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Hip fractures in the older adult: orthopaedic and geriatric shared care model in Southland, New Zealand—a 5-year follow-up study

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ABSTRACT

Background Neck of femur fractures are common with associated high morbidity and mortality rates. National standards include provision of orthogeriatric care to any patient with a hip fracture. This study assessed the outcomes at 5 years following implementation of a collaborative orthogeriatric service at Southland Hospital in 2012.

Methods Retrospective data were collected for patients aged 65 years and older admitted with a fragility hip fracture. Data were collated for 2011 (preimplementation) and 2017 (postimplementation). Demographic data and American Society of Anesthesiologists (ASA) scores were recorded to ensure comparability of the patient groups. Length of stay, postoperative complications and 30-day and 1-year mortality were assessed.

Results 74 admissions with mean age at surgery of 84.2 years in 2011 and 107 admissions with mean age of 82.6 years in 2017. There was a higher proportion of ASA 2 and ASA 3 patients in 2017 compared with 2011 (p=0.036). The median length of stay in the orthopaedic ward was unchanged in the two cohorts but there was a shorter median length of stay by 6.5 days and mean length of stay by 11 days in 2017 in the rehabilitation ward (p<0.001 for both median and mean). Through logistic regression controlling for age, sex and ASA score, there was a reduction in the odds of having a complication by 12% (p<0.001). The study was too small to undertake statistical testing to calculate significant difference in overall 30-day and 1-year mortality between the groups.

Conclusion The orthogeriatric service has reduced the frequency of complications and length of stay on the rehabilitation ward 5 years following implementation.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The adoption of a multidisciplinary approach to the care of patients with neck of femur fractures is becoming the standard internationally, as well as in New Zealand. The Hip Fracture Care Clinical Care Standard was launched in September 2016; one of these standards was that care was offered based on an orthogeriatric model of care. Since these guidelines have been implemented, there has been a steady roll out and uptake since with more than 14 000 hip fractures across Australia and New Zealand captured in the registry in 2020. There have been no medium-term post-implementation follow-up studies of orthogeriatric care in New Zealand.

WHAT THIS STUDY ADDS

⇒ To our knowledge, this is the first study in New Zealand demonstrating medium-term post-implementation follow-up of an orthogeriatric shared care model for patients admitted with neck of femur fractures. The implementation of the service has reduced length of stay and postoperative complications but not significantly impacted on mortality.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The results of this study may be of benefit to other hospitals, in particular secondary-level hospitals, looking to either establish, implement or modify their current collaborative care arrangement, and will add to the growing body of literature supporting the use of orthogeriatric multidisciplinary care.

INTRODUCTION

Fractures of the neck of femur are common in the older adult with significant mortality rates of up to 8%% at 30 days and 27% within the first year following injury.[1 2] This has prompted the introduction of National Registers and guidelines aimed at improving care for this cohort of patients.[1–3] Up to 60% of patients experience a decrease in mobility after recovery from a neck of fracture.[4] As well as a marker of bone fragility, hip fractures indicate a patient's general frailty and high falls risk. Furthermore, medical comorbidities associated with this age group have been implicated as factors contributing to the morbidity and mortality witness and, as such, there is a move internationally towards introducing a formal orthogeriatric multidisciplinary team to optimise the patient. The role of the review includes addressing factors that may have predisposed to the initial fall, optimising perioperative management, managing

medical issues postoperatively, assessing rehabilitation potential and implementing appropriate services and addressing risk of further fragility fractures.[2] With the ageing population, it remains pertinent and timely to continue to strive for improvement in the outcomes of fragility fractures; it has been estimated that in 2050, there will be between 7 and 21 million hip fractures internationally.[5]

Southland Hospital is 157+ bed secondary level base 4 hospital in Invercargill, New Zealand. It services a 108 000 population and has 30 000 emergency department (ED) attendances each year.[6] In 2012, a shared service between the orthopaedics and geriatrics departments of Southland Hospital was implemented. The aim of this study was to assess the outcomes at 5 years post implementation. The primary outcomes of interest were length of stay (LOS) on the orthopaedic and rehabilitation wards. Secondary outcomes included the number of postoperative complications and 30-day and 1-year mortality rates. The results of this study may be of benefit to other hospitals, in particular secondary-level hospitals, looking to either establish, implement or modify their current collaborative care arrangement, and will add to the growing body of literature supporting the use of orthogeriatric multidisciplinary care.

METHODS

Patient and public involvement

Patients and public were not involved in the methodology design.

We identified patients aged 65 years and over, admitted with neck of femur fractures at Southland Hospital, Invercargill, New Zealand during the calendar year of 2011. Patients with periprosthetic fractures or multiple fractures were excluded. Physical and electronic medical records were scrutinised to ascertain patient demographics (gender, age), place of residence preadmission (home, rest home, nursing level care, other), patient comorbidities, ASA score as recorded by the anaesthetist, time to theatre (from hospital presentation to surgery time), type of operation undertaken, postoperative complications, length of inpatient stay on the orthopaedics and rehabilitation wards and destination of discharge. Readmissions within 30 days, 6 months and 1 year of discharge, as well as the reason for readmissions, were identified. Mortality within 30 days and 1 year was recorded.

In 2012, a collaborative service between orthopaedics and geriatrics was implemented. The orthopaedic surgery team provided daily ward rounds focusing on the surgical and orthopaedic management. Meanwhile, a consultant geriatrician provided twice weekly ward rounds of acute inpatients over the age of 65 years (or 55 years and older for Māori and Pacific Peoples) for orthopaedic patients with acute fragility fractures, including neck of femur fractures. A comprehensive geriatric model of care framework is used in the assessment of the patients in this cohort, aligned with the best practice guideline published by the Australian and New Zealand Hip Fracture Registry (ANZHFR). Specifically, this included assessment of the mechanism of falls and ongoing falls risk, osteoporotic risk factors, optimisation of current comorbidities, assessment and identification of dementia and delirium during their hospitalisation stay, problematic polypharmacy and appropriate deprescribing, malnutrition assessment and management, alcohol and smoking history, frailty assessment, and assessment of home environmental factors and social support. Additionally, shared goals of care are established and documented, identification of nosocomial infection and other hospital complications and prevention including pressure injury, inpatient falls, review of catheterisation and prevention of hospital falls. A standardised metabolic blood tests screening (including electrolytes, renal function, complete blood count, calcium/phosphate/parathyroid hormone axis, liver function, thyroid function, B_{12}/folate levels, glycosylated haemoglobin, iron studies) was performed. Additional testing might be conducted as guided by clinical needs including neuroimaging, ECG and chest radiography. A standardised management plan was often instituted based on the premises of the Early Recovery After Surgery model of care and the Hospital Elder Life Program developed by Sharon Inouye and her collaborators.[7 8]

Communication to pertinent family members as often conducted during the ward round, which often assists with discharge planning. This included expedition of transfer to the inpatient rehabilitation ward on liaising with both the charge nurses in surgery and rehabilitation wards, which are co-located within the same hospital, and the rehabilitation was overseen by the two geriatricians involved in the orthogeriatric service, thus allowing continuity of care.

The geriatrician frequently liaised with the surgical ward Charge Nurse and led an informal interdisciplinary team discussion regarding the postoperative care for these patients. Routinely, patients are assessed and ambulated on the first postoperative day unless medically unstable. This is conducted primarily by the ward physiotherapist, with other allied health staff in the surgical ward co-opted in when required, and often proactively involved if the patient is discharged from hospital directly back to their place of abode. A formal functional assessment was conducted in the inpatient rehabilitation ward, with outcomes measured via the Australasian Rehabilitation Outcomes Centre (AROC) primarily using the Functional Independent Measure tool weighted against other variables.[9]

During this time period, a systematic assessment of delirium screening were implemented with education provided to the nursing staff using the 4AT delirium screening tool. Any score greater than 4 on the 4AT would trigger a medical assessment for delirium and management of this.[10]

The geriatrician would also attend the weekly orthopaedic departmental radiology conference to facilitate a collaborate discussion on the complex care of these

patients. Additionally, there is ad hoc input from the geriatrician to assist the orthopaedic service with perioperative management of older patients undergoing orthopaedic surgery including shared decision-making process. Any acute medical issues are reviewed by the Acute Medical service outside of the review hours by the geriatrician.

A formalised fast-track ED ward protocol was not established during the time of the study, although there was ad hoc practice in expediting transfer from ED to the orthopaedic ward. During the study period, a fascia-iliacus block was not standardised, but was encouraged.

2017 marked the fifth year of the shared care orthogeriatric service at Southland Hospital. Retrospective data collection was performed for all patients aged 65 years and over admitted with neck of femur fractures in the 2017 calendar year.

Statistical analysis

Data was analysed using Stata V.16 (StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC). Descriptive summaries were produced and simple comparisons made using χ^2 tests (for categorical variables), a comparison of two proportions (comparing complication proportions) and a Wilcoxon rank-sum test (comparing median LOS). Logistic regression was used to look at whether having a complication was related to the year, sex, age and preanaesthetic medical comorbidities. All data was deidentified.

RESULTS

Overview of cohort

In 2011, there were 74 admissions, 21 male and 53 female, and in 2017 there were 107 admissions, 25 male and 82 female. There were five patients who sustained a neck of femur fracture within the same year on the contralateral side to their first injury, and thus had two admission episodes included in the results (two patients in 2011 and three in 2017). A sensitivity analysis was completed, and it showed that excluding the second of the two admissions did not make any difference to the findings; therefore, all admissions were included for analysis.

Patient characteristics are summarised in table 1.

The average age at time of surgery in 2011 was 84.2 (SD 8.0), and in 2017 it was 82.6 (SD 7.7) (p>0.05).

In 2011, 42 admissions (57%) were from their own home compared with 68 admissions (64%) in 2017, the remainder being admitted from either a rest home or hospital level of care.

There was no significant difference in the demographics of the two cohorts with respect to age at the time of surgery, sex or place of residence, as demonstrated in table 2.

Table 3 lists the surgeries performed and reports on whether there is an association between the year and which type of surgery was performed. In 2017, there were more hemiarthroplasties and total hip replacements performed than in 2011. In 2011, there were more cannulated screw fixations, dynamic hip screw fixations and long intramedullary nails.

Table 1 Characteristics of admissions (n=181) for the years 2011 and 2017

Characteristic	Year of admission	
	2011	2017
	Mean (SD)	
Age at time of surgery	84.2 (8.0)	82.6 (7.7)
	n (%)	
Sex		
Male	21 (28.4)	25 (23.4)
Female	53 (71.6)	82 (76.6)
Place of residence		
Own home	42 (56.8)	68 (63.6)
Rest home	25 (33.8)	31 (29.0)
Nursing home	5 (6.8)	8 (7.5)
Other	1 (1.4)	0 (0.0)
Missing	1 (1.4)	0 (0.0)
Number of complications		
0	21 (28.4)	46 (43.0)
1	30 (40.5)	42 (39.3)
2	14 (18.9)	15 (14.0)
3	9 (12.2)	4 (3.7)
	Median (min, max)	
Length of stay		
Orthopaedics	7 (1, 132)	7 (1, 28)
Rehabilitation	15.5 (1, 63)	9 (0, 31)
Overall	13 (1, 140)	16 (1,42)

Length of stay

Because lengths of stay in hospital tend to have many people in the shorter timeframes and very few in the longer times, it was considered more appropriate to look at medians rather than means. In 2011, the median stay in the orthopaedic ward was 7 days—the same as in 2017. In 2011, however, the longest stay was 132 days while it was only 28 in 2017. In 2011, the median stay in the rehabilitation ward was 15.5 days and only 9 in 2017. This represents a significantly shorter median stay (p<0.001). The longest stay in the rehabilitation ward in 2011 was 63 days and it was 31 days in 2017.

If we are to look at the mean LOS, in 2011 the mean LOS on the orthopaedic ward was 9.8 days (SD 15) and 20.4 days (SD 15) on the rehabilitation ward, compared with 2017, 7.5 days (SD 3.8) and 9.4 days (SD 8.2) on the orthopaedic and rehabilitation wards, respectively. This difference was statistically significantly different for the rehabilitation ward LOS (p<0.001) but not for the orthopaedic ward LOS (p=0.138) or the overall LOS (p=0.405). In 2011, 32/74 patients (43%) were transferred to the

Table 2 Comorbidities

ASA Class	Year of admission 2011	2017
	n (%)	
Normal/healthy (ASA=1)	1 (1.4)	3 (2.8)
Mild systemic disease (ASA=2)	5 (6.8)	13 (12.2)
Systemic disease that limits activity (ASA=3)	42 (56.8)	69 (64.5)
Systemic disease that is a constant threat to life (ASA=4)	9 (12.2)	13 (12.2)
No documentation (ASA=9)	15 (20.3)	5 (4.7)
Missing	2 (2.70)	4 (3.8)

rehabilitation ward while in 2017, 106/107 (99%) of patients were transferred to rehabilitation.

Complications

Logistic regression was used to investigate whether the proportion of admissions resulting in a postoperative complication was different in the 2 years when adjusting for sex, age at surgery and ASA. The results suggest that the odds of having a complication in 2017 were lower by approximately 12% (OR: 0.881; 95% CI 0.781 to 0.994). The severity of comorbidity was also very important. The odds of having a complication was 30 times higher in patients with ASA IV compared with ASA I and II (which were combined for this analysis), regardless of year of admission and controlling for sex and age (OR: 29.7; 95% CI 3.12 to 283.1).

There was not an important difference in the number of readmissions within 30 days between 2011 and 2017 (3/74 and 4/107, respectively).

Mortality

The study size is too small to calculate statistical significance. Mortality at 30 days was 13.7% (10/74) in 2011 compared with 6.8% (7/107) in 2017 and mortality at 1 year was 31.5% (23/74) in 2011 compared with 23.3% (24/107) in 2017.

Table 3 Surgeries performed

Surgery	Year of admission 2011	2017	P value*
	n (%)		
No surgery	2 (2.7)	3 (2.8)	
Cannulated screw fixation	15 (20.3)	7 (6.5)	0.005
Plate screw fixation	36 (48.7)	25 (23.4)	<0.001
Hemiarthroplasty	18 (24.3)	37 (34.6)	>0.05
Total hip replacement	2 (2.7)	16 (15.0)	0.007
Nail-short	0 (0.0)	4 (3.7)	
Nail-long	0 (0.0)	14 (13.1)	0.001
Girdlestones	1 (1.4)	0 (0.0)	

*χ^2 test.

DISCUSSION

The implementation of a consultative orthogeriatric model of care was associated with a statistically significant decreased LOS in the inpatient rehabilitation unit. This occurred in the context of a reduction in 30 days and 1 year mortality rate, and an increase in the ASA score.

The adoption of a multidisciplinary approach to the care of patients with neck of femur fractures is becoming the standard internationally, as well as in New Zealand. In 2014, the Trans-Tasman acute hip fracture care guidelines were published and a hip fracture registry information technology platform was developed, with pilot sites collecting data towards the end of the year.[2] The Hip Fracture Care Clinical Care Standard was subsequently launched in September 2016; one of these standards was that care was offered based on an orthogeriatric model of care.[11] Since these guidelines have been implemented, there has been a steady roll out and uptake since with more than 14 000 hip fractures across Australia and New Zealand captured in the registry in 2020.[2]

Orthogeriatric care involves managing medical comorbidities, optimisation for surgery, medication review, early identification of patient's goals and care coordination to allow for multidisciplinary rehabilitation, and discharge planning liaison with primary care, including falls prevention and secondary fracture prevention.[11] A recent Cochrane review in 2021 showed there is moderate-certainty evidence that rehabilitation after hip fracture surgery, when delivered by a multidisciplinary team and supervised by an appropriate medical specialist, results in fewer cases of 'poor outcome' (death or deterioration in residential status). There was lower certainty evidence that multidisciplinary input may reduce mortality.[12]

There are different models of orthogeriatric care which have been implemented across different hospitals based on the level of care the hospital provides, number of patients, local area covered, available staffing and economic resources available. The care may take place within an orthopaedic ward with the geriatrician being either an integral part of the orthopaedic team with team involvement and shared responsibility or a consultant. Alternatively, care may take place within a geriatric ward with the orthopaedic surgeon acting as a consultant.

A recently published meta-analysis compared three different models of care: shared care between orthopaedics and geriatricians, geriatric advice within an orthopaedic ward and care within an orthogeriatric ward.[13] The results favoured the orthogeriatric ward for the largest reduction in long-term mortality and confirmed assumptions from previous work by Pepersack who felt the orthogeriatric ward would provide the greatest benefit due to the comprehensive multidisciplinary management.[14]

The orthogeriatric model of care implemented in Southland Hospital since 2012 reflects the more formalised Hip Fracture Care Clinical Standards launched from 2016 via the ANZHFR.[2] There are various models of orthogeriatric care, ranging from a true shared care model with intensive daily orthogeriatrician input, to the more common model practised in Southland Hospital with twice a week orthogeriatric consultation. Despite the lack of intensive resources, the outcomes pertaining to LOS, mortality rate and function post discharge are not that dissimilar to more intensive models of care. This might reflect the importance of patient's underlying frailty status and their comorbidities in determining the post fracture outcomes and lends credence to the need in a more formalised assessment and reporting of frailty and comorbidities in this cohort. Unfortunately, this was absent prior to the implementation of the orthogeriatric model of care, to allow meaningful discourse on any secular trend over the 5-year period of the study. One of the authors of this manuscript has had experience in working within both an intensive and a more consultative model of orthogeriatric care. The advantage of having the same geriatrician assessing the patients during their acute orthopaedic stay and subsequent rehabilitations means an improved continuity of care and smoother transition, rather than delays in waiting for another department to take over the rehabilitation care of the patient.

The 2021 Hip Report from ANZHFR showed the demographics nationally were 69% women in NZ, average age of admission was 82 years and 71% were admitted from home prior to their injury.[15] These were comparable to the patients included in this analysis; in 2011, there were 72% women and patients had an average age of 84.2 years, while in 2017 there were 77% women and patients had an average age of 82.6 years.

It is of interest to note that in 2017 there were more people residing in their own home at the time of their fracture, compared with a higher proportion of patients in Aged Residential Care Facility in 2012. This might reflect a difference in entry criteria into Aged Residential Care, with more people living with frailty being supported in their own home in more recent years. Nevertheless, fewer of our patients (57% and 64%) were admitted from their own home compared with ANZHFR where 71% of people were admitted from own home prior to injury, indicating that our patients are generally less independent prior to their neck of femur fracture. Unfortunately, we are unable to account for the missing data on ASA and the ANZHFR data collection commenced at a later date.

Of note, this study is too small to be able to demonstrate statistical difference in mortality. Our data are consistent with other published literature with no reduction in mortality rates at 30 days and 1 year.[12 13]

There have been other hospitals in New Zealand reporting on their neck of femur fracture admissions and the role of geriatric input. Auckland City Hospital initiated a 'fast track' programme to speed up patients progression following surgery to rehabilitation and noted a mean reduction of 5 days in LOS for those that were fast tracked, bringing mean LOS from 28 days down to 23 days.[16] More historical are the initial publications in 1986 from the Christchurch shared care rehabilitation service, which saw a reduction of LOS of 13.5 days for a female patient with a proximal femur fracture in the first year.[17] A decade later, in 1996, Christchurch published on the difference that a review by a geriatrician on admission to acute orthopaedics with a fractured neck of femur made in comparison to a consultation only service; the former showing a mean LOS of 20.7 days at a cost of NZ$9400 compared with a mean LOS of 27 days and a cost of NZ$11 500.[18] Following the implementation of a shared care model, a further publication in 2005 retrospectively auditing admissions found the benefits to be a low in-hospital mortality rate (0.7%) and improved functional outcomes, with the majority of patients returning to their premorbid place of domicile.[19]

To our knowledge, this is the first study in New Zealand demonstrating medium-term postimplementation follow-up of an orthogeriatric shared care model for patients admitted with neck of femur fractures. The implementation of the service has reduced LOS and postoperative complications but not significantly impacted on mortality. During the 5 years following establishment of the service, there was increased awareness and uptake nationally of inputting data to the Hip Fracture Registry and the release of the Hip Fracture Clinical Care Standard. As the standard continues to be implemented, one would hope to see a further reduction in LOS, postoperative complication rate and an impact on mortality rates.

We also noticed a change in the type of hip fracture surgeries undertaken. There are not enough data here to state what the reason for this was. Fracture pattern is the main determinant of surgery offered: intracapsular, extracapsular or subtrochanteric. However, surgeon preference is also a factor and there was a change in orthopaedic consultants during this period, which may be associated with an increase in total hip arthroplasty operations performed as the evidence base remains inconclusive when compared with a hemiarthroplasty, though these are performed on patients who, in general, are active, without a diagnosis of dementia and without significant medical comorbidities.[5 20] Again, surgical preference may be the reason behind the move away from dynamic hip screws and towards intramedullary fixation; this remains a topic of considerable debate in the literature without identifying any consistent superiority and is unlikely to have been a factor in the development of postoperative complications or time to mobilisation.[21 22] It is, however, unlikely that a change in surgeons created the differences seen in outcomes of the study especially given the ongoing debate over whether there is superiority in particular operative procedures.[5 21 22] Any change witnessed is more likely due to the larger change to service provision and implementation of an orthogeriatric model, as witnessed in other units within New Zealand.[16 17]

Our study has several limitations. First, it is a retrospective audit of case notes. We believed that having included patients admitted over a full calendar year preimplantation as well as at 5 years post implementation was a good way of measuring the medium-term effect of the orthogeriatric service. However, we do not have any short-term data and are unable to assess if the change was more rapid. At present, we are unable to confirm if the effects are sustained or not. A reduction in mortality was not identified in our study sample, though our sample size is too small based on power calculations to generate any results of statistical significance. Further larger and long-term studies are required to assess this. Second, the initial data set was collated with the intention of establishing the service. If we were to repeat that data collection, we would try and collect data more in line with the data set that the ANZHFR requires and also focus on preoperative diagnosis of dementia and new incidental delirium perioperatively.

In conclusion, implementation of the orthogeriatric model of care at Southland Hospital has reduced the frequency of complications, and the LOS on the rehabilitation ward. There has been minimal effect on mortality at 30 days and 1 year post surgery. This is the first study in New Zealand demonstrating medium-term data and may be of use to other centres wishing to implement or improve the service they offer.

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Contributors HM developed the initial idea, collected the first cohort of data, was involved in design and implementation of the service and drafted the paper. CC undertook the statistical work and drafted the paper. CV, AN and ML were involved with data collection for the second cohort and assisted in reviewing the paper. YHC and PN supervised the project, assisted with data analysis interpretation and reviewed the paper. All were involved in revising the final paper. PN is the guarantor.

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