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The Patient's Second Hip Fracture – One in Ten

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Abstract

Introduction
The number of fragility hip fractures (>60 years) are estimated to triple/quadruple by 2050. It is estimated that the prevalence of patient's contralateral hip fractures (HF2s) will increase also.

Methods
Single hospital, Retrospective review, 2013-2017, Radiograph review, n = 822.

Results
Management of patient's 2nd hip fractures accounted for 10.5% of all hip fracture surgeries. ~50% occurred within 3 years of the 1st hip fracture. There was no statistically significant difference in discharge destination, length-of-stay or mortality between the HF1 and HF2 cohorts.

Discussion
Patients with HF2s comprised a significant and stable proportion of all hip fractures treated. We advocate for the provision of a Fracture Liaison Service in each of the 16 hip fracture operating hospitals in Ireland to optimise the secondary prevention of hip fractures.

Introduction

Hip fractures are one of the most common presentations to hospital of the older patient and represent a vulnerable group. Globally, ~2 million hip fractures occur annually and this is predicted to increase x 3-4 fold by 2050[1,2]. In 2018, ~ 3,750 hip fractures were managed in Irish hospitals[3]. Hip fractures are costly in terms of the morbidity and mortality impact to the patient and the economic impact to the treating hospital.

Following a hip fracture, an individual will experience a reduction in overall functional status, social independence, mobility and an increase in depressive symptoms[4,5]. There is also a significant increase in mortality following a hip fracture with recent studies reporting a 30-day mortality of 5.7-6.5%[6,7] and 1-year mortality of 22%[8]. A typical hip fracture admission episode in Ireland was recently estimated to cost ~€14,300[9]. Hip fractures are estimated to cost the Irish taxpayer approximately €54 million per year and these costs are projected to increase to ~€162 million per year in 2046[10].

In 2012, the Irish Hip Fracture Database (IHFD) was established and the 8th annual report has recently been published (November, 2019). The IHFD is a prospective database collecting data on each individual hip fracture and continues to demonstrate ongoing improvements in the care of the older, fragile hip fracture patient. One of the principle aims of

the IHFD is secondary fracture prevention and data is continuously collected in relation to (i) bone health assessments and (ii) specialist falls assessment in each of the 16 hospitals which surgically manage hip fractures in Ireland.

The International Osteoporosis Foundation (IOF) has developed a global program ("Capture the Fracture") in order to tackle secondary fracture prevention. The IOF recognised that (i) the first fracture a patient suffers is often not interpreted as a warning sign for future fractures and (ii) there is a "care gap", as ~80% are never offered screening and/or a treatment regimen for osteoporosis[11]. The IOF endorses a multi-disciplinary model of care with a dedicated co-ordinator which acts as a link between the patient and a multi-disciplinary team. This model is called a "Fracture Liaison Service" (FLS)[12] and there are currently 4 FLSs in operation in 4 Irish hospitals.

It is estimated that within 2 years of experiencing a hip fracture, the risk of sustaining a contralateral (2nd) hip fracture is 4-10%[13]. These patients have previously been shown to be associated with poorer post-operative outcomes, increased discharges to long-term care facilities and increased mortality[14]. The literature representing those which have been treated specifically for a 2nd hip fracture in Ireland is lacking.

The main goals of this study were to (i) analyse and compare the characteristics of both 1st and 2nd fracture groups including discharge destination, length of stay and mortality and (ii) establish and analyse the annual number of those patients being treated for a 2nd hip fracture in an Irish trauma hospital.

Methods

The Tallaght University Hospital annual hip fracture datasheets (2013-2017) were analysed to establish baseline characteristics of all fragility hip fractures (≥ 60 years) treated over a 5-year period. These datasheets are managed by a local IHFD audit coordinator, who collects a number of variables on each hip fracture patient which attends their respective hospital for hip fracture management. This information is used by the IHFD to nationally optimise care of patients with a fragility hip fracture.

Those patients which were <60 years old, were managed non-operatively or had peri-prosthetic hip fractures were excluded from this study.

The National Integrated Medical Imaging System (NIMIS)/Picture Archiving System (PACS) was used to analyse each of the patient's radiographs (XR AP Pelvis, n = 822) to establish which patients were treated for a 1st hip fracture (HF1) and which patients had been treated for a second (contralateral) hip fracture (HF2).

A comparison of both groups was undertaken using the collected variables included in the annual hip fracture datasheets.

In order to accurately establish 30-day and 1-year mortality rates in both groups, the Irish Death Events Registry was utilised with the permission of the Department of Public Expenditure and Reform.

Stata SE (Version 13, College Station, Texas for PC) was used with a pre-determined significance level of 0.05.

Results

All surgically managed hip fractures in Tallaght University Hospital (2013-2017)

Between 2013 and 2017, 822 patients underwent surgical management of a hip fracture in Tallaght University Hospital. 736 patients (89.5%) were treated for a 1st hip fracture (HF1) and 86 patients (10.5%) were treated for a 2nd hip fracture (HF2).

The male: female proportions in the HF1 group were 32:68 respectively. These proportions were 24:76 in the HF2 group. The sex difference was not statistically significant (Pearson chi^2; p=0.169). The median age in the HF1 and HF2 populations was 80 and 83.5 years respectively. Age difference was statistically significant between the 2 cohorts (Mann-Whitney Test; p=0.0065). There was also a statistically significant difference in ASA between the groups

(Pearson chi^2; p=0.005); ASA I (HF1/HF2; 2.3 vs 1.2%), ASA II (34.2 vs 19.8%), ASA III (44.3 vs 59.3%), ASA IV (4.1 vs 9.3%, ASA V (No cases). ASA was unrecorded in 15.1% and 10.5% in the HF1 and HF2 groups respectively.

In relation to discharge destination, 33.8% of the HF1 group were discharged home compared to 24.4% in the HF2 group. 31% of the HF1 group and 39.5% of the HF2 group were discharged to a nursing home. 29.5% of the HF1 group and 29.1% of the HF2 group were transferred to another hospital. Discharge destination difference was not statistically significant between both groups (Pearson chi^2; p=0.351). The median length-of-stay of patients with a 1st fracture was 14 days and of those with a 2nd fracture was 15 days. This was not statistically significant (Mann-Whitney; p=0.7357).

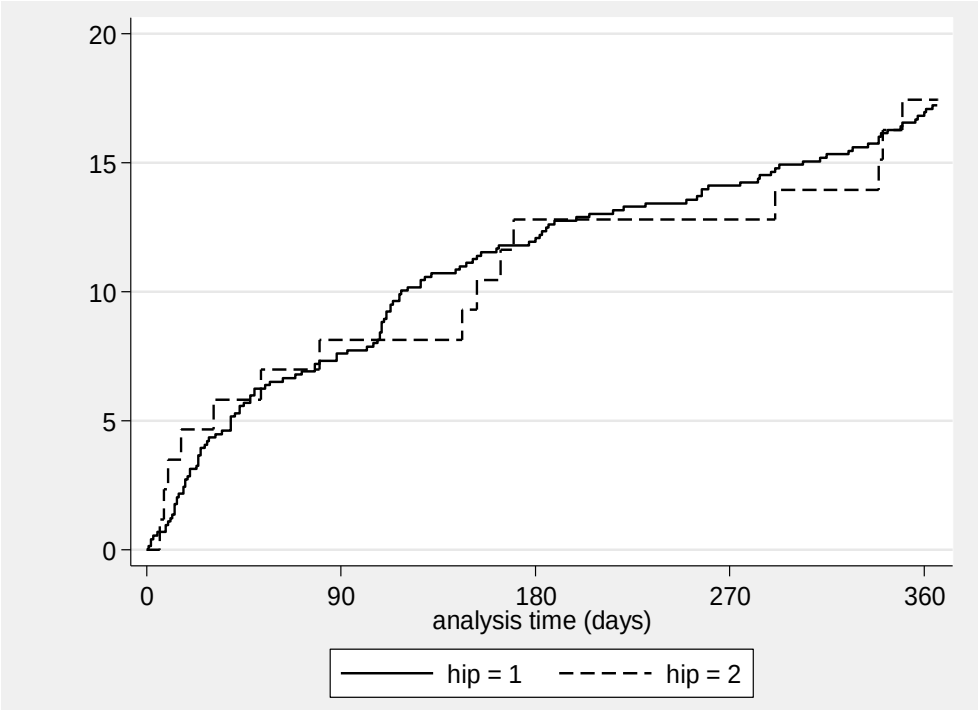
Table 1: Variable Comparison between 1st Hip Fracture & 2nd Hip Fracture Groups.

		All Hip Fractures (%)		1st Hip Fractures (%)		2nd Hip Fractures (%)		Statistically Significant Difference?
n		822	**100.0**	736	**89.5**	86	**10.5**	
Sex	Male	254	**30.9**	233	**31.7**	21	**24.4**	No
	Female	568	**69.1**	503	**68.3**	65	**75.6**	
Age	Median	80		80		83.5		**Yes (p = 0.0065)**
ASA	I	18	**2.2**	17	**2.3**	1	**1.2**	**Yes (p = 0.005)**
	II	269	**32.7**	252	**34.2**	17	**19.8**	
	III	377	**45.9**	326	**44.3**	51	**59.3**	
	IV	38	**4.6**	30	**4.1**	8	**9.3**	
	V	0	**0.0**	0	**0.0**	0	**0.0**	
	Unknown	120	**14.6**	111	**15.1**	9	**10.5**	
Discharge Destination	Home	270	**32.8**	249	**33.8**	21	**24.4**	No
	Nursing Home	262	**31.9**	228	**31.0**	34	**39.5**	
	Hospital Transfer*	242	**29.4**	217	**29.5**	25	**29.1**	
	Died	46	**5.6**	40	**5.4**	6	**7.0**	
	Unknown	2	**0.2**	2	**0.3**	0	**0.0**	
LOS	Median	14		14		15		No
	Range	3	**238**	3	**238**	5	**226**	
Mortality	30 Days	36	**4.4**	32	**4.3**	4	**4.7**	No
	1 Year	142	**17.3**	127	**17.3**	15	**17.4**	No

**Transfer to Referring Hospital/Rehabilitation – final discharge destination not recorded in database*

In relation to mortality, the in-patient mortality for the HF1 group was 5.4% and the HF2 group was 7%. The HF1 30-day mortality rate was 4.3% and the HF2 30-day mortality rate was 4.7%. The 1-year mortality for the HF1 group was 17.3% and the HF2 group was 17.4%. There were no statistically significant differences in in-patient mortality, 30-day mortality or 1-year mortality between both groups.

Figure 1: Time (1-year) & Mortality Graph Comparing 1st & 2nd Hip Fracture Groups.



The 2nd hip fracture group

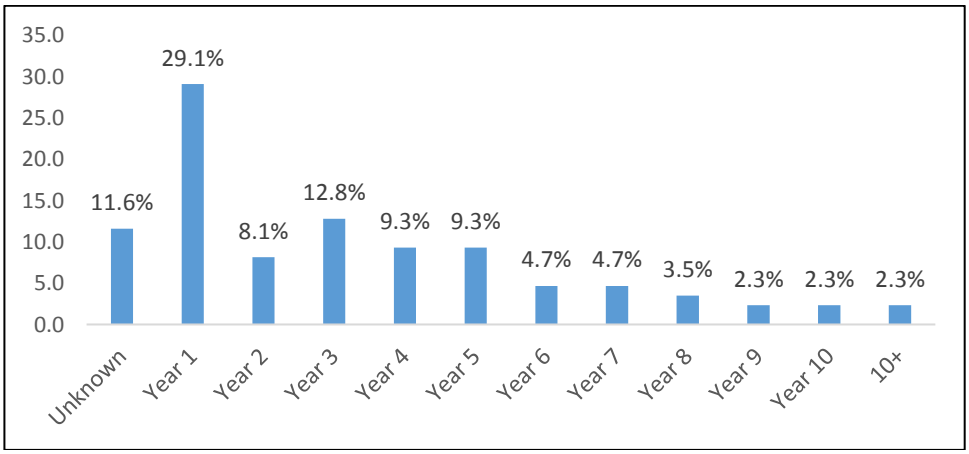
86 patients (10.5%) of the 822 total patients were treated for a 2nd hip fracture. The 2nd fracture group as a percentage of total surgically managed hip fractures (Table 1) from 2013-2017 were as follows; **2013**; *10.7%*, **2014**; *7.3%,* **2015**; *13.6%*, **2016**; *12.2%*, **2017**; *9.5%*. The mean percentage over the 5 years was 10.5%.

Table 1: Annual Prevalence of 2nd Hip Fractures.

Year	2013	2014	2015	2016	2017	Mean
2nd Hip Fractures (%)	10.7	7.3	13.6	12.2	9.5	**10.5**

The 2nd hip fracture most commonly occurred in the 1st year (29.1%) following the patient's index hip fracture (Figure 1). 8.1% occurred in the 2nd year and 12.8% in the 3rd year. In years 4 and 5, 9.3% occurred in each year. After year 5, <5% occur annually. 11.6% of the cohort had an unknown duration between their 1st and 2nd hip fracture (index radiographs not archived on PACS/other imaging system utilised). The median time between HF1 and HF2 was 2.5 years.

Figure 1: Time (in years) between 1st & 2nd Hip Fractures (n = 86).



There were no statistically significant differences in relation to which fracture types occurred as first or second hip fractures. There was fracture type symmetry (HF1=HF2) in 70% of the cases. Hip fracture management modality was symmetrical in 56.5% (Bipolar Hemiarthroplasty 35.3%, Intramedullary Nail 11.8% & Dynamic Hip Screw 9.4%). In the remaining cases (43.5%), an asymmetric pairing of the above modalities was utilised.

Discussion

Over the past ~30 years, the evidence base/guidelines/clinical standards surrounding hip fracture care have improved secondary to efficacious international audit. The IHFD continues to audit hip fracture management in Ireland and is successfully driving improvements across multiple facets of care. As patients are living longer, it is expected that there will be an increase in the prevalence of those experiencing a contralateral 2nd hip fracture. This cohort has not been studied in the Irish context thus far.

736 patients (89.5%) were treated for a 1st hip fracture (HF1) and 86 patients (10.5%) were treated for a 2nd hip fracture (HF2). There was a higher percentage of females in the HF2 group (76% vs. 68%). The median age in the HF2 group was older (83.5 vs 80 years). There were more patients categorised as ASA III & IV in the HF2 group. A higher proportion of females, older patients and increased ASA scores in those with contralateral hip fractures have been published previously[14,15].

In relation to discharge destination, less patients in the HF2 group were discharged home (24.4% vs. 33.8%) and more patients were discharged to a nursing home (39.5% vs. 31%).

As the discharge destination of the patients who were transferred to their primary referring hospitals following surgery is unknown, the overall figures of those discharged (i) home, to (ii) short-term rehabilitation or to (iii) long-term care are unknown. However, the percentages above echo the data in the literature[16] in relation to increased discharges to long-term care and a further loss of independence following a 2nd hip fracture.

The length of stay was similar in both groups (HF1; 14 days, HF2; 15 days). A similar length of stay is consistent with the published literature[17]. Whilst it may be assumed that a 2nd hip fracture may require a longer in-patient stay, a number of factors mitigate for this including (i) nursing home physiotherapy provision which can expedite discharge and (ii) improved adaption secondary to skills developed following HF1.

There were no statistically significant differences in mortality rates during the in-patient stay, after 30 days or 1 year (HF1 vs HF2; inpatient 5.4% vs. 7%, 30-day 4.3% vs. 4.7%, 1-Year 17.3% vs. 17.4%). Figure 1 shows a similar mortality trend over the 1st year following HF1 and HF2. These results were unexpected. A recent large Canadian hip fracture study[18] (n=42,435, 15-year follow up) reported excess mortality associated with a HF2 beyond that associated for increased age. Increased HF2 related mortality has also been recently reported in a large British study[15].

86 patients or 10.5% of the overall surgically managed hip fracture cohort (2013-2017) were those being treated for a HF2. The annual prevalence is consistent and no positive/negative trend was evident over the 5-year period (R^2=0.02642). Further long term annual audit is recommended in order to detect any positive trends secondary to the predicted increased hip fracture burden or negative trends secondary to improved secondary prevention of hip fractures. As the patient characteristics of those being treated throughout Ireland for hip fracture are similar, it may be possible that ~1/10 of the annual national hip fracture cohort (~375 patients) are HF2s. The Irish annual HF2 figure is currently unknown. The management of this estimated number of hip fracture patients would cost the tax-payer approximately €5.36 million annually. This further emphasises the importance of secondary prevention in this cohort.

The median time between HF1 and HF2 (2.5 years) in this study is similar to other peer-reviewed study findings[19]. The HF2 most commonly occurred early (Y1; 29%, Y2; 8.1%, Y3;12.8%) with ~50% occurring within years 1-3 post HF1. Again, this is similar to international findings[20]. The time-related data is important to consider in relation to optimising pharmacological secondary prevention. It has been shown that it may require up to 12-18 months of osteoporosis drug therapy to prevent ~50% of hip fractures[21]. This further stresses the importance of early initiation of bone protecting medications post HF1 to reduce the risk of HF2 and other osteoporosis-related fractures.

There was fracture-type symmetry in 70% of the HF2 cases. A number of factors have been implicated to explain this symmetry, which has been repeatedly shown in the literature[22] (64-83%), however the cause remains unknown.

A limitation of this study was related to the information provided via radiograph review for the total cohort (n = 822). A small number of patients had a total hip replacement on the opposite hip to a bipolar hemiarthroplasty/ intramedullary nail/ dynamic hip screw/ cannulated screw. As we know from previous research at our institution that <5% of hip fractures are treated with total hip replacement, these patients were allocated to the HF1 cohort as the THR was significantly more likely implanted for the treatment of osteoarthritis. This also means that the overall number of HF2s is likely marginally higher than estimated in this study.

Patients with HF2s comprise a significant and stable proportion of all hip fractures treated in Tallaght University Hospital. We advocate for the national prospective routine collection of HF2 prevalence in order to monitor secondary prevention of hip fracture. Secondary prevention of hip fractures is possible and of significant benefit[23]. The FLS represents an invaluable life-ring amidst the rising tide of the "silver tsunami" and we advocate for its provision across each of the 16 hip fracture operating hospitals in Ireland.

Declaration of Conflicts of Interest:
The authors have no conflicts of interest to disclose.

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