Arthroscopy: The Journal of Arthroscopic and Related Surgery 9(3):295–300
Published by Raven Press, Ltd.

Interscalene Block for Shoulder Arthroscopy: Comparison with General Anesthesia

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Summary: Arthroscopic shoulder surgery can be performed under regional or general anesthesia. The objective of this study was to demonstrate that regional anesthesia has several benefits over general anesthesia for this type of surgery, particularly in the ambulatory patient. Forty patients received general anesthesia and 63 an interscalene block. The regional block was found to be safe and effective, with a high degree of patient acceptance. It provided excellent intraoperative analgesia and muscle relaxation. Postoperatively, regional anesthesia resulted in fewer side effects, fewer hospital admissions, and a shorter hospital stay than did general anesthesia. Key Words: Regional anesthesia--Ambulatory patient-Interscalene block-Intraoperative analgesia/relaxation-ivtinimal side effects

Interscalene brachial plexus block has been used for a variety of procedures about the shoulder, including instability repairs, proximal humeral prosthetic replacements, total shoulder arthroplasties. anterior acromioplasties, rotator cuff repairs, and operative treatment of humeral fractures. These blocks have resulted in good surgical anesthesia, a minimum of complications, and a high degree of patient acceptance (1,2). The purpose of this study was to compare interscalene brachial plexus block to general anesthesia in a group of patients undergoing shoulder arthroscopy.

Regional anesthesia has been credited with having several advantages over general anesthesia for shoulder surgery. These advantages include excellent muscle relaxation, less blood loss, shorter hospital stay, reduced postoperative analgesia requirements, and avoidance of the risks and side effects of general anesthesia (2-S). However, none of the previous studies examined shoulder arthroscopy.

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The technique of interscalene brachial plexus block was developed by Winnie (6), who demonstrated that the interscalene space is a continuous, fascial-enclosed sheath containing both the brachial plexus and the cervical plexus. Because the shoulder is innervated by nerves from both plexuses, a single injection into this space provides satisfactory anesthesia for shoulder surgery, including arthroscopic procedures.

MATERIALS AND METHODS

The operative, anesthetic. and hospital records of 103 consecutive patients undergoing shoulder arthroscopy in the Shoulder Service at the New York Orthopaedic Hospital were reviewed. The surgery was performed over the period from August 1988 through March 1990. Patients were divided into two groups, based on the type of anesthesia administered. Group I consisted of 40 patients who had shoulder arthroscopy under general anesthesia. Group 11 consisted of 63 patients undergoing shoulder arthroscopy under interscalene brachial plexus block. The diagnoses were similar in the two groups. These included subacromial impingement. instability, acromioclavicular arthritis, adhesive

capsuiitis, calcific tendinitis, and rotator cuff pathology. Arthroscopic treatment in the two groups was also similar, based on the findings at surgery. All surgery was performed in the beach-chair position (7). The operative procedures performed and their distribution between the two groups are given in Table 1.

Ninety-one patients were admitted on an outpatient basis to the ambulatory surgery unit. Twelve patients were admitted to the hospital on the evening before surgery, five of these for preoperative medical reasons, and the rest for the convenience of out-of-town patients. All patients who underwent an interscalene block were contacted by telephone within 24 h of hospital discharge to inquire about any unanticipated complications or concerns regarding the anesthesia or surgical procedure.

The two anesthetic techniques were compared with regard to the following parameters:

1. Time from the start of administration of anesthetic until the incision was made
2. Duration of surgery
3. Postoperative side effects, including (a) postoperative pain requiring i.v. or i.m. medication, (b) nausea and vomiting, or (c) inability to void
4. Number of patients requiring overnight hospital admission

ANATOMY AND ANESTHETIC TECHNIQUE

After exiting the intervertebral foramina, the anterior primary divisions of the nerves destined to form the brachial plexus (i.e., the fifth through eighth cervical and first thoracic nerves) travel in a groove formed by the tubercles of the transverse processes of the corresponding cervical vertebrae. Beyond the transverse processes, the roots of the brachial plexus lie between the anterior and middle scalene muscles, which are invested by a fascial covering derived from the prevertebral fascia. The fascia splits to invest the scalene muscles. then

TABLE 1. *Operative procedures and distribution between groups*

Operative procedure	*General* anesthesia (Group I)	Interscalene block (Group II)
Labral debridement (and/or bursectomy)	34	24
Calcium removal	4	8
Subacromial decompression	12	9
Acromioplasty	4	8

Values represent number of patients.

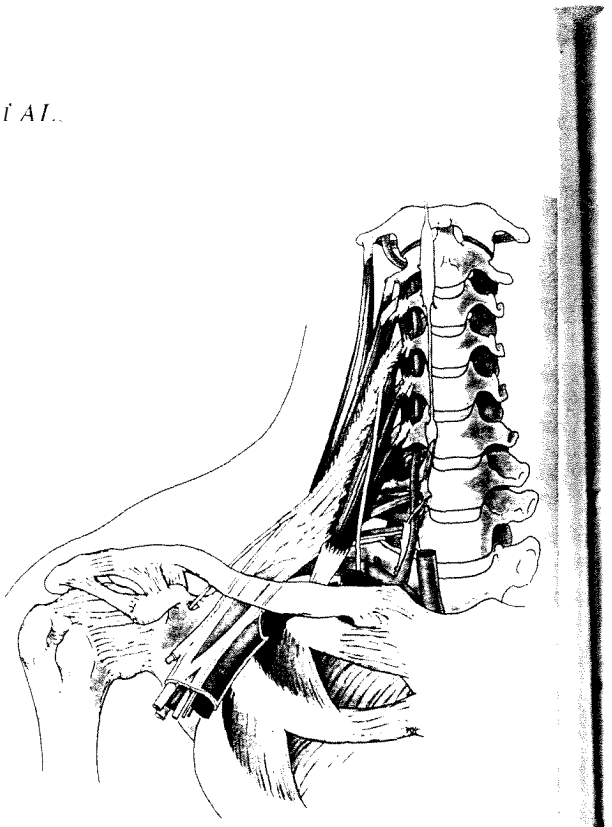

FIG. 1. The fascial enclosed brachial plexus emerging from between the anterior and middle scalene muscles.

fuses again at their lateral margins to form a continuous enclosure or sheath extending from the cervical transverse processes to several centimeters beyond the axilla (Fig. I). At the lower end of the interscalene space, the roots rearrange to form the superior, middle, and inferior trunks of the brachial plexus. The site of injection into the interscalene space is readily located if the appropriate topographic landmarks are observed.

Upon arriving in the operating room, electrocardiographic, blood pressure, and pulse oximetry monitoring is established, followed by insertion of an i.v. line. Before administering the block. sedation is provided as necessary with midazolam (1-2 mg) and fentanyl (25-50 μg). With the patient supine and the head turned away from the side to be blocked, the patient is asked to elevate his or her head slightly off the table. This brings the clavicular portion of the sternocleidomastoid muscle into relief (Fig. 2). With the head still elevated, the anesthesiologist places his or her middle and index tingers behind the posterior border of the tensed sternocleidomastoid muscle at the level of the cricoid cartilage, and the patient lowers his or her head, still keeping it turned to the side. The palpating tinger now rests on the belly of the anterior scalene muscle. If the index finger is then rolled posterolaterally, a groove can be felt between the anterior and

FIG. 2. The patient with head raised to demonstrate the sternal and clavicular heads of the sternocleidomastoid muscle.

middle scalene muscles (Fig. 3). With the index and middle fingers straddling the cricoid line in the interscalene groove, a 2 l&inch, 22-gauge Teflon-coated (i.e., insulated) needle (Becton Dickinson and Company, Rutherford, NJ) is introduced under sterile conditions in a direction perpendicular to the skin in all planes. That is, the needle is directed in a medial, dorsal, and slightly caudad direction (Fig. 4). The needle is attached via extension tubing to a syringe containing the local anesthetic agent. The needle is slowly advanced until the fascial sheath is penetrated. This may be perceived as a distinct click. The correct position of the needle tip is confirmed with a nerve stimulator. At no stage is an attempt made to elicit paresthesia. After aspiration, the local anesthetic agent is slowly injected. In this study, 40 ml of I .5% mepivacaine was used (Fig. 5).

Overlap with segmental nerves T1 and T2 may preserve some sensation over the posterior aspect of the shoulder (Fig. 6). Therefore, the routine use of several milliliters of lidocaine with epinephrine around the posterior portal site is necessary to ensure complete patient comfort.

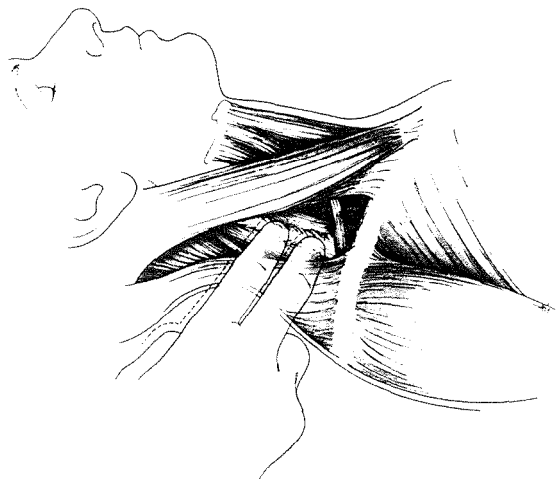

FIG. 3. The palpating fingers are rolled posterolaterally from the belly of the scaienus anterior into the interscalene groove.

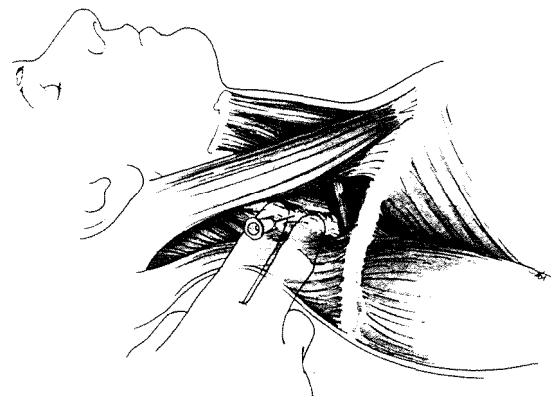

FIG. 4. The needle is inserted at right angles to the skin

During the procedure, the patient was sedated to the point of comfort with a combination of intravenous midazolam and fentanyl. Oxygen was supplied by means of a nasal cannula at a flow rate of 3 L/min.

In the general anesthesia group, endotracheal intubation was performed on all patients. The anesthetic agents used were pentothal (3-5 mg/kg) for induction and succinylcholine (1.5 mg/kg preceded by a 3-mg precurarizing dose of curare) for intubation; nitrous oxide, oxygen, and isoflurane (0.5–1.0%) were the maintenance agents together with atracurium (0.5 mg/kg) or vecuronium (0.1 mg/kg) for muscle relaxation. Analgesia was provided with 100–250 μg fentanyl, the maximum dose being lim-

FIG. 5. Forty milliliters of local anesthetic is injected via extension tubing.

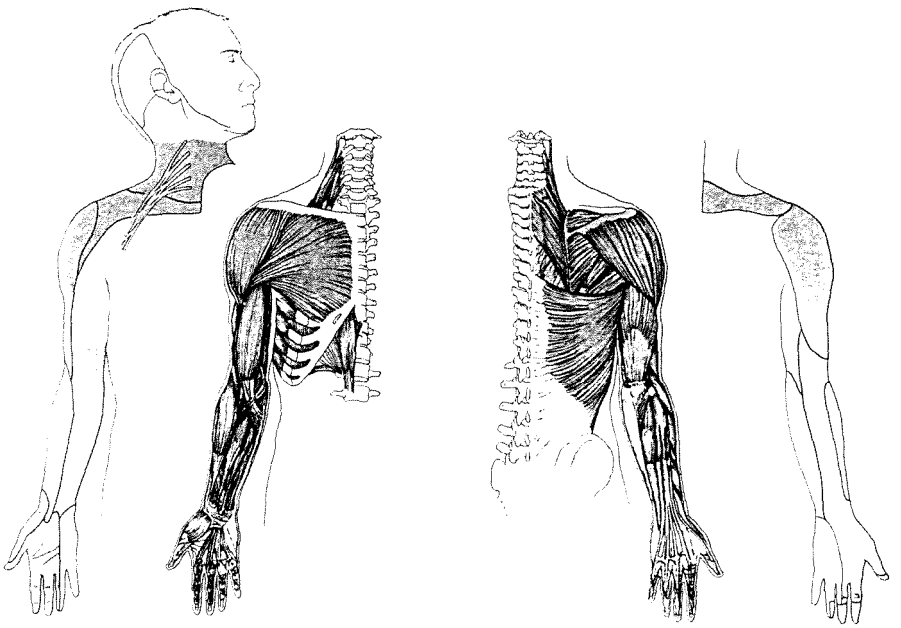

FIG. 6. The distribution of the cutaneous innervation of the upper limb that is blocked by an interscalene brachial plexus block.

ited to 250 μg because of the planned ambulatory nature of the procedure. The decision as to what type of anesthesia the patient would receive was based on the choice of the anesthesiologist and acceptance by the patient. The planned operative procedure did not influence this decision at all.

RESULTS

The average age in group I (general anesthesia) was 37 years (range 18-61). There were 25 men and 15 women. In group II (interscalene block), the average age was 45 years (range 19-69). There were 37 men and 26 women.

A total of 63 interscalene blocks were attempted. Fifty-three patients (84%) had a successful block. Ten blocks were abandoned, and these patients were subsequently given general anesthesia. Reasons for the 10 failed blocks were inadequate anesthesia in six patients, excessive anxiety in two patients, difficulty in breathing in one patient, and difficulty in swallowing in one patient. Other side effects of the block were hoarseness in four patients (6%), Horner's syndrome in three patients (5%), and anxiety (not severe enough to require conversion to general anesthesia) in two patients (3%). The average volume of mepivacaine used was 40 ml (range 20–50). All six patients who received volumes of 30 ml or less had unsuccessful blocks. The average time from the onset of the block to recovery of normal neurological status in the extremity was 195 min.

In group I (general anesthesia), the time required from the start of anesthesia until the incision was made averaged 25 min. In group II (interscalene block), the time from the start of the block until surgical incision averaged 28 min. Failed blocks that subsequently required general anesthesia took an average of 42 min to surgical incision. The average duration of surgery was 76 min in group I and 69 min in group II. There were no surgical complications in either group.

In the immediate postoperative period, 18 patients in group I (45%) experienced pain requiring either i.m. or i.v. medication, 17 patients (43%) experienced nausea requiring antiemetic therapy, and 10 patients (25%) were unable to void. In group II, nine patients (14%) had pain requiring i.m. or i.v. medication, and five patients (8%) complained Of nausea requiring therapy. All the patients in group II were able to void during the postoperative observation period.

Overnight hospital admission was required for 19 patients (48%) in group I. Fourteen of these patients required admission either for the control of their pain and/or as a result of the side effects of either the analgesic therapy alone, or in combination with the effects of the general anesthetic agents. The most common side effects were nausea and vomiting, an inability to void. and oversedation. The re-

maining patients were admitted for a variety of medical reasons (i.e., labile blood pressure in two patients, lack of postoperative control of blood sugar in a diabetic patient, elevated postoperative temperature in two patients, and a patient in whom a pseudocholinesterase deficiency was unmasked by the administration of succinylcholine intraoperatively).

In group II, 11 patients (17%) required overnight admission: four failed blocks and six cases that were started late in the afternoon. Late afternoon cases resulted in insufficient time being available for full recovery from the blocks before the closure of the ambulatory surgery unit for the day. This necessitated overnight admission to the hospital. The remaining patient required admission for control of pain and associated nausea and vomiting.

In follow-up telephone interviews on the first postoperative day, 51 of 53 patients (96%) who had successful blocks said they were satisfied with the block. Two patients felt anxious and claustrophobic and said that they would have preferred general anesthesia.

DISCUSSION

Although some shoulder surgeons have found the interscalene brachial plexus block to be ideal for major reconstructive procedures, there is little mention in the literature of its use in arthroscopic shoulder surgery. In the present study, we found the interscalene block to be safe and effective for shoulder arthroscopy and to offer advantages over general anesthesia. The 84% success rate compares favorably with the results in previously published studies (1,5). An interscalene block results in significantly fewer postanesthetic complications and avoids the side effects of general anesthesia, In the group receiving general anesthesia, 48% of the patients required overnight hospital admission. The reasons for admission in many cases were due to side effects commonly associated with general anesthesia and/or postoperative narcotics (e.g. nausea and vomiting, urinary retention, and oversedation). In the interscalene block group, there was a 17% admission rate. However, of the 11 patients requiring admission, four required general anesthesia after failed blocks, and six were admitted because there was insufficient time to recover the patients in the ambulatory surgery unit. It should be pointed out that when this study was performed, the ambulatory unit at our hospital had recently opened, and many of our patients live a substantial distance from the hospital. We therefore tended to err on the side of extreme caution in terms of satisfying our criteria for discharge. None of these patients would have been hospitalized had their procedures been performed earlier in the day. Thus, in the group of patients who received regional anesthesia alone, only one was admitted for control of pain and associated nausea and vomiting.

In addition, because the average duration of the block was >3 h, the postoperative analgesia requirements of the patients in the interscalene block group were significantly lower than those in the general anesthetic group. Eighteen patients (45%) who received general anesthesia required i.m. or i.v. pain medication in the recovery room, compared with only nine patients (14%) in the interscalene group. Fifty-four patients (86%) who received an interscalene block required nothing more than Tylenol with codeine (McNeil Pharmaceutical, Spring House, PA) or Percocet (DuPont Pharmaceuticals, Manati, Puerto Rico) to control their postoperative pain.

Intraoperatively all patients were injected with 20–30 ml 0.25% bupivacaine into the glenohumeral joint and/or the subacromial space before closure of the portals. Forty-five percent of patients who received general anesthesia required narcotic analgesics for pain control postoperatively, which is a surprisingly high number and probably reflects our early experience in dealing with these patients. However, it reinforces our argument that even under these circumstances, the postoperative course of patients receiving regional anesthesia was much smoother.

No patient with a successful block developed any postoperative medical complications. In the general anesthesia group, two patients with hypertension developed labile blood pressures, one diabetic patient required postoperative control of her blood sugar, and one patient exhibited an underlying pseudocholinesterase deficiency. Each of these complications required hospitalization and medical management. An interscalene block may therefore be a safer alternative in patients with underlying medical conditions in whom general anesthesia may place the patient at significant risk.

One criticism directed against the use of regional anesthesia is the argument that it adds significantly more time to the procedure than general anesthesia. We did not find this to be the case. The time from the start of administration of the anesthetic to the incision averaged 25 min in the general anesthesia

group and 28 min in the interscalene group, an insignificant difference. Positioning, prepping, and draping of the patient while the block is "setting" helps to minimize the waiting time. At the end of the procedure the patient is wide awake and can leave the operating room immediately after the last dressing is applied. This is not always the case after general anesthesia, in which delays can occur due to a "slow awakening" patient, slow reversal of muscle relaxation, and the need to extubate the patient.

An additional benefit of the interscalene block in the beach-chair position is that the awake patient is able to observe the procedure on an overhead monitor.

Various complications have been reported in association with an interscalene brachial plexus block. These include hematoma formation, phrenic and recurrent laryngeal nerve blockade, vasovagal attack, pneumothorax, total spinal anesthesia, high epidurai blockade, and cardiac arrest (2,8–12). We experienced a few of these complications, including a phrenic nerve block in one patient, which necessitated converting the block to a general anesthetic because the patient complained of not being able to breathe. Four patients (6%) complained of hoarseness (recurrent laryngeal nerve block), and three (5%) developed a Horner's syndrome due to a sympathetic block. Both the recurrent laryngeal nerve palsy and Horner's syndrome were transient and resolved without any subjective complaints. These findings are comparable with other published studies (13,14). Although the more serious complications of interscalene blocks are rare (4,6,8), they may be life threatening. For this reason patients should be fully monitored during the insertion of the block, and resuscitation equipment should be immediately available at ail times.

This report represents our initial experience with interscalene blocks for shoulder arthroscopies and includes a significant learning curve. Technical factors associated with block failure included inadequate volume of local anesthetic agent, incorrect needle placement, inadequate explanation of possibly frightening but harmless side effects such as hoarseness and the sensation of shortness of breath, and lack of adequate sedation for the more anxious patients.

Based on this early experience, our protocol was modified to include an anesthesia interview at the time of preoperative testing, during which time the procedure and possible side effects are carefully explained to the patient. In addition, we now use a team of anesthesiologists specially skilled in the technique of interscalene blocks. Patients are appropriately sedated and all shoulder arthroscopies are scheduled for the morning. A comparative study is currently in progress of cases performed under this protocol. Preliminary data indicate a technical success rate of 97%, a significant improvement over the 84% success rate reported in this study.

A further improvement in our practice has been the insertion of the block in a regional anesthesia block room before the patient enters the operating room. This is performed while the operating room is being cleaned and set up, further reducing the turnover time.

In summary, interscalene brachiai plexus block for shoulder arthroscopy is safe and effective, with a high degree of patient acceptance and satisfaction. Compared with general anesthesia, it results in significantly fewer complications and a shorter hospital stay, making this form of anesthesia ideal for outpatient surgery.

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