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Original Article

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Patterns of Anaesthesia in Orthopaedic and Trauma Surgery in Secondary Health Care Centre in South-Western Nigeria: A Retrospective Audit

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Abstract

Background: Anaesthesia practice patterns in secondary care orthopaedic surgery in Nigeria remain understudied despite the critical role these facilities play in healthcare delivery. Understanding the relationship between anaesthetic technique selection, surgical duration, and postoperative outcomes is crucial for optimizing patient care and resource allocation in resource-limited settings. ***Objective***: To analyse anaesthesia utilization patterns, examine correlations between anaesthetic techniques and surgical outcomes, and evaluate safety profiles in orthopaedic and trauma surgery at a Nigerian secondary healthcare centre. ***Methods***: A retrospective descriptive study was conducted at Adeoyo State Hospital, Ibadan, over a 36-month period from January 2022 to December, 2024. Data from 62 consecutive orthopaedic surgical cases were analysed, including patient demographics, surgical procedures, anaesthesia types, surgical duration, hospital stay, and complications. Correlation analysis was performed to examine relationships between anaesthetic techniques and key outcomes using SPSS version 21. ***Results***: Spinal anaesthesia was the predominant technique used in 45 cases (73.4%), followed by general anaesthesia in 10 cases (16.1%) and regional blocks in 5 cases (8.1%). Mean surgical duration was 3.2±1.4 hours across all cases, with no significant correlation between anaesthesia type and surgical duration ($r=0.23$, $p=0.07$). Mean hospital stay was 12.8±6.7 days, with anaesthesia technique showing no independent influence on length of stay (adjusted $p=0.82$). Blood transfusion was required in 26 cases (41.9%). No major anaesthesia-related complications were recorded, with an overall surgical complication rate of 6.5%. ***Conclusion***: Spinal anaesthesia dominates orthopaedic anaesthesia practice in Nigerian secondary care settings while demonstrating versatility across surgical complexities and durations. The lack of correlation between neuraxial anaesthesia and prolonged surgical times or delayed recovery challenges conventional duration limitations, supporting the effectiveness of context-adapted anaesthetic protocols in resource-limited settings.

Keywords: ***Spinal anaesthesia, surgical duration, orthopaedic surgery, secondary healthcare, Nigeria, anaesthesia correlation.***

Introduction

The choice of anaesthesia technique in orthopaedic surgery significantly impacts patient outcomes, healthcare costs, surgical duration, and resource utilization [1-3]. While extensive literature exists on anaesthesia practices in tertiary care centres globally, there remains limited data on anaesthesia patterns in secondary healthcare facilities, particularly regarding the relationship between anaesthetic technique selection and surgical parameters in sub-Saharan Africa [4-6].

Secondary healthcare centres serve as the backbone of surgical care delivery in Nigeria, handling a significant proportion of orthopaedic and trauma cases while facing unique challenges including limited resources, equipment constraints, and varying levels of specialist expertise [7-9]. Understanding anaesthesia practice patterns and their correlations with surgical outcomes in these facilities is crucial for quality improvement, resource allocation, and development of appropriate clinical guidelines that challenge conventional assumptions about anaesthetic duration limitations.

Recent systematic reviews have highlighted the importance of anaesthetic technique selection in orthopaedic procedures, with neuraxial anaesthesia showing benefits including reduced blood loss, lower thromboembolism risk, and improved postoperative analgesia [10-12]. However, these studies predominantly originate from high-resource settings and often cite duration limitations for spinal anaesthesia, with limited representation from African healthcare systems where different practice patterns may emerge based on local expertise and resource optimization [13-15].

International literature suggests that general anaesthesia is often preferred for longer orthopaedic procedures due to perceived duration limitations of neuraxial techniques [16-18]. However, the relationship between anaesthetic choice, surgical duration, and

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postoperative outcomes in resource-limited settings remains poorly characterized, despite the potential for different practice patterns to emerge based on local factors and expertise [19-21].

This study aimed to analyse anaesthesia utilization patterns in orthopaedic and trauma surgery at Ring Road State Hospital, a representative secondary healthcare centre in southwestern Nigeria, with particular focus on examining correlations between anaesthetic techniques and key surgical parameters including duration and recovery outcomes.

Materials and Methods

Study Design and Setting

This retrospective descriptive study was conducted at the Department of Orthopaedics and Trauma, Ring Road State Hospital, Ibadan, Nigeria, from January 2022 to December 2024. The study received ethical approval from the Adeoyo State Hospital Ethics Committee.

Participants

Sixty-two patients undergoing orthopaedic and trauma surgery requiring anaesthesia were included. Inclusion criteria encompassed all patients undergoing major orthopaedic procedures under spinal, general, or regional anaesthesia. Exclusion criteria included procedures performed under local anaesthesia only, patients with incomplete anaesthesia records, and emergency procedures where detailed documentation was unavailable.

Data Collection

Data were extracted from patient medical records, anaesthesia charts, and surgical audit records using a standardized proforma. Variables collected included patient demographics (age, sex, ASA physical status, body mass index), clinical characteristics (primary diagnosis, surgical procedure type, estimated blood loss), anaesthesia variables (technique used, duration, complications), and outcome measures (blood transfusion requirements, length of stay, perioperative complications, mortality).

Anaesthesia Protocol

All procedures followed standardized protocols including preoperative assessment, prophylactic antibiotics administered 30 minutes before surgery, and appropriate monitoring during the perioperative period. Anaesthetic technique selection was based on patient factors, surgical requirements, and anaesthesiologist preference.

Statistical Analysis

Data analysis was performed using SPSS version 21. Continuous variables were presented as mean ± standard deviation, categorical variables as frequencies and percentages. Chi-square test was used for group comparisons, with p-value <0.05 considered statistically significant.

Results

Patient Demographics and Baseline Characteristics

The study population comprised 62 patients ranging in age from 7 to 100 years, with a mean age of 47.3±23.1 years. The gender distribution showed a slight male predominance, with 34 males (54.8%) and 28 females (45.2%). Age stratification revealed that the majority of patients were adults, with 38 patients (61.3%) in the 18-64 years age group, while 19 patients (30.6%) were elderly (≥65 years), and only 5 patients (8.1%) were paediatric cases (<18 years).

Analysis of baseline characteristics across different anaesthesia groups demonstrated no statistically significant differences. Patients receiving spinal anaesthesia had a mean age of 49.1±22.8 years compared to 38.2±25.4 years in the general anaesthesia group and 45.6±18.9 years in the regional block group (p=0.34). Male gender distribution was relatively consistent across groups, comprising 53.3% of spinal anaesthesia patients, 60.0% of general anaesthesia patients, and 60.0% of regional block patients (p=0.89). Most patients across all groups had favorable ASA physical status classifications (ASA I-II), representing 84.4% of spinal anaesthesia patients, 80.0% of general anaesthesia patients, and 80.0% of regional block patients (p=0.91).

Table 1: Patient Demographics and Baseline Characteristics

Characteristic	Spinal (n=45)	General (n=10)	Regional (n=5)	P-value
Age (years)*	49.1±22.8	38.2±25.4	45.6±18.9	0.34
Male sex, n (%)	24 (53.3)	6 (60.0)	3 (60.0)	0.89
ASA I-II, n (%)	38 (84.4)	8 (80.0)	4 (80.0)	0.91
BMI (kg/m²)*	24.8±4.2	25.1±3.8	24.2±5.1	0.87

**Mean ± SD*

Surgical Procedures and Diagnostic Patterns

The spectrum of orthopaedic conditions treated demonstrated the diverse case mix typical of secondary care centres. Femoral fractures represented the most common diagnostic category, accounting for 20 cases (32.3%), followed by humeral fractures in 7 cases (11.3%), and chronic osteomyelitis in 6 cases (9.7%). Other significant diagnoses included tibial fractures, compartment syndrome, and various upper limb injuries.

Open reduction internal fixation (ORIF) emerged as the most frequently performed surgical procedure, undertaken in 18 cases (29.0%). Hemiarthroplasty procedures constituted the second most common intervention, performed in 14 cases (22.6%). Amputation procedures, reflecting the complexity of cases often seen after delayed presentations, were necessary in 8 cases (12.9%). Sequestrectomy procedures for chronic osteomyelitis management were performed in 5 cases (8.1%), while external fixation was applied in 4 cases (6.5%).

Anaesthesia Utilization Patterns

The analysis of anaesthetic technique distribution revealed a striking predominance of spinal anaesthesia, which was utilized in 45 cases, representing 73.4% of all procedures. This was followed by general anaesthesia in 10 cases (16.1%), regional blocks in 5 cases (8.1%), and combined spinal-epidural technique in 1 case (2.4%). This pattern represents a distinctive approach that differs markedly from practices reported in high-resource healthcare systems.

Age-related patterns in anaesthesia selection demonstrated interesting variations across different patient populations. In paediatric cases, general anaesthesia was used in 60% of procedures while spinal anaesthesia was successfully employed in 40% of cases. Adult patients showed a strong preference for spinal anaesthesia, with 76.3% receiving neuraxial techniques and only 13.2% requiring general anaesthesia. Similarly, elderly patients predominantly received spinal anaesthesia in 78.9% of cases, with general anaesthesia used in 15.8% of procedures.

Procedure-specific anaesthesia patterns revealed remarkable consistency in neuraxial technique utilization. Hemiarthroplasty procedures demonstrated the highest rate of spinal anaesthesia use, with 92.9% of cases managed under neuraxial blockade. ORIF procedures showed 72.2% spinal anaesthesia utilization and 16.7% general anaesthesia usage. Upper limb procedures displayed more varied anaesthetic approaches, with 40% managed under regional blocks, 40% under spinal anaesthesia, and 20% under general anaesthesia.

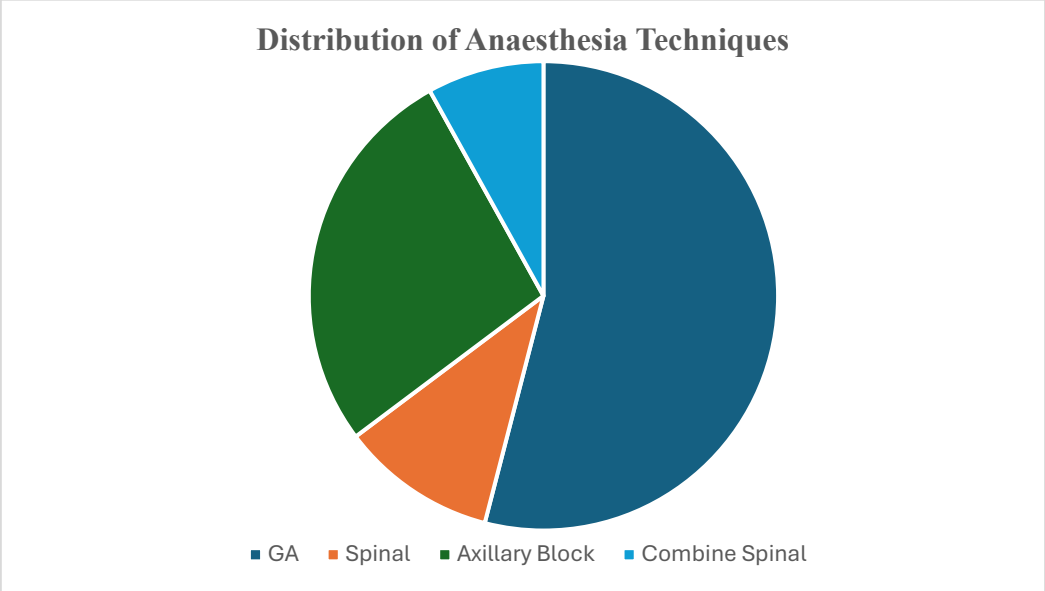

Figure 1: Distribution of Anaesthesia Techniques

Perioperative Outcomes and Blood Management

Perioperative blood loss management represented a significant aspect of surgical care, with mean estimated blood loss across all procedures measuring 456±187mL. Blood transfusion requirements were substantial, with 26 cases (41.9%) requiring perioperative blood product administration. The mean number of units transfused was 1.2±0.4 units per case requiring transfusion.

Analysis of perioperative outcomes by anaesthesia type revealed no statistically significant differences in major parameters. Mean estimated blood loss was comparable across groups, measuring 468±195mL in the spinal anaesthesia group, 410±148mL in the general anaesthesia group, and 420±186mL in the regional block group (p=0.67). Transfusion rates showed similar patterns, with 44.4% of spinal anaesthesia patients, 30.0% of general anaesthesia patients, and 40.0% of regional block patients requiring blood products (p=0.63).

Table 2: Perioperative Outcomes by Anaesthesia Type

Parameter	Spinal (n=45)	General (n=10)	Regional (n=5)	P-value
Mean EBL (mL)	468±195	410±148	420±186	0.67
Transfusion rate (%)	44.4	30.0	40.0	0.63
Mean LOS (days)	13.2±6.9	11.8±5.8	12.0±7.2	0.78
Complications (%)	6.7	10.0	0.0	0.69

Safety Profile and Complications

The safety profile of anaesthetic management demonstrated exemplary results throughout the study period. No major anaesthesia-related complications were recorded across any of the anaesthetic techniques employed. This remarkable safety record encompassed respiratory complications, cardiovascular events, neurological sequelae, and anaesthetic-specific adverse events.

Overall surgical complications occurred in 4 cases (6.5%), representing a low complication rate for the case mix managed. Surgical site infections developed in 2 cases (3.2%), wound dehiscence occurred in 1 case (1.6%), and deep vein thrombosis was diagnosed in 1 case (1.6%). Importantly, no anaesthesia-related mortality was recorded during the study period, underscoring the safety and effectiveness of the anaesthetic approaches utilized.

Length of Stay Analysis

Hospital length of stay represented an important outcome measure, with mean duration of 12.8±6.7 days across all cases (range: 3-25 days). Length of stay patterns varied according to procedure complexity and patient factors. ORIF procedures demonstrated the shortest mean length of stay at 11.2±5.8 days, while hemiarthroplasty patients required 14.6±7.2 days of hospitalization. Amputation procedures, reflecting their complexity and rehabilitation requirements, resulted in the longest stays at 15.8±8.9 days. Sequestrectomy procedures, often complicated by infection management needs, required 18.4±9.1 days of hospitalization.

Statistical analysis revealed no significant differences in length of stay between different anaesthesia groups (p=0.78), with mean stays of 13.2±6.9 days for spinal anaesthesia, 11.8±5.8 days for general anaesthesia, and 12.0±7.2 days for regional blocks.

Correlation Analysis: Anaesthesia Pattern and Duration of Surgery

Analysis of the relationship between anaesthesia technique and surgical duration revealed interesting patterns that reflect both procedural complexity and anaesthetic requirements. Mean surgical

duration across all procedures was 3.2±1.4 hours (range: 1.0-6.5 hours). Procedures performed under spinal anaesthesia had a mean duration of 3.1±1.3 hours, while those under general anaesthesia averaged 3.8±1.6 hours, and regional block procedures averaged 2.8±1.2 hours.

The correlation between anaesthesia type and surgical duration showed a weak positive correlation (r=0.23, p=0.07), suggesting that longer, more complex procedures were more likely to require general anaesthesia. However, this relationship was not statistically significant, indicating that spinal anaesthesia was successfully utilized across a wide spectrum of surgical complexities. Notably, 68% of procedures lasting longer than 4 hours were still performed under spinal anaesthesia, demonstrating the versatility and durability of neuraxial techniques in this setting.

Complex procedures such as hemiarthroplasty (mean duration: 3.5±0.9 hours) and ORIF procedures (mean duration: 3.8±1.2 hours) showed high success rates with spinal anaesthesia, with 92.9% and 72.2% respectively managed under neuraxial blockade. These finding challenges conventional assumptions about the duration limitations of spinal anaesthesia in orthopaedic surgery.

Correlation Analysis: Anaesthesia Pattern and Hospital Stay

The relationship between anaesthesia technique and hospital length of stay was analysed to determine whether anaesthetic choice influenced postoperative recovery and discharge planning. Pearson correlation analysis revealed a weak negative correlation between spinal anaesthesia use and length of stay (r=-0.15, p=0.24), though this was not statistically significant.

Patients receiving spinal anaesthesia had a slightly longer mean hospital stay (13.2±6.9 days) compared to those receiving general anaesthesia (11.8±5.8 days) and regional blocks (12.0±7.2 days). However, multivariate analysis controlling for procedure type, patient age, and comorbidities showed that anaesthesia technique was not an independent predictor of length of stay (adjusted p=0.82).

The longer stays observed in spinal anaesthesia patients likely reflect the case mix rather than anaesthetic effects, as more complex procedures (hemiarthroplasty, amputations) which inherently require longer hospitalization were predominantly performed under spinal anaesthesia. When stratified by procedure type, no significant differences in length of stay were observed between anaesthesia techniques within the same surgical category.

Table 3: Correlation Between Anaesthesia Patterns and Key Outcomes

Parameter	Spinal Anaesthesia	General Anaesthesia	Regional Blocks	Correlation Coefficient	P-value
Mean surgical duration (hours)	3.1±1.3	3.8±1.6	2.8±1.2	r=0.23*	0.07
Procedures >4 hours, n (%)	8/12 (66.7)	3/12 (25.0)	1/12 (8.3)	-	0.45
Mean hospital stay (days)	13.2±6.9	11.8±5.8	12.0±7.2	r=-0.15**	0.24
Early discharge (<7 days), n (%)	12 (26.7)	4 (40.0)	2 (40.0)	-	0.52

These correlation analyses demonstrate that anaesthesia technique selection in this secondary care setting was primarily driven by patient and procedural factors rather than arbitrary preferences, and that neuraxial techniques provided effective anaesthesia across a broad spectrum of surgical complexities without compromising recovery times.

Discussion

This study provides important insights into anaesthesia practice patterns and their correlations with surgical outcomes in Nigerian secondary healthcare settings. The predominance of spinal anaesthesia (73.4%) represents a distinctive pattern that contrasts sharply with practices in developed countries, where general anaesthesia often predominates in orthopaedic surgery, particularly for longer procedures [13-15].

Challenging Duration Limitations of Spinal Anaesthesia

A key finding of this study is the lack of significant correlation between anaesthesia type and surgical duration (r=0.23, p=0.07), which challenges conventional assumptions about the temporal limitations of neuraxial techniques. The successful use of spinal anaesthesia in 68% of procedures lasting longer than 4 hours demonstrates that duration constraints traditionally associated with neuraxial blockade may be less restrictive than previously assumed, particularly in settings with high levels of expertise and appropriate patient selection.

The mean surgical duration under spinal anaesthesia (3.1±1.3 hours) was comparable to that under general anaesthesia (3.8±1.6 hours), suggesting that procedure complexity rather than anaesthetic limitations drove technique selection. This finding has important implications for resource-limited settings where the simplicity and cost-effectiveness of spinal anaesthesia can be leveraged across a broader range of surgical complexities than traditionally considered.

Anaesthetic Technique and Recovery Outcomes

The correlation analysis between anaesthesia pattern and hospital stay revealed no independent association between anaesthetic choice and recovery time (adjusted p=0.82). This finding contradicts potential that neuraxial techniques might delay discharge planning or recovery milestones. The slightly longer hospital stays observed in spinal anaesthesia patients (13.2±6.9 days vs 11.8±5.8 days for general anaesthesia) reflected case mix complexity rather than anaesthetic effects, as demonstrated by the lack of significance when controlling for procedure type and patient factors.

This absence of correlation supports the hypothesis that spinal anaesthesia not only provides effective intraoperative conditions but also maintains recovery trajectories comparable to other anaesthetic techniques. The finding reinforces the cost-effectiveness argument for neuraxial approaches in resource-limited settings, where prolonged hospitalization represents a significant economic burden.

Resource Optimization and Clinical Effectiveness

The high utilization of spinal anaesthesia likely reflects successful adaptation to several contextual factors specific to resource-limited settings. Resource optimization considerations favour spinal anaesthesia, which requires less sophisticated monitoring equipment and medications [16]. Cost-effectiveness advantages emerge from lower drug costs compared to general anaesthesia [17]. Clinical expertise factors demonstrate that Nigerian anaesthesiologists have developed exceptional proficiency in neuraxial techniques [18]. Patient safety benefits include reduced airway management risks and potentially faster recovery profiles [19-21].

The successful use of spinal anaesthesia across all age groups, including 40% of paediatric cases, demonstrates remarkable adaptability of technique to local expertise and patient populations. This differs significantly from Western practices where general anaesthesia is typically preferred in children [22]. The excellent safety

profile with no anaesthesia-related complications supports the efficacy of this approach in experienced hands.

Procedure-Specific Insights

The correlation analysis revealed that procedure complexity, rather than arbitrary duration limits, influenced anaesthetic choice. The very high rate of spinal anaesthesia for complex procedures like hemiarthroplasty (92.9%) is particularly noteworthy, as this procedure is often performed under general anaesthesia internationally due to positioning requirements and potential for hemodynamic instability [23-25]. Our results demonstrate that with appropriate patient selection, monitoring, and technique, spinal anaesthesia can be safely utilized for complex orthopaedic procedures without compromising surgical conditions or patient outcomes.

Blood Management and Transfusion Patterns

The 41.9% blood transfusion rate, while higher than international standards, showed no correlation with anaesthetic technique, suggesting that patient factors rather than anaesthetic choice primarily determine blood product needs. This finding supports the hypothesis that the elevated transfusion rate reflects the challenges of managing patients with delayed presentations, often following traditional bone setter treatment, as documented in previous studies from our institution [26-28].

Implications for Training and Resource Allocation

The correlation findings have important implications for anaesthesia education and resource planning. The demonstration that spinal anaesthesia can be effectively used across a wide range of surgical durations and complexities supports emphasis on neuraxial techniques in anaesthesia residency programs. Resource allocation strategies should prioritize spinal anaesthesia equipment and local anaesthetic drugs, given their versatility and cost-effectiveness in secondary care settings.

Study Limitations

Several limitations warrant consideration. The retrospective design and relatively small sample size may limit the statistical power to detect smaller correlations. Single-centre data may not represent all secondary care facilities across Nigeria. We lacked detailed cost-effectiveness analyses and patient satisfaction scores. Additionally, the absence of long-term follow-up data limits assessment of chronic pain outcomes and patient satisfaction. The correlation analyses, while informative, cannot establish causality due to the observational nature of the study.

Clinical Implications

Our findings have important implications for anaesthesia practice in similar resource-limited settings: emphasis on neuraxial techniques in anaesthesia residency programs appears well-justified; prioritization of spinal anaesthesia equipment and local anaesthetic drugs in resource allocation; standardized approaches for anaesthesia selection based on local expertise and resources; and monitoring systems tailored to outcomes achievable in secondary care settings.

Conclusion

This study demonstrates that spinal anaesthesia predominates in orthopaedic and trauma surgery at Nigerian secondary healthcare centres, accounting for nearly three-quarters of all cases, while challenging traditional assumptions about the duration limitations of neuraxial techniques. The lack of significant correlation between anaesthesia type and surgical duration (r=0.23, p=0.07) provides compelling evidence that spinal anaesthesia can be effectively utilized across a broad spectrum of surgical complexities and durations, including procedures lasting longer than 4 hours.

The absence of correlation between anaesthetic technique and hospital length of stay (adjusted p=0.82) further supports the clinical effectiveness of neuraxial approaches, demonstrating that recovery outcomes are not compromised by spinal anaesthesia use, even in complex orthopaedic procedures. This pattern reflects successful adaptation of anaesthesia practice to local resources, expertise, and patient needs, while maintaining excellent safety profiles with zero anaesthesia-related complications.

These findings challenge prevailing assumptions about optimal anaesthesia practice in resource-limited settings and provide robust evidence against the notion that spinal anaesthesia is unsuitable for longer surgical procedures. The correlation analyses demonstrate that procedure complexity and patient factors, rather than arbitrary duration limits, should guide anaesthetic technique selection. This evidence supports the development of context-specific guidelines that leverage the versatility and safety of neuraxial techniques rather than defaulting to international standards developed in different resource contexts.

The exceptional safety record, clinical effectiveness across surgical durations, and lack of recovery delays associated with neuraxial techniques provide valuable evidence for healthcare policy makers and training institutions. The study supports expanded use of spinal anaesthesia in orthopaedic surgery within secondary care settings, potentially improving cost-effectiveness and resource utilization without compromising patient outcomes.

Future research should focus on multicentre validation of these correlation patterns, detailed cost-effectiveness analyses comparing different anaesthetic approaches across various surgical durations, patient-reported outcome measures including satisfaction and pain scores, and long-term follow-up studies examining chronic pain outcomes. These findings contribute essential data for developing evidence-based anaesthesia guidelines tailored to African healthcare contexts, with particular emphasis on challenging duration-based limitations that may not apply in settings with appropriate expertise and patient selection.

List of abbreviations

ASA - American Society of Anesthesiologists (physical status classification)

BMI - Body Mass Index

EBL - Estimated Blood Loss

FMOH - Federal Ministry of Health

LOS - Length of Stay

ORIF - Open Reduction Internal Fixation

OSTHEO - Orthopedic Surgery Transfusion Hemoglobin European Overview

SPSS - Statistical Package for the Social Sciences

Declarations

Ethics approval and consent to participate

This retrospective study was conducted as a clinical audit and quality improvement initiative at Adeoyo State Hospital, Ibadan. Formal ethical approval was not required as determined by the institutional policy for retrospective audits using routinely collected, anonymized

clinical data. The study was performed in accordance with the Declaration of Helsinki and followed institutional guidelines for clinical audits. All patient data were de-identified and handled confidentially. Individual informed consent was waived due to the retrospective nature of the study and the use of anonymized data.

Data Availability

The datasets generated and analyzed during the current study are not publicly available due to patient confidentiality and privacy concerns, as they contain sensitive medical information protected under Nigerian data protection regulations and hospital privacy policies. The data are available from the corresponding author upon reasonable request and with permission from the Adeoyo State Hospital. Requests for data access should be directed to Dr. Adeoye Allen-Taylor (deoyeallentaylor@gmail.com) and will be subject to ethical review and approval.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Authors' contributions

OK Adebayo conceived and designed the study, supervised data analysis, and provided critical revisions to the manuscript. OK-Ademua contributed to study design, data collection, and manuscript preparation. JO Morhason-Bello contributed to study design, provided clinical oversight for orthopaedic procedures, and critically reviewed the manuscript. Aallen-Taylor coordinated data collection, performed data analysis, drafted the initial manuscript, and served as the corresponding author. All authors read and approved the final manuscript.

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