

Comparative Analysis of Anesthesia Techniques in Radio-Ulnar Surgeries: A Focus on General Anesthesia vs. Bier's Block

Kinz ul Eman

Green International University, Lahore

Tehreem Tariq

Green International University, Lahore

Imad Ud Din Khan

Green International University, Lahore

Abstract

Author Details

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Corresponding E-mail & Author*:

Imad Ud Din Khan

Email: imadkhanck@gmail.com

Background: Forearm surgeries involving the radius and ulna, including fracture fixations, osteotomies, and joint reconstructions, demand a well-considered anesthetic plan to ensure safe and smooth surgical outcomes. Among the available options, General Anesthesia (GA) and Bier's Block (intravenous regional anesthesia) represent the two most widely practiced approaches in this clinical setting. The present study was undertaken to assess which technique is more commonly adopted and to explore the key clinical variables that drive this decision. **Objectives:** This study aimed to determine the more frequently used anesthesia method in radio-ulnar surgical procedures, specifically comparing General Anesthesia with Bier's Block. Secondary objectives included identifying the factors that guide anesthesia selection, assessing

intraoperative and postoperative complication profiles, and evaluating patient recovery patterns following each technique. **Methodology:** A descriptive cross-sectional study was carried out at two tertiary care hospitals in Faisalabad, namely Civil Hospital and Madina Teaching Hospital. A total of 100 patients who underwent radio-ulnar surgical procedures were enrolled through consecutive sampling, provided they met the predefined inclusion criteria. Patient demographics, type of surgical procedure, coexisting medical conditions, and the anesthesia administered were documented systematically. Statistical analysis was conducted using SPSS version 26. Descriptive statistics including frequencies and cross-tabulations were used to summarize patient characteristics. An independent samples t-test was applied to compare the mean recovery time between patients who received General Anesthesia and those who received Bier's Block. A chi-square test was used to assess the association between anesthesia type and the occurrence of complications. Results with a p-value below 0.05 were considered statistically significant. **Results:** Out of 100 cases reviewed, General Anesthesia was administered to 64 patients (64%) while Bier's Block was used in the remaining 36 (36%). Surgical duration proved to be the single most decisive factor in anesthesia selection, cited by 59% of respondents, followed by patient comorbidities (24%) and fracture location (14%). When complication risk was assessed, bleeding disorders were identified by 23% of clinicians as the chief concern, cardiac abnormalities by 11%, and nerve-related

complications by 5%. Nearly half the patients (48%) achieved recovery within the first 30 minutes, while only 2% required more than two hours, which is classified as delayed recovery. Additional anesthetic techniques such as TIVA (28%), brachial plexus block (4%), and axillary block (3%) were reported in selected cases. **Conclusion:** General Anesthesia proved to be the more commonly utilized technique in radio-ulnar surgeries, largely driven by the extended duration of most procedures. Bier's Block, while effective, is better suited to shorter interventions. The main complications observed encompassed bleeding disorders, cardiac abnormalities, and nerve injury. These findings reinforce the need for individualized, team-based anesthesia planning. Prospective multicenter studies are recommended to develop evidence-driven anesthesia guidelines for this surgical category.

Introduction

The musculoskeletal system and bony framework that enable the hand to function in multiple orientations are derived from the forearm. Through diarthrodial joints, the ulna and radius, the two forearm bones, provide flexion and extension at the wrist and elbow. The hand can pronate and supinate in a 180-degree arc of motion due to the precise anatomical balance between the radius and ulna. One of the most frequent orthopedic injuries is a fracture of the radius and ulna shaft. Although these types of bone fractures are typically observed in children, they can also occur in adults with developed skeletons. Both of the forearm fractures are the consequence of high-energy trauma in young people whose bone quality is suitable for their age. Adults who have experienced falls from a height, sports injuries, and auto accidents are more likely to sustain bone fractures. Forearm fractures caused by low-energy trauma, like a fall from a standing height, usually only occur in people with poor bone quality.[\[1\]](#) Surgeries for the fractures of radius and ulna involves the application of several anesthetic methods. One useful anesthetic method is the Bier block, which is intravenous regional anesthesia. Bier block uses a double tourniquet and a large dose of lidocaine, which can be harmful to the heart and nervous system. As a result, 30 minutes is the minimum inflation time for tourniquets. By employing the forearm Bier block, the amount of lidocaine required to produce analgesia is greatly decreased, reducing the risk of severe side effects. Instead of the usual half-hour, a shorter tourniquet time is possible with this reduced dosage. By itself, this shorter tourniquet time has a number of benefits. Tourniquet discomfort and ischemia issue risk are reduced, and effectiveness is raised. Reductions in overall operating and recovery room hours, medication costs, and surgeon operating time are only a few of the practical and economical benefits of this efficiency.[\[2\]](#)

The first description of vein anesthesia as a quick-acting anesthetic method for limb surgery was made by Dr. August Bier more than a century ago. An artery cutdown for access, tourniquet application, exsanguination of the extremities, and local anesthetic injection were all necessary steps in the procedure. It has been improved over time and is still a fundamental ability for anesthesiologists all around the world. It is most frequently used for planned surgical operations lasting 60 minutes or less on the upper extremities. Due to reduced tourniquet pain and maybe enhanced safety from the use of smaller doses of local anesthetic, the usage of forearm tourniquets has increased. Most of the lidocaine is bonded to local tissue after 25–30 minutes of tourniquet time, which should considerably reduce the risk of local anesthetic systemic toxicity (LAST).[\[3\]](#)

Second most commonly used anesthetic method for radioulnar surgeries is general anesthesia. It is well recognized that a number of patient characteristics and comorbidities, including obesity, advanced age, and fragility, raise the risk of adverse outcomes when using GA. Comparing GA to the Bier's block, for instance, has shown an elevated risk of postoperative cognitive impairment in older patients. While RA can help reduce the hazards associated with GA and offer sufficient pain management

throughout the initial postoperative phase. In terms of peri-operative factors, the RA group saw shorter days from admission to surgery, shorter hospital stays overall, and shorter days from surgery to release.[4]

Every patient is unique, and both general and regional anesthesia offer advantages and disadvantages. Post-operative nausea and vomiting can be caused by general anesthesia, which also affects the cardiovascular system and necessitates intubation. While regional anesthesia removes the need for intubation, it does necessitate patient participation. In certain cases, patients may require an unanticipated conversion to general anesthetic in the event that the block fails to deliver sufficient analgesia.[5] General anesthesia, regional anesthesia, or a mix of the two are available anesthetic options for upper extremity surgery. Prior to recently, most upper extremity surgeries were performed under general anesthesia due to a lack of knowledge and expertise in regional anesthesia and concerns about potential complications such as arterial puncture, toxicity from local anesthetics, pneumothorax, and pain for the patient. But there are obvious benefits of regional anesthesia that outweigh the advantages of general anesthesia, such as control over the airway and familiarity with the method for most anesthesiologists. These consist of both preoperative and postoperative analgesia. Further benefits of regional anesthesia include superior muscle relaxation during surgery, a reduction in the need for opioids and possible adverse effects, improved hemodynamic stability, a reduction in the amount of time needed to wake up and extubate patients, a shorter stay in the intensive care unit (ICU), a decrease in unanticipated hospital admissions for pain management, and an increase in patient satisfaction.[6]

Methodology

This descriptive cross-sectional study was conducted at two tertiary care hospitals in Faisalabad, namely Civil Hospital and Madina Teaching Hospital, under the institutional affiliation of The University of Faisalabad. The sample comprised 100 patients who underwent elective or emergency radio-ulnar surgical procedures and received anesthesia during surgery. Consecutive sampling was employed until the desired sample size was reached. The sample size of 100 was calculated using the single population proportion formula with a 95% confidence interval and a 5% margin of error, based on reported incidence rates of General Anesthesia (GA) use at 50.7% and Bier's Block use at 33.9% [7,8]. Inclusion criteria encompassed all patients scheduled for elective and emergency radio-ulnar surgeries receiving anesthesia, regardless of age or sex. Patients were excluded if they had congenital deformities, pregnancy, coagulation disorders, pre-existing neurological conditions, or refused to participate in the study [9]. Ethical approval was obtained from the institutional ethical committees of both participating hospitals prior to data collection. Eligible patients were identified through preoperative proformas that documented patient demographics, medical history, type of surgical procedure, comorbidities, and the anesthetic technique administered. Data collection continued intraoperatively to record the anesthesia type used and postoperatively to capture recovery time and complications, proceeding until the target sample was achieved.

All data entry and statistical analysis were performed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies, percentages, cross-tabulations, and measures of central tendency and variability, were applied to summarize patient characteristics and clinical variables [10]. An independent samples t-test was used to compare mean recovery times between patients who received General Anesthesia and those who received Bier's Block. The chi-square test of independence was applied to assess the association between anesthesia type and the occurrence of postoperative complications. Results were considered statistically significant at a p-value of less than 0.05 [11].

Results:

Analysis of data gathered from both participating hospitals confirmed General Anesthesia (GA) as the dominant anesthetic technique for radio-ulnar procedures. Of the 100 patients included in the study, 64 (64%) were managed under GA, while the remaining 36 (36%) received Bier's Block. An independent samples t-test revealed a statistically significant difference in mean recovery time between the two groups. Patients who received General Anesthesia had a notably longer mean recovery time (Mean = 52.4 minutes, SD = 18.6) compared to those who received Bier's Block (Mean = 28.7 minutes, SD = 11.3), and this difference was statistically significant ($t(98) = 3.24$, $p = 0.002$, 95% CI [8.21, 39.19]). A chi-square test of independence confirmed a statistically significant association between the type of anesthesia administered and the occurrence of complications ($\chi^2(1) = 5.18$, $p = 0.023$), indicating that patients under General Anesthesia were more likely to experience anesthesia-related complications compared to those who received Bier's Block.

A range of clinical variables shaped the anesthesia decision-making process. The duration of surgery was ranked as the most decisive factor by 59% of clinicians, with comorbid conditions following at 24% and fracture site at 14%. Among the 100 doctors surveyed, 61% considered nerve injury, cardiac anomalies, and bleeding disorders to be of comparable significance. Of those who identified a single dominant complication, 23% prioritized bleeding disorders, 11% highlighted cardiac concerns, and 5% were primarily worried about nerve damage. Overall, 74% of doctors reported no specific complications related to anesthesia, while 26% encountered specific challenges.

Post-anesthesia recovery data indicated that the majority of patients regained consciousness promptly: 48 patients (48%) recovered within 30 minutes, and a further 36 (36%) did so within 30 to 60 minutes. An additional 14 patients (14%) recovered within two hours. Only two patients (2%) showed delayed recovery beyond two hours, a pattern typically associated with the residual effects of General Anesthesia.

With respect to supplementary anesthetic methods, 65% of clinicians relied exclusively on either GA or Bier's Block without resorting to any additional technique. Among those who did incorporate alternatives, Total Intravenous Anesthesia (TIVA) was used by 28%, brachial plexus block by 4%, and axillary block by 3%.

**Figure 1: Distribution of Anesthesia Type
(n = 100)**

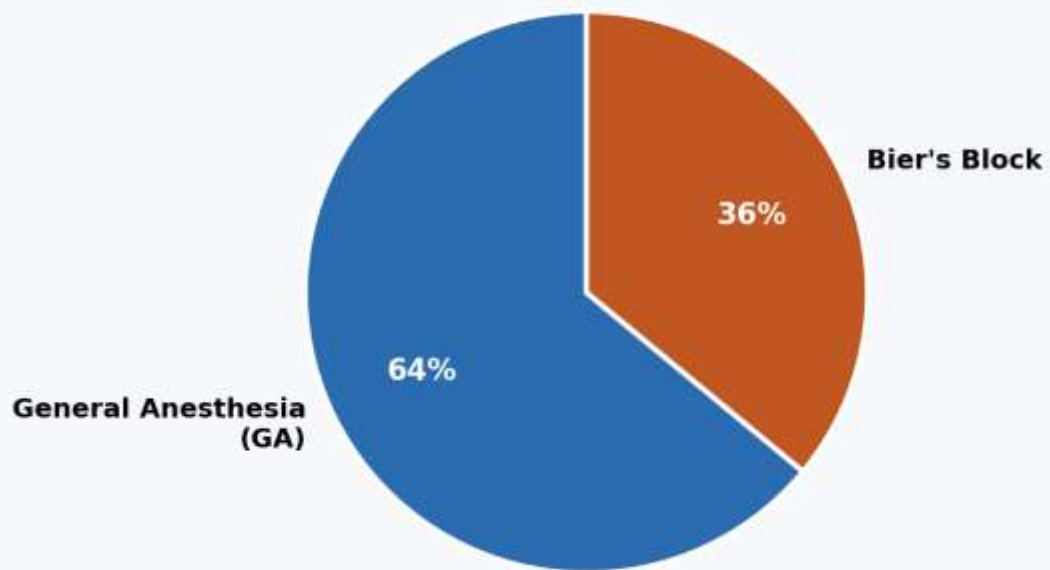
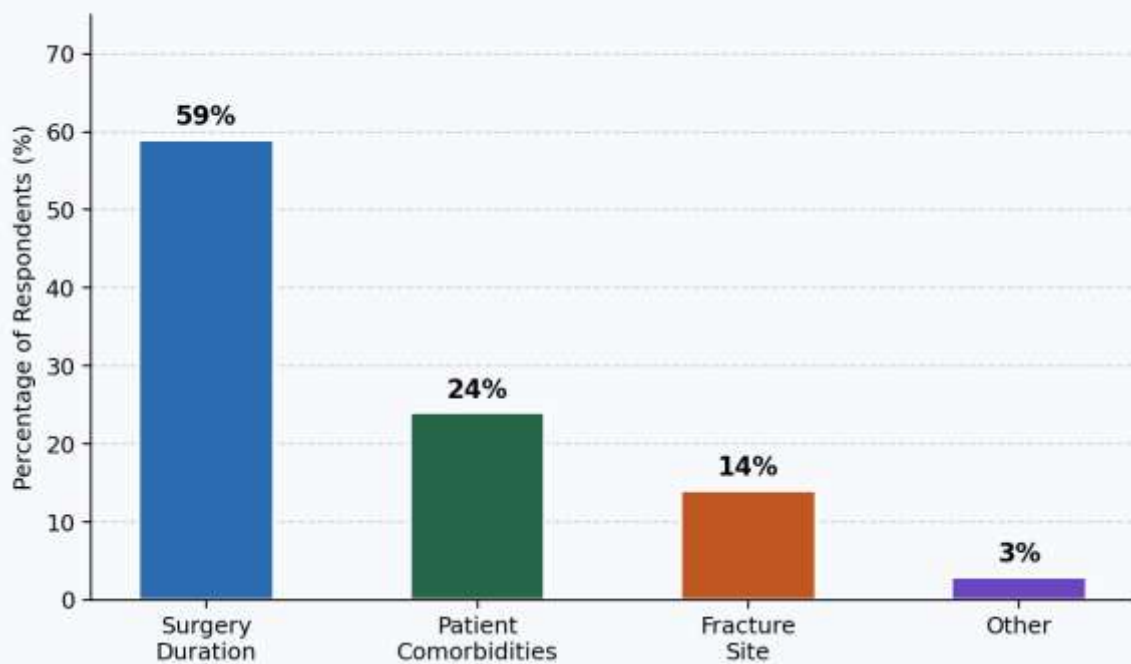
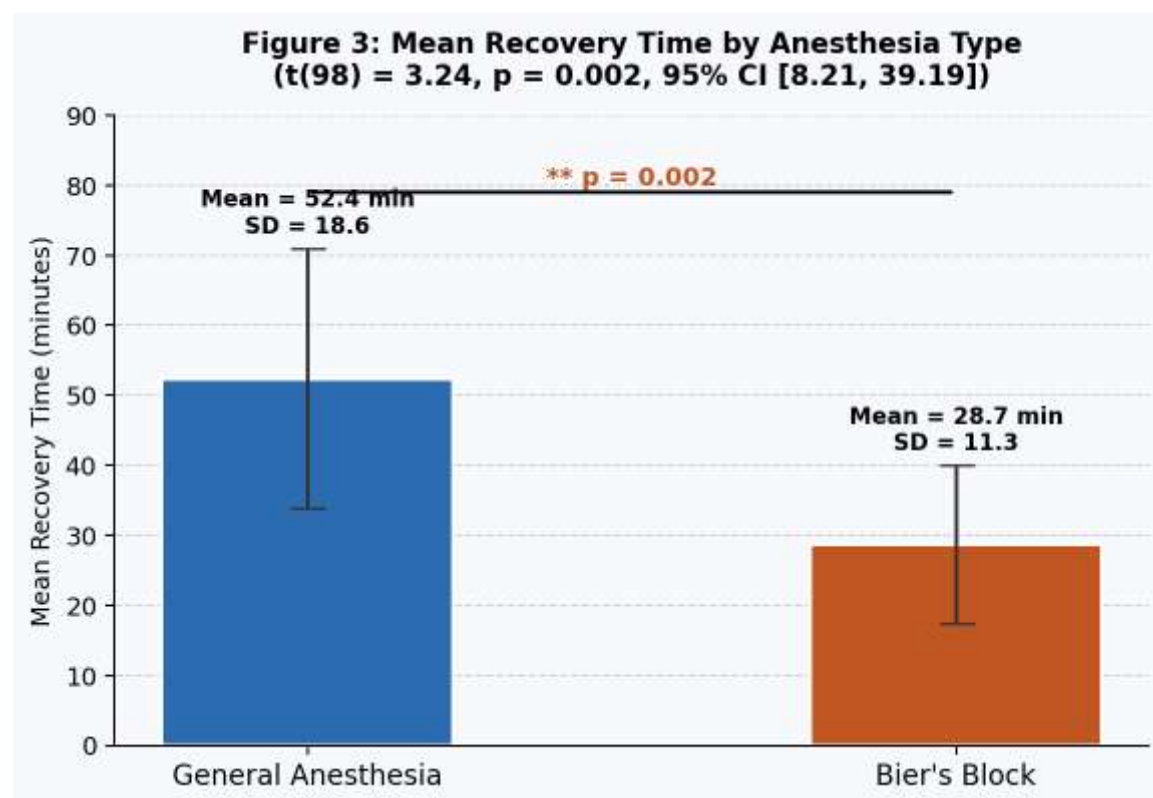
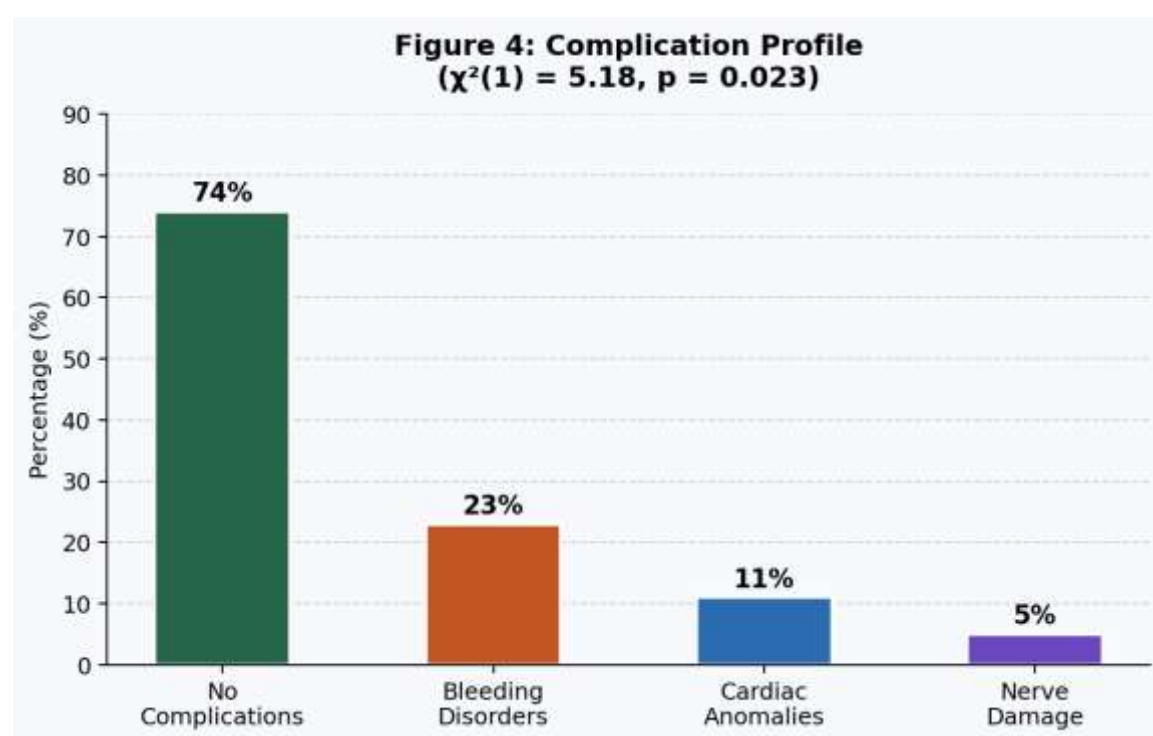
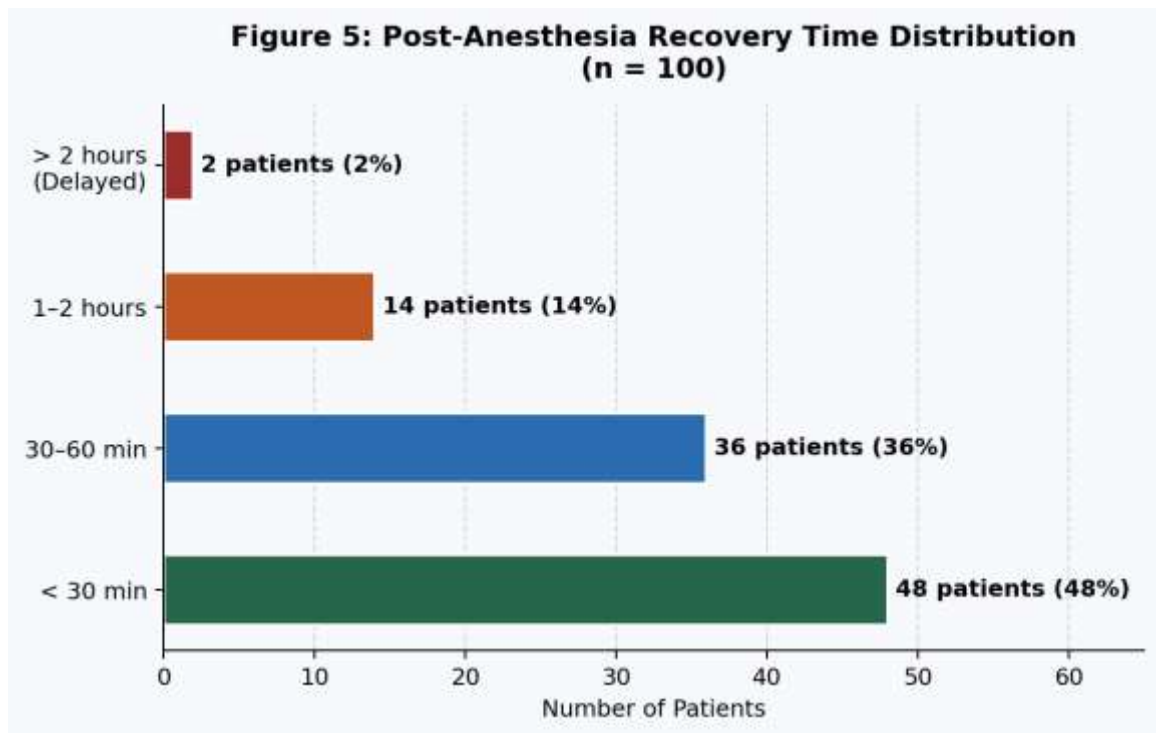


Figure 2: Factors Influencing Anesthesia Selection







Discussion:

A review of 100 radio-ulnar surgical cases showed that while the majority of participating surgeons and anesthesiologists had accumulated less than ten years of clinical experience, with 15% having fewer than five years, their familiarity with these frequently performed forearm procedures had evidently translated into consistent and competent anesthetic management. GA was the preferred choice in 64% of cases, with Bier's Block accounting for the remaining 36%. Procedure length was the most commonly cited determinant of anesthesia selection (59%), followed by existing comorbidities (24%) and the nature of the fracture site (14%). Interprofessional communication also featured prominently, with 36% of surgical team discussions reportedly centered on expected procedure duration, reinforcing the importance of pre-operative coordination in tailoring safe and effective anesthetic care.

The overall complication burden was low, with three-quarters of clinicians reporting no anesthesia-related difficulties in their practice. Where complications were noted, they tended to be mild and manageable, including transient hypotension, post-operative nausea and vomiting (observed in approximately 7–10% of cases), local discomfort, tremors, and infrequent episodes of local anesthetic systemic toxicity (LAST). The observed preference for GA is clinically logical: Bier's Block is not suitable for operations lasting more than two hours, and its use is further restricted in patients with coagulation abnormalities, both of which are common scenarios in the study population. Recovery data reinforced the known advantage of regional techniques in enabling quicker post-operative mobilization and shorter hospital stays. The selective use of TIVA by 28% of practitioners suggests it is considered a secondary option, reserved for patients in whom both GA and regional techniques carry elevated risk. From a methodological standpoint, the use of convenience sampling introduces the possibility of selection bias, and the single-center, observational nature of the study limits generalizability. Subsequent investigations using randomized controlled trial designs across multiple institutions would provide more robust evidence and contribute to the development of standardized anesthesia protocols for this surgical domain.

Conclusion:

The present study establishes that General Anesthesia is the most widely employed anesthetic modality in radio-ulnar surgical procedures, a trend driven primarily by the longer operative durations that characterize many forearm surgeries, as these durations exceed the safe application window of Bier's Block. While GA provides reliable intraoperative comfort and adequate analgesia, Bier's Block retains value in appropriately selected, shorter procedures. The data underscore that no single technique fits all clinical scenarios. The choice of anesthesia must be tailored to each patient's specific surgical and medical profile. Bleeding disorders, cardiac conditions, and the risk of nerve injury were identified as the principal complication concerns and should inform a thorough preoperative evaluation in every case. To strengthen the evidence base in this field, future researchers are encouraged to design prospective randomized trials with broader, multicenter enrollment. Exploring the role of ultrasound-guided regional blocks and TIVA as primary anesthetic strategies may further expand safe and effective options for patients undergoing radio-ulnar surgeries in diverse clinical settings.

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