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Analysis of risk factors of the postoperative complications of surgical treatment of ankle fractures in the elderly: A series of 477 patients

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ABSTRACT

Introduction: The surgical strategy of ankle fractures in elderly subjects is controversial because of the high rate of local and general complications. The goal of this study was to identify the risk factors of complications of ankle fractures in elderly subjects.
Materials and methods: Four hundred and seventy-seven patients operated between 2008 and 2014 were included in this retrospective study. The minimum age was 60 years old for women and 70 for men. Patients presenting with a pilon fracture or with less than 3 months of follow up were excluded. A clinical evaluation of autonomy based on the Parker score and a radiographic assessment were performed preoperatively and during follow up The characteristics of the fracture, comorbidities and the type of internal fixation used were reported.
Results: This series included 384 women (81%), mean age 74 years old (60–99). Most fractures were Weber type B ($n = 336$). Four hundred and thirty-one patients (90.4%) received so-called standard internal fixation and 46 patients (9.6%) received so-called atypical fixation. The rate of general complications was 4.6%, and local complications was 23.9%. Univariate analysis of the risk factors of general complications identified 2 significant criteria: age older than 80 (OR = 3.46, $P = 0.012$) and more than 2 comorbidities 2 (OR = 10.6, $P < 0.0001$). Univariate analysis of risk factors of local complications identified 2 criteria: an open fracture (OR = 4.90, $P = 0.0016$) and age over 80 (OR = 1.85, $P = 0.024$). Multivariate analysis of risk factors of local complications confirmed the relationship with open fractures (OR = 4.67, $P < 0.001$).
Discussion: The results of the management of ankle fractures in elderly subjects is satisfactory. The use of standard internal fixation techniques is recommended. The risk of complications increases with age, the severity of the fracture and the number of associated diseases.
Level of evidence: Level 4.

1. Introduction

Ankle fractures are frequent in the elderly. The incidence has been continuously increasing for several years. Crevoisier et al. [1] found an incidence of 150 per 100,000 including 25% in patients over the age of 65, making this the third most frequent fracture in elderly subjects. Management of these fractures is a public health issue because of the ageing population.

Although it is needed, the therapeutic strategy in elderly subjects has not yet been standardized and is still controversial. Surgical management seems to be the first line therapy of a displaced fracture, allowing early physical rehabilitation and limiting complications that may develop due to bed rest [2]. Nevertheless subjects over the age of 65 have a higher rate of postoperative complications because of comorbidities and bone defects. SooHoo et al. [3] found a higher rate of complications, in particular mortality, in patients over 75 compared to those under 50 (odds ratio (OR) = 1.73, $P < 0.001$). Bariteau et al. [2] reported 9.1% mortality in a geriatric population presenting with a surgically treated fracture.

Certain so-called intrinsic factors associated with the patients themselves, and extrinsic factors associated with the type of fixation are considered to be sources of postoperative complications. The condition of the skin is often altered before the injury. Comorbidities: diabetes, arteropathy or long-term corticosteroid use, increase the risk of sepsis, nonunion, malunion or delayed

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healing [4–7]. The prevalence of osteoporosis makes standard fixation difficult and increases the risk of failure [8].

Despite our understanding of the potential risk factors of complications, the outcome of surgical treatment in elderly subjects is difficult to predict [9]. Precise identification of these risk factors is essential to determine the most appropriate therapeutic strategy.

The goal of this retrospective multicenter series of patients with various surgical approaches is to identify the risk factors of complications of ankle fractures in elderly subjects.

Our hypothesis is that the association of comorbidities that are inherent with age as well as surgical management with non-standard, or so-called atypical techniques are the cause of abnormally high postoperative complications in this group.

2. Materials and methods

2.1. Population

This is a multicenter retrospective study (University Hospitals in Angers, Brest, Caen, Limoges, Nantes and Rouen). Between January 1, 2008 and September 30, 2014, all patients who presented with a fracture of the lateral malleolus, a bimalleolar or a trimalleolar fracture treated surgically, who were over the age of 60 in women and 70 in men, with at least 3 years of postoperative follow up were included in the study. Pilon fractures were excluded, defined by no diaphyseal-epiphyseal connection.

2.2. Data collection

Preoperatively each patient's age, sex, weight, height and body mass index (BMI) were obtained. Comorbidities that could influence bone union and healing such as diabetes, obliterating arteriopathy of the lower limbs, kidney failure, smoking, chronic alcoholism and distal neuropathies as well as factors resulting in immune deficiency – cancer, corticotherapy, chemotherapy, immune suppressant treatment – were identified. A clinical evaluation of function was performed with the Parker score [10] to evaluate the person's previous autonomy. The Gustilo and Anderson [11] classification was used to determine an "open" fracture. Initial ankle dislocation or pre-existing trophic skin lesions were noted. A preoperative AP and lateral X-ray of the ankle made it possible to classify the fracture according to Weber [12], to evaluate medial malleolar injury and injury to the distal talofibular joint.

The choice of internal fixation was reported. Standard internal fixation was defined as plate fixation of the lateral malleolus with two screws or tension band wiring of the medial malleolus.

The patients underwent a postoperative clinical evaluation 6 weeks after surgery to search for general and local complications. An AP and lateral X-ray of the ankle was performed to search for secondary displacement. The Skinner test [13] was used to evaluate surgical reduction of the ankle.

General and local complications were searched for at the final follow up after at least 3 months by a new determination of the Parker score. AP and lateral ankle X-rays were again performed and the Skinner test was re-evaluated.

2.3. Statistical analysis

The statistical analysis was performed with "R" software version 2.15 by the team of biostatistics at the Rouen University Hospital Center. A descriptive analysis of the included population was performed. The rate of complications was estimated according to the confidence intervals on exact binomial law according to the Blaker method. Univariate analysis of risk factors of complications was performed by the Fischer exact test. Multivariate analysis was also performed by logistic regression.

Table 1
Population characteristics.

Epidemiological and morphological data	Value (%) or average	Distribution (interquartile)
Number of patients	477	
Men	93 (19)	
Women	384 (81)	
Age at surgery (years)	74	
Men	76	73–80
Women	73	66–80
Body mass index (kg/m²)	27.3	24.2–29.7
Preoperative autonomy (points)	7.8	
60–69 years old	8.7	
70–79 years old	8.1	
80–89 years old	6.7	
>90 years old	4.9	
Fracture classification		
Weber A	25 (5)	
Weber B	336 (71)	
Weber C	114 (24)	
Skin opening (Gustilo-Anderson)		
Closed	419 (88)	
I	27 (6)	
II	27 (6)	
III	4 (1)	
Comorbidities		
Arteritis	67 (14)	
Cancer	52 (11)	
Chemotherapy	36 (8)	
Corticosteroids	36 (8)	
Diabetes	137 (29)	
Renal failure	37 (8)	
Smoking	79 (17)	
Chronic alcoholism	69 (14)	
Neuropathy	41 (9)	
Immunosuppressive therapy	13 (3)	
Other	76 (19)	
Distribution of comorbidities		
0	195 (41)	
1	103 (22)	
2	82 (17)	
3	45 (9)	
4	33 (7)	
5 or more	19 (4)	
Follow up (days)	222	132–366

3. Results

3.1. Descriptive analysis of the population

This study involved 477 patients with 384 women (81%) and 93 men (19%) with an average follow up of 222 days (CI 95: 132–366). The median age at surgery was 74 years old (CI 95: 73–80). The most frequent co-morbidity was diabetes ($n = 137$, 29%) followed by chronic alcohol intoxication ($n = 69$, 14%) and tobacco use ($n = 79$, 17%). One hundred sixty-nine patients (38%) presented with more than 2 comorbidities. Twenty-five patients (5%) presented with a Weber type A fracture, 336 patients (71%) with a Weber type B and 114 patients (24%) with a Weber type C. Eighty-eight percent ($n = 419$) of the fractures were closed, 6% ($n = 27$) were classified as Gustilo-Anderson 1, 6% ($n = 27$) Gustilo-Anderson 2 and 1% ($n = 4$) as Gustilo-Anderson 3 (Table 1).

3.2. Internal fixation technique

Lateral malleolar fixation was obtained in 90.4% of the cases ($n = 431$), by locking ($n = 15$, 3.1%) or non-locking ($n = 310$, 65%) plate fixation. The other types of internal fixation were retrograde intramedullary nailing ($n = 46$, 9.6%), retrograde intramedullary