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RCT of ESP plane block vs. peri-articular injection for pain control after arthroscopic shoulder surgery

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Introduction

Arthroscopic shoulder surgery can cause moderate-to-severe postoperative pain that interferes with recovery. Although interscalene brachial plexus (ISP) block can provide effective analgesia for shoulder surgery and is considered the gold standard among regional analgesia techniques, it is associated with several drawbacks, including the potential for phrenic nerve blockade; persistent neurological complications; rebound pain; and pneumothorax (1). Proposed alternative techniques include erector spinae plane (ESP) block, selective nerve root blocks, and intra-articular or periarticular injections (PAI). ESP block is becoming increasingly popular because of its relative ease and safety. For shoulder analgesia, there have been multiple case reports involving acute and chronic shoulder pain management, with very few comparative trials (2). Although PAI has been shown to decrease pain and opioid consumption it is less effective compared with other regional anesthetic techniques (3). We hypothesized that ESP would provide superior analgesia with few adverse effects compared with PAI.

Materials and Methods

We used a 2-arm parallel group RCT to compare preoperative ultrasound-guided ESP block performed at the T2 level with surgeon-performed PAI at the end of surgery using a double-dummy blinding strategy. Our primary objective was to compare pain scores at rest in the post-anesthesia care unit (PACU). This trial was approved by the local REB and the protocol was registered and published. Sixty-two patients >18 years undergoing elective arthroscopic shoulder repair as day case surgeries were included after informed consent and randomized using computer-generated permuted blocks to receive active ESP block with saline PAI injection (n=31) or active PAI with saline ESP block (n=31). Patients with allergy to study medications, known coagulopathy, or history of daily opioid intake for chronic pain were excluded. Allocation was known only for pharmacy; patients, health providers, and data collectors were blinded with the pharmacy providing sets of similar-looking syringes, marked as ‘for ESP’ and ‘for PAI’ for each patient. For both groups we used 30 ml of either bupivacaine 0.25% with 5 µg.ml-1 adrenaline, or saline. The ESP block was performed in a dedicated block room with appropriate monitoring by trained anesthetists who perform it on a regular basis. Patient was seated with area over the thoracic spine sterilized and draped. A high-frequency linear ultrasound transducer (LOGIQ e, GE Healthcare) was placed in a longitudinal parasagittal orientation, 3–4 cm lateral to the T2 spinous process. A 21-gauge, 8 cm needle was inserted using an in-plane approach to place the tip into the fascial plane on the deep

(anterior) aspect of the erector spinae muscles. The location was confirmed by injecting dextrose 5% solution and observing fluid spread after which the solution was injected in 5 ml aliquots. The surgeon performed PAI at the end of the surgical procedure, injecting 15 ml into the intra-articular space, and another 15 ml spread between the port sites and subacromial space. All patients received a general anesthetic with the use of a tracheal tube and received pre-operative dexamethasone 8 mg and ondansetron 4 mg before extubation. To be pragmatic, no restrictions were placed on the choice or dosing of intra-operative opioid, except that no long-acting opioid was to be administered within the 30 min before extubation. NSAID use was not permitted, and ketorolac was used as a rescue analgesia after primary outcome measurement. The primary outcome was the resting pain score 30 min after admission in PACU, assessed using the patient-reported 0-10 numeric rating scale (NRS). Secondary outcomes included pain scores with movement; opioid use; patient satisfaction; sensory blockade (based on cold sensation on the side of the operated shoulder and upper limb using ice from C4 to T2), adverse effects in hospital; and outcomes at 24 h and 1 month for persistent pain and opioid use. The study was analyzed using an intention-to-treat approach.

Results/Case Report

Among 270 patients, 69 patients were recruited and 62 were randomized (7 excluded due to other reasons). One patient (ESP group) withdrew, and another was lost to follow-up (Figure 1). Baseline characteristics of included patients were similar (Table 1). We observed no difference in median (IQR) pain at rest in PACU between PAI and ESP block groups, 6 (3–8) and 7 (4–9), median difference (95% CI) 0.57 (1.9–3.1); p=0.65. However, the median postoperative oral morphine equivalent utilization was significantly higher in the ESP block group (21 mg vs. 12 mg; p=0.028) (Table 2). There was no difference in pain scores in PACU or at discharge, intra-operative opioid use, or patient satisfaction (Table 2). There was no difference in the incidence of postoperative nausea and vomiting, itching, or respiratory depression, and there were no cases of diaphragm paralysis or local anesthetic toxicity (Table 3). There was variability in the percentage of patients for segmental sensory blockade. Within the ESP group, the largest percentage (62%) of blockade was observed at T2 and with other levels involving blockade in approximately 50% patients (Figure 2). With PAI, 48% patients reported blockade at C4 and T2 with approximately 30% patients reporting blockade at other levels. There were no differences in 24-h outcomes; 14 patients reported some persistent pain at 1 month, but there were no differences between the groups.

Discussion

Our study demonstrated that ESP plane block was not superior to PAI for arthroscopic shoulder surgery. Reports of successful ESP for shoulder surgical analgesia have been mostly case reports. Nair and Diwan report good analgesia and opioid reduction but suggest the importance of continuous infusion (4). However, Ciftci et al report significant opioid reduction and pain scores at all time-points with single-shot ESP in a small RCT of shoulder surgery patients (5). Sensory testing as well as cadaver studies reveal inconsistent anatomical spread with ESP block. We had some unexpected sensory blockade in PAI group, possibly because of systemic effect. Being a small-sized trial was an important limitation. However, the results do not indicate the potential for therapeutic benefit even with a larger trial, as indicated by the pain scores. As such, high thoracic ESP cannot be recommended for shoulder surgery over other simpler alternatives such as PAI.

References

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please stand up? A systematic review and meta-analysis. Anesthesia and Analgesia 2015; 120: 1114–29.

2. Czuczman M, Shanthanna H, Alolabi B, et al. Randomized control trial of ultrasound-guided erector spinae block versus shoulder peri-articular anesthetic infiltration for pain control after arthroscopic shoulder surgery: Study protocol clinical trial (SPIRIT compliant). Medicine (Baltimore) 2020; 99: e19721.

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Disclosures

No

Tables / Images

Figure 1: Flow chart of patient inclusion in this study. PAI, peri-articular infiltration; ESP, erector spinae plane

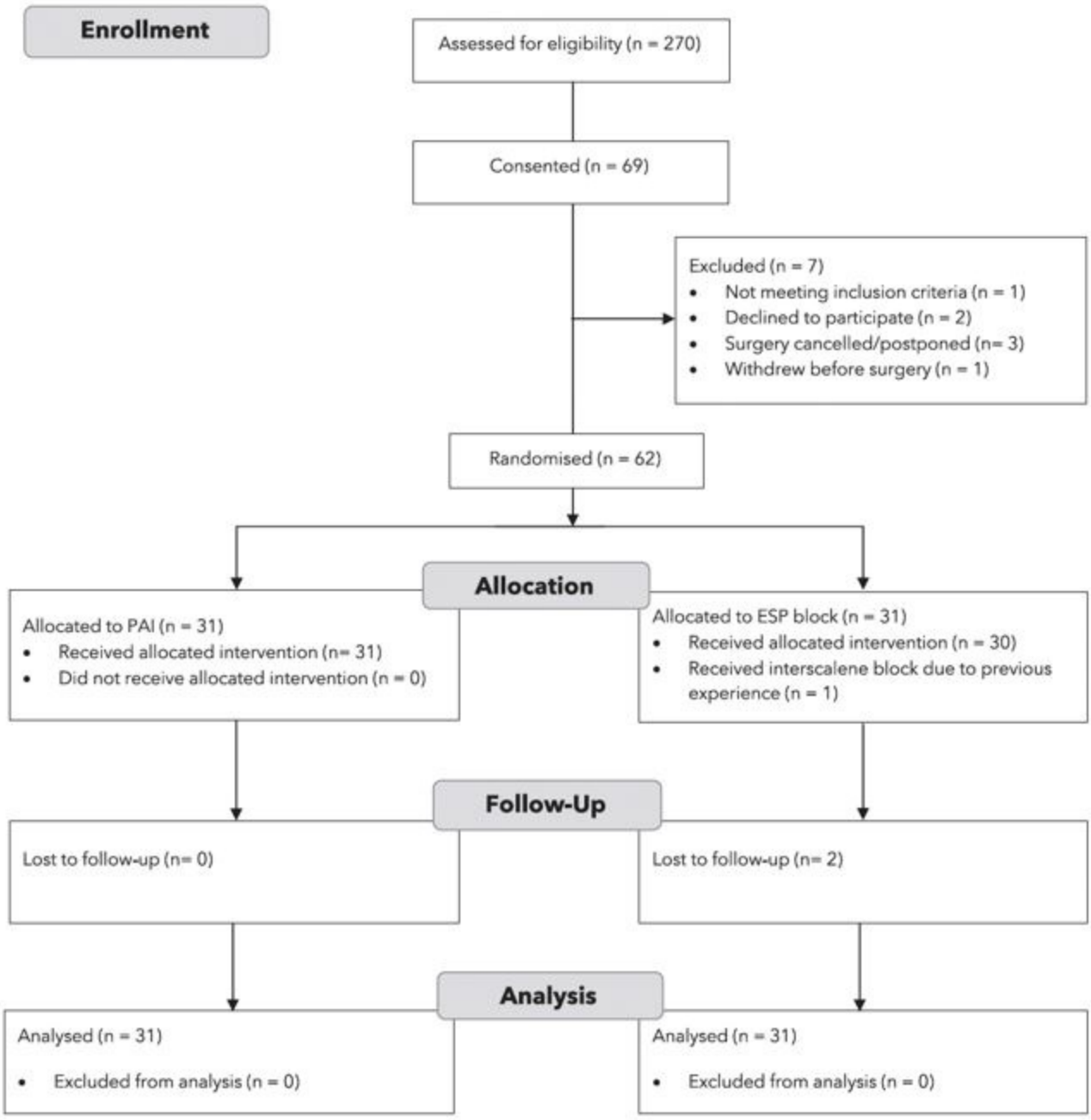

Figure 2: Number of patients with each dermatomal segmental blocked following peri-articular injection (black; n = 31) or erector spinae plane block (grey; n = 29)

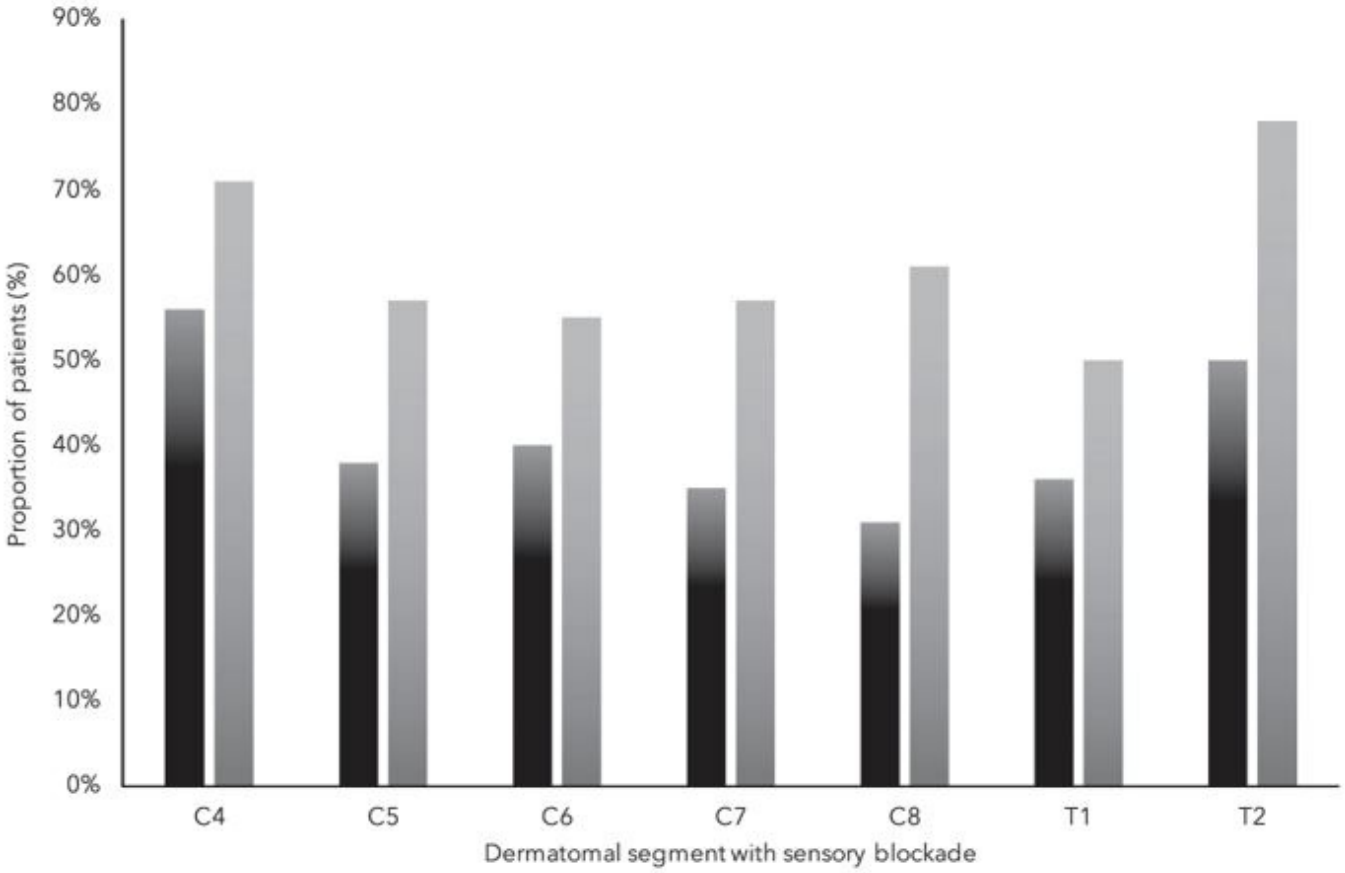

Table 1: Baseline characteristics of patients receiving erector spinae plane block or periarticular injection for analgesia in arthroscopic shoulder joint repair

Variable		PAI (n=31)	ESP Block (n=31)
Age (years): Mean (SD)		43.77 (15.76)	44.81 (15.77)
Sex, n (%)	Female	13 (42)	5 (16)
	Male	18 (58)	26 (84)
Height (cm) - n, mean (SD)		169.42 (10.52)	173.20 (8.69)
BMI - n, mean (SD)		27.76 (4.75)	29.20 (5.50)
ASA, n (%)	1	9 (29)	13 (42)
	2	15 (48)	11 (35)
	3	7 (23)	7 (23)
Duration of surgery in minutes		91.26 (32.91)	97.93 (38.97)

ASA: American Society of Anesthesiologists; BMI: body mass index; n=number; ESP: erector spinae plane; PAI: periarticular injection

Table 2: Primary and secondary outcomes measured during hospital stay and discharge

Outcome		PAI (n=31)	ESP Block (n=29)	Differences in Medians or Means with 95% CI*	P value*
Pain at rest in PACU after 30 minutes	Median (Q1:Q3)	6 (3,8)	7 (4,9)	0.57 (-1.93,3.08)	0.65
	Mean (SD)	5.48 (2.72)	5.9 (3.30)	0.29 (-1.24,1.81)	NA
Pain with movement in PACU after 30 minutes	Median (Q1:Q3)	4 (3,8)	5 (3,7)	1.00 (-1.30,3.30)	0.39
	Mean (SD)	4.71 (3.09)	5.14 (3.04)	0.32 (-1.22,1.87)	NA
Pain at rest at hospital discharge	Median (Q1:Q3)	3 (1,4)	3 (2,5)	0.00 (-2.30,2.30)	>0.99
Pain with movement at hospital discharge	Median (Q1:Q3)	4 (1,5)	4 (2,7)	0.30 (-1.98,2.58)	0.79
Opioid usage in OME postoperatively up to discharge (log)	Median (Q1:Q3)	12 (6.0,19.5)	21 (3.0,32.0)	0.47 (0.05,0.88)	0.028
	Mean (SD)	14.82 (12.31)	20.39 (18.16)	0.42 (0.06,0.79)	NA
Intraoperative opioid usage in IMV:	Median (Q1:Q3)	25 (20,35)	26 (15,35)	1.00 (-5.45, 7.45)	0.76
Patient satisfaction at discharge	Median (Q1:Q3)	6.5 (6,7)	7 (6,7)	0.46 (-0.95,1.88)	0.52

ESP: erector spinae plane block; log: estimated after log transformation because the distribution was highly skewed to right; n: number: NA: not applicable; PACU: postanesthetic care unit; PAI: periarticular injection; PONV: postoperative nausea-vomiting; OME: oral morphine equivalents; IMV: intravenous morphine equivalents; Q1:Q3: first: third quartile.
**Values below were obtained from multiple imputation analyses to account for missing data and using quantile or linear regression tests as appropriate.*

Table 3: Postoperative adverse effects measured during hospital stay

Outcome	PAI (n=31)	ESP Block (n=29)	Differences in Risk with 95% CI*	P value*
Incidence of moderate to severe PONV, n (%)	5 (16)	5 (16)	0.02 (-0.17,0.21)	0.84
Incidence of moderate to severe itching, n (%)	0 (0)	3 (10)	0.10 (-0.00,0.21)	0.06
Incidence of ipsilateral diaphragmatic paralysis, n (%)	0	0	NA	NA
Incidence if respiratory depression, n (%)	7 (23)	7 (23)	0.03 (-0.19,0.24)	0.82
Incidence of local anesthetic toxicity, n (%)	0	0	NA	NA

ESP: erector spinae plane block; n: number: NA: not applicable; PAI: periarticular injection; PONV: postoperative nausea-vomiting
**Values below were obtained from multiple imputation analyses to account for missing data and using binomial regression tests*