Suprascapular Nerve Block for Postoperative Pain Relief in Arthroscopic Shoulder Surgery: A New Modality?

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Arthroscopic shoulder surgery has a 45% incidence of severe postoperative pain. Opiates and interscalene nerve blocks have a high incidence of side effects, and intraarticular local anesthetic has been shown to be ineffective when used for postoperative pain relief. The suprascapular nerve supplies 70% of the sensory nerve supply to the shoulder joint, and local anesthetic block of this nerve is effective in certain shoulder pain disorders. To determine the efficacy of a suprascapular nerve block, subcutaneous saline was compared with a suprascapular nerve block using 10mL of 0.5% bupivacaine with 1:200,000 epinephrine before general anesthesia was induced. In the immediate postoperative period, a 51% reduction in demand and a 31% reduction in consumption of morphine delivered by a patient-controlled analgesic system was demonstrated. There was more than fivefold reduction in the incidence of nausea, as well as reduced visual analog and verbal pain scores for patients who received a suprascapular nerve block. The duration of hospital stay was reduced by 24% in the suprascapular nerve block group. A 24-h phone call interview revealed a 40% reduction in analgesic consumption and a reduction in verbal pain scores at rest and on abduction. There were no complications from the suprascapular nerve block. This study demonstrates that a suprascapular nerve block for pain relief in arthroscopic shoulder surgery is an effective and safe modality of postoperative pain relief.

(Anesth Analg 1997;84:1306–12)

Arthroscopy has enabled shoulder surgery to be performed in the ambulatory surgery setting. Unfortunately, this type of surgery has a 45% incidence of severe postoperative pain (1). Opiate therapy can provide rapid control of severe postoperative pain. However, opioids have side effects, particularly nausea, sedation, and dizziness, which may delay patient discharge (2) or, in extreme cases, warrant hospital admission. Supplementing general anesthesia with a regional nerve block might reduce intraoperative anesthetic requirements, resulting in more rapid recovery and, in combination with systemic narcotics, improve the quality of postoperative pain relief and decrease the incidence of undesirable side effects.

Intraarticular bupivacaine has not been shown to be effective in treating this type of pain (1). Interscalene block is technically more demanding, and the success rate varies widely according to whether supplementation is used. The volume of local anesthetics injected can be a concern for systemic toxicity, and the motor blockade might predispose patients to injury and render postoperative neurological assessment difficult. Finally, this technique is associated with potentially serious complications such as high spinal, phrenic nerve palsy (3–5). The suprascapular nerve provides sensory fibers to 70% of the shoulder joint, including the superior and posterosuperior regions of the shoulder joint, capsule, and, variably, the overlying skin (6). Anteriorly and inferiorly, the joint and skin are supplied by the axillary nerve and the upper and lower subscapular nerves. The suprascapular nerve also supplies motor branches to the supraspinatus and infraspinatus muscles (6). Suprascapular nerve block provides excellent pain relief in shoulder pain disorders (7–11), but it cannot be used alone for surgery. No data are available on the efficacy of suprascapular block on shoulder arthroscopy.

The aim of this study was to assess the analgesic efficacy of suprascapular nerve block in patients undergoing ambulatory arthroscopic shoulder surgery under general anesthesia. We hypothesized that suprascapular nerve block would improve the quality of postoperative pain relief as measured by verbal and visual analog pain scores, reduce the requirement for intravenous (IV) and oral opioids, thus decreasing side

Supported by the physicians of Ontario through the PSI Foundation.

Accepted for publication February 7, 1997.

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0003-2999/97/$5.00

effects, improve patient satisfaction, decrease the duration of recovery, and facilitate same-day discharge.

Methods

Institutional ethical committee approval and written, informed consent were obtained. Patients undergoing arthroscopic shoulder surgery for diagnosis and treatment were included in this randomized, double-blind, placebo-controlled, prospective study. Patients were excluded if they had previously participated in the study, had previous surgery on the same shoulder, were morbidly obese (body mass index >35 kg/m^2), had a history of psychiatric illness, drug abuse, or significant concurrent medical disease, had an anticipated difficult airway, or had used analgesics within 8 h preceding surgery.

Fifty patients were randomized by a computer-generated list to either a placebo (n = 25) or suprascapular nerve block (n = 25) group. The anesthesiologist, block performer, and data collector were different investigators, and all were blinded to the treatment. Preoperatively, patients were instructed in the use of the visual analog scale (VAS) for pain and sedation, the verbal pain scale (VPS), the McGill Pain Questionnaire (MPQ), and the patient-controlled analgesia (PCA) system. Preoperative baseline VAS, VPS, and MPQ scores were assessed at rest and on abduction of the shoulder.

Patients received either placebo block or suprascapular nerve block in the preoperative area. The block was performed at the suprascapular notch with the patient sitting up and leaning forward using the posterior approach described by Moore (11). A line drawn along the length of the spine of the scapula was bisected with a vertical line, forming four quadrants. The angle of the upper outer quadrant was then bisected, and the skin was infiltrated with 2 mL of 1% lidocaine at a point 2.5 cm along this line of bisection of the upper outer quadrant (11). Under sterile conditions, a short, beveled, insulated needle was introduced perpendicular to the skin. The suprascapular nerve was located by stimulation with a 0.5-mA current, which caused contraction of the supraspinatus and infraspinatus muscles and led to an abduction and external rotation of the arm, respectively. In addition, there was a loss of resistance when the needle slid into the suprascapular notch. Ten milliliters of 0.5% bupivacaine with 1:200,000 epinephrine was then injected in 5-mL increments while the investigators observed for systemic toxicity. Placebo block patients were injected with subcutaneous lidocaine followed by 5 mL of subcutaneous normal saline.

The patients were given a standardized general anesthetic. Anesthesia was induced with alfentanil 15 μg/kg and propofol 2–2.5 mg/kg IV. Vecuronium 0.1 mg/kg was administered for tracheal intubation, and the lungs were mechanically ventilated. Anesthesia was maintained with 60% nitrous oxide in oxygen and end-tidal isoflurane 0.5%–2% in a semiclosed circle system using intermittent positive pressure ventilation.

Supplemental isoflurane and alfentanil (administered in doses of 250 μg until 10 min before end of surgery) were administered for heart rate and/or mean arterial blood pressure values exceeding 20% of baseline values and for sweating or lacrimation. Reversal was accomplished by neostigmine 50 μg/kg and glycopyrrolate 10 μg/kg.

A data collector evaluated patients preoperatively and postoperatively. Postoperative analgesia was provided by PCA morphine in 2-mg increments with a 5-min lockout time up to a total of 8 mg. If the VAS score for pain was >4 cm after 8 mg of morphine, 2-mg increments were allowed until the VAS score was <4 cm. The number of PCA demands and the total morphine dose were recorded every 15 min. Patients also received two tablets of acetaminophen with codeine at 1 h postoperatively. Ondansetron 4 mg IV was given for nausea.

Postoperative pain at rest and on abduction of the shoulder was assessed using a self-rating VAS ranging from 0 to 10 (0 = no pain and 10 = worst possible pain) and a VPS ranging from 0 to 3 (0 = no pain, 1 = mild, 2 = moderate, 3 = severe). Pain scores were obtained 1 h preoperatively (baseline), on arrival at the postanesthesia case unit (PACU) (Time 0), and at 15, 30, 45, 60, 90, 120, 180, and 240 min after PACU arrival. The MPQ was assessed preoperatively and 60 and 120 min postoperatively during rest and abduction of the shoulder.

Nausea and vomiting were assessed clinically, and sedation was assessed using a self-rating VAS ranging from 0 to 10 (0 = fully awake and 10 = very drowsy, could fall asleep easily) at the same intervals as those used for postoperative pain.

Postoperative recovery was evaluated using the following criteria: 1) open eyes, 2) obey commands, evaluated every minute, 3) the time to sit, drink, eat, ambulate, and void, evaluated every 30 min, 4) time to reach PACU discharge criteria as defined by an Aldrete score of 9, recorded every 15 min, 5) time of discharge as defined by a postanesthesia discharge scoring system (PADS) ≥9, evaluated every 30 min (Appendix 1) (12).

On discharge from the hospital, patients were given a prescription for acetaminophen with codeine 30 mg. All patients received a questionnaire in a preaddressed, stamped envelope with instructions to answer all questions and return the questionnaire to the investigators after a 72-h interval. This questionnaire evaluated the analgesic consumption at home and VAS score for pain at rest and on abduction of the shoulder. Twenty-four hours postoperatively, a phone

interview was conducted using a standardized questionnaire (Appendix 2). The questions evaluated the degree of pain at rest and on abduction of the shoulder, consumption of acetaminophen with codeine and any other analgesics, presence of nausea or vomiting, satisfaction with pain management, satisfaction and rating of the anesthetic, ability to sleep, degree of activity, and willingness to undergo the procedure as an ambulatory case procedure again.

The Mann-Whitney *U*-test, independent *t*-test, χ^2 analysis, and Fisher's exact test were used when appropriate. A P value of ≤ 0.05 was considered statistically significant.

Table 1. Demographic and Anesthetic Data

	Placebo (n = 25)	Suprascapular nerve block (n = 25)
Demographics		
Age (yr)	39 ± 15	42 ± 14
Weight (kg)	83 ± 12	81 ± 13
Height (cm)	173 ± 9	175 ± 8
Sex (M/F)	22/3	20/5
ASA physical status (I/II)	20/5	19/6
Drugs		
Propofol (mg)	209 ± 33	198 ± 32
Vecuronium (mg)	7.4 ± 1.8	7.2 ± 1.5
Alfentanil (μg)	1286 ± 298	1160 ± 367
Morphine demand (button presses)	39 ± 31*	19 ± 23
Morphine consumption (mg)	12.2 ± 4.6*	8.4 ± 5.0

Data are expressed as mean ± SD.
* $P \leq 0.05$.

Results

There was no significant difference in age, weight, height, sex, or ASA physical status between the treatment and placebo groups (25 patients in each) (Table 1). There was also no significant difference in the type of surgery, the surgeons, or the anesthesiologists anesthetizing the patient or performing the suprascapular nerve block. The procedures performed were acromioplasty, diagnosis, debridement, stabilization, decompression, distal clavicle resection, rotator cuff repair, and frozen shoulder release. The doses of anesthetics and alfentanil given intraoperatively were the same.

There was no complication from the suprascapular nerve block. One patient in the placebo group experienced a fainting sensation when the skin was infiltrated with local anesthetic. In the PACU, the total mean morphine consumption and the frequency of PCA demand were significantly less after the suprascapular nerve block, 20 fewer attempts of button presses than with the placebo (Table 1). The baseline VAS and VPS scores were similar (Table 2). Postoperatively, the VAS score at rest was significantly lower in the treatment group until 180 min. At 240 min, the scores of the two groups were similar, both at rest and on abduction (Fig. 1).

The VPS score was significantly lower at all measurement intervals in the suprascapular block group until 120, 180, and 240 min, when the scores of the two groups were similar (Table 2). The total MPQ scores in the two groups were not significantly different preoperatively or at 60 and 120 min postoperatively (Table 2). The VAS score for sedation was not significantly different between the two groups at any time.

Table 2. Verbal Rating Scale (VPS) and the McGill Pain Questionnaire (MPQ)

	Placebo (n = 25)				Suprascapular nerve block (n = 25)			
	0	Mild	Mod	Severe	0	Mild	Mod	Severe
VPS								
Preop (no patients)	8	14	3		3	18	4	
Awake			8	17		6	8	10*
15 min			9	16		5	11	9*
30 min		1	8	16		7	10	8*
45 min		3	10	12	1	7	13	4*
60 min		5	11	9	1	11	10	3*
90 min		10	15		1	16	18*	
120 min		15	10		2	17	6	
180 min		19	4		2	15	2	
240 min		10	2			5		

	Rest	Abduction	Rest	Abduction
MPQ (total score)				
Preoperative	3.4 ± 5.2	10.3 ± 5.5	3.2 ± 5.5	8.3 ± 3.9
60 min	8.2 ± 4.4	13.2 ± 4.0	7.4 ± 5.4	12.0 ± 5.6
120 min	5.1 ± 2.4	9.6 ± 3.1	4.3 ± 3.1	8.6 ± 4.2

Data are expressed as mean ± SD.
* $P < 0.05$.

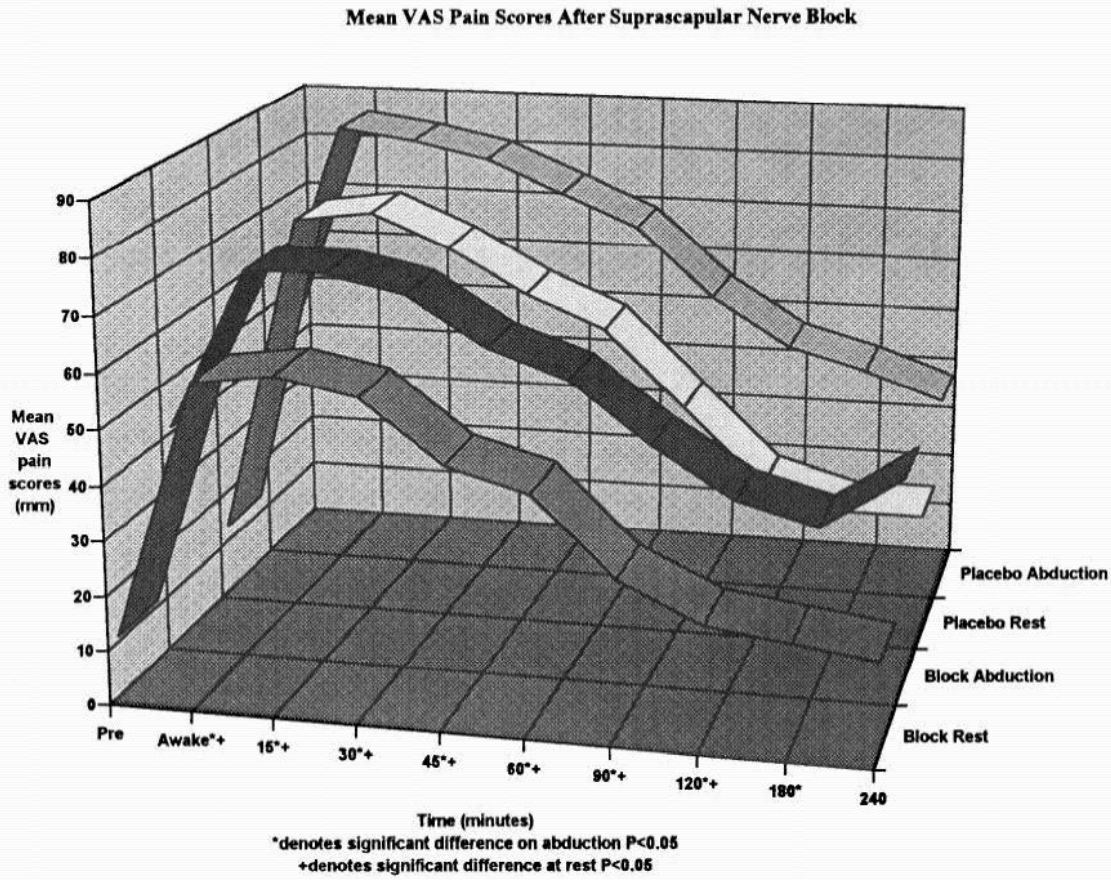

Figure 1. Mean visual analog scale score at rest or on abduction after suprascapular nerve block ($n = 25$) or placebo ($n = 25$): preoperative baseline (pre), awake after surgery (awake), and at various times after surgery.

The incidence of nausea in hospital was significantly less in the treatment group (8%) than in the placebo group (44%, $P < 0.05$). There was no incidence of vomiting in hospital in either group. The time required before the patient could sit, eat, ambulate, and void was significantly shorter in the treatment group (Table 3). The duration of stay in the PACU was not significantly different in the two groups, but the duration of stay in the ambulatory surgery unit was significantly reduced in the treatment group. Total time until discharge was 64 min less after a suprascapular nerve block; however, there was no difference in the time required to achieve an Aldrete score ≥9 or a PADS ≥9.

The phone call interview was completed with all patients. At 24 h postoperatively, the VPS score was significantly less after suprascapular nerve block, both at rest and on abduction (Table 4). The incidence of nausea and vomiting was significantly reduced in the treatment group, as was analgesic consumption. One patient in the placebo group returned to his family doctor because of inadequate pain relief. Patient satisfaction with the pain management and the anesthesia care was not significantly different in the two groups, and the time to return to normal activity was similar. All but one patient from each group would have the same procedure performed on an outpatient basis again.

The 3-day self-completion questionnaire had a 66% response rate. The treatment group had a significant

Table 3. Recovery Profile

	Placebo ($n = 25$)	Suprascapular nerve block ($n = 25$)
PACU	95 ± 27	88 ± 13
ASU	175 ± 90	118 ± 50*
Aldrete ≥9	5 ± 6	4 ± 5
PADS ≥9	124 ± 40	115 ± 23
Total discharge time	270 ± 96	206 ± 52*
Open eyes	4 ± 4	3 ± 4
Obey commands	10 ± 21	6 ± 5
Sit	152 ± 69	117 ± 23*
Drink	112 ± 55	97 ± 15
Eat	200 ± 84	132 ± 25*
Ambulate	184 ± 76	142 ± 42*
Void	206 ± 80	167 ± 49*

Data are presented as the mean ± SD of time interval (minutes).
PACU = postanesthesia care unit, ASU = ambulatory surgery unit, PADS = postanesthesia discharge scoring system.
* $P < 0.05$.

Table 4. Twenty-Four–Hour Phone Questionnaire Results

	Placebo (n = 25)				Suprascapular nerve block (n = 25)			
	0	Mild	Moderate	Severe	0	Mild	Moderate	Severe
Verbal Pain Scale								
Rest	1	16	7	1	6	16	3	0*
Abduction	0	1	13	11	0	7	9	9*
Acetaminophen with codeine use[a]	5 (0–16)				3 (0–8)*			
Use of other analgesics	3				0*			
Return to doctor due to inadequate pain relief	1				0			
Nausea	10				1*			
Vomiting	5				1*			
Not satisfied with pain treatment	4				1			
Not satisfied with anesthetic	1				2			
Would have procedure performed as day case again	24				24			
Did not sleep due to pain	7				5			
Activity scale 1–10[a,b]	5 (2–9)				5 (2–9)			

* $P < 0.05$.
[a] Median (range).
[b] 1 = no activity, 10 = normal activity.

decrease in analgesic consumption on the day of surgery, but the total analgesic consumption was the same in both groups. The VAS scores in the treatment group were significantly reduced on Day 1 on abduction of the shoulder but not on Days 2 and 3 (Table 5).

Discussion

Ambulatory surgery accounts for 60% of the surgery performed in North America (13). More complex procedures, such as shoulder arthroscopy, are now being performed as ambulatory surgery. The incidence of unanticipated admission after shoulder arthroscopy at our institution was 3.5%, with an overall rate of 1.4% (14). Persistent pain, nausea, and vomiting are the major causes of unanticipated admission after ambulatory shoulder arthroscopy. Therefore, it is pertinent to develop an anesthetic regimen that reduces these symptoms.

A combined regimen of general anesthesia and regional anesthesia can result in additive or synergistic effects of two or more drugs that relieve pain by different mechanisms (15–17). For example, local infiltration with bupivacaine has been used in conjunction with epidural bupivacaine and morphine for upper abdominal surgery (15), and intramuscular meperidine, toradol, and local infiltration with bupivacaine for laparoscopic cholecystectomy (16).

Alternatives in regional analgesia for shoulder arthroscopy include intraarticular bupivacaine, interscalene nerve block, and suprascapular nerve block. In one study, 39 outpatients undergoing shoulder arthroscopy were randomly selected to receive either intraarticular bupivacaine or placebo. There was no detectable difference between the two groups.

Interscalene nerve block, alone (17,18) or supplemented with superficial cervical plexus block to ensure the blockade of the supraclavicular nerve (19,20), results in success rates of 87%–100%. However, local anesthetic volumes of at least 30 mL, which can cause systemic toxicity (17), are required. Potentially serious complications include inadvertent epidural and spinal anesthesia, vertebral artery injection, paralysis of vagus, recurrent laryngeal, and cervical sympathetic nerve (17), pneumothorax (21), and injury to the brachial plexus (22). Phrenic nerve block occurs in all patients undergoing interscalene nerve block (3–5). Urmey (3) noted a mean decrease of 41% ± 12% in the forced vital capacity after this procedure.

Suprascapular nerve block offers a safe alternative to interscalene nerve block. A preliminary study of 11 patients undergoing acromioplasty indicated that it provided pain relief (10), and it is effective in the treatment of pain due to rheumatoid arthritis (7), metastases in the humeral head (8), and frozen shoulder (9). The only side effects are inadvertent vascular injection and pneumothorax (<1%) (11).

In the present study, VAS and VPS scores in the immediate postoperative period were reduced in the treatment group. This reflects the efficacy of the suprascapular nerve block, especially as those patients had similar pain on abduction as did the placebo patients at rest. At 180 and 240 minutes, the similarity in VAS and VPS scores between the two groups could be due to the treatment effectiveness of a greater consumption of PCA morphine by the placebo group. In contrast to the VAS and VPS scores, the MPQ score was not different between the two groups. This may

Table 5. Three-Day Self-Completion Questionnaire for Visual Analog Scale (VAS) and Analgesic Consumption

	Placebo (n = 25)				Suprascapular nerve block (n = 25)			
Patients who returned form	14				18			
Total acetaminophen with codeine for 3 days[a]	13 (4–22)				13 (0–40)			
	0	1	2	3	0	1	2	3
Acetaminophen with codeine use after surgery (Day)[a]	5 (2–8)	5 (0–8)	2 (0–6)	2 (0–7)	3 (0–9)*	5 (0–12)	3 (0–12)	2 (0–9)
	1	2		3	1	2		3
VAS scores after surgery (Day)								
Rest	32 ± 21	23 ± 22		20 ± 20	26 ± 28	28 ± 28		17 ± 22
Abduction	69 ± 22	55 ± 30		47 ± 30	51 ± 31*	46 ± 30		30 ± 25

Data are presented as mean ± SD unless otherwise noted.
* $P < 0.05$.
[a] Median (range).

reflect the limitation of the MPQ for assessing acute pain when patients are still sedated.

There was some postoperative pain reported with the suprascapular nerve block. This was anticipated, as the nerve supplies only 70% of the sensory fibers to the joint and capsule. Since there was no cutaneous analgesia from the block, patients also suffered from incisional wound pain.

The higher incidence of nausea and vomiting in the placebo group was likely due to more intense pain (23) and greater postoperative consumption of opioids. Time to achieve PADS ≥9 was not statistically different between the two groups, perhaps because PADS is not sensitive enough to detect the difference in level of pain or because the 30-minute measurement intervals were too long to detect differences between the two groups.

Although the duration of hospital stay was decreased by 64 minutes in the treatment group, the additional cost associated with the block—such as operating room time, anesthesiologist time, and supplies—may be more. We did not assess the overall cost-effectiveness of the suprascapular nerve block in arthroscopic shoulder surgery.

The reduction in VPS scores and analgesic consumption reported at the 24-hour phone call interview demonstrated a prolonged effect of the suprascapular nerve block. This might be due to a preemptive effect. There was no difference in patient satisfaction, time to return to work, or activity scores with the suprascapular nerve block, despite severe pain in the placebo group. This may reflect patient underreporting of dissatisfaction when directly questioned, the multiple sociopsychological factors involved in return to work, or poor correlation with functional scores and postoperative symptoms. The poor response rate for the self-completion questionnaire made interpretation of the results difficult. However, the results on the questionnaire were similar to those obtained from the 24-hour phone interview.

In summary, the concomitant use of suprascapular nerve block and general anesthesia was highly effective in patients undergoing ambulatory shoulder arthroscopy. Blocking the nerve supply to the shoulder provided postoperative pain relief, reduced the postoperative morphine requirement, and shortened the recovery process. In view of its efficacy and relative safety, suprascapular nerve block can be used routinely as a supplement to general anesthesia in ambulatory shoulder arthroscopic surgery.

Appendix 1

Postanesthetic Discharge Scoring System

Vital signs	
2	Within 20% of preoperative value
1	20%–40% of preoperative value
0	40% of preoperative value
Activity, mental status	
2	Orientated and steady gait
1	Orientated or steady gait
0	Neither
Pain, nausea, vomiting	
2	Minimal
1	Moderate
0	Severe
Surgical bleeding	
2	Minimal
1	Moderate
0	Severe
Intake and output	
2	PO fluids and voided
1	PO fluids or voided
0	Neither

The total score is 10; patients scoring ≥9 were fit for discharge to home.
PO = *per os*.

Appendix 2

Twenty-Four–Hour Phone Questionnaire

1. Did you have pain in the operative shoulder at rest in the last 24 hr?
   None Mild Moderate Severe
2. Did you have pain in the operative shoulder on abduction in the last 24 hr?
   None Mild Moderate Severe
3. Did you use any analgesics? What did you use and what was the amount?
4. Have you felt nauseous? Y N
   Have you vomited? Y N
5. Were you satisfied with the pain treatment? Y N
   Would you have the same anesthetic technique again? Y N
   Reason _____
6. Were you satisfied with your anesthetic care? Y N
   How would you rate it?
7. If you were to have the same procedure again, would you have it as a day case procedure? Y N
8. On a scale of 1 to 10, 1 being no activity and 10 being back to your normal activity, where would you rate yourself?
9. Did you sleep normally? Y N
   What disturbed your sleep? _____
10. Did you call your doctor or return to the Emergency Department after discharge? Y N

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