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Perioperative respiratory and analgesic effects of ultrasound-guided extrafascial versus interfacial interscalene brachial plexus block in patients undergoing shoulder arthroscopy

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Abstract
Background: It has been shown that placing local Anesthetics (LA) as far as 4 mm laterally from the sheath of the brachial plexus throughout US-guided ISBPB can result in beneficial analgesia for shoulder surgeries, demonstrating the significance of needle-nerve proximity in the context of ISBPB. The distance to the phrenic nerve is increased by this extrafascial injection, which may lessen the possibility that the local anesthetic spread would block it. The purpose of this work is to compare the effects of extrafascial and intrafascial (ISBPB) on the diaphragmatic excursion (phrenic nerve blockade).
Methods: This work was performed on 50 adult individuals, their age ranges between 21-60 years of both sexes with American Society of Anesthesiologists (ASA) physical state classification I-II who were planned for shoulder arthroscopic surgery under general anaesthesia. Patients were allocated into two groups at random (25 patients each) according to the US-guided method of interscalene block: Group I (Intrafascial injection group): 10 ml of 0.5% bupivacaine were given to the individuals for intrafascial (conventional) ISBPB. Group E (Extrafascial injection group): 10 ml of 0.5% bupivacaine were given to the individuals for extrafascial ISBPB.
Results: In group I, at PACU, the diaphragmatic excursions were significantly lower when compared to pre-block values. In group E, At PACU, the diaphragmatic excursions were comparable to pre-block values (*P* value = 0.062). After 30 minutes of block, the extrafascial block (group E) had a significantly (*P* value = 0.005) lower effect on diaphragmatic excursion than intrafascial block (group I). The same effect was observed at PACU. Extrafascial block had a significantly (*P* value <0.001) lower effect on a diaphragmatic excursion to intrafascial block. No difference between both groups was observed regarding the analgesic properties.
Conclusions: Given the increased incidence of partial hemi-diaphragmatic paralysis (HDP) with an intrafascial approach, extrafascial method to interscalene brachial plexus block is likely a more appropriate choice.

Keywords: Intrafascial, extrafascial, interscalene brachial plexus block, diaphragmatic excursion

Introduction
One of the most effective and often used methods for regional anesthetic of the upper extremity is the interscalene brachial plexus block (ISBPB). It numbs the middle (C7) and superior (C5, C6) the brachial plexus trunks [1].
The most frequent consequence of ISBPB, which affects 100% of the individuals receiving large volumes of local anesthesia, is the development of phrenic nerve palsy [2].
With varying contributions from the C3 and C5 roots, the phrenic nerve mostly emerges from the C4 root. It is created at the anterior scalene muscle's upper lateral border and runs caudally between the muscle's ventral side and the prevertebral fascial layer that surrounds it. As a result, There is just a thin fascial layer between it and the brachial plexus. The closeness to the brachial plexus or the cephalad diffusion of local anesthetic to the C3-5 the cervical plexus roots prior to their development of the phrenic nerve might therefore consider for its block in ISBPB [3]. Widespread acceptance of the use of ultrasonography for peripheral nerve blocks has been achieved.

It may be utilized to locate needles, determine the structure of the brachial plexus, and see how local anesthetic spreads. Since individual nerves may be more precisely found and smaller quantities of local anesthetic are placed around the structure being tated, this approach may enhance proper local anesthetic application and reduce problems. This may therefore result in a reduction in the accidental distribution of local anesthetic to the phrenic nerve [3].

Instead of the anterior central tendon observed in fluoroscopy, whose movement is less by 40 percent with breathing, ultrasound primarily concentrates on the lateral and posterior regions of the diaphragm, these are the muscular components supplied by the phrenic nerve. The patient's position determines its location and movements. [4]

It was shown that placing local anesthetics (LA) as much as 4 mm lateral to the sheath of the brachial plexus throughout US-guided ISBPB may result in satisfactory analgesia during shoulder surgeries, to study the significance of needle-nerve closeness in the context of ISBPB [5]. The distance to the phrenic nerve is increased by this extrafascial injection, which may lessen the possibility that the local anesthetic spread would block it.

The purpose of the work is to determine the impact of the extrafascial against intrafascial (ISBPB) on the diaphragmatic excursion (phrenic nerve blockade).

Patients and Mea thods

This work was performed on 50 adult individuals, their age ranges between 21-60 years of both sexes with American Society of Anesthesiologist (ASA) physical state classification I-II who were planned for shoulder arthroscopic surgery under general anaesthesia in beach chair position.at Tanta University Hospitals over 18 months after permission from the Faculty of Medicine, Tanta University's institutional ethics committee in May 2020.

Each participant included in the trial provided signed informed consent. Every individual was given a description of the study's intervention and its purpose. A secret code number was given for each patient, and to protect participant privacy and the confidentiality of the information, the images were only used on the portion of the body related to the study.

Criteria for the exclusion were the patient's refusal, pre-existing (obstructive or restrictive) pulmonary disease, history of neck surgery or radiotherapy, history of local anaesthetics allergy, infection in the site of the block, bleeding disorders (coagulopathy), pregnancy, mental dysfunction, and body mass index (BMI) > 40 kg/m².

Participants were divided into 2 categories, each with 25 individuals according to the ultrasound-guided approach of interscalene block:

Group I (Intrafascial injection group): 10 ml of bupivacaine with a concentration of 0.5% were given to the individuals for intrafascial (conventional) ISBPB. Group E (Extrafascial injection group): 10 ml of bupivacaine with a concentration of 0.5% were given to the individuals for extrafascial ISBPB.

The group assignment was concealed from the participants and the research assistant whom were evaluating the effectiveness of the block and diaphragmatic functioning.

Preoperative assessment

Patients were properly evaluated prior to surgery by taking a thorough medical history and inquiring about any current or prior medical conditions, clinical examination including vital signs, airway assessment, chest examination, cardiac examination, auscultation, evaluation of neurological and mental status, routine laboratory investigations, pulmonary function testing [(FVC), forced expiratory volume in 1 second (FEV1) and (PEF)] to get a baseline report.

To assess postoperative pain intensity, patients were trained to use the NRS in a special visit one day before surgery. It enables patients to assess their level of discomfort on an established 11-point scale, with 0 denoting no pain and 10 denoting the most terrible agony possible.

On the day of surgery, participants were hospitalized in the preparation room to perform ISBPB. Non-invasive blood pressure (NIBP), ECG, and peripheral oxygen saturation (SpO2) monitors were routinely applied, and supplemental oxygen was provided via nasal cannula at a 3 L/ min flow rate.

Assessment of Diaphragmatic Excursion

Every individual exhibited a baseline diaphragmatic excursion prior to interscalene block. Ultrasound-guided assessment of diaphragmatic excursion with deep breath was evaluated to get the baseline value. According to Cuvillon *et al*. [6], diaphragmatic excursion with deep (sigh) breathing was assessed using a curved US probe (C5-1MHz) in M-mode while patients were in semi-sitting position and their arms extended.

Participants were imaged across the anterior axillary line with the US probe tilted cranially on the right and left sides, respectively, utilizing the spleen or liver as an acoustic window. Positive motion is defined as normal caudad diaphragmatic excursion, whereas negative motion is defined as paradoxical cephalad motion. [7].

During deep breathing, an image was obtained. The amount of diaphragmatic paralysis as described by Renes *et al*. **[8]** was then determined using these measures, with no paralysis being defined as 0–25% (a percentage change from baseline), partial paralysis being defined as 25–75%, and total paralysis being defined as 75% or more.

Thirty minutes after the block, this ultrasound-guided assessment of diaphragmatic excursion was done again.

Group I (Intrafascial Injection Group)

Before performing the intended block, a 20-gauge peripheral intravenous (IV) line was made, and (0.03 mg/kg) of midazolam was given intravenously to sedate the patient. ISBPB was carried out utilizing an ultrasonic (US) machine (Phillips Cx-50, Amsterdam, Netherlands) and a linear probe (L12-3 MHz) following the skin had been sterilized with povidone-iodine (Betadine). To see the 3 hypoechoic structures, which stand in for the roots and trunks of the brachial plexus, the transducer of the US was placed sterile along the neck side at the cricoid cartilage level (C6). Between the middle and anterior scalene muscles, both of the outermost nerve roots (C5 and C6) were recognized. Utilizing an in-plane approach, a skin wheal had been raised with 1-3 ml of 1% lidocaine.

When its tip was situated beneath the prevertebral fascia between both of the most superficial hypoechoic structures, the block needle proceeded from lateral to medial, where Bupivacaine 0.5% in 10 ml was administered in the space between the two hypoechoic circles under direct US guidance, while in Group E (Extrafascial Injection Group), The needle tip location was set 4 mm from the brachial plexus sheath's lateral edge, at a point halfway between the C5 and C6 roots. Following the injection of the local

anaesthesia (10 ml bupivacaine 0.5%), the plexus was pressed medially and the local anaesthetic disseminated next to the plexus. The distance of 4 mm lateral to the hyperechoic fascial layer of the brachial plexus covering the middle scalene muscle was selected based on the estimated success rate of above 90% [5].

In all patients, traditional techniques for ensuring safety were utilized during the interscalene block including assessing the patient feedback (paresthesia), assessing resistance to injection and frequent aspiration during injection.

Postoperative management

The individuals were sent to the post-anaesthesia care unit (PACU) and were kept under observation while wearing oxygen masks. Full recovery of the patients was confirmed with complete restoration of conscious level. Ultrasound assessment of diaphragmatic excursion was done again. Postoperative pain was assessed using NRS by the anaesthesiologist on duty who was blinded to the study arm to which the patient belonged. Postoperative analgesia was achieved by IV infusion of paracetamol (1 gm / 6 hours) as a regular analgesia, whereas IV morphine 0.05 mg/kg was given if NRS is > 3 as a rescue analgesia.

Measurements

The following parameters were evaluated in both studied groups: Demographic data (Age, gender, BMI, ASA classification and operative data), primary outcome: Ultrasound assessment of diaphragmatic excursion: Using M-mode ultrasound, the prevalence of hemi-diaphragmatic paresis is determined, was calculated 30 minutes after the block and then postoperatively in the PACU.

Block-related results, respiratory-related results, and outcomes associated with pain were the three categories of secondary outcomes. Evaluation of motor and sensory blockages was one of the results associated to blocks: Pinprick was used to measure sensory block in the C5 and C6 dermatomes, with scores ranging from 0 to 2 representing normal sensibility, diminished sensation, and loss of sensation to touch or pinprick. Arm abduction (C5) and forearm flexion (C6) were used to measure motor function (inability to resist gravity equals zero; decreased force contrasted with contralateral arm = one; no force loss equals two) [9]. Complete sensory (score = 0) and motor (scoring = 0) blockage in the placement of the C5 and C6 nerve roots is considered an effective block. This was preformed every 5 minutes after the block for 30 minutes. Failure of the block is considered if the score was 2 either sensory or motor, in this case the patient was dropped out from the study.

Respiratory-related outcome included spirometric parameters (FVC, FEV1 and PEF) that were measured before block and after discharge from PACU with a laboratory spirometer (Carefusion Germany Spirometer; Master screen PFT). During the test, Patients were told to sit up straight, and a clip was put on their nose. They were instructed to wrap their lips securely around a plastic mouthpiece that was attached to the spirometry equipment, inhale as deeply and fully as they could, and then exhale as forcefully and quickly as they could. Testing was carried out at least 3 times to ensure the most favorable outcomes since this maximum effort is crucial.

Pain related outcomes included pain intensity that was assessed by NRS. After entering the PACU, it was documented at the First, Second, Fourth, Eighth, twelfth, and twenty-fourth postoperative hours. An NRS of no more than three is considered to be pain alleviation. The patient required rescue analgesia in the form of 0.05 mg/kg of morphine until the NRS dropped to ≤ 3 if the score was more than 3. Postoperative analgesic consumption: The time to the initial demand for rescue analgesia was documented in all patients included in the study, the total 24-hour consumption of rescue analgesia was calculated for each patient, and any complication of general or regional anaesthesia was recorded and managed.

The research endpoint is reached if toxicity of local anesthetic drug occurs, or any unanticipated hazards that surfaced throughout the study were promptly disclosed to the participants and the ethics committee.

Sample size calculation

estimating the sample size based on earlier research [9] revealed that at least 21 patients were necessary in every group to find a substantial decrease of diaphragmatic excursion of at least 50% (from 90% with the use of conventional Intrafascial brachial plexus block to 45% with the use of extrafascial brachial plexus block) at alpha value of 0.05, power of study 90%, and ratio of cases to control 1:1. Twenty-five patients were included in each group to overcome the possible dropout cases.

Statistical analysis

SPSS v28 (IBM©, Chicago, IL, USA) was used for the statistical evaluation. Histograms and the Shapiro-Wilks test were applied to assess the normality of the data distribution. Unpaired student t-test was used to evaluate quantitative parametric information that was reported as mean and standard deviation (SD). To contrast two quantitative parametric measures inside the same group, a paired student t-test was performed. Interquartile range (IQR) and median were used to show and evaluate quantitative non-parametric information. The Fisher's exact test or Chi-square test was used to examine qualitative parameters that were reported as frequency and percentage (%).

The impact of injection placement on the elapsed time after the initial analgesic demand was calculated using the Kaplan-Meier curve (survival analyses). Statistical significance was defined as a two-tailed P value <0.05.

Results

75 individuals were examined to determine their eligibility for the research; 15 individuals did not satisfy the requirements, and 10 individuals declined to take part. The remaining 50 individuals were split into two distinct categories, each with 25 patients. We tracked down and statistically studied each patient. Figure 1 displays the flow diagram for the CONSORT (consolidated standards of reporting trials) protocol.

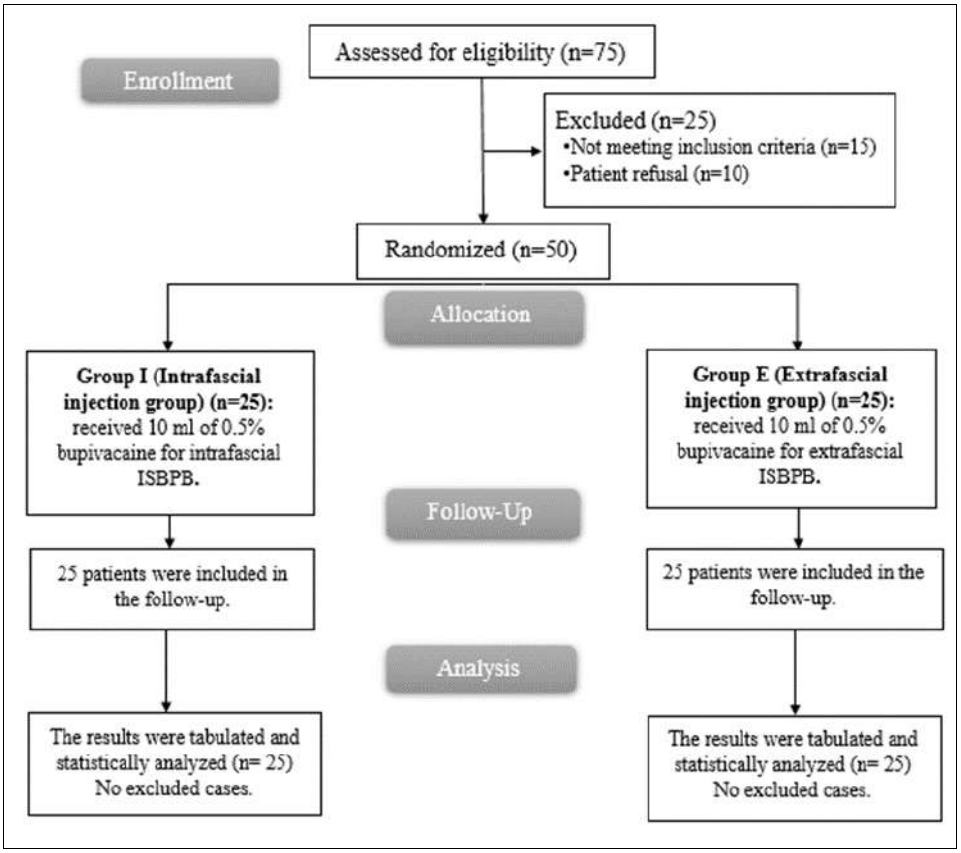

Fig 1: CONSORT flow diagram of the enrolled patients

No statistically substantial variation was existed among the two groups as regard regarding demographic and baseline line characteristics. (Table 1)

Table 1: Demographic and baseline characteristics of the studied groups.

	Group I (n = 25)	Group E (n = 25)	*P* value
Age (years)	35.6±8.2 (22 – 56)	37.8±10.4 (21–53)	0.394
Sex			
- Male	21 (84%)	19 (76%)	0.48
- Female	4 (16%)	6 (24%)	
ASA physical status			
- I	18 (72%)	20 (80%)	0.508
- II	7 (28%)	5 (20%)	
BMI (kg/m^2)			
	27.9±3.9	28.6±3.7	0.467
	(20.2-34.9)	(22.6-36.3)	
Type of surgery			
- Acromioclavicular joint resection	5 (20%)	5 (20%)	0.911
- Biceps tenotomy	7 (28%)	6 (24%)	
- Shoulder joint capsular stabilization	9 (36%)	8 (32%)	
- Open reduction-internal fixation of the clavicle	2 (8%)	3 (12%)	
Duration of surgical procedure (min)	108.6±16.3	106.4±14.8	0.613
	(82–137)	(81–139)	

Data are presented as mean ± SD (range) or count (percentage).
ASA: American Society of Anesthesiologists; BMI: body mass index
P value <0.05 indicates statistical significance.

In group, I the pre-block diaphragmatic excursions at deep inspiration had a mean of 4.14±0.39 cm. Thirty minutes after the block, the diaphragmatic excursions had a significantly decreased mean value of 3.45±0.32 cm (*p-value* <0.001). At PACU, the diaphragmatic excursions had a mean value of 2.7±0.58 cm which was significantly lower when compared to pre-block values (p value <0.001). In group E, the pre-block diaphragmatic excursions at deep inspiration had a mean value of 3.98±0.6 cm. Thirty minutes after the block, the diaphragmatic had insignificantly decreased mean value of 3.85±0.59 cm (*P* value = 0.452).
At PACU, the diaphragmatic excursions had a mean value of 3.64±0.65 cm which was comparable to pre-block values (*P* value = 0.062).
Both groups had comparable pre-block values (*P* value = 0.258). After 30 minutes of the block, extrafascial block (group E) had a significantly (*P* value = 0.005) lower effect on diaphragmatic excursion than intrafascial block (group

I). The same effect was observed at PACU. Extra-fascia block had a significantly (*p-value* <0.001) lower effect on a diaphragmatic excursion (Figure 2).

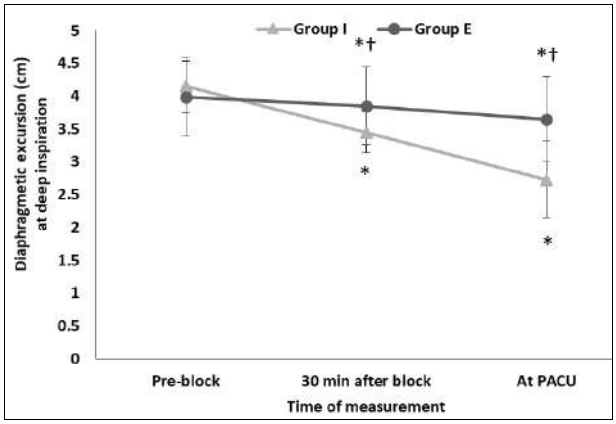

Fig 2: Diaphragmatic excursion (cm) changes at deep inspiration in the studied groups.

Data are presented as mean ± SD.
* Indicates substantial variation *vs.* pre-block value.
† Indicates substantial variation *vs.* group I at the same time of measurement.
P value <0.05 indicates statistical significance.

The effect of extrafascial block on diaphragmatic excursions at deep inspiration was significantly lower than the effect of intrafascial block (*P* value <0.001). In group E, the percentage reduction in diaphragmatic excursions ranged from 2 to 7% with a mean value of 3±1%, whereas in group I, the percentage reduction had a mean value of 16±9%. At PACU, patients subjected to extrafascial block had significantly lower percentage reduction in diaphragmatic excursions at deep inspiration as compared to those subjected to intrafascial block (*p* value <0.001). The mean value was 9±7% in group I, while in group E, the mean value was 33±16 %. (Table 2)

Table 2: Percentage reduction of diaphragmatic excursion at deep inspiration in the studied groups.

	Group I (n = 25)	Group E (n = 25)	95% CI	*P* value
% Reduction of pre-block values after 30 min	16±9 (2-38)	3±1 †(2-7)	0.092:0.168	*p*<0.001
% Reduction of pre-block values at PACU	33±16 (10-64)	9±7 † (4-30)	0.179:0.318	*p*<0.001

Data are presented as mean ± SD (range).
† Indicates substantial variation *vs.* group I at the same time of measurement.
CI: confidence interval.
P value <0.05 indicates statistical significance.

In both groups, the incidence of subjects with complete hemi-diaphragmatic paralysis (i.e., >75% reduction in diaphragmatic excursion from baseline) either 30 minutes after the block or at PACU was zero %. On the other hand, the incidence of partial hemi-diaphragmatic paralysis (i.e., 25-75% reduction) was 12% and 0% thirty minutes after intrafascial and extrafascial block; respectively. At PACU, the incidence was significantly (*P* value = 0.003) reduced to 12% in group E compared with 56% in group I. (Figure 3)

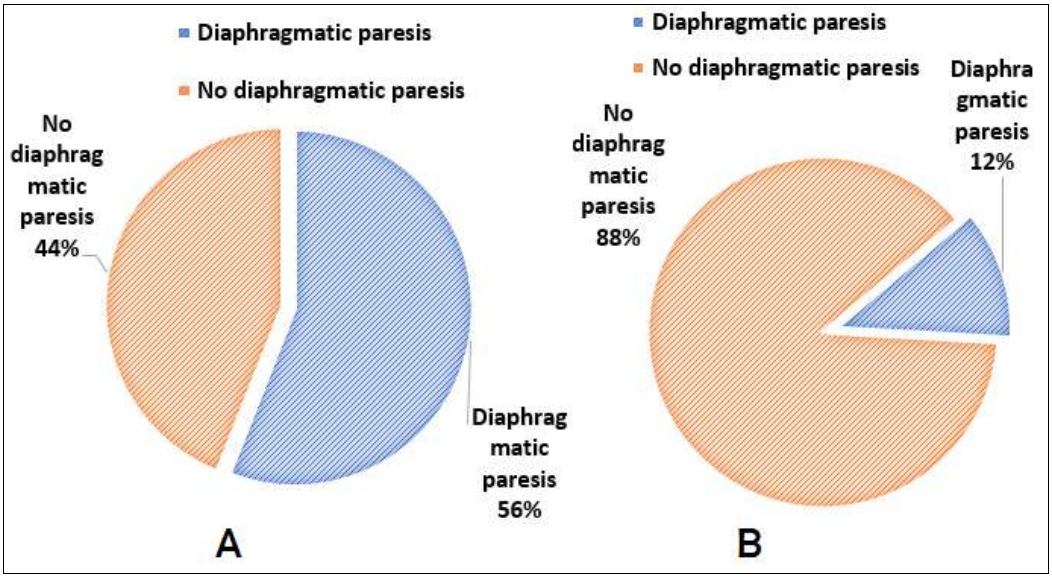

Fig 3: Incidence (%) of partial hemi-diaphragmatic paralysis in group I patients (a) and group E patients (b).

In group I, the onset of the sensory block had a mean of 14.4±2.02 min and a mean of 16.3±2.08 min in group E. The extrafascial block was associated with a significantly (*p*>value=0.002) delayed onset of the sensory block as compared to intrafascial block. Regarding the onset of motor block, it had a mean of 12.6±3.12 min in group I, and a mean of 15.3±2.88 min in group E. The extrafascial injection was associated with a significantly (*P* value = 0.003) delayed onset of motor block compared to intrafascial one. (Table 3)

Table 3: Onset (minutes) of sensory and motor block in the studied groups.

	Group I (n = 25)	Group E (n = 25)	95% CI	*P* value
The onset of sensory block	14.4±2.02 (10 – 18)	16.3±2.08 † (13–20)	-3.085: -0.755	0.002
The onset of motor block	12.6±3.12 (9–19)	15.3±2.88 † (11–21)	-4.388: -0.972	0.003

Data are presented as mean ± SD (range).
P value <0.05 indicates statistical significance.
† Indicates significant difference *vs.* group I.

CI: confidence interval.

No statistically substantial variation existed among pre-block and at PACU measurements of FVC, FEV1 and PEF in both groups I and E.

No statistically substantial variation existed among the two groups E and I as regard pre-block and PACU measurements of FVC, FEV1 and PEF. (Figure 4)

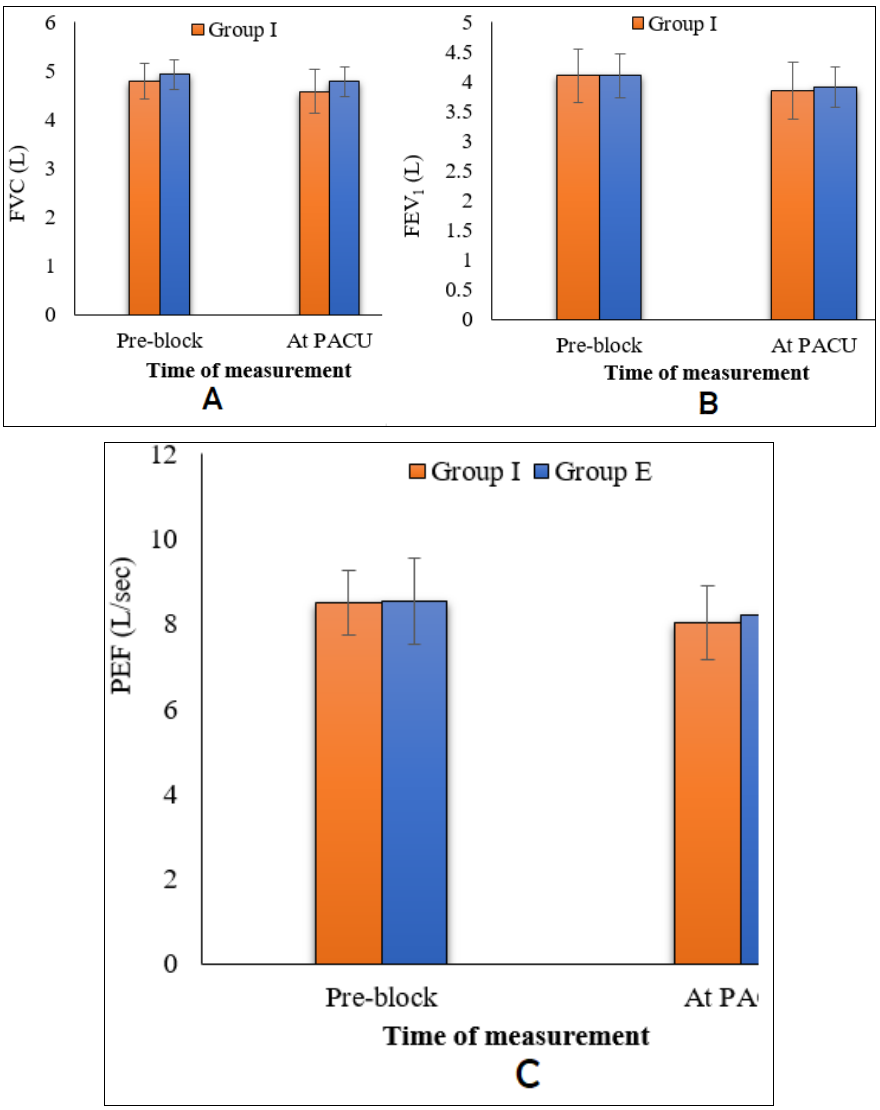

Fig 4: FVC (a), FEV1 (b), and PEF (c) changes in the studied groups

No statistically substantial variation was existed among the two groups as regard NRS scores of patients. (Figure 5)

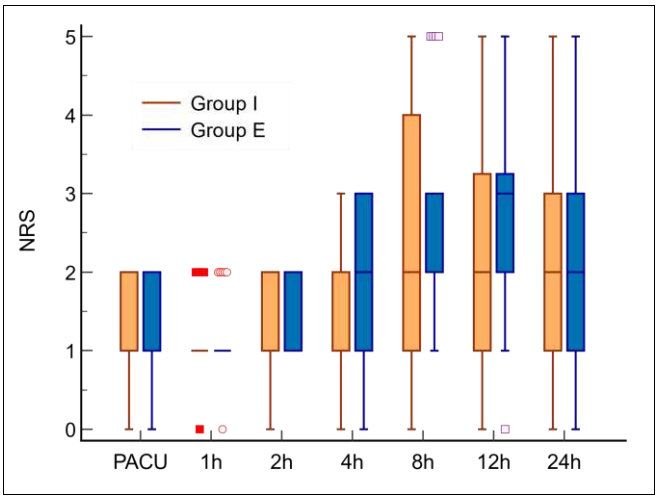

Fig 5: Box and whisker plot of NRS between both groups 1st 24 hours

In group I, the recorded NRS scores after 2, 4, 8 and 12 hours postoperatively were significantly higher than that recorded at PACU (*P* value = 0.038, *p*<0.001, 0.002, 0.002; respectively). In group E, The recorded NRS scores after 4, 8, 12 and 24 hours postoperatively were substantially greater than values recorded at PACU. (Figure 5) no statistically substantial variation was existed among the two groups according to time to first rescue analgesic according to the type of injection among the studied patients. (Figure 6)

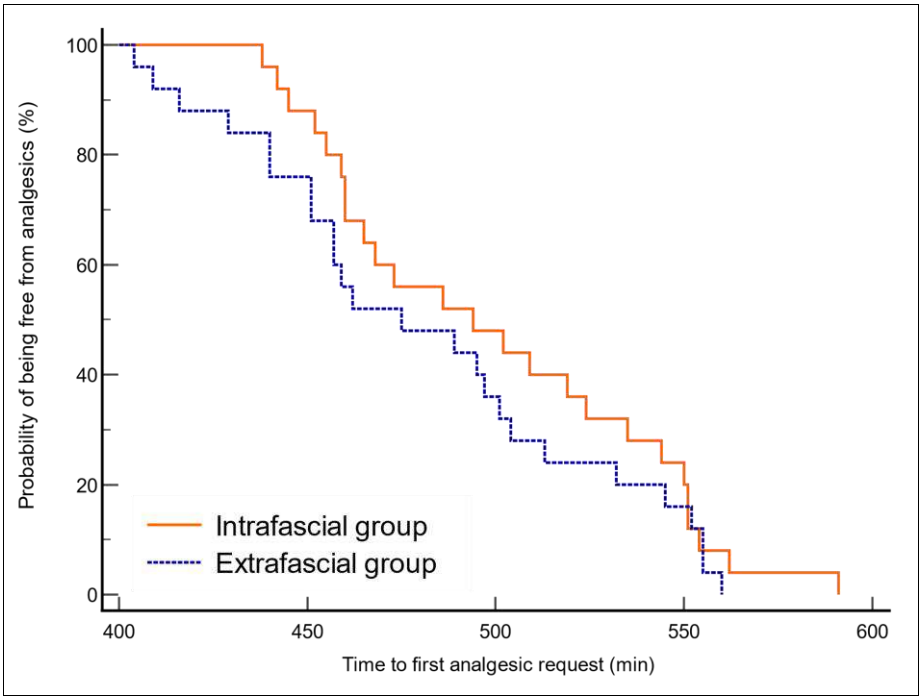

Fig 6: Kaplan-Meier graph for time to first rescue analgesic according to the type of injection among the studied patients.

Discussion

Our results reveled that extrafascial injection of bupivacaine in group E has less effect on diaphragmatic excursion either 30 min after the block, or at PACU, compared to intrafascial injection of bupivacaine in group I.

The findings of this research indicated that the frequency of partial hemi-diaphragmatic paralysis (i.e., 25-75% reduction) was 12% and 0% thirty minutes after intrafascial and extrafascial block; respectively. At PACU, the incidence was 12% in group E contrasted with 56% in group I. This might be a result of the C4 root's phrenic nerve being involved, with varied involvement from C3 and C5. Comparable with our result, Palhais *et al.* [9] stated that the incidences of hemi-diaphragmatic paresis were 90% and 21% in the intra-fascial and extra-fascial injection groups, correspondingly. In a previous study, [10]. In 40 individuals scheduled for surgery on the shoulder under general anesthesia, an US-guided ISBPB of either 5 or 20 ml ropivacaine 0.5% was administered at random. The frequency of diaphragmatic paresis was reduced, according to the authors, to 45%.

Conversely to our research, Sinha and his colleagues [11] found that lowering the interscalene block volume from 20 to 10 mL had no effect on the prevalence of hemi-diaphragmatic paresis or lung function deterioration. No discernible variations in analgesic quality or duration were found. Additionally, Sowmiya *et al.* [12] revealed that the rate of hemi-diaphragmatic paresis was substantially reduced in the extrafascial injection group contrasted with the intrafascial injection group. In the study by Kim *et al.* [13] concluded that the incidence of hemidiaphragmatic paresis was 53.8% with 10 mL group which near to our findings in intrafascial group.

According to our results, the studied patients in both groups were of comparable spirometric parameters before block and after discharge from PACU. Extrafascial interscalene block showed a lower effect on FVC, FEV_1 and PEF than intrafascial interscalene block. Despite this, there was no clinical indication of oxygen desaturation or dyspnea due to the degree of decrease. These minimal changes may be attributed to unilateral block. These findings are in line with Albrech *et al.* [14] who revealed that postoperative FEV1, FVC and PEF were insignificantly different between intrafascial and extrafascial ISB.

Contrary to our results, Palhais *et al.* [9] showed that post-procedure FEV1, FVC and PEF were significantly higher in extrafascial injection contrasted to intrafascial injection. They injected 20 ml of 0.5% bupivacaine and 1:200 000 epinephrine into the interscalene groove between C5 and C6, but we only utilized 10 ml of 0.5% bupivacaine. The different dose can explain the difference between the two studies. Ayyanagouda and his colleagues [15] disagreed with our findings as they proved that post-procedural FVC, FEV_1 and PEF in the extrafascial injection group was significantly higher compared to intrafascial injection group. This difference may be due to the different type and volumes of anesthesia used (ropivacaine versus bupivacaine).

In the present study, the extrafascial injection of bupivacaine was correlated with a delayed onset of motor and sensory blockage when compared to intrafascial injection. When administered extrafascially, the delayed start of block is probably caused by the time it takes for the medication to spread via the fascia into the nerve root. These results are supported by findings of Palhais *et al.* [9] Furthermore, Sowmiya *et al.* ([12] proved that onset of motor and sensory blockage were substantially delayed in

extrafascial injection than intrafascial injection. In another study, [15] the onset of motor and sensory blockage was faster after intrafascial contrasted to extrafascial ISBPB.

The current study showed that the time to first analgesic request and numerical rating scale (NRS) were similar for both groups in the 1st 24 hours. Compatible with our results, Palhais *et al*. [9] found that numeric rating scale (NRS) at 24 hours postoperatively were insignificantly different between intrafascial and extrafascial injection groups. Furthermore, Ayyanagouda *et al*. [15] concluded that pain scores at 6 hr (NRS) was insignificantly different between intrafascial and extrafascial group.

The current study showed that the total consumption of morphine in the 1st 24 hours were insignificantly different between both groups. Compatible with our results, Palhais *et al*. [9] found that cumulative IV morphine equivalent consumption at 24 h postoperatively was insignificantly different between intrafascial and extrafascial injection groups. On the other hand, Albrech *et al*. [14] reported that cumulative IV morphine equivalent consumption was insignificantly different between intrafascial and extrafascial groups.

In the present study, no patient in either group experienced any adverse effect in terms of Horner's syndrome, external jugular vein / intra-arterial puncture, nerve injury or epidural/spinal injection. Additionally, no one of them developed subjective dyspnea or oxygen desaturations. The incidence of the reported side effects after ISBPB varied amongst previous studies. Riazi *et al*. [10] showed that lower volume (5 ml) showed no adverse events while Three individuals (15%) each had Horner's syndrome, Three individuals (15%) had post-block hoarseness in higher volume group (20 ml). Palhais *et al*. [9] proved that their paresthesia occurred in 30%, hoarseness 35% and Horner syndrome 35% patients in intrafascial injection group and paresthesia didn't develop in extrafascial injection group while hoarseness occurred in 5% and Claude-Bernard-Horner syndrome 20% patients.

We didn't contrast the placebo groups in this trial, nor did we evaluate general anesthesia without an interscalene block. These could be potential study topics in the future**.** Another limitation is that the sample size in this study was small and none of the patients experienced any side effect due to block. It is probable that difficulties may have happened in any group with a bigger sample size. When contrast to a traditional intrafascial injection, US-guided ISBPB utilizing an extrafascial injection of LA lowers the occurrence of HDP and its influence on breathing capacity. Therefore, extrafascial block is likely a more appropriate choice than intrafascial one**.** Future clinical studies on individuals with respiratory impairment may be conducted to verify the outcomes of the extrafascial method. Long follow up period for the patients. Extrafascial injection safer than intrafascial injection with the same efficacy so it is suggested to be used in the shoulder arthroscopy.

Conclusions

Patients undergoing shoulder arthroscopy have better diaphragmatic excursion after extrafascial than after intrafascial ISBPB. A delayed onset of motor block is caused by the extrafascial method of managing interscalene brachial plexus block, as well as sensory block. Both approaches provide effective and comparable analgesia without any adverse effects. Given the increased incidence of partial hemi-diaphragmatic paralysis (HDP) with intrafascial approach, extrafascial method to interscalene brachial plexus block is likely a more appropriate choice.

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References

1. Brown AR, Weiss R, Greenberg C, Flatow EL, Bigliani LU. Interscalene block for shoulder arthroscopy: comparison with general Anaesthesia. Arthroscopy. 1993;9:295-300.
2. Urmey WF, Talts KH, Sharrock NE. One hundred per cent incidence of hemidiaphragmatic paresis associated with interscalene brachial plexus anaesthesia as diagnosed by ultrasonography. Anesth Analg. 1991;72:498-503.
3. Chan VW. Applying ultrasound imaging to interscalene brachial plexus block. Reg Anesth Pain Med. 2003;28:340-3.
4. Houston JG, Morris AD, Howie CA, Reid JL, McMillan N. Technical report: Quantitative assessment of diaphragmatic movement-A reproducible method using ultrasound. Clin Radiol. 1992;46:405-7.
5. Albrecht E, Kirkham KR, Taffé P, Endersby RV, Chan VW, Tse C, *et al*. The maximum effective needle-to-nerve distance for ultrasound-guided interscalene block: an exploratory study. Reg Anesth Pain Med. 2014;39:56-60.
6. Cuvillon P, Le Sache F, Demattei C, Lidzborski L, Zoric L, Riou B, *et al*. Continuous interscalene brachial plexus nerve block prolongs unilateral diaphragmatic dysfunction. Anaesth Crit Care Pain Med. 2016;35:383-90.
7. Lloyd T, Tang YM, Benson MD, King S. Diaphragmatic paralysis: the use of M mode ultrasound for diagnosis in adults. Spinal Cord. 2006;44:505-8.
8. Renes SH, Rettig HC, Gielen MJ, Wilder-Smith OH, van Geffen GJ. Ultrasound-guided low-dose interscalene brachial plexus block reduces the incidence of hemidiaphragmatic paresis. Reg Anesth Pain Med. 2009;34:498-502.
9. Palhais N, Brull R, Kern C, Jacot-Guillarmod A, Charmoy A, Farron A, *et al*. Extrafascial injection for interscalene brachial plexus block reduces respiratory complications compared with a conventional intrafascial injection: a randomized, controlled, double-blind trial. Br J Anaesth. 2016;116:531-7.
10. Riazi S, Carmichael N, Awad I, Holtby R, McCartney C. Effect of local anaesthetic volume (20 vs 5 ml) on the efficacy and respiratory consequences of ultrasound-guided interscalene brachial plexus block. Br J Anaesth. 2008;101:549-56.
11. Sinha SK, Abrams JH, Barnett JT, Muller JG, Lahiri B, Bernstein BA, *et al*. Decreasing the local anesthetic volume from 20 to 10 mL for ultrasound-guided interscalene block at the cricoid level does not reduce the incidence of hemidiaphragmatic paresis. Reg Anesth Pain Med. 2011;36:17-20.
12. Sowmiya S. Extrafascial Injection for Interscalene Brachial Plexus Block reduces Respiratory Complications Compared with a Conventional Intrafascial Injection: A Randomized, Controlled,

Double Blind Trial: Madurai Medical College, Madurai; 2019.
13. Kim KS, Ahn JH, Yoon JH, Ji HT, Kim IS. Hemidiaphragmatic Paresis Following Interscalene Brachial Plexus Block With 2-Point Injection Technique. Pain Physician. 2021;24:507-15.
14. Albrecht E, Bathory I, Fournier N, Jacot-Guillarmod A, Farron A, Brull R. Reduced hemidiaphragmatic paresis with extrafascial compared with conventional intrafascial tip placement for continuous interscalene brachial plexus block: A randomized, controlled, double-blind trial. Br J Anaesth. 2017;118:586-92.
15. Ayyanagouda B, Hosalli V, Kaur P, Ambi U, Hulkund SY. Hemi-diaphragmatic paresis following extrafascial versus conventional intrafascial approach for interscalene brachial plexus block: A double-blind randomised, controlled trial. Indian J Anaesth. 2019;63:375-81.

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