

# Patient-Controlled Interscalene Analgesia After Shoulder Surgery: Catheter Insertion by the Posterior Approach

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Insertion and maintenance of an interscalene catheter is technically challenging using lateral or anterior approaches. We report a technique to provide continuous brachial plexus blockade through a 48-h infusion of ropivacaine 0.1% (5 mL/h with a 5 mL bolus dose, 20-min lockout interval) using a catheter inserted with cannula-over-needle technique on the posterior side of the neck in 120 patients undergoing shoulder surgery. All catheters were successfully placed. There were no technical complications (impossibility to thread catheter, accidental vascular, epidural or subarachnoid location), catheter dislodgment, or analgesic solution leak-

age. Dysphonia, Horner's syndrome, and difficulty breathing were observed in 12 patients, four patients, and one patient, respectively. One patient complained of minor paresthesia that spontaneously resolved. Three patients complained of cervical pain. Pain scores as well as ropivacaine requirement via a patient-controlled analgesia device were low. Evaluation of acute and non-acute complications in a large-size study is needed to compare efficacy and safety of this approach with existing techniques.

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**C**ontinuous interscalene blockade for 24-48 h is an effective means of analgesia after shoulder surgery (1). However, catheter insertion and maintenance in the brachial plexus sheath remains technically challenging (2-5).

In this report, we evaluate the reliability of the posterior approach to continuous interscalene block.

## Methods

With local ethics committee approval and informed consent, patients undergoing shoulder surgery were recruited. Exclusion criteria included contraindications to the interscalene plexus block and ASA physical status IV-V.

Patients were premedicated with oral hydroxyzine 1-2 mg/kg. In the anesthesia induction room, standard monitoring was established and a peripheral IV cannula was inserted. The surface landmarks were those reported by Pippa et al. (6) (Fig. 1). Under local anesthesia, a 64-mm or 110-mm, 15°-30° short-bevel,

18-gauge or 20-gauge insulated needle (Contiplex® D; B. Braun) connected to a nerve stimulator was horizontally advanced in the anteroposterior plane. Correct placement of the needle was defined as isolated or mixed contractions of the deltoid, biceps, or triceps muscles at an intensity of <0.5 mA. Ropivacaine 0.75% (20-30 mL) was injected after repeated aspiration. The needle was withdrawn, maintaining the Teflon cannula within the sheath. A 20-gauge or 22-gauge catheter was advanced 3-4 cm beyond the tip of the Teflon cannula, which was then withdrawn. The catheter was secured with adhesive tape, sterile liquid adhesive, and a transparent occlusive dressing. The position of the catheter related to the brachial plexus was checked by radiography after injection of 5-mL contrast medium. Intraoperatively, sedation or general anesthesia was performed according to patient and surgeon preference.

Postoperatively, a patient-controlled analgesia device was connected to the catheter to allow a continuous infusion of 5 mL/h of ropivacaine 0.1%, with a 5-mL bolus and 20-min lockout interval. Pain using a 0-100 graded visual analog scale (VAS) and patient satisfaction were assessed at 0, 6, 12, 24, 36, and 48 h postoperatively. Pain related to surgery and catheter insertion (cervical pain) was assessed. If VAS score was more than 20 at rest or 30 at passive extension of the arm, the pump infusion was increased to 10 mL/h.

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**Figure 1.** The patient is in sitting position with the head leaning forward. The needle entry site (X) is on a horizontal line at equal distance from the spinous processes of the sixth and seventh cervical vertebra, 3–3.5 cm lateral to the midline of the spinous process. The seventh cervical vertebra is easily identifiable because it does not move during neck extension. “Y” is the Boezaart needle insertion point at the apex of the “V” formed by the trapezius and levator scapulae muscles at the level the sixth cervical vertebra (C6); this point is between 4 and 12 cm lateral of the midpoint of the spinous process of C6.

At any time, supplemental analgesics were administered on patient request (100-mg IV/12 h ketoprofen and 2 g of IV/6h pro-paracetamol).

Occurrence of clinical adverse effects such as respiratory or cardiovascular complications, symptoms of local anesthetic toxicity, neuraxial spread, Horner’s syndrome, and dysphonia were recorded during the 48-h hospital stay. Irritation of the skin, hematoma, blood aspiration via the catheter, and occlusion of the catheter were monitored twice daily. After patient discharge, motor (weakness) and sensory (loss of feeling) deficits, the persistence of paresthesia or dysesthesia, and pain not related to surgery were monitored monthly during a 3-mo period.

## Results

A total of 122 consecutive patients were enrolled in the study. One patient was eliminated from the study after positive aspiration of blood in the catheter at the time of starting the pump, and a second was eliminated because of accidental catheter removal. Demographic and surgical data of the 120 remaining patients are summarized in Table 1.

Time from skin puncture to correct evoked muscle contractions was  $1.8 \pm 1.2$  min (range, 0.25–5.21 min). Time to catheter placement, i.e., from the end of ropivacaine injection to the withdrawal of the Teflon cannula was  $1.2 \pm 0.8$  min (range, 0.26–5 min). Resistance to threading the catheter was encountered in six (5%)

**Table 1.** Demographic and Surgical Characteristics

Number of patients	120
ASA class I/II/III	67/40/13
Sex (M/F)	58/62
Age (yr)	$52 \pm 16$
Body mass index ( $\text{kg}/\text{m}^2$ )	$26.0 \pm 3.4$
Surgery (open/arthroscopic)	
Shoulder arthroplasty	2/0
Acromioplasty	13/15
Rotator cuff repair	53/14
Bankart operation	19/1
Other	2/1
Surgical time (min)	$99 \pm 31$
Anesthetic technique	
General anesthesia	100
Regional anesthesia	20

Values are expressed as n and mean  $\pm$  SD.



**Figure 2.** Tubular opacification of the brachial plexus compartment.

patients. The distribution of contrast medium showed a cervical tubular or pyramidal aspect along the cervical spine or the clavicle midpoint in 95% of patients (Fig. 2). In six other patients, the radiograph was doubtful as the outlines were irregular and not systematized. Pain scores and analgesic requirement were low (Table 2 and 3).

Dysphonia, Horner’s syndrome, and difficulty breathing were observed in 12 patients, four patients, and one patient, respectively. Three patients (2.5%) complained of cervical pain, which spontaneously resolved 48 h later at catheter removal. One month after the surgery, one patient complained of minor paresthesia of two fingers, which spontaneously resolved 2 wk later.

## Discussion

Different anatomical approaches for continuous brachial plexus blockade have been reported at the cervical level, with failure rates varying from 1% (1) to

**Table 2.** Pain Scores at Rest and Motion and Patient Satisfaction with Analgesia

	T0	T6	T12	T24	T36	T48
VAS-R	3 ± 11	5 ± 13	8 ± 15	7 ± 13	5 ± 11	5 ± 10
VAS-M	4 ± 15	9 ± 19	13 ± 20	17 ± 21	14 ± 18	11 ± 14
Patient satisfaction						
Excellent	94	85	83	78	80	81
Good	4	13	14	18	17	18
Poor	2	2	3	4	3	1
Unsatisfied	0	0	0	0	0	0

Values are expressed as mean ± SD and percentage of patients.

VAS-R = visual analog scale score at rest; VAS-M = visual analog scale score at motion; T0 = recovery room admission.

**Table 3.** Analgesic Dose Requirement and Staff Interventions During the 48-Hour Study Period

Ropivacaine dose requirement (mg/h)	7.3 ± 1.7
Patients requiring an increased infusion rate (n)	6
Supplemental analgesics at least once	
Pro-pacetamol (n)	46
Ketoprofen (n)	46
Total pro-paracetamol dose (g)	2.3 ± 2.3
Total ketoprofen dose (mg)	57.4 ± 65.3

Values are expressed as n and mean ± SD.

25% (2). Comparisons among techniques are difficult because of differences in level of blockade, local anesthetic solution, dose regimens, delivery system, and the equipment used for catheter insertion. Experience of the investigator inextricably contributes to the reliability and efficiency of a technique.

In the posterior approach, the relatively long pathway of the catheter in the extensor muscles of the neck may have improved the catheter fixation and prevented analgesic solution leakage, leading to a possible loss of efficacy.

Inserting a catheter by the posterior approach has been reported recently by Boezaart et al. (7) modifying the Pippa's landmarks. With Boezaart et al.'s technique, the needle entry point is located on the lateral side of the neck, which is not very different from the lateral modified approach (1), and the needle is directed medially and approximately 30° caudal, making a pneumothorax and a central block theoretically possible (8). In our study, the puncture site was located on the posterior side of the neck, invariably 3 cm lateral to the midpoint of the spinous process of the sixth cervical vertebra, and the needle was inserted forward and horizontally. In addition, the incidence of cervical pain was infrequent. This contrasts to the first of Boezaart et al.'s attempts, probably for technical reasons. The use of a large Tuohy needle, a loss-of-resistance to air technique and a stimulating catheter

without a first local anesthetic injection into the depth and the perineural sheath might explain the occurrence of pain (7).

Except for the two large-size studies of Borgeat et al. (1,9), information on paresthesias, dysesthesias, and pain not related to surgery persisting more than 1 month after continuous interscalene blocks is still lacking. It is thus difficult to know the incidence of chronic neurological complications with these techniques and to compare the different approaches. Further studies including more patients are needed to compare safety.

In conclusion, our results indicate that catheter insertion into the brachial plexus sheath through the posterior approach successfully provided analgesia after shoulder surgery. However, evaluation of efficacy and risks in a large-scale study is needed.

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