Orthopaedics & Traumatology: Surgery & Research 101 (2015) 277–282

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Original article

Treatment of type B periprosthetic femur fractures with curved non-locking plate with eccentric holes: Retrospective study of 43 patients with minimum 1-year follow-up

A. Lunebourg [a,*,c], E. Mouhsine [a,b], S. Cherix [a], M. Ollivier [c], F. Chevalley [a], M. Wettstein [a,b]

[a] Service de chirurgie orthopédique et traumatologie, département appareil-locomoteur, centre universitaire hospitalier vaudois (CHUV), 46, rue du Bugnon, 1011 Lausanne, Switzerland
[b] ITOLS, clinique de Genolier, 3, route de Muids, 1272 Genolier, Switzerland
[c] Service de chirurgie orthopédique et traumatologie, institut du mouvement et de l'appareil locomoteur, hôpital Sainte-Marguerite, 270, boulevard Sainte-Marguerite, 13009 Marseille, France

ARTICLE INFO

Article history:
Received 26 August 2014
Accepted 16 January 2015

Keywords:
Fracture
Femur
Prosthesis
Hip
ORIF
Plate

ABSTRACT

Introduction: Periprosthetic femur fracture (PFF) is a serious complication after total hip arthroplasty that can be treated using different internal fixation devices. However, the outcomes with curved non-locking plates with eccentric holes in this indication have not been reported previously. The objectives of this study were to determine: (1) the union rate; (2) the complication rate; (3) autonomy in a group of patients with a Vancouver type B PFF who were treated with this plate.
Hypothesis: Use of this plate results in a high union rate with minimal mechanical complications.
Materials and methods: Forty-three patients with a mean age of 79 years ± 13 (41–98) who had undergone fixation of Vancouver type B PFF with this plate between 2002 and 2007 were included in the study. The time to union and Parker Mobility Score were evaluated. The revision-free survival (all causes) was calculated using Kaplan-Meier analysis. The average follow-up was 42 months ± 20 (16–90).
Results: Union was obtained in all patients in a mean of 2.4 months ± 0.6 (2–4). One patient had varus malunion of the femur. The Parker Mobility Score decreased from 5.93 ± 1.94 (2–9) to 4.93 ± 1.8 (1–9) (P = 0.01). Two patients required a surgical revision: one for an infection after 4.5 years and one for stem loosening. The survival of the femoral stem 5 years after fracture fixation was 83.3% ± 12.6%.
Conclusion: Use of a curved plate with eccentric holes for treating type B PFF led to a high union rate and a low number of fixation-related complications. However, PFF remains a serious complication of hip arthroplasty that is accompanied by high morbidity and mortality rates.
Level of evidence: Retrospective study, level IV.

1. Introduction

Periprosthetic femur fractures (PFF) are occurring more frequently because of our aging population and the increase in the number of patients with hemiarthroplasty or total hip arthroplasty [1]. The incidence of PFF is estimated to be less than 1% after primary arthroplasty and up to 4% after revision arthroplasty [1–3]. PFF are the second-leading cause of revision arthroplasty [3–6]. Several risk factors have been identified: female gender, age, osteoporosis, rheumatoid arthritis, varus stem misalignment, previous femoral surgery and presence of osteolysis [3,7,8].

The Vancouver [9] classification is a reproducible classification system for PFF that can be used as the basis for determining the treatment strategy [10–15]. According to this classification, internal fixation should be used for type B fractures, potentially in combination with femoral stem revision depending on the current implant's stability and the periprosthetic bone stock. Several fracture fixation devices are available for use either by direct or minimally-invasive approach, but the results are variable [16–24]. Biomechanical studies have shown that constructs with proximal monocortical screws and distal bicortical screws, and constructs with proximal cables/wire cerclage in combination with distal bicortical screws were significantly more stable in axial compression, lateral bending and torsion [25,26]. Moreover, use of standard (non-locking) cable plates for PFF fixation around stable stems seems to be superior mechanically to use of locking plates, especially when used in combination with an allograft strut [27].

* Corresponding author. Tel.: +41 (0) 21 314 27 98; fax: +41 (0) 21 314 97 92.
E-mail address: alexandre.lunebourg@gmail.com (A. Lunebourg).

http://dx.doi.org/10.1016/j.otsr.2015.01.015
1877-0568/

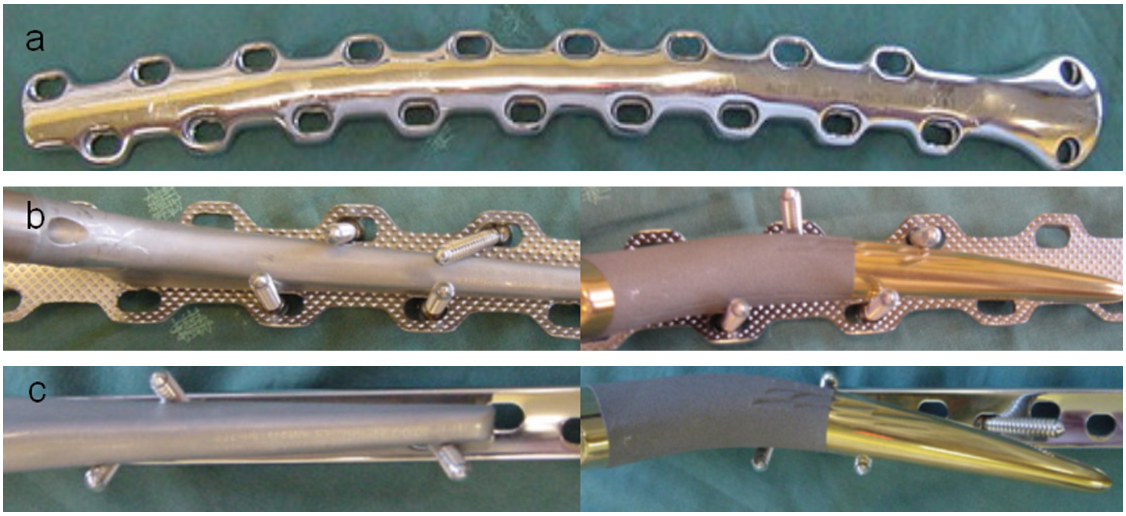

Fig. 1. a: stainless steel plate with eccentric holes for a left femur that is curved in the anteroposterior direction to best fit the femur's curvature; b: examples of screw position in a plate with eccentric holes around straight and curved femoral stems; c: examples of screw position in a plate with centered holes around straight and curved femoral stems.

However, placing screws around an intramedullary stem is technically difficult and is plagued by poor screw hold in osteoporotic bone [28]. Moving the holes away from the center of the plate may be a solution for placing screws around the existing femoral stem (Fig. 1). However, to our knowledge, the outcomes of using a curved non-locking plate with eccentric holes have not been reported previously. Our working hypothesis is that use of a curved non-locking plate with eccentric holes results in stable fixation and a high union rate with minimal complications. The objectives of this study were to determine:

- the union rate;
- the complication rate;
- autonomy results in a group of patients with a Vancouver type B PFF who were treated with this plate.

2. Patients and methods

2.1. Patients

A retrospective analysis was carried out of all the patients who presented with a Vancouver type B PFF after total hip arthroplasty or hemiarthroplasty between 2002 and 2007. Patients were included if they had a type B PFF following primary hip arthroplasty that was treated with a curved plate with eccentric holes and had at least 1 year follow-up. Patients treated with different internal fixation devices or those with a sepsis episode before the PFF were excluded. The fractures were classified according to the Vancouver classification system [9] using information in the radiology file and the operative report. In all, 43 patients with a mean age of 79 years ± 13 (41–98) were included (Fig. 2).

The Charnley Score [29], American Society of Anesthesiologists (ASA) Score [30] and Parker and Palmer Scores [31] were used to evaluate the patient's preoperative status. The main patient characteristics, type of femoral stem (cemented, cementless) and time elapsed between the arthroplasty procedure and fracture are given in Table 1.

Table 1
Patient characteristics.

		Patients (n = 43)
Age (years)	Mean ± SD (min–max)	79 ± 13 (41–98)
Female		22 (49%)
Left side		16 (37%)
Vancouver type [9]	B1	18 (42%)
	B2	23 (53%)
	B3	2 (5%)
ASA Score [30]	II	8 (44%)
	III	10 (56%)
Charnley Score [29]	A	7 (16%)
	B	24 (56%)
	C	12 (28%)
Time between index surgery and fracture (months)		52 ± 63 (1–312)
Type of stem fixation at index surgery	Cemented	32 (74%)
	Cementless	11 (16%)
Type of index surgery	Primary	43 (100%)
	Revision	0 (0%)

Main patient characteristics. ASA: American Society of Anesthesiologists; n: number of patients; SD: standard deviation.

2.2. Surgical technique

All patients were operated by senior surgeons at a mean of 3.1 ± 2.4 days (0–10) after the fracture. The procedure was performed with the patient in lateral decubitus through a posterolateral approach that was extended distally over the lateral aspect of the thigh. An arthrotomy was performed systematically for cases of B2 and B3 fractures. If a spiral or multifragment fracture was present, 1.25-mm metal cerclage wires were used to provide temporary fixation of the reduced fracture before final fixation with screws and plate was applied to achieve a stable construct [25]. In patients with unstable cementless stems (type B2 and B3), these cerclage wires helped to tighten the bone around the stem so as to stabilize it, thereby avoiding an implant revision. The stainless steel anatomically curved plate (Aesculap, Tuttingen, Germany) used in this study was available in three lengths: 12 holes (250 mm), 15 holes (300 mm) and 18 holes (350 mm). This plate was our preferred device for internal fixation of type B PFF. The plate length was selected based on the fracture location; the goal was to insert at least three bicortical screws above the most distal part of the fracture. At least three of the periprosthetic screws were bicortical in nature; however in two cases, only two periprosthetic bicortical