Mortality rate in elderly patients over the age of sixty with a surgically treated hip fracture at a regional hospital in South Africa

By

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Overview of the thesis

Hip fractures are prevalent and serious injuries among patients over the age of 60, representing a significant public health issue with substantial morbidity, mortality, and healthcare costs. In recent decades, there has been a notable increase in the incidence of hip fractures, reflecting demographic shifts and an aging population. While conservative treatment may be appropriate for incomplete fractures, surgical intervention is typically required to restore mobility and reduce complications.

Research indicates that several factors significantly influence the mortality rate in patients with hip fractures. Advanced age, poor physical status, male gender, and delayed treatment have been identified as critical determinants of mortality. These patients often present with significant comorbidities, such as cardiovascular disease, diabetes, and osteoporosis, which complicate their overall health status and elevate the risk of pre-operative and post-operative complications. Consequently, the mortality rate for hip fractures is higher compared to other types of fractures.

The mortality rate following hip fractures is not only a measure of the severity of the injury but also serves as a crucial metric for evaluating the quality of care provided by healthcare facilities. It reflects the effectiveness of medical interventions, surgical procedures, and post-operative care. High mortality rates may indicate deficiencies in healthcare delivery, while improvements in these rates can signify advancements in medical practice and patient management.

Understanding and identifying risk factors for increased mortality is essential for developing targeted interventions and improving patient outcomes. Anticipating potential complications and implementing strategies to mitigate these risks can enhance the overall care of patients with hip fractures.

Given the importance of this issue, this study aims to determine the one-year post-surgery mortality rate of patients with hip fractures and to identify the comorbidities associated with these patients. By analysing these factors, the study seeks to provide insights into the prognosis of hip fracture patients and to inform clinical practices and healthcare policies aimed at reducing mortality and improving the quality of care for this vulnerable population.

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Part 1: The Review of Literature

Anatomy of the hip and definition of hip fractures

The hip joint is a synovial joint with articulation between the femur head and the pelvic acetabulum. The acetabulum is formed from the confluence of the ischium, ilium, and pubis. The ball and socket joint are designed for stability and weight bearing conferred by bony and ligamentous restraints. A head and neck characterize the femur. The head of the femur is connected to the proximal portion of the femoral shaft by the neck of the femur.

Abrahamsen et al. (2008)[1] defined a hip fracture as any fracture of the femur between the articular cartilage of the hip joint to 5 cm below the distal point of the lesser trochanter.

Hip fractures can be classified as intra or extracapsular, that is, a fracture inside or outside the joint capsule of the hip. This broad anatomical distinction is crucial since it reflects the likelihood that blood supply to the femoral head is disrupted [2]. Intracapsular fractures involve the femoral neck, while extracapsular fractures involve the intertrochanteric and subtrochanteric regions.

The prognosis of hip fractures varies by the anatomic region of the fracture. Intertrochanteric fractures occur between the greater and lesser trochanters of the proximal femur. These extracapsular fractures occur in cancellous bones with an abundant blood supply. As a result, nonunion and osteonecrosis are less problematic than femoral neck fractures. Displacement in this region can occur due to deforming muscle force, which usually is shortening, external rotation, and varus position at the fracture.

In contrast, the femoral neck has a decreased amount of cancellous bone, a thin periosteum, and a relatively poor blood supply that is susceptible to disruption. Neck femur fractures have a high incidence of complications, such as non-union, osteonecrosis, and degenerative changes in the hip joint.

Diagnosis following a hip fracture is based on clinical and radiographic evidence. Patients with impacted or stress fractures may present with groin pain, lack of deformity, and may be able to bear weight. The patient with displaced fractures complains of severe pain and the inability to maintain weight. Patients with a femoral neck fracture have a shortened, flexed, and externally rotated lower extremity. Radiographic evaluation should include anteroposterior and lateral plain radiographs of the entire femur as well as an anteroposterior pelvis radiograph[3].

Conservative and surgical options are available for hip fracture management. Conservative treatment, primarily for undisplaced fractures, consists of bed rest followed by protective weight bearing. Non-operative management of undisplaced fractures has a high rate of failure due to late displacement in more than 20% of cases.[4]

Surgical options include open reduction and internal fixation (sliding hip screws, cannulated screws, and compression screws), hemiarthroplasty, or total hip replacement.

Epidemiology

Hip fractures are a significant cause of disability and hospitalization, increasing morbidity and mortality, and have been recognized worldwide as an important public health problem. Hip fractures are the third most common cause of patients becoming bedridden after cerebrovascular disease and senility, thus markedly decreasing the quality of life[5]. The incidence of hip fractures increases with age, is more prevalent in women, and is becoming more frequent in the aging population[6]. The incidence of hip fractures shows significant geographic variation, with higher rates observed in Nordic countries, America, and Europe. Differences may also be found within each country[6]. The absolute incidence of hip fractures is expected to increase to 2.6 million by 2025 and 4.5 million by 2050[1]. Most cases of hip arise because of low-impact trauma in an individual with underlying bone fragility.

An analysis of hip fracture incidence rates in Spain showed a continuous rise in people 65 years of age or older. The study reported an analysis of 7111035 people over 14 years (1997-2010). During this period, there were 119857 hip fractures in men and 415421 in women. The female-to-male ratio was 3.2 to 1. The number of fractures in men above 85 years and older was 6.8 times higher compared to men 65-69 age range. In women, it was 14.6 times higher. In this study, the crude incidence rates have gradually increased more in men than women.[6]

A study conducted in Belarus during 2011-2012 looked at hip fractures in men and women aged 50 years and older. For the 2-year period,117 cases of hip fractures were reported, of whom 83 underwent surgery. The number of hip fractures in women was 76 and 41 in men (ratio of 1.9 to 1). Incidence in both sexes increased with age. The hip fracture incidence was higher among women. Hip fracture rates vary markedly in different countries; the incidence in this study was similar in Russia, Lithuania, and Poland. The limitation of this study was that only 1.2% of the population was examined[7]. In Geneva, Switzerland, hip fracture trends have been studied from 1991 to 2000. Hip fractures were sustained in 2981 females and 822 males aged 50 and over in the 10-year period. The overall hip fracture incidence was 455 per 100,000 persons in females

and 153 per 100,000 men. The study found that the number of hip fractures remained constant over the ten years in the aging population. A considerable decline of 1.4% per year for age-adjusted rates in females aged 60-64 and 90 years and over was also concluded. The rate remained unchanged in males[8]. The number of hip fractures occurring worldwide will increase from 1.66 million in 1990 to 6.26 million in 2050[9]. However, a study in the United States utilized hospital discharge data (1990 to 2006) to determine the national trends in hip fracture incidence for people over 65 years. Hip fracture incidence decreased substantially from 1990 to 2006. The rates decreased from 54.6 and 108.4 in 1990 to 48.8 and 91.7 per 10,000 in 2006 and males and females, respectively[10]. These results are consistent with those of Kannus et al (2006)[11], who reported that the incidence of hip fracture declined by 20% in women and 6% in men from 1997 to 2004 in Finland. Factors that could account for these declines and challenge Cooper's (1992)[9] finding that the incidence of hip fractures will increase include a healthier aging population, improved functional abilities in the elderly, removal or withdrawal of the use of psychoactive drugs, and an increase in average body weight[11].

After adjustment for age and sex, the incidence rate rose from 471 to 567 in males and from 637 to 759 per 100,000 in females per year. The total increase in incidence over the study period was calculated to be 13%. Compared to the result of Chevalley et al. (2007)[8], the rise in incidence is held accountable by the increase in patients over 80.

In Lebanon, Maalouf et al. (2013)[12] conducted a study with a total of 1199 using a national database of hip fractures admitted to hospitals in Lebanon in 2007 in patients over 50. In contrast to many regions, such as Europe, North America, and Eastern Asia, only a few reports have evaluated the epidemiology of hip fractures in the Middle East. The crude annual incidence rate in patients over the age of 50 was 147 per 100000 with a male-to-female ratio of 1: 2. The incidence was projected to rise to 284 per 100,000 by 2050. Of the total 1199 hip fractures, 503 occurred in males, with 696 in females. The main findings were that hip fracture incidence rates in Lebanon are consistent with patterns described in most populations, where there is an exponential increase with age for both sexes. As expected, over half of hip fractures in both genders occur at 75 years or older. A few studies are available on the incidence of hip fractures in Africa. Osteoporosis and fragility fractures are believed to be uncommon in Africa. Fragility fractures are believed to be uncommon in Africa due to reduced longevity[13]. Zebaze et al. (2003)[14] in Cameroon, and Maghraoui et al. (2002)[13] conducted a similar study in Morocco; both studies concluded that hip fragility fractures occur in Africa but less frequently compared to other

countries. In Cameroon, severe trauma was the most common cause of hip and wrist fractures in men and women younger than 50. After age 50, 90% and 83.3% of the fractures in women and men were fragility fractures resulting from falls. In Cameroon, the incidence of hip fractures in men over the age of 65 is 35 per 100,000 persons per year [(14)]. In Morocco, a rise in incidence rate was found for both men and women with increasing age; the age-adjusted incidence of hip fracture was 52.1 and 43.7 per 100,000 in women and men, respectively[(13)]. The characteristics of hip fractures described in these two studies imply that fragility fractures occur in Africa, although significantly less frequently than in most North American, European, and Asian countries. Fragility fractures occur more frequently in Northern Africa compared to sub-Saharan African countries. Low fragility fracture rates are likely due to reduced longevity and underreporting in Africa.

In South Africa, the prevalence and incidence rates for hip fractures in the elderly population have not been determined. However, the prevalence rate for falls in the elderly is 26%, and the incidence of falls is 236 and 407.5 per 1,000 persons per year for males and females, respectively[(15)].

Guerri-Fernandez et al. (2013)[(16)] reported that HIV infection and antiretroviral therapies damage bone metabolism. The authors, therefore, explored the association between HIV infection and the risk of sustaining a hip or major osteoporotic fracture in Spain. After adjusting for age, gender, smoking, alcohol consumption, and co-morbidities, a significant association between HIV infection and hip fracture risk was reported.

In summary, hip fracture incidence rates are rising worldwide, especially in developing countries in Asia, South America, and Africa. The factors that account for cultural and social differences in hip fracture rates and incidences include differences in the demographic profile, level of physical activity, calcium intake, body weight, cigarette smoking, alcohol consumption, and the frequency of falls in the elderly. More recently, it has also been reported that HIV infection is significantly associated with hip fracture risk[(16)].

Mortality following hip fractures

Hip fractures are the most serious consequence of falling in older people. 87 to 96% of hip fractures occur in patients over 65 years and are associated with increased mortality.[(17)]

One study stated that survival declines soon after hip fracture but later parallels the general population's expected survival. Excess mortality after hip fractures may be linked to complications following the fracture, such as pulmonary embolism, infection, and heart failure [(17)].

Roche et al. (2005)[18] carried out a prospective observational cohort study in Nottingham, England, whereby they evaluated postoperative complications and the mortality associated with these complications at thirty days and one year postoperatively. The association between preexisting comorbidities and the development of postoperative complications and mortality was also examined in elderly patients admitted with an acute hip fracture. Roche et al. (2005)[18] concluded that the most common postoperative complication was chest infections, followed by heart failure. At 30 days, mortality was 9.6%, and mortality was 33% at one year. There was a significant difference in 30-day mortality rates in women and men, 8.2% and 15%, respectively. A large sample of patients was included in this study, and a 100% follow-up on mortality statistics was completed. In a large Danish nationwide population-based cohort study investigating the quality of care and 30-day mortality in elderly patients with a hip fracture, the 30-day mortality rate was 10.3%. The authors concluded that high-quality patient treatment significantly lowered 30-day mortality rates[19]. The above Nationwide cohort studies in first-world countries reveal consistent 30-day mortality rates for elderly patients with hip fractures.

In Africa, Mnif et al. (2009)[20] assessed the mortality and morbidity following a trochanteric fracture in 100 elderly patients in Tunisia. In two years, the mortality rate was 28%. This 28% consisted of a 3% mortality rate during the first week postoperatively, 8% between two weeks and three months, 7% between four and 12 months, and 10% between 12 and 24 months. Age was among the most significant risk factors influencing the two-year mortality rate. Patients belonging to the "old-old" age group (>90 years) had a 100% two-year mortality rate, compared to 25% and 5%, respectively, for those in the "middle-old" (75-90) and "young-old" (60-74) age group. Associated co-morbidities and fracture instability were also associated with increased mortality.

In South Africa, the in-hospital mortality in elderly patients with an intertrochanteric fracture is 14% [21]. The mortality rate rises significantly to 32% during the first year and 39% in the second year. No difference was found in mortality rates when associated with the place of residence before hospital admission and the time elapsed between admission and the date of operation if the operation was performed during the first week of admission[21]. The mortality rates between the two studies in Africa varied substantially, Mnif et al. (2009)[20] recorded a 3% in-hospital mortality rate, 7% one-year mortality, and 28% two-year mortality in comparison to Ngobeni (2010)[21] who observed 14%, 32%, and 39%. In each of the studies by Ngobeni (2010)[21] and Mnif et al. (2009)[20], 64% and 68% of the patients, respectively, who died throughout the study had one or more pre-existing comorbidity. Mnif et al. (2009)[20] and Ngobeni (2010)[21] limited the inclusion criteria to trochanteric fractures, and any femoral neck fractures were excluded. Literature has

shown that patients who sustain a femoral neck fracture have significantly higher mortality rates when compared to those with trochanteric fractures. The mean age in Ngobeni's (2010)[21] study was 79 years, and the mean age in Mnif et al.'s (2009)[20] study was 76 years. Despite similar demographics in each of the studies, varying results were reported. These differences can be attributed to the social and cultural factors that vary across different geographical settings and influence the prognosis of hip fractures.

Patients admitted to the hospital with three or more pre-existing comorbidities, male gender, respiratory disease, renal disease, or increased age are more likely to have a significantly increased 30-day mortality rate[18]. Ngobeni (2010)[21] further concluded that time to surgery was not associated with higher in-hospital mortality.

References

1. Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C. Excess mortality following hip fracture: a systematic epidemiological review. Osteoporosis International. 2009;20(10):1633-50.

2. Azagra R, Lopez-Exposito F, Martin-Sanchez JC, Aguye A, Moreno N, Cooper C, et al. Changing trends in the epidemiology of hip fracture in Spain. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2014;25(4):1267-74.

3. Ramanau H, Chernyanin I, Rudenka E, Lesnyak O, Zakroyeva A, Bilezikian JP, et al. Epidemiology of hip fracture in Belarus: development of a country-specific FRAX model and its comparison to neighboring country models. Archives of osteoporosis. 2018;13(1):42.

4. Zebaze RM, Seeman E. Epidemiology of hip and wrist fractures in Cameroon, Africa. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2003;14(4):301-5.

5. Chevalley T, Guilley E, Herrmann FR, Hoffmeyer P, Rapin CH, Rizzoli R. Incidence of hip fracture over a 10-year period (1991-2000): reversal of a secular trend. Bone. 2007;40(5):1284-9.

6. Stevens JA, Anne Rudd R. Declining hip fracture rates in the United States. Age and Ageing. 2010;39(4):500-3.

7. Maalouf G, Bachour F, Hlais S, Maalouf NM, Yazbeck P, Yaghi Y, et al. Epidemiology of hip fractures in Lebanon: a nationwide survey. Orthopaedics & traumatology, surgery & research : OTSR. 2013;99(6):675-80.

8. Fernandez MA, Griffin XL, Costa ML. Management of hip fracture. British medical bulletin. 2015;115(1):165-72.

9. Ly TV, Swiontkowski MF. Treatment of femoral neck fractures in young adults. Instr Course Lect. 2009;58:69-81.

10. Marais L, Ferreira N. Management of femoral neck fractures. SA Orthopaedic Journal. 2013;12:58-61.

11. Yoshimura N, Suzuki T, Hosoi T, Orimo H. Epidemiology of hip fracture in Japan: incidence and risk factors. J Bone Miner Metab. 2005;23 Suppl:78-80.

12. Cooper C, Campion G, Melton LJ, 3rd. Hip fractures in the elderly: a world-wide projection. Osteoporosis international : a journal established as result of cooperation between

the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 1992;2(6):285-9.

13. Kannus P, Niemi S, Parkkari J, Palvanen M, Vuori I, Jarvinen M. Nationwide decline in incidence of hip fracture. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2006;21(12):1836-8.

14. El Maghraoui A, Koumba BA, Jroundi I, Achemlal L, Bezza A, Tazi MA. Epidemiology of hip fractures in 2002 in Rabat, Morocco. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2005;16(6):597-602.

15. Kalula SZ, Ferreira M, Swingler GH, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatr. 2016;16:51.

16. Güerri-Fernandez R, Vestergaard P, Carbonell C, Knobel H, Avilés FF, Castro AS, et al. HIV infection is strongly associated with hip fracture risk, independently of age, gender, and comorbidities: a population-based cohort study. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2013;28(6):1259-63.

17. Panula J, Pihlajamäki H, Mattila VM, Jaatinen P, Vahlberg T, Aarnio P, et al. Mortality and cause of death in hip fracture patients aged 65 or older - a population-based study. BMC Musculoskeletal Disorders. 2011;12(1).

18. Roche JJ, Wenn RT, Sahota O, Moran CG. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. Bmj. 2005;331(7529):1374.

19. Nielsen KA, Jensen NC, Jensen CM, Thomsen M, Pedersen L, Johnsen SP, et al. Quality of care and 30 day mortality among patients with hip fractures: a nationwide cohort study. BMC Health Services Research. 2009;9(1):186.

20. Mnif H, Koubaa M, Zrig M, Trabelsi R, Abid A. Elderly patient's mortality and morbidity following trochanteric fracture. A prospective study of 100 cases. Orthopaedics & traumatology, surgery & research : OTSR. 2009;95(7):505-10.

21. R N. Mortality in elderly patients with intertrochanteric fractures: three years experience. SA Orthipaedic Journal. 2010(9):55-60.

Part 2: Submission-ready manuscript

Mortality rate in elderly patients over the age of sixty with a surgically treated hip fracture over one year at a regional hospital in South Africa

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Abstract

Aims and Objectives: Hip fractures represent prevalent orthopaedic injuries among individuals aged 60 and above, posing a significant public health challenge characterized by notable morbidity, mortality, and considerable healthcare expenditures.

Extensive literature suggests that factors such as advanced age and delayed treatment play pivotal roles in determining mortality rates following hip fractures.

The objective of this study was to ascertain the one-year mortality rate among patients over the age of sixty following surgical intervention for hip fractures, with a specific focus on identifying associated risk factors and comorbidities.

Methods: A retrospective analysis was conducted on a cohort of 87 patients aged 60 and above who underwent surgical management for hip fractures at a regional hospital in South Africa between January 2022 and December 2022. This investigation aimed to assess the one-year mortality rate. Key variables, including age, gender, time to surgical intervention, type of surgical procedure, and their respective impacts on mortality rates, were comprehensively evaluated.

Results: The one-year mortality rate post-surgery was determined to be 36.8% (32 out of 87 patients). Of these, 19.5% demised within the initial three months, 9.2% between four to six months, and 8.1% between seven to twelve months. At the one-year mark, 63.2% of subjects remained alive.

Conclusion: In our investigation, heightened mortality rates were noted among individuals aged over 80 years, those presenting with neck of femur fractures and those presenting with two or more comorbidities. However, significant correlations with mortality for other investigated factors could not be established. Given the elevated mortality rate identified in our study, we advocate for future research endeavours aimed at elucidating risk factors associated with early mortality following hip fractures.

Level of evidence: Level 4

Key Words *Neck of femur fracture, hip fracture, intertrochanteric fracture, mortality in elderly neck of femur fracture*

Introduction

The incidence of hip fractures in patients has demonstrated a recent upward trend, with an annual increase of 1.5%. There are approximately 104 cases per 100,000 inhabitants, resulting in an estimated annual occurrence of 50,000 fractures.[1] Hip fractures among older adults constitute a prominent public health concern, with statistical projections indicating that one in three women and one in 12 men will experience a hip fracture during their lifetime. Moreover, 86% of hip fractures occur in individuals aged 65 years and older.[2]

The majority of patients following hip fractures undergo surgical management. Treatment decisions for hip fractures in individuals over 60 are multifaceted, incorporating considerations such as physiological age, activity level, systemic diseases, bone quality, and the extent of fracture displacement. Among the treatment modalities for osteoporotic hip fractures, proximal femoral nails and cemented or cementless hemiarthroplasty are commonly employed.

Numerous complications stemming from hip fractures, including osteonecrosis, non-union, implant failure, and limb shortening, contribute to suboptimal functional outcomes, thereby diminishing the quality of life and hindering the return to pre-fracture activity levels.[3] Consequently, hip fractures in older patients represent a prevalent diagnosis necessitating admission to emergency and orthopaedic departments.

Globally, mortality statistics associated with hip fractures are well-documented, making them a leading cause of death within the elderly population. Approximately 2% of individuals worldwide diagnosed with hip fractures succumb upon admission, with nearly 30% experiencing mortality within the first year.

Anticipated improvements in healthcare services and recent advancements in medical science, driven by increasing life expectancies, are expected to contribute to a heightened incidence of hip fractures in the future.[4] Consequently, contemporary research endeavours should aim to explore the intricacies of hip fractures, mortality patterns, and contributing factors within the seventy-five years and older age group.[5]

Material and Methods

Following obtaining ethical approval, we conducted a comprehensive review of patients aged over 60 presenting with hip fractures at a regional hospital in South Africa over the course of one year (January 2022 to December 2022). Data collection was carried out through an examination of medical records and supplemented by telephonic communication with patients and their relatives. Patients who had succumbed prior to surgical intervention, received conservative management, or were readmitted due to complications arising from prior surgeries were excluded from the study. The choice of surgical approach varied among surgeons, dictated by the fracture pattern and the implant choice. Post-operatively, all patients in this study were sent to the general orthopaedic ward as there was no high-care or ICU facility available at the hospital. Patients who were transferred to another facility intensive care unit (ICU) were not included in the study. Post-operative protocol included administration of prophylactic antibiotics, intravenous analgesia and deep vein thrombosis (DVT) prophylaxis with low molecular weight heparin. Key variables encompassing age, gender, premorbid functional status, fracture site, fracture management, time of fracture occurrence, time of hospital admission, time to surgical intervention, type of fixation employed, and mechanism of injury served as confounding factors for the investigation.

Patient Data

A comprehensive chart review encompassing all patients enrolled in the study was conducted. A structured data collection instrument was employed to extract pertinent information from patients' medical records. Individuals who sustained hip fractures within the designated timeframe underwent a chart review, with relevant data recorded in the data collection tool. Subsequently, the amassed data underwent analysis, with statistical methodologies employed to elucidate associations among the variables of interest. Findings were presented through statistical analyses, tables, and graphical representations.

Between January 2022 and December 2022, the medical records of 101 patients diagnosed with hip fractures were identified. Twelve were excluded due to insufficient or incomplete medical documentation, while an additional two were excluded due to demise before undergoing surgical intervention, culminating in a final study cohort comprising 87 patients. Communication with these patients or their next of kin was facilitated via telephone, utilizing contact details procured during hospital admission.

Statistical Methods

The collected data was organized and tabulated in a Microsoft Excel spreadsheet under the supervision of a qualified statistician. For statistical analysis, the means and standard deviations of the measurements within each group were calculated. Statistical analyses were performed using the SPSS 22.00 software for Windows (SPSS Inc., Chicago, USA). The disparity between the two groups was assessed utilizing the chi-square test, with a predetermined significance level set at $p < 0.05$.

Results

Between January 2022 and December 2022, a cohort of 87 individuals diagnosed with hip fractures was enrolled in this investigation. Among them, 32 patients (36.8%) demised within a year, while 55 patients (63.2%) survived.

A comparative analysis between the survival and deceased cohorts was performed (Table 1). Notably, the survival cohort exhibited a significant association with the age bracket of 61-70 years, while the deceased cohort was predominantly represented by individuals aged over 80 years. These findings bore statistical significance ($p=0.004$).

Table 1: Comparative Analysis between demised and survival groups

Variable	Group						
	Death(n=32)		Survival(n=55)		Total(n=87)		
	n	%	n	%	n	%	p
Sex							0.17
Female	44	77.2	19	63.3	63	72.4	
Male	13	22.8	11	36.7	24	27.6	
Age							0.004
61-70	9	28.1	28	51	37	42.5	
71-80	8	25	19	34.5	27	31	
>80	15	46.9	8	14.5	23	26.5	
Premorbid ambulators							0.42
Home ambulator	24	47	27	53	51	58.6	
Community ambulator	20	55	16	45	36	41.4	
Fracture pattern							0.043
Intertrochanteric	19	30.2	13	54.2	32	36.8	
Neck of femur	42	66.7	9	37.5	51	58.6	
Subtrochanteric	2	3.1	2	8.3	4	4.6	
Type of Procedure							0.19
Arthroplasty	20	62.5	26	47.3	46	52.9	
Nail	11	34.4	29	52.7	40	46	
Pin and Plate	1	3.1	0	0	1	1.1	
Time to surgery							0.68
25-48 hours	1	3.2	0	0	1	1.1	
>72hours	31	96.8	55	100	86	98.9	
Delay in Surgery							0.245
Delayed Presentation	20	62.5	41	74.5	61	70.1	
Required Optimization	4	12.5	2	3.6	6	6.9	
No Operating time	8	25	12	22	20	22.9	
Number of Co-morbidities							0.045
None	4	12.5	18	32.7	22	25.2	
One	6	19	17	31	23	26.4	
Two	9	28	11	20	20	22.9	
Three	10	31.2	7	12.7	17	19.5	
More than three	3	9.3	2	3.6	5	6	
Co-morbidities							
Diabetes	10	31.2	15	27.2	22	25.2	0.58
Hypertension	13	40.6	21	38.1	21	24.1	0.763
Stroke	6	19	4	7.2	10	11.4	0.56

IHD	4	12.5	5	9	9	10.3	0.84
Dementia	2	6.25	1	1.8	3	3.4	0.045
Depression	4	12.5	3	5.4	7	8	0.91
HIV	10	31.2	13	23.6	23	26.4	0.53
COPD	2	6.25	1	1.8	3	3.4	0.876
CRF	4	12.5	4	7.2	10	11.4	0.648
Hypothyroidism	3	9.3	6	10.9	9	10.3	0.73
Dyslipidaemia	3	9.3	6	10.9	9	10.3	0.657
Anaemia	4	12.5	3	5.4	7	8	0.041

IHD = Ischaemic heart disease; HIV = Human Immunodeficiency Virus; COPD = Chronic Obtructive Pulmonary Disease; CRF = Chronic Renal Failure

Gender distribution within the study cohort revealed a predominance of females (72.4%) compared to males (27.6%). The mean age of the cohort was calculated as 76 ± 10 years. Notably, there existed no discernible disparity between the groups concerning gender distribution (p=0.17).

The study cohort predominantly comprised premorbid home ambulators (58.65%), with the remaining individuals identified as community ambulators (41.4%). Notably, the overwhelming majority of fractures (97.7%) resulted from falls, while a negligible minority (2.3%) were attributed to motor vehicle accidents.

One-year post-surgery, females constituted the majority of patients in both the survival and deceased groups (63.3% and 77.2%, respectively), with males constituting the remainder (36.7% and 22.8%, respectively). However, these gender-based discrepancies did not reach statistical significance (p=0.17).

Regarding the temporal interval between surgery and mortality, the highest mortality rate was observed within the initial three months post-surgery (19.5%), followed by the 4–6-month interval (9.2%), and finally, the 7–12-month timeframe (8.1%).

Among the various fracture types observed in the study cohort, the most prevalent were neck of femur fractures (58.6%), followed by intertrochanteric fractures (36.8%) and subtrochanteric fractures (4.6%). The specific fracture pattern and the physiological condition of the patient dictated the selection of implants. Notably, arthroplasty emerged as the most frequently utilized osteosynthesis implant (52.9%), followed by femur nail fixation (46%) and pin and plate surgery (1.1%).

In the context of the correlation between fracture pattern and mortality, individuals with neck of femur fractures demonstrated the highest mortality rate (66.7%), followed by those with intertrochanteric fractures (30.2%) and subtrochanteric fractures (3.1%). Notably, these observations reached statistical significance (p=0.043).

The time from injury to surgical intervention, denoted as time to surgery, was precisely assessed in this investigation. A substantial majority of patients (98.9%) underwent surgery beyond 72 hours post-injury, with only a minority (1.1%) receiving surgical intervention between 25- and 48-hours post-injury. Notably, none of the patients underwent surgery within 24 hours or less following the injury.

Concerning the correlation between time to surgery and mortality, our analysis revealed that the survival cohort predominantly underwent surgical intervention beyond the 72-hour mark. Likewise, the overwhelming majority of patients in the deceased group (98%) also received surgical treatment after 72 hours, while the remainder underwent surgery between 25- and 48-hours post-injury. However, this observed disparity in time to surgery between the survival and deceased cohorts did not achieve statistical significance (p=0.68).

A comparison between the survival and deceased cohorts concerning factors contributing to delayed surgical intervention was investigated. A predominant proportion of patients (70.11%)

presented at the hospital beyond 24 hours following injury. A subset of patients (6.90%) required preoperative optimization, while the remainder (22.99%) encountered delays stemming from insufficient theatre resources, leading to surgical case cancellations. However, subsequent statistical analysis did not reveal a significant association between these factors and patient outcomes (p=0.245).

Examination of the surgical site in relation to mortality outcomes, shows that within the survival cohort, the majority (66.7%) underwent right-sided surgical procedures, while the remaining portion (33.3%) received left-sided interventions. Conversely, in the deceased cohort, nearly half (49.1%) underwent left-sided surgery, with the remaining cases (50.9%) involving right-sided procedures. However, statistical analysis did not demonstrate significant associations between surgical site and mortality (p=0.16).

Regarding the number of comorbidities per patient, the presence of no comorbidities was associated with the survival group, and the presence of three comorbidities was associated with the death group (p=0.045).

Two comorbidities were significantly associated with the death group: dementia (p=0.041) and anaemia (p=0.045)

Discussion

This study investigated the one-year mortality rate among elderly patients who underwent surgery for hip fractures. The findings revealed a mortality rate of 36.8%. The objective of presenting this data is to advocate for enhancements in the quality of current healthcare services. This advocacy begins with raising awareness among health officials, hospital administrators, physicians, and other stakeholders regarding the significant challenges posed by these conditions.

In this study, 27.6% of the subjects were males, while 72.4% were females. The mean age of the subjects was 76.28 ± 9.71 years. Du Toit ALJ et al.[22] revealed in their study that the mean age at presentation was 77.96 years, with a predominance of female patients. These findings are consistent with the demographics observed in the present study.

Mundi et al.[23], in a systematic review of randomized controlled trials spanning 31 years, reported similar results, with an average age at presentation ranging between 77 and 81 years. However, they noted a gradual increase in the average age at presentation over this period.

This trend of increasing age at presentation was also observed by Haleem et al.[24], who conducted a review spanning 40 years and found a rise in the mean age at presentation (from 73 to 79 years). They also noted a predominance of female patients (>71%), which aligns with our findings.

The predominance of female patients and the increasing age at presentation observed across these studies underscore the demographic trends associated with hip fractures. Such insights are valuable for healthcare professionals in understanding the population at risk and tailoring interventions to address the specific needs of elderly individuals, particularly females, who are disproportionately affected by this condition.

Numerous publications have extensively documented patient outcomes after surgical intervention for hip fractures, with particular emphasis on mortality rates and demographic factors. Mortality rates at the one-year post-fracture mark, irrespective of the fixation method employed, commonly range from 11% to 38%, with notable geographical discrepancies reported. Presently, surgical intervention stands as the widely accepted standard treatment for managing displaced intracapsular femoral neck fractures. This approach has demonstrated reduced mortality and enhanced morbidity outcomes in comparison to non-operative management strategies.

Research examining patients treated with hemiarthroplasty for displaced intracapsular femoral neck fractures has consistently revealed comparable and occasionally elevated one-year mortality rates ranging from 25% to 38% when juxtaposed with those managed through total hip arthroplasty. Nevertheless, these rates remain notably lower than the corresponding mortality rates observed among patients subjected to nonoperative management strategies.

The findings of our investigation reveal a sobering reality regarding the mortality rates associated with hip fractures, particularly among the elderly population. With 63.2% of the subjects observed to be alive and 36.8% deceased, our study underscores the significant impact of hip fractures on mortality outcomes. Notably, a substantial proportion of deceased individuals demised within relatively short time frames, with 19.5% passing away within three months of the fracture occurrence. This highlights the acute and potentially life-threatening nature of hip fractures, particularly in the immediate post-injury period.

Comparing our results to findings from previous research sheds light on the global landscape of hip fracture mortality rates. Haleem et al.'s[24] comprehensive review spanning 40 years revealed mortality rates ranging from 11–23% at six months and 22–29% at one year, aligning closely with our observations. However, it is noteworthy that their review did not include studies from Africa, indicating a gap in the literature that our study aims to address.

Furthermore, insights from systematic reviews by Mundi et al[23]., focusing on North America, and studies originating from Asia, Scandinavia, Europe, and the United Kingdom provide valuable context to our findings. While mortality rates in North America and certain regions of Asia and Scandinavia demonstrate comparably low figures ranging from 10% to 20%, slightly higher rates are observed in Europe and the United Kingdom, as indicated by Yoon et al.'s[25] study in Korea.

The study by du Toit ALJ et al[22]. provides additional perspective on mortality rates at various post-surgery time points, indicating a progressive increase over time, with a noteworthy 34.30% mortality rate observed at one-year post-surgery.

Our study adds to the growing body of evidence highlighting the substantial mortality burden associated with hip fractures, particularly among elderly individuals. By contextualizing our findings within the broader landscape of global research, we underscore the need for continued efforts to enhance preventive measures, optimize surgical interventions, and improve post-fracture care to mitigate mortality risks and improve outcomes for this vulnerable patient population.

This study delves into various aspects surrounding hip fractures, shedding light on critical factors such as mode of injury, fracture pattern, delay in surgery, type of surgery, site of surgery, and time to surgery and their associations with mortality rates.

Premorbid ambulation emerged as a notable consideration, with the majority of subjects having premorbid home ambulation. This underscores the impact of hip fractures on individuals' mobility and independence. Interestingly, the prevalence of falls far outweighed that of motor vehicle accidents, highlighting falls as a predominant cause of hip fractures in the studied population.

The distribution of fracture patterns revealed a considerable proportion of neck of femur fractures, followed by intertrochanteric and subtrochanteric fractures. Such insights are invaluable for clinicians in understanding the prevalence and distribution of different fracture types within the population, aiding in treatment decision-making.

The reasons for the delay in surgery varied, with a substantial portion experiencing delayed presentation or encountering no operating theatre time. This delay could potentially influence outcomes and underscores the importance of prompt surgical intervention in hip fracture management.

Time to surgery did not show a significant association with mortality rates, suggesting that the timing of surgery may not be a decisive factor in predicting patient outcomes in this context. However, further investigation into factors influencing surgical timing and their impact on outcomes could provide valuable insights for future research.

Gender, although not significantly associated with mortality rates in this study, has been observed as a contributing factor in mortality outcomes in other research, as evidenced by González-Marcos E et al.[26] This underscores the multifactorial nature of mortality in hip fracture patients and the need for comprehensive assessment and management strategies tailored to individual patient profiles.

The most prevalent comorbidities were hypertension, diabetes mellitus, heart disease, stroke, anaemia, dementia, and HIV. This profile is consistent with that observed in several studies [24,25,26]. Although hypertension and diabetes mellitus combined accounted for over 70% of prevalence, these comorbidities are not determinants of an unfavourable outcome. Anaemia and dementia were significantly associated with the death group and are mentioned in the literature as factors associated with increased morbidity and mortality. In the present study, an increase was observed in mortality among patients with three comorbidities prior to fracture. Studies show that the number of previous diseases influences the mortality of patients with proximal end femur fractures and that the presence of two or more comorbidities is associated with increased morbidity and mortality [26].

Overall, this study offers valuable insights into the multifaceted nature of hip fractures and their management,providing a foundation for further research and the development of targeted interventions to improve outcomes in this patient population.

We recognize potential limitations in our study, including its retrospective design and the fact that it was conducted at a single academic hospital. Additionally, we considered all-cause mortality data, which may include deaths unrelated to hip fracture surgery. Although the mortality data is

highly accurate, the secondary findings should be interpreted with caution due to the retrospective nature of the study.

Conclusion

In our investigation, we observed a notable trend: a higher mortality rate among patients who sustained a neck of femur fracture compared to other types of hip fractures and patients over the age of 80. This finding underscores the significance of fracture patterns in determining patient outcomes following hip fractures. Patients with anaemia, dementia, or more than 2 comorbidities were found to have an increased risk of mortality. However, despite thorough analysis, we did not find any other factors that were significantly associated with mortality in our study cohort.

The elevated mortality rate observed in our study raises concerns about the overall prognosis and management of hip fractures in elderly patients. Given the substantial impact of hip fractures on morbidity and mortality in this population, it is imperative to identify and understand the underlying risk factors contributing to early mortality.

Therefore, we advocate for further research endeavours aimed at elucidating the risk factors associated with early mortality following hip fractures. By delving deeper into the factors influencing mortality outcomes, future studies have the potential to uncover valuable insights that can inform clinical practice and enhance patient care strategies.

Identifying and addressing these risk factors proactively can lead to targeted interventions and tailored management approaches, ultimately contributing to improved outcomes and enhanced quality of life for elderly patients who suffer from hip fractures. This proactive approach aligns with the principles of evidence-based medicine and underscores the importance of ongoing research efforts in advancing our understanding and management of hip fractures in the elderly population.

Ethics Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this study, formal consent was not required. Prior to the commencement of the study, ethical approval was obtained from the following ethical review board: UKZN BREC, reference number BREC/00006041/2023

Author contributions

FM: Study conceptualisation, data capture, data analysis, first draft preparation, manuscript revision

JR: Data analysis, final draft preparation, Language, and grammar correction.

1. Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C. Excess mortality following hip fracture: a systematic epidemiological review. Osteoporosis International. 2009;20(10):1633-50.

2. Azagra R, Lopez-Exposito F, Martin-Sanchez JC, Aguye A, Moreno N, Cooper C, et al. Changing trends in the epidemiology of hip fracture in Spain. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2014;25(4):1267-74.

3. Ramanau H, Chernyanin I, Rudenka E, Lesnyak O, Zakroyeva A, Bilezikian JP, et al. Epidemiology of hip fracture in Belarus: development of a country-specific FRAX model and its comparison to neighboring country models. Archives of osteoporosis. 2018;13(1):42.

4. Zebaze RM, Seeman E. Epidemiology of hip and wrist fractures in Cameroon, Africa. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2003;14(4):301-5.

5. Chevalley T, Guilley E, Herrmann FR, Hoffmeyer P, Rapin CH, Rizzoli R. Incidence of hip fracture over a 10-year period (1991-2000): reversal of a secular trend. Bone. 2007;40(5):1284-9.

6. Stevens JA, Anne Rudd R. Declining hip fracture rates in the United States. Age and Ageing. 2010;39(4):500-3.

7. Maalouf G, Bachour F, Hlais S, Maalouf NM, Yazbeck P, Yaghi Y, et al. Epidemiology of hip fractures in Lebanon: a nationwide survey. Orthopaedics & traumatology, surgery & research : OTSR. 2013;99(6):675-80.

8. Fernandez MA, Griffin XL, Costa ML. Management of hip fracture. British medical bulletin. 2015;115(1):165-72.

9. Ly TV, Swiontkowski MF. Treatment of femoral neck fractures in young adults. Instr Course Lect. 2009;58:69-81.

10. Marais L, Ferreira N. Management of femoral neck fractures. SA Orthopaedic Journal. 2013;12:58-61.

11. Yoshimura N, Suzuki T, Hosoi T, Orimo H. Epidemiology of hip fracture in Japan: incidence and risk factors. J Bone Miner Metab. 2005;23 Suppl:78-80.

12. Cooper C, Campion G, Melton LJ, 3rd. Hip fractures in the elderly: a world-wide projection. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 1992;2(6):285-9.

13. Kannus P, Niemi S, Parkkari J, Palvanen M, Vuori I, Jarvinen M. Nationwide decline in incidence of hip fracture. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2006;21(12):1836-8.

14. El Maghraoui A, Koumba BA, Jroundi I, Achemlal L, Bezza A, Tazi MA. Epidemiology of hip fractures in 2002 in Rabat, Morocco. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2005;16(6):597-602.

15. Kalula SZ, Ferreira M, Swingler GH, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatr. 2016;16:51.

16. Güerri-Fernandez R, Vestergaard P, Carbonell C, Knobel H, Avilés FF, Castro AS, et al. HIV infection is strongly associated with hip fracture risk, independently of age, gender, and comorbidities: a population-based cohort study. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2013;28(6):1259-63.

17. Panula J, Pihlajamäki H, Mattila VM, Jaatinen P, Vahlberg T, Aarnio P, et al. Mortality and cause of death in hip fracture patients aged 65 or older - a population-based study. BMC Musculoskeletal Disorders. 2011;12(1).

18. Roche JJ, Wenn RT, Sahota O, Moran CG. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. Bmj. 2005;331(7529):1374.

19. Nielsen KA, Jensen NC, Jensen CM, Thomsen M, Pedersen L, Johnsen SP, et al. Quality of care and 30 day mortality among patients with hip fractures: a nationwide cohort study. BMC Health Services Research. 2009;9(1):186.

20. Mnif H, Koubaa M, Zrig M, Trabelsi R, Abid A. Elderly patient's mortality and morbidity following trochanteric fracture. A prospective study of 100 cases. Orthopaedics & traumatology, surgery & research : OTSR. 2009;95(7):505-10.

21. R N. Mortality in elderly patients with intertrochanteric fractures: three years experience. SA Orthipaedic Journal. 2010(9):55-60.

22. Egol KA, Strauss EJ. Perioperative considerations in geriatric patients with hip fracture: what is the evidence? J Orthop Trauma. 2009;23(6):386-94.

23. Karademir G, Bilgin Y, Erşen A, Polat G, Buget MI, Demirel M, et al. Hip fractures in patients older than 75 years old: Retrospective analysis for prognostic factors. Int J Surg. 2015;24(Pt A):101-4.

24. Schnell S, Friedman SM, Mendelson DA, Bingham KW, Kates SL. The 1-year mortality of patients treated in a hip fracture program for elders. Geriatric orthopaedic surgery & rehabilitation. 2010;1(1):6-14.

25. Pourabbas B, Emami MJ, Vosoughi AR, Mahdaviazad H, Kargarshouroki Z. MORTALITY AND FUNCTION AFTER SURGICALLY-TREATED HIP FRACTURE IN ADULTS YOUNGER THAN AGE 60. Acta Ortop Bras. 2017;25(4):129-31.

26. Tsang C, Boulton C, Burgon V, Johansen A, Wakeman R, Cromwell DA. Predicting 30-day mortality after hip fracture surgery: Evaluation of the National Hip Fracture Database case-mix adjustment model. Bone Joint Res. 2017;6(9):550-6.

27. Barceló M, Torres O, Ruiz D, Casademont J. Hip Fractures in People Older Than 95 Years: Are Patients Without Age-Associated Illnesses Different? J Gerontol A Biol Sci Med Sci. 2018;73(10):1424-8.

28. Klestil T, Röder C, Stotter C, Winkler B, Nehrer S, Lutz M, et al. Impact of timing of surgery in elderly hip fracture patients: a systematic review and meta-analysis. Sci Rep. 2018;8(1):13933.

29. du Toit A, van der Merwe J. Mortality following hip fractures managed with hemiarthroplasty in the elderly in South Africa. SA Orthopaedic Journal. 2018;17:30-4.

30. Morri M, Ambrosi E, Chiari P, Orlandi Magli A, Gazineo D, F DA, et al. One-year mortality after hip fracture surgery and prognostic factors: a prospective cohort study. Sci Rep. 2019;9(1):18718.

31. Hwang KT, Moon JK, Kim YH. Do we really need a surgery for hip fractures in elderly patients? Mortality rate and influencing factors. Arthroplasty. 2019;1(1):7.

32. Bulut O, Pazarci Ö, KilinÇ S, ÖZtÜRk H, Tezeren G, ÖZtemÜR Z, et al. Effect on mortality of treatment method and surgerytime for hip fracture patients aged over 65 years. Ulusal Travma ve Acil Cerrahi Dergisi. 2020;26(3):439-44.

33. Thoors O, Mellner C, Hedström M. Good clinical outcome for the majority of younger patients with hip fractures: a Swedish nationwide study on 905 patients younger than 50 years of age. Acta Orthop. 2021;92(3):292-6.

34. Padhi PP RP. Hip fractures: mortality and correlation with preoperative comorbidities in Indian elderly population. International Journal of Research in Orthopaedics. 2021;7:1185-9.

35. Charles-Lozoya S, Cobos-Aguilar H, Manilla-Muñoz E, De La Parra-Márquez ML, García-Hernández A, Rangel-Valenzuela JM. Survival at 30 days in elderly patients with hip fracture surgery who were exposed to hypothermia: Survival study. Medicine (Baltimore). 2021;100(39):e27339.

36. González-Marcos E, González-García E, Rodríguez-Fernández P, Sánchez-González E, González-Bernal JJ, González-Santos J. Determinants of Higher Mortality at Six Months in Patients with Hip Fracture: A Retrospective Study. J Clin Med. 2022;11(9).

37. Dimet-Wiley A, Golovko G, Watowich SJ. One-Year Postfracture Mortality Rate in Older Adults With Hip Fractures Relative to Other Lower Extremity Fractures: Retrospective Cohort Study. JMIR Aging. 2022;5(1):e32683.

38. Yang L, Yang H, Chen Q, Shen H, Wang Z. Analysis of risk factors for 90-day mortality after surgery in elderly patients with intertrochanteric fractures and a history of cardiovascular disease. Annals of Palliative Medicine. 2022;11(1):155-62.

39. Dawod MS, Alisi MS, Saber YO, Abdel-Hay QA, Al-Aktam BM, Alfaouri Y, et al. Characteristics of Elderly Hip Fracture Patients in Jordan: A Multicenter Epidemiological Study. Int J Gen Med. 2022;15:6591-8.

40. Mundi S, Pindiprolu B, Simunovic N, Bhandari M. Similar mortality rates in hip fracture patients over the past 31 years. Acta Orthop. 2014;85(1):54-9.

41. Haleem S, Lutchman L, Mayahi R, Grice JE, Parker MJ. Mortality following hip fracture: trends and geographical variations over the last 40 years. Injury. 2008;39(10):1157-63.

42. Yoon H-K, Park C, Jang S, Jang S, Lee Y-K, Ha Y-C. Incidence and Mortality Following Hip Fracture in Korea. J Korean Med Sci. 2011;26(8):1087-92.

Appendix 1: The final Study Protocol

University of KwaZulu-Natal

College of Health Sciences

School of Clinical Medicine

Title: Mortality rate in elderly patients over the age of sixty with a surgically treated hip fracture at a regional hospital in South Africa

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BACKGROUND AND LITERATURE REVIEW

1.1 Defining the Clinical Problem

Hip fractures are very common serious injuries in patients over the age of 60. It is a public health issue associated with significant morbidity, mortality, and medical and healthcare costs. A significant increase in the incidence of hip fractures has been observed in recent decades. Hip fractures can be treated conservatively in cases of incomplete fractures.

However, in most cases, surgery is indicated. Several studies indicate that advanced age, physical status, male gender, and delayed treatment are determining factors in mortality. Because hip fractures occur in patients with significant comorbidities and a high risk of pre-operative complications, this condition has a high mortality rate when compared to other fractures.

Mortality rate serves as an important indicator in the evaluation of care provided as well as determining the performance of a hospital over time. It is also important to identify risk factors for increased mortality following trauma and to anticipate complications. Given the importance of this topic, this study will aim to determine the mortality rate of patients at 1 year follow up who undergo surgery and to identify comorbidities associated with these patients.

1.2 Literature Review:

Introduction

This literature review examines the current literature on hip fracture mortality in the elderly. It defines hip fractures, examines epidemiological trends, and discusses mortality.

Anatomy of the hip and definition of hip fractures

The hip joint is a synovial joint with articulation between the femur head and the pelvic acetabulum. The acetabulum is formed from the confluence of the ischium, ilium, and pubis. The joint is a ball and socket joint designed for stability and weight bearing conferred by bony and ligamentous restraints. The femur is characterised by a head, neck, and shaft. The head of the femur is connected to the proximal portion of the femoral shaft by the neck of the femur. Abrahamsen et al[1] defined a hip fracture as any fracture of the femur between the articular cartilage of the hip joint to 5 cm below the distal point of the lesser trochanter.

Hip fractures can be classified as intra or extracapsular, that is, a fracture inside or outside the joint capsule of the hip. This broad anatomical distinction is important since it reflects the likelihood with which the blood supply to the femoral head is disrupted [2]. Intracapsular fractures involve the femoral neck while extracapsular fractures involve the intertrochanteric and subtrochanteric regions.

The prognosis of hip fractures varies by the anatomic region of the fracture. Intertrochanteric fractures occur in the region between the greater and lesser trochanters of the proximal femur. These extra capsular fractures occur in cancellous bone with an abundant blood supply. As a result, nonunion and osteonecrosis are less problematic than in femoral neck fractures. Displacement in this region can occur due to deforming muscle forces which will usually produce shortening, external rotation and varus position at the fracture.

In contrast, the femoral neck has a decreased amount of cancellous bone, a thin periosteum, and a relatively poor blood supply that is susceptible to disruption. Neck of femur fractures have a high incidence of complications, such as nonunion, osteonecrosis, and degenerative changes in the hip joint.

Diagnosis following a hip fracture is based on clinical and radiographic evidence. Patients with impacted or stress fractures may present with groin pain, lack of deformity, and may be able to bear weight. The patient with displaced fractures complains of severe pain and the inability to bear weight.

Patients with a femoral neck fracture have a shortened, flexed, and externally rotated lower extremity. Radiographic evaluation should include anteroposterior and lateral plain radiographs of the entire femur as well as an anteroposterior radiograph of the pelvis [(3)].

Conservative and surgical options are available for hip fracture management. Conservative treatment, primarily for undisplaced fractures, consists of a period of bed rest followed by protective weight bearing. Non-operative management of undisplaced fractures has a high rate of failure due to late displacement in more than 20% of cases[(4)]. Surgical options include open reduction and internal fixation (sliding hip screws, cannulated screws, and compression screws), hemiarthroplasty, or total hip replacement.

Epidemiology

Hip fractures are a major cause of disability and hospitalization, increasing morbidity and mortality, and have been recognized worldwide as a major public health problem. Hip fractures are the third most common cause of patients becoming bedridden after cerebrovascular disease and senility, thus markedly decreasing the quality of life [(5)]. The incidence of hip fractures increases with age, is more prevalent in women, and is becoming more frequent in the aging population [(6)]. The incidence of hip fractures shows marked geographic variations, with higher rates observed in Nordic countries, America, and Europe. There may also be differences found

within each country [6]. The absolute global incidence of hip fractures is expected to increase to 2.6 million by 2025 and 4.5 million by 2050 [1]. Most cases of hip fractures arise because of low-impact trauma in an individual with underlying bone fragility.

In Spain, hip fracture incidence rate trends were examined. The analysis showed a continuous rise in people 65 years of age or older. The study reports an analysis of 7.111035 people over 14 years period (1997-2010). During this period, there were 119857 hip fractures in men and 415421 in women. The female-to-male ratio was 3.2 to 1. The number of fractures in men 85 and older was 6.8 times higher compared to men in the 65-69 age range. In women, it was 14.6 times higher. In this study, the crude incidence rates have gradually increased more in men than in women [6].

A study conducted in Belarus during the period 2011-2012 looked at hip fractures in men and women aged 50 years and older. For the 2-year period, 117 cases of hip fractures were reported, of whom 83 underwent surgery. The number of hip fractures in women was 76 and 41 in men (ratio of 1.9 to 1). Incidence in both sexes increased with age. The hip fracture incidence was higher among women. Hip fracture rates vary markedly in different countries for reasons that are ill understood; however, the incidence in this study was similar in Russia, Lithuania, and Poland. A limitation of this study with regard to the incidence is that only 1.2% of the population was examined [7].

In Geneva, Switzerland, hip fracture trends have been studied from 1991 to 2000. Hip fractures were sustained in 2981 females and 822 males aged 50 years and over in the 10-year period. The overall hip fracture incidence was 455 per 100,000 persons in females and 153 per 100,000 persons in men. The study found that the number of hip fractures remained constant over the 10

year period despite an aging population. A considerable decline of 1.4% per year for age-adjusted rates in females in particular age groups of 60 - 64 years of age and 90 years and over was also concluded. The rate remained unchanged in males [8].

The number of hip fractures occurring worldwide will increase from 1.66 million in 1990 to 6.26 million in 2050 [9]However, a study in the United States used hospital discharge data (1990 to 2006) to determine the national trends in hip fracture incidence for people over the age of 65.

Hip fracture incidence decreased substantially from 1990 to 2006. The rates decreased from 54.6 and 108.4 in 1990 to 48.8 and 91.7 per 10,000 in 2006 and in males and females respectively [10]. These results are consistent with those of Kannus et al [11], who reported that the incidence of hip fracture declined by 20% in women and 6% in men from 1997 to 2004 in Finland. Factors that could possibly account for these declines and challenge Cooper's [9] finding that the incidence of hip fractures will increase include, a healthier ageing population, improved functional abilities in the elderly, removal or withdrawal of the use of psychoactive drugs, and an increase in average body weight [11].

After adjustment for age and sex, the incidence rate rose from 471 to 567 in males and from 637 to 759 per 100,000 in females per year. The total increase in incidence over the study period was calculated to be 13%. The rise in incidence, when compared to the result of Chevalley et al [8] is held accountable for the rise in patients seen over the age of 80 years.

In Lebanon, Maalouf et al [12], conducted a study with a total of 1199 using a national database of hip fractures admitted to hospitals in Lebanon in 2007 in patients over the age of 50. In contrast to many regions, such as Europe, North America, and Eastern Asia, only a few reports have evaluated the epidemiology of hip fractures in the Middle East. The crude annual incidence rate in patients over the age of 50 was 147 per 100,000 with a male-to-female ratio of 1: 2. The incidence was projected to rise to 284 per 100,000 by 2050. Of the total

1199 hip fractures, 503 occurred in males with 696 in females. The main findings were that hip fractures incidence rates in Lebanon are consistent with patterns described in most populations, where there is an exponential increase with age for both sexes. As expected, over half of the total number of hip fractures in both genders occurs in the age 75 years or older.

A few studies are available on the incidence of hip fracture in Africa. Osteoporosis and fragility fractures are believed to be uncommon in Africa. Fragility fractures are believed to be uncommon in Africa due to reduced longevity[13]. Zebaze et al [14] conducted a study in Cameroon and Maghraoui et al [13] conducted a similar study in Morocco, both of the studies concluded that fragility fractures of the hip do occur in Africa, but less frequently when compared to other countries. In Cameroon, severe trauma was the most common cause of hip and wrist fractures in men and women younger than 50 years. After the age of 50, 90% and 83.3% of the fractures in women and men respectively were fragility fractures resulting from falls. In Cameroon, the incidence of hip fractures in men over the age of 65 is 35 per 100,000 persons per year [14]. In Morocco, a rise in incidence rate was found for both men and women with increasing age, the age-adjusted incidence of hip fracture is 52.1 and 43.7 per 100,000 in women and men, respectively [13]. The characteristics of hip fractures described in these two studies imply that fragility fractures occur in Africa, although significantly less frequently than in most North American,European and Asian countries. Fragility fractures occur more frequently in Northern Africa compared to sub-Saharan African countries. Low fragility fracture rates are most likely due to reduced longevity and under reporting in Africa.

In South Africa, the prevalence and incidence rates for hip fractures in the elderly population has not been determined, however the prevalence rate for falls in the elderly is 26% and the incidence of falls is 236 and 407.5 per 1,000 persons per year for males and females respectively [15].

Guerri-Fernandez et al [16] reported that HIV infection and antiretroviral therapies have damaging effects on bone metabolism, the authors therefore explored the association of HIV infection and risk of sustaining a hip or major osteoporotic fracture in Spain. After adjusting for age, gender, smoking, alcohol consumption and the presence of co-morbidities, a significant association between HIV infection and hip fracture risk was reported.

In summary, hip fracture incidence rates are rising worldwide, more so in developing countries in Asia, South America and Africa. The factors that account for cultural and social differences in hip fracture rates and incidences include differences in the demographic profile, level of physical activity, calcium intake, body weight, prevalence of cigarette smoking and alcohol consumption and the frequency of falls in the elderly population. More recently, it has also been reported that HIV infection is significantly associated with hip fracture risk [16].

Mortality following hip fractures

Hip fractures are the most serious consequence of falling in the older people. 87 to 96% of hip fractures occur in patients over 65 years and are associated with increased mortality [17].One study stated that survival declines soon after hip fracture but thereafter parallels the expected survival of the general population. Excess mortality after hip fractures may be linked to complications following the fracture , such as pulmonary embolism, infection, and heart failure [17]. Roche et al [18] carried out a prospective observational cohort study in Nottingham England whereby they evaluated post operative complications and the mortality associated with these complications at 30 days and one year post operatively. The association between pre-existing co-morbidities and development of post operative complications and mortality were also examined in elderly patients admitted with an acute hip fracture. Roche et al [18] concluded that the most common post operative complication was chest infections and then followed by heart failure. At 30 days, mortality was 9.6% and at one year mortality was 33%. In women and men there was a significant difference in 30 day mortality rates, this being 8.2% and 15%

respectively. A large sample of patients were included in this study and a 100% follow up on mortality statistics was completed. In a large Danish nationwide population-based cohort study investigating the quality of care and 30 day mortality in elderly patients with a hip fracture, the overall 30 day mortality rate recorded was 10.3%. The authors concluded that high quality of treatment offered to patients resulted in significantly lowered 30 day mortality rates [19]. Both of the above nationwide cohort studies in first world countries reveal consistent 30 day mortality rates for elderly patients with a hip fracture.

In Africa, Mnif et al [20] assessed the mortality and morbidity following a trochanteric fracture in 100 elderly patients in Tunisia. At two years, the mortality rate was 28%. This 28% comprised of a 3% mortality rate during the first week postoperatively, 8% between two weeks and three months, 7% between four and 12 months and 10% between 12 and 24 months. Age was one of the most significant risk factors influencing the two year mortality rate.
Patients belonging to the "old-old" age group (>90 years) had a 100% two year mortality rate, compared to 25% and 5% respectively for those in the "middle-old" (75-90) and "young-old" (60-74) age group. Associated co-morbidities and fracture instability was also found to be associated with increased mortality.

In South Africa the in-hospital mortality in elderly patients with an intertrochanteric fracture is 14% [21]. The mortality rate rises significantly to 32% during the first year and to 39% in the second year. No difference was found in mortality rates when associated with the place of residence prior to hospital admission and the time elapsed between admission and date of operation, as long as the operation was performed during the first week of admission [21]. The mortality rates between the two studies in Africa varied substantially, Mnif et al [20] recorded a 3% in hospital mortality rate, 7% one year mortality and 28% two year mortality in comparison to Ngobenis' [21] 14%, 32% and 39% respectively. In each of the studies by Ngobeni [21]and Mnif et

al [20], 64% and 68% of the patients respectively who died throughout the course of the study had one or more pre-existing co-morbidity. Mnif et al [20] and Ngobeni [21] limited the inclusion criteria to trochanteric fractures and any femoral neck fractures were excluded. Literature has shown that patients who sustain a femoral neck fracture have significantly higher mortality rates when compared to those with trochanteric fractures. The mean age in Ngobeni's [21] study was 79 years and the mean age in Mnif et al [20] study was 76 years.

Despite similar demographics in each of the studies, varying results were reported. These differences can be attributed to the social and cultural factors that varies across different geographical settings and influence the prognosis of hip fractures.

Patients admitted to hospital with three or more pre-existing co-morbidities, male gender, respiratory disease, renal disease or increased age are more likely to have a significantly increased 30 day mortality rates [18]. Ngobeni [21] further concluded that time to surgery was not associated with a higher in-hospital mortality.

References

1. Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C. Excess mortality following hip fracture: a systematic epidemiological review. Osteoporosis International. 2009;20(10):1633-50.

2. Fernandez MA, Griffin XL, Costa ML. Management of hip fracture. British medical bulletin. 2015;115(1):165-72.

3. Ly TV, Swiontkowski MF. Treatment of femoral neck fractures in young adults. Instr Course Lect. 2009;58:69-81.

4. Marais L, Ferreira N. Management of femoral neck fractures. SA Orthopaedic Journal. 2013;12:58-61.

5. Yoshimura N, Suzuki T, Hosoi T, Orimo H. Epidemiology of hip fracture in Japan: incidence and risk factors. J Bone Miner Metab. 2005;23 Suppl:78-80.

6. Azagra R, Lopez-Exposito F, Martin-Sanchez JC, Aguye A, Moreno N, Cooper C, et al. Changing trends in the epidemiology of hip fracture in Spain. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2014;25(4):1267-74.

7. Ramanau H, Chernyanin I, Rudenka E, Lesnyak O, Zakroyeva A, Bilezikian JP, et al. Epidemiology of hip fracture in Belarus: development of a country-specific FRAX model and its comparison to neighboring country models. Archives of osteoporosis. 2018;13(1):42.

8. Chevalley T, Guilley E, Herrmann FR, Hoffmeyer P, Rapin CH, Rizzoli R. Incidence of hip fracture over a 10-year period (1991-2000): reversal of a secular trend. Bone. 2007;40(5):1284-9.

9. Cooper C, Campion G, Melton LJ, 3rd. Hip fractures in the elderly: a world-wide projection. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 1992;2(6):285-9.

10. Stevens JA, Anne Rudd R. Declining hip fracture rates in the United States. Age and Ageing. 2010;39(4):500-3.

11. Kannus P, Niemi S, Parkkari J, Palvanen M, Vuori I, Jarvinen M. Nationwide decline in incidence of hip fracture. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2006;21(12):1836-8.

12. Maalouf G, Bachour F, Hlais S, Maalouf NM, Yazbeck P, Yaghi Y, et al. Epidemiology of hip fractures in Lebanon: a nationwide survey. Orthopaedics & traumatology, surgery & research : OTSR. 2013;99(6):675-80.

13. El Maghraoui A, Koumba BA, Jroundi I, Achemlal L, Bezza A, Tazi MA. Epidemiology of hip fractures in 2002 in Rabat, Morocco. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2005;16(6):597-602.

14. Zebaze RM, Seeman E. Epidemiology of hip and wrist fractures in Cameroon, Africa. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2003;14(4):301-5.

15. Kalula SZ, Ferreira M, Swingler GH, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatr. 2016;16:51.

16. Güerri-Fernandez R, Vestergaard P, Carbonell C, Knobel H, Avilés FF, Castro AS, et al. HIV infection is strongly associated with hip fracture risk, independently of age, gender, and comorbidities: a population-based cohort study. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2013;28(6):1259-63.

17. Panula J, Pihlajamäki H, Mattila VM, Jaatinen P, Vahlberg T, Aarnio P, Kivelä S-L. Mortality and cause of death in hip fracture patients aged 65 or older - a population-based study. BMC Musculoskeletal Disorders. 2011;12(1).

18. Roche JJ, Wenn RT, Sahota O, Moran CG. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. Bmj. 2005;331(7529):1374.

19. Nielsen KA, Jensen NC, Jensen CM, Thomsen M, Pedersen L, Johnsen SP, et al. Quality of care and 30 day mortality among patients with hip fractures: a nationwide cohort study. BMC Health Services Research. 2009;9(1):186.

20. Mnif H, Koubaa M, Zrig M, Trabelsi R, Abid A. Elderly patient's mortality and morbidity following trochanteric fracture. A prospective study of 100 cases. Orthopaedics & traumatology, surgery & research : OTSR. 2009;95(7):505-10.

21. R N. Mortality in elderly patients with intertrochanteric fractures: three years experience. SA Orthipaedic Journal. 2010(9):55-60.

22. du Toit A, van der Merwe J. Mortality following hip fractures managed with hemiarthroplasty in the elderly in South Africa. SA Orthopaedic Journal. 2018;17:30-4.

23. Mundi S, Pindiprolu B, Simunovic N, Bhandari M. Similar mortality rates in hip fracture patients over the past 31 years. Acta Orthop. 2014;85(1):54-9.

24. Haleem S, Lutchman L, Mayahi R, Grice JE, Parker MJ. Mortality following hip fracture: trends and geographical variations over the last 40 years. Injury. 2008;39(10):1157-63.

25. Yoon H-K, Park C, Jang S, Jang S, Lee Y-K, Ha Y-C. Incidence and Mortality Following Hip Fracture in Korea. J Korean Med Sci. 2011;26(8):1087-92.

26. González-Marcos E, González-García E, Rodríguez-Fernández P, Sánchez-González E, González-Bernal JJ, González-Santos J. Determinants of Higher Mortality at Six Months in Patients with Hip Fracture: A Retrospective Study. J Clin Med. 2022;11(9).

1.3 The research question (or hypothesis)

What is the mortality rate in elderly patients over the age of sixty with a surgically treated hip fracture?

AIMS AND OBJECTIVES

Aim of the study

To analyse the overall mortality rate at 6 weeks, 6 months and 1 year follow up in patients over the age of sixty with hip fractures at a regional in South Africa.

Objectives

1. To determine the influence of pre-existing comorbidities and its contribution to the mortality rate
2. To determine the influence of different surgical fracture treatments on the mortality rate
3. To determine the influence of time to surgery on mortality rate
4. To determine the influence of patient demographics on mortality rate
5. To determine the influence of fracture site on mortality rate.

METHODS

Study design

This is a retrospective chart review study. The study will identify factors that influence the outcome (mortality) of hip fractures. In this study the age, gender, time to surgery, type of surgical intervention and its influence on mortality rate.

Setting

The study site is R.K.Khan Hospital

Participant selection and sampling strategy

Study population:

All elderly patients over the age of sixty years admitted to R.K.Khan Hospital with a hip fracture

Sampling technique:

Random sampling or convenient sampling, if required

Inclusion and exclusion criteria:

- Inclusion:
- Patients over the age of sixty years admitted to R.K. Khan Hospital with a hip fracture, treated surgically from January 2022 to December 2022.
- Exclusion:
- Patients who die prior to surgical intervention and who are treated conservatively or re-admitted with complications of a previous surgery will not be included in this study.

Measurements:

The principal investigator is Dr Farhaad Mahomed. A data collection tool is needed to gather information. A review of patients' charts and inclusion criteria will be applied. Information from the patient chart will be entered into the study on a Microsoft Excel data sheet (Data collection sheet below). Data will be analyzed by a statistician registered with the University of KwaZulu Natal. Results obtained will be reflected in the form of statistical analysis, tables, and graphs.

Data collection and statistical analysis:

Data will be imported from an MS Excel spreadsheet for Data analysis. The collected data will be captured and subsequently analysed using the Statistical Package for Social Sciences (Spss Version 25).

In this study, data will be analysed as follows:

Constant variables such as age will be expressed as mean +/—standard deviation or median (intercondylar range) and compared using the Student T-test or the Willcoxon Mann Whitney test, as appropriate.

Categorical variables such as age groups and gender will be expressed as proportions or percentages and compared using chi-squared tests or Fisher's exact test as appropriate.

A binary logistical regression model will be used to relate the independent variables to the outcome of surgery. All analysis will be conducted using SPSS version 25, and a statistical significance will be set at $P < 0.05$

Reliability and validity

All patients who sustained a hip fracture between January 2022 and December 2022 will have their charts reviewed. All information will be taken from the chart and filled into the research tool. If all required information is available, patients will be included in the study. These patients will then be contacted directly or via relatives at one year to determine mortality.

Database design

The study will be conducted through a review of medical records and telephone contact with patients and their relatives. The information on death and its date will be obtained through telephone contact. Patients whose medical records were incomplete or who died prior to surgical management will be excluded.

The following variables will be studied: age, sex, co-morbidities, type of fracture, surgical procedure, type of implant used, mean time between fracture and surgery, postoperative complications, and death. Data will be entered into a database created on a Microsoft Excel spreadsheet and used for data analysis. The data file will be assembled in consultation with a statistician.

Data management

Information will be collected from patient chart reviews, which are stored at medical records in R.K. Khan Hospital. The master copy of patients' names and information will be available to the main investigator only after the data is captured.

Collected de-identified data encrypted by a number system will be entered into a password-protected database. The research team will only handle the data, which will be kept with the main investigator until submission for data analysis. Only de-identified data will be submitted for analysis.

The original data files will be kept in a locked office in the Department of Orthopaedics at R.K. Khan Hospital and destroyed once five years have elapsed, in keeping with the university policy.

Statistical tests

Constant variables such as age will be expressed as mean +/—standard deviation or median (intercondylar range) and compared using the Student T-test or the Willcoxon Mann Whitney test, as appropriate.

Categorical variables such as age groups and gender will be expressed as proportions or percentages and compared using chi-squared tests or Fisher's exact test as appropriate.

A binary logistical regression model will be used to relate the independent variables to the outcome of surgery

ETHICAL CONSIDERATIONS

Community participation

Community engagement is not necessary for this research. Patient information and clinical auditing of the files will always be confidential.

Social Value

This study will allow us to determine the mortality rate in elderly patients who undergo surgery for a hip fracture as well as possible contributing factors to the mortality rate. We have many elderly patients who present with fractures of the hip. The information obtained from the study will help us determine the mortality rate and factors that increase the mortality rate and to try and minimize these factors to improve the mortality rate.

Scientific validity

The methods used are scientifically valid and informed by current literature. The use of a biostatistician will add further scientific validity to the study and ensure statistically significant results. The study will be optimally powered and free of statistical errors.

Fair selection of participants

All patients over the age of sixty who underwent surgery for a hip fracture as per our inclusion and exclusion criteria.

Risk/ benefit balance

There is a risk of breach of confidentiality when reviewing a patient's records. Storing data on a password-protected computer accessible by the study authors only decreases this risk.

The study can help improve the management of elderly patients with hip fractures. By determining factors impacting the mortality rate in elderly patients undergoing hip surgery, we can develop a treatment protocol to minimize factors contributing to increased mortality in these patients.

Independent ethics review

Submission will be made to the local ethics committee at UKZN to achieve BREC approval. After that, the CEO and Hospital Management at RKK hospital require consultation for site approval at the study location.

Informed consent

As this is a retrospective chart review, patient consent is not necessary.

Ongoing respect for participants

Patient information and clinical auditing of the files will always be confidential.

METHODOLOGICAL CHALLENGES AND STUDY LIMITATIONS

- Patients will only be selected from a single center, creating a relative selection bias.
- The study's patient number depends on the number of patients over sixty with a hip fracture during the study period and the inclusion/exclusion criteria.
- The data analyzed will represent short—to medium-term outcomes and further studies will be required to determine long-term functional outcomes.
- There is no control group.
- Retrospective data collection.

Poor records: Inadequate patient data recorded by medical personnel (poor note-keeping). Incorrect date and time recorded.

FEASIBILITY:

Timelines and project management

The research protocol is to be submitted for ethics approval. Once approval is obtained, data collection will take 1 month. Completion is expected 6 months after ethics approval.

Study team, contributors, and authorship

Name:	Department:	Contribution:	Author or Acknowledgement
Dr J Rajpaul	Orthopaedics	Supervisor	Author

Participating Centers

R.K Khan Hospital, Durban, South Africa

Study Funding and Progress

The study is of a retrospective chart design and requires no funding.

STUDY SIGNIFICANCE:

Our study aims to determine the mortality rate in elderly patients with a hip fracture who are treated surgically and the factors that contribute to it. This is significant because we know from previous studies around the world that the mortality rate in these patients is high. In our setting, we encounter elderly patients with hip fractures daily. This study will help us determine whether the factors contributing to this high mortality can be minimised or avoided. Improving factors contributing to increased mortality while maintaining a good standard of care is our goal to reduce the mortality rate in these elderly patients.

Appendix 2: The Guidelines for Authorship for the Journal selected for submission of the manuscript

South African Orthopaedic Journal

https://www.saoj.org.za/index.php/saoj/information-for-authors

Instructions for Authors

Criteria for publication

- The article falls within the scope of the journal.
- Methods, statistics, and other analyses are performed to a high technical standard and are described in sufficient detail.
- Results reported have not been published elsewhere.
- Conclusions are presented appropriately fashion and are supported by the data.
- The article is presented in an intelligible fashion and is written in standard English (British usage).
- The research meets all applicable ethical standards.
- The article adheres to guidelines provided in the instructions for authors section.

Guidelines for authorship

- Each author should participate and is responsible for the content and design of the study, the preparation of the manuscript and its revisions, and final approval.
- Other contributors can be acknowledged at the end of the manuscript together with their contribution.
- Authors of manuscripts representing a multi-centre study may list members of the group in the footnote on the title page of the published article, and their affiliations are listed in an appendix.
- The authors should indicate the predominant surgeon or surgeons who have contributed patients to the study.
- On submission of your article, the ORCID (Open Researcher and Contributor ID) identifier of at least the corresponding author will be required. ORCID provides a persistent digital identifier that distinguishes you from every other researcher and supports automated linkages between you and your professional activities, ensuring that your work is recognised. To register and find more information, please visit: http://orcid.org

Registration of clinical trials

- A clinical trial is defined as any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects of health outcomes. Interventions include drugs, surgical procedures, devices, behavioural treatments, dietary interventions, and process-of-care changes.
- Clinical trials should be registered in a public trials registry in accordance with International Committee of Medical Journal Editors
- Trials must be registered and approved by the relevant authorities before the onset of patient enrolment.
- The Medicines Control Council (MCC) reference number and the SA National Clinical Trial Register (SANCTR) registration number should be included at the end of the abstract of the article.
- Purely observational studies (those in which the assignment of the medical intervention is not at the discretion of the investigator) do not require registration.

Reporting guidelines

- All articles should be prepared in accordance with the guidelines relevant to the study design, as described in the Equator Network Guidelines (https://www.equator-network.org/reporting-guidelines/)
- Randomised trials should be accompanied by a flow diagram that illustrates the progress of patients through the trial, including recruitment, enrolment, randomisation, withdrawal and completion, and a detailed description of the randomisation procedure.

Reporting of statistics

In terms of the statistical reporting, the Equator Network advises on the use of the SAMPL guideline: https://www.equator-network.org/2013/02/11/sampl-guidelines-for-statistical-reporting/

The SAMPL guidelines provide two guiding principles

1. *"Describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results."* When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Avoid relying solely on statistical hypothesis testing, such as *P* values, which fail to convey important information about effect size.
2. *Provide enough detail that the results can be incorporated into other analyses.* This requires reporting the descriptive statistics from which other statistics are derived, such as the numerators and denominators of percentages, especially in risk, odds, and hazards ratios. Likewise, P-values are not sufficient for re-analysis. Needed instead are descriptive statistics for the variables being compared, including sample size of the groups involved, the estimate (or effect size) associated with the P-value, and a measure of precision for the estimate, usually a 95% confidence interval.

Some specific guidelines applicable to the SAOJ:

- Consistency is one of the most important factors in presenting a well-formatted, professional manuscript.
- The nature of the measurements and variables reported on will often dictate the amount of precision required. Report numbers - especially measurements? with an appropriate degree of precision. For ease of comprehension and simplicity, round to a reasonable extent.
- The recommendation is to report the number of decimals that have both clinical and statistical meaning and consistently reporting all other variables in the same manner.
- Note: Generally, for descriptive purposes, percentages are reported as whole numbers except when dealing with really large sample sizes
- At least for the primary outcomes, report a measure of precision (a confidence interval).
- Although not preferred to confidence intervals, if desired, *p* values should be reported as equalities to three decimal places (e.g., $p = 0.031$ and not as inequalities: e.g., $p < 0.05$). Do NOT report NS; give the actual *P-value*. The smallest *P*-value that needs to be reported is $P < 0.001$.
- Report numerators and denominators for all percentages
- Summarize data that are approximately normally distributed with means and standard deviations (SD). Use the format: mean (SD) not mean ?
- Summarize data that are not normally distributed with medians and interpercentile ranges, ranges, or both.
- Do NOT use the standard error of the mean (SE) to indicate the variability of a data set. Use standard deviations, inter-percentile ranges, or ranges instead.

Formatting examples:

- p = 0.028 or p < 0.001
- (43% vs 21%; p = 0.002)
- (odds ratio (OR) 0.38; 95% confidence interval (CI) 0.71 to 1.82; p = 0.822) or after first use (OR 1.62; 95% CI 1.41 to 1.86; p < 0.001)
- *Descriptive stats normal distribution:* mean age 36 years (SD 4 years) or 36 years (SD 4; range 40 to 97 years)
- *Descriptive stats non-normal distribution:* median age 36 years (IQR 44 to 88 years) or 36 years (IQR 44 to 88 years; range 40 to 97 years)
- *Descriptive stats percentage:* (149 of 202; 74%)

Formatting of submissions

Text formatting

- Use Helvetica or Arial font, size 11.

- Use double line spacing throughout the document.
- Number the pages of the blinded manuscript consecutively.
- Use italics for emphasis.
- When referring to an article with multiple authors, please use the following format: Rabinowitz et al. published their retrospective review.
- Do not use field functions.
- Use tab stops or other commands for indents, not the space bar.
- Use the table function, not spreadsheets, to make tables.
- Use the equation editor or MathType for equations.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

Headings

- Use no more than three levels of displayed headings.

Abbreviations

- Define abbreviations and acronyms at first mention and use consistently thereafter.

Units

- Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.

Figures

- Figures should be numbered consecutively with illustration Arabic numbers 1, 2, 3, etc.
- The figure should be listed in the text as follows: … wound irrigation and splinting (*Figure 1*).
- Figures should be clear and easily understandable with a full descriptive legend stating any areas of interest and explaining any markings, letterings or notations. All figures and figure legends should be understandable as a stand-alone item, without having to read the main body of the text.
- For radiographs, please ensure you state the view used and the time point at which it was taken, as well as the demographic details of the patient if applicable.
- Please submit the original JPEG (300 dpi) or TIFF of all photographs, as well as the figure saved as a Word document. The Word version of the figure should be complete with the legend and any necessary markings such as letters or arrows.
- Figures such as graphs and algorithms should be in Word or PowerPoint in order to be editable.
- Figures should not be imbedded in the text file but should be submitted as separate individual files. Each figure should be a separate file, entitled Figure 1, Figure 2, etc.

- Remove all markings, such as patient identification, from radiographs before photographing. Clinical photos must be adequately anonymised.
- A statement of patient consent for clinical photographs must be provided on the title page.
- In images depicting X-rays of children there should exhibit adequate shielding of radiation.
- All line or original drawings must be done by a professional medical illustrator.
- We accept a maximum of six figures. You may apply to the Editor-in-Chief for permission to include more figures if considered critical to the clarity and completeness of the submission.
- Do not submit any figures, photos, tables, or other works that have been previously copyrighted or contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.

Tables

- Tables should carry uppercase Roman numerals, I, II, III, etc.
- Tables should always be cited in the text in consecutive numerical order.
- The table should be identified in the text as follows: Details of results are listed in *Table I*. Or, alternatively,? high-energy trauma that is often associated with these fractures (*Table II*).
- Tables should be used to present information in a clear and concise manner. All tables should be understandable without the main text.
- For each table, please supply a table heading explaining the components of the table.
- Identify any previously published material by giving the original source in the form of a reference at the end of the table heading.
- Footnotes to tables should be indicated by superscript lower-case letters and included beneath the table body.
- Please submit tables as editable text and not as images. They should be created using the Table tool in Word.
- Do not embed tables in the text file but submit them as separate individual files. Each table should be a separate file, entitled Table I, Table II, etc.
- We accept a maximum of eight tables.
- Do not duplicate information given already in the text.
- Do not submit any figures, photos, tables or other works that have been previously copyrighted or contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.

References

- References should be numbered consecutively in the order that they are first mentioned in the text and listed at the end in numerical order of appearance.
- Identify references in the text by Arabic numerals in superscript after punctuation.
- References should not be a listing of a computerised literature search but should have been read by the authors and have pertinence to the manuscript.
- Accuracy of references is the authors' responsibility, and the author is to verify the references against the original documents.
- Manuscripts in preparation, unpublished data (including articles submitted but not in the press) and personal communications may not be included in the reference listing. They may be listed in the text in parentheses only if absolutely necessary to the contents and meaning of the article.
- The titles of journals should be abbreviated according to the style used in Index Medicus, obtainable through the website http://www.nlm.nih.govshould
- The following format should be used for references:

Journal article:

Sidhu GS, Ghag A, Prokuski V, Vaccaro AR, Radcliff KE. Civilian gunshot injuries of the spinal cord: a systematic review of the current literature. *Clin Orthop Relat Res* 2013;**471**:3945-55.

Ideally, the names of all authors should be provided, but the usage of *et al*. in long author lists (more than six authors) will also be accepted: Fong K, Truong V, Foote CJ, *et al*. Predictors of nonunion and reoperation in patients with fractures of the tibia: an observational study. *BMC Musculoskelet Disord* 2013;**14**:103.

Online journal article:

Caetano-Lopes J, Lopes A, Rodrigues A, *et al*. Upregulation of inflammatory genes and downregulation of sclerostin gene expression are key elements in the early phase of fragility fracture healing. *PLoS One* 2011;**6**:e16947.

Web reference (with authors):

Cierny G, DiPasquale D. Adult osteomyelitis protocol. http://www.osteomyelitis.com/pdf/treatment_protocol.pdf.

(date last accessed 05 March 2013).

Web reference (no authors listed):

No authors listed. International commission on radiological protection. http://www.icrp.org (date last accessed 20 September 2009).

Chapter in a book:

Young W. Neurophysiology of spinal cord injury. In: Errico TJ, Bauer RD, Waugh T (eds). *Spinal Trauma*. 3rd ed. Philadelphia: JB Lippincott; 1991: 377-94.

Dissertation:

Borkowski MM. Infant sleep and feeding: a telephone survey of Hispanic Americans [dissertation]. Mount Pleasant (MI): Central Michigan University; 2002.

Abstract:

Peterson L. Osteochondritis of the knee treated with autologous chondrocyte transplantation [abstract]. ISAKOS Congress, 2001.

Structure and content of submission

- We accept a maximum of 3 500 words, including the abstract and body of the text (excluding references).
- Exceptions to this rule may be made for systematic reviews and meta-analysis at the discretion of the Editor-in-Chief.
- Please follow the following structure when preparing your submission. Each of the following should be submitted as a separate file.
- Title page (title, authors and affiliations, corresponding author and declarations)
- Blinded manuscript (Abstract, keywords, introduction, methods, results, discussion, funding sources, conflict of interest statement, ethics statement, acknowledgements and references)
- Tables (with headings), each table as a separate file.
- Figures (with legends), each figure as a separate file.

Title page

Title

- The title should be concise and informative.

Author names and affiliations

- Please provide the following information for each author:
    - Full names and surname, as well as title
    - Qualifications
    - Designation
    - Affiliation and address
    - ORCID ID (see Article Submission section)
- Please check that all names are accurately spelled.
- Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate affiliation details.

- Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.

Corresponding author

- Clearly indicate who will handle correspondence at all stages of refereeing and publication, including post-publication.
- Ensure that the e-mail address and permanent address is given and that contact details are kept up to date by the corresponding author.
- Please note that the corresponding author's contact details will be provided in the final article.
- Provide the following information for the corresponding author:
    - Full names and title
    - Affiliation
    - Physical address
    - Postal address
    - Telephone number
    - E-mail address

Declarations

Authors are to insert a section at the end of the title page entitled declarations (please provide the author's name, signature and date). The following statements are required under the declarations section:

Authorship

The authors confirm that all authors have made substantial contributions to all of the following:

- The conception and design of the study, or acquisition of data, or analysis and interpretation of data.
- The drafting of the article or its critical revision for important intellectual content.
- Final approval of the version to be submitted.

Sound scientific research practice

The authors further confirm that:

- The manuscript, including related data, figures and tables, has not been previously published and is not under consideration elsewhere.
- No data have been fabricated or manipulated (including images) to support conclusions.
- This submission does not represent part of a single study that has been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time (e.g. 'salami-publishing').

Plagiarism

The authors confirm that the work submitted is original and does not transgress the plagiarism policy of the journal.

- No data, text or theories by others are presented as if they were the authors' own.
- Proper acknowledgements of others' work have been given (this includes material that is closely copied, summarised and/or paraphrased); quotation marks are used for verbatim copying of material.
- Permissions have been secured for copyrighted material.

Conflict of interest statement

A conflicting interest exists when professional judgment concerning a primary interest (such as the patient's welfare or the validity of research) may be influenced by a secondary interest (such as financial gain or personal rivalry). It represents a situation in which financial or other personal considerations from authors, reviewers or editors have the potential to compromise or bias professional judgment and objectivity. It may arise for the authors when they have a financial interest that may influence their interpretation of their results or those of others. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, grants or other funding. All potential conflicts of interest need to be declared. The conflict of interest statement should list each author separately by name, e.g.,

'Author A.B. (*use initials of relevant author, not full name in order for the document to remain blinded*) has received research grants from Company A. Author B.C. has received a speaker honorarium from Company X and owns stock in Company Y. Author C.D. is a member of committee Z.'

If no conflicts of interest exist, state this as follows:

'The authors declare they have no conflicts of interest that are directly or indirectly related to the research.'

Funding sources

All sources of funding should be declared. Also, define the involvement of study sponsors in the study design, collection, analysis and interpretation of data; the writing of the manuscript; and the decision to submit the manuscript for publication.

List all funding sources as follows:

'This work was supported by the xxxx (grant numbers xxxx, yyyy).'

When funding is from a block grant or other resources available to a university, college or other research institution, submit the name of the institute or organisation that provided the funding.

If no funding was received, state as follows:

'No funding was received for this study.'

Compliance with ethical guidelines

- For all publications:

‘The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.’

Available from: http://publicationethics.org/resources/international-standards-for-editors-and-authors

Institutional Review Board (IRB) ethical approval must have been given if the study involves human subjects or animals. Please provide the approval number. IRB documentation should be available upon request.

‘Prior to the commencement of the study ethical approval was obtained from the following ethical review board: *Provide name and reference number’*

- For studies with human subjects include the following:

‘All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.’

‘Informed written consent was or was not obtained from all patients for being included in the study.’

‘Consent was obtained from patients for the use of clinical photographs and these images were adequately anonymised.'

- For studies with animals, include the following sentence:

‘All institutional and national guidelines for the care and use of laboratory animals were followed.’

- For articles that do not contain studies with human or animal subjects:

‘This article does not contain any studies with human or animal subjects.’

- If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study. If any identifying information about patients is included in the article, the following sentence should also be included: Additional informed consent was obtained from all patients for which identifying information is included in this article. The Helsinki Declaration 2008 can be found at http://www.wma.net/en/30publications/10policies/b3/

Please provide the names and email addresses of two reviewers.

Title Page Example

Title of Submission

John Smith*

MBChB, FC Orth SA, MMed (Ortho)

University of South Africa, 123 High Street, Pretoria

ORCID ID 1234-1234-1234-1234

Paula Taylor

MBChB, FC Orth SA

University of South Africa, 123 High Street, Pretoria

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Tel: 012 123 4567

e-mail: johnsmith@unisa.ac.za

Declarations:

Authorship

The authors confirm that all authors have made substantial contributions to all of the following:

- The conception and design of the study, or acquisition of data, or analysis and interpretation of data.
- The drafting of the article or its critical revision for important intellectual content.
- Final approval of the version to be submitted.

Sound scientific research practice

The authors further confirm that:

- The manuscript, including related data, figures and tables, has not been previously published and is not under consideration elsewhere.
- No data have been fabricated or manipulated (including images) to support conclusions.
- This submission does not represent part of a single study that has been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time (e.g. ‘salami-publishing’).

Plagiarism

The authors confirm that the work submitted is original and does not transgress the plagiarism policy of the journal.

- No data, text or theories by others are presented as if they were the authors’ own.

- Proper acknowledgements of others' work have been given (this includes material that is closely copied, summarised and/or paraphrased); quotation marks are used for verbatim copying of material.
- Permissions have been secured for copyrighteed material.

Conflict of interest statement

John Smith declares that he has no conflict of interest. Paula Taylor has received research grants from Drug Company A.

Funding sources

No funding was received for the purposes of performing this study.

Compliance with ethical guidelines

The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.

Prior to the commencement of the study ethical approval was obtained from the following ethical review board: *Provide name and reference number.*

All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Informed written consent was or was not obtained from all patients for being included in the study.

Consent were obtained from patients for the use of clinical photographs/ and these images were adequately anonymised.

Author Name	**Signature**	**Date**
J Smith		15/8/2017
P Taylor		16/8/2017

<u>Blinded manuscript</u>

To ensure a blinded review, the main body of the manuscript should not contain any identifying information, including author's names, institutions or affiliations. Please do not include the name of the ethics committee, this information should be provided in the title page.

Abstract

- A structured abstract (maximum of 350 words) summarising the most important points in the article is required.
- The abstract consists of four paragraphs with the subheadings:

    - Background (must include the aim of the study)
    - Patients and methods
    - Results
    - Conclusion
- References should be avoided. Avoid uncommon abbreviations. If essential, they must be defined at their first mention in the abstract itself.

Keywords

- Immediately after the abstract, provide a maximum of six keywords using standard searchable terms. These keywords will be used for indexing purposes.

Level of evidence

- Level 1 to 5.
- Please follow the level of evidence guidelines provided by the Oxford Centre for Evidence-Based Medicine (OCEBM); version 2.1.
- Available from: OCEBM Levels of Evidence Working Group. 'The Oxford Levels of Evidence 2'.Oxford Centre for Evidence-Based Medicine. http://www.cebm.net/index.aspx?o=5653

Introduction

- The introduction should contextualise the study by providing the background to the research; explain the problem that is to be addressed, and provide the rationale for the study.
- Briefly outline the relevance of the study with respect to the current literature. Avoid a detailed literature survey or a summary of the results.
- The last sentence should outline the research question or hypothesis.

Patients (or Materials) and methods

- State the methods, outcome measures, and selection criteria. The following aspects need to be described:
    - The study design and research methodology
    - Whether randomisation (with methods) was applied
    - If case-controlled, how the controls were selected
    - The time period under review
    - Number of patients/subjects under investigation and why this number was chosen
    - Inclusion and exclusion criteria
    - Case and outcome definitions

    - A description of the procedure or intervention, including post-operative protocol
    - The outcome measures or scores used
    - The minimum follow-up period
    - Statistical analysis paragraph. This should be included at the end of this section to detail statistical tests and package used, the reasons why these tests were used, and what p-value was considered statistically significant. A power analysis is recommended for studies comparing two or more groups.
- Provide sufficient detail so that another researcher can replicate the study.
- The reader should understand from this description all potential sources of bias such as referral, diagnosis, exclusion, recall or treatment bias. This includes the manner in which investigators selected the patients. Consecutive inclusion implies all patients with a given diagnosis are included, while selective implies patients with a given diagnosis but selected according to certain explicit criteria (e.g., state of disease, choice of treatment).
- Do not describe standard procedures for common operations. Only include new procedures or adaptations to standard procedures.
- If you name any specific product, it requires the manufacturer's name, city and state/country.
- Present information in the narrative format and use the past tense.
- Where relevant, tables or figures may be included to provide information more clearly.
- Generally, no data should be presented in this section.

Results

- Describe the relevant results and analysis thereof.
- Provide details of the number of patients included and excluded, as well as the reason for exclusion.
- It is important to state the follow-up period (mean and range).
- The results can be broken down into separate sections, e.g. Treatment, Functional outcome, Complications, etc.
- Tables may be used but avoid repeating data reported in the text in the tables.
- All appropriate data should be presented as means with ranges, not with standard deviations (SDs). Medians should only be used when the data is skewed, accompanied by an interquartile range (IQR).
- Avoid using percentages in studies involving well under 100 subjects.
- All results must be backed up with p-values or survivorship analysis. All Kaplan-Meier data should be presented with confidence intervals. Always present exact absolute p-values, whether significant or not, unless $p<0.001$.

- However, *P-values* do not always convey the entire picture and where relevant, the confidence interval will also be required (in addition to the power of the study reported in the methods section).

Discussion

- The question or hypothesis stated at the end of the introduction should be discussed and either supported or rejected.
- The results must be interpreted clearly, and any deficiencies expressed. All possible confounding factors, sources of bias or weaknesses in the study should be identified.
- Explore the significance of the results of the work rather than repeating the results.
- The discussion must point out the relevance of the work described in the paper and its contribution to current knowledge.
- Explain what can be deduced from the results and how will it affect clinical practice.
- Include a review of the relevant literature, placing the results of the study in the context of previous work in this area.
- Discussion of relevant prior research and references must be concise. Avoid extensive citations and discussion of published literature emphasize previous findings that agree (or disagree) with those of the present study.
- Do not repeat the introduction.
- Present the limitations of the study and suggest how the study could have been improved for a future study.
- Avoid making inferences from non-significant trends unless you believe your study is adequately powered to answer the question; in that case, provide a power analysis.

Conclusion

- Provide a summary statement that conveys the conclusions of the findings.
- Do not draw conclusions not supported by the data obtained from the specific study presented.

Ethics statement

- For studies involving human subjects, please include an ethics statement as follows: ‘All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.’
- For animal studies, please include the following ethical statement: ‘All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.’
- If the study did not involve human or animal subjects, state that: ‘This article does not contain any studies with human participants or animals performed by any of the authors.’

- Please also include an informed consent statement: ‘Informed consent was obtained from all individual participants included in the study.’
- Alternatively, for retrospective studies, please add the following sentence: ‘For this study formal consent was not required.’
- If identifying information about participants is available in the article, the following statement should be included: ‘Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.’

Acknowledgements

- Acknowledgements should be placed at the end of the discussion and before the references.
- In this section, persons who were involved but did not earn authorship can be acknowledged.
- Statements should be brief. A person can be thanked for assistance or comments.
- Do not include contributions by editors or referees.

Author contributions

- Please state the contributions of each author
- For example: ‘A.B contributed to the study conceptualisation, design, data analysis and manuscript preparation. C.D. contributed to data collection and manuscript preparation. E.F. contributed to ....’
- The types of contributions are:
    - Conceptualisation and design
    - Data collection or contribution
    - Data analysis
    - Manuscript preparation
    - Other contributions (please specify)

References

- Please refer to the section on Formatting of submissions.

Tables and figures

- Tables and figures should not be imbedded in the text file but should be submitted as separate individual files. Each table should be a separate file, entitled Table I, Figure 2, etc.
- Each table and figure should be provided with a heading or legend.
- Please refer to the ‘Formatting of submission’ section for further guidelines.

Case reports

In addition to the preceding guidelines the following applies:

- The following headings need to be adhered to in the body of the manuscript:
    - Abstract
    - Keywords
    - Background
    - Case report
    - Discussion
    - Conclusion
    - Ethics statement
    - References
- Abstract: Minimum 250 words (350 maximum), using the following headings:
    - Background
    - Case report
    - Discussion
    - Conclusion
- Statement of informed consent must be included in the ethics statement.

Current Concepts Review Article (by invitation only)

General Guidelines:

- A narrative review will suffice (and systematic or scoping review not necessary)
- A thorough literature review needs to be done prior to writing the manuscript to ensure that the author is well acquainted with the current concepts related to the topic (with emphasis on the most recent developments)
- A balanced and unbiased view of the current clinical aspects of the topic.
- Focus on clinical aspects like diagnosis and treatment.
- Discuss controversies and state both sides of the argument.
- Avoid extensive discussion of basic science (anatomy/physiology/pathology) aspects, except for some really novel and clinically relevant new developments in the field.
- The topic may be adapted, but only with the permission of the Editor-in-Chief.

Outline of Article:

- Abstract = One paragraph, no headings, ≤350 words.
- Introduction = Brief introduction to the topic

- Contents = Please use headings (in bold) and sub-headings (in italics) to structure the manuscript in a reader-friendly manner
- South African context = Discuss matters which may be particularly relevant or unique to the South African clinical setting.
- Learning points = Make use of tables to summarize important learning points
- Conclusion = Brief evidence-based conclusion and summary
- Conflict of interest statement
- References = As usual

Appendix 3: Ethical approvals

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address: 330 Langalibalele Street, Pietermaritzburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/ 3123 Fax: 033 394 3782
Email:
www.kznhealth.gov.za

DIRECTORATE:
Health Research & Knowledge Management

Ref: KZ_201908_027

Dear Dr F Mahomed
(UKZN)

Subject: Approval of a Research Proposal:

1. The research proposal titled **'Mortality rate in elderly patients over the age of sixty with a surgically treated hip fracture at a local hospital in the eThekwini Region'** was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at RK Khan hospital.

2. You are requested to take note of the following:

   a. *Kindly liaise with the facility manager BEFORE your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.*
   b. *Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.*
   c. *Provide an interim progress report and final report (electronic and hard copies) when your research is complete.*

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Ms G Khumalo on 033-395 3189.

Yours Sincerely

[redacted]

Dr E Lutge
Chairperson, Health Research Committee
Date: 02/10/19

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

12 September 2023

Dr Farhaad Mahomed (200203367)
School of Clinical Medicine
Medical School

Dear Dr Mahomed,

Protocol reference number: BREC/00006041/2023
Project title: The mortality rate in elderly patients over the age of sixty with a surgically treated hip fracture at a regional hospital in South Africa
Degree: MMed

EXPEDITED APPLICATION: APPROVAL LETTER

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application.

The conditions have been met and the study is given full ethics approval and may begin as from 12 September 2023. Please ensure that any outstanding site permissions are obtained and forwarded to BREC for approval before commencing research at a site.

This approval is valid for one year from 12 September 2023. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on RIG on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2020) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be noted by a full Committee at its next meeting taking place on 10 October 2023.

Yours sincerely,

[redacted]

Prof D Wassenaar
Chair: Biomedical Research Ethics Committee

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

16 October 2019

Dr F Mahomed (200203367)
School of Clinical Medicine
College of Health Sciences
Farhaad.mahomed@gmail.com

Protocol: Morality rate in elderly patients over the age of sixty with surgically treated hip fracture at a local hospital in the EThekwini Region.
Degree: Non-Degree **BREC Ref No: BE525/18**

EXPEDITED APPLICATION: APPROVAL LETTER

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 20 August 2019.

The study was provisionally approved pending appropriate responses to queries raised. Your response received on 07 October 2019 to BREC correspondence dated 27 February 2019 has been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have been met and the study is given **full ethics approval** and may begin as from 16 October 2019. Please ensure that site permissions are obtained and forwarded to BREC for approval before commencing research at a site.

This approval is valid for one year from **16 October 2019.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **noted** by a full Committee at its next meeting taking place on **12 November 2019.**

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

[redacted]

Professor V Rambiritch
Chair: Biomedical Research Ethics Committee

Supervisor: phakspg@gmail.com Postgrad admin: SCMpgrad@ukzn.ac.za

Appendix 4: Data collection tools

Data Collection Sheet	Dr F.Mahomed

Mortality rate in patients over the age of 60 admitted with a hip fracture, treated surgically at R.K.Khan Hospital

Inpatient Number : **Date of birth /**

Age: **Nam** **Surna**

Sex: **Male** **or** **Female**

Contact Number:

Next of Kin Contact:

Premorbid ambulation: Community ☐ or ho ☐

Co morbidities: ☐

Mechanism of Injury: fall ☐ PVA/MV ☐ ☐

Date of Injury: ☐ Date of Den ☐

Date of Admission: ☐ Demise from time of surgery (months)

☐ <3 4-6 7-9 10-12 >12

Date of surgery: ☐

Delay in surgery: No ☐ Yes Theatre time or Needed to Optimise or Other

Fracture Pattern: Neck of fer ☐ Intertroch ☐ Sub ☐ trochanteric

Type of Surgery: Arthroplast ☐ CM/ IM Na ☐ ☐

Left side fracture: ☐ or Right side fractu ☐

Time to surgery: < 24hr ☐ 25- 48 ☐ 48-72 ☐ > ☐