

A prospective study of two methods of analgesia in shoulder arthroscopic procedures as day case surgery

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ABSTRACT

Background & purpose: The recent advances in anaesthesia and analgesia have significantly improved the early recovery and effective post-operative pain control in day care surgery e.g. shoulder arthroscopic procedures. Adequate analgesia improves the early rehabilitation for a better outcome. We prospectively evaluated the post-operative pain relief following the two methods of analgesia i.e. regional Inter-scalene block (ISB) vs Intra-articular (IA) injection using 0.5% Chirocaine in various therapeutic arthroscopic shoulder procedures.

Methods: A prospective comparative study was performed on a group of 105 patients (ASA grade I or II) who underwent the following procedures at two different hospitals: diagnostic arthroscopy, subacromial decompression (SAD) alone, SAD in combination with mini open cuff repairs or distal clavicle excision, anterior stabilization (Bankart's repair) and inferior capsular shift. A successful Inter-scalene block (0.5% Chirocaine-30mls) preceded the general anaesthesia (Group 1–52 patients). Local intra-articular infiltration (0.5% Chirocaine - 20 mls) was given postoperatively (Group 2–53 patients). Post operatively visual analogue scores (VAS) from 0 (no pain) to 10 (severe pain) were assessed in post-anaesthesia care unit (PACU), at 4hrs, at 24hrs and at 48 h. The amount of morphine consumption for the first 2 days after surgery was recorded.

Results: Patient characteristics were similar in both groups at both the hospitals. The median post-operative pain score of VAS <3 was observed in both groups. Significant difference ($p < 0.0001$) was observed in the VAS scores between the two groups at all the time intervals. The mean length of adequate sensory block in group 1 was significantly higher than in group 2 [20.5 h: 4.2 h] ($p < 0.001$). The mean analgesic (morphine) consumption was lower in Group 1 as compared to Group 2 [4.6 mg/24 h: 18.8mg/24 h] ($p < 0.0001$). Bone shaving procedures e.g. SAD, SAD + Rotator Cuff repair, SAD + Lateral clavicular excision required significantly higher analgesia in both groups compared to the soft tissue procedures.

Conclusion: Single dose ISB provided longer and effective postoperative analgesia. The bone shaving procedures required more analgesia in IA Group as compared to ISB Group.

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1. Introduction

Arthroscopic shoulder procedures are increasingly performed as day case surgery in many hospitals across the world. This is because of increasing demand for beds and the pressure to meet targets in busy hospitals. Safe and effective post-operative analgesia is the

key to the success in any day care surgery. Regional anaesthesia and analgesia has improved post-operative analgesia in most of the shoulder arthroscopies which can be performed as day care surgery procedure.^{1,2}

Post-operative pain in shoulder arthroscopic surgeries is often moderate to severe³ and necessitates high dose opioid usage.² To avoid complications of opioids, several methods of analgesia have been emerged such as interscalene brachial plexus block,⁴ interscalene continuous infusion, intra-articular injection, intra-articular infusion pumps, suprascapular nerve block⁵ and a

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combination of these methods.^{6,7} Interscalene block is gaining popularity as an effective method of analgesia in shoulder day-case surgeries.^{8,9} Supplementing general anaesthesia with regional nerve block improves quality of postoperative pain relief.⁶

The aim of this study was to compare the analgesic effect of single injection of Interscalene block (ISB- group 1) and intra-articular injection (IA-group 2) using 0.5% Chirocaine (levobupivacaine injection) in day-case shoulder arthroscopic surgeries.

2. Materials and methods

This prospective clinical trial was conducted after approval from Hospital Ethics Committee and after obtaining written informed consent from patients. This study was conducted in two hospitals in two countries at two different period of time i.e. one in the UK and one in India. The centre in UK had two surgeons and two anaesthetists who performed the procedures. The centre in India had one Surgeon and one anaesthetist who performed the procedure. One hundred five (105) patients between the ages of 25–50 years with ASA (American Society of Anaesthesiologists) grade 1–2 undergoing diagnostic and therapeutic shoulder arthroscopies were enrolled in this prospective comparative study in two different centres. The various arthroscopic surgeries included were: diagnostic arthroscopy, subacromial decompression (SAD), rotator cuff repair, lateral end of clavicle excision and stabilization procedures. Exclusion criteria consist of patients with coagulation abnormality; pre-existing neurological deficit or severe chronic obstructive pulmonary disease (COPD), previous shoulder surgery and inability to understand pain scores. Informed consent was sought from all eligible subjects prior to randomization. A computer generated list of random numbers was used. Allocation numbers were sealed in opaque envelopes, which were opened in sequence by an independent doctor who was not involved in the assessment of outcomes. At the initial visit, the allocation sequence was hidden from the physicians who screen the patient. When the patient's eligibility was confirmed they were randomly allocated. The physician was informed by the study coordinator as to which arm the patient belongs, i.e. ISB or IA group, based on the randomization list generated. Outcome assessors were blinded to the treatment allocation. Only the study coordinator, independent from patient assessment and recruitment, had access to the randomization list.

All patients had premedication with oral Diclofenac 75 mg and Diazepam 5 mg. All patients had an intravenous cannula (18G) applied to a peripheral vein in the forearm opposite the surgical side. Standard monitors were attached in the form of five-lead ECG, noninvasive blood pressure monitor, pulse oximeter, and capnograph. The patients were instructed preoperatively to use visual analogue scale (VAS) for pain. Pre-emptive ISB was performed in anaesthetic room prior to GA through a standard approach.

A successful ISB Group 1 (0.5% Chirocaine-30mls) preceded the general anaesthesia (Group 1–25 patients in Centre A & Group 1–27 patients in Centre B). Local IA Group 2 (0.5% Chirocaine –20 mls) was given postoperatively (Group 2–26 patients in Centre A & 27 patients in Centre B) (Fig. 1). The specific doses has been based on the previously published papers.^{5–7}

2.1. Technique of interscalene block (ISB)

The classic approach of Winnie (anterior approach) is still commonly performed, especially for single-injection blockade.⁴ The patients were positioned supine with the head turned to the opposite side with slightly extended neck. The skin of the neck was sterilized and an ultrasound probe (SIEMENS Acuson, SC 2000; Siemens Medical Solutions, USA) was placed in a sterile sheath. The interscalene groove was identified at the level of the cricoid

cartilage (C6 vertebra). After skin infiltration with 2 ml of lignocaine 1%, a 22-G, 5-cm nerve block needle (B. Braun Medical Inc., Bethlehem, Pennsylvania, USA) (connected to nerve stimulator) was inserted in groove with the probe to visualize the entire needle length. The proximity of the needle to the brachial plexus was confirmed by evidence of muscular activity (contraction of the triceps muscle) following nerve stimulation (B-Braun-Stimuplex HNS 11–12218, Stockert GmbH, Botzinger StraBe 72, D-79111 Freiburg, Germany) with 0.3–0.5 mA of current. Then 30 mls of 0.5% Chirocaine was injected slowly with aspiration to avoid intravascular injection and the local anaesthetic spread was observed. From the end of local anaesthetic injection until readiness for surgery, block success was assessed. Sensory block was assessed by pinprick using 22-G needles over the lateral side of the forearm and thumb. Motor block was assessed by asking the patient to abduct the arm at the shoulder and flex the forearm at the elbow against resistance.

After the blockade, all patients received GA using atropine 0.01 mg/kg, propofol 2.0–2.5 mg/kg, fentanyl 1 mg/kg, and atracurium 0.5 mg/kg for insertion of endotracheal tube, and controlled ventilation was started.

2.2. Technique of intra-articular injection

In the IA group, the local anaesthetic agent (20 mls of 0.5% Chirocaine) was injected into the shoulder joint esp. subacromial space & portals of entry after closure of the arthroscopic portals. All patients had pressure dressing at the end of procedure.

2.3. Post-operative follow-up

Post operatively visual analogue scores (VAS) from 0 (no pain) to 10 (severe pain) were assessed in recovery (PACU), at 4hrs, at 24hrs and at 48 h. All the patients were discharged home the same day with a standard analgesic regimen, which consisted of paracetamol, diclofenac and oral morphine for break through pain. All the patients were provided with a data sheet, which had a provision for recording pain scores (VAS), analgesic tablets used and any complications such as nausea and vomiting requiring antiemetic. Patients were reviewed in clinic postoperatively at two weeks. The specific question to all patients to know the satisfaction was “whether they were highly satisfied (excellent), moderately satisfied (good) or not at all satisfied (fair/poor) with the method of anaesthesia/analgesia”.

2.4. Statistical analysis

The sample size estimation was based on mean difference in VAS score at baseline (recovery) and at 48 h.¹⁰ The sample size was computed based on the assumption of an anticipated overall difference in VAS of 1.5 with a standard deviation (SD) of 0.5. Type 1 error was set at 0.05. The sample size analysis showed that 30 patients per group would be sufficient to detect a difference among the groups.

The record of the analgesic requirement, pain relief and their satisfaction scores were collected from all patients. An independent observer reviewed the data sheets. We used SPSS version 20 (Chicago, Illinois, USA) to perform the statistical analysis. Chi square (χ^2) test was performed (significance level of $p < 0.01$) to compare the two groups for age, sex, BMI, ASA grade and surgical procedure. Student t-test was used (significance level of $p < 0.01$) to compare the mean VAS scores, morphine requirements and patient satisfaction scores in the two groups.

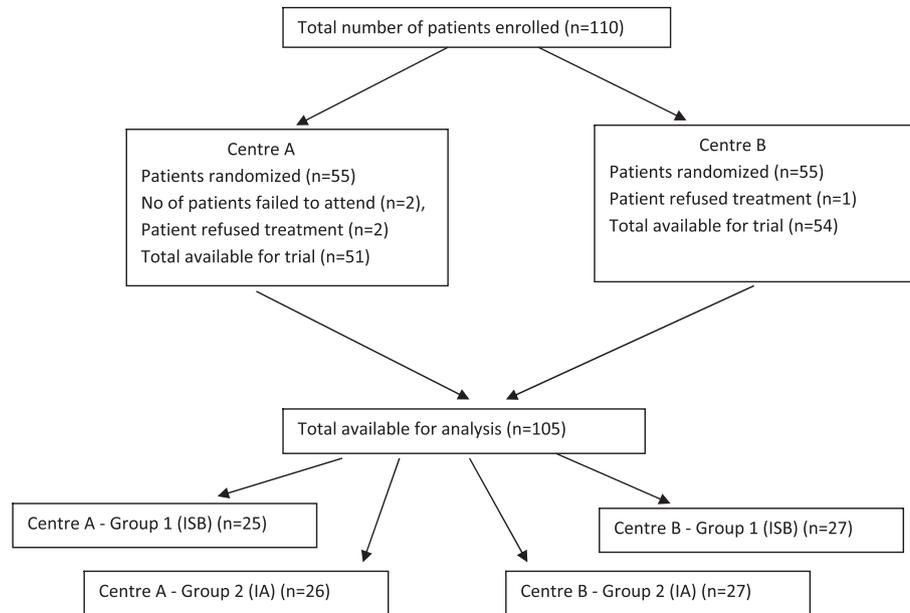


Fig. 1. Consort diagram.

3. Results

Out of 105 patients, 52 were in the ISB group and 53 in the IA group (Fig. 1). Both the groups in the two centres were comparable in age, sex, BMI, ASA grade and number of arthroscopic surgical procedures (Table 1). SAD (27.6%) was the most common procedure followed by soft tissue stabilization (23%) in both the groups.

Significant difference ($p < 0.0001$) was observed in the VAS scores between the two groups at all the time intervals (Table 2). The difference in VAS scores at PACU and at 48 h was significant between the two groups. The difference in morphine requirement was significantly high in the IA group as compared to the ISB group ($p < 0.0001$). The mean duration of pain relief was 20.5hrs in the ISB group which was significantly higher than the IA group ($p < 0.001$). The patient satisfaction scores were significantly lower in the IA group (Table 2). Bone shaving procedures e.g. SAD, SAD + Rotator Cuff repair, SAD + Lateral clavicular excision required significantly higher analgesia in both groups compared to the soft tissue procedures (Table 3).

Six patients in the IA group and one patient in the ISB group required anti-emetics due to supplemental morphine. There were no infections in either groups.

4. Discussion

The use of regional anaesthetic techniques and the availability of

Table 1
Demographic data of the two groups i.e. Interscalene Block (ISB) vs Intra-articular analgesia (IA).

Variables	ISB	IA	P value*
No of patients	52	53	
Age (range) in years	44 (24–70)	44.5 (23–73)	0.64
Sex ^{M/F}	30/22	30/23	0.86
BMI ^{SD}	27 (3)	26 (4)	0.53
ASA Grade ^{1/2/3}	35/17/0	36/14/3	0.58
Surgery ^{a/b/c/d/e}	7/14/9/10/12	8/15/9/9/12	0.99

^aDiagnostic arthroscopy/^bSubacromial Decompression (SAD)/^cSAD + Rotator Cuff Repair/^dSAD + Clavicular excision/^eSoft tissue stabilization.

*Chi Square test.

rapid and shorter acting intravenous and volatile anaesthetics has facilitated early recovery in the ambulatory setting for patients undergoing shoulder arthroscopic procedures as day cases.¹¹ Thus, patients could remain relatively pain free in the post-operative period before being discharged home on the same day with a protective sling and analgesic medication.

4.1. Interscalene block regional anaesthesia has been shown to provide excellent intraoperative anaesthesia for arthroscopic shoulder procedures.^{9,11,12}

Most recently, a prospective randomised blinded study showed that single dose ISB is the most effective analgesic method after arthroscopic acromioplasty of the shoulder.⁶ From this prospective study we confirm that single dose ISB is an effective method of analgesia in different therapeutic shoulder arthroscopic procedures as day surgeries. Pain in the first two days of postoperative period is at its peak and necessitates more analgesia. IA has been used as an alternative analgesia method although the effectiveness is controversial.¹³ Continuous local analgesic delivered by an infusion pump is found to be more cumbersome for the patient which compromises the results¹⁴ with increased risk of infection locally.¹⁵ Joint infection is a potential risk with the continuous intra articular infusion pumps.^{6,16}

Suprascapular nerve block was proven less effective than single dose ISB.⁶ Continuous ISB and infraclavicular block are exciting alternatives.^{14,17} Levo-bupivacaine has been used more commonly nowadays because of its comparable anaesthetic potency to Bupivacaine with less cardiotoxicity. In the current study, the ISB group had a longer duration of postoperative analgesia, with significantly reduced usage of opioid consumption. Also, a reduced rate of associated complications such as nausea and vomiting was observed. These results are similar to the previous studies that single dose IA did not provide satisfactory analgesia and its analgesic effect was not durable.^{3,13,18} This could be explained by the seepage of anaesthetic drug (Chirocaine) through the arthroscopic portals and the remaining irrigating fluid in the joint dilutes the anaesthetic drug as well as obliterates the joint space for adequate local anaesthetic infiltration.⁶ The pressure dressings of the

Table 2

Showing Pain scores, morphine requirement and patient satisfaction scores in the two groups.

Variable		ISB (CI)	IA (CI)	P Value**
Mean VAS (range)	PACU	1.44 (1.20–1.68)	2.15 (1.92–2.39)	<0.0001
	4 h	1.16 (.88–1.43)	2.38 (2.11–2.65)	<0.0001
	24 h	1.24 (0.93–1.54)	2.96 (2.66–3.25)	<0.0001
	48 h	0.8 (0.49–1.11)	2.27 (1.96–2.57)	<0.0001
Morphine (mg/24hrs)		4.6 (1.87–7.33)	18.8 (16.17–21.52)	<0.0001
Mean duration of pain relief (hours)		20.5 (12–36)	4.2 (2–7)	<0.001
Patient satisfaction scores (% & no of patients)	Excellent	80% (42)	50% (26)	<0.001
	Good	16% (8)	12% (6)	
	Poor	4% (2)	30% (16)	
	Unsatisfied	0	8% (5)	

**Student t-test.

Table 3

Showing mean morphine requirement (mg/24hrs) in different procedures.

Arthroscopic Shoulder Procedure	ISB (SD) (no of pts)	IA (SD) (no of pts)	P Value*
Soft tissue Surgery (n = 39)	2.77 (1.5) (20)	10.44 (3.6) (19)	0.005
Bone shaving + Soft tissue Surgery (n = 66)	5.66 (2.7) (32)	23.23 (7.2) (34)	<0.0001

* Student t-test.

shoulder following the procedure also expel some anaesthetic fluid out of the joint. Compared to the IA group, the ISB group required lesser post-operative oral analgesia. The bone shaving procedures e.g. sub-acromial decompression and distal clavicle excision required more oral analgesia in the IA group compared to ISB group (Table 3).

Several previous studies challenged the safety of ISB and reported high rates of complications.^{19,20} It is well-recognised fact that failure rates of ISB and the complications mainly depend on the level of experience of the anaesthetist.⁹ The anaesthetists were committed to and practice blocks on a regular basis who has had no failure of blocks in this series. Major complications with the interscalene block are rare, but the capacity to view the needle with ultrasound may be beneficial in reducing complications.²¹

Successful results with fewer incidences of complications are reported in the more recent literature.^{1,6,9} In this series, patient satisfaction in the soft tissue as well as bony procedures was excellent in ISB group with minimal complications. Although, taking into consideration of longer duration of anaesthesia esp. numbness of the hand and forearm is not a problem as most of times lower roots escape the anaesthetic effect.

5. Conclusion

Shoulder arthroscopic procedures producing moderate to severe pain maybe managed with a single-injection interscalene block. ISB provided longer and effective postoperative analgesia. The bone shaving procedures required more analgesia in IA Group as compared to ISB Group.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jcot.2019.06.008>.

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