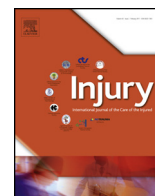




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Trauma surgery by general surgeons: Still an option for proximal femoral fractures?

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ABSTRACT

Introduction: Surgery for proximal femoral fractures in the Netherlands is performed by trauma surgeons, general surgeons and orthopaedic surgeons. The aim of this study was to assess whether there is a difference in outcome for patients with proximal femoral fractures operated by trauma surgeons versus general surgeons. Secondly, the relation between hospital and surgeon volume and postoperative complications was explored.

Methods: Patients of 18 years and older were included if operated for a proximal femoral fracture by a trauma surgeon or a general surgeon in two academic, eight teaching and two non-teaching hospitals in the Netherlands from January 2010 until December 2013. The combined endpoint was defined as reoperation or surgical site infection. Multivariate analysis was used to adjust for patient and fracture characteristics and hospital and surgeon volume. Categories for hospital volume were >170/year (high volume), 96–170/year (medium volume) and <96/year (low volume).

Results: In 4552 included patients 2382 (52.3%) had surgery by a trauma surgeon. Postoperative complications occurred in 276 (11.6%) patients operated by a trauma surgeon and in 258 (11.9%) operated by a general surgeon ($p=0.751$). When considering confounders in a multivariate analysis, surgery by trauma surgeons was associated with less postoperative complications (OR 0.746; 95%CI 0.580–0.958; $p=0.022$). Surgery in high volume hospitals was also associated with less complications (OR 0.997; 95%CI 0.995–0.999; $p=0.012$). Surgeon volume was not associated with complications (OR 1.008; 95%CI 0.997–1.018; $p=0.175$).

Conclusion: Surgery by trauma surgeons and high hospital volume are associated with less reoperations and surgical site infections for patients with proximal femoral fractures.

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Introduction

Surgery for proximal femoral fractures has high postoperative complication percentages. For patients of 60 year and older complication percentages of 20% are reported [1]. In the Netherlands more than 15 thousand patients with a proximal femoral fracture are admitted each year, accounting for 20% of all

hospital admissions due to trauma [2]. Patients with proximal femoral fractures in the Netherlands are admitted to the department of surgery or the department of orthopaedic surgery, depending on local agreements.

Currently, surgery for proximal femoral fractures in the Netherlands is performed by trauma surgeons, general surgeons and orthopaedic surgeons. Certification of trauma surgeons in the Netherlands started in 2010 with the goal to further improve the quality of treatment of trauma patients. This certification is executed and registered by the Dutch society for Surgery (NVvH) and the Dutch society for trauma surgery (NVT) [3]. Surgeons that qualify for this certificate spend at least 20% of their clinical activities to trauma care, or finished trauma differentiation after or within their surgical training. Besides specialization of the

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² See Appendix A for further details.

surgeon, surgeon and hospital volume are also clinician related parameters that could influence the complication rates after surgery for proximal femoral fractures [4–6].

The aim of this study was to investigate whether there is a difference in postoperative complications between patients with proximal femoral fractures operated by trauma surgeons compared to general surgeons. Secondly, the relation between hospital and surgeon volume and complication percentages was investigated in this patient group.

Methods

Study population

Inclusion criteria were age of 18 years or older, surgery for proximal femoral fracture in two academic, eight teaching hospitals and two non-teaching hospitals in the Netherlands from January 2010 until December 2013. Proximal femoral fracture was defined as a fracture of the femoral neck, pertrochanteric or subtrochanteric femur. Exclusion criteria were multitrauma (Injury Severity Score ≥ 16), fractures with malignancy and absence of the operative report. Patients operated by orthopaedic surgeons were excluded since this study focused on specialization within general surgery.

Definitions

Surgery was defined as performed by a trauma surgeon if a surgeon certified by the Dutch society of trauma surgeons (NVT) was the first surgeon or the first assistant when a resident was performing the surgery. Every surgeon not certified by the NVT was defined as general surgeon. In case a trauma surgeon acted as assisting surgeon next to a general surgeon it was considered to be a form of supervision and the operation was filed as surgery by a trauma surgeon (Fig. 1).

Complications were defined by a combined endpoint, consisting of a reoperation within one year and deep or superficial surgical site infections. Removal of osteosynthesis material for complaints of pain, patients request or surgeons' preference did not count as an reoperation. Surgical site infections were defined by the criteria of the US Center for Disease Control and Prevention [7]. Superficial wound infections were scored if only the skin or subcutaneous tissue of the surgical site was involved and occurred within 30 days after surgery. Deep surgical site infections were scored if the fascial or muscle layers or joint of the surgical site were involved and occurred within one year. The combined endpoint was formulated before the start of data collection.

Surgery during out of office hours was defined as surgery after 6 p.m. and before 7 p.m. during weekdays and surgery during the weekend.

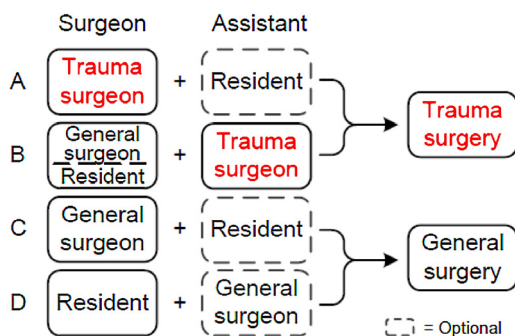


Fig. 1. Definition of surgery by trauma surgeon (certified by the Dutch society for trauma surgery).

Hospital volume was defined as the count of surgery for proximal femoral fractures at the surgery department per year averaged for the complete study period. Surgeon volume was defined as the count of operations performed by a surgeon during the respective calendar year. Surgeon volume for the most experienced surgeon in the operating team was used to define the surgeon volume for each operation.

Patient selection and data collection

Patients were selected from two regional trauma registries in the Netherlands. Patients with an Abbreviated Injury Scale (98 edition) for a fracture of the femoral neck, pertrochanteric or subtrochanteric femur and an admission date within the study period were screened for in- and exclusion criteria. Patient identifier variables were verified by the hospital information system. Study specific variables and variables missing from the regional trauma registry were collected from the surgery and anesthesia reports, admission and discharge letters. The local institutional review board determined that the proposed study was not subject to the Dutch Medical Research Involving Human Subjects Act (WMO).

Statistical analysis

All data was analyzed using SPSS version 22 (SPSS inc., Chicago, Illinois). Descriptive data is presented as percentages for categorical data, averages with standard deviation for normal distributed continuous data and median and interquartile ranges for non-normal distributed continuous data. Distribution of the data was assessed by Shapiro-Wilk and Kolmogorov-Smirnov test and frequency distribution histograms.

Data was compared by Chi² test for categorical data, students *t*-test for unpaired normal distributed continuous data and Mann-Whitney *U* test for non-normal distributed continuous data. Differences were considered significant if *p*-value < 0.05. Multivariate analysis was performed to adjust for patient and fracture characteristics, hospital and surgeon volume. Hospital and surgeon volume were divided in three categories with the aim to obtain equal patient counts. Odds ratio's (OR) with 95% confidence intervals (95%CI) were calculated in comparison to the low volume categories.

Results

8356 patients with a proximal femoral fracture were selected from two regional trauma registries. 3804 patients were excluded of which 84.1% for surgery by an orthopaedic surgeon. Of the 4552 included patients 2382 (52.3%) had surgery performed by a trauma surgeon and 2170 (47.7%) by a general surgeon (Fig. 2). Patient groups were not different regarding age, sex, severe co-morbidity and timing of surgery (Table 1). Fracture location and type of surgery were different between groups (Fig. 3). Trauma surgeons performed surgery for the femoral neck more often ($p < 0.001$) and inserted more hemiarthroplasties compared with general surgeons ($p < 0.001$). Osteosynthesis with cannulated screws was not different between groups ($p = 0.551$). General surgeons performed more surgery for pertrochanteric fractures ($p < 0.001$) and used more dynamic hip screws ($p < 0.001$) and intramedullary fixation ($p < 0.001$).

Surgery by trauma surgeons

In 11.6% of the patients treated by trauma surgeons a postoperative complication occurred, which did not differ significantly from the 11.9% of the patients operated by general

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