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Original article

Internal fixation of intra-capsular proximal femoral fractures in patients older than 80 years: Still relevant? Multivariate analysis of a prospective multicentre cohort

suppl. Informations

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ABSTRACT

Background: Arthroplasty is now widely used to treat intra-capsular proximal femoral fractures (PFFs) in older patients, even when there is little or no displacement. However, whether arthroplasty is associated with lower mortality and complication rates in non-displaced or mildly displaced PFFs is unknown. The objectives of this prospective study were: (1) to evaluate early mortality rates with the two treatment methods, (2) to identify risk factors for complications, (3) and to identify predictors of functional decline.
Hypothesis: Arthroplasty and internal fixation produce similar outcomes in non-displaced fractures of patients older than 80 years with PFFs.
Material and methods: This multicentre prospective study included consecutive patients older than 80 years who were managed for intra-capsular PFFs at eight centres in 2014. Biometric data and geriatric assessment scores (Parker Mobility Score, Katz Index of Independence, and Mini-Nutritional Assessment [MNA] score) were collected before and 6 months after surgery. Independent risk factors were sought by multivariate analysis. We included 418 females and 124 males with a mean age of 87 ± 4 years. The distribution of Garden stages was stage I, $n = 56$; stage II, $n = 33$; stage III, $n = 130$; and stage IV, $n = 323$. Arthroplasty was performed in 494 patients and internal fixation in 48 patients with non-displaced intra-capsular PFFs.
Results: Mortality after 6 months was 16.4% overall, with no significant difference between the two groups. By multivariate analysis, two factors were significantly associated with higher mortality, namely, male gender (odds ratio [OR], 3.24; 95% confidence interval [95% CI], 2.0–5.84; $P < 0.0001$) and high ASA score (OR, 1.56; 95% CI, 1.07–2.26; $P = 0.019$). Two factors were independently associated with lower mortality, with 75% predictive value, namely, high haematocrit (OR, 0.8; 95% CI, 0.7–0.9; $P = 0.001$) and better Parker score (OR, 0.5; 95% CI, 0.3–0.8; $P = 0.01$). The cut-off values associated with a significant risk increase were 2 for the Parker score (OR, 1.8; 95% CI, 1.1–2.3; $P = 0.001$) and 37% for the haematocrit (OR, 3.3; 95% CI, 1.9–5.5; $P = 0.02$). Complications occurred in 5.5% of patients. Surgical site infections were seen in 1.4% of patients, all of whom had had arthroplasty. Blood loss was significantly greater with arthroplasty (311 ± 197 mL versus 201 ± 165 mL, $P < 0.0002$). Dependency worsened in 39% of patients, and 31% of patients lost self-sufficiency. A higher preoperative Parker score was associated with a lower risk of high postoperative dependency (OR, 0.86; 95% CI, 0.76–0.97; $P = 0.014$).
Discussion: Neither treatment method was associated with decreased mortality or better function after intra-capsular PFFs in patients older than 80 years. Early mortality rates were consistent with previous reports. Among the risk factors identified in this study, age, preoperative self-sufficiency, and gender are not amenable to modification, in contrast to haematocrit and blood loss.

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Conclusion: Internal fixation remains warranted in patients older than 80 years with non-displaced intracapsular PFFs.
Level of evidence: III, prospective case-control study.

1. Introduction

Intra-capsular proximal femoral fractures (PFFs) in older individuals are managed by internal fixation when not or mildly displaced or by arthroplasty when markedly displaced (Garden III or IV) [1–6]. Arthroplasty has benefited from recent technical advances that provide a faster functional recovery with immediate weight bearing after a fairly simple procedure. Few studies have compared outcomes after arthroplasty and internal fixation, particularly in non-displaced fractures. A prospective study of patients with non-displaced fractures found higher mortality after arthroplasty and a higher reoperation rate after internal fixation [7]. Most studies, however, failed to separate the fractures based on the degree of displacement. The Norwegian Hip Fracture Register has been used to compare internal fixation for non-displaced fractures to arthroplasty for displaced fractures [8]. Quality of life scores were not significantly different between these two groups. A similar comparative study found less pain and better function after internal fixation of non-displaced fractures [9]. Thus, whether arthroplasty is associated with decreased mortality and complication rates remains unclear, particularly for fractures with little or no displacement.

We therefore conducted a prospective study with the following objectives: (1) to evaluate early mortality rates after internal fixation and arthroplasty, (2) to identify risk factors for complications, (3) and to identify predictors of functional decline. Our working hypothesis was that morbidity, mortality, and functional outcomes were similar after internal fixation of non-displaced fractures and arthroplasty of other intra-capsular PFFs in patients older than 80 years of age.

2. Material and method

2.1. Patients

This prospective multicentre study included consecutive patients who were older than 80 years in 2014 when they sustained an intra-capsular PFF, in the absence of hip osteoarthritis. The patients were recruited at eight university and community hospitals. The choice between internal fixation and arthroplasty was made according to the standard protocol applied at each centre. This protocol involved arthroplasty for Garden III and IV fractures in all centres; for Garden I and II fractures, six centres routinely performed internal fixation and two performed arthroplasty in those patients with a Parker mobility score greater than 6 indicating good mobility [9].

2.2. Assessment methods

In addition to biometric data, the following were collected preoperatively and 6 months after surgery: Parker mobility score [9], modified Katz index of independence in activities of daily living [10] (Appendix 1), and Mini-Nutritional Assessment (MNA) score (Appendix 2) [11]. We also recorded the type of fracture, type of treatment, perioperative events, American Society of Anesthesiologists (ASA) score [12], and characteristics of the trauma. Total blood loss was estimated from the haemoglobin decline according to Mercuriali and Inghilerri [13].

2.3. Statistical analysis

Mortality 6 months after surgery was the primary outcome measure. Secondary outcome measures were morbidity (change in nutritional status, systemic complications, and revision for mechanical failure), and functional outcomes (dependency and self-sufficiency as evaluated by the Parker score and modified Katz index, respectively). Functional outcomes were assessed in two categories based on the scores changes from baseline to 6 months, namely, unfavourable (increase in dependency and decline in self-sufficiency) or favourable. This qualitative assessment is less accurate but more reliable than a quantitative approach, given the inevitably limited reproducibility of the Parker score and Katz index values in a multicentre study.

Quantitative variables were described as mean ± SD and compared using Student's test or Wilcoxon's test. Qualitative variables were described as percentages and compared using the Chi^2 test or Fisher's exact test; correlations (score changes versus baseline) were assessed using Pearson's test. Multivariate analysis was performed to look for independent associations linking the treatment method and/or other variables to early mortality, morbidity, and/or functional outcomes. Bivariate analyses were first performed to determine whether the following variables were associated with the outcome measures: age, gender, Parker score and Katz index at baseline, ASA score, blood loss, proportion of patients given blood transfusions and number of units transfused, baseline nutritional status, baseline haematocrit, comorbidities, body mass index, degree of initial fracture displacement, and time from injury to surgery in days. Those variables associated with P values ≤ 0.25 were entered into the multivariate models. However, the treatment method (internal fixation or arthroplasty) was routinely entered into all multivariate models, as this variable was the focus of the study hypothesis. The multivariate analysis used a stepwise approach with ranking of the selected variables by order of decreasing statistical significance. The results were expressed as odds ratios (ORs) with their 95% confidence intervals (95% CIs).

For quantitative variables that were independently and significantly associated with one of the outcome measures, we looked for a cut-off by plotting receiver operating characteristics (ROC) curves. The variable was then entered into a multivariate analysis as a categorical variable (above or below the cut-off). The predictive value of each multivariate model was estimated to assess the power of the model based on the number of cases. Power was considered acceptable when the predictive value exceeded 70% and good when predictive value exceeded 80%.

3. Results

3.1. Study population

Of 703 eligible patients (703 hips), 161 were excluded, 143 because of missing data and 18 because they received functional treatment for non-displaced fractures (these 18 patients were not ambulatory and had contra-indications to general anaesthesia).

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