



When does hip fracture surgery fail?



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ABSTRACT

Introduction: Hip fractures remain the most common orthopaedic injury requiring hospital admission. Failed surgery for any cause carries a higher morbidity, mortality, and healthcare-related cost. The aims of this study were to determine risk factors for surgical complications of hip fracture surgery, when they occurred and their effect on mortality.

Patients and methods: From a prospectively collected consecutive database of 795 hip fractures admitted between July 2007 and June 2008, all surgical and non-surgical complications were identified as well as re-operation for any cause and mortality in the 4 years since surgery.

Results: Fifty-five (6.9%) patients were found to have developed a surgical complication requiring further intervention. Risk factors included younger age, smoking and cannulated screw fixation. Cannulated screw fixation was associated with a 30.9% rate of re-operation. Post-operative medical complication occurred in 21.8%. It was associated with a 78.5% mortality at 4 years with a median time to mortality of 58 days (95% CI 0–120 days).

Conclusions: Mechanical failure was the most common reason for cannulated screw re-operation. Hip hemiarthroplasty most commonly failed by infection. Inter-trochanteric and sub-trochanteric fracture fixation had very low failure rates. Post-operative medical complications, but not surgical complications, were associated with a higher mortality rate.

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Introduction

Hip fractures remain the most common reason for hospital admission following orthopaedic injury [1]. The ageing population means the incidence of this fracture is predicted to rise [2,3]. An estimated 86,000 hip fractures occur every year in the United Kingdom at annual cost of £1.7 billion to the NHS and social care services [4]. Fragility fractures of the hip in the elderly are a substantial cause of mortality and morbidity [5–8]; approximately 10% of patients die within 30 days and up to 27% within one year of hip fracture [3]. After surgery a significant increase in social support may be required, with greater dependence on social and community care [9]. This demand for limited resources is compounded where complications occur with treatment, or when more than one surgical procedure is required [10]. A previous study has reported rates of complications requiring a second procedure to be 6.9% [11]. There is no data available on which patients are commonly affected, when complications occur and

their effect on longer-term mortality. The aims of this study were to identify risk factors for surgical and non-surgical complications, when surgical complications occur and the effect of complications after hip surgery on patient mortality.

Patients and methods

Patients who were admitted with a hip fracture to a high volume single centre between July 2007 to June 2008 were identified from a prospectively collected trauma database. There were 795 consecutive patients, 73% of whom were women, with a mean age 80.6 years (SE ± 0.39). The fracture pattern, mechanism of injury, pre-injury domicile, and level of pre-injury mobility were recorded. Medical co-morbidity including chronic medical conditions, dementia, American Society of Anaesthesiologists (ASA) grade, a history of alcohol excess and smoking at time of injury were also recorded. Alcohol excess was defined as units in excess of current recommendations, which for men was defined as no more than 3–4 units per day and no more than 21 units in a week. For female patients, this was defined as 2–3 units per day and no more than 14 units in a week.

All patients with a post-operative surgical or acute medical complication, readmission, or further surgery within 4 years

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of their primary hip fracture surgery were identified retrospectively. All post-operative complications and causes for re-operation were recorded. Surgical complications and failure included mechanical causes such as implant failure, implant cut-out or prominence, dislocation and fracture malunion; biological causes such as secondary osteoarthritis (which required further surgery), wound haematoma, fracture non-union; traumatic causes such as peri-implant fractures; plus deep and superficial surgical site infections. Deep surgical site infection was defined as microbiological confirmation of infection from culture of tissue samples or fluid taken from deep to the fascia lata. The definition of acute complication, taken from the Mayo clinic guidelines, was deemed to be <30 days post-procedure [12]. Secondary outcome measures were date and cause of mortality within 4 years of hip fracture obtained from hospital records and national registries of the deceased.

The socioeconomic status of the patient was assessed using the Scottish Index of Multiple Deprivation [13] (SIMD) which takes into account factors such as employment, income, crime, housing, health, education and access to services. Scotland is divided into 6505 data zones that are ranked in order of decreasing deprivation and each data zone is allocated a SIMD decile based on this rank. The first decile includes the most deprived and the tenth decile comprises the least deprived on a national level [14]. Each patient was allocated to a zone using their postcode, and hence assigned their SIMD deprivation decile [13].

Surgery was performed within 48-h of admission in 92.9% patients. 1.5 g of cefuroxime was administered intravenously on induction of anaesthesia as prophylaxis against infection. No postoperative doses were routinely given. All procedures were performed in laminar flow theatres by a registrar or consultant-grade surgeon as the primary operator. The treatment method and implant choice was determined in all cases by the supervising orthopaedic trauma consultant. For intra-capsular neck of femur fractures, the implant options used included closed reduction and cannulated screw fixation (Smith and Nephew, UK) placed in a “three-screw V-shape” configuration [15], the Austin-Moore uncemented hemiarthroplasty (Stryker UK Ltd., Newbury, UK) and the Exeter cemented bipolar head hemiarthroplasty (Stryker UK Ltd.). Gentamicin-loaded Palacos cement (Heraeus, Hanau, Germany) was used in all cemented cases. A sliding hip screw (SHS), Dynamic Hip Screw (Zimmer, Indiana, USA), was used for inter-trochanteric and basal cervical fractures, and an intramedullary Gamma nail (Stryker UK Ltd.) was used for sub-trochanteric fractures and unstable inter-trochanteric fracture patterns. No bilateral surgeries were performed.

Data collected remained strictly confidential and was managed in accordance with Caldicott principles. Data was analysed using

SPSS statistical software version 19.0 (SPSS Inc., Chicago, IL, USA), using a chi-squared test for independence with discrete data, a Mann–Whitney test with non-parametric and Student's *t*-test with parametric data. The probabilities of survival and mortality were estimated using the Kaplan–Meier test and Cox's regression analysis. A *p*-value < 0.05 was considered statistically significant.

Results

Of the 795 consecutive hip fractures, 99.2% had complete records and were included in the final analyses. Of those included in final analysis, 35.1% were A-type fractures and 64.9% were B-type fractures in accordance to the AO/OTA classification. Fixation was the primary procedure in 53.0% and arthroplasty in 46.2%. Conservative management was pursued in 0.6% of patients, who were too medically unwell to undergo surgery. Fifty-five (6.9%) patients developed a complication requiring further intervention. The mean age of those with a surgical complication was 75.6 years (± 1.99 Standard error (SE)) compared with 80.9 years (± 0.39 SE) in whom complications did not occur ($p = 0.01$). In those in whom complications occurred 32.7% were current smokers at the time of surgery compared with 17.9% in those who did not experience complications ($p = 0.01$). Of those who developed surgical complications, internal fixation with cannulated hip screws was the primary procedure in 17 cases (30.9%); SHS fixation in 17 cases (30.9%), one of which had an additional de-rotation screw; cemented bipolar hemiarthroplasty in 13 cases (23.6%); uncemented monopolar hemiarthroplasty in five cases (9.1%) and total hip arthroplasty (THA) in three cases (5.5%) (Table 1).

Mechanical complications were the most common complication of all patients who underwent re-operation (23.1%, $n = 12$) (Table 2). The proportion of all cannulated screw fixations with complications was 32.1% ($n = 17$). All cases of AVN of the femoral head and fracture non-union in this series were associated with cannulated screw fixation. SHS fixation was associated with a surgical complication rate of 5.2% ($n = 17$). The most common complication was mechanical (3.1%, $n = 10$) which included cut-out (1.2%, $n = 4$), prominent metalwork (1.2%, $n = 4$), delayed union (0.3%), malunion (0.3%, $n = 1$), and post-traumatic OA (0.3%, $n = 1$). Cemented bipolar hemiarthroplasty had a surgical complication rate of 6.1% ($n = 13$). Deep infection was the most common cause of complication (4.2%, $n = 9$). Uncemented unipolar hemiarthroplasty was associated with a complication rate of 4.2% ($n = 5$). Mechanical failure (1.7%, $n = 2$) was the most common cause of complication, in the form of dislocation (0.8%, $n = 1$) and malreduction at the time of surgery (0.8%, $n = 1$). THA was found to have a complication rate of 9.1% ($n = 3$). Deep surgical site infection was the most common cause (6.1%, $n = 2$). There were no surgical complications associat-

Table 1
Significant factors associated with development of post-operative surgical complications.

		Surgical complications	No surgical complications	<i>p</i> -Value
Mean age at time of injury (years) (standard error)		75.64 (± 1.99)	80.91 (± 0.39)	0.01
Smoker	Yes	32.7	17.9	0.01
	No	67.3	82.1	
Primary management	Cemented bipolar hemiarthroplasty	27.3	27.3	<0.01
	Uncemented unipolar hemiarthroplasty	9.1	15.3	
	Total hip arthroplasty	5.5	4.1	
	Cannulated screws	30.9	4.7	
	SHS	29.1	41.4	
	SHS plus de-rotation screw	1.8	0.4	
	Reconstruction nail	0.0	5.8	
	PFNA	0.0	0.1	
	Excision arthroplasty	0.0	0.1	
Conservative		0.0	0.7	

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