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The clinical profile and progression of patients presenting for total joint arthroplasty at a central Johannesburg hospital – A cross-sectional study.

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Abstract

Background
This study aimed to describe the clinical profile and immediate postoperative course of patients presenting for total hip and total knee arthroplasty at Charlotte Maxeke Johannesburg Academic Hospital, and explore associations between anaesthetic techniques and postoperative destination and length of hospital stay.

Methods
A retrospective, cross-sectional review was conducted using convenience sampling. Adult patients presenting for primary hip or knee arthroplasty surgery were included in the study, and various statistical methods were used to analyse the data.

Results
The study population included 187 patients, the majority of whom were female. The median age was 67 (IQR 60 to 73). The median BMI was 31.1 kg/m^2 (IQR 26.5 to 34.5), and 59% of the patients were obese. Hypertension was the most common comorbidity (61%), and ASA I and II patients were the most prevalent. Regional anaesthesia (RA) was more frequent (69.5%) than general anaesthesia (GA) (30.5%). Most patients (94.1%) were discharged to a ward. Patients who received GA had a more extended hospital stay, a median stay of nine days (IQR 6 to 14 days), than those who received RA. Late discharge was more common among males with a median duration stay of nine days (IQR 6 to 14 days) (p = 0.029). The complication rate was 9.6%, with an in-hospital mortality rate of 1.1%.

Conclusion
In this single-centre cohort, the case-mix was older patients, comorbidity-burdened, and regional anaesthesia was used predominantly. Crude associations were observed between anaesthetic technique and immediate postoperative disposition and/or length of hospital stay. These hypothesis-generating findings require adjusted analyses and external validation.

Recommendation
Further multicentre, prospective studies are recommended to evaluate postoperative outcomes and long-term progression following TJA. The current findings may assist in improving preoperative assessment and healthcare planning in resource-limited settings.

Keywords: *Total joint arthroplasty, Regional anaesthesia, General anaesthesia, complications, Length of hospital stay*
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Introduction

The demand for arthroplasty surgery is growing exponentially, putting pressure on health care systems to meet this demand.[1] The incidence of joint replacement procedures is high, with over one million total hip (THR) and total knee replacement (TKR) surgeries performed each year in the United States of America alone.[2] As total joint arthroplasty (TJA) procedures become increasingly common, the importance of mitigating the impact of adverse events continues to grow. While knowledge of the risk factors is valuable for risk stratification and potentially directing appropriate prophylaxis, some risk factors are inherent to patients and are unmodifiable.[3] Most elective TJA patients have modifiable risk factors, providing an opportunity for preoperative intervention.[4] Some of these modifiable risk factors include weight, tobacco use, preoperative anaemia and comorbidities, including hypertension and diabetes requiring optimum control. Many of these and other perioperative risks have been noted to contribute to poor outcomes after TJA. Risk factors such as age, gender, chronic diseases, preoperative use of walking aids, pre-and postoperative anaemia, the need for blood transfusion, a high American Society Anaesthesiology (ASA) score, and time between surgery and mobilisation, were all found to negatively influence postoperative outcome in general, length of stay and patient satisfaction.[5] The impact of obesity and increasing age on the outcome of joint arthroplasty remains controversial. There is evidence showing that operative time is longer in morbidly obese patients however, the extent of the time difference is controversial.[6] Significantly higher rates of deep and superficial wound infections have been reported in obese patients who present for hip and knee arthroplasty. Additionally, long-term implant survival is reduced with higher rates of implant failure.[6] Increasing age has also resulted in increased length of stay following TJA. This has been attributed to poorer rehabilitation potential leading to slower rehabilitation times and increased comorbidities, resulting in more postoperative complications.[6, 7] A study by Glassou et al. (2017), found that THA and TKA patients with diabetes and cardiovascular diseases before the primary procedure had an increased risk of mortality.[8]

The chosen anaesthetic technique impacts the conduct of surgery and the perioperative outcome as a whole. [9] Arthroplasty surgery, especially that of the knee, is a painful procedure, and suboptimal pain management amplifies the stress response and hinders early mobilisation, putting patients at risk of developing postoperative venous thromboembolism (VTE) and pulmonary complications. [1] Therefore, a comprehensive anaesthetic technique for TJA is essential for facilitating patient comfort during the procedure, ensuring patient safety, and enhancing successful surgical outcomes. Factors affecting the selection of an appropriate anaesthetic for an individual patient include surgical requirements for performing the procedure, anticipated duration of surgery, patient comorbidities and preferences, plans for providing postoperative analgesia, and the experience and preferences of the anaesthetist. [10] The different anaesthetic techniques that can be used for TJA include general anaesthesia (GA), regional anaesthesia (RA) (subarachnoid or epidural block), and peripheral nerve blocks (PNBs), or a combination of these techniques. The effects of spinal versus general anaesthesia on 30-day mortality after TJA remain unclear. [11] The lack of superiority of any specific technique was demonstrated in a large-scale randomised trial in older adults with hip fractures. In a 2012 study by Studner and colleagues,[10] RA was associated with decreased morbidity, a reduction in blood loss and surgical site infections, as well as a lower rate of admission to critical care services, compared with GA for TJA.[9, 11-13] A meta-analysis comparing RA and GA for elective THR by Mauermann et al. (2006), showed statistically significant reductions in the operative time, intraoperative blood loss, and the incidence of VTE when neuraxial block was used. [12] A 2006 meta-analysis by Rashiq and Finnegan [14] demonstrated that RA reduces perioperative bleeding and transfusion by lowering arterial and venous pressure. Outcome data related to the impact of anaesthetic techniques on postoperative mortality after TJA are limited. With mortality rates in the range of 1- 4 in 1000 patients, previous clinical randomised controlled trials have been underpowered for this outcome. In addition, many studies published over 30 years ago may no longer reflect current surgical and anaesthesia practices. Memtsoudis et al (2016) showed an association between using PNBs and the risk of complications. [15] This association is important given that the joint arthroplasty population represents an elderly and comorbid group at risk for complications. In their study, complications such as VTE, chronic pain, increased risk of transfusion, and infections were less likely to occur in those patients who had received a PNB versus those who had not if used during THR. The authors also identified an association between PNBs and reduced resource use for patients with total hip arthroplasty.

Furthermore, Molloy et al. (2017) showed that hospital costs for TJA increased from 2002 to 2013 but were attenuated by a reduction in inpatient length of stay. [16] Much of the hospital cost for total knee and hip arthroplasty comprised the length of stay. [16]

A study by Memstoudis et al. (2016) on using Critical Care Services (CCS) among patients undergoing TJA

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found that approximately 3% of patients undergoing primary TJA required critical care services. [17] Compared with non-CCS patients, patients using CCS received more blood transfusions and mechanical ventilation, had higher mortality rates, incurred higher costs, and had more extended hospital stays. [17] Risk factors with increased odds of requiring CCS included advanced age, hip versus knee surgery, surgical indications other than osteoarthritis and rheumatoid arthritis, use of general versus neuraxial anaesthesia, emergent admissions, increasing comorbidity burden, and the presence of postoperative cardiopulmonary complications. [17] Increased surveillance of patients with risk factors may diminish the need for CCS. AbdelSalam et al. (2012) identified other risk factors for needing CCS after TJA as being age (>65 years), male gender, a positive smoking history, obesity (body mass index ≥ 30.6kg/m2), and ethnicity (Caucasians having a lower risk than other populations). [18]

Little is known about the outcomes or the number of total joint replacements performed in sub-Saharan Africa. [19] The relative increase in the elderly population and the changing indications for younger patients are predicted to result in a growing number of patients undergoing joint arthroplasty. [9] This study aimed to describe the clinical profile and immediate postoperative course of TJA patients at CMJAH from June 2023 to June 2024 and explore the associations between anaesthetic techniques and level of care postoperative destination, as well as the length of hospital stay.

Methods

Study design and study setting

A retrospective, cross-sectional review was conducted. The study population was adult patients presenting for elective primary knee and hip arthroplasty surgery at CMJAH from June 2023 to June 2024. CMJAH is a primary teaching hospital for the University of the Witwatersrand, which offers specialised, tertiary, and quaternary healthcare services.

Sample size

In consultation with a biostatistician, a sample size was calculated considering potential lost or incomplete records. Similar studies with a 95% confidence interval were examined to estimate the profile and clinical progression of TJA patients at CMJAH. In 2008, a study by Husted et al. found that 22% and 12% of patients underwent THR and TKR, respectively. In the same study, 41% of the patients were discharged after three days, and 92% were discharged within five days. [5] This conservative discharge proportion of 41% after three days was used to estimate an initial sample size using a conservative proportion with an alpha of 5% and a margin of error of 8% at a 95% confidence interval. However, according to theatre and orthopaedic department records, an average of ten knee and hip arthroplasty patients were operated on per week. The monthly total number averaged 35 cases. Considering this, a sample size of 250 with a difference of +/-8% and an alternative proportion of 50% was considered feasible because this study has not been done in our setting before. This was estimated using the Stata 17 Statistics programme. A final sample size of 187 was used because there was missing data for the other 14 patients, and they could not be used.

Sampling technique

A convenience sampling method was used.

Inclusion and exclusion criteria

Patients included in the study were adults (age > 18) presenting for elective primary hip or knee arthroplasty surgery from June 2023 to June 2024. Patients excluded from the study were those presenting for non-TJA-related, revision joint, hemiarthroplasty, and all emergency non-orthopaedic surgeries.

Data measurement

Data was collected by the principal investigator using a validated data tool formatted on Research Electronic Data Capture (REDCap).

Variables

The variables investigated included patient demographics and patient characteristics such as comorbidities, ASA classification, and BMI. Anaesthetic details such as the type of anaesthesia and intraoperative analgesia were also investigated. The type of surgery, need for intraoperative blood transfusion, and the length of surgery were included in the study. Postoperative destination and the type of postoperative complications and their incidence were also investigated. Thromboembolic events (confirmed by imaging and use of therapeutic anticoagulation), wound infection (confirmed using clinician diagnosis and use of antibiotics), and in-hospital mortality were defined as postoperative complications. Early discharge was defined as the first six days postoperatively, and late discharge was defined as seven or more days postoperatively, according to the institution's protocol.

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Statistical methods

Data was analysed using STATA version 18. The data captured included demographics, patient characteristics, anaesthetic, surgical, intraoperative, and postoperative details. Continuous variables were summarised as median (IQR) after inspection of distributions. Group comparisons used were the Wilcoxon rank-sum or the Kruskal–Wallis. Categorical variables were summarised as n (%); group comparisons used χ^2 or Fisher's exact. We prespecified logistic regression for (a) late discharge (≥7 days) and (b) high-care/ICU destination, with anaesthetic technique as the main exposure adjusted for age, sex, BMI, ASA class, and procedure (THA vs TKA). We report ORs with 95% CIs and exact p-values. For LOS, we report the Hodges–Lehmann median difference with 95% CI and explore quantile regression adjusted for the same covariates. Statistical significance was set at $p < 0.05$.

Ethical consideration

The approval to conduct this retrospective and cross-sectional study was obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical) (Human Research Ethics Certificate number M240650) obtained on the 21st of April 2024.

Results

Of the 201 patients screened, a total of 187 patients were eligible to be included in this study; 14 were excluded due to missing or incomplete data, as shown in Figure 1:

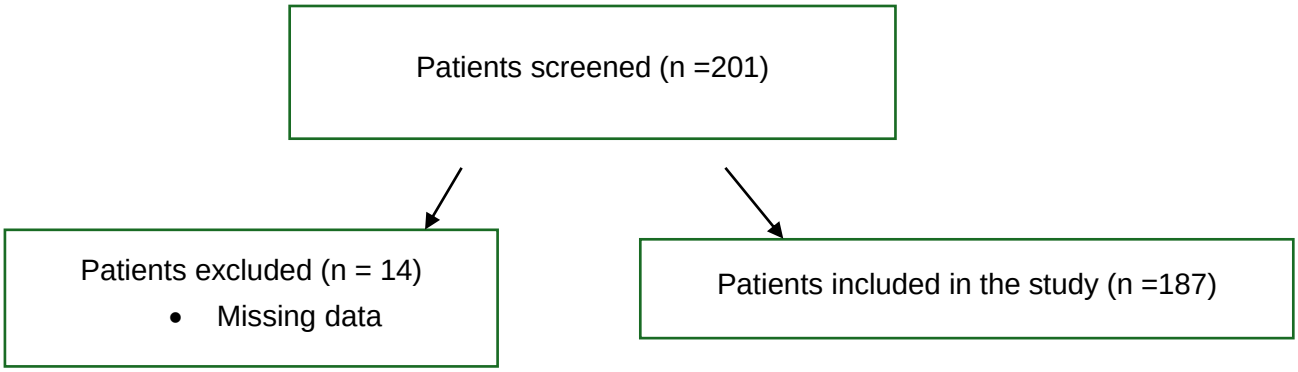

Figure 1: Flow diagram of patients screened, excluded, and included in the study

Baseline characteristics of the patients are shown in *Table I.* The median age of the cohort was 67 years (IQR: 59.0 to 73.0). The sample was predominantly female (68.4%), while males accounted for 31.6%. Regarding perioperative risk stratification, most patients were classified as ASA I or ASA II (66.7%), whereas 33.3% were ASA III. Data was missing for 4 patients. The median BMI was 31.1kg/m^2 (IQR:26.5 to 34.5). BMI data were missing for 43 patients. In terms of surgical distribution, 98 patients (52.4%) underwent total hip replacement, while 89 patients (47.6%) had total knee replacement. Regional anaesthesia was utilised in the majority of cases (130 patients, 69.5%), whereas general anaesthesia was used in 57 patients (30.5%).

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Table I: Demographics and case-mix

Variable	Statistic	Median (Q1, Q3)
Age		67.0 (59.0, 73.0)
Gender		
Male		59 (31.6)
Female		128 (68.4)
ASA status		
I and II		122 (66.7)
III		61 (33.3)
Missing		4
BMI (Kg/m^2)		31.1 (26.5,34.5)
Missing		43
Type of surgery	**n (%)**	
Total hip replacement	98 (52.4)	
Total knee replacement	89 (47.6)	
Type of anaesthesia	**n (%)**	
General anaesthesia	57 (30.5)	
Regional anaesthesia	130 (69.5)	

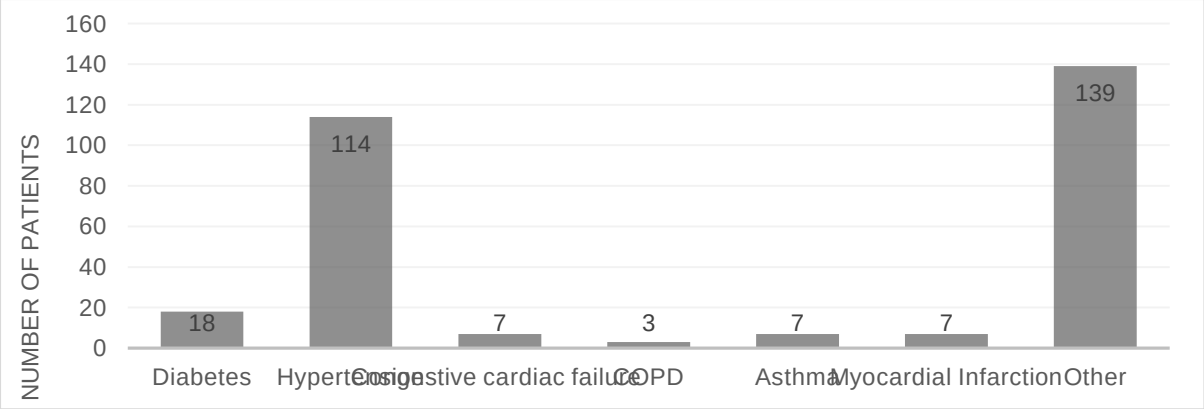

Figure 2: Comorbidities

Hypertension was the most common comorbidity, with a prevalence of 61%, followed by diabetes (9.6%) (*Figure 2).* Other comorbidities, including HIV, hypercholesterolemia, and haemophilia, were present in 74.3% of patients.

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Of those who received GA, 4.8% received a nerve block, 35.8% received paracetamol, 32.1% received morphine, and 13.4% received ketamine (*Figure 3)*. The most common nerve block performed was the fascia iliaca block .

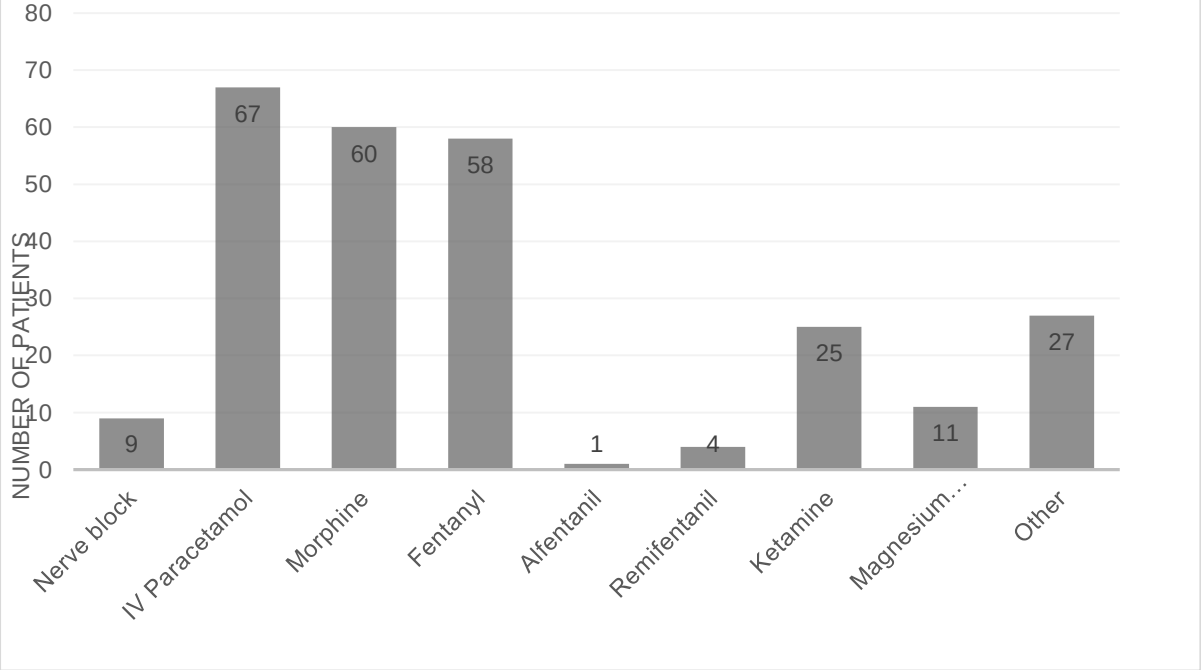

Figure 3: Intraoperative analgesia

Table II: Association between postoperative details by type of anaesthesia

Variable	Class	General Anaesthesia n(%) N=57	Regional Anaesthesia n(%) N=130	p-value
Postoperative destination	General ward High care unit ICU	50 (87.7) 4 (7.0) 3 (5.3)	126 (96.9) 2 (1.6) 2 (1.6)	0.047
Duration of HCU stay (days)	0 1	52 (100) 0 (0)	120 (98.4) 2 (1.6)	0.353
Duration of ICU stay (days)	0 2	50 (100) 0 (0)	120 (99.2) 1 (0.8)	0.519
Length of hospital stay	Median (Q1,Q3)	9.0 (6.0, 14.0)	7.0 (5.0, 11.0)	0.034
Discharge	Early discharge Late discharge	17 (29.8) 40 (70.2)	48 (37.2) 81 (62.8)	0.330
Complications	Yes No	6 (10.5) 51 (89.5)	12 (9.2) 118 (90.8)	0.782
Thromboembolic events	Yes No	2 (3.5) 55 (96.5)	3 (2.3) 127 (97.7)	0.639
Wound infection	Yes No	3 (5.3) 54 (94.7)	2 (1.5) 128 (98.5)	0.146
In-hospital mortality	Yes No	1 (8.8) 56 (98.2)	1 (0.8) 129 (99.2)	0.547
Other complications	Yes No	5 (8.8) 52 (91.2)	8 (6.2) 122 (93.8)	0.517

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Table II shows postoperative outcomes between patients who received GA and those who received RA. The majority of patients in both groups were transferred to the general ward, but this proportion was significantly higher in the RA group (96.9%) compared to GA(87.7%). A higher proportion of GA patients required admission to high care (7.0% vs 1.6%) or ICU (5.3% vs 1.6%). No significant difference was observed in the duration of HCU stay (p = 0.353) or ICU stay (p = 0.519) between GA and RA. Median hospital stay was significantly longer in GA patients (9 days, IQR: 6 to 14) compared to RA patients (7 days, IQR: 5 to 11). Early discharge was slightly more common in the RA group (37.2%) compared to GA (29.8%), although this difference did not reach statistical significance.

The overall complication rates were similar between GA (10.5%) and RA (9.2%). Thromboembolic events (3.5% vs 2.3%) and wound infections (5.3% vs 1.5%) occurred more frequently in GA patients, though not statistically significantly. Other complications were also higher in GA (8.8% vs 6.2%). Mortality was low in both groups:1.8% in GA versus 0.8% in RA, with no significant difference.

Table III: Relationship between patient profile and length of hospital stay

	UOR [95% CI]	p-value	AOR [95% CI]	p-value
Age	0.98 [0.96;1.01]	0.184	0.99[0.96; 1.01]	0.300
Gender				
Male	1 (base)		1 (base)	
Female	0.46 [0.23; 0.93]	0.031	0.49[0.24;0.98]	0.045

Table III presents the association between age and gender, and the length of hospital stay following TJA. Age did not demonstrate a statistically significant relationship with hospital stay. In both unadjusted (UOR 0.98; 95% CI: 0.96–1.01) and adjusted analyses (AOR 0.99; 95% CI: 0.96–1.01), the odds ratios approached unity, indicating that increasing age did not influence the likelihood of prolonged admission in this cohort. Gender, however, showed a significant association. Compared to males, females were less likely to experience extended hospitalisation. In the unadjusted analysis, females had a UOR of 0.46 (95% CI: 0.23 to 0.93; p = 0.031), and this remained significant after adjustment for potential confounders, with an AOR of 0.49 (95% CI: 0.24 to 0.98; p = 0.045). This finding suggests that female patients had approximately 50% lower odds of prolonged length of stay compared to males.

The analysis demonstrated that patients who underwent surgery under GA had a significantly longer median hospital stay compared with those who received RA. Specifically, the median difference in length of stay was 1 day (95% CI: 0 to 3 days), which reached statistical significance (p = 0.033).

Discussion

This study examined the clinical profile and progression of patients undergoing TJA at CMJAH. The findings provide insights into patient demographics, comorbidities, perioperative management, complications, and mortality. This data is essential for evaluating surgical outcomes, benchmarking against global standards, and optimising patient care.

The patients included were adults presenting for primary total hip and knee arthroplasty, with a predominance of female patients (68.4%) and a median age of 67 years. Most patients were classified as ASA categories II and III. This is consistent with global data, where TJA is more commonly performed in older adults, particularly women, due to higher rates of osteoarthritis and osteoporosis in this population. [20] Prior research has established that adverse outcomes following THA and TKA are associated with advanced age, obesity, and multiple comorbidities. [3] While recognising these risk factors is critical for stratifying surgical risk and guiding preoperative optimisation, certain risk factors remain inherently unmodifiable. This study corroborates prior findings, demonstrating that hypertension and obesity are among the most prevalent comorbid conditions in this patient population. Bernstein et al. (2018) highlighted that a substantial proportion of elective TJA patients present with modifiable risk factors, emphasising the importance of targeted preoperative interventions. [4]

Perioperative risk factors influencing postoperative outcomes, length of hospital stay, and patient satisfaction have been well documented. Factors such as age, gender, chronic diseases, preoperative functional status, anaemia, blood transfusion requirements, a high American Society of Anaesthesiology (ASA) score, as well as the timing of postoperative mobilisation were found to influence postoperative outcome negatively in general, length of stay, and patient satisfaction. [5] This study did not, however, find a significant correlation between age, comorbidities, ASA status, BMI, and preoperative haemoglobin level with length of hospital stay. This may reflect effective perioperative management of these patients or a relatively small study sample. Notably, male patients had a more extended hospital stay, which contrasts with the results of Husted et al. (2008), who reported a prolonged hospital stay among female

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patients. [5] This may suggest potential underlying factors, clinical or social, that might influence recovery time or discharge readiness in males. Additionally, differences in pain perception, coping strategies, or adherence to postoperative rehabilitation protocols may contribute to shorter LOS among female patients. The choice of anaesthetic technique has been shown to influence perioperative outcomes in TJA significantly. [9] Consistent with existing literature, this study found that RA was the predominant modality used, with patients receiving GA demonstrating more extended hospital stays and increased ICU admissions. These findings are supported by prior research by various researchers, indicating that neuraxial anaesthesia is associated with reduced morbidity, less blood loss, decreased rates of surgical site infections, and diminished critical care use compared with GA.[9-12]

A study by Molloy et al. (2017) demonstrated that hospital costs for TJA increased from 2002 to 2013 but were attenuated by a reduction in inpatient length of stay. [16] According to Husted et al. (2008), predictors of length of stay and patient satisfaction after hip and knee replacement surgery include fast-track experience. [5] In their study, 92% of the patients were discharged directly to their homes within five days and 41% within three days. Although no significant statistical association was observed between anaesthetic technique and length of hospital stay in this study, RA was associated with a trend toward improved postoperative recovery and reduced length of stay. While other factors, such as surgical complexity, patient comorbidities, surgical cancellations, delays in preoperative optimisation, ICU bed availability, and operating room constraints, could contribute to the length of hospital stay, RA may confer benefits such as reduced postoperative pain and quicker mobilisation. [5]

In alignment with the findings of Glassou et al. (2017) who reported increased mortality among THA and TKA patients with pre-existing diabetes and cardiovascular diseases, the observed in-hospital mortality rate of 1.1% in this cohort is consistent with global benchmarks, where rates range between 0.5% and 1%.[8, 21] Patients who succumbed to postoperative complications predominantly had underlying hypertension and diabetes, underscoring the impact of these comorbidities on postoperative outcomes.

Effective pain management in TJA is imperative to facilitate early mobilisation and mitigate the risk of venous thromboembolism (VTE) and pulmonary complications. [1] In our study, the complication rate was relatively low (9.6%), indicating good perioperative care. Thromboembolic events and wound infections each occurred in 2.7% of patients, and the difference in wound infection rates between GA and RA recipients did not reach significance, likely due to small event numbers. Despite the absence of a significant association between anaesthetic technique and VTE incidence in this study, RA has been previously linked to improved postoperative analgesia and functional recovery. The mortality rate was low and not significantly different between those receiving GA and those receiving RA, suggesting that, on balance, the perioperative risk was well managed. Although underutilised in this dataset, peripheral nerve blocks may offer additional analgesic benefits and warrant further investigation. Using critical care services (CCS) in TJA patients remains an area of ongoing research. Memtsoudis et al. (2013) reported that approximately 3% of patients undergoing TJA required CCS, demonstrating increased transfusion rates, mechanical ventilation dependency, higher mortality, prolonged hospitalisation, and higher healthcare costs. [17]

These findings support the continued or increased use of RA, where appropriate, to reduce hospital stays and free up higher-level resources. Many of the patients in this study could potentially receive perioperative care at a regional hospital, provided there is adequate surgical and anaesthesia expertise, thereby unburdening the tertiary hospitals.

Generalizability

The findings of this cross-sectional study are primarily generalizable to patients presenting for total joint arthroplasty at similar public-sector tertiary hospitals in urban South Africa. Because the study was conducted at a single central Johannesburg hospital, the results are most applicable to populations with comparable public healthcare systems, referral patterns, resource availability, and perioperative practices.

Conclusion

In this single-centre study, patients undergoing THA and TKA at CMJAH were typically older females with hypertension and obesity, and experienced low complication and mortality rates. While no significant association was found between patient profile and LOS or CCS use, RA showed trends toward enhanced recovery and reduced resource utilisation. These hypothesis-generating findings require adjusted analyses and external validation.

Limitations

A single-centre retrospective study is not representative of all tertiary hospitals. The unavailability of some patient records was also a limiting factor, resulting in a smaller sample size. A notable limitation of this study is the proportion of missing BMI data (23%), which may have reduced statistical power and introduced potential bias. The study did not consider surgical indications for

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hip and knee arthroplasty. Consequently, the findings should be interpreted with caution.
Missing data were not included in the study, and this was one of the limitations of the study.

Recommendation

Further multicentre, prospective studies are recommended to evaluate postoperative outcomes and long-term progression following total joint arthroplasty. The current findings may assist in improving preoperative assessment and healthcare planning in resource-limited settings.

Conflict of interest

No conflict of interest

Funding statement

No funding was received for this study.

List of abbreviations

AOR adjusted odds ratio
ASA American Society of Anaesthesiologists
BMI body mass index
CCS critical care services
CCU critical care unit
GA general anaesthesia
HOD Head of Department
IQR interquartile range
ICU intensive care unit
PNB peripheral nerve block
RA regional anaesthesia
THA total hip arthroplasty
TJA total joint arthroplasty
TKA total knee arthroplasty
UOR unadjusted odds ratio
VTE venous thromboembolism

Author contributions

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