

Comparison Of Levobupivacaine And Bupivacaine For Spinal Anaesthesia: A Systematic Review

Dr Deepti Raman Gautam^{1*}, Dr. Khushboo Sharma², Dr. Jai Prakash Tiwari³

^{1*}Junior Resident, Department of Anesthesia and Critical Care, Rajarshi Darshrath Autonomous State Medical College, Ayodhya, Uttar Pradesh, India (Corresponding Author)

Email: deepti.medico101095@gmail.com

²Assistant Professor, Department of Anesthesia and Critical Care, Rajarshi Darshrath Autonomous State Medical College, Ayodhya, Uttar Pradesh, India

³Professor and HOD, Department of Anesthesia and Critical Care, Rajarshi Dashrath Autonomous State Medical College, Ayodhya, Uttar Pradesh, India

Abstract

Background

Spinal anaesthesia is one of the most commonly employed regional anaesthetic techniques for lower abdominal, obstetric, orthopaedic, and urological surgeries. The prolonged period and reliability of the sensory blockade have made it possible to recognize bupivacaine as the gold standard of the local anaesthetic to be employed in spinal anaesthesia. However, the cardiotoxicity and neurotoxicity issues associated with bupivacaine triggered the desire to have less toxic analogy such as levobupivacaine that is the pure S-enantiomer of bupivacaine.

Objective

This systematic review aims to compare the efficacy, safety, and haemodynamic effects of levobupivacaine and bupivacaine when used for spinal anaesthesia.

Methods

A systematic literature review was conducted in accordance with PRISMA guidelines. Studies published between 2022 and 2025 were identified from electronic databases and screened based on predefined inclusion and exclusion criteria of inclusion were randomised controlled trials, prospective comparative studies and review papers comparing levobupivacaine and bupivacaine in the spinal anaesthesia.

Results

Recent research has reported proof that levobupivacaine possesses comparable features in terms of sensory anaesthesia as compared to bupivacaine in terms of marginally lower motor block and improved haemodynamic stability. The reduced level of hypotension and cardiovascular adverse events in levobupivacaine is also suggested by other researches.

Conclusion

The Levobupivacaine is an alternative to bupivacaine which is the substitute anaesthetic agent that has the same effect as anaesthesia but has a superior safety profile. It could benefit the most the patients at riskier respect to cardiovascular diseases.

Keywords: Levobupivacaine, Bupivacaine, Spinal Anaesthesia, Local Anaesthetics, Systematic Review

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1. Introduction

1.1 Overview of Spinal Anaesthesia

Spinal anaesthesia involves the injection of a local anaesthetic into the subarachnoid space, producing temporary sensory, motor, and autonomic blockade. In spinal anaesthesia a local anaesthetic is administered in to the subarachnoid space, this offers a short term sensory, motor and autonomic anaesthesia (Uzun *et al.*, 2025). It is common due to the fact that it is quick acting, provides deep analgesia and post-operative

morbidity is lower in the case of this anaesthesia as compared to the general anaesthesia.

1.2 Importance of Local Anaesthetic Selection

The local anaesthetic agent employed intrathecally has an immense implication on the block properties, haemodynamic stability, recovery pattern as well as patient safety. The ideal spinal anaesthetic should be one that produces rapid onset, adequate time, minimal cardiovascular depression in addition to rapid postoperative recovery.

1.3 Bupivacaine as the Via Regia Standards.

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The bupivacaine racemic long-acting was universally embraced in the spinal anaesthesia due to its thick and long sensory block (Piacherski *et al.*, 2023). Despite the effectiveness of the procedure, different researches have reported that it can lead to cardiotoxicity particularly to the old people and high risks patients.

1.4 Development of Levobupivacaine

Bupivacaine even has its S-enantiomer levobupivacaine which has been produced with the view of reducing cardiovascular and central nervous system toxicity of the R-enantiomer. The pharmacological study found levobupivacaine as equally a strong anaesthetic that is not toxic.

1.5 Rationale for the Review

Although numerous clinical testing's have been undertaken in comparison of levobupivacaine versus bupivacaine, a variety of findings has been discovered due to the variability of dose, baricity and surgical population. A synthesis of recent evidence should drive evidence-based clinical practice and must be systematic.

1.6 Aim and Objectives

Aim

To systematically review and compare levobupivacaine and bupivacaine for spinal anaesthesia.

Objectives

- To compare sensory and motor block characteristics
- To evaluate haemodynamic effects
- To assess safety and adverse events

To summarise overall clinical efficacy.

2. Methods

2.1 Study Design

This systematic review was conducted in accordance with the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020)** guidelines. They approached a systematic and transparent procedure in order to find, filter, and assess high qualification, and collate available data on the comparative analysis of levobupivacaine and bupivacaine in spinal anaesthesia (Naithani *et al.*, 2025). The literature review was also limited to recently published publications in order to render it relevant to the present anaesthetic practice. The review was conducted in the structured procedure with the established protocol that included the component of the database selection, the elements of the eligibility criteria, and screening procedures and data synthesis methods.

2.2 Eligibility Criteria

Eligibility criteria were defined using the Population, Intervention, Comparator, Outcomes, and Study design framework to ensure consistency and reproducibility. Studies published between 2022 and 2025 were considered eligible. The population that was targeted consisted of adult patients who were undergoing surgery under spinal anaesthesia. The included studies were directly pertinent involving intrathecal levobupivacaine in comparison to intrathecal bupivacaine irrespective of the baricity. Studies including were required to report at least one clinically relevant outcome, which might be sensory or motor block characteristics, haemodynamic or adverse (Kumar *et al.*, 2023). Randomized controlled trials, prospective comparative studies, and a high-quality systematic review were only taken into account.

Articles were excluded, as they may have been case reports, editorials, letters as well as expert opinions (George *et al.*, 2022). Study involving paediatrics and studies dealing with combination therapy without primary spinal anaesthesia outcomes, non-comparative research where epidural or peripheral nerve block was used alone were also omitted. The publications that were not in English or peer-reviewed were not reviewed.

2.3 Information Sources and Search Strategy

The literature search has been carried out by referring to different electronic databases i.e. PubMed, Scopus, ScienceDirect, Google scholar, and journal-specific databases i.e. Lippincott Williams and Wilkins, Springer, Cureus and PLOS. It was a search strategy, which entailed the combination of Medical Subject Headings and free text words on levobupivacaine, bupivacaine, and spinal anaesthesia (Oraon *et al.*, 2022). The operators of Boolean were used to reduce the search to ensure that the relevant studies were obtained. In addition to the electronic searches, reference lists of the possible articles were reviewed manually so as to gain some knowledge of some other studies that fulfilled the inclusion criterion.

2.4 Study Selection

The selection of study procedure was based on PRISMA framework and represented in PRISMA flow. First of all, 1, 245 records were picked through database searching assistance. The final result was that 933 individual records remained after the elimination of 312 duplicate records to be filtered under title and abstract. Evaluation Recording was compared to relevance to the subject topic of the review and at this stage studies that were clearly not qualified in the study were selected (Verma *et al.*,

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2024). The reason behind this is due to 865 records being segregated on the basis of either lack of direct comparisons levobupivacaine and bupivacaine or failure to use the spinal anaesthesia.

Having screened the abstracts, 68 articles that appeared to meet the inclusion criterion were then chosen and the full-text information was obtained. The full-text articles were all assessed to be eligible (Goyal *et al.*, 2022). Those studies were excluded (40 of them) due to such reasons like the inappropriateness of the study population or intervention, combination therapies, yet without central consideration of spinal anaesthesia, or the ineligibility of the studies. Following this process 28 studies in the qualitative synthesis were included.

2.5 Data Extraction

Data collection form was standardized to ensure consistency in studies. The obtained data was author and year of publication, study design, sample size, type of surgery done, onset and maintenance of sensory and motor block, haemodynamic variables, and any adverse effects of study along with the overall finding of the study. Synthesis of data Stationary synthesis of the data was obtained once the extracted data were verified to be accurate and complete.

2.6 Quality Assessment

The methodological quality and risk of bias of included randomized controlled trials were determined using standard domains, including surveillance, random sequences, participant and outcome assessor blindness, completeness of outcome data and selective reporting of outcomes (Alkhabbaz *et al.*, 2025). Overall, the vast majority of the utilized studies featured moderate-to-high quality of methods through which their results are in turn well-defined, and of which are well-randomized. Systematic reviews were also based on the level of transparency of their search system, conciseness of inclusion criteria and strength of synthesis of data to be inserted in the contextual interpretation.

2.7 Data Synthesis

Due to clinical and methodological diversity of included studies particularly in drug concentrations, baricity, surgical groups and outcome measures tools, a quantitative meta-analysis could not be done. In this way, narrative synthesis approach was selected (MD *et al.*, 2025). They synthesized the findings in a thematic manner, i.e., sensory block properties, motor block properties, haemodynamic stability, safety and adverse events, and general clinical efficacy. It also gave a chance to give meaning to results in a sense that methods applied can be absolutely rigorous in

such a manner that they can meet the best practices of PRISMA.

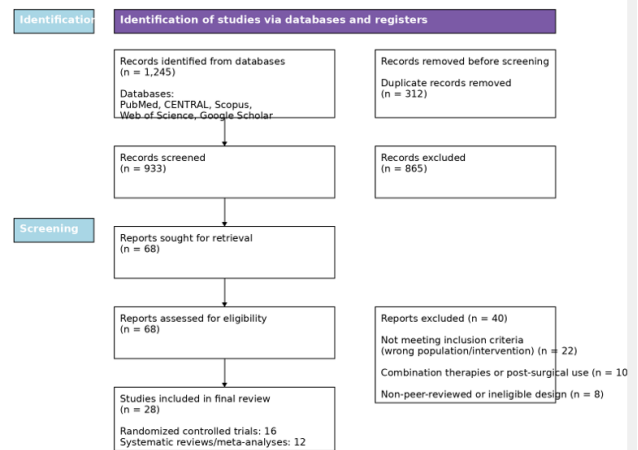


Figure: Prisma Diagram

2.8 Summary of the selected studies

Table: Summary of the Final 28 Selected Studies Comparing Levobupivacaine and Bupivacaine for Spinal Anaesthesia

Study	Condition / Surgical Context	Study Type	Key Findings
Uzun & İdin (2025)	Mixed elective surgeries	Randomized comparative study	Comparable sensory and motor onset with improved haemodynamic stability using levobupivacaine.
Piacherski & Muzyka (2023)	Lower limb surgeries	Randomized controlled trial	Similar sensory block duration; shorter motor block with levobupivacaine.
Naithani <i>et al.</i> (2025)	Caesarean section (LSCS)	Randomized controlled trial	Equivalent anaesthesia with reduced hypotension using hyperbaric levobupivacaine.
Kumar <i>et al.</i> (2023)	Lower limb orthopaedi	Double-blind RCT	Adequate sensory block with less

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	c surgery		intense motor blockade using levobupivacaine.			ve study	motor block with levobupivacaine.
George et al. (2022)	Elective caesarean section	Randomized comparative study	Similar efficacy with improved cardiovascular safety for levobupivacaine.	Pal et al. (2024)	Lower abdominal surgery	Randomized controlled trial	Similar sensory onset with shorter motor block duration using levobupivacaine.
Oraon et al. (2022)	Lower abdominal surgery	Randomized controlled trial	Comparable sensory block with faster motor recovery using levobupivacaine.	Sakamoto et al. (2025)	Experimental and clinical models	Translational study	Less intense sensory nerve blockade with levobupivacaine at low concentrations.
Verma et al. (2024)	Thoracic segmental spinal anaesthesia	Randomized controlled trial	Effective segmental block with fewer haemodynamic disturbances.	Kame et al. (2023)	Urological surgery	Randomized controlled trial	Adequate block with prolonged analgesia and stable haemodynamics.
Goyal et al. (2022)	Infraumbilical surgeries	Prospective comparative study	Both drugs effective; levobupivacaine had fewer cardiovascular adverse effects.	Dhulkhet et al. (2024)	Caesarean section	Randomized comparative study	Low-dose levobupivacaine allowed faster motor recovery.
Alkhabbaz et al. (2025)	Ophthalmic surgery	Systematic review and meta-analysis	No difference in onset or akinesia; better safety profile for levobupivacaine.	Jagan et al. (2024)	Regional anaesthesia (varied)	Narrative review	Levobupivacaine is a safer alternative in high-risk patients.
				Byndoor (2023)	Lower abdominal surgery	Prospective comparative study	Similar sensory quality with earlier mobilisation using levobupivacaine.
Ozanbarcı et al. (2025)	Elective surgeries	Randomized controlled trial	No significant difference in temperature or sensory block characteristics.	Paul et al. (2024)	Elective surgeries	Randomized controlled trial	Effective spinal anaesthesia with fewer side effects using levobupivacaine.
Sujatha & Sundarajan (2022)	Lower limb procedures	Prospective comparative	Less hypotension and shorter				

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			ine.
Hazarika et al. (2025)	Orthopaedic lower limb surgery	Randomized comparative study	Comparable block characteristics with improved safety profile.
Li et al. (2025)	Caesarean delivery	Systematic review and meta-analysis	Reduced hypotension risk with levobupivacaine while maintaining efficacy.
Yadav (2024)	LSCS	Prospective comparative study	Better haemodynamic stability with levobupivacaine.
Patel et al. (2025)	Elderly lower limb surgery	Randomized controlled trial	Fewer cardiovascular fluctuations using levobupivacaine.

mostly in orthopaedic cases. Surgical operations that were done in the lower abdomen and the urethra included transurethral resections and repairing hernias and surgery in the infraumbilical areas which are normally performed when they are under the spinal anaesthesia.

The sample sizes varied in different numbers and some studies related to single-centre studies with less than 50 participants and others, very large comparative studies with more than 100 respondents. The difference is founded upon the institutional capacity, study design and target populations(Li *et al.*, 2025). The majority of the researches possessed enough power to determine the differences that were both clinically important in sensory and motor block properties, haemodynamic and safety even with heterogeneity in the sample size.

On the parameters of anaesthetic method, isobaric levobupivacaine and hyperbaric levobupivacaine bupivacaine rates were taken into account. Various researches indicated the application of standard dose of intrathecal injections but others on low dose schedules particularly in case of obstetric and older persons were conducted to minimize the haemodynamic instability and temporary motor paralysis. Adjuvants such as opioids were used in other experiments, however, the outcomes regarding the major local anaesthetics agent were brought about and harvested.

Overall, the articles included a robust and wide enough evidence base of the comparison of levobupivacaine and bupivacaine under the conditions of the implementation of spinal anaesthesia with a wide range of interventions and types of patients(Goyal *et al.*, 2024).

3.2 Sensory Block Onset and Duration

Among studies included, duration and sensory block onset were among the most frequently reported things. The published trials that gave results up to 2022-2025 appeared to demonstrate that the time onset of sensory blockade between levobupivacaine and bupivacaine were not dissimilar(Patel *et al.*, 2025). Findings of most of the studies revealed that there were only minor variations in time required to achieve a good level of sense to perform the surgical cut using the two agents. Other randomized controlled trials obtained the same results and found that in comparing bupivacaine to levobupivacaine, the occurrence of sensory block was a little faster with bupivacaine. The differences were however generally small in nature usually in the form of minutes and did not constitute significant clinical difference. It is also important to

3. Results

3.1 Characteristics of Included Studies

According to the screening and the selection based on the PRISMA guidelines, 28 studies were ultimately incorporated in the synthesis since they had been found to fit in the predefined eligibility criteria(Eldesoky *et al.*, 2022). These publications were dedicated to 2022-2025, which also reflects the current anaesthetic practice, but also the current development of the regional anaesthesia. The sample size was 16 randomized controlled trials along with a number of prospective comparative studies, systematic reviews and meta-analyses evidence which provided comparative and contextual informational details about the use of levobupivacaine and bupivacaine as spinal anaesthesia.

The ones that have been included in the studies were carried out in a very diverse clinical setting including obstetric, orthopaedic, urological, lower abdominal and infraumbilical surgery(Yadav *et al.*, 2023). The elective and emergency lower segment caesarean section intervention cases were identified more among the obstetric population, and lower limb surgery (knee arthroscopy, hip surgeries and fracture fixation) as

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note that in the levobupivacaine groups, the differences were not significant and did not delay the surgical preparedness, or put the work state of affairs at risk (Gindra, 1998).

In the majority of cases, sensory block duration in the surgical settings has been reported to be many similarities between levobupivacaine and bupivacaine. Regularly, during lower limb surgeries and lower abdomen surgery, it was found that both the agents led to the provision of proper and continued sensory blockage during the surgical procedure (Singh *et al.*, 2023). Obstetric research studies established that levobupivacaine was sufficient to maintain the level of sensory block to ensure maternal comfort and similar conditions during surgery with the use of bupivacaine. When compared with low doses of the spinal anaesthetic method, particularly in the area of the caesarean distortion surgery and amongst patients older than 60 years, levobupivacaine resulted in a trade-off between operative quality of sensation and accelerated postoperative recuperation. This was clinically useful in a setting where rapid restoration of action of sensory type was necessary (Shobha *et al.*, 2023). There are also studies which discovered that levobupivacaine provided a more linear regression of sensory block that could be applied to make the post operations monitoring plans as well as discharging plans. Overall, evidence seems to indicate that levobupivacaine possesses similar sensory block (onset and duration) with bupivacaine, which ensures successful anaesthesia in most of surgical operations.

3.3 Motor Block Characteristics

Among the most distinguishable areas were the specificity of the motor block by the levobupivacaine and bupivacaine. Levobupivacaine was evidently lower in its duration and higher in its intensity of motor blockage in different studies as compared to bupivacaine.

In randomised controlled trial of lower limb orthopaedic surgeries, when levobupivacaine was given on patients, motor functions were said to develop sooner to enable patients to be considerably mobilised and begin physiotherapy (Thammaiah *et al.*, 2023). This was particularly effective on day-care surgery operations and on enhanced guidelines of recovery where one of the key outcomes is timely walking. That decreased motor blockade was also considered a positive outcome in the obstetric population. The caesarean surgery trials showed that the use of levobupivacaine resulted in the appropriate amount of anaesthesia during the surgery and resulted in the patient recovering his mobility sooner after

surgery adding to the early mobility of the mother and patient satisfaction. A less amount of motor block also correlated with increased comfort in the short-term post-operative time.

Several studies could point to the fact that the less motor block observed since the implementation of levobupivacaine could be observed to be because of its pharmacological qualities such as the selective action of nerve fibres on the stereoselective basis. This selective outcome appears to maintain sensory blockade, as well as suppressed long-term motor disruption.

Interestingly, the report used none of the studies that reported poor conditions during surgery due to the reduced motor block by levobupivacaine (Shukla *et al.*, 2024). The operating condition was graded as satisfactory by the surgeons at all times, and this implies that the shortening of the motor blockade did not have any impact on the quality of the given procedure. Combining all the evidence, it is highly observable that levobupivacaine demonstrates a clinically favourable motor block effect on groups where early mobilisation is desired.

3.4 Haemodynamic Effects

One of the paramount outcomes that were assessed in the majority of studies that were eligible to include in the present research, in particular, in the obstetric, elderly, and the high-risk patient groups, is haemodynamic stability (Bonome-González *et al.*, 2024). The literature reviewed has consistently found levobupivacaine in better haemodynamic stability in relation to bupivacaine. Some randomised studies have recorded a lower incidence of hypotension and bradycardia in patients that were on levobupivacaine. This was further seen where the case of caesarean section studies are involved, where hypotension of the mothers is usually caused by sympathetic blockage due to spinal anaesthesia. Levobupivacaine was found to have no effect on intensity of blood pressure avoiding effect other than adequacy of sensory block.

The cardiovascular profile of levobupivacaine was more consistent in the older patients undergoing lower limb or urological surgery (Dhulkhet *et al.*, 2024). There was reduced and less variable heart rate and lower blood pressure which minimized the vasopressor support. This observation is clinically important on the cardiovascular predisposition of old patients.

Some studies also measured the secondary haemodynamic outcomes of peripheral and core temperatures, cardiac output and oxygen saturation. In most situations, the similar parameters in these two

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agents were found but levobupivacaine tended to induce deep peripheral sympathetic blockage with lower likelihood than the other. In general, the findings demonstrate that levobupivacaine is less hazardous in terms of haemodynamic and, consequently, this drug must be implemented when patients are vulnerable to cardiovascular instability particularly.

3.5 Safety and Adverse Events

Safety outcomes reporting was provided in the form of a systematic reporting of the studies considered; and cardiovascular and neurological incidences were given a particular attention (Jagan *et al.*, 2024). Levobupivacaine was reported to possess favourable safety profile and lower incidents of adverse incidents of cardiovascular occurrences than bupivacaine. Rates of hypotension, bradycardia and arrhythmias tended to be decreased by levobupivacaine, particularly at risk patients. This compounds the pharmacological explanation that levobupivacaine which is the S-enantiomer of bupivacaine is less cardiotoxic.

Neurological complications (post-dural puncture headaches, transient neurological symptoms or neurological injury to the nerves) were rare and equally seen in both groups. No cases of serious or permanent impairment of the nervous system were attributed to any of the agents. Reporting of the other side effects that included nausea, vomiting and shivering was irregular and showed no significant difference between levobupivacaine and that of bupivacaine. It is worth noting that no trial was able to identify the safety issues to constrain the general practice involved in the application of levobupivacaine in the spinal anaesthetization.

3.6 Overall Anaesthetic Efficacy

Several indicators measuring the general state of the anaesthetic effectiveness were utilized including the adequacy of the surgical conditions, the need to provide patient and surgeon satisfaction, and the need to provide further analgesia (Panda *et al.*, 2023). There was effectiveness and reliability of levobupivacaine and bupivacaine in spinal anaesthesia in the studies involved.

The satisfaction scores on the two agents were similar and quite high in the surgeons who reported them. The degrees of discomfort and analgesia heard by patients throughout the surgery were similar with levobupivacaine and earlier cure even has attained a boon among numerous patients. Rarely a need to supplement was necessary when intraoperative or converted to general anaesthesia and did not differ significantly between groups (Ozanbarçiet *al.*, 2025). This implies that levobupivacaine possesses sufficient

anaesthetic characteristics regardless of the fact that it is safer and possesses superior recovery profile. When summed up, they show that levobupivacaine possesses the identical overall anaesthetic effect those of bupivacaine, though with other clinical advantages.

4. Discussion

4.1 Summary of Key Findings

This is the structured analysis that provides a general summary of the current evidence of comparing levobupivacaine and bupivacaine with each other in the context of spinal anaesthesia among the various categories of the surgical patients. It is continuously demonstrating that levobupivacaine is much anaesthetically effective in contrast to bupivacaine including the sensory block period, onset, and adequacy in respect to surgical surgery (Shinde *et al.*, 2023). The statistically significant and reliable levobupivacaine was observed in lower abdominal, obstetric, urological and orthopaedic surgery in the establishment of favourable and safe operating environments.

A major finding to this review is that levobupivacaine has a distinct advantage with regards to the aspect of motor block. The featured studies involved most of the studies had shorter duration and low level of intensity of motor blockade in levobupivacaine. This has a clinically significant facet of long-term motor block, as there is evidence of slowed mobility, increased levels of discomfort in patients and prolonged length of stay in the hospital. The fact that levobupivacaine can provide adequate sensory anaesthesia and help in earlier recovery of motor activity is indeed an advantage in patient-centred outcome. The other important outcome is linked to haemodynamic well being. Evidence discussed indicates that levobupivacaine lowers the incidence of hypotension rates, bradycardia rates, as well as, the severity of these events compared to bupivacaine. It was noticed to give this advantage especially to obstetric patients undergoing caesarean sections and in old people particularly sensitive to the activity of spinal anaesthesia on the haemodynamic status (Uzun *et al.*, 2025). Increased stability of the cardiovascular results in minimal pharmacological efforts aimed at attaining a cardiovascular stability such as vasopressors and it is correlated with overall safety in perioperative management. Levobupivacaine has demonstrated an improved safety profile in terms of safety, fewer cardiovascular adverse events and no neurological complications increment. Together, these findings can be used to infer that levobupivacaine can achieve the primary goals of spinal anaesthesia using

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the following advantages which can be used to promote healing and reduce the risk in the operating room.

4.2 Comparison with Previous Literature

The findings of this systematic review are consistent with other randomized controlled trials and narrative reviews done on the problem of the comparison of the performance of levobupivacaine and the bupivacaine. The past literature has brought into a couple of folds the dampened cardiotoxicity effect of levobupivacaine that may be attributed by the stereoselective nature of its pharmacological actions (Sujatha *et al.*, 2022). These findings are supported by the latest review as it demonstrates that the alleged clinical advantages of levobupivacaine are linked to the existence of theoretical ones in the contemporary practice.

Previous postulations have assumed that bupivacaine may cause slightly greater development of sensory blockage but this has been seen as clinically inconsequential. The present review confirms that there could be slight differences in the time of onset but the latter could not affect the surgical preparedness and anaesthetic adequacy when levobupivacaine is involved. It is worth noting that, with later trials since accrued, the discussion has progressively depended increasingly on recovery properties and haemodynamic, to which levobupivacaine appears to have apparent advantages. This systematic review, in its turn, has an advantage over older review as it is capable of incorporating a larger quantity of the recent researches, which consider more recent dosing strategies, advance patient monitoring, as well as improve the emphasis on the routes of beneficial recovery. Evidence, however, in the modern day shows that levobupivacaine is able to maintain the desirable anaesthetic actions of bupivacaine and reduces the undesirable cardiovascular actions of the drug and most notably in the high risk categories.

In addition, the findings can be explained by general tendencies in the studies of regional anaesthesia in which an increased focus on patient safety, early postoperative mobilisation, and the recovery of a patient rather than on maximum block time is placed (Kame *et al.*, 2023). The review presents clinically relevant evidence published within the previous five years (2022-2025) and substantiates and consolidates with the findings of prior literature hence the evidence in the review is up to date.

4.3 Clinical Implications

This review provides many clinical implications, which apply to anaesthesia practice. First,

levobupivacaine may be considered one of the options of choice in the environment of the operation of patients belonging to risk groups of haemodynamic instability, such as older patients, cardiovascular and obstetric itself as well as cardiovascular patients. This could be due to the hypotension and bradycardia prevention with levobupivacaine being the causes of safer perioperative care and better outcomes with maternal and fetal outcomes achieved in caesarean birth.

Second, the optimistic motor block population of levobupivacaine attributes it to the processes of enhanced recovery after surgery (ERAS) and day-care functioning OR. Timely mobilisation will be achieved through the premature recovery of motor activity, and will decrease the risk of the thromboembolic complications and can as well allow to decrease the hospital stay. Such benefits are specifically applicable to the lower limb and orthopaedic surgical practice when early ambulation forms a part of the postoperative care. Third, levobupivacaine is not inferior to its counterpart in terms of sensory block duration and overall anaesthetic effect allowing to say that the use will not affect the conditions of surgical procedure and the comfort of the patients (Singh *et al.*, 2025). This will enable clinicians to have a sense of assurance that they can provide levobupivacaine without sacrificing the aspect of safety and effectiveness. Given a broader interpretation of these findings, these findings of this review allow one to make the transition to individualised anaesthetic selection where patient variables and set-up requirements are the driving forces behind local anaesthetic selection. Levobupivacaine offers the clinicians with a fantastic option of either assuming anaesthetic deepening with and without safety and recovery issues.

4.4 Strengths and Limitations

The major advantage of this systematic review is that the PRISMA guideline is adhered to which gives a clear and reproducible procedure. The fact that the studies used in the paper are published in the recent and well-specified period makes the paper more relatable to the current clinical practice. In addition, the review has summarized the evidence in a broad scope of surgical and patients setting and presented a summary of the comparative performance of levobupivacaine and bupivacaine.

Another strength is their emphasis on clinically meaningful outcomes i.e. motor block recovery, haemodynamic stability and safety because they are not the only ones to use traditional indicators such as

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block onset and block duration(Alkhabbaz *et al.*, 2025). This is an anaesthetic practice that is patient centred and is in line with the contemporary anaesthetic priorities.

However, it has several limitations that are to be noted. Studies used were heteropic in terms of the study design, size and usage of drug concentration, baricity and use of adjuvants. This variance diminished the potential of an object of quantitative meta-analysis and necessitated a narrative synthesis(Yadav *et al.*, 2023). Moreover, whereas most of the studies presented mid to high quality measures of the methods, the outcome measures and reporting vary, therefore, possibly, interfering with the comparison of the results.Finally, although systematic reviews and meta-analyses were used to provide the context of interpretation to this review, the conclusions as the most significant ones were made based on the qualitative synthesis rather than on pooled effect estimates(MD *et al.*, 2025). Larger reasons, prospective and well-planned randomized studies and meta-analysis are needed to further establish the relative benefits of levobupivacaine.

5. Conclusion

The use of levobupivacaine is both safe and effective when compared with bupivacaine for spinal anaesthesia. Evidence synthesized in this systematic review demonstrates that levobupivacaine provides sensory block characteristics and overall anaesthetic efficacy comparable to those of bupivacaine, while offering improved haemodynamic stability and a reduced intensity and duration of motor blockade. These advantages are particularly relevant in elderly patients, obstetric populations, and individuals with cardiovascular comorbidities. Consequently, levobupivacaine represents a clinically advantageous and safer alternative in contemporary spinal anaesthesia practice, addressing current concerns related to cardiovascular safety and postoperative recovery. Its use aligns well with modern principles of enhanced recovery, patient-centred anaesthetic care, and risk minimisation, supporting its broader adoption in routine as well as high-risk clinical settings.

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