ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

ARTHROSCOPIC SHOULDER SURGERY- COMPARISON OF COSTOCLAVICULAR BLOCK WITH INTERSCALENE BLOCK FOR POSTOPERATIVE ANALGESIA

Dr Dillip Kumar Chand[1], Dr Sujit Kumar Lakra[2], Dr Shankar Prasad Hatei[3] Dr Aniruddha Mishra,[4] Dr Kamala Kanta Pradhan[5]

[1]Assistant Professor**,** Department of Orthopaedics. Shri Jagannath Medical College, Puri

[2]Assistant Professor**,** Department of Orthopaedics**.** S.C.B Medical College, Cuttack

[3] Assistant Professor Department of Anaesthesiology. Govt Medical College, Sundargarh

[4] Assistant Professor, Department of Anaesthesiology. S.C.B Medical College, Cuttack

[5]Associate Professor, Department of Anaesthesiology, Govt Medical College, Sundargarh

Corresponding Author: Dr Aniruddha Mishra. Assistant Professor, Department of Anaesthesiology. S.C.B Medical College, Cuttack

Abstract

Background & aim: Interscalene brachial plexus block provides efficient analgesia after arthroscopic shoulder surgery. But it is associated with a greater occurrence of unilateral diaphragmatic paralysis. This may add to patient dissatisfaction and also may not be tolerated well by patients having respiratory diseases. We have compared the efficacy of costoclavicular block (CCB) with interscalene block (ISB) for postoperative analgesia in patients undergoing arthroscopic shoulder surgery.

Methods: Fifty patients were randomly divided in to two group of 25 each (ISB or CCB group). 20 mL of levobupivacaine (0.5%) with 4 mg of dexamethasone were used in both ultrasound guided ISB and CCB. Numerical rating scale (NRS)scores for pain was assessed at 0.5, 1,2, 4, 6, 12, and 24 hr in postoperative period. The mean onset time, time to first analgesia request, total analgesic requirement for 24 hrs postoperatively, patient satisfaction, incidence of hemidiaphragmatic paralysis and any other complications were recorded.

Results: Numerical rating scale pain scores in both groups at 0.5, 1, 2, 3, 6, 12, and 24 hours were comparable. ($P > 0.05$) Mean onset time of block was earlier in ISB group compared to CCB group. ($P < 0.05$) There was higher incidence of unilateral diaphragmatic paralysis in ISB group compared to CCB group ($P < 0.05$). There was no significant difference regarding time to first analgesia request and total analgesic requirement in 1st 24 hrs. Patients were more satisfied in CCB group compared to ISB group.

Conclusion: As CCB provided equivalent analgesia in postoperative period like ISB without any risk of unilateral diaphragmatic paralysis, it can be a better alterative to ISB for postoperative analgesia in arthroscopic shoulder surgery.

Keywords: Interscalene block, costoclavicular block,postoperative pain, shoulder surgery, arthroscopy.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

Introduction: Arthroscopic shoulder surgeries are minimally invasive, surgeries, which is usually associated with moderate to severe postoperative pain. This can produce serious aches and pains to the patients ,leading to delayed recovery,rehabilitation and discharge.[1] Patients with pre-existing respiratory diseases pose a challenge for postoperative analgesia after shoulder surgery as interscalene block (ISB), the gold standard block for shoulder surgery, can produce unilateral diaphragmatic paralysis (UDP).ISB was also associated with complications like weakness of arm, hoarseness of voice and Horner's syndrome**.** Where as so many diaphragm sparing nerve blocks have been studied, none has come close to provide equipotent analgesia to ISB without producing UDP. [2] In a study by Wiegel et al [3], they concluded that analgesic efficacy of isolated suprascapular blocks was not so potent. Lee JJ et al [4] studied combined suprascapular nerve blocks with targeted axillary nerve blocks which produced poor analgesia after arthroscopic surgery. Karmakar et al [5] described the costoclavicular block (CCB) which targets the brachial plexus in the costoclavicular space. In the costoclavicular space, the three cords are tightly clustered and densely packed. So low volume of local anesthetic is required for the block and also avoid the chance of pneumothorax and unilateral diaphragmatic paralysis (UDP). The costoclavicular space is bounded by the subclavius and pectoralis major muscles ventrally, and anterior chest wall dorsally. Garcia-Vitoria et al[6] in their study opined that the costoclavicular space can act as a retrograde channel to supraclavicular brachial plexus blocks which can avoid unilateral diaphragmatic paralysis**.** There were very few studies in literature comparing ISB with CCB for postoperative analgesia after arthroscopic shoulder surgeries. So in this study, we have compared CCB with ISB for postoperative analgesia in patients undergoing arthroscopic shoulder surgery.

Methods

This prospective randomized study was conducted in a tertiary care hospital from Jan 2020 to Jan 2021 after obtaining institutional ethical committee approval. 50 patients of ASA I/II and of aged 19-70years, posted for arthroscopic shoulder surgery were enrolled in our study and written informed consent was obtained from all patients. Patients with pre-existing respiratory disease, coagulopathy, infection at block site, liver or renal problems, pregnancy, allergy to local anesthetics, and prior surgery in the block site were excluded from the study. On arrival in operation theatre, an 18-G iv cannula was put. Premedicant like IV midazolam 0.04mg/kg and fentanyl 1 µg/kg was administered to all patients. Oxygen was supplemented at 4 L/min and Spo2,heart rate,noninvasive blood pressure and ECG were monitored. For both blocks, a GE Logiq F™ (General Electric Healthcare, Little Chalfont, United Kingdom) ultrasound with a high frequency (6–15 MHz) 38 mm L6–12 linear probe and a Stimuplex® A 50/100 mm (B Braun HNS 11-12218, Stockert GmbH, BotzingerStrabe 72, D-79111 Freiburg, Germany) were used. Using a computer initiated sequence of random numbers all patients were randomly allocated into one of the two groups, ISB (n=25) and CCB (n=25). The allocation outcome were kept sequentially in a sealed, opaque envelope, which was opened by the anaesthesiologist

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

before executing the blocks.ISB was given as described by Spence et al [7]. The transducer was put on the lateral side of the neck at the level of the cricoid cartilage. Three hypoechoic structures, representing the roots and trunks of the brachial plexus was visualized. Using in-plane approach, the needle was advanced from lateral-to-medial direction. When tip reaches below the prevertebral fascia between the two superficial hypoechoic structures,20 ml of Levobupivacaine 0.5% with 4 mg dexamethasone was injected.CCB was given as described by Karmakar et al.[5] The transducer was initially put over the middle third of the clavicle. Then it was gradually shifted off the lower border and placed in the medial infraclavicular fossa. Axillary artery was recognized below the subclavius muscle and lateral to the axillary artery, three cords of the brachial plexus were identified. Using an in-plane approach ,needle was advanced until its tip was located in the middle of the three cords where 20 ml of Levobupivacaine 0.5% with 4 mg dexamethasone was injected. All the blocks were given by experienced anesthesiologist. After the performance of the blocks, blocks were evaluated at every 5 min until 30 min. Sensory block was tested on the area over the clavicle and the lateral surface of the deltoid. Each area was classified as per a three point scale utilizing a cold test: 0-failed block, 1-analgesia, 2=anesthesia. Motor block was assessed using various movements like shoulder abduction for axillary nerve and external shoulder rotation for suprascapular nerve using a three point scale: 0-failed block, 1-weakness, 2-paralysis. Block was complete, if the composite score was ≥6 after 30 min. [8] Unilateral diaphragmatic paralysis was assessed by the anesthesiologist blinded to the study group at 30 min after the blocks**.** Onset time of block was interpreted as the time required for composite score of 6 to be achieved. After assessment of all blocks, patients were administered general anesthesia using IV propofol (2 mg/kg), fentanyl (1 µg/kg), and rocuronium (0.6 mg/kg) At the end of surgery, patients were extubated and shifted to post anesthesia care unit (PACU).In PACU, another anesthesiologist assessed pain on rest at 0.5,1, 2, 3, 6, 12, and 24 hours using a 0–10 numerical rating scale (0=no pain; 10=worst imaginable pain). If the NRS score was > 4, paracetamol 1gm was given IV.Same anesthesiologist evaluated unilateral diaphragmatic paralysis at 30 min after arrival in the PACU using ultrasound. Mean performance time ,complete blocks at 30 min, mean onset time, time of 1st analgesia request and total analgesic consumption was recorded. The incidence of other complications like hoarseness and horner syndrome was recorded. Patient satisfaction score was assessed on questionnaire method with a 4 point scale. (excellent, good, fair, poor)

A difference in NRS score between ISB and CCB group of less than 1.3 points measured at various time interval was considered significant. Based on a previous study,[10] it was presumed that the standard deviation would be 1.5 in the NRS score between the two groups on the 1st 24hrs. So, taking the α=0.05 and power = 0.90, the minimum required sample size was estimated to be at each 22 for each group. Anticipating 10% loss to follow-up, the sample size was increased to 25 patients per each group. Chi-square test was used for categorical data and Student t or ANOVA was used for the numerical data. *P* values <0.05 was taken as statistically significant.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

Results

There was no statistically significant difference in both groups regarding demographic parameters, ASA status, pre op NRS score, type of surgery and duration of surgery.(table1) NRS scores were comparable in both groups at 0.5, 1, 2, 3, 6, 12, and 24 hours postoperatively.($p>0.05$) (table 1)Mean onset time of block was earlier and patient satisfaction was better in CCB group compared to ISB block.($p<0.05$) Both groups were comparable regarding mean performance time ,complete blocks at 30 min, time of 1st analgesia request and total analgesic consumption. ($p>0.05$)(table 2) Incidence of UDP 30 min after the block and in the PACU was greater in ISB group compared to CCB group. ($p<0.05$) Regarding other complications like horner syndrome and hoarseness, both groups were comparable. (table 3)

Table 1: Patient characteristics

Variables	Group ISB (n-25)	Group CCB (n-25)	P value
Mean age in years	50.42± 12.84	51.85± 12.94	0.291
Male /Female(n)	22/3	21/4	0.314
Mean BMI in (kg/m^2)	26.12±2.45	25.86± 3.12	0.451
ASA status-I/II (n)	20/5	20/5	0.164
Pre op NRS score at rest	2.11± 1.15	2.64± 1.42	0.240
Type of surgery(n)-			
Rotator cuff repair	14	14	0.151
Acromioplasty(n)	6	7	0.192
Bankart Repair(n)	5	4	0.208
Duration of surgery(mins)	115.55± 29.14	116.34± 29.68	0.112

Table 2: Block parameters and analgesia requirement

Parameters	Group ISB(n-25)	Group CCB (n-25)	P value
Mean performance time (SD) (min)	9.5 ±4.9	9.1± 6.9	>0.05
Mean onset time (SD) (min)	16.78± 5.50	18.42± 4.74	<0.05
Complete blocks at 30 min (N (%))	25(100%)	25(100%)	>0.05
Time of 1st analgesia request(HR)	7.8 ± 1.5	7.4 ± 1.8	>0.05
Total analgesic consumption(gm)	2.6 ± 0.7	2.7 ± 0.6	>0.05
Patient satisfaction at 24 hours(n)(excellent:good:fair:poor)	7:15:2:1	20:4:1:0	<0.05

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

Table 3 : Complications of ISB/CCB block

Parameters	Group ISB (n-25)	Group CCB (n-25)	P value
Unilateral diaphragmatic paralysis (30 min after block) (n (%))	20(80%)	0	<0.05
Unilateral diaphragmatic paralysis in PACU) (n (%))	20(80%)	0	<0.05
Horner syndrome (n (%))	5(20%)	0	>0.05
Hoarseness (n (%))	5(20%)	2(8%)	>0.05

Discussion

Interscalene block is the gold standard for postoperative pain management after any shoulder surgery. ISB decreases the pain scores for minimum 6 to 8 hrs and reduces opioid requirement in postoperative 24 hrs.[11] Efficacy of ISB in shoulder surgery has been well studied by Dhir et al [12], Pitambo et al [13], and Neuts et al [14]. But there were concerns regarding phrenic nerve paresis and unilateral diaphragmatic paralysis in ISB which can produce transient and long-term respiratory complications.[5] Many deferent diaphragm-sparing nerve blocks for shoulder analgesia have been studied by Tran et al [15] . They opined that, no block provided surgical anaesthesia without phrenic nerve paralysis. Few cadaveric and clinical studies have opined that, CCB can be utilized as an substitute to ISB for post operative analgesia after shoulder surgery.Mistry et al has given bilateral CCB with 15 ml of local anesthetics on each side and reported good analgesia without phrenic nerve paralysis.[16] Koyalamundi et al [17] in a recent human cadaveric study also supported this. In his study, 20 mL of 0.1% methylene blue dye was injected to costoclavicular space(CCS) and the dye was found spreading towards cephalad part of brachial plexus. The dye stained all the trunks and cords of the brachial plexus, but phrenic nerve was not stained. So they opined that,local anesthetics injected to CCS may spare phrenic nerve. But the incidence of phrenic nerve paralysis in CCB in deferent studies are variable as deferent volume of drug was used in those studies. Sivashanmugam et al [18] in their study concluded that,the incidence of unilateral phrenic nerve paralysis was nil with 20 ml of drug and 8.9% with 35 ml of drug after ultrasound guided CCB in deferent studies. In our study,we found that NRS scores were comparable in both ISB and CCB groups at 0.5, 1, 2, 3, 6, 12, and 24 hours postoperatively. Mean onset time of block was earlier and patient satisfaction was better in CCB group compared to ISB block. Incidence of HDP, 30 min after the block and in the PACU was greater in ISB group compared to CCB group. ($p<0.05$) This was in agreement with a study by Aliste et al. [10] They have also compared the efficacy of CCB with ISB for post operative analgesia in arthroscopic shoulder surgery and also compared its complications. Both ISB and CCB produced equivalent analgesia without any occurrence of phrenic nerve paralysis. They hypothesized that,the rostral spread of the local anesthetics from costoclavicular space towards the roots of brachial plexus could have blocked the innervation of the shoulder joint area sparing the phrenic nerve, there by avoiding phrenic nerve paralysis.They have have

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

advocated for larger trial taking more no of patients to validate their findings.Spread of local anesthetics in interscalene groove in the direction of phrenic nerve or towards C3–C5 nerve roots are possible mechanism of unilateral diaphragmatic paralysis after ISB. Leurcharusmee et al [19] in their study opined that, on moving from ISB towards supraclavicular brachial plexus blocks, occurrence of UDP gradually decreases from 100% to as low as 67%. On moving further below towards the costoclavicular space in the infraclavicular region, incidence of UDP further decreased. Aliste et al [10] hypothesized that the CCB reliably anesthetize the lateral cord,posterior cord, supraclavicular brachial plexus, and the suprascapular nerve and termed it as a sweet spot. One of the dilemma in CCB was that, the ideal volume of local anesthetic was still not known. Sotthisopha et al [20] in his study of CCB ,concluded that the minimum effective volume of local anesthetic lidocaine (1.5%) in 90% of patients is 34 mL for effective block.[20] But in our study, we have used low volume (20 mL) of local anesthetic as suggested by Karmakar et al.[5] With our aim to homogenize the local anesthesia volume in the two groups and to reduce incidence of UDP, we have used 20 mL of local anesthesia in our study.We have added dexamethasone(4mg) as adjuvant to levobupivacaine to prolong the duration of action. Lastly CCB may be an alternative to ISB as it was equally potent and spare the phrenic nerve but one of the limitation our study was that,the no of participants was low. So large scale studies are required to authenticate our findings**.**

Conclusion

Compared to interscalene block, costoclavicular block results in equivalent postoperative analgesia without any risk of unilateral diaphragmatic paralysis.

References

1. Auyong DB, Yuan SC, Choi DS, Pahang JA, Slee AE, Hanson NA. A Double-Blind Randomized Comparison of Continuous Interscalene, Supraclavicular, and Suprascapular Blocks for Total Shoulder Arthroplasty. Reg Anesth Pain Med. 2017 May/Jun;42(3):302-309.
2. Tran DQ, Elgueta MF, Aliste J, Finlayson RJ. Diaphragm-Sparing Nerve Blocks for Shoulder Surgery. Reg Anesth Pain Med. 2017 Jan/Feb;42(1):32-38.
3. Wiegel M, Moriggl B, Schwarzkopf P, Petroff D, Reske AW. Anterior Suprascapular Nerve Block Versus Interscalene Brachial Plexus Block for Shoulder Surgery in the Outpatient Setting: A Randomized Controlled Patient- and Assessor-Blinded Trial. Reg Anesth Pain Med. 2017 May/Jun;42(3):310-318.
4. Lee JJ, Kim DY, Hwang JT, Lee SS, Hwang SM, Kim GH, Jo YG. Effect of ultrasonographically guided axillary nerve block combined with suprascapular nerve block in arthroscopic rotator cuff repair: a randomized controlled trial. Arthroscopy. 2014 Aug;30(8):906-14.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

5. Karmakar MK, Sala-Blanch X, Songthamwat B, Tsui BC. Benefits of the costoclavicular space for ultrasound-guided infraclavicular brachial plexus block: description of a costoclavicular approach. Reg Anesth Pain Med. 2015 May-Jun;40(3):287-8.
6. García-Vitoria C, Vizuete J, López Navarro AM, Bosch M. Costoclavicular Space: A Reliable Gate for Continuous Regional Anesthesia Catheter Insertion. Anesthesiology. 2017 Oct;127(4):712.
7. Spence BC, Beach ML, Gallagher JD, Sites BD. Ultrasound-guided interscalene blocks: understanding where to inject the local anaesthetic. Anaesthesia. 2011 Jun;66(6):509-14.
8. Aliste J, Bravo D, Fernández D, Layera S, Finlayson RJ, Tran DQ. A Randomized Comparison Between Interscalene and Small-Volume Supraclavicular Blocks for Arthroscopic Shoulder Surgery. Reg Anesth Pain Med. 2018 Aug;43(6):590-595.
9. Aliste J, Bravo D, Finlayson RJ, Tran DQ. A randomized comparison between interscalene and combined infraclavicular-suprascapular blocks for arthroscopic shoulder surgery. Can J Anaesth. 2018 Mar;65(3):280-287.
10. Aliste J, Bravo D, Layera S, Fernández D, Jara Á, Maccioni C, Infante C, Finlayson RJ, Tran DQ. Randomized comparison between interscalene and costoclavicular blocks for arthroscopic shoulder surgery. Reg Anesth Pain Med. 2019 Jan 11:rapm-2018-100055.
11. Singelyn FJ, Lhotel L, Fabre B. Pain relief after arthroscopic shoulder surgery: a comparison of intraarticular analgesia, suprascapular nerve block, and interscalene brachial plexus block. Anesth Analg. 2004 Aug;99(2):589-92,
12. Dhir S, Sondekoppam RV, Sharma R, Ganapathy S, Athwal GS. A Comparison of Combined Suprascapular and Axillary Nerve Blocks to Interscalene Nerve Block for Analgesia in Arthroscopic Shoulder Surgery: An Equivalence Study. Reg Anesth Pain Med. 2016 Sep-Oct;41(5):564-71.
13. Pitombo PF, Meira Barros R, Matos MA, Pinheiro Módolo NS. Selective suprascapular and axillary nerve block provides adequate analgesia and minimal motor block. Comparison with interscalene block. Braz J Anesthesiol. 2013 Jan-Feb;63(1):45-51.
14. Neuts A, Stessel B, Wouters PF, Dierickx C, Cools W, Ory JP, Dubois J, Jamaer L, Arijs I, Schoorens D. Selective Suprascapular and Axillary Nerve Block Versus Interscalene Plexus Block for Pain Control After Arthroscopic Shoulder Surgery: A Noninferiority Randomized Parallel-Controlled Clinical Trial. Reg Anesth Pain Med. 2018 Oct;43(7):738-744.
15. Tran DQ, Layera S, Bravo D, Cristi-Sanchéz I, Bermudéz L, Aliste J. Diaphragm-sparing nerve blocks for shoulder surgery, revisited. Reg Anesth Pain Med. 2019 Sep 20:rapm-2019-100908.
16. Mistry T, Balavenkatasubhramanian J, Natarajan V, Kuppusamy E. Ultrasound-guided bilateral costoclavicular brachial plexus blocks for single-stage bilateral upper limb surgeries: Abstain or indulge. J Anaesthesiol Clin Pharmacol. 2019 Oct-Dec;35(4):556-557.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE5, 2024

17. Koyyalamudi V, Langley NR, Harbell MW, Kraus MB, Craner RC, Seamans DP. Evaluating the spread of costoclavicular brachial plexus block: an anatomical study. Reg Anesth Pain Med. 2021 Jan;46(1):31-34.
18. Sivashanmugam T, Maurya I, Kumar N, Karmakar MK. Ipsilateral hemidiaphragmatic paresis after a supraclavicular and costoclavicular brachial plexus block: A randomised observer blinded study. Eur J Anaesthesiol. 2019 Oct;36(10):787-795.
19. Leurcharusmee P, Elgueta MF, Tiyaprasertkul W, Sotthisopha T, Samerchua A, Gordon A, Aliste J, Finlayson RJ, Tran DQH. A randomized comparison between costoclavicular and paracoracoid ultrasound-guided infraclavicular block for upper limb surgery. Can J Anaesth. 2017 Jun;64(6):617-625.
20. Sotthisopha T, Elgueta MF, Samerchua A, Leurcharusmee P, Tiyaprasertkul W, Gordon A, Finlayson RJ, Tran DQ. Minimum Effective Volume of Lidocaine for Ultrasound-Guided Costoclavicular Block. Reg Anesth Pain Med. 2017