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Comparison of the Haemodynamic Effects of Interscalene Block Combined with General Anaesthesia and Interscalene Block Alone for Shoulder Surgery

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Interscalene brachial plexus block (ISB) anaesthesia is widely used with or without general anaesthesia in patients undergoing shoulder surgery, which is generally done with the patient in a sitting position. This position affects haemodynamics, and supplementing ISB with general anaesthesia can exaggerate these haemodynamic changes. This study compared ISB combined with general anaesthesia, with ISB alone, in 29 patients undergoing elective shoulder surgery. Heart rate and oxygen saturation remained stable throughout the study in both groups. Mean arterial pressure was significantly decreased when the patient moved into the sitting position in those given combined anaesthesia, whereas in those given ISB alone mean arterial pressure did not change significantly. Neither pain scores nor patient satisfaction scores differed significantly between the two groups. All of the patients were either satisfied or entirely satisfied with their anaesthesia/analgesia. There were no significant differences in side-effects and no severe complications in either group. We advocate using ISB alone for patients undergoing shoulder surgery, but further larger studies are needed to confirm the present results.

KEY WORDS: Interscalene brachial plexus block; Shoulder surgery; Haemodynamic effects

Introduction

Interscalene brachial plexus block (ISB) anaesthesia has been widely used, with or without general anaesthesia (GA), in patients undergoing shoulder surgery.[1 – 3] Whichever anaesthetic technique is used, in most cases, a pre-operative interscalene catheter is placed in these patients to provide effective pain control post-operatively.[4,5] There are few reports comparing the effects of ISB combined with GA and ISB alone with regard to the operating and recovery room times, hospital stay,[6] ISB-related complications or quality of analgesia.[7] During shoulder surgery patients are generally in a sitting

position, which affects haemodynamics,[8,9] and supplementing ISB with GA in this position can exaggerate haemodynamic changes.[10] We are unaware of any data comparing the intraoperative haemodynamic effects of these two anaesthetic techniques.

The aim of this study was to compare ISB combined with general anaesthesia with ISB alone, in patients undergoing shoulder surgery, with respect to intraoperative haemodynamic data, post-operative analgesia quality and patient satisfaction.

Patients and methods

PATIENTS

After institutional ethics committee approval and written informed consent, in-patients (American Society of Anesthesiologists' physical status I or II) scheduled for elective shoulder surgery were enrolled in this prospective, randomized study. Patients who had contraindications to ISB, severe bronchopulmonary disease, diabetes, neuropathy, contralateral diaphragmatic paralysis, allergy to the trial drugs or who were receiving opioid analgesic therapy were excluded. The procedures performed were acromioplasty, a Bankart operation, and rotator cuff repair.

PROCEDURE

After the insertion of an 18-gauge intravenous cannula in the unaffected forearm, 5 ml/kg normal saline was infused over 15 min and standard parameters were monitored, including non-invasive arterial blood pressure, heart rate and peripheral arterial oxygen saturation. In all patients an interscalene catheter (Contiplex™; B. Braun Melsungen AG, Melsungen, Germany) was introduced pre-operatively, in the operating room, into the perivascular sheath using the technique described by Winnie.[11] After skin infiltration with 2 ml 1% lidocaine, the brachial plexus was identified using a nerve stimulator (Stimuplex, DIG™; B. Braun Melsungen AG). Placement of the needle was considered successful when a contraction of the deltoid and/or triceps muscle occurred with a current output of < 0.5 mA. After negative aspiration, 30 ml bupivacaine 0.375% was injected before the catheter placement. The catheter was introduced and secured by a skin suture. ISB was confirmed by sensory and motor block of the radial and median nerve within 20 min of the administration of local anaesthetic. The quality of block was assessed every min for 15 min after injection. A single anaesthetist with 15 years' experience performed all the blocks. If the block was unsuccessful, GA was given and these patients were excluded from the statistical analysis.

After evidence of a successful sensory and motor block had been obtained, patients were randomized to one of two groups using a sealed envelope system. Patients in group 1 received ISB plus GA, and those in group 2 received ISB alone.

In group 1, GA was induced with remifentanil 0.5 µg/kg (over 60 s) and thiopental sodium 3 – 5 mg/kg, and maintained with sevoflurane in oxygen (1 – 2% inspired concentration). Tracheal intubation was facilitated by administration of vecuronium 0.1 mg/kg. In group 2, patients were sedated with intravenous midazolam (2 – 3 mg), titrated to moderate sedation (rousable on commands). The patients were then placed in a sitting position and the surgery started approximately 15 min later.

ASSESSMENTS AND ANALGESIA

Heart rate and peripheral arterial oxygen saturation were continuously monitored. Arterial blood pressure was measured and recorded before and after ISB, anaesthesia induction, patient positioning, incision and extubation, and every 5 min throughout the study. Intraoperative haemodynamic

variables including mean arterial pressure (MAP), heart rate and duration of surgery were recorded. If the decrease of baseline MAP was more than 30%, ephedrine 5 mg was administered intravenously. Atropine 0.5 mg was given intravenously when the heart rate fell to 50 beats/min.

At the end of the surgery, all patients were transferred to the recovery room and their pain was assessed using a verbal analogue scale (VAS) ranging from 0 (no pain) to 10 (most severe pain imaginable). Sedation was assessed using a scale from 1 (fully awake) to 5 (very drowsy; could fall asleep easily). The patient-controlled interscalene analgesia (PCIA; Pain Management Provider, Abbott Laboratories, North Chicago, IL, USA) was then started in both groups via the interscalene catheter. Bupivacaine 0.125% was given as bolus doses of 8 ml with a lockout time of 30 min. Rescue analgesic treatment consisted of diclofenac 75 mg given intramuscularly when the VAS score was above five.

The pain and sedation scores, and the appearance of side-effects at 2 h, 6 h, 12 h, 24 h and 48 h after the operation were recorded by a colleague who was blind to the study. Total bupivacaine consumption, rescue analgesic requirement, and the incidences of nausea, vomiting and other side-effects were also recorded. After 48 h, the catheter was removed, and the patient's satisfaction was assessed on a scale of 1 (not satisfied) to 5 (entirely satisfied). Patients were also questioned about their satisfaction. They were asked 'Would you recommend this type of anaesthesia to future patients?' and 'If operated on again in the future, would you ask for the same anaesthesia/analgesia technique?'

STATISTICAL ANALYSIS

Statistical analysis was done using the program SPSS version 10.0 for Windows. The Mann Whitney-*U* test was used to compare continuous variables, whereas categorical data were analysed using the χ^2 or Fisher's exact test when necessary. Results were presented as median (range). A *P*-value of < 0.05 was considered statistically significant.

Results

A total of 30 patients were initially enrolled in the study and divided equally into the two groups. One patient, who received ISB alone, did not achieve surgical block within 50 min of the bupivacaine injection. In this patient, GA was given and the patient was withdrawn from the study. The two groups were similar with regard to demographic and surgical data (Table 1).

Heart rate and oxygen saturation remained stable throughout the study. MAP was significantly decreased ($P = 0.006$), when the patient was moved into the sitting position in group 1, but in group 2, it did not change significantly at this stage (Fig. 1). None of the hypotensive episodes required treatment with ephedrine. There were no episodes of acute or chronic local anaesthetic toxicity.

Two catheters in group 2 were noted to be dislodged at the 24 h evaluation. Since the primary endpoint of this study was intraoperative haemodynamic changes, these patients were included in all data analysis except pain scoring for the rest of the study. Anaesthesia-related side-effects were Horner's syndrome, nausea and prolonged paraesthesia. The groups did not differ significantly in these side-effects. No severe complications were reported in either group.

Pain scores, as assessed by VAS at the pre-defined times, were similar in the two groups during the whole study period. The need for rescue analgesics was also similar in the two groups, and the sedation scores in the two groups did not differ significantly at any

TABLE 1:
Demographic and surgical characteristics of patients undergoing shoulder surgery using interscalene brachial plexus block (ISB) with general anaesthesia (group 1) or ISB anaesthesia alone (group 2)

	Group 1	Group 2
Number of patients	15	14
Age (y)	48 (22 – 61)	44 (28 – 65)
Weight (kg)	74 (57 – 88)	74 (57 – 87)
Gender (M/F)	6/9	5/9
Duration of surgery (min)	85 (50 – 165)	80 (45 – 140)

There were no significant differences between the groups. Values are expressed as median (range).

time. Total post-operative bupivacaine use was not significantly different between the two groups at the end of the study.

Patient satisfaction scores did not differ significantly between the two groups; they were 5.0 (3 – 5) in group 1 and 5.0 (4 – 5) in group 2.

All patients in both groups were either satisfied or entirely satisfied with their anaesthesia/analgesia. All of them stated they would accept the same anaesthetic technique for a future operation and they would recommend this type of anaesthesia to other patients.

Discussion

Shoulder surgery is frequently associated with severe post-operative pain, especially within the first 48 h.[12] Pain control is important in this setting, not only to improve the patient's well-being, but also to facilitate rehabilitation.[4] PCIA, therefore, by continuous or patient-controlled infusion of local anaesthetic, is

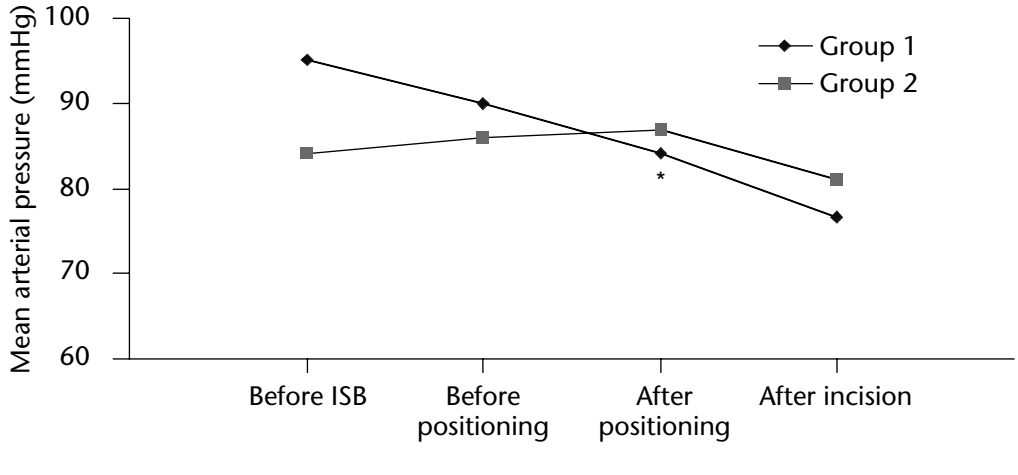


FIGURE 1: Mean arterial pressure changes during anaesthesia in patients undergoing shoulder surgery using interscalene brachial plexus block (ISB) with general anaesthesia (group 1) or ISB anaesthesia alone (group 2). *P = 0.006 (in group 1 only) compared with the value before the patients adopted the sitting position

currently considered the gold standard after this type of surgery.[1] In patients receiving PCIA, either ISB[1] or GA[13] alone or a combination of the two[10,12,14] has been used intraoperatively. Several studies have demonstrated that intraoperative ISB alone decreases post-operative pain, nausea, vomiting and urinary retention, and increases patient satisfaction compared with GA alone.[2,6,15]

Grossi *et al.*[16] suggested that supplementing ISB with GA avoids the stress experienced by the patient who is awake while undergoing surgery. Inadequate sedation might result in the patient complaining of noise or discomfort from prolonged immobility and will not compensate for an inadequate block. In addition, deep sedation when ISB alone is used requires continuous observation of the airway.

On the other hand, Chelly *et al.*[6] compared GA combined with ISB and ISB alone, in rotator cuff surgery, and concluded that ISB alone is safe and effective, and can contribute to shortening the hospital stay. Similarly, Jochum *et al.*[7] compared these two techniques and found the quality of analgesia with ISB to be superior to that with combined anaesthesia.

In the present study, arterial blood pressure in patients receiving ISB combined with GA decreased significantly when the patients were tilted, despite adequate fluid administration and slow positioning of the patient. Position-related haemodynamic changes were slight in the ISB group. No hypotensive episodes needed treatment with vasopressors in either group, probably because our study population was 18 – 65 years old, ASA I or II and otherwise healthy.

One contributory factor to hypotension in the patients in our study population was the patient's position. The sitting position causes pooling of blood in the lower extremities, thus decreasing ventricular volume and cardiac output.[8] There are, however, many surgical advantages to performing shoulder procedures using this position, including ease of conversion to an open procedure, excellent intra-articular visualization, and less traction on the brachial plexus.[15,17] In addition, it has been shown that hypotension and bradycardia may occur during shoulder arthroscopy in the sitting position with ISB.[8] These investigators explained their findings by the activation of the Bezold Jarish reflex, an inhibitory reflex originating in cardiac sensory receptors with vagal afferents, which are influenced by either chemical or mechanical stimuli.[8] The decrease we observed in MAP in our ISB group is similar to that reported by these authors.

To our knowledge, since there is no study comparing the haemodynamic effects of ISB combined with GA with ISB alone in patients undergoing shoulder surgery, our data are not directly comparable with any other study. In the study of Culebras *et al.*,[10] however, the primary aim of which was to investigate the analgesic and haemo-dynamic effects of clonidine supplement in ISB combined with GA, the investigators concluded that the haemodynamic effects of clonidine can be accentuated by GA used in association with ISB. This can be deleterious in patients operated on in a semi-sitting position. The placebo group findings in that study are comparable with those in our study. In that study, the placebo group had received ISB combined with GA, according to the same protocol as in group 1 in our study, and the results were similar.

In the present study, there were no significant differences between the groups in terms of the quality of post-operative analgesia and patient satisfaction. There are no objective data in the literature, but this is at variance with the commonly held view that combined anaesthesia is necessary in

order to obtain better security, comfort and satisfaction of patients.[10,16] Our results clearly indicate that these goals can be achieved with ISB alone. In view of the definite advantages of using ISB alone, such as early detection of air embolism and reduced costs, we advocate ISB alone for patients undergoing shoulder surgery in which haemodynamic changes are particularly important, but further larger studies are needed to confirm this.

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