Injury, Int. J. Care Injured xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

A double-plating approach to distal femur fracture: A clinical study

Ely L. Steinberg*, Jacov Elis, Yohai Steinberg, Moshe Salai, Tomer Ben-Tov

Orthopaedic Division, Tel-Aviv Sourasky Medical Center, Sackler Faculty of Medicine, Tel-Aviv University, Tel Aviv, Israel

ARTICLE INFO

Keywords:
Distal femur fracture
Fracture stabilization
Double-plating

ABSTRACT

Background: Locked plating is one of the latest innovative options for treating supracondylar femur fractures with relatively low failure rates. Single lateral plating was often found to have a relative higher failure rate. No clinical studies of double-plating distal femur fixation have thus far been reported. The aim of this study is to present our clinical experience with this surgical approach.
Patients and methods: Thirty-two patients (26 females and 6 males, mean age 76 years, range 44–101) were included in the study. Eight of them patients had a periprosthetic stable implant fracture and two patients were treated for a nonunion.
Results: All fractures, excluding one that needed bone grafting and one refracture, healed within 12 weeks. One patient needed bone grafting for delayed union and one patient needed fixation exchange due to femur re-fracture at the site of the most proximal screw. Two patients developed superficial wound infection and one patient required medial plate removal after union due to deep infection.
Conclusions: Based on these promising results, we propose that the double-plating technique should be considered in the surgeon's armamentarium for the treatment of supracondylar femur fractures, particularly in patients with poor bone quality, comminuted fractures and very low periprosthetic fractures.

Introduction

Supracondylar femur fractures are frequently associated with severe comminution and substantial soft tissue injury. Periprosthetic fractures following total knee arthroplasty reportedly have the same fracture rate as simple fractures, ranging between 0.4% to 2.5% [1–4]. Most of these fractures are complicated by poor bone quality (severe osteoporosis), a distal segment that is too short for adequate fixation, blood loss, malunion and nonunion, and increased mortality in the elderly [5,6].

Supracondylar femur fractures were historically treated with condylar buttress plates [7]. Fixed-angle implants, angle-blade plates, intramedullary retrograde nails and dynamic supracondylar screws were found to have a superior biomechanical design for decreasing varus collapse events compared to condylar buttress plates [8,9]. Locking plates have increased biomechanical resistance with the possibility of greater numbers of fixation screws in the distal femur metaphysis [10,11]. Locking plates were found to provide increased stability and resistance to failure compared to retrograde nails in elderly with poor bone stock [12–14]. New retrograde nails were eventually developed to increase stability, and biomechanical cadaveric studies showed that they even had a better performance than locking plates in terms of fatigue resistance [15]. The perioperative complications associated with supracondylar femur fractures, whatever the choice of fixation, include delayed union or nonunion that requires reoperation, deep infection, proximal implant failure and malunion [5,16,17].

Fracture type, muscle forces acting on the distal part of the femur, the weight of the lower extremity and natural gravity of the entire limb may increase lever arm and affect fracture stabilization and warrant load neutralization. Numerous biomechanical studies have been performed in the past and many others are currently ongoing with the aim of achieving an optimal stable construct. Most of them tested fracture stability in cadaveric bones by comparing locking plates with retrograde nails [12,14,15,18,19].

We faced some hardware failures in elderly patients who had been initially treated by a single-side plate and screws and then needed reoperations. One example of a second surgery included double plating for preserving the joint (Fig. 1), while a megaprosthesis was needed for other patient due to screw penetration into the joint due to poor bone quality (Fig. 2). Based on the failed cases encountered by our team and those reported in

* Corresponding author at: Orthopadic Division, Tel-Aviv Sourasky Medical Center, 6 Weizmann St., Tel-Aviv, 6423906, Israel.
E-mail address: steinberge@tlvmc.gov.il (E.L. Steinberg).

http://dx.doi.org/10.1016/j.injury.2017.07.025
0020-1383/

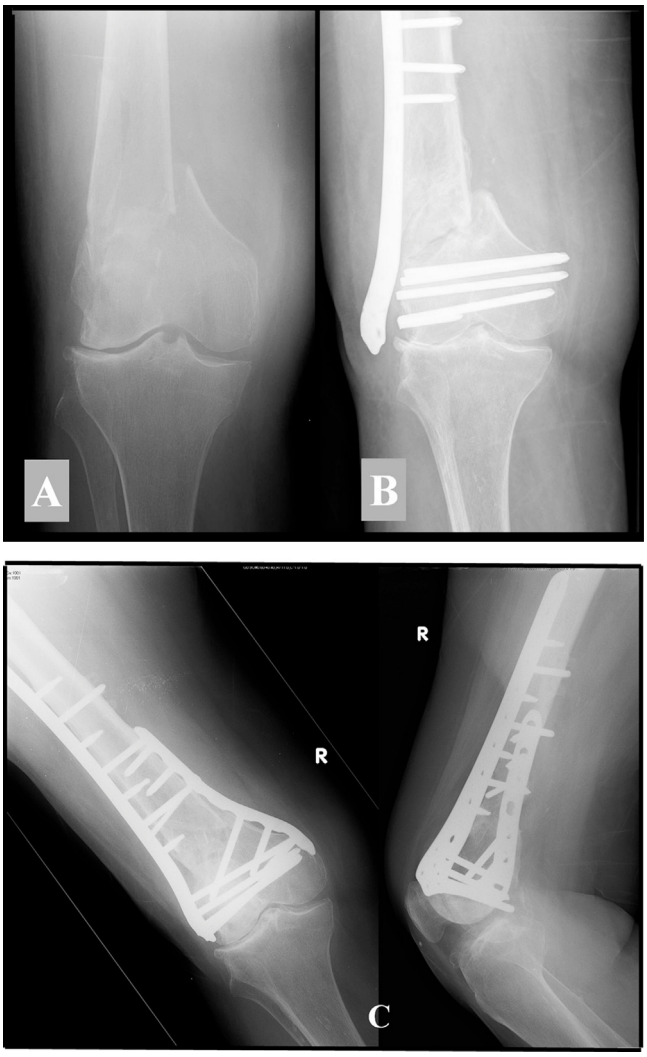

Fig. 1. A 92-year-old female with a Type 33-A3 supracondylar femur fracture (a) initially treated by a lateral locking plate. Hardware breakage and nonunion were detected 5 months following surgery (b). A double-plating procedure was performed, and good radiographic healing of the fracture was observed 2 years following the injury (c).

the literature, we decided to increase the support of distal femur fracture stabilization. We chose to use the double-plating technique for the distal femur, similar to the treatment for other two-column fracture types, such as, acetabulum, tibial plateau and distal humerus.

The purpose of this study was to evaluate our experience with the use of double plating technique for the treatment of unstable supracondylar femur comminuted fractures with poor bone quality.

Patients and methods

We used a double plating approach in patients with supracondylar femur fractures that fulfill the following criteria: nonunion, non-union following hardware failure, poor bone quality, Type A3, C3, according to AO/OTA classification and very low supracondylar and periprosthetic fractures. The clinical course of all the study patients was prospectively documented. The recorded data included the patient's clinical and radiographic healing time,

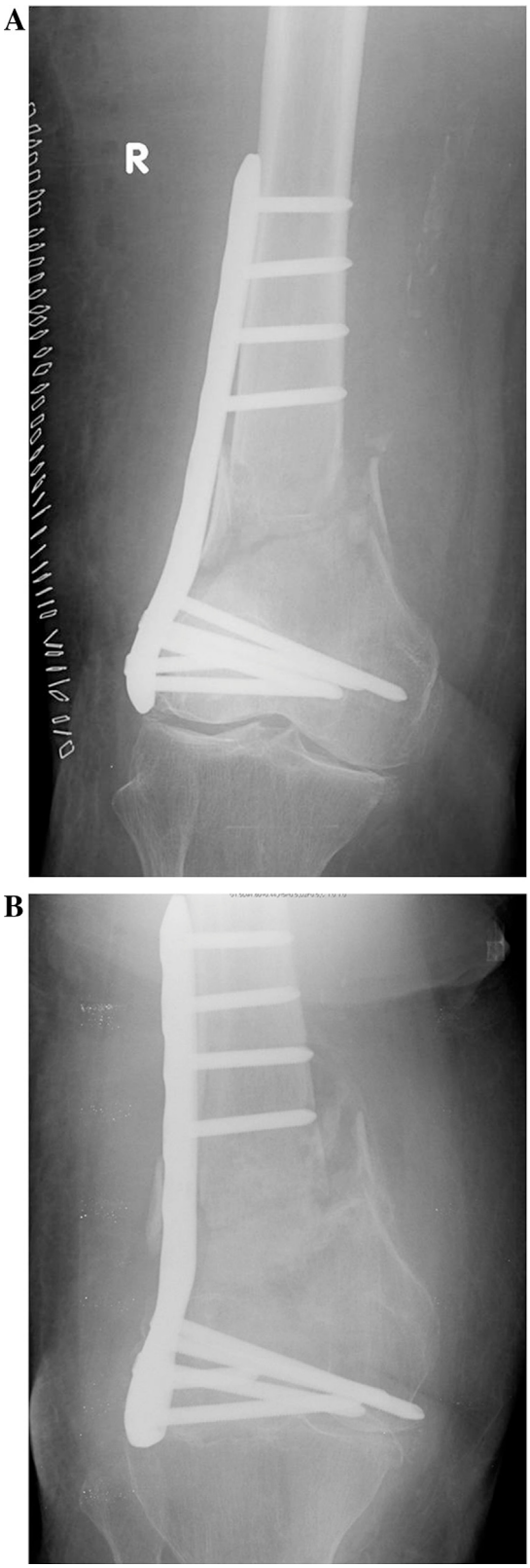

Fig. 2. A 90-years-old female with a Type 33-A3 supracondylar femur fracture treated by a lateral locking plate (a). Fracture displacement and joint penetration were detected 2 months following surgery (b).

hospitalization time, reoperations, infection and other local and systemic complications. After receiving institutional ethics committee approval, all data were analyzed in a retrospective manner.

Please cite this article in press as: E.L. Steinberg, et al., A double-plating approach to distal femur fracture: A clinical study, Injury (2017), http://dx.doi.org/10.1016/j.injury.2017.07.025