ACTA
ORTHOPAEDICA
et
TRAUMATOLOGICA
TURCICA

Acta Orthop Traumatol Turc 2010;44(2):105-110
doi:10.3944/AOTT.2010.2144

Functional results of conservative therapy accompanied by interscalane brachial plexus block and patient-controlled analgesia in cases with frozen shoulder

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Objectives: We evaluated the efficacy of simultaneous interscalene block and catheter analgesia applied as an aid to conservative treatment in improving shoulder functions in patients with frozen shoulder.

Methods: Three patients (2 women, 1 man; mean age 47 years) with frozen shoulder underwent conservative treatment including manipulation under interscalene brachial plexus block and subsequent rehabilitation under catheter analgesia to improve shoulder range of motion and function. Following manipulation under interscalene block, the patients were hospitalized for 15 to 28 days (mean 21 days) for an exercise program performed by a physiotherapist and orthopedist at least twice a day under interscalene catheter analgesia. Thirty minutes before each rehabilitation session, patient-controlled analgesia was administered via a pain relief pump. Active and passive range of motion (ROM) were measured and the severity of pain was rated using a visual analog scale (VAS) prior to and following interscalene block, during the exercise program, and at the end of the treatment. Functional assessments were made before and after treatment using the University of California in Los Angeles (UCLA) Shoulder Scale. The exercise program under interscalene analgesia was performed until pain-free and sufficient active movements were obtained, with at least 80% improvement in active and passive motion, a VAS score of 0-2, and an UCLA score of >27.

Results: Compared to pretreatment values, the ROM values showed remarkable increases at the end of the treatment. Active ROM reached at least 30° external rotation, 40° internal rotation, 150° flexion, 45° extension, and 100° abduction in all cases. On presentation, the VAS scores of all cases were 10 for both active and passive movements, whereas they ranged from 0 to 2 on discharge. The mean UCLA score increased from 12.3 to 30.3 after treatment. Immediately after the interscalene block, two patients exhibited signs of Horner's syndrome which resolved spontaneously within an hour without the need for treatment. No complications or catheter-related problems such as infection, break-off, or displacement developed throughout the treatment period. There was no requirement for additional analgesia.

Conclusion: In patients with frozen shoulder, interscalene block and continuous patient-controlled analgesia via an interscalene catheter provided sufficient analgesia and contributed to the recovery of shoulder functions through an effective and safe exercise program, with no side effects or complications. However, further studies are needed to assess the feasibility of home applications of interscalene patient-controlled analgesia to increase cost-effectiveness and patient satisfaction.

Key words: Analgesia, patient-controlled; brachial plexus; catheterization; exercise therapy; manipulation, orthopedic; nerve block; pain/etiology; range of motion, articular; shoulder joint/pathology/therapy.

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Submitted: November 10, 2008 **Accepted:** July 5, 2009

Frozen shoulder, first described by Codman in 1934, is the third most common cause of pain in the musculoskeletal system.[1-4] Although several factors have been put forward to explain the pathophysiology, the most widely accepted one is inflammation of the joint capsule and fibrosis developing in the surrounding soft tissue. This condition is characterized by pain together with loss of flexibility and contracture of the glenohumeral joint capsule and restricted humeroscapular motion.[1,3,4] Its prevalence in the general population is about 2% to 3%, and it is more common at ages 40 to 60.[1,5] The nondominant side is more often affected, 6% to 17% of cases have bilateral involvement, and there is a slight female preponderance with a female-to-male ratio of about 1.4.[6]

Several surgical and conservative treatment methods have been used for frozen shoulder. The goal of treatment is to relieve pain, improve functions, and achieve permanent recovery.[2,4] Nowadays, various peripheral regional anesthesia techniques are applied for pain relief.[7] One of these techniques is interscalene brachial plexus block which is used in shoulder surgery for anesthesia and postoperative analgesia, with successful results.[8-11] It may be convenient to incorporate this technique into rehabilitation of patients to enhance the effectiveness of conservative treatment for frozen shoulder. Although there are case reports or case series in which interscalene block has been utilized in the rehabilitation of frozen shoulder, reports on patient-controlled continuous interscalene block analgesia are limited.[12-16]

This study was designed to evaluate the efficacy of interscalene block and analgesia through continuous catheter placement to facilitate and contribute to the rehabilitation of three patients with frozen shoulder.

Patients and methods

The study included three ASA I patients (2 women, 1 man; mean age 47 years) who presented to the Department of Orthopedics and Traumatology, Medicine Faculty of Uludağ University, with complaints of severe shoulder pain of six-month history and extremely limited motion. All the patients gave a history of excessive use of the shoulder and repeated micro trauma that resulted in pain worsening at night and increasing limitation of shoulder movement in their dominant extremities. On physical examination, all had advanced limitation in external and internal rotation of the shoulder. The abdominal compression test and lift-off test were positive. Due to excessively decreased abduction and flexion movements of the shoulders, attempts to assess shoulder impingement and the rotator cuff (Hawkin's sign, Jobe's test) were not helpful. There were no hormonal, cardiovascular, or cervical problems. Magnetic resonance imaging showed signs of rotator cuff tendonitis. The patients were diagnosed as having frozen shoulder and conservative treatment was planned. However, initial attempts with medical and physical therapy were unsuccessful in symptom relief. Thus, manipulation under simultaneous interscalene brachial plexus block and further rehabilitation under analgesia were decided to improve the range of motion and function of the shoulder joint.

Application of the interscalene block

The patients were sedated with 2 mg intravenous midazolam after basic monitoring in the operating room. Following antiseptic preparation of the neck area, interscalene block was applied by the same anesthesiologist, as described by Winnie.[17] With the patient in the supine position, the posterior edge of the sternocleidomastoid muscle, the scalene hiatus, and cricoid cartilage were marked to determine the entry point. The head was turned to the opposite side of application, then a horizontal line was drawn from the cricoid cartilage to the interscalene groove. At the intersection of this line with the posterior edge of the sternocleidomastoid muscle, an 18 G, 50 mm Stimuplex needle (B. Braun, Melsungen, Germany) was inserted and advanced in the caudal, medial, and posterior directions to elicit shoulder muscle contraction with an intensity of 2 mA stimulation. Upon observation of muscle contraction when the intensity of the stimulation was decreased to 0.5 mA, a 30 ml of local anesthetic mixture was injected consisting of 20 ml 0.5% bupivacaine and 10 ml 2% lidocaine. Following the injection, a 20 G catheter (Contiplex-T, B. Braun) was inserted 4 cm through the needle, which was then withdrawn leaving the catheter in place. The catheter was stitched to the skin and stabilized with a sterile adhesive tape (Fig. 1).

Manipulation

After complete loss of movement and sensation in the upper extremity, the patients were placed in the semi-sitting position, sedated with 2-4 mg intravenous

midazolam, and manipulation was applied on the glenohumeral and scapulothoracic joints. The shoulder joint was first brought to external rotation and then to internal rotation at varying degrees of abduction (0°-90°). Then, with the upper extremity placed in the scapular plane, 0° abduction and external rotation were applied to the shoulder, followed by external rotation to the extremity and 90° abduction to the shoulder. Excessive force was avoided in all the maneuvers and the movements were performed until full range of motion was obtained in all directions.

Post-manipulation period

Following interscalene block and manipulation, the patients were kept under observation in the recovery unit for two hours during which vital parameters were within normal limits. Before transferring the patients to the orthopedics and traumatology clinic, an analgesia program was prepared for each patient consisting of a patient-controlled pain relief pump (Abbott, Provider Pain Management Pump) do dispense 5 ml of 0.125% isobaric bupivacaine solution every 30 minutes. Under simultaneous interscalene analgesia, an exercise program was implemented by a physiotherapist and orthopedist at least twice a day throughout hospitalization. To enable the patient to perform the exercises without pain, patient-controlled analgesia was administered via the catheter approximately 30 minutes before each exercise. The duration of hospital stay following manipulation ranged from 15 to 28 days (mean 21 days). The catheter was checked every other day and particular care was taken not to cause displacement during replacement of the dressings. After each exercise session, a cold compress was applied for 15 minutes. Range of motion (ROM) for active and passive movements was measured with a goniometer and the severity of pain was rated using a 10-item visual analog scale (VAS) (0= no pain, 10=most severe pain) prior to and following interscalene block, during the exercise program, and at the end of the treatment. Functional assessments were made before and after treatment using the University of California in Los Angeles (UCLA) Shoulder Scale, where a score of >27 shows a good or very good result, and a score of <27 shows a poor result.[18]

The exercise program under continuous interscalene analgesia was performed until pain-free and sufficient active movements were obtained. The treatment was discontinued when at least 80% improvement in active and passive motion, a VAS score of 0-2, and an UCLA score of >27 were achieved.

Fig. 1. The interscalene catheter fixed to the skin and use of the analgesic pump by the patient.

Results

Table 1 shows the mean ROM and VAS values of the patients before and after interscalene block, during treatment and at the end of the exercise program, together with pre- and posttreatment UCLA scores. Compared to pretreatment values, the ROM values showed remarkable increases at the end of treatment. On presentation, the VAS scores of all cases were 10 for both active and passive movements, whereas they ranged from 0 to 2 on discharge. The mean UCLA score increased from 12.3 to 30.3 after treatment.

Immediately after the interscalene block, the two female patients exhibited signs of Horner's syndrome characterized by ptosis, mydriasis, and anhidrosis due to the involvement of sympathetic nerves on the affected side. However, this condition resolved spontaneously within an hour without the need for treatment.

No complications or catheter-related problems such as infection, break-off, or displacement developed throughout the treatment period. There was no requirement for additional analgesia.

The patients were discharged with a home exercise program when active ROM reached at least 30° external rotation, 40° internal rotation, 150° flexion, 45° extension, and 100° abduction, at which time the VAS scores were below 3 and the UCLA scores were greater than 27.

Table 1
The mean range of motion measurements and pain scores of the patients before and after interscalene block, during treatment, and at the end of the exercise program, with pre- and posttreatment UCLA scores

	Before interscalene block		During treatment		
	Active motion	Passive motion	Post block	Patient-controlled	Final
Range of motion					
External rotation (°)	0.0	13.3	63.3	26.7	36.7
Internal rotation (°)	5.0	20.0	68.3	31.7	41.7
Flexion (°)	3.3	13.3	180.0	146.7	160.0
Extension (°)	5.0	11.7	66.7	36.7	45.0
Abduction (°)	6.7	21.7	138.3	93.3	110.0
Pain score					
External rotation (°)	10.0	10.0	2.3	2.3	1.7
Internal rotation (°)	10.0	10.0	2.3	2.0	1.3
Flexion (°)	10.0	10.0	2.7	2.3	0.7
Extension (°)	10.0	10.0	2.0	2.7	1.0
Abduction (°)	10.0	10.0	2.0	3.0	0.7
UCLA score	12.3			30.3	

Discussion

The availability of different methods of treatment for frozen shoulder poses difficulty in choosing the most appropriate method. Besides invasive and nonconservative methods such as open or closed (arthroscopy) surgery, steroid injections, and capsule distension, minimally invasive and conservative methods also exist.[2,8,19]

It has been stated that most cases of frozen shoulder can be treated by conservative methods without the need for surgical methods.[8] The success of physiotherapy is related to the absence of pain during application of the program. However, severe shoulder pain and extremely limited joint motion in these patients usually hamper the effectiveness of exercises. Improvements in the range of motion provided by manipulation under general anesthesia, but without any surgical procedure, cannot be maintained throughout the rehabilitation period due to severe pain.[14] It may be possible to resolve this problem by the use of regional anesthesia methods. There are few studies in the literature which evaluate the effectiveness of interscalene block and continuous analgesia through a catheter for the treatment of frozen shoulder, without the need for any other surgical treatment.[12-16] Application of analgesia through an implanted interscalene catheter for frozen shoulder was found effective by Pollock et al.[9] in 93 patients initially treated with arthroscopy, and by Cohen et al.[10] in 30 patients who did not benefit from surgery. Diklić et al.[12] treated their patients with manipulation under general anesthesia followed by exercise therapy under simultaneous interscalene analgesia and found that improvements obtained in elevation and external rotation during manipulation were maintained by 95% and 81%, respectively, at the end of treatment. Lierz et al.[13] treated 37 patients with manipulation under brachial plexus block using 20 ml of 0.375% bupivacaine followed by exercise therapy at six-hour intervals under simultaneous interscalene analgesia with a bolus dose of 0.25% bupivacaine and reported patient satisfaction as 100%, with no requirement of additional analgesia in 89% of the patients. We did not use any other surgical procedure or general anesthesia in our patients and, following manipulation under interscalene block, we used continuous patient-controlled analgesia via the infusion pump instead of bolus analgesia. At the end of treatment, we achieved remarkable improvements in shoulder functions, VAS and UCLA scores without the need for additional analgesia.

Despite very small sample size, our results suggest that utilization of interscalene catheter analgesia can be an alternative conservative method in the treatment of frozen shoulder, obviating the need for surgery. However, the need for hospitalization during the application of pain-free exercise therapy provided by continuous analgesic infusion through

the interscalene catheter may adversely affect both cost-effectiveness and patient satisfaction. Recently, several studies have found home exercise programs under analgesia as an appropriate choice in selected patients after necessary training and motivation are provided.[11,20-22] Nielsen et al.[11] reported on four cases who received continuous interscalene brachial plexus block at home following major shoulder surgery. The authors estimated that the total cost of home visits by healthcare staff was only 12.8% of the daily cost of hospitalization. Considering the high costs associated with a lengthy hospital stay, implementation of patient-controlled analgesia programs at home in appropriate cases seems to be a feasible and cost-effective approach.

Although interscalene block and catheterization have been found as a safe method by many authors, it is not devoid of problems including minor complications such as infection and displacement of the catheter, and major complications such as cardiac arrest, cervical and thoracic epidural block, and pneumothorax.[23,24] The incidence of these complications can be reduced when regional anesthesia is applied by experienced anesthesiologists and using standard approaches. In our cases, interscalene block was applied by the same anesthesiologist using the approach described by Winnie[17] and no complications were observed. We believe that routine catheter care, attention paid to placing and stitching the catheter to the skin, and stabilization with a sterile adhesive tape were effective in preventing catheter-related complications.

In conclusion, the early results of three patients with frozen shoulder showed that interscalene block and continuous patient-controlled analgesia via an interscalene catheter provided sufficient analgesia and contributed to the recovery of shoulder functions through an effective and safe exercise program, with no side effects or complications. Prospective, randomized, and comparative studies with sufficient number of cases are needed to determine the ideal method of treatment for frozen shoulder in terms of the effectiveness, safety, and cost-effectiveness of various techniques, with focus on home applications and patient satisfaction.

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