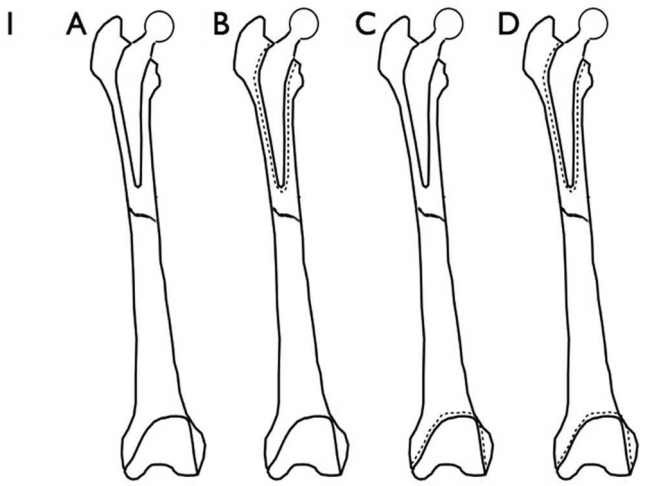

Fig. 1. Interprosthetic fracture surrounding hip.

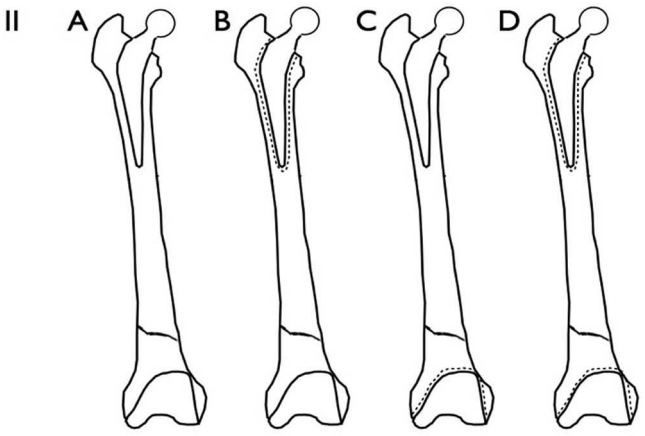

Fig. 2. Interprosthetic fracture surrounding knee.

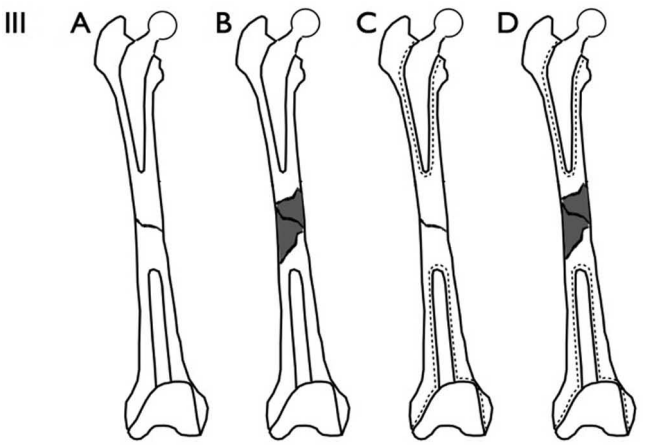

Fig. 3. Interprosthetic fracture with femoral extension stem.