A View of Comparison of Nalbuphine and Fentanyl with 0.375% Ropivacaine for Ultrasound Guided Costoclavicular Brachial Plexus Block in Upperlimb Surgeries: A Randomized Control Study

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Abstract

Background: The costoclavicular block is a regional block technique targeted at the brachial plexus cords in the costoclavicular space. It provides adequate anaesthesia and analgesia for upper limb surgery, with benefits such as enhanced ultrasound visualization and assured spread of the local anaesthetic. The choice of drug is what makes the block successful. Fentanyl, a potent opioid, enhances analgesia, while nalbuphine, a kappa agonist and mu antagonist, is an opioid with fewer side effects. A comparison of the adjuvants in costoclavicular blocks maximizes pain relief through a balance of efficacy and safety profiles. **Objective:** The trial was performed with the goal of comparing sensory and motor block onset time, sensory and motor block duration, hemodynamic fluctuations, postoperative pain and sedation scores, and complications of the adjuvants used in costoclavicular block in combination with ropivacaine. **Methods:** From November 2024 through February 2025, the randomized controlled trial was implemented atTrichy SRM Medical College Hospital and Research Centre, Trichy. Group F (Fentanyl) and Group N (Nalbuphine) were randomly assigned to 60 patients undergoing upper limb surgery. Both groups were administered an ultrasound-guided costoclavicular block of 0.375% ropivacaine with nalbuphine (0.3mg/kg) or fentanyl (2 µg/kg). The onset time and duration of sensory and motor block were the primary outcomes measured. The secondary outcomes measured included hemodynamic parameters, postoperative pain and sedation scores, patient comfort, and rate of complications. Appropriate tests were employed to statistically examine the data with a significance level set at $p < 0.05$. **Results**: Compared to the nalbuphine group, the fentanyl group experienced sensory and motor block substantially sooner ($p < 0.01$). The nalbuphine group had a considerably longer latency to sensory and motor block ($p < 0.001$), indicating a longer duration of analgesia. The nalbuphine group had much better late postoperative pain alleviation, as evidenced by postoperative VAS values that were similar in the first few hours but significantly lower from the fourth hour onwards ($p < 0.05$). At all periods, the groups' sedation scores were similar ($p > 0.05$). The nalbuphine group had a significantly larger percentage of patients who rated themselves as "very satisfied" ($p = 0.041$), indicating an increase in patient satisfaction. **Conclusion**: Nalbuphine and fentanyl, when utilized as adjuvants to costoclavicular blocks, yield adequate analgesia. Nalbuphine yielded longer analgesia and increased patient satisfaction, whereas fentanyl had a quicker onset of blockade. These results indicate that nalbuphine can be an ideal choice for earlier onset and long-standing postoperative pain relief.

Keywords: Fentanyl, Nalbuphine, Ropivacaine, Ultrasound-guided costoclavicular block, Upper limb surgery, Regional anaesthesia

Introduction

Management of postoperative pain following upper limb surgery remains one of the mainstays of optimizing patient recovery and outcome. Among the various methods of brachial plexus blockade, the costoclavicular approach is associated with an extremely high success rate in achieving complete and homogeneous anaesthesia coverage. The procedure is now commonly performed under ultrasound guidance, which offers a greater level of accuracy in needle placement, reduces complications, and increases the overall safety of the procedures.[1,2]

Local anaesthetics like ropivacaine are also commonly employed in brachial plexus blocks due to their prolonged duration of block and a great side effect profile. Ropivacaine is particularly noted for its motor and sensory blockade with an acceptable low incidence of cardiovascular and central nervous system toxicity over other local anaesthetics like bupivacaine. Although local anaesthetics are effective, adjuncts are frequently utilized to provide the highest grade of block, reduce the onset time, and prolong analgesia. Fentanyl and other opioid adjuncts have long been used to enhance the effects of local anaesthetics.[3,4]

A potent opioid analgesic with a rapid onset of action, fentanyl can cause adverse effects such as nausea, pruritus, and respiratory depression. With the medical society attempting to decrease the practice of opioid use and minimize the risks created by opioid-related side effects, other analgesics have been of heightened interest. The partial opioid agonist-antagonist, nalbuphine, presents a very relevant alternative for fentanyl use.[5]Nalbuphine has been observed to exert sufficient analgesia with fewer side effects, including respiratory depression and other opioid complications, as a potential adjunct to regional anaesthesia.[6]

By quantifying the time from injection to peak effect and the time to complete recovery, the current study seeks to assess the onset and duration of sensory and motor block. The evaluation of haemodynamic parameters, including blood pressure and heart rate, as well as adverse effects like bradycardia, hypotension, nausea, and vomiting are the other objectives.

Materials and Methods

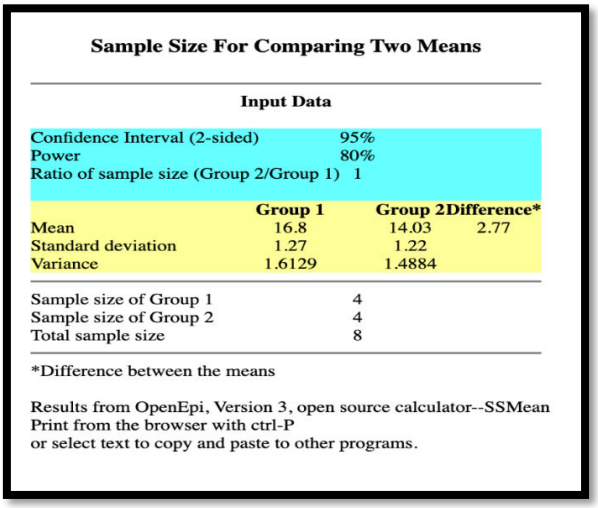
This randomized controlled study was carried out at theTrichy SRM Medical College and Research Centre in Trichy between November 2024 and February 2025. When used as an adjuvant to 0.375% ropivacaine in upper limb surgery under ultrasound-guided costoclavicular brachial plexus block, the trial sought to ascertain the effects of nalbuphine in comparison to fentanyl. All patients gave written informed consent prior to being enrolled in the trial, and the Institutional Ethics Committee approved the study. According to research transparency and ethical guidelines, the study was registered with the Clinical Trials Registry of India (CTRI/2024/11/076643).

The ethical standards outlined in the Declaration of Helsinki were followed in this study. All of the patients gave their informed consent after being fully informed about the study's purpose and nature, potential hazards, and the steps that would be

taken. Before being included, all patients gave their informed written consent. Confidentiality of the patients was maintained while conducting the trial, and the patient's medical and personal details were kept safe. The rights and safety of the patient were always of the highest concern during the trial, and any issue or adverse effect encountered was reported instantly and appropriately.

By comparing the averages and standard deviations of the motor block onset time in minutes for the two groups in the study by Kumar et al.[7] the sample size was determined using Openepi.com.[7]Eight people in total made up the determined sample size. Sixty patients were studied to enhance the reliability of the study and for anticipated dropouts. The sample size calculation is depicted in Figure 1.

Figure 1: Sample size calculation



Sample Size For Comparing Two Means

Input Data

Confidence Interval (2-sided)	95%
Power	80%
Ratio of sample size (Group 2/Group 1)	1

	Group 1	Group 2	Difference*
Mean	16.8	14.03	2.77
Standard deviation	1.27	1.22	
Variance	1.6129	1.4884	

Sample size of Group 1	4
Sample size of Group 2	4
Total sample size	8

*Difference between the means

Results from OpenEpi, Version 3, open source calculator--SSMean
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

Adult patients between the ages of 18 and 60 years old undergoing elective upper limb surgeries were involved in the study. Patients were randomly selected in accordance with their medical history, and regional anaesthesia was necessitated in upper limb operations. Exclusion criteria included subjects who had relative contraindications to regional anaesthesia, for example, current infection in the area where the injection will be made, allergy to local anaesthetic, history of significant cardiovascular or pulmonary disease, or illness that may preclude administering appropriate blocks (e.g., morbid obesity). In addition, pregnant patients, patients with known neurological diseases, and those who could not understand or follow the study protocols (e.g., language discordance and cognitive impairment) were excluded from enrolment. Only patients who could give informed consent were recruited in the study.

A computer-generated randomization sequence was used to divide the sixty patients into two groups at random. 0.375% ropivacaine with fentanyl as an adjunct was given to Group F (fentanyl group), while 0.375% ropivacaine with nalbuphine was given to Group N (nalbuphine group). The anesthesiologist performing the procedure and the patient were both blinded to the group assignment. Randomisation ensured the study's internal validity by making the groups similar at baseline.

To ensure precise needle placement and increase the block's success rate, all blocks were performed under the supervision of a qualified anaesthesiologist using ultrasound guidance. To expose the clavicular region, patients were positioned in a comfortable supine position prior to the surgery, with their heads slightly turned to the opposite side of the block. The skin was disinfected using a sterile antiseptic solution that covered the costoclavicular space in its entirety. To prevent pain on the insertion of the needle, a local injection of 2% lignocaine was done after sterilization. Blockage was conducted in the costoclavicular space, identified with the help of the ultrasound probe, utilizing a 50-mm, 22-gauge needle. When the tip of the needle had been placed with care close to the brachial plexus, 20 millilitres of 0.375% ropivacaine was injected. Fentanyl (2µg/kg) and nalbuphine (0.3mg/kg) were mixed into the local anaesthetic solution for Group F and Group N, respectively. Precautions to prevent complications such as haematoma or damage to the nerves were taken in the injection process.

This study's main goal was to ascertain the timing of the start and complete length of sensory and motor blocks. The beginning of the sensory block is the interval between the injection of the local anaesthetic and the loss of feeling as assessed by pinprick testing. The term "onset of motor block" refers to the time gap between the local anaesthetic injection and the Modified Bromage Scale measurement of the target muscles' maximal motor weakness. The duration of the sensory and motor block were recorded from the start of the block until the block was entirely resolved. Secondary outcomes were hemodynamic stability, patient comfort, procedure satisfaction, and rate of adverse effects.

Hemodynamic measures such as systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and oxygen saturation (SpO_2) were recorded. Hypotension, bradycardia, or desaturation were promptly treated. Pain was rated on a 10-point visual analogue scale (VAS), and satisfaction with the procedure was measured on a 5-point Likert scale[8,9]. Sedation levels will be assessed using the Ramsay Sedation Score (RSS) [10]. Adverse effects like nausea, vomiting, respiratory depression, hypotension, and pruritus were noted and treated according to protocol. All the patients were monitored postoperatively closely in the PACU for 24 hours for recovery from anaesthesia. Regular checks were made for vital signs and any complications such as respiratory distress, bleeding, or infection. Pain was monitored intermittently with the VAS, and supplementary analgesia injection paracetamol 1gm IV was administered on demand. After stability was achieved, patients were discharged on proper instructions for postoperative care.

SPSS version 27 was used to process the data. Continuous variables were summarised using descriptive statistics and then presented as means and standard deviations. For categorical variables, frequencies and percentages were used. The length of analgesia, sensory block start time, and key outcomes were compared between the two groups using an independent t-test. The chi-square test was employed to compare categorical variables, such as the frequency of problems and side effects. A p-value below 0.05 was considered statistically significant.

Results

In patients undergoing upper limb surgery, the study aimed to examine the safety and effectiveness of two analgesic regimes. Demographic information, primary outcomes, secondary outcomes, and complications are all included in the findings. According to Table 1, the participants' average ages were comparable in Group F and Group N, with Group F's mean age being 38.6 ± 9.2 years and Group N's being 39.1 ± 10.5 years. There was no discernible age difference between the two groups, according to the p-value of 0.8452. With 16 males and 14 women in each group, the gender distribution was likewise the same. There was no significant difference by gender, according to the p-value of 0.98 for this gender comparison. The means ± SD are shown in the table below. Group F's and Group N's body mass index (BMI) mean was 24.3 ± 3.5 kg/m² and 24.6 ± 3.7 kg/m², respectively, with a p-value of 0.7481, confirming that there were no appreciable variations in BMI between the two groups.

Table 1: Demographic Characteristics

Parameter	Group F	Group N	p-value
Age (years)	38.6 ± 9.2	39.1 ± 10.5	0.8452
Gender (M/F)	16/14	16/14	0.98
BMI (kg/m²)	24.3 ± 3.5	24.6 ± 3.7	0.7481

[Group F (fentanyl group) and Group N (nalbuphine group)]

Results from Table 2 demonstrated that Group N had significantly shorter onset times for both motor block and sensory block than Group F. The onset of motor block was 9.2 ± 1.7 minutes for Group N versus 11.0 ± 2.4 minutes for Group F (p = 0.004), and the onset of sensory block was 8.6 ± 1.5 minutes for Group N versus 10.1 ± 2.2 minutes for Group F (p = 0.0031). Group N had extended analgesia, as evidenced by a significantly longer sensory block duration (4.3 ± 1.2 hours) compared to Group F (3.2 ± 1.6 hours) (p-value < 0.001). Additionally, Group N experienced a longer motor block duration (3.8 ± 1.1 hours) than Group F (2.7 ± 1.5 hours), with a p-value < 0.001, indicating that Group N experienced longer motor blockade. The two groups' surgeries lasted about the same amount of time. Group F took 129.6 ± 19.4 minutes on average, whereas Group N took 132.4 ± 17.8 minutes. The two groups' surgery times were comparable because this difference was not statistically significant (p = 0.3432).

Table 2: Comparison of Sensory and Motor Block Characters and Duration of Surgery

Outcome	Group F	Group N	p-value
Onset Time of Sensory Block (min)	10.1 ± 2.2	8.6 ± 1.5	0.0031
Duration of Sensory Block (hours)	3.2 ± 1.6	4.3 ± 1.2	< 0.001
Onset Time of Motor Block (min)	11.0 ± 2.4	9.2 ± 1.7	0.004
Duration of Motor Block (hours)	2.7 ± 1.5	3.8 ± 1.1	< 0.001
Duration of Surgery (min)	132.4 ± 17.8	129.6 ± 19.4	0.3432

HR, SBP, DBP, oxygen saturation, patient comfort, and post-procedure satisfaction were secondary measures that were similar in both groups, as shown in Table 3. With a p-value of 0.3056, there was no difference between Group F and Group N's HR at 0 minutes, which were 76.6 ± 8.4 beats/min and 74.5 ± 7.3 beats/min, respectively. With a p-value of 0.2453, Group F's HR at 15 minutes was 78.1 ± 7.9 beats per minute, whereas Group N's was 75.4 ± 7.1 beats per minute. Similarly, at 30 minutes, Group F's HR was 76.9 ± 8.2 beats per minute, while Group N's was 74.8 ± 7.5 beats per minute. The HR of the two groups did not differ significantly, as indicated by the p-value of 0.2684. Group F's SBP was 118.35 ± 12.42 mmHg at zero minutes, but Group N's was 120.43 ± 10.55 mmHg.

The two groups did not differ significantly, according to a p-value of 0.4873. The SBP at 15 minutes was 115.7 ± 11.5 mmHg in Group F and 118.1 ± 12.3 mmHg in Group N, with a p-value of 0.4232. Group F's SBP was 116.2 ± 11.3 mmHg at 30 minutes. With a p-value of 0.3754, Group N's SBP was 119.6 ± 11.0 mmHg, indicating that the two groups did not vary significantly. At 0 minutes, Group F's DBP was 76.3 ± 8.1 mmHg, while Group N's was 78.2 ± 7.5 mmHg, with a p-value of 0.4021. At 15 minutes, Group F's DBP was 74.9 ± 7.7 mmHg, while Group N's was 76.5 ± 7.2 mmHg, with a p-value of 0.5618.

The DBP values for Group F and Group N at 30 minutes were 75.1 ± 7.4 mmHg and 77.1 ± 7.0 mmHg, respectively, with a p-value of 0.4773. The DBP measurements for the two groups did not differ significantly. At 0 minutes, Group F's oxygen saturation was 98.2 ± 1.3%, whereas Group N's was 98.4 ± 1.2%. With a p-value of 0.4536, no significant difference was found. At 15 minutes, Group F's oxygen saturation was 98.3 ± 1.2%, while Group N's was 98.5 ± 1.1%, with a p-value of 0.59. Thirty minutes after administration, Group F's oxygen saturation was 98.1 ± 1.4%. Group N had an oxygen saturation rate of 98.3 ± 1.3% and a p-value of 0.5207, indicating no significant differences between the two groups.

Table 3: Comparison of Hemodynamic Parameters

Outcome	Group F	Group N	p-value
Hypotension (%)	10%	13.30%	0.7214
Patient Comfort (VAS)	2.1 ± 1.3	2.4 ± 1.1	0.3386
Post-Procedure Satisfaction	4.5 ± 0.6	4.4 ± 0.5	0.4859
HR at 0 min (beats/min)	76.6 ± 8.4	74.5 ± 7.3	0.3056
HR at 15 mins (beats/min)	78.1 ± 7.9	75.4 ± 7.1	0.2453
HR at 30 mins (beats/min)	76.9 ± 8.2	74.8 ± 7.5	0.2684
SBP at 0 mins (mmHg)	118.35 ± 12.42	120.43 ± 10.55	0.4873
SBP at 15 mins (mmHg)	115.7 ± 11.5	118.1 ± 12.3	0.4232
SBP at 30 mins (mmHg)	116.2 ± 11.3	119.6 ± 11.0	0.3754
DBP at 0 mins (mmHg)	76.3 ± 8.1	78.2 ± 7.5	0.4021
DBP at 15 mins (mmHg)	74.9 ± 7.7	76.5 ± 7.2	0.5618
DBP at 30 mins (mmHg)	75.1 ± 7.4	77.1 ± 7.0	0.4773
Oxygen Saturation at 0 min (%)	98.2 ± 1.3	98.4 ± 1.2	0.4536
Oxygen Saturation at 15 mins (%)	98.3 ± 1.2	98.5 ± 1.1	0.59
Oxygen Saturation at 30 mins (%)	98.1 ± 1.4	98.3 ± 1.3	0.5207

The VAS scores post-surgery were not significantly different between the two groups in the early hours. VAS scores in Group F and Group N were similar at 1 hour and 2 hours post-surgery, with p-values of 0.214 and 0.152, respectively. From the 4^{th} hour, a considerable difference was seen, with increased VAS scores in Group F than in Group N. During the 4^{th}, 5^{th}, and 6^{th}hours, the p-values were 0.012, 0.004, and <0.001, respectively, reflecting superior analgesia in Group N in the subsequent postoperative hours. RSS were similar between groups throughout the six-hour postoperative course without any statistically significant differences. Throughout all time points, the p-values were greater than 0.3, which indicates that the two groups had comparable sedation levels. The results thus imply that Group N offered better analgesia during the latter postoperative period but that the sedation levels were comparable between the two groups (Table 4).

Table 4: Comparison of postoperative VAS and RSS

Outcome	Group F (Mean ± SD)	Group N (Mean ± SD)	p-value
VAS 1 hour	2.4 ± 0.9	2.1 ± 0.8	0.214
VAS 2 hour	2.9 ± 1.0	2.5 ± 0.9	0.152
VAS 3 hour	3.3 ± 1.2	2.8 ± 1.0	0.098
VAS 4 hour	4.1 ± 1.3	3.0 ± 1.1	0.012
VAS 5 hour	4.8 ± 1.4	3.3 ± 1.2	0.004
VAS 6 hour	5.2 ± 1.5	3.5 ± 1.3	< 0.001

RSS 1 hour	2.5 ± 0.6	2.4 ± 0.7	0.34
RSS 2 hour	2.3 ± 0.5	2.2 ± 0.6	0.41
RSS 3 hour	2.2 ± 0.4	2.1 ± 0.5	0.56
RSS 4 hour	2.1 ± 0.4	2.0 ± 0.5	0.67
RSS 5 hour	2.0 ± 0.3	1.9 ± 0.4	0.72
RSS 6 hour	1.9 ± 0.3	1.8 ± 0.4	0.79

Table 5 shows the patient satisfaction ratings of both groups. More patients in Group N (56.7%) were "Very Satisfied" than those in Group F (33.3%), with a significant difference (p = 0.041). The number of patients who were "Satisfied" was similar in the two groups (p = 0.774). Neutral and dissatisfied ratings did not differ significantly between the groups (p > 0.05). There was only one patient in Group F who was "Very Dissatisfied." These results indicate that Group N was more satisfied overall than Group F.

Table 5: Patient Satisfaction Scores

Satisfaction Level	Group F (n = 30)	Group N (n = 30)	p-value
Very Satisfied (5)	10 (33.3%)	17 (56.7%)	0.041
Satisfied (4)	9 (30.0%)	8 (26.7%)	0.774
Neutral (3)	6 (20.0%)	3 (10.0%)	0.472
Dissatisfied (2)	4 (13.3%)	2 (6.7%)	0.671
Very Dissatisfied (1)	1 (3.3%)	0 (0.0%)	0.512

The rate of complications, according to Table 6, was minimal and comparable for both groups. 10% of patients in Group F and 13.3% of patients in Group N experienced hypotension; the p-value of 0.74 indicates that there was no statistically significant difference in the two groups' rates of hypotension. There were no episodes of bradycardia, respiratory depression, or other complications in either group.

Table 6: Complications

Complication	Group F	Group N	p-value
Hypotension (%)	3 patients (10%)	4 patients (13.3%)	0.74
Bradycardia (%)	0	0	-
Respiratory depression (%)	0	0	-
Other Complications (%)	0	0	-

Discussion

The costoclavicular block has emerged as a valuable option for brachial plexus anaesthesia due to its speedy onset, uniform distribution, and decreased risk of complications like phrenic nerve involvement. The selection of adjuvants plays an integral part in maximizingtheir efficacy, duration of analgesia, and patient comfort. Fentanyl, a highly lipophilic opioid, is often employed to prolong the analgesic effect by modulating nociceptive pathways at spinal and supraspinal levels. Nalbuphine, a kappa agonist-mu antagonist, is an effective analgesic with minor respiratory depression and a lower incidence of opioid side effects. The combination of the above agents with local anaesthetics in costoclavicular blocks could contribute to improved intraoperative and postoperative pain relief, further enhancing surgical performance and patient satisfaction.[7-10]

Our research groups were well-matched in terms of demographic data. The two groups did not differ statistically significant in terms of age, gender, or BMI. Group F was 38.6 ± 9.2 years old on average, and Group N was 39.1 ± 10.5 years old on average. Age did not significantly differ, according to a p-value of 0.8452. With 16 males and 14 females, the two groups similarly had the same gender distribution, and the p-value of 0.98 suggested no indication of gender bias. The mean BMI for Group F was 24.3 ± 3.5 kg/m², and for Group N, it was 24.6 ± 3.7 kg/m² (p-value 0.7481). These identical demographic variables demonstrate that the reported clinical outcomes were not influenced by age, gender, or body mass index, thus rendering the results reliable. This is in line with the studies of Song et al., Rajkhowa et al., and Das et al.[11-14]

Both sensory and motor blocks started earlier in Group N, with the sensory block starting at about 8.6 minutes as opposed to 10.1 minutes in Group F and the motor block starting at 9.2 minutes as opposed to 11.0 minutes in Group F. Both the motor and sensory blocks were longer in Group N, lasting up to 3.8 hours as opposed to 2.7 hours in Group F. The sensory block lasted roughly 4.3 hours as opposed to 3.2 hours in Group F. These results show an increased anaesthetic effect in Group N, which could be translated into enhanced postoperative pain relief. Despite all these differences, operating time was similar between the two groups at around 130 minutes, indicating that the type of anaesthetic drug administered had no impact on operating time. This is consistent with the study ofShi et al.[15]

Our study revealed no detectable differences between the two groups regarding haemodynamic parameters or patient comfort. In all three measurement time points (0, 15, and 30 minutes), HR, SBP, DBP, and oxygen saturation were similar in both groups. This concords with earlier research illustrating that such opioids exert minimal impact on cardiovascular stability under conditions of regional anaesthesia. This agrees with research by Kamble et al. and Kumar et al.[7,16]Postoperatively, pain scores for both groups were equal in the early hours. Beginning from the fourth hour, however, Group N had lower VAS scores than Group F, reflecting better analgesia in the later part of the postoperative period.

By the sixth postoperative hour, pain scores were significantly higher in Group F, supporting the extended analgesic effect of Group N. Sedation scores, as measured by RSS, were similar in both groups over the postoperative period, and no differences were significant at any time. This indicates that Group N, though offering superior analgesia, did not cause undue sedation. Patient satisfaction surveys also validated these results, as a greater percentage of Group N patients were "Very Satisfied" versus Group F. Fewer patients were "Satisfied" in either group. Overall levels of dissatisfaction remained low. These are similar to the results of the studies by Kumar et al., Das et al., and Rajkhowa et al.[7,13,14]

Complication rates in our study were likewise similar across the two groups, with no incidences of respiratory depression or bradycardia in either group and hypotension in 10% of patients in Group F and 13.3% in Group N. The results are consistent with earlier research that demonstrated that both nalbuphine and fentanyl have a low rate of adverse effects when used in peripheral nerve blocks. These results are comparable to those of Kumar et al. and Kamble et al.[7,16]

Compared to Group F, Group N experienced a shorter duration of analgesia and a noticeably earlier onset time of sensory block. In the later stages of the postoperative periods, Group N's VAS scores were comparatively lower. In terms of complications and haemodynamic parameters, the two groups were similar. In terms of patient satisfaction and VAS scores, Group N fared better in terms of the onset and duration of sensory and motor block.

This study has a few drawbacks in spite of these positive results. First, the findings may not be as broadly applicable as they may be due to the limited sample size. Greater statistical power and accurate identification of any possible variations between the two opioids would be made possible by a bigger sample size. Second, the study was only carried out in one location, which might have limited the findings' external validity.Other centres might use different anaesthesia regimens and patient populations and thus yield different results. This study did not also try to measure the pharmacokinetics or pharmacodynamics of fentanyl and nalbuphine when used together with ropivacaine, which could disclose even more about their mechanism of action in regional anaesthesia.

Conclusion

Nalbuphine and fentanyl were both effective adjuvants to ultrasound-guided costoclavicular brachial plexus block for upper limb surgery with no substantial difference in terms of hemodynamic stability or rate of complications. Nalbuphine proved to have superior analgesic effects during the subsequent postoperative hours, which resulted in enhanced pain control and increased patient satisfaction than fentanyl. The level of sedation in both groups was similar. The findings support the possible advantage of nalbuphine as an adjuvant for producing sustained analgesia with no adverse effects.

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