LCDR Mark R. Gohl, CRNA, MS, NC, USN
Camp Pendleton, California

LT Robin K. Moeller, CRNA, MS, NC, USN
Great Lakes, Illinois

CDR R. Lee Olson, CRNA, MS, NC, USN
San Diego, California

CDR Charles A. Vacchiano, CRNA, PhD, NC, USN
Bethesda, Maryland

The addition of interscalene block to general anesthesia for patients undergoing open shoulder procedures

Several studies have demonstrated that interscalene brachial plexus anesthesia alone decreases postoperative pain, nausea, vomiting, urinary retention, and unplanned hospital admissions compared with general anesthesia alone. Anecdotal evidence suggests that an interscalene block combined with general anesthesia decreases unwanted effects of general anesthesia following open shoulder surgery. We compared the effect of combined interscalene block and general anesthesia with general anesthesia alone on Aldrete scores, length of postanesthesia care unit (PACU) stay, verbal rating scale (VRS) pain scores, incidence of postoperative narcotic administration and nausea, and patient satisfaction in a convenience sample of 52 men and women, ASA physical status I, II, or III. Group 1 received standard general anesthesia alone. Group 2 received an interscalene block in combination with general anesthesia using a standard technique.

Group 2 had significantly lower VRS scores than group 1 while in the PACU, on the day of surgery, and on postoperative days 1 and 2. Overall satisfaction with the anesthetic technique was higher in the group 2 than in group 1. Results suggest that adding an interscalene block to general anesthesia can be of value in today's outpatient-dominated surgery schedule.

Key words: Combined technique, general anesthesia, interscalene block, shoulder surgery.

Introduction

Anesthesia techniques that produce minimal side effects and are associated with few complications offer a rapid return to preoperative baseline homeostasis.[1] Patients, providers, and third-party payers demand shorter postanesthesia care unit (PACU) stays and fewer complications, highlighting the potential value of regional anesthesia techniques for the outpatient surgical population. The use of regional anesthesia can result in more expedient recovery and, subsequently, more rapid discharge to home compared with general anesthesia.[2]

Several studies have shown that patients receiving general anesthesia alone have more postoperative pain, increased nausea and vomiting, less ability to void, and a higher occurrence of overnight hospital stays than patients receiving interscalene block alone for shoulder surgery.[3-8] A perception among some surgeons and anesthesia providers is that an interscalene block alone for shoulder surgery is inadequate, takes longer to initiate, has a high failure rate, and has too many adverse effects compared with general anesthesia alone.[3] However, other surgeons and anesthesia providers believe that patients undergoing shoulder surgery with interscalene block alone have better postoperative pain relief, less nausea and vomiting, and less blood loss than patients who receive general anesthesia alone.[7]

Controversy remains as to whether a combination of interscalene block and balanced general anesthesia reduces PACU stay and promotes early discharge for patients undergoing open shoulder surgery. A study published in the European literature in 1991 by Brandl and Taeger[8] demonstrated that a combined technique reduced intraoperative anesthetic and immediate postoperative narcotic requirements. In addition, the subjects had lower pain scores through 24 hours after surgery and higher satisfaction with the combined technique compared with subjects who received general anesthesia alone.[8]

The purpose of the present study was to determine the value of this technique for reducing PACU time, the severity of postoperative pain, and the incidence of postoperative nausea in patients undergoing open shoulder surgery in our institution. In addition, overall patient satisfaction with the anesthetic technique was measured.

Materials and methods

A convenience sample of 52 men and women, ASA physical status I, II, or III, scheduled for elective open shoulder procedures as inpatients consented and were enrolled in this investigational review board–approved study. Exclusion criteria included a history of chronic pain syndrome, brachial plexus injury, or obstructive pulmonary disease. Subjects initially were assigned randomly to receive general endotracheal anesthesia (group 1, control) or general endotracheal anesthesia plus an interscalene block (group 2, experimental). However, during the consent process, subjects frequently declined enrollment into the study due to their perception that the addition of an interscalene block to the anesthetic regimen would reduce their postoperative discomfort. This problem was resolved by allowing subjects to self-select group assignments and accepting the possible introduction of selection bias into the research design. This resulted in 15 subjects in group 1 and 37 subjects in group 2.

Both groups received standardized preoperative sedation, induction, and maintenance of anesthesia. Group 2 received an interscalene block, before induction, in combination with general anesthesia, and group 1 received general anesthesia alone. Preoperative sedation included midazolam, 1 to 4 mg intravenously (IV), and fentanyl, 25 to 100 µg IV. Interscalene blocks were performed using the immobile needle technique, as described by Winnie[9] and Raj et al,[10] in a block room immediately before transport to the operating room and induction of general anesthesia. Briefly, a 22-gauge, 40-mm insulated ProBloc II needle (Life-Tech, Inc, Houston, Tex) was placed with the aid of a peripheral nerve stimulator (AA50068 Neurotechnology, Houston, Tex), and a volume not exceeding 3 mg/kg of 0.5% bupivacaine with epinephrine 1:200,000 was injected.

The general anesthesia protocol included fentanyl, up to 5 µg/kg IV; propofol, 2 mg/kg IV; and vecuronium, 0.1 mg/kg IV. For rapid-sequence induction, succinylcholine, 1 to 1.5 mg/kg IV, was administered. Anesthesia was maintained with isoflurane, up to 1.5%, with nitrous oxide and oxygen. Reversal of neuromuscular blockade was accomplished with neostigmine, 0.05 to 0.07 mg/kg IV, combined with glycopyrrolate, 0.2 mg IV per milligram of neostigmine. Patients were not pretreated for prevention of nausea or vomiting before admission to the PACU.

Upon completion of the procedure, general anesthesia was terminated, and the patient was transferred to the PACU. Standard PACU orders consisted of the following: (1) morphine, 2 to 4 mg IV every 5 to 10 minutes; (2) meperidine, 10 to 20 mg IV every 10 minutes for pain or shivering not to exceed 100 mg; and (3) the antiemetics ondansetron, 4 mg IV every 60 minutes as needed, or droperidol, 0.125 mg IV one time only.

Data collection in the PACU included admission Aldrete score, length of PACU stay, pain scores, and the incidence of narcotic administration and nausea. The PACU length of stay was determined by the time difference between PACU admission and the time the subject was assigned an Aldrete score of 9. Postoperative pain was quantified using an 11-point verbal rating scale (VRS). The subject was asked to verbally rate pain from 0 (no pain) to 10 (worst pain imaginable).[11] Staff nurses served as recorders for data collected in the PACU. They were not blinded to the subjects' group assignment.

The investigators visited subjects the morning after surgery, before discharge, to obtain the overnight VRS score and the incidence of narcotic administration and nausea. This information was considered day of surgery (DOS) data. Subjects were contacted by telephone at 24 and 48 hours following discharge to obtain postoperative day (POD) 1 and POD 2 VRS scores, incidence of analgesic use, incidence of nausea, and overall satisfaction with the anesthetic technique. Satisfaction was measured on POD 2 with a verbal response to a 6-point Likert-type scale (1, extremely dissatisfied; 6, very satisfied).

The Mann-Whitney rank sum and Fisher exact tests were used to compare the dependent variables between groups. Data are reported as percentages or as mean ± SD. A *P* value of less than .05 was considered significant.

Results

Initially, 52 subjects were enrolled in the study. Two subjects in group 2 were eliminated due to incomplete data collection; for one, the surgical procedure was postponed after the block was placed, and another could not be reached by telephone. Seven additional subjects in group 2 were excluded from final data analysis due to failed block, language barrier for data collection, or prolonged PACU stay unrelated to the anesthetic regimen. This resulted in a total of 43 subjects in the final data analysis, 15 in group 1 and 28 in group 2.

Sample demographics closely approximated the makeup of the adult surgical population at our institu-

Table. Demographics*

	Group 1 (n = 15)	Group 2 (n = 28)
Mean ± SD age (y)	38 ± 16	38 ± 17
Sex		
Men	15 (100)	23 (82)
Women	0 (0)	5 (18)
Race		
White	12 (80)	22 (79)
Black	1 (7)	3 (11)
Hispanic	1 (7)	1 (3)
Asian	0 (0)	2 (7)
Other	1 (7)	0 (0)
Site		
Left arm	5 (33)	11 (39)
Right arm	10 (67)	17 (61)

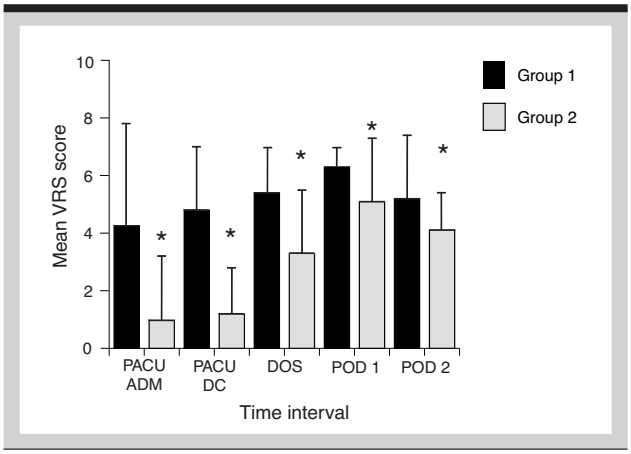
*** Data are given as number (percentage) unless otherwise indicated. Group 1 received general anesthesia alone; group 2, combined interscalene block and general anesthesia. No significant difference was noted between groups (*P*>.05).**

tion. The 2 groups did not differ significantly in age, ethnicity, sex, or affected extremity (Table). Men constituted the majority of subjects (88%) with 15 in group 1 and 23 in group 2. Women accounted for 12% of the total enrolled. No women selected group 1, and 5 selected group 2. The time to perform the interscalene block was 11 ± 7 minutes with a total dose of 33 ± 4 mL of bupivacaine. The nerve stimulator current used to locate the brachial plexus was 0.45 ± 0.12 mA. Staff Certified Registered Nurse Anesthetists supervised trainee administration of the majority of the blocks (22/28 [78.6%]), while staff anesthesiologists were involved with the remaining blocks (6/28 [21.4%]). Nurse anesthesia students administered 26/28 (92.9%) of the blocks, and anesthesia residents administered 2/28 (7.1%). Surgical procedures consisted of the following: repair of a Bankhart lesion, rotator cuff repair, Weaver-Dunn procedure, Neer-Mumford reconstruction, and shoulder hemiarthroplasty.

There was no significant difference in median PACU admission Aldrete scores between groups 1 and 2, (median score 8 for each group; $P = .6419$). In addition, the total PACU time was not significantly different between groups (group 1, 60 ± 14 minutes; group 2, 69 ± 34 minutes; $P = .7202$).

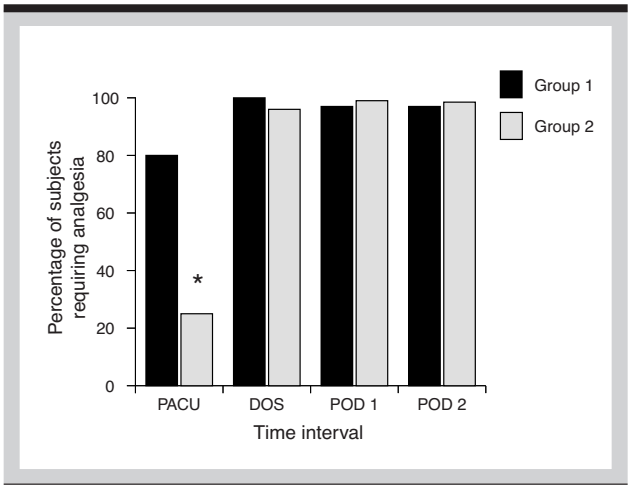
The VRS pain scores were significantly lower for group 2 compared with group 1 on PACU admission and discharge, the DOS, and PODs 1 and 2 ($P<.05$; Figure 1). This difference was most marked on PACU admission (1.1 vs 4.3) and PACU discharge (1.2 vs 4.7). The percentage of subjects in each group requesting at least 1 dose of pain medication is shown in Figure 2. During the PACU period, 12 (80%) of 15 subjects in group 1 requested pain medication, while 7 (25%) of 28 subjects in group 2 requested treatment ($P<.001$). However, there was no significant difference between groups in the percentage requiring at least 1

Figure 1. Comparison of mean verbal rating scale (VRS) pain scores between groups 1 and 2 on admission (ADM) to and discharge (DC) from the postanesthesia care unit (PACU), on the day of surgery (DOS), and on postoperative days (PODs) 1 and 2.*



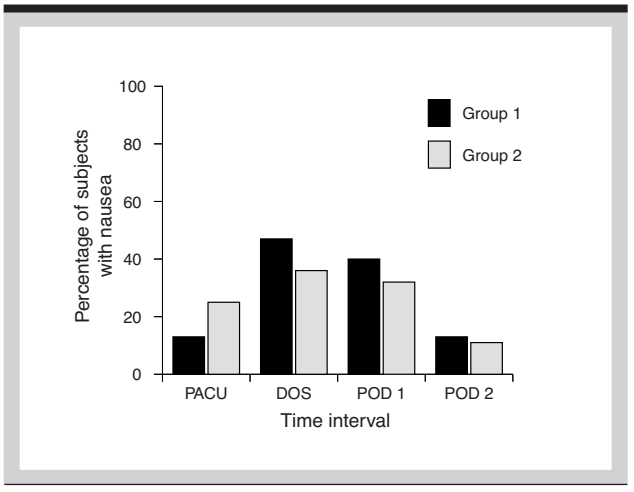
*Group 1 received general anesthesia alone; group 2, combined interscalene block and general anesthesia. Asterisks indicate that pain scores were significantly lower for group 2 compared with group 1 at each time interval studied ($P<.05$; N = 43).

Figure 2. Comparison of the percentage of subjects in groups 1 and 2 requiring pain medication in the postanesthesia care unit (PACU), on the day of surgery (DOS), and on postoperative days (PODs) 1 and 2.*



*Group 1 received general anesthesia alone; group 2, combined interscalene block and general anesthesia. In group 2, significantly fewer subjects required pain medication compared with group 1 while in the PACU ($P<.001$). There was no significant difference between groups at any other time interval studied ($P>.05$; N = 43). Asterisk indicates significant difference.

Figure 3. Comparison of the percentage of subjects in groups 1 and 2 with nausea in the postanesthesia care unit (PACU), on the day of surgery (DOS), and on postoperative days (PODs) 1 and 2.*



*Group 1 received general anesthesia alone; group 2, combined interscalene block and general anesthesia. There was no significant difference between groups at any time interval studied ($P>.05$; N = 43).

dose of pain medication on the DOS or on POD 1 or 2. The percentage of subjects experiencing nausea was not significantly different between groups for any time interval studied ($P>.05$; Figure 3). This percentage peaked on the DOS, with 10/15 (66%) of group 1 and 7/28 (25%) of group 2 experiencing nausea.

Finally, subjects in group 2 reported a significantly higher median satisfaction score with the anesthetic technique compared with subjects in group 1 (median scores 6 versus 5; $P<.001$).

Discussion

The results of this study demonstrate the ability of an interscalene block, when combined with general anesthesia, to significantly reduce postoperative pain in the PACU and through POD 2. In addition, narcotic requirements were decreased significantly in the group 2 while in the PACU. Researchers in the area of pain medicine have suggested that pain scores in the range from 0 to 3 are consistent with adequate analgesia. This "zone of analgesia" promotes examination of pain intensity data in clinically relevant terms. The mean pain scores for group 2 fell within the zone of analgesia on admission and discharge from the PACU and through the DOS time interval. The mean pain scores for group 2 again approached the zone of analgesia on POD 2, while scores for group 1 remained well above this zone. This suggests that the VRS scores for subjects who had an interscalene block supplemented with general anesthesia may return to the zone of analgesia more rapidly than those who received general anesthesia alone.

The current practice at our institution is to admit patients undergoing open shoulder surgery overnight for pain management with intravenous or intramuscular narcotics. Based on the results of this study, the addition of an interscalene block to the anesthetic regimen for patients undergoing open shoulder surgery would promote outpatient treatment. By significantly decreasing postoperative pain on the DOS, satisfactory analgesia could be achieved using nonnarcotic medication at home. This practice could save patients the inconvenience of an overnight admission and reduce costs to patients and insurers.

The absence of a significant reduction in length of PACU stay in group 2 was unexpected based on the difference in pain scores and narcotic use in the PACU. Closer inspection revealed that multiple uncontrolled factors contributed to the length of PACU stay. The primary factor was a difference in interrater interpretation of the "ready for discharge" criteria. This led to additional factors, such as patient transportation problems, wards unable to receive the patient due to staffing issues, and delays in postoperative radiographs or laboratory testing that affected the length of PACU stay. In addition, surgeons routinely requested that the subject's systolic blood pressure be maintained below 100 mm Hg or 20% below preoperative baseline for subjects with a history of hypertension. This typically was accomplished by increasing the inspired concentration of isoflurane or the administration of additional narcotics. This requirement for a deeper plane of anesthesia also may have contributed to the lack of a difference in PACU time between groups.

The addition of an interscalene block to the general anesthetic did not affect the incidence of nausea. This variable remained a problem for both groups on the DOS and after discharge and presumably could affect the rate of readmission if this procedure were performed on an outpatient basis.

Surgeons often voice the concern that performance of an interscalene block requires too much time and slows room turnover. We found that the time required to place an interscalene block was 11 ± 7 minutes. This result may be higher than the national norm, as the study was conducted in a large teaching institution where nurse anesthesia students and anesthesia residents performed the blocks under the guidance of a staff anesthesia provider. Performance of the block in a timely manner required cooperation among the anesthesia provider, the operating room staff, and the surgeon. By using appropriate scheduling and a team approach, interscalene blocks can be performed without contributing to operating room delays. We believe, based on the data from this study and our experience with this technique, that the combination of an interscalene block and general anesthesia can be of value in today's outpatient-dominated surgery schedule. Patients receiving an interscalene block and general anesthetic had a more favorable opinion of their anesthesia experience compared with those receiving general anesthesia alone. When used in conjunction with general anesthesia, an interscalene block may provide analgesia well into the postoperative period.

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AUTHORS

LCDR Mark R. Gohl, CRNA, MS, NC, USN, is currently a nurse anesthetist at the Naval Hospital, Camp Pendleton, Calif.

LT Robin K. Moeller, CRNA, MS, NC, USN, is a nurse anesthetist at the Naval Hospital, Great Lakes, Ill.

CDR Ronald L. Olson, CRNA, MS, NC, USN, is the clinical coordinator of the Navy Nurse Anesthesia Program, Naval School of Health Sciences, San Diego, Calif.

CDR Charles A. Vacchiano, CRNA, PhD, NC, USN, is the research coordinator at the Navy Nurse Anesthesia Program, Naval School of Health Sciences, Bethesda, Md.

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