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Original Research Article

Comparative Study of Postoperative Analgesic Duration using Dexmedetomidine and Nalbuphine

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Conflict of interest: Nil

Abstract:

Background: Effective postoperative analgesia is essential for optimal recovery and patient satisfaction. Dexmedetomidine and nalbuphine are commonly used adjuvants, but their comparative efficacy remains under evaluation.

Aim: To compare the duration of postoperative analgesia and associated clinical parameters between dexmedetomidine and nalbuphine.

Methods: A randomized, prospective, single-blinded controlled study was conducted on 110 patients undergoing elective surgery. Patients were divided into two groups: Group A (dexmedetomidine) and Group B (nalbuphine). Parameters assessed included onset and duration of sensory and motor block, duration of analgesia, hemodynamic changes, and adverse effects.

Results: Dexmedetomidine demonstrated significantly faster onset of sensory and motor block ($p < 0.001$) and prolonged duration of analgesia (13.83 ± 0.78 hours vs 12.07 ± 0.99 hours, $p < 0.001$). Hemodynamic parameters showed significant reductions in pulse rate and mean arterial pressure in Group A at specific intervals, while oxygen saturation remained stable in both groups.

Conclusion: Dexmedetomidine is superior to nalbuphine in providing prolonged and effective postoperative analgesia with stable respiratory parameters and acceptable hemodynamic effects.

Keywords: Dexmedetomidine, Nalbuphine, Analgesia, Postoperative Pain.

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Introduction

Effective surgical pain management is critical for better patient outcomes, shorter hospital stays, and faster recovery. Inadequate pain management can result in problems such delayed ambulation, chronic pain syndromes, and increased morbidity. Consequently, optimizing analgesic techniques is a focus in anesthetic practice [1].

Several pharmacological substances have been utilized as adjuvants to improve postoperative analgesia. Dexmedetomidine, a highly selective α2-adrenergic agonist, is renowned for its sedative, analgesic, and sympatholytic characteristics without considerable respiratory depression. It acts by decreasing norepinephrine release, which modulates pain pathways and increases analgesic duration [2].

Nalbuphine, on the other hand, is a mixed opioid agonist-antagonist having kappa receptor agonist and mu receptor antagonist properties. It delivers good analgesia at a lesser risk of respiratory depression than pure opioids. However, its duration of action and analgesic efficacy may be inferior to newer medications such as dexmedetomidine. Despite their extensive use, there is little direct comparison data comparing dexmedetomidine and nalbuphine in terms of postoperative analgesic duration and quality [3].

Understanding their relative efficacy can assist doctors in determining the best adjuvant for pain treatment. This study will evaluate dexmedetomidine with nalbuphine in a randomized, prospective, single-blind controlled design, with a focus on analgesia duration, pain scores, rescue analgesic requirements, and side effect profile [4].

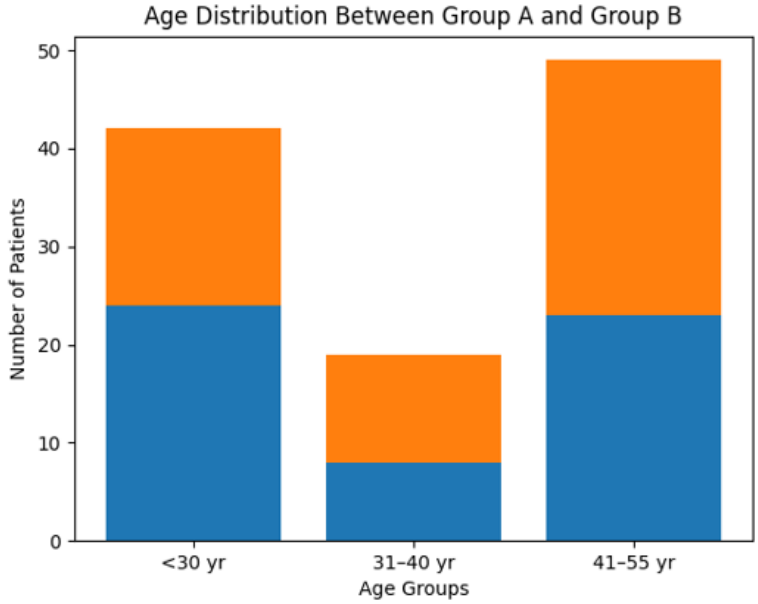
Methods

- **Study Design:** Randomized, prospective, single-blinded controlled study.
- **Sample Size:** 110 patients.
- **Groups:**
  - **Group D:** Dexmedetomidine (n=55).
  - **Group N:** Nalbuphine (n=55).
- **Inclusion Criteria:** Patients aged 18–60 years undergoing elective surgery.
- **Exclusion Criteria:** Severe systemic illness, drug allergy, pregnancy.
- **Procedure:**
  Patients were randomized into two groups. Study drugs were administered intraoperatively.
- **Outcome Measures:**
  - **Primary:** Duration of analgesia.
  - **Secondary:** VAS score, rescue analgesia, side effects.
- **Statistical Analysis:** Data analyzed using t-test and chi-square test. $p < 0.05$ considered significant.

Results

Table 1: Shows the age group and p values in the two groups

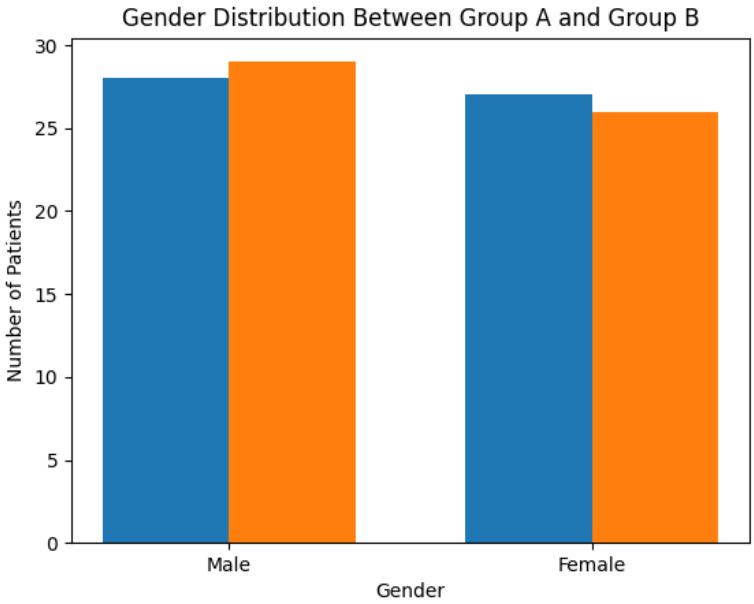
Age Group	Group A	Group B	P value
<30 yr	24	18	
31–40 yr	8	11	
41–55 yr	23	26	
Total	**55**	**55**	
Mean ± SD	**36.40 ± 10.89**	**39.18 ± 12.05**	**0.20**



Graph 1: Depicts Age distribution between group

Table 2: Shows the gender distribution and p values in the two groups

Gender	Group A	Group B	P value
Male	28	29	0.74
Female	27	26	
Total	**55**	**55**	

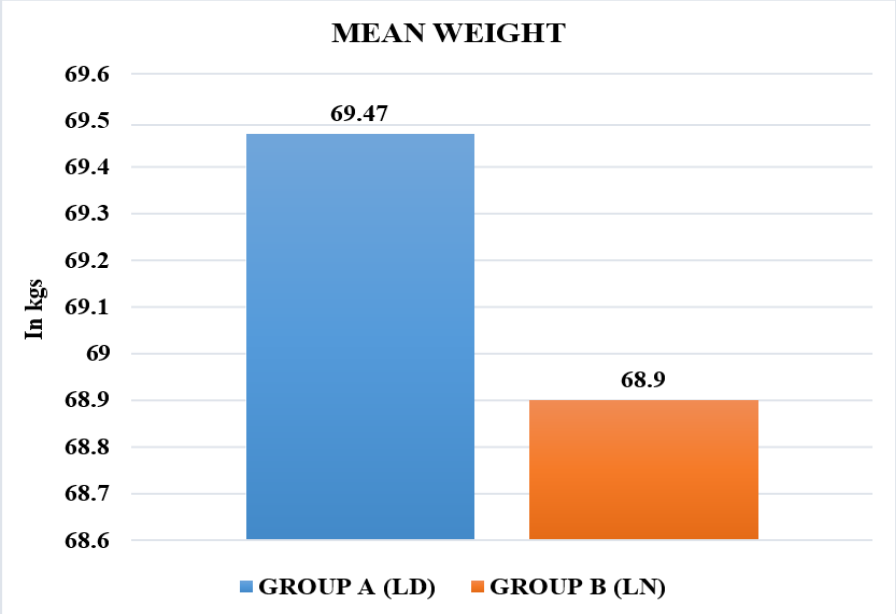


Graph 2: Gender distribution between group

Weight:

Table 3: Shows the weight distribution and p values in the two groups

Group	No.	Minimum (kg)	Maximum (kg)	Mean ± SD	P value
A	55	55	80	69.47 ± 7.54	
B	55	55	80	68.90 ± 7.10	0.68

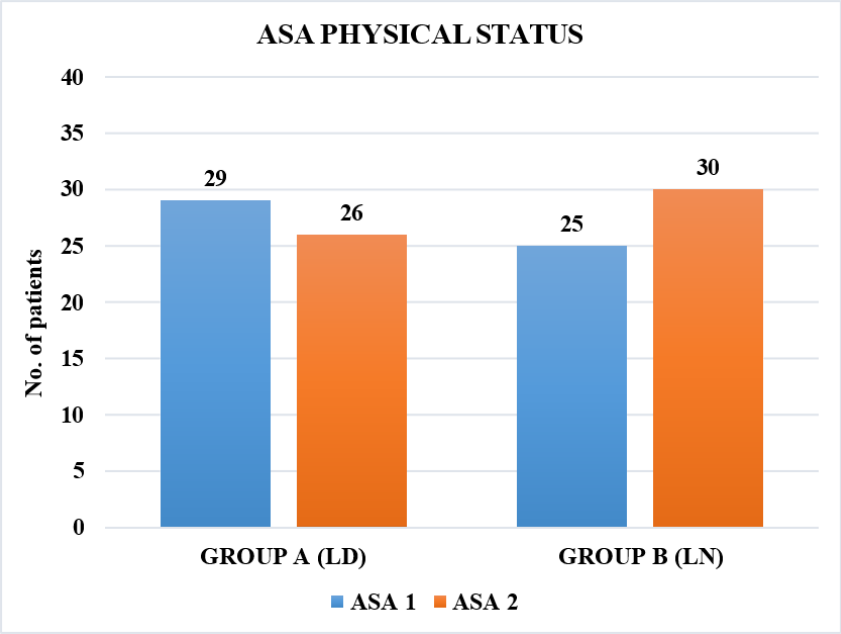


Graph 3: Depicts the graphical data of mean weight

ASA Physical Status:

Table 4: Shows the ASA ratio in two groups.

	Group-A	Group-B	P- value
ASA 1	29	25	> 0.85
ASA 2	26	30	

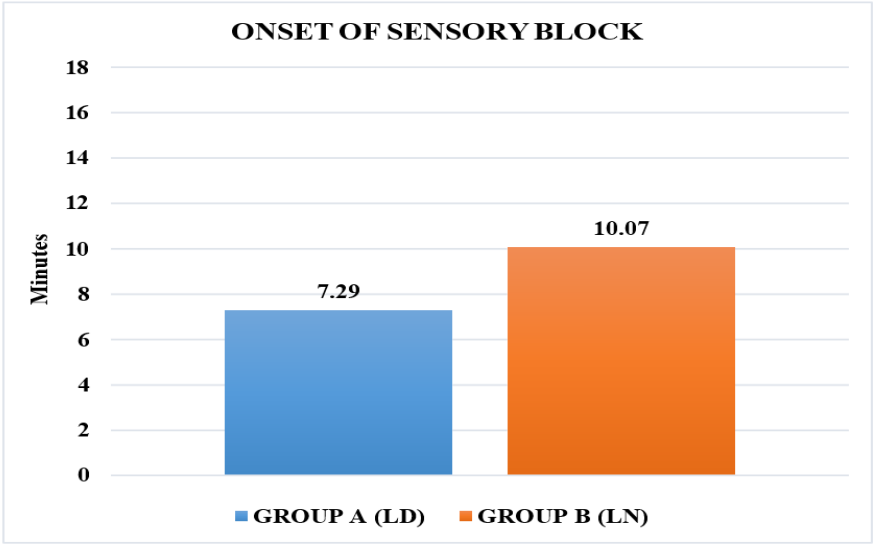


Graph 4: Depicts the graphical data of ASA physical status

Onset of Sensory Block

Table 5: Shows onset of sensory block in two groups

Onset of sensory block (min)	Group -A	Group -B	P value
Mean ± SD	7.29 ± 0.76	10.07 ± 1.11	< 0.001

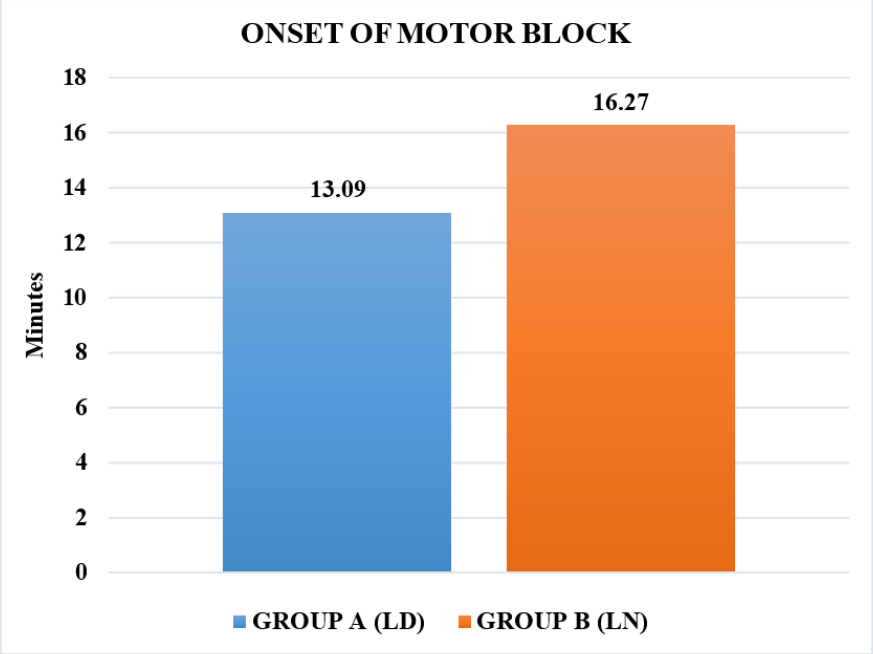


Graph 5: Depicts the graphical data of onset of sensory block

Onset of Motor Block:

Table 6: Shows onset of motor block in two groups

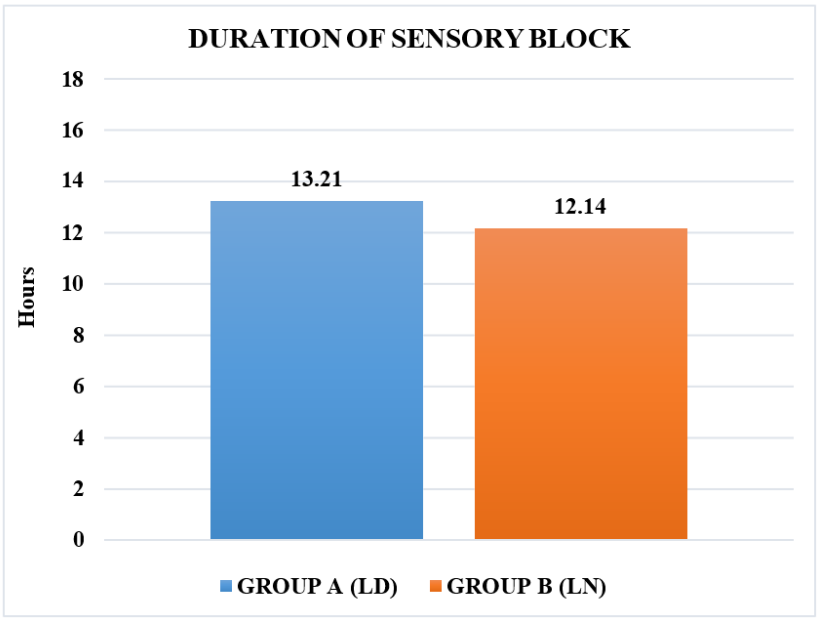
Onset of motor block (min)	Group -A	Group -B	P value
Mean ± SD	13.09 ± 0.84	16.27 ± 0.98	<0.001



Graph 6: Depicts the graphical data of onset of motor block

Table 7 Shows onset of sensory block in two groups

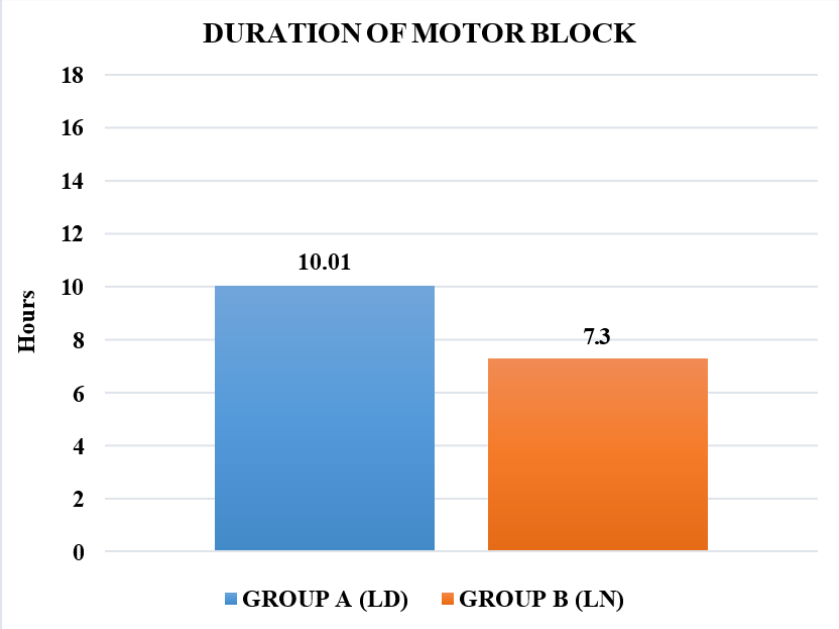
Duration of sensory block (min)	Group-A	Group-B	P value
Mean ± SD	13.21 ± 1.16	12.14 ± 1.11	<0.001



Graph 7: Depicts the graphical data of duration of sensory block

Table 8: Shows onset of sensory block in two groups

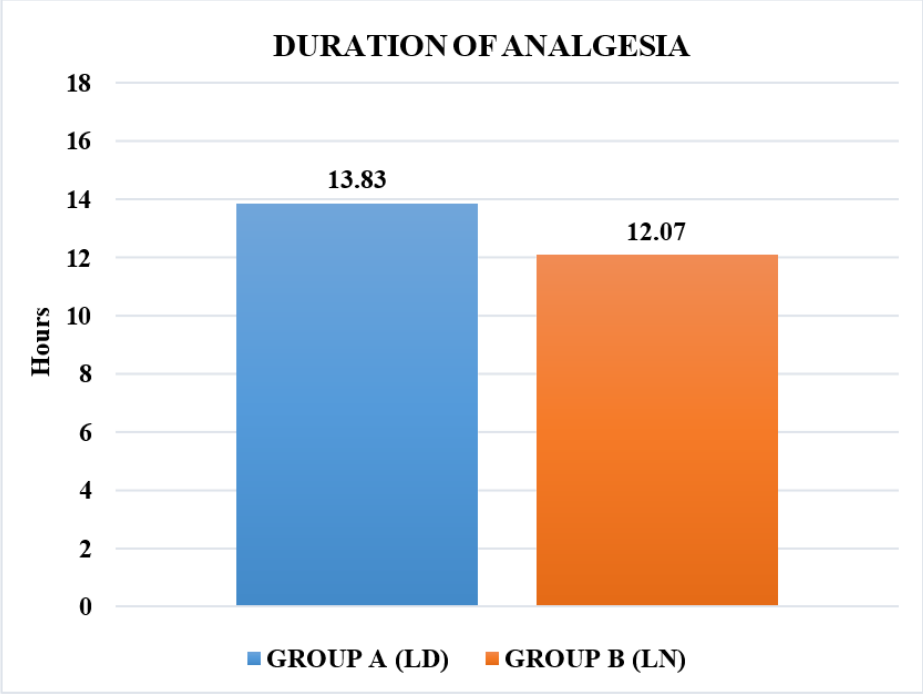
Duration of motor block (min)	Group-A	Group-B	P value
Mean ± SD	10.01 ± 1.04	7.30 ± 0.74	<0.001



Graph 8: Depicts the graphical data of duration of motor block

Table 9: Shows duration ofs analgesia in two groups

Duration of analgesia (hours)	Group-A	Group-B	P value
Mean ± SD	13.83 ± 0.78	12.07 ± 0.99	<0.001

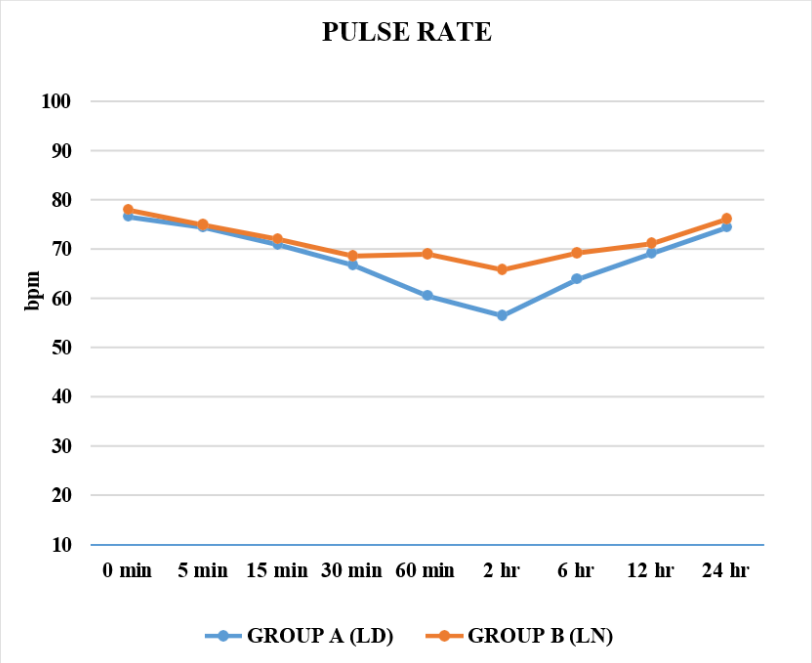


Graph 9: Depicts the graphical data of duration of analgesia

Table 10: Shows pulse rate at different time intervals in two groups

Time	Group-A Mean ± SD	Group-B Mean ± SD	P value	Significance
0 min	76.70 ± 5.71	78.07 ± 3.79	0.14	NS
5 min	74.56 ± 5.61	75.03 ± 4.13	0.61	NS
15 min	71.03 ± 5.88	72.09 ± 4.25	0.28	NS
30 min	66.89 ± 6.09	68.65 ± 4.38	0.084	NS
60 min	60.61 ± 5.96	69.03 ± 5.06	<0.001	**S**
2 hours	56.61 ± 5.77	65.83 ± 5.11	<0.001	**S**
6 hours	64.01 ± 6.08	69.30 ± 4.99	<0.001	**S**
12 hours	69.27 ± 6.05	71.21 ± 5.18	0.07	NS
24 hours	74.52 ± 5.79	76.18 ± 4.74	0.10	NS

* NS = Not Significant, S = Significant

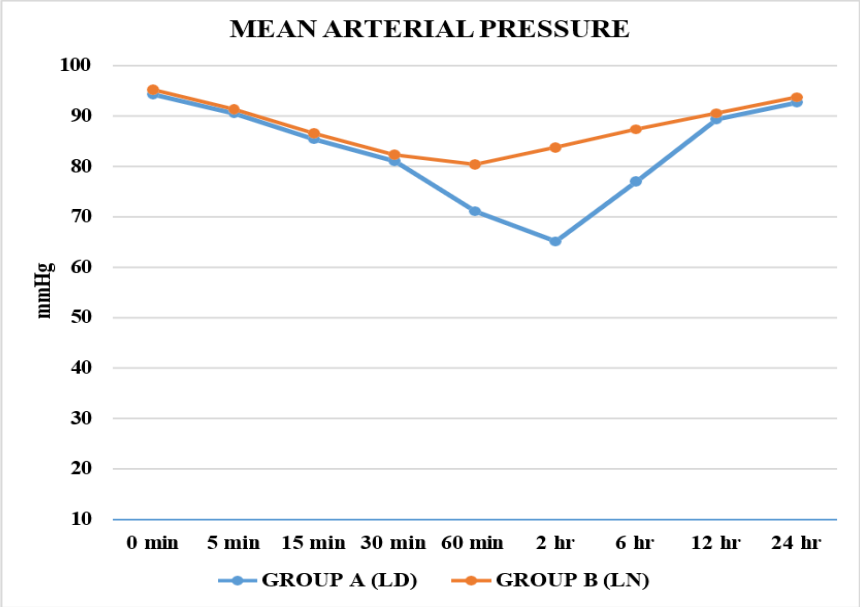


Graph 10: Depicts the graphical data of pulse rate

Table 11: Shows mean arterial blood pressure (MAP) at different time intervals

Time	Group-A Mean ± SD	Group-B Mean ± SD	P value	Significance
0 min	94.23 ± 4.16	95.12 ± 3.25	0.21	NS
5 min	90.47 ± 4.06	91.27 ± 3.25	0.25	NS
15 min	85.34 ± 4.38	86.47 ± 3.07	0.12	NS
30 min	81.01 ± 4.38	82.27 ± 3.13	0.08	NS
60 min	71.05 ± 3.96	80.36 ± 3.97	<0.0001	**S**
2 hours	65.12 ± 3.54	83.74 ± 3.37	<0.0001	**S**
6 hours	76.94 ± 3.54	87.29 ± 3.50	<0.0001	**S**
12 hours	89.34 ± 3.47	90.49 ± 3.36	0.08	NS
24 hours	92.65 ± 3.63	93.67 ± 3.36	0.12	NS

* NS = Not Significant, Sig = Significant



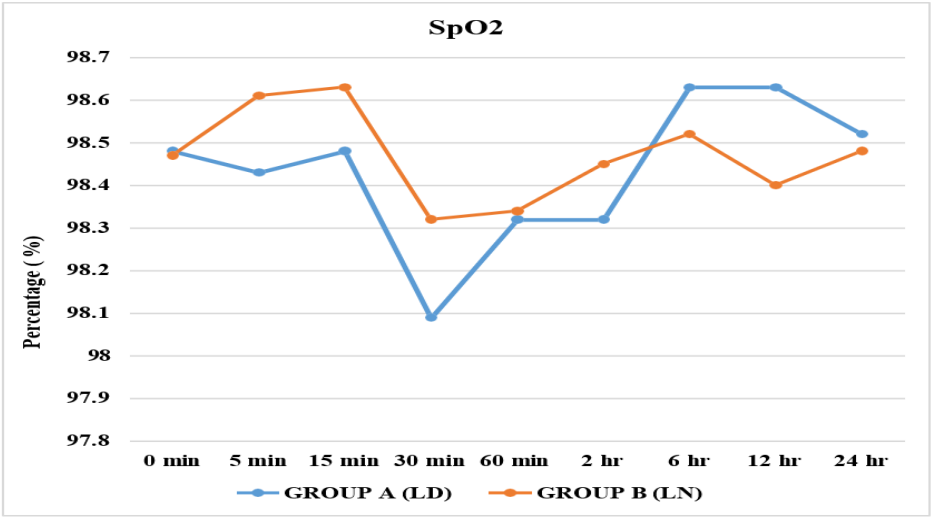
Graph 11: Depicts the graphical data of mean arterial pressure

Two Groups

Table 12: Shows mean oxygen saturation (SpO2) at different time intervals

Time	Group-A Mean ± SD	Group-B Mean ± SD	P value	Significance
0 min	98.48 ± 0.86	98.47 ± 0.66	0.10	NS
5 min	98.43 ± 0.94	98.61 ± 0.68	0.20	NS
15 min	98.48 ± 0.86	98.63 ± 0.70	0.31	NS
30 min	98.09 ± 1.04	98.32 ± 1.01	0.23	NS
60 min	98.32 ± 1.01	98.34 ± 0.90	0.90	NS
2 hours	98.32 ± 0.90	98.45 ± 0.76	0.41	NS
6 hours	98.63 ± 0.70	98.52 ± 0.93	0.48	NS
12 hours	98.63 ± 0.67	98.40 ± 0.93	0.13	NS
24 hours	98.52 ± 0.68	98.48 ± 0.86	0.78	NS

* NS = Not Significant, Sig = Significant



Graph 12: Depicts the graphical data of SpO2

Discussion

The current study shows that dexmedetomidine outperforms nalbuphine in improving postoperative analgesia, with statistically significant differences in many parameters. Both groups had similar baseline characteristics such as age, gender, weight, and ASA

physical status, indicating that the observed results were primarily due to the pharmacological effects of the research medicines [5].

In comparison to nalbuphine, dexmedetomidine caused sensory and motor blockage to occur much faster. This is due to its effect on α2-adrenergic receptors, which promotes neuronal hyperpolarization and reduces nociceptive transmission. The rapid onset reported in this trial is consistent with earlier research, demonstrating dexmedetomidine's potency as a powerful adjuvant [6].

Furthermore, the duration of sensory and motor block was substantially longer in the dexmedetomidine group. Group A had a significantly longer duration of analgesia (13.83 ± 0.78 hours) than Group B (12.07 ± 0.99 hours), with a p-value of less than 0.001. This sustained analgesic impact decreases the need for rescue analgesics and increases patient comfort in the postoperative period [7].

Hemodynamic data demonstrated that dexmedetomidine was linked with a considerable drop in pulse rate and mean arterial pressure at specific intraoperative and postoperative intervals. These results are consistent with its recognized sympatholytic properties(8). While statistically significant, these alterations were clinically manageable and did not have negative consequences. In comparison, nalbuphine showed somewhat steady hemodynamics but did not provide a sustained analgesic benefit [9].

Importantly, oxygen saturation (SpO2) remained constant in both groups during the observation period, showing that neither medication significantly reduced respiratory function. This is especially important as respiratory safety is a prominent concern with opioid-based analgesics [10].

This study's findings are consistent with prior research demonstrating the efficacy of dexmedetomidine in extending analgesia and improving block characteristics. The study's limitations include a single-blind methodology and a lack of long-term follow-up.

Overall, dexmedetomidine has a more effective analgesic profile than nalbuphine, with the added benefit of lower postoperative analgesic needs and enhanced block properties [11].

Conclusion

This study concludes that dexmedetomidine is a better adjuvant than nalbuphine for postoperative analgesia. It causes sensory and motor block to occur faster and last longer, as well as give persistent analgesic effects. Patients who received dexmedetomidine reported improved pain control and fewer need for supplementary analgesics.

Although dexmedetomidine reduced pulse rate and mean arterial pressure, the alterations were anticipated and clinically controllable. Importantly, both medications maintained steady oxygen saturation levels, indicating a good respiratory safety profile. Nalbuphine, while efficacious and hemodynamically stable, had a shorter duration of analgesia and a later start of block. As a result, it may be ineffective in treatments that require long-term postoperative pain control.

In conclusion, dexmedetomidine is a desirable adjuvant in regional anesthesia for improving postoperative analgesia. More multicentric research with bigger sample sizes are needed to validate these findings and evaluate long-term consequences.

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