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Geriatric distal femoral fractures: A retrospective study of 30 day mortality

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ABSTRACT

Introduction: Distal femoral fractures have many of the same challenges as hip fractures, but there has been limited research into outcomes following these. The aim of this study was to assess 30 day mortality following distal femoral fractures in comparison to hip fractures presenting to a single institution Secondary outcomes included risk factors for mortality, post-operative complications and union.
Methods: A retrospective case series of all distal femoral fragility fractures in patients over 65, and hip fractures over a 5 year period at a single institution.
Results: 88 distal femoral fractures and 2837 hip fractures fulfilled the inclusion criteria. In the distal femoral fractures there were 80 females and 8 males with a mean age of 82.4 (range 65–103). The mean age of the hip fractures was 83.7 (range 65–106) and there were 2066 females and 771 males.
The overall 30 day mortality for hip fractures was 7.7% and was 9.1% for distal femoral fractures. The risk ratio was 1.1777(95% CI 0.6009–2.3080) (p = 0.6338). There was no significant difference in 30 day mortality between the two fracture types.
Of the 88 distal femoral fractures 75 (85.2%) underwent open reduction internal fixation, 5 (5.7%) intramedullary nail and 8 (9.1%) conservative treatment. 11.4% suffered a medical complication. 9.1% patients required at least 1 further surgical procedure. The union rate was 94.3%. The 1 year mortality was 34.1%.
Conclusions: There is no significant difference in 30 day mortality between distal femoral and hip fractures. Distal femoral fractures occur in a complex group of patients that is similar to hip fractures. They have high mortality and complication rates.

Background

There has been extensive research into hip fractures in elderly patients to improve patient outcomes and reduce mortality. Distal femoral fractures have many of the same challenges as hip fractures, but there has been limited research into their treatment and outcomes. The incidence of distal femoral fractures is approximately 8.7 per 100,000 per year and account for 3–6% of all femoral fractures [1–3].

Distal femoral fractures are often fragility fractures in elderly patients with many medical co-morbidities. They occur in a similar patient cohort to hip fractures [4]. Few studies have looked at mortality, but have found rates of upto 38% at 1 year with comparable rates to hip fractures [5–14].

The surgical treatment of distal femoral fractures depends on both patient and fracture characteristics. Options include conservative treatment, open reduction internal fixation, intramedullary nails or distal femoral replacement [15]. These are often complex procedures with long operating times and high blood loss.

The aim of this study was to assess 30 day mortality following distal femoral fractures in comparison to hip fractures presenting to a single institution. Secondary outcomes were to compare demographics between distal femoral fractures and hip fractures, risk factors for mortality, 1 year mortality, post-operative complications, re-operations and union.

Methods

A retrospective cohort study was undertaken between1st January 2011 and 31st March 2016. Distal femoral fractures were identified by ICD codes for distal femoral fractures and a hospital database. A distal femoral fracture was defined as any fracture in the metaphysis and epiphysis of the distal femur. Inclusion criteria were patients 65 years and older, and a fragility fracture

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due to low energy trauma. Patients were excluded if the fracture was in the diaphysis or proximal femur, was a periprosthetic fracture, was due to high energy trauma or the patient was less than 65 year of age.

Patients notes were retrospectively reviewed for patient demographics, surgical details, complications, union and mortality.

Patients radiographs were reviewed by both authors and classified based on the AO-OTA classification [16].

Hip fractures were identified from the data collected for the National Hip Fracture Database. Every hip fracture presenting to the institution has prospective data collected. All hip fractures in patients 65 year of age and older that presented were included.

Statistical analysis was undertaken. For parametric data the Mann Whitney U test was used and for non-parametric data the Chi squared test. The significance level of 0.05 was chosen. A risk ratio calculation was undertaken to compare mortality between distal femoral and hip fractures

Results

Comparison of distal femoral fractures to hip fractures

88 distal femoral fractures and 2837 hip fractures fulfilled the inclusion criteria. There were 32.2 hip fractures for every distal femoral fracture.

In the distal femoral fractures there were 80 females and 8 males with a mean age of 82.4 (range 65–103). The mean age of the hip fractures was 83.7 (range 65–106) and there were 2066 females and 771 males. The demographics can be seen in Table 1. The only significant difference between the two groups was an increased proportion of females in the distal femoral fractures.

The 30 day mortality for hip fractures was 7.7%. The significant risk factors for 30 day mortality were increasing age, male sex, an increased ASA, lack of capacity, institutional living and a decreased pre-operative mobility (Table 2).

8 (9.1%) of distal femoral fractures died within 30 days following injury. An increasing age was the only significant risk factor for 30 day mortality (Table 3).

The overall 30 day mortality for hip fractures was 7.7% and was 9.1% for distal femoral fractures. The risk ratio was 1.1777(95% CI 0.6009–2.3080) (p = 0.6338). There was no significant difference in 30 day mortality between the two fracture types.

The median length of stay in distal femoral fractures was 15 days (range 4–116 days) and was 11 days (range 2–141) in hip fractures.

Table 1
Baseline demographics of hip fractures and distal femoral fractures.

	Hip fractures (n = 2837)		Distal femur (n = 88)		P Value
Age	83.7 (65–106)		82.4 (65–103)		0.0714
Sex	Males	771	Males	8	0.0002
	Females	2066	Females	80	
ASA	ASA 1	66	ASA 1	2	0.3269
	ASA 2	790	ASA 2	17	
	ASA 3	1466	ASA 3	53	
	ASA 4	515	ASA 4	16	
Capacity	Capacity	1972	Capacity	62	0.8496
	No capacity	865	No capacity	26	
Residential Status	Home	2169	Home	67	0.9449
	Institution	668	Institution	21	
Pre-op mobility	Independent	1139	Independent	27	0.1549
	1 aid	676	1 aid	22	
	Zimmer	1012	Zimmer	39	

Distal femoral fractures classification, surgery and complications

Of the 88 distal femoral fracture, 67 were classified as 33-A, 5 were classified as 33-B, and 16 were classified as 33-C (Table 4) 75 (85.2%) underwent open reduction internal fixation, 5 (5.7%) intramedullary nail and 8 (9.1%) conservative treatment.

Of the 80 operatively managed fractures the median wait to surgery was 53 h. 23 underwent surgery in less than 36 h. Of the 8 patients that died within 30 days, 1 underwent surgery within 36 h, 6 in greater than 36 h, and 1 patient managed conservatively. Of those that survived 30 days 22 underwent surgery in less than 36 h, 51 in more than 36 h, and 7 underwent conservative treatment. Time to surgery was not a significant risk factor for 30 day mortality (p = 0.3761). In total 4 patients developed a non-union of the 70 patients that survived at least 6 months. Therefore the union rate was 94.3%.

11.4% (10 patients) suffered a medical complication. These included 2 patients developing an acute kidney injury, 2 developing a urinary tract infection, 2 congestive cardiac failure, 1 pulmonary emobolism, 2 lower respiratory tract infections and 1 case of gastroenteritis 2 suffered a delayed union, and 2 a non-union. 1 of these non-unions required revision plating.

3 patients suffered a periprosthetic fracture following union which all required plating.

2 suffered metalwork failure. 1 underwent ORIF, and 1 underwent an eventual knee fusion due to infection. 2 patients required open washout for infection. In 1 of these cases there was metalwork failure, but 1 went onto union.

Overall 8 (9.1%) patients required at least 1 further surgical procedure.

4 patients developed a non-union of the 70 patients that survived at least 6 months. Therefore the union rate was 94.3%.

The 30 day mortality was 9.1% (8 patients), 6 month mortality was 20.5% (18 patients) and 1 year mortality was 34.1% (30 patients).

Discussion

Distal femoral fractures occur in a similar patient population as those with hip fractures, and with a similar incidence of mortality and morbidity [4,5]. Despite this there has been limited research into there outcomes.

Previous studies have demonstrated high mortality rates with a 30 day mortality between 2% and 8%, and a 1 year mortality between 23% and 38% [5–13]. These numbers are similar to those in hip fractures. In our study the 30 day mortality of 9.1% was higher than the 30 day mortality for hip fractures, but this did not reach clinical significance.

The high mortality rates in hip fractures have improved in recent years following the introduction of NICE guidelines. These have brought in changes such as regular orthogeriatirc review and surgery within 36 h. This has reduced the overall 30 day mortality in England and Wales to approximately 7% [17,18]. Due to the financial incentives and monitoring of patient outcomes, the majority of resources have been driven at improving outcomes of patients with hip fractures. The same has not been targeted at distal femoral fractures. This study and previously published work has demonstrated high mortality rates. Distal femoral fracture patients have similar patient characteristics as hip fractures and therefore require the same multidisciplinary approach with expert medical input from admission to discharge.

This study found the only significant risk factor for 30 day mortality was an increased age. Many other studies have found a range of risk factors associated with mortality. These have included male gender, an ASA of greater than 2, older age and an increased Charlson Comorbidity Score [6,8,9]. Several studies have analysed

Table 2
Risk factors for 30 day mortality in hip fractures.

	Alive at 30 days (n = 2618)		Dead at 30 days (n = 219)		P Value
Age	83.4 (65–106)		87.4 (65–103)		<0.0001
Sex	Males	697	Males	74	0.0220
	Females	1921	Females	145	
ASA	ASA 1	65	ASA 1	1	<0.0001
	ASA 2	783	ASA 2	7	
	ASA 3	1370	ASA 3	96	
	ASA 4	400	ASA 4	115	
Capacity	Capacity	1855	Capacity	117	<0.0001
	No capacity	763	No capacity	102	
Residential Status	Home	2024	Home	145	0.0002
	Institution	594	Institution	74	
Pre-op mobility	Independent	1097	Independent	42	<0.0001
	1 aid	630	1 aid	46	
	Zimmer	891	Zimmer	131	

Table 3
Risk Factors for 30 day mortality in distal femoral fractures.

	Alive at 30 days (n = 80)		Dead at 30 days (n = 8)		P Value
Age	80.7 (65–103)		89.3 (79–99)		0.0153
Sex	Males	8	Males	0	0.9165
	Females	72	Females	8	
ASA	ASA 1	2	ASA 1	0	0.5588
	ASA 2	15	ASA 2	2	
	ASA 3	47	ASA 3	6	
	ASA 4	16	ASA 4	0	
Capacity	Capacity	56	Capacity	6	0.7676
	No capacity	24	No capacity	2	
Residential Status	Home	60	Home Institution	7	0.4290
	Institution	20		1	
Pre-op mobility	Independent	26	Independent	1	0.4483
	1 aid	20	1 aid	2	
	Zimmer	34	Zimmer	5	
Charlson co-morbidity score	0–1	0	0–1	0	0.6649
	2–3	11	2–3	0	
	4–5	35	4–5	6	
	6–7	30	6–7	2	
	>7	4	>7	0	

Table 4
AO classification of distal femoral fractures and treatment undertaken.

Classification	Number	Surgery	
33-A1	36	ORIF	28
		IM nail	4
		Conservative	4
33-A2	17	ORIF	14
		IM nail	1
		Conservative	2
33-A3	14	ORIF	13
		Conservative	1
33-B1	1	ORIF	1
33-B2	3	ORIF	2
		Conservative	1
33-B3	1	ORIF	1
33-C1	7	ORIF	7
33-C2	5	ORIF	5
33-C3	4	ORIF	4

a delay to surgery as a risk factor for mortality with conflicting results [8–11,14,19].

There is currently debate about the surgical treatment of these fractures. This study, like many previously has demonstrated that the majority of patients currently undergo open reduction internal fixation [5,9,11]. There is currently a move towards distal femoral replacement for these complex fractures which has the potential benefit of allowing early weight bearing, and therefore aiming to prevent complications associated with immobility and non-union [15,20,21]. A study by Hart et al found that at 1 year all patients who underwent distal femoral replacement were ambulatory, whilst 1 in 4 that underwent ORIF were wheelchair bound [14].

The non-union rate in this study was approximately 5%. This is favourable to many previous studies, that have found non-union rates of upto 25% [8,15,22–24]. All the patients in this study used locking plates for fracture treatment.

This study found a re-operation rate of 9.1% which is similar to the current literature [8,14]. There was also a high rate of systemic complications. This all adds to the knowledge that these patients have a high risk of mortality, morbidity, complications and non-union

The limitations of this study include the retrospective data collection and that it is a single centre study. Whilst this study compares distal femoral fractures with a large number of hip fractures, it is still underpowered. Due to the rare occurrence of distal femoral fractures, multi-centred studies would be required to determine if there is actually a significantly increased mortality with these fractures. A further limitation is the lack of functional outcomes for this population. Further research should be targeted to assess functional outcomes in these patients.

This study presents one of the largest cases series distal femoral fractures. It demonstrates high mortality rates in these patients that are similar to hip fractures. This study highlights the need for

an increased priority be given to these patients, to aim to improve outcomes and reduce patient morbidity and mortality.

Conclusions

There is no significant difference in 30 day mortality between distal femoral and hip fractures. Distal femoral fractures occur in a complex group of patients that is similar to hip fractures. They have high mortality and complication rates. These patients should be prioritised along with hip fractures with orthogeriatrician input to aim to reduce mortality.

Conflict of interest

No conflicts of interest to declare.

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