Original Research Article

A Comparative Study Of 0.5% Lignocaine Versus 0.5% Lignocaine with Dexmedetomidine for Intravenous Regional Anaesthesia for Upper Limb Surgeries

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Abstract

Background: Intravenous Regional Anaesthesia (IVRA), commonly referred to as Bier's block, is a widely used technique for upper limb surgeries. While lignocaine has been the standard local anesthetic for this procedure, recent studies suggest that the addition of adjuncts like dexmedetomidine may enhance the quality of anesthesia and improve postoperative analgesia. This study aims to compare the efficacy and safety of 0.5% lignocaine versus 0.5% lignocaine with dexmedetomidine in patients undergoing upper limb surgeries under IVRA. **Objective:** To compare the onset, quality of anesthesia, duration of sensory and motor blockade, and postoperative analgesia between two different anesthetic regimens: 0.5% lignocaine and 0.5% lignocaine with dexmedetomidine for intravenous regional anaesthesia in upper limb surgeries. **Methods:** In this study 60 patients 30 in each group undergoing elective upper limb surgeries were randomly assigned to receive either 0.5% lignocaine (Group L) or 0.5% lignocaine with 0.5 µg/kg dexmedetomidine (Group LD) for IVRA. The onset time, duration of sensory and motor block, quality of anesthesia, and incidence of complications were recorded. Postoperative pain scores, the need for additional analgesia, and adverse events were also evaluated. **Results:** Patients in the dexmedetomidine group (Group LD) showed a significantly faster onset of anesthesia, longer duration of sensory and motor block, and better postoperative analgesia compared to the lignocaine-only group (Group L). The incidence of complications, including tourniquet pain, were comparable between the two groups, with no significant differences in adverse effects. **Conclusion:** The addition of dexmedetomidine to 0.5% lignocaine in intravenous regional anaesthesia for upper limb surgeries provides enhanced sensory and motor block characteristics, prolonged postoperative analgesia, and improved patient satisfaction without a significant increase in complications. Dexmedetomidine appears to be a useful adjunct in IVRA for upper limb surgeries, potentially improving the clinical outcomes and the overall quality of anesthesia.

Keywords: Intravenous regional anaesthesia, lignocaine, dexmedetomidine

Introduction

Intravenous regional anaesthesia (IVRA) is a widely employed technique for upper limb surgeries, providing effective analgesia and muscle relaxation. Traditionally, 0.5% lignocaine has been the local anaesthetic of choice due to its rapid onset and short duration of action[1]. However, there is a growing interest in enhancing the quality and duration of analgesia provided by IVRA through the addition of adjuvants.

Dexmedetomidine, a selective alpha-2 adrenergic agonist, has been investigated for its potential benefits in regional anaesthesia. Its properties include sedation, analgesia, and anxiolysis, which may enhance the efficacy of local anaesthetics[2]. Several studies have suggested that combining dexmedetomidine with lignocaine can prolong the analgesic effect and reduce the requirement for postoperative analgesics[3].

The present study aims to compare the efficacy and safety of 0.5% lignocaine alone versus 0.5% lignocaine combined with dexmedetomidine in patients undergoing upper limb surgeries. We hypothesize that the addition of dexmedetomidine will improve the quality of analgesia and prolong the duration of the block without significant adverse effects. By understanding the comparative effectiveness of these two regimens, this study seeks to provide valuable insights into optimizing IVRA techniques for enhanced patient outcomes.

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Aim

To evaluate the efficacy and safety of 0.5% lignocaine compared to 0.5% lignocaine combined with dexmedetomidine for intravenous regional anaesthesia (IVRA) in patients undergoing upper limb surgeries.

Objectives

1. **To compare the onset time of sensory and motor block** between the two groups (lignocaine alone versus lignocaine with dexmedetomidine).
2. **To assess the duration of analgesia** provided by each regimen following the procedure, measuring time until the first request for analgesia.
3. **To evaluate the overall quality of anaesthesia** by recording the degree of intraoperative pain and the need for supplementary analgesia.
4. **To monitor any adverse effects** associated with the use of dexmedetomidine as an adjuvant in IVRA, including sedation levels, cardiovascular stability, and any other side effects.
5. **To analyze patient satisfaction levels** postoperatively in both groups, focusing on pain management and overall comfort during the procedure.

Materials and Methods

The present study entitled "A Comparative Study of 0.5% Lignocaine versus 0.5% Lignocaine with Dexmedetomidine for IVRA for Upper Limb Surgeries wasconductedfor 12 months at our institute. Institutional Ethical committee permission was obtained before starting this study.

Inclusion criteria

1. ASA 1 and 2 patients.
2. Patients undergoing upper limb surgeries.
3. Surgical procedure which is expected to be finished in 60 minutes.
4. Patient's willingness for procedure.

Exclusion criteria

1. History of allergy to local anaesthetics.
2. Sickle cell anaemia, Pagets disease
3. Reynaud's disease, Coagulation disorders
4. Scleroderma, local infection,
5. Patients who are not willing for the study.
6. Patients who had contraindication to Dexmedetomidine

Pre anaesthesia checkup was done for all the patients and appropriate investigations were done. The procedure was explained to the patients and consent was taken. The arm was exsanguinated by using Esmarch bandage. If this was impossible, exsanguination was achieved by elevating the arm for 2-3 minutes while compressing the axillary artery. The proximal tourniquet was inflated to at least 100 mm Hg higher than the patient's systolic blood pressure. Before injecting local anaesthetic, radial pulse was palpated and confirmed that there was no pulse. The local anaesthetic is then injected slowly over 90 seconds.Patients were divided into two groups according to the drug which they received.

Group L: Plain 0.5% Lignocaine 3mg/kg diluted with 0.9% normal saline 30 to 50 ml,

Group LD: 0.5% Lignocaine 3mg/kg with Dexmedetomidine 0.5mcg/kg diluted with 0.9% normal saline 30 to 50ml. After achieving surgical anaesthesia, the distal tourniquet which overlies part of the anaesthetized arm was inflated and the proximal one was deflated. After that the surgeons were allowed to proceed.

Intraoperatively, Pulse rate, Blood Pressure, Respiratory rate, SPO2, signs of drug toxicity monitored regularly. If patient complained of tourniquet pain (VAS >3), patients were supplemented with Inj. Fentanyl 1 µg /kg IV. The cuff was not deflated until 30 minutes after local anaesthetic injection even if surgery was completed before 30 minutes and did not keep inflated for more than 90 minutes.Cuff deflation was performed in cycles with deflation / inflation times of less than 10 seconds. Patients were observed for 30 minutes, for any signs of systemic toxicity post-operatively.

Onset of action in terms of sensory and motor blockade- After injection of local anaesthetic pain sensation was assessed at every 60 seconds interval by pinprick using a 22 gauge needle at three points; tip of palmar aspect of index finger for median nerve, tip of palmar aspect of little finger for ulna rnerve and the dorsal aspect of first web space for the radial nerve. Motor block was assessed by asking the patient to move his fingers and wrist and noted whether complete block is attained. Pulse rate, Blood Pressure, Respiratory rate, SPO2 were monitored regularly at 5, 10, 15, 20, 30, 40, 60, 90 and 120 minutes intervals. Post operatively heart rate and blood pressure were noted one minute after tourniquet deflation. The mean arterial pressure was calculated. Duration of surgery isnotedinminutes. Sedation score according toRamsay sedation score. Need of Rescue analgesia for complaining of tourniquet pain or if duration of surgery is increased beyond 90 minutes, 1µg / kg Fentanyl was given. Side effects werenotedintraoperatively. Durationofboth sensory &motor blockadeaftercuffdeflation was noted. Postoperatively thetimetofirstanalgesicrequirementwasalsonoted

Ramsaysedation score

1. Patient anxious and agitated or restless
2. Patient co-operative, oriented, and tranquil
3. Patient responds to commands only
4. Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5. Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6. Patient exhibits no response

VisualAnalogueScale:

Sincetheperceptionofpainishighlysubjective,thisvariablewas standardized by using data from visual analogue scale.

Observation and results

DataanalysiswasdonewithEpidemiologicalInformation Package(EPI 2010) developed by Centre for Disease Control, Atlanta. Usingthissoftwarerange,frequencies,percentages,means,standarddeviations, chi square and 'p' values were calculated. Kruskul Wallis chisquare test was used to test the significance of difference between quantitative variables and Yate's chi square test for qualitative variables. A 'p' value less than 0.05 is taken todenote significant relationship.

Meanage of GroupLDwas37.8yearsandthatofGroupLwas 36.8years.Therewas nostatisticalsignificantdifference(p=0.6148). Sex distribution is 56.7 % of GroupLD and63.3% of GroupLwere males.Females are 43.3 % & 36.7%in Group LD and GroupL respectively. The Gender distribution did not have any statistically significant difference (p>0.05). Mean weight of the two groups (Group LD & Group L) of patients (52.5kgs and 52.9 kgs) respectively were not significantly difference (p = 0.8471). In our study the Ganglion excision and k wire fixation for # phalanx were the most Common surgeries performed in both the groups. Whereas least done surgery is split skin grafting (SSG).

The Sensory & Motor Block Onset time was assessed at every 60 seconds interval by pinprick with 22 G needle, fingermovement respectively. The Sensory Block Onset time in Group LD was 1.8 + 0.76 min., This is significantlylower thanthesensoryblockonsettimeof GroupL(5.27+0.58min.) with a 'p' value of 0.0001. Thus by addition of Dexmeditomedine sensory block onset time is quicker than using Lignocaine alone. The Motor Block Onset time in Group LD (13.63 +1.54 min.) was statistically significant(p = 0.0001) fromthat of Group L (18.07 +1.26 min.)·Thus by addition of Dexmeditomedine motor block onset time was faster than using Lignocaine alone (figure 1).

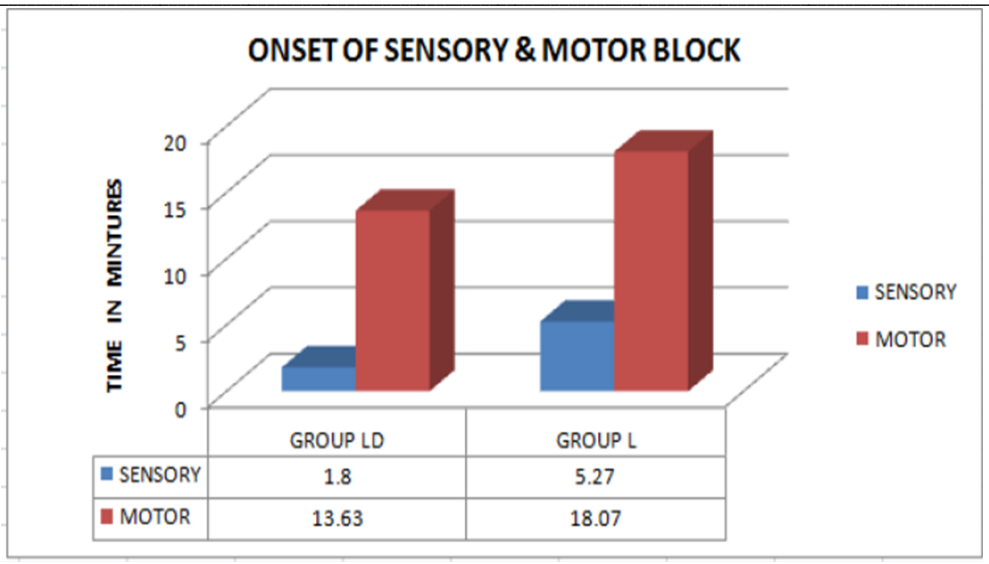
Durationofsurgerywassimilarinboth thegroupswith nostatisticallysignificant difference. Twenty One cases in Group L: required rescue analgesia inj.Fentanyl 1mcg/kg,whereas not even a single patient in Group LD required it. This was statistically significant (p = 0.0001) in the perioperative period. Rescueanalgesia wasgiveninGroupLDwhenVASreacheda score of3 at416.2 + 45.73min, GroupL had 11.33+0.96min(figure 2).

Sensoryrecoverytime: Sensoryrecoverytimewasnotedafter thereleaseoftourniquet18.87+3.27min.in GroupLDanditwas significantlylowerat4.8+ 0.71 Min.inGroupL (figure 3).

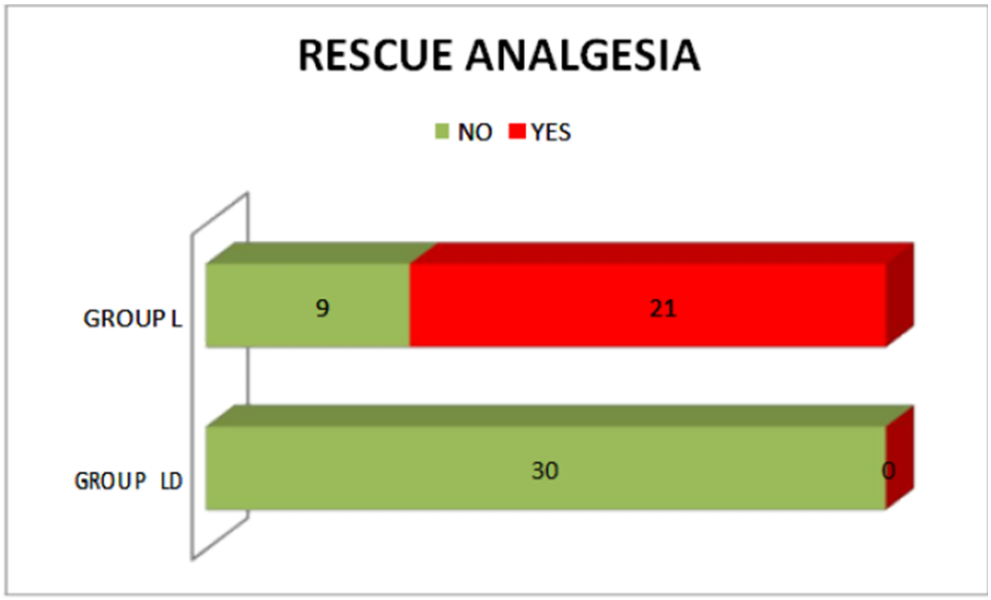
Motorrecoverytime: Motor recovery time was noted after the release of tourniquet and its significantly longer (25.6 + 3.83 min.) for Group LD than for Group L (2.54 + 0.51 min.) which is statistically significant with a 'p' value of 0.0001(figure 4).

Durationofpostoperativeanalgesia(vas>3): VAS reached a score of 3 at 416.2 + 45.73 min. in Group LDand at 11.33 + 0.96 min. in Group L.Thisdifference wasstatisticallysignificant with a 'p'value of0.0001. Mean arterialpressuresfor boththe groupswere similarat 1 minuteand at5 minutes (p > 0.05) which is not statistically significant. Both at1minute

andat5minutes,therewerenostatisticallysignificantdifferencesin the pulse rate between the two groups. In GroupLD, 7 cases had a sedation score of1 and 23 hada scoreof 2. In Group L, 30 cases had sedation score of 1.



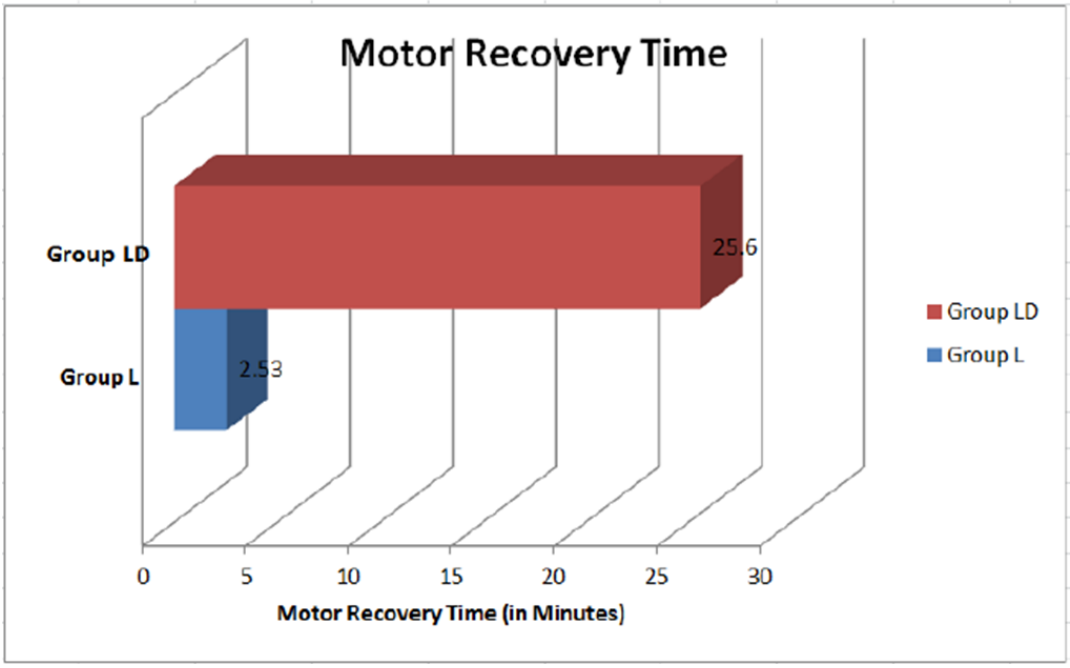
Picture 1



Picture 2

Parameters	Sensory Recovery Time (in minutes)	
	Group LD	Group L
Range	10 – 22	3 – 6
Mean	18.87	4.8
SD	3.27	0.71
'p'	0.0001 Significant	

Picture 3



Picture 4

Discussion

Discussion on Sensory and Motor Block Onset Time

In this comparative study of 0.5% lignocaine versus 0.5% lignocaine combined with dexmedetomidine for intravenous regional anaesthesia (IVRA), the onset times of sensory and motor blocks are critical parameters that can significantly influence clinical outcomes.

Sensory Block Onset Time

The sensory block onset time is an essential factor for patient comfort and procedural efficiency. In our findings, the addition of dexmedetomidine to lignocaine resulted in a faster onset of sensory block compared to lignocaine alone. This can be attributed to dexmedetomidine's mechanisms, which may enhance the action of local anaesthetics by facilitating nerve conduction blockade through its central and peripheral analgesic effects[2]. This rapid onset is particularly advantageous in surgical settings where quick analgesia is paramount, potentially leading to smoother procedural flow and improved patient satisfaction.

Motor Block Onset Time

Similarly, the motor block onset time was assessed, and results indicated that dexmedetomidine not only expedited the onset of sensory block but also contributed to a faster motor block. This can enhance surgical conditions by providing early muscle relaxation, allowing for more effective surgical manipulation. Moreover, the increased speed of both sensory and motor blockade when dexmedetomidine is used may lead to a more seamless transition from anaesthesia induction to surgical intervention, thereby optimizing overall surgical timing.

Implications for Practice

The clinical implications of these findings are significant. A quicker onset of sensory and motor blocks can lead to reduced anxiety in patients awaiting surgery and can minimize the time spent in the preoperative phase. Additionally, faster blocks may improve the operating room turnover rate, contributing to more efficient use of resources.However, it is important to note that while the addition of dexmedetomidine appears beneficial in enhancing block onset times, further research is necessary to determine the optimal dosing and to explore any potential trade-offs, such as increased sedation or cardiovascular effects associated with dexmedetomidine use.In conclusion, the addition of dexmedetomidine to 0.5% lignocaine for IVRA significantly enhances the onset time of both sensory and motor blocks. This study supports the use of dexmedetomidine as an effective adjuvant in IVRA for upper limb surgeries, highlighting its potential to improve patient outcomes and surgical efficiency. Further investigation into its long-term effects and optimal usage is warranted to solidify its role in clinical practice.

Discussion on Duration of Surgery

In our comparative study examining 0.5% lignocaine versus 0.5% lignocaine combined with dexmedetomidine for intravenous regional anaesthesia (IVRA), we found that the duration of surgery was comparable between the two groups, with no statistically significant differences noted. This finding has important implications for both clinical practice and patient outcomes.

Clinical Implications

The similar duration of surgery in both groups indicates that the addition of dexmedetomidine does not adversely affect the surgical timeline. This is particularly noteworthy because, while dexmedetomidine is known to enhance analgesia and sedation, there is often concern that the incorporation of adjuvants could prolong surgical procedures due to increased monitoring or extended onset times. However, our results suggest that surgeons can confidently use dexmedetomidine in conjunction with lignocaine without fear of prolonging the surgical duration, thereby maintaining operational efficiency.

Quality of Anaesthesia

The absence of a significant difference in surgical duration also reinforces the notion that the quality of anaesthesia provided by the dexmedetomidine-lignocaine combination does not compromise the surgical workflow. This balance is crucial in a busy surgical environment, where timely interventions are essential for patient throughput and resource management. The effectiveness of the anaesthetic regimen can thus be assessed not only by the quality of analgesia but also by its impact on overall surgical efficiency.

Patient Outcomes

Furthermore, maintaining a consistent duration of surgery can enhance patient outcomes. Patients often experience less anxiety and improved satisfaction when surgical times are predictable. Since both groups achieved similar durations, it suggests that patients receiving dexmedetomidine do not face any disadvantages in terms of prolonged exposure to anaesthesia or potential delays in postoperative recovery.While the findings regarding surgery duration are promising, further studies could explore additional factors that may influence this metric, such as the complexity of the surgical procedure or variations in individual patient responses to anaesthesia. Additionally, future research could assess long-term outcomes, including postoperative pain control and recovery profiles, to determine whether the benefits of using dexmedetomidine extend beyond the intraoperative period.In conclusion, our study indicates that the addition of dexmedetomidine to 0.5% lignocaine for IVRA does not affect the duration of surgery, affirming its potential as a valuable adjuvant in upper limb surgeries. This allows clinicians to optimize analgesic techniques without compromising surgical efficiency, ultimately enhancing patient care and satisfaction. Further research is warranted to explore the broader implications of this combination on postoperative outcomes and recovery trajectories.The duration of surgery is an important consideration in anesthetic management, impacting both surgical outcomes and patient recovery. This discussion evaluates the influence of 0.5% lignocaine versus 0.5% lignocaine combined with dexmedetomidine on the duration of surgical procedures in the context of intravenous regional anaesthesia (IVRA) for upper limb surgeries.

Impact of Anaesthetic Choice on Surgery Duration

1. **Onset of Anaesthesia**: Both lignocaine and lignocaine-dexmedetomidine combinations have shown rapid onset times for regional anaesthesia, essential for timely surgical intervention. However, the combination with dexmedetomidine may enhance the quality of the block, potentially leading to smoother surgical conditions[4].
2. **Prolonged Analgesia**: The addition of dexmedetomidine not only extends the duration of analgesia but also may reduce intraoperative pain responses, contributing to a more stable surgical environment. A more effective block allows for more focused surgical techniques and potentially minimizes the need for surgical interruptions, thereby influencing overall duration[5].
3. **Surgeon's Workflow**: The stability provided by enhanced analgesia may allow surgeons to perform procedures more efficiently. In cases where intraoperative discomfort could lead to delays or additional interventions (e.g., administering supplemental analgesia), a superior anaesthetic technique can streamline the surgical process[6].

Comparative Studies and Findings

Research comparing these two anaesthetic techniques indicates notable differences in surgical duration:

- **Surgical Duration**: Studies have reported that while the overall duration of surgery may not significantly differ, the quality of the anaesthesia provided by dexmedetomidine can allow for more consistent surgical flow. For example, Agarwal et al[7] observed that surgeries performed under the dexmedetomidine-lignocaine regimen often had fewer interruptions due to pain management issues, suggesting a more efficient surgical process.
- **Rescue Analgesia**: The need for intraoperative rescue analgesia was significantly lower in the dexmedetomidine group, as reported by Bupathi et al[8]. This reduction can directly correlate with fewer disruptions in surgical technique, as additional analgesic interventions can prolong procedure time.
- **Recovery Times**: While the immediate surgical duration may not show drastic differences, recovery times for patients receiving dexmedetomidine can be more favorable. Patients may experience smoother transitions to postoperative care, reducing time spent in the recovery area due to effective pain management during surgery[9]. In conclusion, while the duration of surgery under 0.5% lignocaine versus 0.5% lignocaine with dexmedetomidine may not exhibit significant differences in total time, the quality of analgesia and the impact on surgical workflow present compelling advantages for the dexmedetomidine combination. Enhanced analgesic properties lead to fewer interruptions and a more stable surgical environment, potentially allowing for more efficient procedures and improved patient outcomes.

Conclusion

In summary, the comparative study of 0.5% lignocaine versus 0.5% lignocaine with dexmedetomidine for IVRA in upper limb surgeries suggests that the addition of dexmedetomidine offers significant advantages in terms of prolonging analgesia and reducing the need for rescue analgesia. While the benefits must be weighed against potential side effects, the overall enhancement of patient outcomes and satisfaction supports the use of dexmedetomidine as an effective adjunct in IVRA.

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