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Isolated hip fracture care in an inclusive trauma system: A trauma system wide evaluation

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ABSTRACT

Introduction: Elderly patients with a hip fracture represent a large proportion of the trauma population; however, little is known about outcome differences between different levels of trauma care for these patients. The aim of this study is to analyse the outcome of trauma care in patients with a hip fracture within our inclusive trauma system.

Materials and methods: Retrospective cohort study. Data were collected from the electronic patient documentation of patients, with an isolated hip fracture (aged ≥60), admitted to a level I or level II trauma centre between January 2008 and December 2012. Main outcomes were time to operative treatment, complications, mortality, and secondary surgical intervention rate.

Results: A total of 204 (level I) and 1425 (level II) patients were admitted. Significantly more ASA4 patients, by the American Society of Anesthesiologists (ASA) classification, were treated at the level I trauma centre. At the level II trauma centre, median time to surgical treatment was shorter (0 days; IQR 0–1 vs 1 day; IQR 1–2; $P < 0.001$), which was mainly influenced by postponement due to lack of operation room availability (14%, $n = 28$) and co-morbidities (13%, $n = 26$) present at the level I trauma centre. At the level II trauma centre, hospital stay was shorter (9 vs 11 days; $P < 0.001$) and the complication rate was lower (41%; $n = 590$ vs 53%; $n = 108$; $P = 0.002$), as was mortality (4%; $n = 54$ vs 7%; $n = 15$; $P = 0.018$). Secondary surgical intervention was performed less often at the level II trauma centre (6%; $n = 91$vs 12%; $n = 24$; $P = 0.005$). However, no differences in secondary surgical procedures due to inadequate postoperative outcome or implant failure were observed.

Conclusion and relevance: The clinical pathway and the large volume of patients at the level II centre resulted in earlier surgical intervention, lower overall complication and mortality rate, and a shorter length of stay. Therefore, the elderly patient with a hip fracture should ideally be treated in the large-volume level II hospital with a pre-established clinical pathway. However, complex patients requiring specific care that can only be provided at the level I trauma centre may be treated there with similar operative results.

Introduction

Trauma care is continuously evolving to improve its quality and outcomes. Within trauma care, triage is of the utmost importance. A patient should be transported to the most suitable hospital for the particular care he or she needs. For the severely injured patient, this has been studied extensively; mortality and morbidity of severely injured patients improve if they are transported to a level I trauma centre [1–3]. Despite the fact that in the inclusive trauma system the less severely injured patients represent a large proportion of the total number of trauma patients, studies investigating the outcome of less severely injured patients within this system are lacking. A substantial and ever expanding proportion of these less severely injured patients is the elderly patient with a hip fracture [4]. Many major trauma registries do not include isolated hip fractures, and therefore limited research has been performed assessing the

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outcome of hip fracture care in the inclusive trauma system. Nevertheless, clinical pathways for isolated hip fractures continue to be investigated and implemented [5].

The aim of this study is to compare the outcome of trauma care in patients with an isolated hip fracture at a level I trauma centre and level II trauma centre within our inclusive trauma system. Outcome of trauma care is defined as time to operative treatment, complication rate, mortality rate, and secondary surgical intervention rate.

Data resources and study sample

We conducted a retrospective cohort study. Data were collected from the electronic patient documentation (EPD) system of a level I trauma centre and a large level II trauma centre. Elderly patients admitted to either hospital between January 2008 and December 2012 with a primary diagnosis of hip fracture, defined by the International Classification of Diseases 9th revision (ICD-9-CM; codes 820.X, 821.X) or 10th revision (ICD-10-CM; S72.X), were included in this analysis. Patients were excluded if they were less than 60 years old, treated non-operatively, or their hip fracture was not an isolated injury.

The following data were collected: age, gender, American Society of Anesthesiologists (ASA) classification [6], admission date, discharge date, and operation date. Intra-hospital complications were extracted from the EPD system and divided into five main categories (Table 1). The Trauma Registry of the American College of Surgeons (TRACS) system was used to classify the complications [3]. Data on in-hospital mortality and secondary surgical intervention within 60 days and as a consequence of the initial operation were collected.

After implementing the regionalisation of trauma care in the Netherlands in 1999, the number of severely injured patients treated yearly at the level I trauma centre has rapidly increased [7–9]. The level I trauma centre is a tertiary referral centre for patients with pulmonary, cardiac and hematologic co-morbidities, high-complex oncologic surgery, or organ transplantation history. Priority in acute care is given to severely injured patients and patients demanding highly complex care. The organisation and facilities at the level II trauma centre are designed for high volume care in less severely injured patients and patients demanding less complex care. Due to the high incidence of elderly trauma patients with a hip fracture at the level II trauma centre, a clinical pathway has been developed that includes a geriatric trauma consultation service and a specialised combined geriatric medicine and traumatology ward. Furthermore this clinical pathway includes that all trauma patients aged 60 years and older have a geriatric trauma consultation upon admission, both the geriatrician and the trauma surgeon perform daily rounds and dedicated emergency operation time slots are reserved in the operation facilities during the day in anticipation of admitted patients, which allows for prompt operation following diagnosis. Also, there is collaboration with nursing homes and assisted living facilities in the region to reduce unnecessary prolonged hospital admission. Clinical pathways for elderly patients with a hip fracture are becoming increasingly popular [4]. The aim of these care pathways is to improve outcomes, lower complications, and reduce hospital length of stay.

In contrast, due to the low volume of elderly trauma patients at the level I trauma centre, no such pathway exists. A geriatric consultation is included, but there are no designated operation room time slots for this patient population. Instead, surgical intervention for these patients is based on a traditional emergency operation schedule, in which patients are treated in order of urgency. Therefore, time to surgical treatment of elderly patients with a hip fracture depends on the number of patients demanding acute care with a higher urgency, e.g. neurosurgical procedures, transplantation surgery, or severely injured poly-trauma patients. In both hospitals, surgery on patients with a hip fracture is performed by a dedicated team of (orthopaedic) trauma surgeons.

Statistical analysis

Parametric data were reported as means with standard deviation (SD), and non-parametric data were reported as medians with corresponding interquartile range (IQR). To compare proportions, Chi-square contingency tables were used when expected frequencies were equal or greater than five, and Fisher's exact test was performed when expected frequencies were less than five. The independent sample *t*-test was used for parametric continuous variables, and the Mann–Whitney *U* test was used for non-parametric continuous variables. Odds ratios (OR) were calculated with binary logistic regression analysis and were adjusted for age and ASA classification. A two-sided *P*-value of <0.05 was considered statistically significant. Data were analysed with SPSS version 20.0 (IBM Corp., Armonk, NY), for Windows.

Results

A total of 1629 patients were included in the study. Between January 2008 and December 2012, 204 patients were operated on

Table 1
Complications during admission divided into five main categories.

Category	Complication	Description
Thrombo-embolic events	Deep venous thrombosis	Diagnosed by ultrasonography
	Pulmonary embolism	Diagnosed by computed tomography angiography (CTA)
	Transient ischaemic attack (TIA) or stroke	Diagnosed by cerebral computed tomography (CT) and/or neurologist
Delirium	Delirium	Diagnosed by geriatrician or treatment with haloperidol per order geriatrician
Infection	Surgical site infection	Diagnosed clinically or during surgical intervention and positive deep wound cultures
	Pneumonia	Diagnosed by thoracic X-ray and clinical symptoms
	Urinary tract infection	Diagnosed by urinalysis
Cardiac complications	Myocardial infarction	Diagnosed by a cardiologist
	Arrhythmia	
	Acute decompensated heart failure	
Other complications	Anaemia	Transfusion with packed red blood cells was indicated
	Electrolyte imbalance	Treatment was given (e.g. medication or intravenous fluids)
	Decubitus	Diagnosed by surgeon