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ORIGINAL ARTICLE

Dedicated orthogeriatric service reduces hip fracture mortality

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Abstract
Background Hip fracture is a common serious injury afflicting the geriatric population and is associated with poor clinical outcomes, functional and walking disabilities and high 1-year mortality rates. A multidisciplinary approach has been shown to improve outcomes of geriatric patients with fragility fracture.
Aims We piloted a dedicated orthogeriatric service for hip fracture patients to determine if the service facilitated a change in major patient outcomes, such as mortality, length of stay and dependency.
Methods A dedicated orthogeriatrics service for hip fracture was established as a collaborative project between the Department of Geriatric Medicine and Department of Orthopaedic Surgery at a university teaching hospital. Orthogeriatrics service data were collected prospectively on an orthogeriatric filemaker database from July 2011 to July 2012 ($N = 206$). Data were compared to previously recorded data (Irish Hip Fracture Database) on a cohort of hip fracture patients admitted to the same orthopaedic trauma unit from July 2009 to July 2010 ($N = 248$).
Results Patients in the orthogeriatric service group experienced significant reductions in 1-year mortality ($\chi^2 = 13.34$, $P < 0.001$), length of acute hospital stay ($U = -3.77$, $P < 0.001$) and requirements for further rehabilitation ($\chi^2 = 26.59$, $P < 0.001$). Patients in the pre-service establishment group were significantly more dependent following their fracture than the patients in the orthogeriatric service group ($\chi^2 = 5.34$, $P = 0.021$).
Conclusions A multidisciplinary management approach to fragility fracture of the femoral neck that involves comprehensive geriatric assessment, daily medical involvement of a geriatric team and specialised follow-up assessment leads to a significant reduction in mortality and improved outcomes.

Keywords Orthogeriatric · Fragility fracture · Neck of femur · Hip fracture · Comprehensive geriatric assessment

Introduction

Ireland has an aging population with 535,393 people, or 11.6 % of the population, aged 65 years or over in 2011 [1]. It is estimated that this figure will increase to up to 728,606 people by 2021 [2]. As the older population continues to grow, optimizing the management of fragility fractures is becoming a widespread imperative, with 35 % having at least one serious comorbidity [3]. Femoral neck fracture is the most common serious injury afflicting older patients [4]. It is associated with poor clinical outcomes, functional and walking disabilities and 1-year mortality rates ranging from 14 to 36 % [5]. Fewer than half of older patients who fracture a femoral neck will return to their pre-fracture functional status [6]. A multidisciplinary approach has been shown to improve the outcomes of older patients with a fragility fracture [7]. Coordinated multidisciplinary care leads to reduced mortality and

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complications, earlier functional independence and reduction in institutional care in these patients [8–13]. Additional benefits may accrue from receiving a geriatric assessment that takes into account their unique psychological, social and functional needs [11]. Our group has previously shown significant improvements in care and outcomes in stroke patients following comprehensive geriatric care [15]. There is evidence that older patients with femoral neck fractures benefit from multidisciplinary Orthogeriatric care [8]. We piloted an Orthogeriatric service (OG) for femoral neck fracture patients at an Irish University hospital to determine if there was a change in major patient outcomes, such as mortality and dependency before and after establishment of the service.

Materials and methods

Prior to the commencement of the study, local ethical approval was received from the University Hospital Limerick's Research Ethics Committee.

Description of service

An OG service was established in July 2011 as a collaborative pilot project between the Department of Medicine for the Elderly and Department of Orthopaedic Surgery at a University teaching hospital. All patients with a fragility fracture of the femoral neck received a comprehensive geriatric assessment, daily medical involvement of a geriatric team and specialized follow-up assessment of bone and vascular health.

Participants

All patients admitted with fragility hip fracture between July 2011 and July 2012 ($N = 206$) were seen by the OG. A comparative group was obtained from the Irish Hip Fracture Database and consisted of all patients admitted to the same hospital with fractured neck of femur between July 2009 and July 2010 ($N = 248$).

Each patient in the OG group received a comprehensive geriatric medical assessment perioperatively, which included full medical history and examination as well as routine pre-op blood tests, ECG and chest X-ray. Any medical condition was addressed perioperatively and managed closely. Bone health and falls assessments were performed postoperatively and at follow up. Each patient was offered follow up at a dedicated fracture liaison secondary prevention clinic. The falls assessment initially involved a thorough history of previous falls as well as mobility and balance assessment by the ward physiotherapist. Patients who were identified at high risk were offered further outpatient falls risk assessment, which consisted of head up tilt test and ambulatory cardiac and blood pressure monitoring. All patients received laboratory testing of serum calcium, parathyroid hormone and Vitamin D levels and were offered a DEXA scan.

The comparative group received the usual standard of care, which consisted of standard orthopedic care with medical, or geriatric consults received on an as requested basis.

Outcome measures

The main outcome measures included differences in length of hospital stay, mortality rates, use of medical and rehabilitative services and level of dependency on discharge between the two groups.

Statistical analysis

All patient data for the intervention group were collected prospectively on a newly developed Orthogeriatric database using Filemaker Pro 12 (Santa Clara, CA). This database was created to accommodate extra information collected by the OG service for future research purposes. Data were compared to previously recorded electronic data (Irish Hip Fracture Database) on a cohort of hip fracture patients admitted to the same orthopaedic unit from July 2009 to July 2010, which was collected reliably by a dedicated specialist nurse.

Statistical analyses were performed using SAS-JMP 10 statistical software (Cary, NC). Statistical significance was considered at $P < 0.05$. Mann–Whitney and Chi square analyses were used to evaluate outcome measures as appropriate.

Results

There were 248 patients in the comparative group of which 66 % were female. The median age was 82 years (range 44–96). In the intervention group there were 206 patients with a median age of 82 years (range 54–100) and 73 % were female. Outcomes of mortality, hospital length of stay, inpatient medical consults, requirements of further rehabilitation and dependency in long-term care requirements can be seen in Table 1.

Comorbidities and complications

There was a median of three comorbidities per patient (range 0–10) in the OG service group. Common comorbidities were dementia (24 %), osteoporosis (19 %), previous fracture (19 %) and recurrent falls (12 %). Thirty-

Table 1 Main Outcome Measures and corresponding statistical analyses for pre/post OG establishment

	July 2009–July 2010 (pre-service establishment) $N = 248$	July 2011–July 2012 (OG) $N = 206$
Length of acute hospital stay (days)[a]	Median = 10 (range 2–56)	Median = 8 (range 2–71)
	$U = -3.77$, $P < 0.001$	
In hospital mortality rate	11 (4.4 % of patients)	4 (1.9 % of patients)
	$\chi^2 = 2.19$, $P = 0.14$	
One-year mortality rate[a]	47 (19 % of patients)	20 (9.7 % of patients)
	$\chi^2 = 13.34$, $P < 0.001$	
Medical consults required[a]	36 (15 % of patients)	13 (6 % of patients)
	$\chi^2 = 7.14$, $P = 0.008$	
Requirement of further rehabilitation[a]	148 (60 % of patients)	82 (41 % of patients)
	$\chi^2 = 26.59$, $P < 0.001$	
Discharge destination[a]	56 % home (Δ-26.8 %)	72 % home (Δ-9.0 %)
	29 % nursing home (Δ12.4 %)	27 % nursing home (Δ9.4 %)
	$\chi^2 = 5.34$, $P = 0.021$ + mortality accounts for remainder	

The *delta* represents change from admission/discharge location; as an example, Δ-26.8 % indicates that 26.8 % of the patients who lived at home before their fracture were not discharged back to their home, either they were deceased or discharged to a nursing home

[a] Indicates statistical significance

eight percent of the OG patients experienced one or more post-operative complications, inclusive of both medical and surgical. The most common complication experienced was bowel or bladder disturbance (11.4 %), followed by respiratory tract infection (9.5 %), anaemia requiring blood transfusion (5.7 %) and delirium (3.4 %). Data relating to comorbidities and complications experienced are not available for the comparative group.

Surgical delay

There was a statistically significant difference in surgical delay between the two groups. The comparative group had 73.7 % of patients and the intervention had 61.9 % of patients operated on within 48 h of presentation to hospital ($\chi^2 = 10.6$, $P = 0.001$). Reasons for delay were recorded categorically as either logistical, for example admission bed or theatre space unavailability, or medical, such as waiting medical review/investigation and medical instability. Although the reasons for delay in the intervention group were 36 % medical and 64 % logistical, this was not significantly different than the comparison group at 43 % medical and 57 % logistical ($\chi^2 = 1.14$, $P = 0.29$).

Discussion

Patients in this study were of similar age [4, 8, 10, 11, 16–19] and predominantly female [4, 11, 16–19] when compared to other femoral neck fracture OG evaluation studies.

Length of stay

This study demonstrated that an OG service significantly reduced length of acute hospital stay, however this result has variable support in literature [4, 8, 17, 19–21]. These wide variations may be due to the heterogeneity in the models of Orthogeriatric care studied [14]. This suggests that perhaps there is an optimal model of Orthogeriatric care for femoral neck fracture.

The median length of stay for both groups in this study are less than many others reported in literature [4, 8, 11, 17, 19, 21] with the exception of an American based study [18]. The substantial difference in structure, in terms of balance between acute and rehabilitative care, and high cost of multisourced funding of the American health care system is likely responsible for the shortest hip fracture hospital stay reported. In our study it is possible that access to multiple rehabilitation units explain the overall shortened length of stay compared to other studies. This is in contrast to another Irish study, which has length of stays that are two to three times higher than our study findings [4]. This suggests that rehabilitation resource allocation may be as important as the availability of specialist consultation.

Surgical delay

Since the recognition that delay to hip fracture repair surgery can have a negative effect on patient outcomes there has been a focus on reducing surgical delay, specifically targeted to keeping delay to less than 48 h [7]. There are

mixed reports as to what is considered an acceptable delay and at what time that delay negatively impacts on patient outcomes [22]. Confounding the evidence is the multi-morbid nature of this patient population. Surgery as early as possible is most beneficial for those patients who are medically fit whereas surgical delay to allow for medical optimisation of the multi-morbid patient is of most benefit for these individuals [22]. Practitioners' judgment and medical expertise are integral in balancing the need for expedient surgery with medical optimisation. In this study, the OG service group had significantly more patients with delayed surgery, yet patient outcomes were improved over the comparative group. Delays were largely attributed to administrative or resource constraints with medical reasons in the minority for both groups. This study has no specific data that would help to analyse the potential reason(s) behind the improved outcomes in the intervention group being associated with greater delay to surgery. However, it is conceivable that optimization of medical conditions preoperatively may have contributed to balancing the medical and surgical needs of the patient contributing to overall improved patient outcomes during an extended pre-operative period.

Mortality

The OG service significantly decreased 1-year mortality rate in patients who fractured a neck of femur from 19 % (pre-service) to 9.7 % which is well below published rates of 14 % to 36 %, typically seen in this population [5]. As with in-hospital mortality and length of stay outcome measures, some studies have shown a significant reduction in 1-year mortality rates with an OG service [4, 8, 20, 23] while others found no difference [17, 21]. The success of this service could be attributable to three main components of its service delivery: comprehensive geriatric assessment [24], daily medical involvement of a geriatric team [25] which was continued through outpatient follow-up [25]. Since a multimodal approach to management of the OG service patient group was used it is impossible to say what specific component or intervention contributed to reduction in 1-year mortality. However, addressing factors which may have contributed to the initial fracture in selected individuals has been shown to have a positive outcome for patients in another study [26]. For the Orthogeriatric service group in this study, specialised and targeted follow-up relating to vascular and bone health assessments by a dedicated falls investigation unit may have contributed to the reduction in 1-year mortality.

OG services have been shown to provide a statistically significant reduction in in-hospital mortality rates [8, 17, 20, 27], however this study's service demonstrated a non-significant reduction, which may be partially due to lack of statistical power with a low number of patient deaths. Alternatively, this discrepancy could be due to the fact that individual studies comparing effects of OG establishment may have discrepancies in comorbid disease burden of the populations being compared, which may explain the marked decrease in in-patient mortality seen with the establishment of their service [3]. Although this study cannot comment on the pre-service group's disease burden, as that data was not recorded, the disease burden of the OG service group is consistent with other studies reporting on the rates of disease burden in geriatric femoral neck fracture patients [4, 17–19, 27]. Additionally, the OG service group in-hospital mortality rate of 1.9 % is in keeping with other published rates of 0.6–4.7 % [10, 14, 15, 19].

Discharge destination

Relative functional dependency is often reflected by one's residential status, such that residing in a nursing home implies some degree of dependency in mobility, cognition and continence [28]. Therefore, a patient admitted from his or her own home to the hospital who is subsequently discharged into nursing home care implies a relative increase in functional dependency. One of the aims of OG services for femoral neck fracture patients is preservation of functional independence. Our study showed an increase in patients returning to their own home and a reduction in the number of new nursing home admissions post-fracture in patients who were seen following the establishment of an OG. This is similar to other studies [4, 8, 10, 11, 19], although this improvement in patient outcomes is not found by all [21, 27]. In this study, the improvements observed in preservation of functional status may be due to earlier assessment and targeted intervention as well as appropriate referring of patients from acute care to rehabilitation or other care destinations. Fewer patients in the OG service group required further rehabilitation than before the service was established, yet patient outcomes significantly improved with the service.

Complications and comorbidities

The complication rate in the OG service group was 38 %, which is lower than other published rates of 45–57 % [17]. Limited conclusions can be made on the effect of the OG service on complication rates as these were not recorded for the pre-service group. The specific type of complication experienced by patients in our study is consistent with other studies [3]; for example respiratory tract infections occurred in 13 % of patients as compared to 9 % of patients in another study [3]. Dementia is a common comorbidity in this patient population. The prevalence of this disease in our study population was 24 % of patients,

which is similar to other published rates of 23–39 % [19]. Similarly, recurrent falls was seen in 12 % of our study population compared with 14 % in other studies [3]. Since both the number and type of comorbidies, dementia in particular [29], are prognostic factors for survival following femoral neck fracture [3, 30] appropriate medical management is essential in ensuring better patient outcomes.

The synergy of medical and surgical care in this OG service demonstrated that a multidisciplinary approach to the patient with fragility fracture of the femoral neck, involving comprehensive geriatric assessment, daily medical involvement of a geriatric team and specialised follow-up assessment leads to a significant reduction in mortality and improved functional outcomes.

Compliance with ethical standards

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Conflict of interest There are no conflicts of interest.

Ethical standards Prior to the commencement of the study local ethical approval was received from the University Hospital Limerick's Research Ethics Committee; this study has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Data for this study was collected as an audit and no identifying patient factors were included.

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