



# Distal Femoral Fractures in the Elderly: Assessment of Length of Stay and Morbimortality

## *Fracturas de fémur distal en población geriátrica: Evaluación de estadía hospitalaria y morbimortalidad*

Diego Edwards<sup>1,2</sup> Rodrigo Guiloff<sup>2</sup> Sergio Arellano<sup>1,2</sup> Andrés Schmidt-Hebbel<sup>1,2</sup>  
Carlos Valderrama<sup>2</sup> Alex Vaisman<sup>1,2</sup>

<sup>1</sup>Traumatology Service, Knee Surgery, Padre Hurtado Hospital, Santiago, Chile  
<sup>2</sup>School of Medicine, Clínica Alemana Universidad del Desarrollo, Santiago, Chile

Address for correspondence Diego Edwards Silva, MD, Traumatology Service, Knee Surgery, Padre Hurtado Hospital, Esperanza 2150, San Ramon, Santiago, Chile, Postal Code 7690888 (e-mail: edwardsdiego@gmail.com).

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### Abstract

**Introduction** Distal femoral fractures (DFF) are a relevant problem for public health worldwide. As the population ages, an increase in the rate of these lesions is expected in the next few years.

**Objective** To describe the complications and mortality from DFF in geriatric patients.

**Materials and Methods** A descriptive and retrospective study with patients aged 60 years or older who underwent surgery due to DFF. All subjects received treatment in the same trauma center from 2011 to 2015 and underwent a minimum follow-up of 1 year. Patients with incomplete medical records were excluded. We analyzed demographics, radiological findings, local and systemic complications, length of stay, and mortality rates.

**Results** In total, 16 patients met the inclusion criteria; their median age was of 72 (range: 61 to 93) years, and 14 subjects (87,5%) were female. The classification of the Association for the Study of Internal Fixation (Arbeitsgemeinschaft für Osteosynthesefragen, AO, in German) was as follows: A – 12 patients (75%); B – 2 patients (12.5%); and C – 2 patients (12.5%). There were no open fractures. The devices used in the operations included dynamic condylar screw (DCS) plates (9 subjects; 56%), distal femur locking compression plates (LCPs) (4 subjects; 25%), and retrograde distal femoral nails (DFNs) (3 subjects; 19%). The median time until surgery was of 10 (range: 3 to 27) days, with a median length of stay of 14 (range: 5 to 47) days. Complications were presented by 6 (37.5%) patients: 2 (12.5%) cases of pulmonary thromboembolism and 4 (25%) cases which required reintervention (2 due to hardware failure, 1 because of arthrofibrosis, and 1 due to aseptic nonunion); there were no cases of infection. The mortality rate at 12 months was of 0%.

**Conclusion** The patients with DFF in this geriatric cohort presented a long length of stay, with a high rate of complications, including a rate of 25% of reintervention. Nevertheless, the 1-year mortality rate was of 0%.

### Keywords

- ▶ distal femoral fractures
- ▶ geriatric population
- ▶ length of stay
- ▶ mortality

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## Resumen

**Introducción** Las fracturas de fémur distal (FFD) son un problema importante de salud pública. Con el envejecimiento de la población, se espera un incremento de esta lesión en los próximos años.

**Objetivo** Describir las complicaciones y la mortalidad de las FFD en un grupo de pacientes geriátricos.

**Materiales y Métodos** Estudio descriptivo y retrospectivo de pacientes mayores de 60 años operados por FFD, todos tratados en un mismo centro, entre 2011 y 2015, con al menos 1 año de seguimiento. Se excluyeron pacientes con ficha incompleta. Se analizaron los datos demográficos y radiológicos, las complicaciones locales y sistémicas, la estadía hospitalaria y la mortalidad.

**Resultados** En total, 16 pacientes cumplieron con los criterios de selección; tenían una mediana de edad de 73 (rango: 61 a 93) años, y 14 (87,5%) eran mujeres. La clasificación de la Asociación para el Estudio de la Fijación Interna (Arbeitsgemeinschaft für Osteosynthesefragen, AO, en alemán) de las fracturas fue: A – 12(75%); B – 2 (12,5%); y C – 2(12,5%). No hubo casos de fractura expuesta. Un total de 9 (56,3%) pacientes fueron operados con placa condilar dinámica, 4 (25%), con placa bloqueada, y 3 (19%), con clavo retrógrado. La mediana de latencia quirúrgica fue de 10 (rango: 3 a 27) días, con una mediana de hospitalización de 14 (rango: 5 a 47) días. Complicaciones fueron presentadas por 6 (37,5%) pacientes: 2 (12,5%) casos de tromboembolismo pulmonar y 4 (25%) casos que requirieron reintervención (2 fallos de osteosíntesis, 1 artrofibrosis y 1 no unión aséptica). No hubo complicaciones infecciosas. La mortalidad a 12 meses fue de 0%.

**Conclusiones** Los pacientes con FFD en esta cohorte geriátrica presentaron una larga estadía hospitalaria, con una alta tasa de complicaciones, que incluye un 25% de reintervenciones. Pese a esto, la mortalidad a 12 meses fue de 0%.

### Palabras clave

- ▶ fracturas de fémur distal
- ▶ población geriátrica
- ▶ estadía hospitalaria
- ▶ mortalidad

## Introduction

Distal femur fracture (DFF) occurs in the distal 15|cm of the femur, potentially with an articular compromise.<sup>1</sup> They account for up to 6% of all femoral fractures,<sup>2</sup> and their incidence increases in elderly patients due to low energy mechanisms in osteoporotic bone.<sup>3,4</sup> These fractures pose a real challenge to public health, since they present important morbidity and mortality and economic implications. This is especially true in elderly subjects,<sup>5</sup> who may require a long hospital stay (resulting from many comorbidities), and high complication (infections, thromboembolism, reinterventions due to osteosynthesis failure) and mortality rates, the latter reported as ranging from 20% to 30% per year.<sup>6-9</sup>

The particular biomechanics of this body segment and the need to achieve early mobilization of these patients lead most of them to prefer surgical treatment.<sup>10</sup> This, added to the technical difficulty to perform reduction and fixation and the low bone quality typical of this age group, makes achieving therapeutic success a challenge.

Distal femur fracture is the second most common fragility fracture in the femur after the hip.<sup>11,12</sup> However, there is much more information published for the latter, with widely used international guidelines to help with decision-making

and standardize its treatment, in contrast to the distal femur.<sup>13,14</sup>

The objective of the present study was to describe a series of cases of geriatric patients (> 60 years old) with DFFs undergoing surgery, with an analysis of their complications and 1-year mortality.

## Materials and Methods

The present retrospective descriptive study included patients older than 60 years of age undergoing surgery for DFF. We retrieved patient data from the registry of a case series operated on by the same surgical team in a public hospital of the Southeast Metropolitan Health Service, Santiago, Chile, from 2011 to 2015, with at least 1 year of follow-up. The types of osteosynthesis used varied over time. Initially, we used dynamic condylar screw (DCS) plates (DePuy Synthes, Raynham, MA, United States) and, next, retrograde distal femoral nails (DFNs) (DePuy Synthes) or locking compression plates (LCPs, DePuy Synthes), depending on the fracture type (we used DFNs whenever the fracture spared the last most distal 5|cm of the femur). Patients with incomplete epidemiological data or periprosthetic fractures were excluded from the study.

Based on the data obtained, we analyzed the following variables:

- Demographics (age and gender);
- Type of fracture;
- Surgical latency (until the definitive surgery);
- Type of osteosynthesis used;
- Local and systemic complications;
- Length of hospital stay; and
- One-year mortality.

Mortality data was obtained from Chile's national civil registry, with identification of the condition (alive/dead) and the date of demise in the corresponding cases. Data tabulation and processing were performed with the Microsoft Office Excel 2007 (Microsoft Corp., Redmond, WA, United States). There was no requirement for statistical tests due to the nature of the study. The institutional Ethics Committee approved the study.

## Results

The initial sample consisted of 17 patients, but we excluded 1 subject who presented a periprosthetic fracture. The remaining 16 patients had complete clinical records, which enabled their inclusion in the study.

Regarding the demographic data, 14 patients were female (87.5%), and 2 were male (12.5%), with a ratio of 7 women for every man operated on in this age group. The median age was of 72 (range: 61 to 93) years. Most patients had at least 1 comorbidity (the most frequent were hypertension and diabetes), and the mechanism of injury was low-energy trauma in 13 cases (fall on a level) and high-energy trauma in 3 subjects (who had been run over on public roads). There were no open fractures.

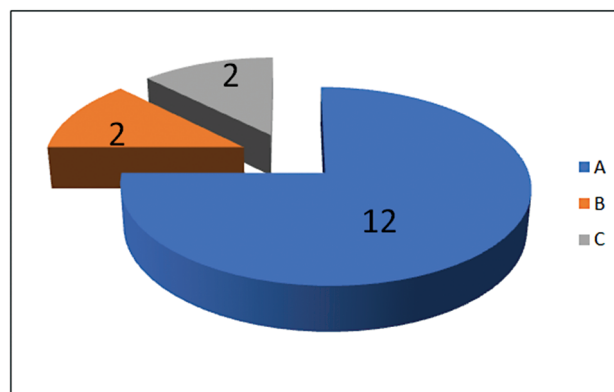
► **Figure 1** shows the fracture type distribution. Most fractures were type A per the classification of the Association for the Study of Internal Fixation (Arbeitsgemeinschaft für Osteosynthesefragen, AO, in German). The median surgical latency time was of 10 (range: 3 to 27) days, with a median hospital stay of 14 (range: 5 to 47) days.

The definitive surgery used a DCS plate in 9 (56%) cases, a distal femur LCP in 4 (25%) cases, and a retrograde DFN in 3 (19%) cases (► **Figure 2**). The median surgical time was of 1 hour and 58 minutes; there were no significant intra-operative complications.

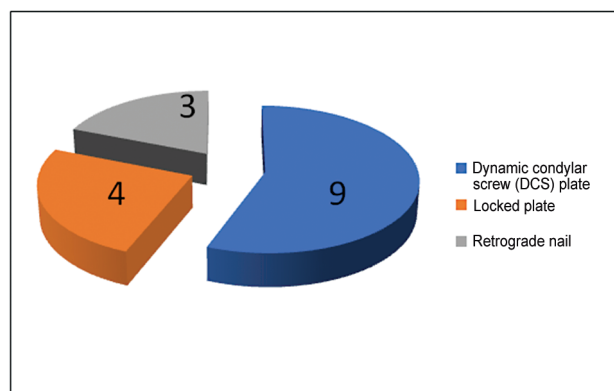
## Complications

In total, 37.5% of the sample (6 patients) presented complications, and their distribution, shown in ► **Figure 3**, was as follows:

- Reintervention: 4 patients (25%) required reintervention: 1 due to arthrofibrosis (6.25%), 1 due to aseptic nonunion (6.25%), and 2 because of osteosynthesis failures (12.5%). All of these patients initially received DCS plates. Treatment of the case of arthrofibrosis included mobilization under anesthesia, and the nonunion case received a new plate plus bone graft. Regarding the two



**Fig. 1** Fracture type according to the AO classification.



**Fig. 2** Type of implant used.

osteosynthesis failures, the first case presented a varus collapse with a plate angulation, and treatment included a double plate (a new DCS and a non-locked plate), which consolidated despite having presenting a new failure. The second patient presented a displaced fracture with amputation of the screws proximal to the fracture. For this case, reintervention required a locked distal femur plate, which also failed, so a new revision was necessary using wires to achieve consolidation (► **Figures 4 and 5**).

- Thromboembolism: 2 patients (12.5%) presented pulmonary thromboembolism. One of them had a confirmed case of distal deep vein thrombosis.
- There were no cases of compartment syndrome, neurovascular injury, or infection.
- No patients died in up to 12 months of follow-up (1-year mortality rate: 0%).

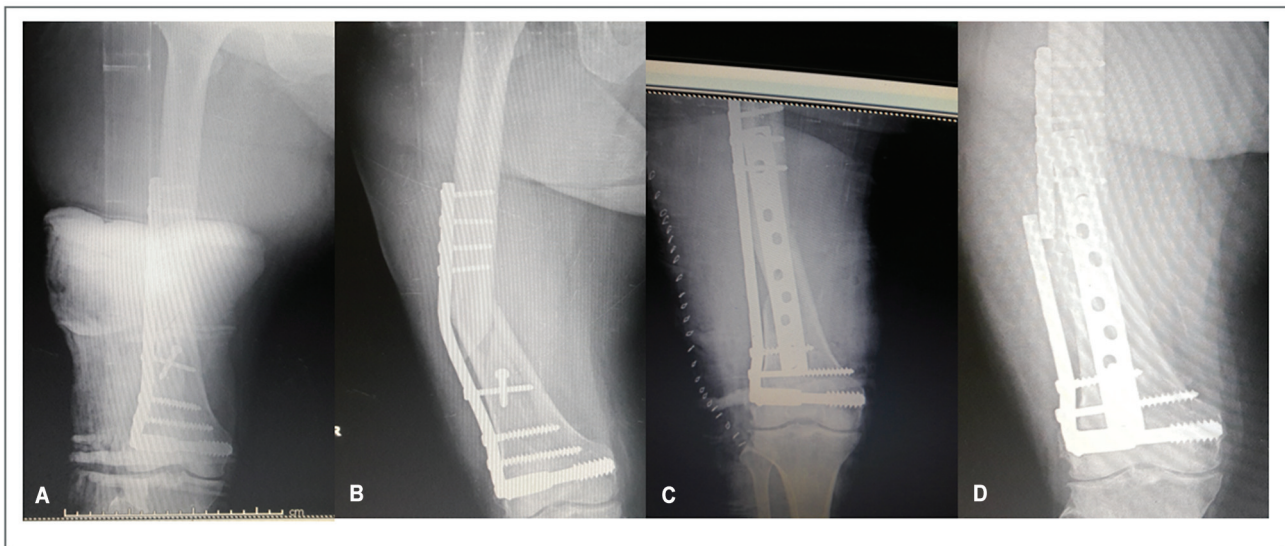
## Discussion

In elderly patients, DFFs are a public health concern in any country, because of the associated comorbidities, poor bone quality, high failure rates, and high mortality.<sup>6-9</sup> Along with hip fractures, DFFs are fragility fractures. However, hip fractures have been widely studied in the literature, with standardized management guidelines in many countries, such as the National Hip Fracture Database (NHFD)<sup>13</sup> in

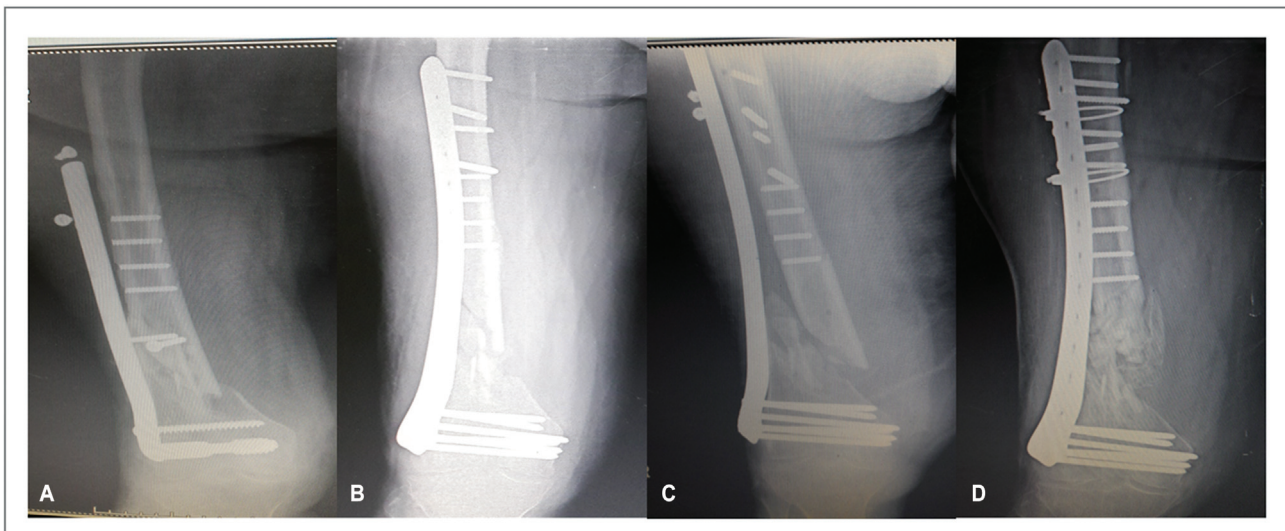
**Complications**

- Reintervention: 4 cases (25%)
- Pulmonary thromboembolism: 2 cases (12.5%)
- Infections: 0
- Mortality: 0

**Fig. 3** Complications.



**Fig. 4** Osteosynthesis failure in a fracture treated with a dynamic condylar screw (DCS) plate (A,B). A double-plate revision also failed, but further treatment resulted in consolidation (C,D).



**Fig. 5** Osteosynthesis failure in a fracture treated with a DCS plate replaced by a locked plate for the distal femur (A,B). New failure of the osteosynthesis revised with wires (C,D).

England or the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) in the United States.<sup>14</sup> In contrast, there is not the same amount of published information on DFF nor national or international popular guidelines for its treatment. As a result, DFFs are a challenge for orthopedic surgeons, and our group proposed to investigate and publish the outcomes from their treatment.

The demographics of our patients show an age and a male percentage somewhat lower than those of published guidelines such as the NHFD. The median age of our patients was of 72 years, but most patients were over 80 years old in the English registry. However, it is worth noting that the NHFD provides information on patients over 65, not 60 years, as in the present study. Under that criterion, our average age would be of 77 years, which is more consistent with the previously mentioned guideline. Concerning gender, although the percentage of women was lower (74%) in the NHFD, our cohort is similar to those of most studies, such as those by Janzing et al.,<sup>15</sup> Kammerlander et al.,<sup>5</sup> and Chung et al.,<sup>16</sup> which helps in the comparison of our results with those of the literature.

Some decades ago, authors such as Miclau et al.<sup>17</sup> and Perren<sup>18</sup> already referred to complications from DFF treatment, whose rates could be as high as 80%. The present study had a lower complication rate than these values, which is consistent with most recent papers, including those by Kammerlander et al.<sup>5</sup> (2012) and Smith et al.<sup>10</sup> (2015), who reported rates lower than 50%. This decreased complication rate may be secondary to several factors, including better implant technology, better access to health care, more compensated comorbidities, and improvements in hospital health standards. Our cohort had 3 cases (18.75%) of osteosynthesis failure with no technical faults in its placement, and these patients required a new surgery. These patients received the oldest of the three implants used, that is, the DCS plate. As a result, our surgical team looked for treatment alternatives to achieve fewer complications. Therefore, these more modern devices may have decreased the revision rate due to implant failure. However, we should mention that even though locked plates proved to present lower failure rates than devices such as the DCS plate, both in the international literature<sup>9</sup> and in the present study, they are not exempt from failure. One of our cases demonstrated this failure possibility, in which a DCS plate was replaced by an LCP, with acceptable radiographic follow-up; nevertheless, after a while, the new LCP also failed, requiring another LCP plus wires to eventually achieve fracture consolidation.

The present study was not designed to compare the effectiveness of different fixation methods and recommend one over another, but rather to collaborate in the understanding of DFFs and of their demographics, and complications. However, in light of the results, we believe it is also reasonable not to encourage the use of DCS plates for this population, since they may present a higher failure rate than that of other devices, such as locked plates and retrograde nails. This fact motivated our surgical team to

put aside DCS plates for this population and generate guidelines for general DFF management (► **Figure 6**).

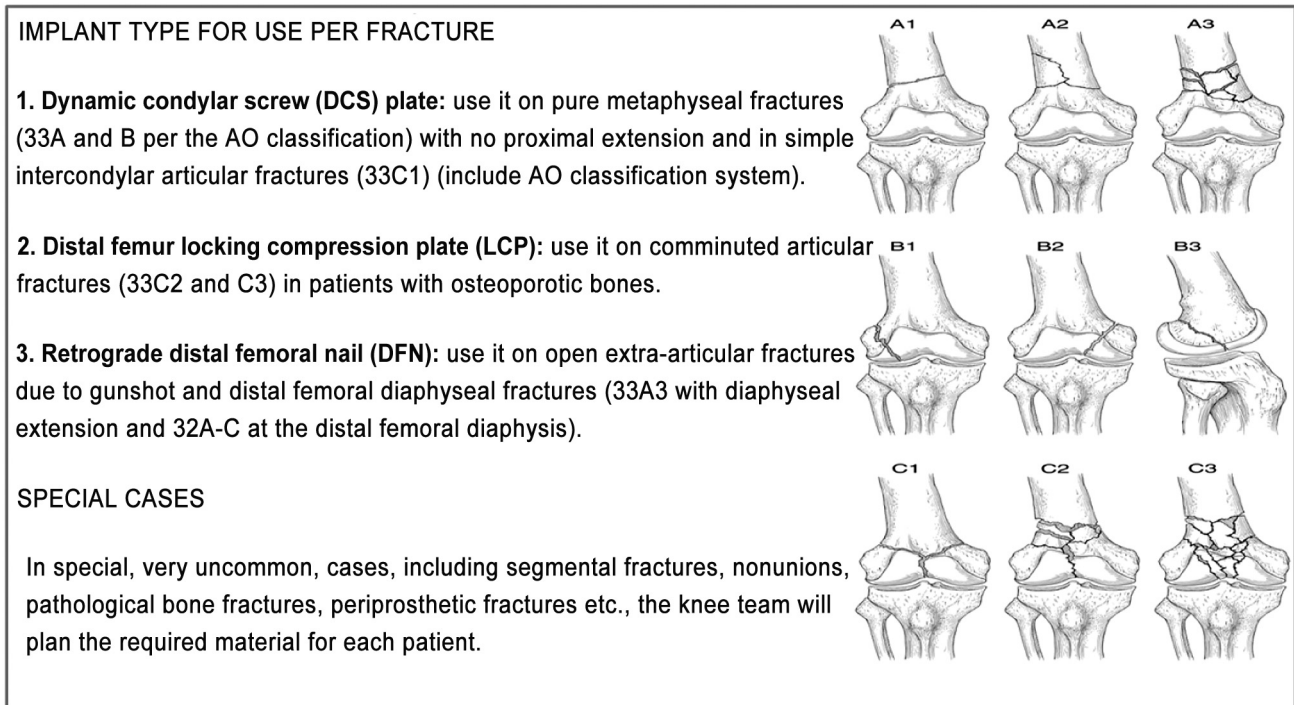
The surgical latency in the present study was of 12 days, which is explained by patient factors (presence of comorbidities requiring optimization) and local factors of our institution, in which interconsultants are not always available, and the surgical team in charge of this type of fracture has only 1 day in the ward during the week, which delays admission for the procedure.

Regarding infections, this complication did not occur in our population despite the surgical latency of 12 days. We believe this may have been favored by the absence of open fractures in the cohort, the correct preoperative study and patient status and comorbidity optimization, as well as the good management of the surgical wound and associated comorbidities in the immediate postoperative period. Other studies have also reported the lack of infection in these patients, including Kammerlander et al.,<sup>5</sup> who demonstrated that it is possible (and must be a goal) to achieve this despite advanced age and comorbidities. However, we had 2 cases of pulmonary thromboembolism, which corresponds to an extremely high percentage (12.5%); these patients have likely developed the complication due to multiple comorbidities and prothrombotic state concerning the Virchow triad. Although the surgical team followed all the prophylactic anticoagulation protocols of our institution during their stay and within the first weeks after discharge, these occurrences resulted in a review of our thromboprophylaxis protocols.

The 1-year mortality was of 0% and, along with the thromboembolism rate, is the most controversial result of the present study. We believe that the lack of deaths 12 months after surgery partly reflects good patient and comorbidity management in our institution in the preoperative preparation and the postoperative period. However, this result may also be secondary to the small size of the sample, since a single case would already lead to a significant percentage. However, the present study shows that low mortality is possible, and should be an objective.

The records of our hospital regarding mortality in hip fractures (with the same team of nurses and interconsultant physicians) show a yearly mortality rate of around 20% to 25%. This data could reflect that, under similar health standards, DFFs would present a lower mortality rate than hip fractures, contrary to what has been published by authors such as Streubel et al.,<sup>7</sup> who found a similar mortality rate, of 25%, for both fractures at 12 months in a cohort of 92 elderly patients.

The limitations of the present study include the small size of the cohort, as previously stated, the lack of complete radiological studies to determine consolidation, and the lack of clinical score analyses. On the other hand, the present is the first Chilean study on demographics and complication and mortality rates of DFF in the geriatric population. In addition, we discouraged the use of DCS plates given their higher failure incidence and demonstrated the possibility of achieving a low mortality rate even



**Fig. 6** Management protocol for distal femur fractures.

though the geriatric population has a considerable complication rate.

## Conclusion

In this geriatric population sample, DFFs result in a prolonged hospital stay and a high complication rate, including reinterventions and thromboembolism. However, low one-year infection and mortality rates are possible under standards of care similar to those used for hip fractures. In the present cohort, mechanical failures only occurred with the DCS plate (2/9 subjects receiving DCS versus 0/7 subjects receiving other osteosyntheses).

### Conflict of Interests

The authors have no conflict of interests to declare.

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