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ORIGINAL ARTICLE

Comparative Study Between the Effect of Ultrasound-guided Interscalene Block Versus Patient-controlled Intravenous Analgesia on Postoperative Analgesia After Shoulder Surgery

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Abstract

Background: **The gold standard for evaluating the efficacy of acute postoperative pain treatment is PCA. PCIVA is used more often in conjunction with opioids, however, potent opioids might have undesirable side effects, such as nausea and pruritus. Brachial plexus block has important advantages for upper extremity surgery over general anaesthesia. With the ISB, any surgery on the upper extremities is possible. In contrast, to single-shot ISB with a long-acting local anaesthetic, parenteral opioids are less effective, but the effect is only temporary. Parenteral opioids or single-shot ISB are less effective at relieving pain than continuous ISB.**

Aim: **To contrast intravenous analgesia is managed by the patient with an interscalene block guided by ultrasonography for postoperative pain relief following shoulder surgery.**

Subject and methods: **In Cairo's Al-Azhar University Hospitals, this study involved 60 patients divided into two groups.**

Results: **The group ISB required less amount of total narcotic consumption in the first 24 h. There is a significant difference between the groups regarding studied adverse effects especially narcotic-related side effects which are higher in the PCA group.**

Conclusion: **Ultrasound-Guided interscalene is more effective than patient-controlled intravenous analgesia after shoulder surgery in controlling pain, HR and blood pressure. However, there is no significant difference between the groups regarding time to rescue analgesia, side effects and patient satisfaction.**

Keywords: Analgesia, Surgery, Ultrasound-guided interscalene block

1. Introduction

Upper limb surgeons face a hurdle with postoperative analgesia. The assessment standard for gauging the effectiveness of immediate postoperative pain management is patient-controlled analgesia (PCA). PCIVA is used more often in conjunction with opioids, However, strong opioids might have unwanted side effects, including respiratory depression, pruritus, nausea, and respiratory distress.[1] Both the patient and the surgeon need postoperative analgesia with fewer adverse effects. Because brachial plexus block provides a lower surgical stress response, better blood flow to the surgical site (sympathectomy), and higher postoperative analgesia than general anaesthesia, it is preferred for procedures on the upper extremities, quicker outpatient release, and lesser risk of adverse effects.[2] For a very long period, descriptions of the common techniques—interscalene, supraclavicular, infraclavicular, and axillary—have been available.[2]

Any surgery involving the upper extremities can be performed using the interscalene block (ISB).[3] Since continuous ISB is preferred over parenteral

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opioids because it is more effective than a single-shot ISB with a long-acting local anaesthetic (bupivacaine), the majority of publications recommend it.[4] Continuous ISB and parenteral (IM or IV PCA) opioids are both more effective in reducing pain than single-shot ISB.[5,6] Effective pain management is critical in this condition to promote the patient's health and aid in recovery. Long-acting local anaesthetics are used to extend postoperative analgesia and reduce the demand for opioids and the side effects that go along with them.[7]

Our study compares the effects of patient-controlled intravenous analgesia and ultrasound-guided interscalene blocks on postoperative pain following shoulder surgery. The VAS pain score at 0, 6, 12, 24, 30, 36, 42, and 48 h was the main study outcome. Patient satisfaction and any negative effects or problems were the secondary outcomes.

2. Patients and methods

The most effective approach for achieving the study's goals was found to be a prospective, randomised controlled clinical trial. The local ethical committee gave its approval for this study to be carried out for boys in Cairo's Al-Azhar University Hospitals.

Each subject was given a signed informed consent after being informed of the study's purpose. The present study included (60) patients divided into 2 groups: **Group A:** ultrasound-Guided interscalene block) ISB): (30) cases undergo ultrasound-Guided interscalene block before the operation. **Group B:** Patient-controlled analgesia administered intravenously (30): Following surgery, patients were instructed to use a PCA pump (PCA). Patient-controlled intravenous analgesia or an ultrasound-guided interscalene block was given to an equal number of individuals. Just before the block was administered, the opaque envelopes carrying the computer-generated random numbers were cracked open. All the blocks were administered by the same anesthesiologist. Until the trial's conclusion, The randomization was concealed from the practical data collectors.

2.1. Inclusion criteria

Patients accepting to join the study, age: between 18 and 60 years and ASA physical status I and II.

2.2. Exclusion criteria

Patient refusal, patient with coagulation disorders, age: Less than 18 more than 60 years old, infection at the site of injection, patient's sensitivity to used drugs and allergy to drugs used in the study.

Baseline measures of oxygen saturation (PO2), heart rate (HR), and mean arterial blood pressure (MAP) were taken during preoperative monitoring.

2.3. Anaesthetic techniques

Ultrasound-guided interscalene brachial plexus block Patients were positioned supine with their necks slightly turned to the other side. The skin was prepared in a sterile manner as is customary. An M-Turbo ultrasound machine was used to perform an interscalene block (SIEMENS ACUSON P300) (Fig. 1).

A sterile adhesive bandage covers the transducer. With the probe's long axis parallel to the clavicle, a transverse scan was carried out at the interscalene groove level. The brachial plexus roots were then located after a modest caudal movement of the transducer. All patients were instructed to report any signs of local anaesthetic toxicity, such as numbness around the mouth or on the tongue, alteration of vision or hearing, lightheadedness, or tinnitus (Fig. 2).

2.4. Measurement

At 0, 6, 12, and 24 h after surgery, the postoperative pain of the patient was assessed using a visual analogue scale (VAS) pain score (range, 0–10; 0, no pain; 10, maximum pain). When a patient's respiration rate was greater than 10/min and their VAS was greater than 3, the dose of intravenous morphine was gradually increased by 2 mg every

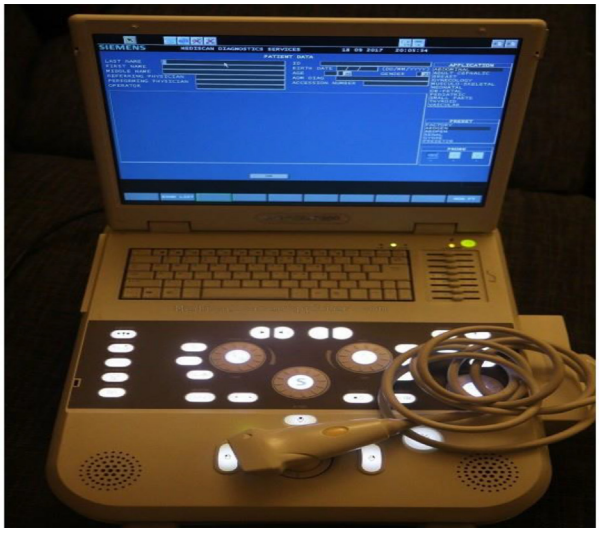

Fig. 1. The Siemens us device used in the study.

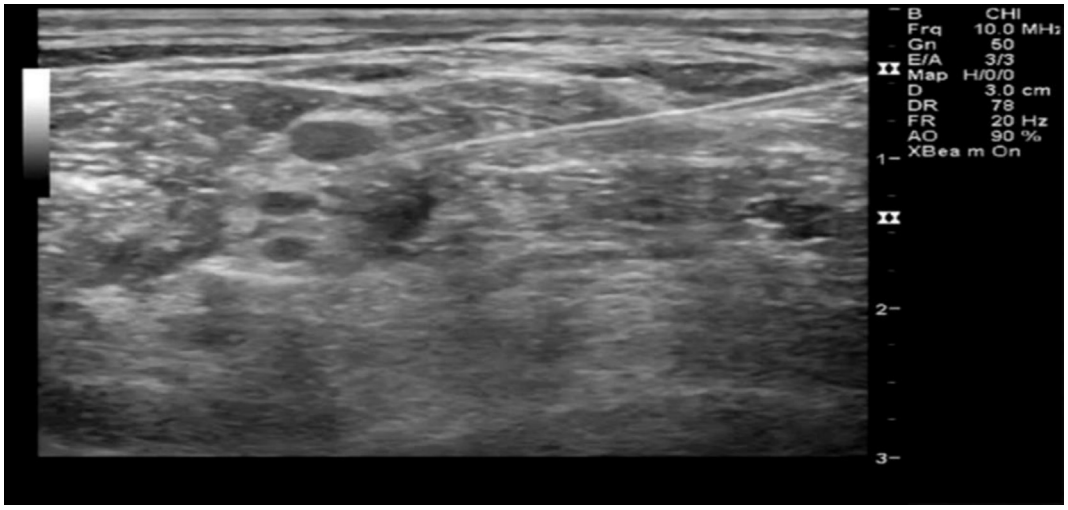

Fig. 2. Pictures showing the injection needle in the interscalene groove.

10 min until the patient's VAS was equal to or lower than 3. During the first postoperative hours, postoperative morphine was used in total, and the number of patients who required it was recorded. The patient's mean arterial blood pressure and heart rate were measured at the time of admission to the postoperative anaesthesia care unit (time 0), at 6, 12, and 24 h following surgery. Patient satisfaction was evaluated using a four-point rating scale (1, excellent 2, good 3 fair 4, poor). Any unfavorable effects or issues were documented.

2.5. Statistical analysis

We utilized MedCalc 13 for Windows and SPSS 22.0 for Windows (SPSS Inc., Chicago, IL, USA) to collect data, tabulate, and statistically analyse all of the data (MedCalc Software bvba, Ostend, Belgium). For parametric and non-parametric variables, respectively, the Independent T test and the Mann-Whitney test were employed to calculate the difference between quantitative variables in two groups. All statistical comparisons were two-tailed and significant when the level of *P*-value was 0.05 or below, 0.001 or higher, and $P > 0.05$, which denotes a non-significant difference.

3. Results

This table shows that there is no significant difference between the two studied groups regarding age, BMI, and sex (Table 1).

This table shows that there is no significant difference between the two studied groups regarding ASA, operative time, and anaesthesia time (Table 2).

This table shows that there is a significant difference between the two studied groups regarding MAP at 2 h and 6 h (Table 3).

Table 1. Demographic data of the two studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	*t*	*P*
Age (years) Mean ± SD	45.62 ± 9.11	47.33 ± 10.56	0.672	0.505
BMI (kg/m^2) Mean ± SD	27.44 ± 2.37	28.11 ± 3.62	0.848	0.399
Sex				
Male	19 (63.3%)	17 (56.7%)	0.278	0.598
Female	11 (36.7%)	13 (43.3%)		

Table 2. Operative characteristics of the two studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	χ^2/t	*P*
ASA				
I	5 (16.7%)	5 (16.7%)	0.166	0.921
II	22 (73.3%)	21 (70%)		
III	3 (10%)	4 (13.3%)		
Operative time (min) Mean ± SD	83.54 ± 24.6	75.43 ± 26.8	1.22	0.227
Anaesthesia time (min) Mean ± SD	137.63 ± 42.79	130.92 ± 8.63	0.842	0.403

Table 3. Mean arterial blood pressure changes between the two studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	t	*P*
Baseline Mean ± SD	84.5 ± 2.43	84.94 ± 6.36	0.354	0.725
2 h Mean ± SD	79.61 ± 3.22	82.83 ± 3.35	3.8	0.001
6 h Mean ± SD	79.17 ± 3.17	83.72 ± 3.2	5.53	<0.001
12 h Mean ± SD	86.89 ± 4.32	88.59 ± 3.46	1.68	0.098
24 h Mean ± SD	82.94 ± 2.15	83.2 ± 2.44	0.438	0.663

Table 4. Heart Rate changes of the two studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	t	*P*
Baseline Mean ± SD	94.32 ± 5.11	95.19 ± 3.12	0.796	0.429
2 h Mean ± SD	83.44 ± 8.55	85.78 ± 5.52	1.26	0.213
6 h Mean ± SD	83.78 ± 3.04	84.83 ± 3.43	1.25	0.215
12 h Mean ± SD	83.63 ± 2.74	85.91 ± 4.53	2.36	0.022
24 h Mean ± SD	81.35 ± 2.11	82.27 ± 3.61	1.21	0.233

Table 5. Time to rescue analgesia among the two studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	t	*P*
Time to rescue analgesia Mean ± SD	8.44 ± 2.71	8.07 ± 2.38	0.562	0.576

This table shows that there is a significant difference between the two studied groups regarding HR at 12 h (Table 4).

This table shows that there is no significant difference between the groups regarding time to rescue analgesia (Table 5).

This table shows that total analgesia consumption was significantly higher among the PCA group compared to the ISB group at 12 h and 24 h postoperatively (Table 6).

This table shows that there is no significant difference between the groups regarding studied adverse effects (Table 7).

This table shows that there is no significant difference regarding patient satisfaction (Table 8).

4. Discussion

Patient-controlled analgesia (PCA), which is preceded by initial intravenous titration and may promptly provide a sufficient analgesic dose upon admission to the postoperative care unit, is a useful approach for postoperative analgesia (PACU).[8] The effects of patient-controlled intravenous analgesia and ultrasound-guided interscalene blocks on postoperative pain following shoulder surgery were examined in this study. This clinical study investigation was done on boys in Cairo at the hospitals connected to Al-Azhar University. There were 60 patients in the current study, split into two groups. Before surgery, interscalene blocks were carried out in 30 instances in Group A under ultrasound guidance. Patients were instructed to use a Patient-

Table 8. Satisfaction distribution among the studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	χ^2	*P*
Excellent	16 (53.3%)	11 (36.7%)	2.46	0.483
Good	12 (40%)	15 (50%)		
Fair	2 (6.7%)	3 (10%)		
Poor	0	1 (3.3%)		

Table 6. Total amount of analgesia consumption among the two studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	*t*	*P*
12 h postoperatively Mean ± SD	63.29 ± 25.82	84.74 ± 31.62	2.88	0.006
24 h postoperatively Mean ± SD	120.33 ± 38.63	186.47 ± 46.58	5.99	<0.001

Table 7. Adverse effects distribution among the studied groups.

	ISB ($N = 30$)	PCA ($N = 30$)	χ^2	*P*
Dizziness	1 (3.3%)	4 (13.3%)	1.96	0.161
Nausea and vomiting	2 (6.7%)	5 (16.7%)	1.46	0.228
Numbness	1 (3.3%)	0	1.02	0.315
Urine retention	0	1 (3.3%)	1.02	0.315

Controlled Analgesia (PCA) pump following surgery. The trial lasted between six and twelve months in Group B, which used patient-controlled intravenous analgesia (IV PCA). There is no obvious difference between the two study groups in terms of age, BMI, or sex.

As far as we are aware, there has not been any prior research comparing intravenous analgesia with patient control versus an ultrasound-guided interscalene block for postoperative analgesia after shoulder surgery. Our findings were supported by a research by Karaman *et al*.,[9] which reported the inclusion of 60 patients (29 patients in the group with supraclavicular brachial plexus block (SB) and 31 patients in the group with interscalene brachial plexus block (IB)) in the analysis. The patients in the two groups had comparable demographic characteristics.

The study by Cho *et al*. looked at 40 instances of patient-controlled analgesia being used during arthroscopic rotator cuff repairs. The 0.5% bupivacaine subacromial infusion group (group 1, 20 cases) and the fentanyl and ketorolac tromethamine intravenous injection group were formed from the 40 cases (group 2, 20 cases). In bunch 1, there were 24 patients—12 female and 8 male—with a mean period of 54.1 years. In bunch 2, there were 13 male and 7 female patients, with a mean period of 53.5. Members' ages and the extent of men to ladies didn't genuinely contrast between the two gatherings ($P = 0.113$ and 0.752, separately).

The consequences of the current examination uncovered no calculable distinction in comorbidities between the two review gatherings. The discoveries of Chen *et al*., who revealed that 151 careful patients got PCA after shoulder a medical procedure, are upheld by the discoveries of our review. The preliminary included 48 careful patients who just got intravenous PCA and 103 careful patients who got a solitary bolus interscalene block alongside PCA (bunch PCAIB) (bunch PCA). The ongoing investigation discovered that neither the medical procedure side nor the kind of activity fundamentally varied between the two gatherings. Between the gatherings, there was no way to see a distinction in the patient qualities or preoperative comorbidities. Also, of the 10 cases in bunch 1 of Cho *et al*. study, 's[7] impacted the right shoulder and 13 the left. In bunch 2, 13 examples impacted the right shoulder and in 7 cases the left shoulder. The area of the medical procedure did not essentially vary between the two gatherings ($P = 0.058$). Furthermore, Zanfaly *et al*.,[10] reported that the patients were separated into three equal groups (each consisting of 25 patients) using sealed, opaque numbered envelopes. The GA-only group was made up of patients who received only GA. Prior to GA induction, patients in the GA + ISB group had ISB that was guided by a nerve stimulator and received ultrasound therapy.

The kind of operation was similar between the three groups ($P > 0.05$), and patients in the GA + ShB group had nerve stimulator-guided suprascapular and axillary nerve blocks (ShB) before induction of GA. In the study at hand, there is no discernible difference in ASA, operational time, or anaesthetic time between the two investigated groups. Additionally, Karaman *et al*.,[9] showed that there were no changes between the groups in terms of scanning, needling, and process times. Additionally, Chen *et al*.,[11] found that there were no statistically significant changes in surgery time and anaesthesia time during the perioperative period. Furthermore, 13 patients from Ryu *et al*. study's (interscalene brachial plexus block (ISBPB) group: $n = 47$; supraclavicular brachial plexus block (SCBPB) group: $n = 46$) were randomly assigned to one of two groups.

In comparison to the ISBPB group, the SCBPB group's procedural time was lengthier.

In 44 individuals (95.7%) in the SCBPB group, proximal diffusion of the local anaesthetics to the interscalene groove was observed.

The current investigation demonstrated a substantial difference in MAP at 2 h and 6 h between the two analyzed groups. Regarding HR at 12 h, there is a substantial difference between the two study groups. At 2 h and 12 h, the VAS in the ISB group was found to be considerably lower than in the PCA group. Also, **Borgeat** *et al*.,[12] detailed that a comparable torment decrease following significant shoulder a medical procedure was accomplished with PCIA utilizing 0.2% ropivacaine and 0.15% bupivacaine. Nonetheless, ropivacaine 0.2% was connected to prevalent hand strength protection and diminished finger paresthesia. Casati *et al*.[13] found that PCIA with 0.125% levobupivacaine offered satisfactory agony control after a significant open shoulder medical procedure with less neighborhood sedative implanted during the principal postoperative day and no distinctions in the recuperation of engine capability when contrasted with 0.2% ropivacaine. Pain relievers, for example, narcotics and neighborhood sedatives infused into the subacromial bursa, have been utilized following shoulder a medical procedure. For postoperative absense of pain, it is disputable whether these analgesics ought to be continually given subacromially. Besides, Boss *et al*.[14] found that bupivacaine 0.25% at a pace of 6 ml/h given as an imbuement in the subacromial locale couldn't

diminish the postoperative aggravation in open acromioplasty patients. The utilization of subacromial ropivacaine 0.25% as PCA gave powerful postoperative agony to the board, as indicated by Harvey *et al*. The adequacy of patient-controlled interscalene absense of pain (PCISA) and patient-controlled intravenous absense of pain was explored in the concentrate by Tuncer *et al*.,[15] which took a gander at the administration of postoperative torment in 36 patients (PCIVA).

A visual simple scale was ordinarily used to gauge torment easing. Patients' fulfilment and secondary effects were noted. After the activity, the exploration time frame finished 48 h after the fact. Six, twelve, 24, and thirty hours following a medical procedure, the PCISA bunch had impressively further developed torment the board (P 0.05). No recognizable change in torment score between the two gatherings was seen at 36, 42, or 48 h.

What's more, Borgeat *et al*.,[16] to treat postoperative agony following significant shoulder a medical procedure, patient-controlled interscalene absense of pain (PCIA), neighborhood sedatives, intravenous patient-controlled absense of pain (PCA), and narcotics were looked at. PCIA or PCA was tentatively randomized to 40 patients booked for elective significant shoulder a medical procedure. At $t = 12$ and 18 h, the PCIA bunch had extensively further developed torment control (P 0.05). Also, Chen *et al*.,[11] exhibited that normal or most awful VAS did not contrast essentially between the two gatherings. Our discoveries were upheld by research by Cho *et al*.,[17] who depicted that the repeat of extra agony-easing mixtures for torture control during PCA was 3.4 times in pack 1 and 3.8 times in bundle 2 until postoperative day 5. The continuous survey uncovered that there is no massive distinction between the social occasions as to time to protect nonappearance of agony.

Between bundles 1 and 2, there was not a huge contrast in the repeat ($P = 0.662$). Moreover, 19 times of first bolus organization and paracetamol supplementation in the two gatherings were analyzed in the concentrate by Borgeat *et al*. Our discoveries showed that there is little contrast between the gatherings with regards to zeroing in on unfavorable impacts. As to fulfilment, there is no massive contrast. In the concentrate by Cho *et al*.,[17] of the 20 patients in parcels 2, 3 showed brief hypotension, tiredness, and regurgitating. At postoperative 12 h, two of them handed themselves over to PCA, and the additional patient did as such at postoperative 48 h. Pack 1 announced that there were no instances of disease at the proper site. As per Tuncer *et al*.,[15] one patient in parcel 1 experienced gentle sickness and spitting at the 12-h mark after a medical procedure however went on with PCA (P 0.05). In the PCIVA gathering, retching and pruritus were seen all the more regularly (P 0.05). None of the preliminary members encountered any critical troubles. Furthermore, Borgeat *et al*.[16] observed that heaving and pruritus were 0 versus 25% and 0 versus 25% for the PCIA and PCA gatherings, separately (P 0.05). Patients in the PCIA bunch were more joyful generally speaking (P 0.05). Moreover, as per Karaman *et al*.,[9] no patients showed roughness or dyspnea. Nonetheless, 8 patients in the IB gathering and 1 patient in the SB bunch had Horner's disorder, and there was a genuinely massive distinction between the gatherings for this condition ($P = 0.015$).

The study's first drawback was the limited sample size, which increased the likelihood that the findings would differ from reality. Additionally, the study's assessment of the degree of muscular relaxation was flawed. Finally, there was no multi-centre source of cases and all patients received care at the same hospital.

4.1. Conclusion

After shoulder surgery, ultrasound-guided interscalene is more effective at managing pain, HR, and blood pressure than patient-controlled intravenous analgesia. Regarding side effects, patient satisfaction, and time to rescue analgesia, In terms of MAP at 2 h and 6 h, The two research groups differ significantly from one another. At 2 h and 12 h, the VAS in the ISB group was found to be significantly lower than in the PCA group, indicating that there is a substantial difference between the two study groups, but there is no discernible alteration in HR at that time.

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Authorship

All authors have a substantial contribution to the article.

Conflicts of interest

The authors declared that there were NO conflicts of Interest.

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