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Ultrasound guided interscalene brachial plexus block for upper-limb surgery

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Abstract

Introduction: After upper limb surgery performed in patients with interscalene nerve block, fast track, capability, and postoperative pain management in the Post Anesthesia Care Unit (PACU) are improved compared with general anesthesia alone. It is widely accepted that upper limb procedures shouldn't be performed, while under the effects of the Interscalene brachial plexus block. That's might be due to its neglected effect on the lower trunk. Nevertheless, the interscalene brachial plexus block is frequently used for anesthesia and pain control during procedures on the upper extremities.

Aim of the study: The study aimed to assess the usage of ISB, a regional anesthesia technique, in upper limb surgery for patients with interscalene nerve block.

Subjects and methods: Sixty patients underwent upper limb surgery. Thirty patients underwent ultrasound-guided interscalene brachial plexus blocks to determine the degree of blockage in each nerve and muscle as well as any other problems. Other thirty underwent general anesthesia. Moreover, comparisons were made for the Visual Analogue Scale (VAS) scores and opioid consumption in the PACU and incidence of complication.

Results: The level of sensory and motor block was efficient for surgical procedures such as general anesthesia. Opioid consumption in PACU was significantly less in the interscalene group, which had significantly better VAS scores during PACU stay than in general anesthesia.

Conclusions: That study proved that using ISB, a suitable sensory and motor block, could be produced in the upper limb without any problems.

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1. Introduction

The brachial plexus, which separates into the superior, middle, and inferior trunks under the clavicle. That leads to the lateral, posterior, and medial cords. It eventually

creates the peripheral nerves that supply the arms, originates from the C5-T1 ventral rami. The brachial plexus block is frequently used to anesthetize and relieve discomfort in the upper limbs. There are few methods for the nerve block and interscalene approach, such as axillary approach, supraclavicular approach, and infraclavicular approach. The C6 level of the cricoid cartilage is the location of the conventional interscalene technique, which has been used to treat shoulder operations [1].

2. Subjects and methods

2.1. Subjects

The current study was a randomized controlled trial. The study was conducted at the Anesthesia department of the Fayoum University Hospital between May 2018 and April 2019.

2.2. Inclusion criteria

The inclusion criteria for patients who had upper limb surgeries followed the guidelines of the physical status of the American Society of Anesthesiologists (ASA), where the study participants were either status 1 or 2 [2].

2.3. Exclusion criteria

Patients with coagulation disorders, under 19 or over 74, weighing less than 51 kg or in excess of 101 kg, with any neurological debilitation, or those with careful site contaminations were excluded from the current study.

2.4. Ethical considerations

The study was approved by the institutional Research and Ethics Committee of the faculty of medicine, Fayoum University, Fayoum, Egypt (approval number was D166). At first, Verbal and written information was given to all eligible patients before informed written consent was obtained. Then after the clinical exploration morals audit board at our emergency clinic gave its leeway, we educated the patients regarding the review goals and any dangers or secondary effects that might be involved. The preliminary was directed to the patients after their acceptance to participate in the study.

2.5. *Methods*

At the working room, patients were monitored with a painless EKG, beat oximeter, and circulatory strain screen to screen their important bodily functions. Peri-operative anesthesia-related side effects were recorded by a study nurse. An infusion of 500 ml of lactated Ringer's solution was initiated, then patients were divided into two groups:

A) The ISB group:

Patients were confronted away from the side of the block, while lying on their backs. Prior to setting the straight ultrasonic test in the interscalene groove at C6, the neck was cleaned with Betadine. The materials used were 20G, 40 mm needles, sanitized plastic wrap, and gels. The withdrawal of each muscle (pectoralis, deltoid, arm, lower arm, or hand) was recorded utilizing a nerve trigger working at 0.6 Mama. 15 ml each of 0.5% bupivacaine

and 2% lidocaine were utilized as the neighborhood sedative. We utilized liquor napkins with a worth of 0 (no sensation) to 10 (typical sensation) above, underneath, and on the shoulder to affirm the tactile block at five and ten minutes following the infusion of the neighborhood sedative [1].

We additionally estimated the elbow and wrist flexion and expansion, the arm pronation and wrist flexion (interceded nerve), and the flexion and resistance of the fourth and fifth fingers toward the thumb to survey the muscles capacity to contract (ulnar nerve). Then, at that point, to decide if a successful engine block had happened, we searched for proof of loss of motion (absence of constriction) [3].

B) The GA group:

Anesthesia was induced with midazolam 0.05 mg/kg, fentanyl 3 mg/kg, propofol 4 mg/kg, and rocuronium 0.3 mg/kg. Subsequently, the trachea was intubated, and GA was continued with 1 MAC sevoflurane in air/O2 (FIO2 30%) and 1.5 liter/min fresh gas flow. Mechanical ventilation was performed in a pressure-controlled mode to maintain EtCO2 between 4.6 and 5.3 kPa. Fentanyl boluses 1.5 mg/kg were administered at the discretion of the responsible anesthetist. At the beginning of the skin closure, anesthesia was discontinued, and tracheal extubating was performed once the patient was awake.

Intraoperative bradycardia, Heart rate is equal to 50 beats/min, was treated with atropine 0.5 mg. Hypotension, decrease of MAP 30% from baseline, was treated with bolus administration of lactated Ringer's solution 3 ml/kg and bolus application of ephedrine as appropriate. Intraoperatively, all patients received acetaminophen 1 g IV. Postoperative analgesia was standardized with boluses of nalbuphine 10 mg IV. to achieve analgesia visual analog scale (VAS) scores of 3. In cases of postoperative nausea and vomiting, patients received ondansetron 8 mg. After the operation, patients were transferred to the PACU for a minimum of 30 min. Immediately after admission to PACU and every 10 min, an independent observer assessed the hemodynamic status, the pain profile, and the recovery score. Patients fulfilled discharge criteria as soon as they had a modified Aldrete score of 9 or more and required no treatment for pain (NRS 3) or nausea and vomiting. Opioid consumption on the day of surgery was the main outcome variable. All patients received routinely diclofenac twice a day (75 mg at 8 am and 8 pm) paracetamol three times a day (500 mg at 8 am, 12 pm, and 8 pm) per os. Additional analgesics were administered intravenously as needed according to a pain step protocol, using an 11-point numeral rating scale (NRS; 0, no pain; 10, worst pain imaginable): step 0: NRS 0–2: no further analgesics, step 1: NRS 3–4: 1,000 mg paracetamol (Perfalga 10 mg/ml, Bristol-Meyrs Squibb, Munich, Germany) or 1,000 mg metamizole (Novaminsul-fon-Ratiopharm, Ulm, Germany) depending on the individual belongings of the patients, step 2: VAS 50–60: 1,000 mg paracetamol and 1,000 mg metamizole and step 3: VAS 70–100: 1,000 mg paracetamol and 1,000 mg metamizole and 20 mg nalbuphine Analgesic consumption was measured in the

recovery room and then daily at 08:00 am until patients were discharged from hospital.

2.6. Statistical Analysis

Data was gathered, coded to make data manipulation easier, double-entered into Microsoft Access, and then analyzed using SPSS software version 22 on a Windows 7 computer (SPSS Inc., Chicago, IL, USA). Simple descriptive analysis using percentages and numbers for qualitative data, arithmetic means for measuring central tendency, and standard deviations for quantifying dispersion for parametric quantitative data. For qualitative data, Chi-square test was used to compare two of more than two qualitative groups. *P-value< 0.05* was considered statistically significant.

3. Results

Tables 1 and 2 showed the demographic and clinical information about the patients, including age, height, weight, gender, and the kind of operation. The degree of sensory block was determined to be 2.8 1.6 and 1.1 1.8 on a scale of ten, respectively, at five and ten minutes following the block technique. After 10 minutes, 27 out of 30 patients (92.8%) experienced motor block.

Table 1: Patient Demographic Data.

Variables	ISB	GA	*P-value*
Sex (Males: Females)	22:18	27:13	0.1273
Age (years)	54.1±11.7	49.3±13.6	0.2251
Body height (cm)	172.6±10.7	172.2±9.9	0.2615
Bodyweight (kg)	83.3±16.6	88.2±19.2	0.2285
BMI (kg/m2)	27.9±4.7 29	28.6±5.2	0.3531

Table 2: Patient Demographic Data.

Variables	Frequency
Elbow curettage and drilling	6 (20%)
Distal radius	9 (30%)
Shoulder surgery	7 (23.3%)
ORIF Ulnar metal removal	3 (10%)
Ganglion excision	5 (16.7%)

ORIF: open reduction and internal fixation.

The time analysis is demonstrated in Table 3. Additionally, during the procedure, in

the recovery area, or the wards, there were no indications of problems like dyspnea or Horner syndrome (Table 4).

Table 3: Time analysis during anesthesia.

Variables	ISB	GA	*P-value*
ISB time (min)	11 (7)		
Sensory onset time of ISB (min)	7 (3)		
Ready for surgical procedure (min)	8 ±3	13 ±5	0.001*
Surgical time (min)	82±23	82 ±34	0.1273
OR emergence time (min)	4 ±3	10 ±5	0.001*
Anesthesia control time (min)	12 ±4	23 ±6	0.001*
Total anesthesia time (min)	22 ±8	23 ±6	0.2251
PACU time (min)	45±17	70 ±20	0.001*

**Significant at P<0.05.*

Table 4: Time analysis during anesthesia.

Variables	ISB	GA	*P-value*
Horner syndrome	1		
Hypotension (n; %)	2; 10	12; 60	0.001*
Nalpuphine (mg)	0 (0– 3)	2 (0 –12)	0.01*
Pain NRS PACU	0 (0– 4)	6 (0 –10)	0.001*

**Significant at P<0.05.*

4. Discussion

In the current study, we performed ultrasonographic-guided ISB. The main advantages of ultrasonographic guidance for regional anesthesia are the faster performance of blocks, faster onset times, longer duration of blocks, and higher success rates [4-5].

Analgesic demand was the primary outcome variable of our study. There was a significant reduction of opioid consumption in patients receiving ISB compared with GA in the recovery room and on the day of surgery, which might be explained by the long duration of the local anesthetics compared with fentanyl. That agreed with Zoremba *et al.,* 2015, in their study about supplemental interscalene blockade to general anesthesia for shoulder arthroscopy [6]. That confirmed ISB might achieve sufficient regional anesthesia, in the daily routine a combination with GA [7]. GA was

mostly performed either to cover block failures or satisfy patients wish for sedation [8]. Opioid agonists evoke emesis and are a risk factor for nausea and vomiting in the late postoperative period [8-9]. In the current study, ISB reduced the need for general anesthesia, the number of opioids for induction of anesthesia, and consecutively the incidence of PONV.

In the current study, we found results that intraoperative vitals did not differ significantly in either group. The duration of surgery was also comparable in both groups. Time from the start of anesthesia to readiness for the surgical procedure was significantly lower in ISB than in GA (*P=0.001*). That finding agreed with the study by Gonano *et al.,* 2009, where the economic aspects of interscalene brachial plexus blockade and general anesthesia started duration between the start of anesthesia to the incision and was significantly more in patients receiving interscalene brachial plexus blocks (27.10 ± 6.09 min) than in general anesthesia (20.78 ± 10.59 min [10]. On contrast, our findings didn't correlate to studies of Brown *et al.,* 1993, who compared interscalene block for shoulder arthroscopy with general anesthesia and concluded that the time required from the start of anesthesia until incision was made significantly more in the group receiving block (28 min) [11]. Similar conclusions were derived by Lehmann *et al.,* 2015, who compared interscalene plexus block with general anesthesia for shoulder surgery [12]. That might be due to the combination of ISB to general anesthesia, which take prolonged time.

The duration of time spent in PACU was significantly less in patients receiving a block for surgery (35.60 ± 5.59 min), as contrasted to patients receiving general anesthesia (53.13 ± 6.95 min). Similar observations were made by Bosco *et al.,* 2017, who analyzed the pre- or post-operative interscalene block group and general anesthesia group posted for arthroscopic surgery [13]. They concluded that the group receiving only block had less PACU time than the group receiving general anesthesia.

There was only one case of complication of Horner's syndrome, otherwise no complications due to the block, such as respiratory depression, arterial puncture, hematoma formation, or pneumothorax. That is due to increased safety and efficacy with the use of ultrasound to delineate the anatomical structures better and reduced requirement of drugs as compared to the blind technique where there is an untoward flow of drugs to undesired surrounding structures. Balaban et al., 2018, did not report any complications in their study of ultrasound-guided combined interscalene and superficial cervical plexus block for surgical anesthesia in clavicular fractures [14]. Brown *et al.,* 1993, also concluded a lower incidence of complications such as nausea, vomiting, urinary retention, and overnight hospital admission after interscalene block was administered for shoulder surgery than in the general anesthesia group [11]. The other advantage, which could be associated with the use of blocks (though not studied in our case), was their safety use.

Conclusion

From our study, we concluded that ultra-sound-guided interscalene brachial plexus block was a safe and effective mode of anesthesia and was comparable to general anesthesia in upper limb surgeries. We found a greater pain-free period, lesser opioid requirement, and lesser PACU stay duration in patients receiving blocks. Interscalene brachial plexus block can be an alternative in upper limb surgeries for patients belonging to ASA Grade I or II.

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Ethical Approval Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

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