

Length of stay and contributing factors in elderly patients who have undergone hip fracture surgery in a tertiary hospital in South Africa

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Abstract

Background: Length of stay and factors that contribute to length of stay in elderly patients who have undergone hip fracture surgery is under researched in developing countries, including South Africa. The purpose of this study was to describe the factors that increase length of stay (LOS) among elderly patients who have had hip fracture surgery.

Methods: A retrospective review of patient records of elderly (> 65 years) patients who had hip fracture surgery in a public hospital in South Africa. Descriptive statistics were used to report demographic data, LOS and frequency distributions of individual factors relating to LOS. Two sample t-tests were used to compare the LOS in patients with and without main complications reported.

Results: The mean total length of stay was 33 (19) days. Patients presented with numerous comorbidities, with hypertension (n = 93) being the most prevalent. The most frequently occurring complications included anaemia (n = 42) and wound infection (n = 21). The LOS was significantly lower for patients not presenting with wound infections compared to those who sustained a wound infection (p = 0.041). Social factors delayed departure from the hospital for 48 patients. **Conclusion:** Elderly patients who had hip fracture surgery and developed wound infections had an increased LOS. However social issues also contributed to the increase in length of stay that could be addressed by proper planning and involvement of families and care givers. The factors identified could be used as a starting point for planning services aimed at decreasing the hospital stay of elderly patients.

Introduction

Worldwide, the elderly population is increasing due to better lifestyles and improved health services. According to [Gregson et al. \(2019\)](#) the population aged 60 years and older in sub-Saharan Africa is twice as high as in Northern Europe. This increase in the aging population places a greater demand on healthcare to address the escalating needs of the elderly ([Bang et al., 2017](#); [McPake and Mahal, 2017](#)). According to South African statistics, the elderly population has increased from 2 765 991 in 2012 to 4 507 946 in 2016 ([South African Statistics, 2017](#)). The ageing population also requires an increase in the expenditure of the health budget on hospitalisation due to degenerative and/or chronic conditions and fragility fracture care ([Gregson et al., 2019](#)).

Older people sustain fragility or pathological hip fractures due to weakened bones caused by osteoporosis, tumours or chronic infections ([Kojima, 2015](#)). Many elderly people live alone and do their own household chores, increasing their susceptibility to falls. Falls are recognised as a major public health concern in terms of morbidity, mortality and the cost to health and social services for older people ([Prestmo et al., 2015](#)). Furthermore, falls are the leading cause of hip fractures and the primary aetiology of accidental deaths in persons over 65 years of age ([Sahandifar and Kleiven, 2018](#)). However, limited

information regarding hip surgery is available for Africa ([Du Toit & Van Der Merwe, 2018](#)). Patients with hip fractures are primarily treated with surgical intervention and spend around five to eleven days in hospital in developed countries ([Bohm et al., 2015](#); [Newman et al., 2017a](#); [Chen et al., 2019](#)). Length of stay (LOS), especially when prolonged, has detrimental effects on the older person's quality of life. Complications such as immobility, infection, pressure ulcers and deep-vein thrombosis increase the length of hospital stay ([Prestmo et al., 2015](#)). In addition, comorbidities such as dementia, Parkinson's disease, history of stroke, hypertension, dysrhythmias, pulmonary disease, diabetes mellitus and renal failure could increase the development of complications and prolong the LOS.

Healthcare services are seeking ways to cope with the increased demand for beds and surgery for older patients with hip fractures as the healthcare environment is characterised by ever decreasing resources ([Panteli et al., 2014](#)). To address the problems experienced by healthcare services regarding the LOS, it is necessary to identify the factors that contribute to LOS for elderly people. The objective of this study was to describe the LOS and the pre- and post-operative contributing factors related to LOS among older patients after hip fracture surgery in a tertiary hospital in the Limpopo Province, South Africa.

Methodology

A retrospective quantitative study was conducted using data collected at a public tertiary hospital in the Limpopo Province of South Africa, which serves as a referral hospital for 5 regional and 38 district hospitals. The Limpopo province is in the northern part of the country and borders Botswana, Zimbabwe and, Mozambique. It has a population of 5.8 million people with 307 050 people over the age of 65 years. The province has the 3rd highest rate of poverty and 80% of the population live in rural areas and make use of the public health system (South African Statistics, 2017).

The Research Ethics Committee (No: 286/2014) provided ethical clearance. The hospital's orthopaedic team performs around 547 hip surgeries each year. To identify the factors related to the LOS of elderly patients (> 65 years) after hip fracture surgery, an audit tool based on the hospital documentation and a literature review was developed. Assessment of face validity of the audit tool was done prior to data collection to test for adequacy, appropriateness and quality.

The unit of analysis consisted of the records of patients who had undergone hip fracture surgery in the period from January 1, 2013 to December 31, 2013. The sample included the hospital records of patients over the age of 65 years who had sustained hip fractures and undergone hip fracture surgery, following patients from admission to discharge. Of the 200 patients who underwent hip fracture surgery in the 12 month frame, 100 patients' records were randomly sampled and assigned a unique identify number. For consistency, the first author audited the records using the developed audit tool that consisted of four sections: 1) demographic data; 2) the pre-operative phase; 3) intra-operative phase; and 4) the post-operative phase. Captured data was analysed using Microsoft Excel. The demographic data, LOS and the frequency distribution of individual factors relating to LOS was analysed using descriptive statistics. Two sample t-tests were conducted to determine significant differences between specific means at a confidence level of 95% ($p < 0.05$).

Results

Demographics

Of the 100 patient records audited, 58 records related to patients who were women and 42 who were male. These patients had an average age (SD) of 74.9 (7.8) years, and their ages varied between 65 and 93 years. The patients mostly lived with their families (58%), while 37% of them lived on their own and 5% lived in nursing homes. The causes of their hip fractures were either singular or a combination that led to hospitalisation and are presented in Table 1.

Pre-operative factors

The preoperative factors identified in the selected sample were comorbidities and skin status. All the patients included in the sample presented with existing comorbidities. The three most prevalent

Table 1

Indication for hip surgery of patients (n = 100).

Indication	Frequency n (%)
Falls	87 (87%)
Pathological	15 (15%)
Osteoporosis	35 (35%)
Confusion	33 (33%)
Other:	
Motor vehicle accident	5 (5%)
Pedestrian vehicle accident	3 (3%)
Painful joints	3 (3%)
Septic hip prosthesis	1 (1%)

Table 2

Most prevalent patient comorbidities on admission (n = 100).

Comorbidities	Frequency n (%)
Hypertension	93 (93%)
Diabetes Mellitus	55 (55%)
Dementia	30 (30%)
Heart failure	13 (13%)
Arthritis	9 (9%)
Anaemia	7 (7%)
Depression	6 (6%)
Malignancy	5 (5%)
Stroke	5 (5%)

reported co-morbidities were hypertension (n = 93), diabetes mellitus (n = 55) and dementia (n = 30) (Table 2). Additional comorbidities reported in less than 5% of the sample included; chronic obstructive pulmonary disease (n = 3), osteoporosis (n = 3), low blood pressure (n = 2), renal failure (n = 2), dysrhythmias (n = 1), Parkinson's disease (n = 1), cancer of the cervix (n = 1), dehydration (n = 1), palpitations (n = 1), rheumatism (n = 1) and urinary tract infection (n = 1).

The skin status of all patients was audited and the majority of patients' skin was intact on admission (n = 83), while eleven patients had skin that was not intact. Six (n = 6) of the patient records did not make any mention of skin status. The majority of patients (n = 97) were continent, two (n = 2) were catheterised, and one (n = 1) used a pad due to incontinence. Non of the patients had any known allergies. The mean (SD) time from admission to surgery was 16 (15) days, with a minimum and maximum time of zero and 70 days respectively.

Post-operative factors

The type of hip fracture surgery the patients received included; total hip replacements (n = 38), dynamic hip screws (n = 30), nail implants (n = 20) and plates (n = 12) for the fixation of the hip fracture. The mean (SD) estimated intra-operative blood loss during the intra-operative phase was 253 (68) ml, ranging between 100 ml and 400 ml. All patients but two (n = 2) received urinary catheters intra operatively.

Eighty-five (85) of those who had undergone hip fracture surgery developed complications, of which 48 developed various combinations of complications (Table 3). Anaemia, wound infection, pneumonia and wound haematomas were most frequently reported. The mean (SD) time to mobilisation after surgery (n = 89) was 3.9 (1.0) days post-operatively and eleven (n = 11) were put on postoperative traction.

Table 3

Patient complications after hip surgery (n = 85).

Complication	Frequency n (%)
Anaemia	42 (49.4%)
Wound infection	21 (24.7%)
Pneumonia	17 (20.0%)
Wound haematomas	17 (20.0%)
Urinary tract infection	12 (14.1%)
Difficulty in walking	11 (12.9%)
Deep venous thrombosis	4 (4.7%)
Stroke	4 (4.7%)
Immobilisation	3 (3.5%)
Pressure ulcers	1 (1.2%)
Hypotension	1 (1.2%)
Limited hip movement	1 (1.2%)
Pyrexia	1 (1.2%)
Severe diabetes mellitus	1 (1.2%)

Length of stay

The mean (SD) total LOS (admission to departure) was 33 (19) days, with a minimum of 8 and a maximum of 82 days. The LOS was further divided into number of days from operation to discharge and from discharge to actual date of departure from the hospital as some patients had to wait in hospital until they were picked up to go home. The number of days from operation to discharge was found to be a minimum of five days and a maximum of 75 days with a mean (SD) of 15 (12) days. Some patients stayed even longer as the time from the date of readiness for discharge to actual departure from the hospital varied from zero to 33 days, with a mean (SD) of 1 (4) days. The reasons for delayed departure included; waiting for hospital transport (n = 25), awaiting for relatives (n = 15), waiting for nursing home transport (n=5), and other reasons (n = 3) such as attending physiotherapy sessions and waiting for a wheelchair.

Complications related to increased length of stay

The LOS from operation to discharge was compared between patients having the most prevalent complications such as anaemia, wound infections, pneumonia and wound haematomas; and those who did not develop a specific complication (Table 4). The comparison was used to assess whether the LOS could be attributed to having a specific complication. The length of stay tended to be shorter in patients not presenting with three of the main complications compared to those with the complications, although LOS was only significantly lower for those not presenting with wound infections as a complication. The LOS in patients presenting with wound haematomas was very similar when compared to patients not having wound haematomas (p = 0.364).

The LOS from operation to discharge was also compared between patients having only one complication compared to having two or more complications. Patients who reported only one complication had a significantly lower mean (SD) LOS (12 (7) days) compared to those who reported more than one complication (19 (15) days) (P = 0.001).

Discussion

Our study found that, following hip fracture surgery, elderly patients between 65 to 93 years of age stayed in hospital on average for 16 days, 5 days more than the maximum LOS reported in Canada and China (Bohm et al., 2015; Chen et al., 2019; Newman et al., 2017a). Hip fractures increase direct health care and social care costs as they often cause functional limitation and reduced quality of life (Gregson et al., 2019; Du Toit & Van Der Merwe, 2018). In developed countries hip fractures cost around US\$43 669 per patient (Williamson et al., 2017), but no costing analysis for hip fracture has been determined for Sub-Saharan Africa (Gregson et al., 2019). African countries spend 6.1% of their GDP (gross domestic products) on health, 3.5% less than OECD countries, due to the focus of healthcare expenditure in Africa being on mother and child services and HIV with very little focus on the health of the elderly. The identification of factors to improve services are essential in that they influence the length of stay of patients after hip fracture surgery. The incidence of hip fractures are likely to rise due to fragility of the ageing population (National Research Council, 2012).

Table 4
Length of stay in relation to patient complications.

Complication	Presenting with complication Length of stay (days) Mean (SD)	Not presenting with complication Length of stay (days) Mean (SD)	p-value
Anaemia	18 (16)	14 (8)	0.060
Wound infections	19 (14)	14 (11)	0.041
Pneumonia	19 (17)	15 (10)	0.154
Wound Haematoma	15 (2)	16 (1)	0.364

Pre-operative factors

The entire sample (n = 100) in this study, presented with existing co-morbidities, either singular or a combination, in contrast to the international literature that reports the presence of comorbidities in elderly patients undergoing hip fracture surgery at 12.5–75% (Flikweert et al. et al., 2018). Hypertension was the most commonly recorded comorbidity, in line with the findings of Kaze et al. (2017) regarding the African population. The findings of the present study, however, differ from those from Canada that indicated diabetes as the second and hypertension as the third highest incidence of co-morbidities in patients undergoing hip fracture surgery (Pincus et al., 2017). Diabetes mellitus was found to be the second highest recorded comorbidity in the present sample, which is representative of the high prevalence of diabetes mellitus in South Africa and globally (Stokes et al., 2017; Chen et al., 2012). The incidence of hip fractures are higher in older people with hypertension and diabetes mellitus due to associated bone demineralisation (Ye et al., 2017).

After the patients included in the present study sustained hip fractures, surgical intervention was performed on approximately day 16; almost double the number of days it takes from injury to discharge after hip fracture surgery in the United States (Ricci et al., 2015). The time lapse from admission to surgery has been indicated as a contributing factor to the development of complications following hip fracture surgery (Fan et al., 2016). This could be attributed to attempts by healthcare professionals to control or modify the patient's presenting comorbidities, aiming to reduce the risk of possible post-operative complications (Marmor and Kerroumi, 2016). Data was not collected on these issues and further research should be undertaken to explore the reasons for the length of time between admission and surgery as there is evidence that patients are less prone to the development of complications if they have undergone hip fracture surgery within 24 h after the injury (Rai et al., 2018).

Post-operative factors

Bleeding, wound complications and thromboembolic disease are the first three major complications that are expected in patients after hip fracture surgery as published by the Hip Society on their standardised list of surgical complications (Newman et al., 2017a). In this study no post-operative active bleeding was recorded, however patients lost on average 253 ml of blood compared to the average blood loss of between 160 ml (George et al., 2017) to 186 ml (Newman et al., 2017b) as reported in the literature; this could be a contributing factor for the development of anaemia.

Taking into consideration that patients in this study sample presented with pre-operative comorbidities and half of the patients had anaemia due to bleeding post-operatively, the development of infections does not come as a surprise. Healy et al. (2016) reported anaemia as a risk factor for developing infections post-operatively. The risk of developing complications that increases the length of stay are further exacerbated when patients suffer from diabetes mellitus (Rasouli et al., 2014), with just over half of the patients in the study sample having diabetes as a comorbidity. In the present study, 50% of patients developed wound complications while 5% of patients developed deep vein thrombosis. Orthopaedic surgical site infection has been reported in the literature to occur in between 3 and 10% of patients (Martin et al., 2016; Fornwalt et al., 2016) while, in the present study, the surgical site infection rate was double that at 21%.

Other significant complications not directly linked to the surgical procedure in the present study included pneumonia (n = 17) and urinary tract infection (n = 12). The development of pneumonia was observed in 20% of included patients, which is double the 10% Flikweert et al. (2018) reported in their study population. The patients in the present study could have developed pneumonia due to the prolonged time from operation to mobilisation which averaged

approximately four days after surgery, more than the average time of total hospitalisation reported in the literature (Newman et al., 2017a; Rasouli et al., 2014; Tissingh et al., 2017). The goal for mobilisation after hip fracture surgery is within the first 24 h postoperatively to decrease complication rates and improve independence of the patient (Tissingh et al., 2017). However, Soffin and YaDeau (2016) stated that, although early mobilisation is beneficial, the role it plays in dislocation and loosening of the prosthesis is still unclear. The Hip Society reports hip dislocation as the sixth most common complication after hip surgery (Newman et al., 2017a); no incidence of dislocation was reported in the present study population. Further investigation of actions and mechanisms that could lead to dislocation or its prevention of it is needed.

Pertaining to the urinary tract infection (n = 12), the incidence reported in our study was significantly lower than a retrospective cohort study conducted in the USA which reported a frequency of around 50% of the sample that developed urinary tract infection (Malik et al., 2019). The reason for the low infection rate of our study could be that 98 patients had catheters inserted in the operating room.

Factors that increased length of stay

From the findings, it came to light that wound infections and having more than one complication contributed significantly to increased LOS. Furthermore, anaemia and pneumonia showed a tendency to increase LOS after hip fracture surgery.

The total LOS was further increased in 53% of patients in the study population due to social factors. On average, patients stayed one day longer in hospital due to waiting for transport, family and equipment. A possible cause for awaiting transport is because of the vast referral area of the hospital as well as high levels of poverty in the area. The cost and distances family members have to travel to fetch their elderly family member could take days to a week as the public transport system is informal and space in the vehicle may be limited. Hospital policy and human rights awareness protects the patients to stay in hospital. The fact that patients are ready for discharge but not able to leave the hospital increases the financial implications for the health system as well as blocks beds for new patients to be admitted for surgery, possibly contributing to the long waiting time from admission to operation.

Implications for practice

On admission of a patient with a hip fracture, the patient's comorbidities and control, haemodynamic status and diagnostic test should be taken into consideration prior to surgery. Specific attention is required to identify underlying infections, for instance urinary tract infections have shown to cause deep joint infections after hip surgery (Garg et al., 2015).

Furthermore nutritional status needs to be assessed prior to surgery as it has shown to have an effect on comorbidities and the development of anaemia and infections (Stokes et al., 2017; Newman et al., 2017a). As anaemia was the major complication in this study sample, it was clear that the possibility of expanding the recording of blood loss to cover the loss from wound drains is needed in order to better measure total blood loss.

In order to decrease the LOS postoperatively, it could benefit the patient if nurses received training to initiate and assist in the early mobilisation of the patient instead of waiting for the physiotherapist. As for wound infections, in-service training relating to wound care could be conducted regularly to ensure retention of knowledge and skills. Furthermore, investigations relating to the type and origin of the infection-causing microorganisms could be undertaken to isolate the sources of infection.

The results call out for a more co-ordinated multidisciplinary effort to address the needs of the elderly during their hip fracture surgery journey as well as improved ways of dealing with the identified factors

that could prolong the length of stay. Nurses should actively assess the social issues around the patient in order to plan and activate appropriate home care. Co-ordinated discharge planning involving the healthcare professionals as well as the patient's family and caretakers could decrease the number of days from discharge to departure from the hospital.

Limitations

The study was conducted in only one tertiary hospital in Limpopo, a province in South Africa that serves an aging impoverished community, so the results may not be transferable. The small sample size limited the assessment of the contribution of individual factors to the increased LOS. Pre-operative factors and the reasons for the mean of 16 days before the operation were not investigated, due to limited information that could be found in the patients' files. Intra-operative factors that contribute to increased LOS were inadequately assessed and further investigation is required.

Conclusion

The ageing population increases the burden for the management within the health system for non-communicable diseases. From the findings of the study, it is clear that the care provided during the pre-operative and post-operative phases to the elderly after hip fracture surgery in this public tertiary hospital is less than optimal. However, the findings created a broad picture of the situation in resource-poor communities and identified aspects that should further be investigated to address the care of elderly patients undergoing hip fracture surgery.

Ethical statement

The study was approved by the Research Ethics Committee, Faculty of Health Sciences, University of Pretoria (Reference number: 286/2014).

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Contributions

All authors contributed to the conceptualization of the article and the work and rework of the draft article, clarification and reworking of statistics and finalization.

Declaration of competing interest

We concur that we have no conflict of interest to declare.

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