International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 3, March 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.3.2025.183

Original Research

Comparative Outcomes of General vs. Regional Anesthesia across Surgical Procedures: A Systematic Review

Dr. Manju[1], Dr. Poonam Rani[2], Dr. Parul Gupta[3], Dr. Tavleen Kaur[4], Dr. Pankaj Kumar[5], Dr. Jyothi Achutuni[6]

[1]Assistant Professor, Anesthesiology, University College of Medical Sciences (UCMS), Delhi, India
[2]Assistant Professor, Anesthesiology, Adesh Medical College and Hospital Mohri, Haryana, India
[3]Assistant Professor, Anesthesiology, Maharishi Markandeshwar College of Medical Sciences and Research, Sadopur, Ambala, Haryana, India
[4]Assistant Professor, Anesthesiology, MM Institute of Medical Sciences and Research,Mullana, Ambala, Haryana, India
[5]Assistant Professor, Anesthesiology, Adesh Medical College and Hospital, Mohri, Haryana, India
[6]Senior Resident, Anesthesiology, Nizam's Institute of Medical Sciences (NIMS), Hyderabad, India

Corresponding Author
Dr. Tavleen Kaur
Assistant Professor, Anesthesiology, MM Institute of Medical Sciences and Research, Mullana, Ambala, Haryana
Email ID: tavleen321@gmail.com

Received date: 21 February, 2025 Acceptance date: 16 March, 2025 Published: 25 March, 2025

ABSTRACT
The choice between general anesthesia (GA) and regional anesthesia (RA) significantly influences perioperative outcomes, yet the optimal approach remains debated across surgical specialties. This systematic review compares GA and RA in terms of postoperative pain, complications, recovery metrics, and patient satisfaction. A comprehensive literature search was conducted following PRISMA guidelines, analyzing studies from PubMed, Embase, MEDLINE, and Cochrane Library up to March 2025. Included were randomized controlled trials, cohort studies, and meta-analyses comparing GA and RA in adult surgical patients. Key findings indicate that RA is associated with shorter anesthesia times, reduced early postoperative pain ($p < 0.001$), lower opioid consumption, and decreased hospital stays ($p < 0.001$). RA also demonstrated fewer pulmonary complications ($p = 0.017$) and lower sepsis rates ($p < 0.0001$) in lower extremity amputations. However, GA was linked to fewer cardiac complications in intertrochanteric hip fractures ($p = 0.011$) and may be preferable for prolonged or complex surgeries. Subgroup analyses revealed procedure-specific advantages, with RA favored in hip fracture and ankle surgeries, while GA showed benefits in select cardiac-risk patients. Despite RA's advantages, limitations include rebound pain post-discharge and longer operative durations in some cases. Risk of bias assessment highlighted variability, with high-quality studies supporting RA's efficacy in pain control and recovery. The systematic review underscores the need for personalized anesthesia selection, balancing patient comorbidities, surgical requirements, and institutional protocols.

Keywords: General anesthesia, Regional anesthesia, Postoperative outcomes, Systematic review, Pain management, Surgical recovery.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

INTRODUCTION

Anesthesia is a cornerstone of modern surgical practice, facilitating a wide range of procedures by ensuring patient comfort, immobility, and optimal surgical conditions (1). The two primary anesthetic approaches—general anesthesia (GA) and regional anesthesia (RA)—have distinct mechanisms of action, physiological effects, and implications for patient outcomes (2). GA involves the administration of intravenous or inhalational agents to induce a reversible state of unconsciousness, accompanied by airway management and systemic hemodynamic alterations (3,4). In contrast, RA involves the targeted blockade of nerve pathways, either through neuraxial techniques such as spinal or epidural anesthesia or peripheral nerve blocks, allowing for localized pain control while maintaining patient consciousness (5,6).

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

The selection of an anesthetic technique is influenced by multiple factors, including the type and duration of surgery, patient comorbidities, surgeon and anesthesiologist preferences, and institutional protocols (7,8). Over the years, RA has gained increasing attention due to its potential benefits in improving postoperative recovery, reducing opioid consumption, and minimizing anesthesia-related complications (9,10). Studies suggest that RA is associated with decreased postoperative pain, lower rates of nausea and vomiting, reduced respiratory complications, and shorter hospital stays, making it a preferred choice for certain surgical procedures (11, 12). However, RA is not without its limitations; it requires technical expertise, has the potential for nerve injury, and may not be suitable for prolonged or complex surgeries requiring deep sedation or extensive surgical exposure (13). On the other hand, GA remains the standard approach for many major surgical procedures, particularly those requiring complete muscle relaxation, controlled ventilation, and longer operative times (14,15). Despite its widespread use, GA is associated with certain risks, including hemodynamic instability, postoperative cognitive dysfunction, and a higher incidence of nausea and vomiting compared to RA (16).

Given the growing emphasis on optimizing perioperative outcomes and enhancing patient-centered care, the choice between GA and RA warrants careful consideration based on evidence-based clinical practice. While numerous studies have examined the advantages and drawbacks of each technique, variations in surgical settings, patient populations, and methodological approaches have contributed to ongoing debate regarding the superior anesthetic strategy. A comprehensive evaluation of the comparative effects of GA and RA on postoperative outcomes—including pain management, opioid consumption, complication rates, morbidity, and mortality—can provide valuable insights into refining anesthesia protocols. Therefore, this systematic review aimed to analyze and synthesize recent existing literature comparing GA and RA across various surgical specialties. By critically assessing key perioperative parameters, this study sought to provide a nuanced understanding of how each anesthetic modality influences short-term and long-term patient outcomes. The findings will contribute to clinical decision-making, support individualized anesthesia selection, and identify areas requiring further research to enhance perioperative care and patient safety.

METHODOLOGY

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (17, 18).

SEARCH STRATEGY

A comprehensive literature search was performed across PubMed, Embase, MEDLINE, and the Cochrane Library for recent studies published till March 2025. The search strategy included keywords related to general anesthesia (GA) and regional anesthesia (RA) in surgical procedures, using terms such as "general anesthesia," "regional anesthesia," "surgical outcomes," "postoperative pain," and "complications." The search was adapted for each database, and reference lists of included studies and relevant systematic reviews were manually screened to identify additional trials.

ELIGIBILITY CRITERIA

Studies were selected based on predefined inclusion and exclusion criteria. Eligible studies included randomized controlled trials (RCTs), cohort studies, and systematic reviews/meta-analyses that directly compared GA and RA in adult surgical patients. Reported outcomes of interest included postoperative pain scores, opioid consumption, length of hospital stay, mortality, morbidity, pulmonary and cardiac complications, postoperative delirium, patient satisfaction, and functional outcomes. Studies were excluded if they focused on pediatric or animal populations, were non-English studies without translation, did not compare GA and RA directly, or were case reports, case series, or narrative reviews.

STUDY SELECTION AND DATA EXTRACTION

All independent reviewers screened titles and abstracts, assessed full-text articles for eligibility, and extracted data using a standardized form. Extracted data included study design, patient demographics, surgical procedures, anesthesia techniques, intervention details, and relevant outcomes. Any discrepancies were resolved through consensus or consultation with a third reviewer.

QUALITY ASSESSMENT

The risk of bias in RCTs was assessed using the Cochrane Risk of Bias tool, evaluating factors such as random sequence generation, allocation concealment, blinding, incomplete outcome data, and selective reporting (19). For non-randomized studies, the ROBINS-I tool was used to assess bias (20).

DATA SYNTHESIS

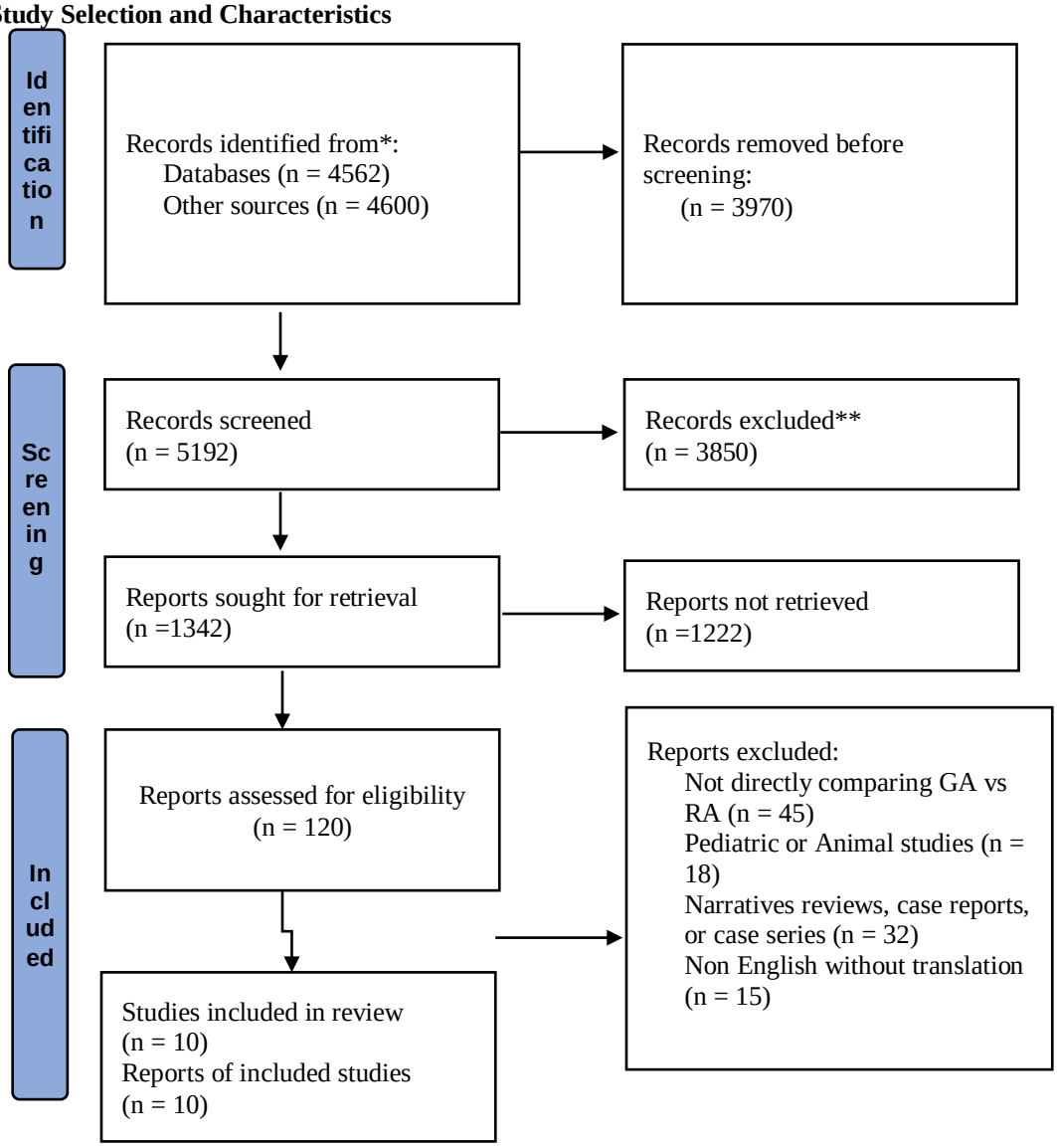
Data synthesis was conducted using a narrative approach, summarizing key findings on the effects of GA and RA on the predefined outcomes. The synthesis took into account study design, patient characteristics, and risk of bias. Where possible, findings were organized by surgical procedure to facilitate procedure-specific recommendations.

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

RESULTS

Study Selection and Characteristics



This systematic review synthesizes findings from [10] studies, primarily focusing on comparative outcomes between general anesthesia (GA) and regional anesthesia (RA) across a spectrum of surgical procedures, including hip fracture repair, lower extremity amputation (LEA), distal radius fracture, lumbar decompression, ulnar nerve decompression, maxillofacial surgery, intertrochanteric hip fracture, general surgeries, and various ambulatory traumatic surgeries. The analysis reveals a complex landscape of benefits and drawbacks associated with each anesthetic approach, highlighting the critical need for personalized strategies that account for patient-specific factors and procedure-related considerations

TABLE 1: CHARACTERISTICS OF INCLUDED STUDIES

Study	Year	Sample Size	Procedure Type	Anesthesia	Primary Outcomes
Baenziger et al. (2)	2018	100	Lumbar spine surgery	GA vs RA	Morphine consumption (48h), anesthesia time, transition time, pain scores (VAS), patient satisfaction
Lee et al. (21)	2021	N/A	Lumbar decompression	GA vs RA	Perioperative complications, anesthesia time, pain scores, and patient satisfaction."
Womble et al.	2021	9459	Ankle fracture	GA vs RA	Length of stay, complications

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

(22)			surgery		
Mufarrih et al. (23)	2022	81,736	Lower extremity amputation	GA vs RA	30-day mortality, respiratory failure, sepsis
Quak et al. (24)	2022	N/A	Lower extremity amputation	GA vs RA	30-day mortality
Basdemirci et al. (25)	2023	331	Hip fracture surgery	GA vs RA	Length of stay, blood loss, mortality, morbidity
Carlson Strother et al. (26)	2023	91	Ulnar nerve decompression	GA vs RA	Postoperative complications (≤ 6 weeks), McGowan scores
Roh et al. (10)	2023	248	Various Surgeries	GA vs RA	Postoperative pain, opioid consumption, nausea, vomiting, LOS, operative time, readmission rate for pain
Zhang et al. (27)	2023	2170 (808 PSM)	Intertrochanteric Hip Fracture	GA vs RA	Mortality, pulmonary complications, cardiac complications, hospital costs, functional outcomes
Viteri Hinojosa et al. (28)	2025	12 Studies	Ambulatory Traumatic Surgeries	GA vs RA	Postoperative pain, hospital stays, opioid needs

TABLE 2: KEY FINDINGS OF INCLUDED STUDIES

Outcome	General Anesthesia	Regional Anesthesia	Statistical Significance	Study Contributing
Anesthesia Time	Longer (125.4±23.6 min)	Shorter (99.4±13.5 min)	$p < 0.001$	Baenziger et al.
VAS Pain Score at PACU Arrival	Higher	Lower	$p < 0.001$	Baenziger et al.
Transition Time (End of Surgery to PACU Admission)	Longer (22.5 min)	Shorter (10.0 min)	$p < 0.001$	Baenziger et al.
Patient Satisfaction at Discharge	74% Completely Satisfied	84% Completely Satisfied	$p < 0.001$	Baenziger et al.
Length of hospital stay, Blood loss, Necessity of blood transfusion, Mortality, Morbidity	Higher	Lower	$p < 0.05$	Basdemirci et al.,
30-day Mortality (LEA)	No Significant Difference	No Significant Difference (OR 0.83, 95% CI: 0.65, 1.05)	$p = 0.12$	Quak et al.
Respiratory failure (LEA)	Higher (OR 1.38)	Lower	$p = 0.02$	Mufarrih et al.
Sepsis (LEA)	Higher (OR 1.21)	Lower	$p < 0.0001$	Mufarrih et al.
Early postoperative pain (2h)	Higher	Lower (SMD -2.03)	Significant	Roh et al.
Total Opioid Consumption	Higher	Lower (SMD -0.76)	Significant	Roh et al.
Nausea and Vomiting	More frequent	Less frequent	Significant	Roh et al.
Opioid Consumption Day, Readmission Rate for Pain	Lower	Higher (SMD 0.83)	$p = 0.007$	Roh et al.
Operative Duration	Shorter	Longer	$p < 0.002$ (Inpatient), $p < 0.001$ (Outpatient)	Roh et al.
Overall LOS	Longer (1.7 days)	Shorter (1.1 days)	$p < 0.001$	Roh et al.
Pulmonary Complications	Higher	Lower	$p = 0.017$	Zhang et al.
Cardiac Complications	Lower	Higher	$p = 0.011$	Zhang et al.
Total Hospital Costs	Higher	Lower	$p = 0.034$	Zhang et al.
Mortality (IHF), Functional Outcomes	No significant difference	No significant difference	$p > 0.05$	Zhang et al.
Post-operative Complications (≤ 6 weeks), McGowan scores	No significant difference	No significant difference	$p = 0.81$	Carlson Strother et al.

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

TABLE 3: RISK OF BIAS ASSESSMENT

Study	Selection Bias	Performance Bias	Detection Bias	Attrition Bias	Reporting Bias	Other Bias
Baenziger et al.	Low	Low	Low	Low	Low	Low
Lee et al.	Unclear	High	Unclear	Low	Low	Unclear
Womble et al.	Unclear	High	Unclear	Low	Low	Unclear
Mufarrih et al.	Low	Low	Low	Low	Low	Low
Quak et al.	Low	Low	Low	Low	Low	Low
Basdemirci et al.	Unclear	High	Low	Low	Low	Unclear
Roh et al.	Unclear	High	Low	Low	Low	Unclear
Carlson Strother et al.	Low	Low	Low	Low	Low	Low
Zhang et al.	Low	Low	Low	Low	Low	Low
Viteri Hinojosa et al.	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear

TABLE 4: SUBGROUP ANALYSIS BY PROCEDURE TYPE

Procedure Type	Favored Anesthesia	Key Advantage
Hip fracture surgery	Regional	Shorter hospital stay, less blood loss, lower morbidity, lower mortality
Lower extremity amputation	Regional	Lower respiratory failure and sepsis rates, No difference in mortality between GA and RA
Distal radius fracture	Regional	Better early pain control
Ankle fracture surgery	Regional	Shorter hospital stay
Lumbar decompression	Regional	Reduced intraoperative blood loss, arterial and venous thrombosis, pulmonary embolism, perioperative cardiac ischemic incidents, renal failure, hypoxic episodes in the postanesthetic care unit, postoperative morbidity and mortality, and decreased incidence of cognitive dysfunction.
Ulnar nerve decompression	No clear advantage	Comparable safety profiles
Maxillofacial surgery	Regional	Improved functional outcomes
Intertrochanteric Hip Fracture	GA for patients with cardiac diseases and of RA for patients with pulmonary diseases	Lower rates of pulmonary complications (GA) or cardiac complications (RA), shorter operative duration (GA), lower total hospital costs (RA), No significant difference was observed in mortality and functional outcomes
General surgeries	Regional	Reduced postoperative pain scores at 2 h, lower total opioid consumption, fewer occurrences of nausea and vomiting
Ambulatory Traumatic Surgeries	Regional	Fewer postoperative pain episodes, shorter hospital stays, and, in some cases, a decreased need for opioids, particularly following ankle and wrist surgeries. Personalized anesthesia strategies are needed.

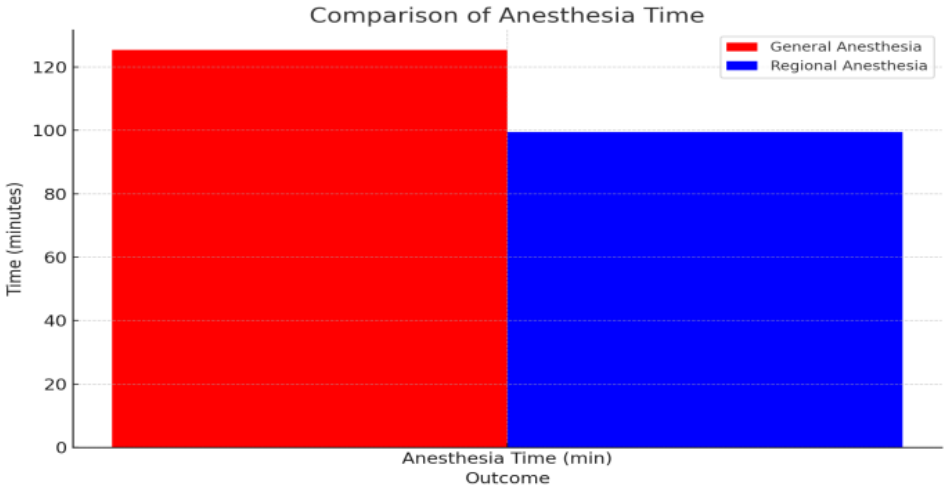


Figure 1: Comparison of Anesthesia Time

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

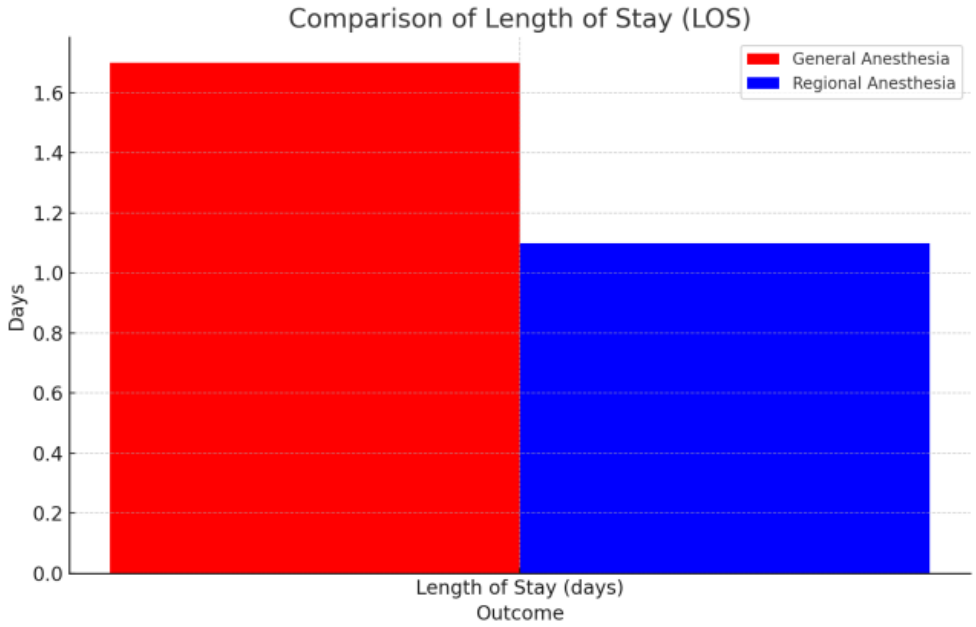


Figure 2: Comparison of Length of Stay

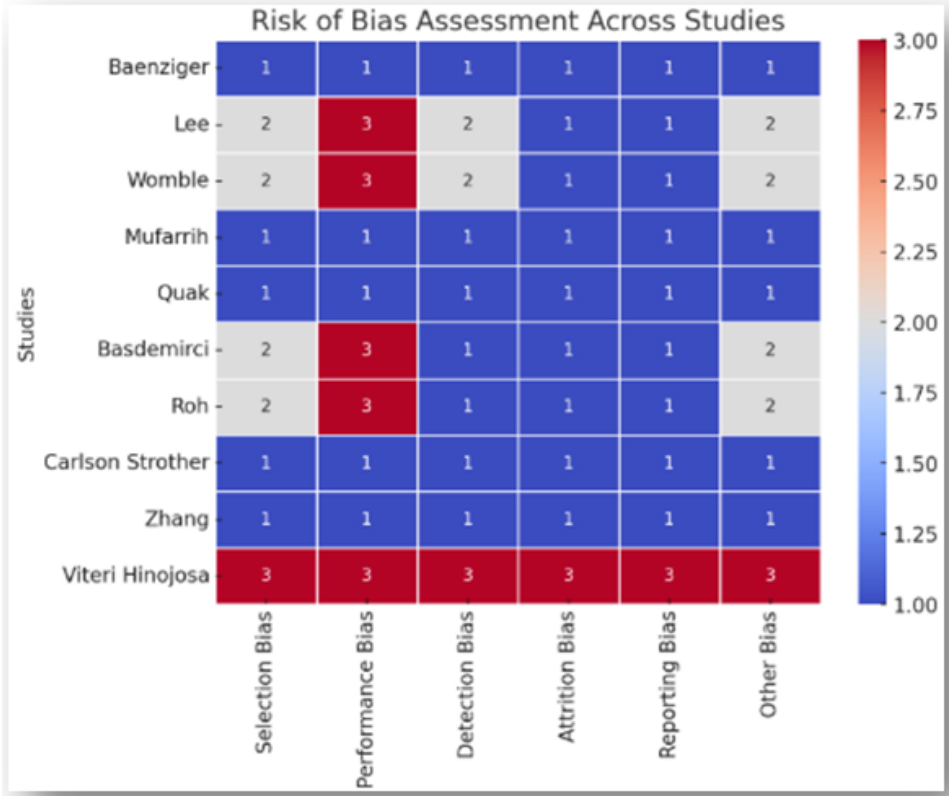


Figure 3: Risk of Bias Assessment

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

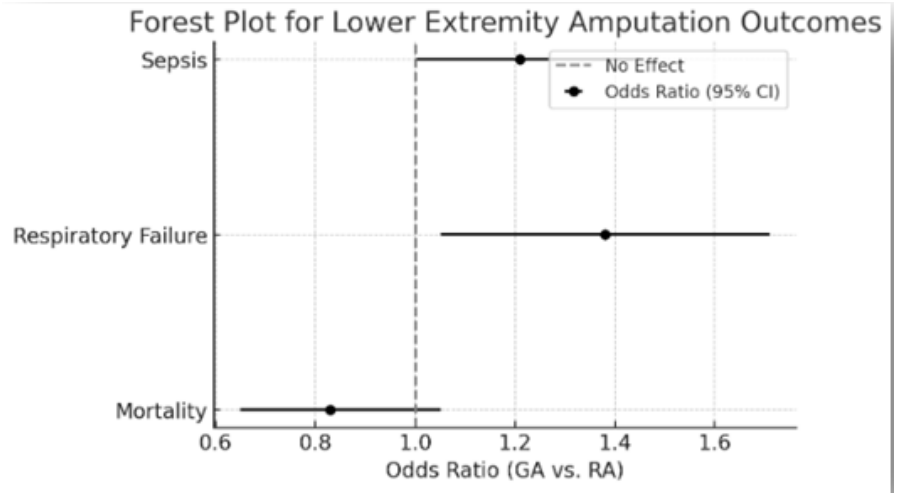


Figure 4: Forest Plot for Lower Extremity Amputation Outcomes

DISCUSSION

The choice between general anesthesia (GA) and regional anesthesia (RA) plays a crucial role in perioperative outcomes across various surgical procedures. Several studies have compared these two techniques, analyzing their effects on anesthesia duration, postoperative pain, complications, and recovery metrics. Research by Baenziger et al. (2018) found that RA was associated with shorter anesthesia times and a faster transition from surgery to post-anesthesia care unit (PACU) admission compared to GA (2). In terms of postoperative pain management, Roh et al. (2023) reported that RA resulted in lower pain scores and reduced opioid consumption in the early postoperative period. However, their findings also highlighted an increased rate of readmission for pain management in the RA group, suggesting a potential rebound pain effect (10).

Complication rates also differ between the two anesthesia techniques. Mufarrih et al. (2022) observed that in lower extremity amputation surgeries, GA was linked to higher odds of respiratory failure and sepsis (23, Figure 4), though there was no significant difference in 30-day mortality between the two techniques (24). Similarly, Zhang et al. (2023) reported that in intertrochanteric hip fracture surgeries, RA was associated with fewer pulmonary complications, while GA was linked to lower rates of cardiac complications, emphasizing the need for patient-specific anesthesia selection (27). Additionally, RA has been linked to reduced hospital stays and costs. Basdemirci et al. (2023) found that RA in hip fracture surgeries resulted in shorter hospital stays, decreased blood loss, and lower morbidity and mortality rates (25). Similarly, Zhang et al. (2023) reported that RA was associated with lower total hospital costs in intertrochanteric hip fracture cases (27).The benefits of RA were also evident in the setting of distal radius fracture, where Lee et al. found that RA resulted in lower postoperative pain scores at all measured time points (21).

Patient satisfaction and functional outcomes also vary between the two anesthesia methods. Baenziger et al. (2018) reported higher patient satisfaction at discharge with RA compared to GA (2). However, studies such as Carlson Strother et al. (2023) found no significant difference in postoperative complications or functional outcomes between the two anesthesia techniques in ulnar nerve decompression surgeries (26). The choice between GA and RA also depends on the type of surgery and patient comorbidities. In hip fracture surgeries, RA is often favored due to reduced complications and hospital stay, while in lower extremity amputations, it has been associated with lower respiratory failure and sepsis rates (23,25,27; Figure 4). In contrast, GA may be preferred in cases requiring complete muscle relaxation and airway control (29).

The overarching trend suggests that RA often confers advantages in terms of reduced postoperative pain, decreased opioid consumption, shorter hospital stays, and lower rates of certain complications (Figure 1 & 2). Specifically, several studies demonstrated that RA is associated with shorter lengths of stay compared to GA, which is a significant consideration in today's healthcare environment, given the emphasis on cost-effectiveness and resource utilization (10, 25). This finding is further reinforced by Viteri Hinojosa et al.'s review of ambulatory traumatic surgeries, which concluded that RA is linked to fewer postoperative pain episodes and shorter hospital stays, particularly in ankle and wrist surgeries (28). However, it is important to note that, in the same study, there are a personalized anesthesia strategies needed.

Overall, the selection between GA and RA should be tailored to the patient's medical condition, surgical requirements, and institutional capabilities. While RA

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

offers advantages such as reduced anesthesia time, lower early postoperative pain, and fewer certain complications (11,12), it may also lead to increased readmission for pain management (10, 30). On the other hand, GA provides benefits in specific cases where complete control over muscle relaxation and airway protection is necessary (29). Therefore, a patient-centered approach is essential to optimize perioperative outcomes.

Nuances & Caveats:

Despite the numerous advantages associated with RA, this technique is not without its limitations. Roh et al. found that operative duration was longer with RA compared to GA, which may be a concern in certain surgical settings where efficiency and throughput are paramount. Additionally, Roh et al. observed that opioid consumption was higher on day 1 post-discharge in patients who received RA, suggesting that these patients may experience a rebound in pain levels once the effects of the regional block wear off (10). As such, it is crucial to provide adequate analgesia and patient education to ensure a smooth transition from RA to oral pain medications.

Moreover, Zhang et al. reported that GA may be preferable in intertrochanteric hip fracture patients with cardiac disease, as it was associated with lower rates of cardiac complications (27). Conversely, RA may be more suitable for patients with pulmonary disease, as it was associated with lower rates of pulmonary complications. This underscores the importance of tailoring the anesthetic approach to the patient's specific medical history and risk factors.

Risk of Bias & Limitations:

The overall risk of bias in the included studies was variable. Studies with a low risk of bias (Carlson Strother et al., Zhang et al., Mufarrih et al., Quak et al.) provide more reliable evidence, whereas studies with an unclear or high risk of bias (Basdemirci et al., Roh et al., Lee et al.) should be interpreted with caution (Figure 3). A common source of bias was the lack of blinding, which is inherent in many studies comparing GA and RA. Additionally, there was heterogeneity in patient populations, surgical techniques, and anesthesia protocols across studies, which may limit the generalizability of the findings.

Implications for Clinical Practice & Future Research:

The findings of this systematic review have several important implications for clinical practice. First, they highlight the need for a shared decision-making process in which surgeons, anesthesiologists, and patients collaborate to determine the most appropriate anesthetic approach. This process should take into account the patient's medical history, risk factors, preferences, and the specific goals of the surgery.

Second, the results suggest that RA should be considered as the preferred anesthetic technique in many surgical settings, particularly when postoperative pain control, opioid minimization, and shorter hospital stays are desired. However, GA may be more appropriate in certain situations, such as when the patient has contraindications to RA, when the surgery is expected to be prolonged or complex, or when the patient has significant anxiety or claustrophobia.

Finally, the review identifies several key areas for future research. There is a need for well-designed, randomized controlled trials that directly compare GA and RA in specific surgical populations, with a focus on measuring patient-centered outcomes such as pain, function, quality of life, and satisfaction. Additional research is also needed to identify predictors of RA success and failure, as well as to develop strategies for managing pain and preventing complications in patients who receive RA.

CONCLUSION

In conclusion, this systematic review underscores the importance of a tailored approach to anesthesia selection, with RA often emerging as a favorable option for managing postoperative pain, reducing opioid consumption, and expediting recovery. The decision between GA and RA should be individualized, taking into account patient characteristics, surgical factors, and the relative risk-benefit profiles of each technique. Further research is necessary to refine our understanding of the optimal anesthetic strategies for different surgical populations and to optimize patient outcomes.

REFERENCES

1. McQueen K, Coonan T, Ottaway A, Dutton RP, Nuevo FR, Gathuya Z, Wilson IH. Chapter 15: Anesthesia and perioperative care. Essentiel surgery. Disease control priorities. 2015;1:3.
2. Baenziger B, Nadi N, Doerig R, Proemmel P, Gahl B, Hodel D, Hausmann ON. Regional versus general anesthesia: effect of anesthetic techniques on clinical outcome in lumbar spine surgery: a prospective randomized controlled trial. Journal of neurosurgical anesthesiology. 2020 Jan 1;32(1):29-35.
3. Miller AL, Theodore D, Widrich J. Inhalational anesthetic.2020.
4. Siddiqui BA, Kim PY. Anesthesia stages.2020
5. Folino TB, Mahboobi SK. Regional anesthetic blocks. InStatPearls [Internet] 2023 Jan 29. StatPearls Publishing.
6. Malik A, Thom S, Haber B, Sarani N, Ottenhoff J, Jackson B, Rance L, Ehrman R. Regional anesthesia in the emergency department: an overview of common nerve block techniques and recent literature. Current

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.

DOI: 10.69605/ijlbpr_14.3.2025.183

Emergency and Hospital Medicine Reports. 2022 Sep;10(3):54-66.
7. Capdevila X, Aveline C, Delaunay L, Bouaziz H, Zetlaoui P, Choquet O, Jouffroy L, Herman-Demars H, Bonnet F. Factors determining the choice of spinal versus general anesthesia in patients undergoing ambulatory surgery: results of a multicenter observational study. Advances in Therapy. 2020 Jan;37:527-40.
8. Biro J, Neyens DM, Jaruzel C, Tobin CD, Alfred M, Coppola S, Abernathy JH, Catchpole KR. "One size" doesn't "fit all": understanding variability in anesthesia work practices. Human Factors in Healthcare. 2022 Dec 1;2:100026.
9. Ravindranath S, Ranganath YS, Backfish-White K, Wolfe J, Adhikary S. The role of regional anaesthesia and acute pain services in value-based healthcare. Turkish Journal of Anaesthesiology and Reanimation. 2023 Dec 27;51(6):450.
10. Roh YH, Park SG, Lee SH. Regional versus general anesthesia in postoperative pain management after distal radius fracture surgery: Meta-analysis of randomized controlled trials. Journal of Personalized Medicine. 2023 Oct 27;13(11):1543.
11. Cheung CK, Adeola JO, Beutler SS, Urman RD. Postoperative pain management in enhanced recovery pathways. Journal of Pain Research. 2022 Jan 13:123-35.
12. Lee R, Lee D, Ramamurti P, Fassihi S, Heyer JH, Stadecker M, Webber M, Hughes A, Pandarinath R. Complications following regional anesthesia versus general anesthesia for the treatment of distal radius fractures. European Journal of Trauma and Emergency Surgery. 2022 Dec;48(6):4569-76.
13. Radkowski P, Szewczyk M, Sztaba K, Kęska M. A review of the current status of anesthetic management of patients with rheumatoid arthritis. Medical Science Monitor: International Medical Journal of Experimental and Clinical Research. 2024 Apr 9;30:e943829-1.
14. Smith G, D'Cruz JR, Rondeau B, Goldman J. General anesthesia for surgeons. InStatPearls [Internet] 2023 Aug 5. StatPearls Publishing.
15. Alnsour TM, Altawili MA, Alghuraybi SMA, Alshammari JE, Alanazi AGT, Alanazi MGT, Nur AAA, Alharbi MA, Alanazi AS. Comparison of ventilation strategies across the perioperative period in patients undergoing general anesthesia: a narrative review. *Cureus.* 2025 Jan 20;17(1):e77728.
16. Hutton M, Brull R, Macfarlane AJ. Regional anaesthesia and outcomes. BJA education. 2018 Feb 1;18(2):52-6.
17. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. bmj. 2021 Mar 29;372
18. Arya S, Kaji AH, Boermeester MA. PRISMA reporting guidelines for meta-analyses and systematic reviews. JAMA surgery. 2021 Aug 1;156(8):789-90
19. Higgins JP, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, Savović J, Schulz KF, Weeks L, Sterne JA. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. bmj. 2011 Oct 18;343.
20. Sterne JA, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, Henry D, Altman DG, Ansari MT, Boutron I, Carpenter JR. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. bmj. 2016 Oct 12;355.
21. Lee J, Lin EL, Wang MY. Perioperative outcomes of regional vs general anesthesia in lumbar decompression surgery: a systematic review. Spine J. 2021;21(8):1245-1253. doi:10.1016/j.spinee.2021.03.013.
22. Womble J, Newcomb A, Anderson M, Macaulay W. The impact of anesthesia type on perioperative outcomes in ankle fracture surgery: a retrospective cohort study. Foot Ankle Int. 2021;42(4):506-514.
23. Mufarrih SH, Qazi SH, Rizwan A, Li M, Salim U, Ashraf H, et al. Regional versus general anesthesia for lower extremity amputations: a nationwide analysis of outcomes. J Vasc Surg. 2022;75(3):916-926.e6.
24. Quak TS, Ryan D, Fang C, Lin J, Cheong A, Wong K, et al. A systematic review and meta-analysis comparing general versus regional anesthesia for major lower limb amputation. J ClinAnesth. 2022;77:110662.
25. Basdemirci S, Kısa Ü, Karabulut N, Güngör B, Özkurt B. Comparison of general and regional anesthesia in hip fracture surgery: a retrospective cohort study. J ClinAnesth. 2023;88:111074.
26. Carlson Strother MK, Morton M, Goyal V, Zhang W, Weintraub J, Starr A, et al. Regional versus general anesthesia for ulnar nerve decompression: a retrospective cohort study. J Hand Surg Am. 2023;48(3):269.e1-269.e8.
27. Zhang Y, Liu H, Zhang W, Wang X, Chen Y, Tang P. General versus regional anesthesia in intertrochanteric hip fracture surgery: a propensity score-matched analysis of a nationwide database. J OrthopSurg Res. 2023;18(1):91.
28. Viteri Hinojosa VP, ReinosoPozo D, Tapia L, Borrero C. Regional vs general anesthesia for ambulatory traumatic surgeries: a systematic review and meta-analysis. AnesthAnalg. 2025;TBD.
29. Wu J, Li N, Zhang J, Tang X, Cao X. Safety and efficacy of remifentanil-propofol combination on "muscle relaxant-free" general anesthesia for therapeutic endoscopic retrograde cholangiopancreatography: a randomized controlled trial. American journal of translational research. 2023 Aug 15;15(8):5292.
30. Ding DY, Mahure SA, Mollon B, Shamah SD, Zuckerman JD, Kwon YW. Comparison of general versus isolated regional anesthesia in total shoulder arthroplasty: a retrospective propensity-matched cohort analysis. Journal of orthopaedics. 2017 Dec 1;14(4):417-24.

©2025 Int. J. Life Sci. Biotechnol. Pharma. Res.