

## The Frozen Shoulder Syndrome

### Description of a new technique and five case reports using the subscapular nerve block and subscapularis trigger point infiltration

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**Summary:** *Background and Objectives:* A frozen shoulder is considered by some authors to be a common stage of many disorders affecting the shoulder, while others regard it as an independent idiopathic condition. A consistent finding is that subscapularis muscle trigger points play a key role in the development of the frozen shoulder syndrome. Apart from the conventional treatment, a selective subscapularis fossa nerve block combined with subscapularis trigger points infiltration, may be an effective treatment in preventing chronic pain. *Methods:* In this manuscript the posterior injection technique of the subscapularis fossa nerve block is described. *Results:* Five patients with typical symptoms of frozen shoulder, who did not respond to conventional treatment, but obtained pain relief after a combination of a subscapularis nerve block with the infiltration of trigger points, are presented. *Conclusion:* The results of this block in various painful situations of the shoulder region suggest the importance of subscapularis muscle in the etiology of the frozen shoulder. Using this technique, we could demonstrate that a subscapular nerve block and subscapularis trigger points infiltration have both a diagnostic and therapeutic value for the treatment of the frozen shoulder.

**Key words:** Chronic pain ; subscapularis nerve ; subscapularis muscle ; frozen shoulder ; subscapularis nerve block.

#### INTRODUCTION

Irritation of subscapularis muscle trigger points and adjacent nerves produce pain both during movement and at rest, resulting in pain radiating to the scapula, posterior deltoid muscle, elbow and / or dorsal wrist (Fig. 1). The pain usually worsens at night. The usual scenario restricts arm abduction and external rotation, reducing movement in all directions, ending in a stiff, frozen shoulder. Many synonyms are used in the literature: adhesive capsulitis (2, 3), peri-arthritis or periarticular arthritis (2, 3, 15), pericapsulitis (3), scapulo-costal syndrome (23), calcified tendinitis of the

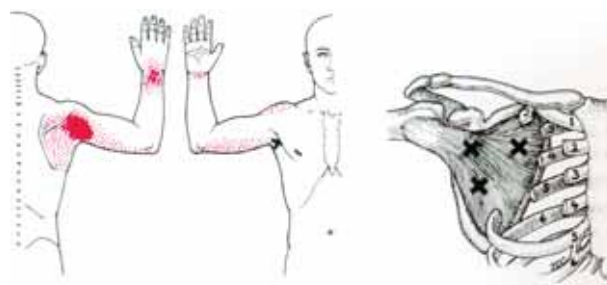


Fig. 1. — Referred pain pattern projected from trigger point (X) in the right subscapularis muscle. (Travell J.G., Simons D.G., *Myofascial Pain and Dysfunction. The Trigger Point Manual*. Vol. 1, Baltimore : Williams & Wilkins, 1983, with permission).

rotator cuff (2), degenerative tendinitis of the rotator cuff (2, 3, 23), acromioclavicular arthritis (2).

The etiology of a frozen shoulder is complex (3, 23). A common finding is that the subscapularis muscle trigger points play a key role in the development of a frozen shoulder (23). A selective subscapularis fossa nerve block with subscapularis trigger points infiltration may be very effective in preventing progression to chronic pain.

#### ANATOMY OF THE FOSSA SUBSCAPULARIS

The subscapularis muscle is located at the anterior surface of the subscapularis fossa (13). The subscapularis, the most important internal rotator muscle of the arm (it also acts as an adductor when the arm is raised or flexed, and together with the rotator cuff, keeps the head of the humerus pressed

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into the glenoid fossa) is innervated by the subscapular nerve complex, which includes 2 or 3 nerves arising from various parts of the posterior cord of the brachial plexus, innervating the subscapularis, teres major, and latissimus dorsi muscles (10) (Fig. 2).

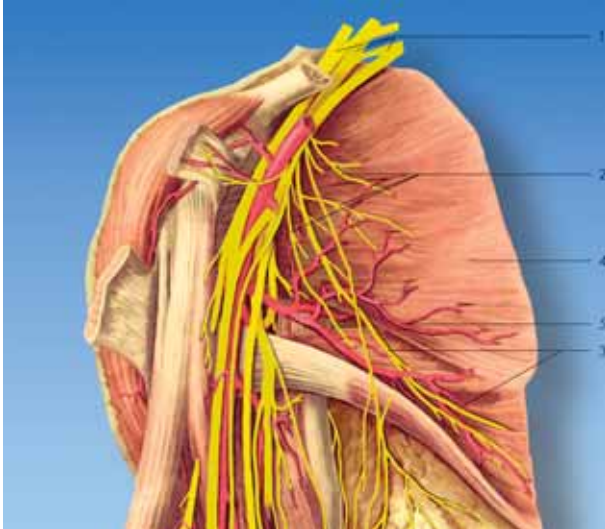


Fig. 2. — The subscapular nerve complex consists of : 2 or 3 nerves that arise from the posterior cord of the brachial plexus (1) the upper and lower subscapular nerves (2) the thoracodorsal nerve (or middle subscapular nerve) (3). The subscapularis muscle (4) is clearly visible with in front of it the circumflex scapulae artery (5) (Jankovic D., *Regional Nerve Blocks & Infiltration Therapy*, Third Edition, Oxford – Boston : Blackwell Science, 2004, with permission).

## INDICATIONS

Indications for a subscapular nerve block and subscapularis trigger points infiltration are presented in Table 1.

Table 1

Indications for subscapular nerve block and subscapularis trigger points infiltration

|                      |   |
|----------------------|---|
| <b>Diagnostic :</b>  | in painful conditions of the shoulder girdle/joint  |
| <b>Therapeutic :</b> | in the following situations (in combination with physiotherapy) :   |
|                      | <ul style="list-style-type: none"> <li>• frozen shoulder syndrome</li> <li>• rheuma</li> <li>• diabetes</li> <li>• post-trauma neuralgia</li> <li>• post-herpetic neuralgia</li> <li>• post-hemiplegia neuralgia</li> <li>• ankylosing spondylitis</li> </ul> |

## TECHNIQUE

Informed consent has to be obtained prior to injection. While the patient is in the sitting posi-

tion, the patient's ipsilateral arm is pulled back to identify the contours of the scapula (13). Mark the midpoint of the medial margin of the scapula as the point of needle insertion and localize the acromion. Under sterile conditions, local anesthetic is injected through a skin wheal at the spotted mark. Prior to the subscapularis injections the operator should manually bend the shaft of a, 7 cm 20-G needle to form approximately a 20° angle. In this technique paresthesias are not sought. Insert the needle into the midpoint of the medial margin of the scapula, pointing towards the acromion (Fig. 3), and advance the needle subscapularly, parallel to the surface of the skin between the anterior surface of the subscapularis fossa and the posterior thoracic wall (ribs), to introduce the needle into the subscapularis fossa. Withdraw the needle when it contacts the edge of the ribs, to the subcutis and reinsert it again. At a depth of four to six cm (depending on the anatomy), following careful aspiration for blood or air, a total volume of 10-15 mL of the local anesthetic solution is injected. The signs of a successful subscapularis injection are : spread extending into the shoulder joint and upper arm, and often as far as distal the wrist, corresponding to the typical radiation pattern of the trigger points of the subscapular muscle (Fig. 1). The analgesia after injection with long-acting anesthetic solutions lasts

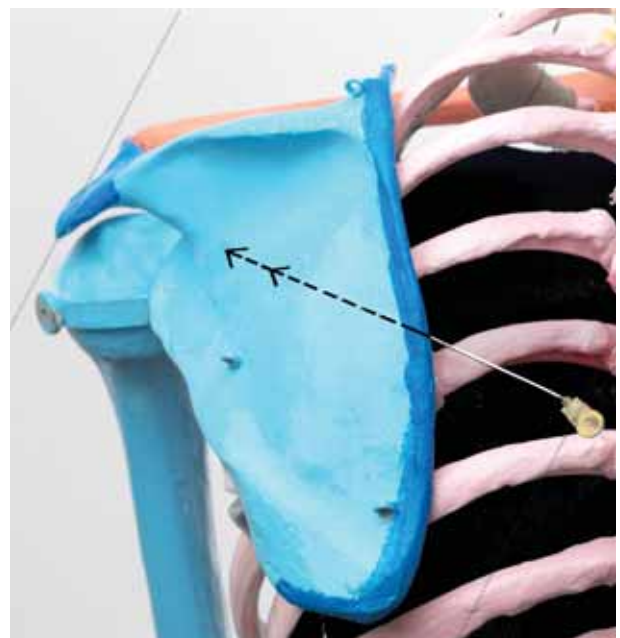


Fig. 3. — Pull the patient's ipsilateral arm back. Localize the acromion and medial margin of the scapula, bend the needle to form approximately a 20° angle. The insertion point of the needle is the midpoint of the medial margin of the scapula aiming the tip towards the acromion (in the skeleton) (Jankovic D., *Regional Nerve Blocks & Infiltration Therapy*, Third Edition, Oxford – Boston : Blackwell Science, 2004, with permission).

on average between 6 and 8 hours, depending on the volume and concentration of the local anesthetic injected. The local anesthetic solutions used are 5 mL of prilocaine 1% or mepivacaine 1% blocks for diagnostic or 10 to 15 mL of ropivacaine 0.375-0.75% or bupivacaine 0.25-0.5% blocks for therapeutic procedures. Severe painful situations may benefit from the addition of 4-8 mg dexamethasone or 20-40 mg triamcinolone acetate. Repeated injections may be useful in patients who show a positive result.

#### COMPLICATIONS

Possible complications are : intravascular injection ; intrathoracic injection (pneumothorax) ; and infection, if a strict aseptic technique is not adhered to. An overdosage of local anesthetic solution may produce transient weakness in the shoulder and upper arm and results in a partial intercostal block. We practise in outpatients a maximum of 60 mg ropivacaine 0.375%, or 40 mg bupivacaine 0.25%, in order to avoid an overdose producing transient weakness in the shoulder-arm area. No motor weakness has been observed after using the recommended dose. Nevertheless outpatients should be informed about this possibility. A bilateral block can also result (e.g. in rheumatic conditions). Having used the described technique no complications were seen in the patients we treated. The results of our initial experience using this injection suggest that it is a potentially safe and effective technique.

In order to illustrate the effectiveness of the subscapular nerve block and subscapularis trigger point infiltration, we present five case reports who originally did not respond to conventional therapy.

#### CASE 1

A 51-year-old woman with diabetes mellitus presented with a four month history of left shoulder pain, both at rest and while in motion, worsening at night and affecting her sleep. Patient described the pain as a constant ache in the posterior deltoid area, extending from the posterior aspect of the arm to the elbow. The patient rated the pain intensity as 8/10 by the Visual Analogue Score for Pain (VAS).

Physical examination revealed tenderness of the humeral attachment on muscle palpation as well as restricted abduction and external rotation of the arm at the shoulder. A Magnetic Resonance

Imaging (MRI) scan of the left shoulder found no abnormalities.

Oral medication with NSAIDs, local anesthetic infiltration by the orthopaedic surgeon and analgesic infusion failed to give any benefit. Physical therapy aggravated the patient's pain, and therefore could not be performed efficiently.

After obtaining informed consent a subscapularis nerve block and the infiltration of subscapular trigger points with a total of 40 mg of triamcinolone in 15 mL of 0.375 ropivacaine was performed. Twenty-four hours later, the patient reported a remarkable reduction in pain (VAS 4/10). Six repeated ropivacaine injections (three blocks weekly) without triamcinolone followed, allowing the patient to undergo physical therapy and perform stretching exercises. Four months later, on her last follow-up examination, the patient was still painfree.

#### CASE 2

A 68-year-old woman presented with no previous medical history other than occasional shoulder problems. Six weeks before, following sudden stress overload, the patient began experiencing severe left shoulder pain both at rest and in motion. The pain worsened at night, radiating to the elbow and wrist. Patient suffered sleep disturbances and the pain strongly reduced her daily activities. Physical examination showed a severely restricted abduction to less than 35 degrees and an inability to reach the opposite armpit. An MRI scan revealed no specific diagnostic findings. No sensory or motor deficit could be detected.

Local infiltrations with local anesthetic solution, analgesic infusion and oral medication with buprenorphine (0.8 mg), ibuprofen (400 mg every six hours), diazepam (20 mg in the evening) and TENS failed to give adequate pain relief. Patient rated the pain as 9/10 on the VAS scale. With physical therapy, the pain became worse. Informed consent has been obtained prior to injection. A subscapularis nerve block and infiltration of subscapularis trigger points with 40 mg triamcinolone in 15 mL of 0.5% ropivacaine resulted 24 hrs later in partial pain relief (VAS score 5/10), allowing her to sleep at night. The next injection was administered using the same solution and two days later the patient experienced further improvement in pain relief (VAS score 3/10). Except for 10 mg diazepam in the evening, oral medication was stopped.

Subsequently, five injections with 15 mL 0.375% of ropivacaine without triamcinolone (two

to three blocks weekly) were administered. The patient was able to undergo physical therapy and could perform stretching exercises following each block without experiencing pain.

Eight months later, on her final follow-up examination, the patient remained painfree.

#### CASE 3

A 38-year-old man who had suffered a right-shoulder trauma presented with prolonged immobilization and inactivity for two weeks. Physical examination showed pain and tenderness over the deltoid insertional area in the upper outer quadrant of the humerus, tenderness over the greater tuberosity and the biceps tendon. Every motion, active and passive, aggravated the pain and the patient experienced anxiety over the movement of the right shoulder and arm. There was only a limited active abduction of the arm and the patient rated the pain as 7/10 on the VAS scale.

Physical therapy and muscle stretching exercises aggravated the pain. Oral medication of oxycodone, ibuprofen and muscle relaxing drugs brought minimal pain relief. Ten days of oral methylprednisolone provided no relief.

Informed consent was obtained and a combination of subscapular nerve block (12 mL of 0.75% ropivacaine) with suprascapular nerve block (8 mL of 0.75% ropivacaine) without corticosteroid was administered three times a week for five weeks. Intensive physical therapy could be performed successfully after each block. Eight weeks later the patient returned to work painfree.

#### CASE 4

A 64-year-old hemiplegic man presented seven weeks following a stroke, in a flaccid state, with a painful left-shoulder, loss of deep tendon reflexes, loss of tone on the afflicted side and sensory loss. The left shoulder was functioning only partially, the scapula rotated downward and forward, the spine was bent laterally toward the hemiparetic side, the humeral head subluxated downward and outward. The humeral attachment of the subscapularis muscle and the trigger points of supraspinatus, trapezius and serratus muscles, were very tender and painful on palpation. The patient rated his pain as 8/10 on the VAS scale. Oral medication with oxycodone and diclofenac failed to give any benefit. Physical therapy was stopped as it aggravated the pain further.

After obtaining informed consent, a combination of subscapular nerve block (10 mL of 0.75% ropivacaine) and a suprascapular nerve block (8 mL of 0.75% ropivacaine) without corticosteroid, was administered three times a week immediately prior to physical therapy and stretching exercises. The nonaffected shoulder was also stretched.

This therapy regimen was continued for five weeks and resulted in a clear improvement of the patient's shoulder function, reducing the pain score to 2/10 on the VAS scale. Physical therapy was continued and four months later, at the last follow-up examination, the patient reported improved mobility and an 80% reduction of pain.

#### CASE 5

A 67-year-old woman with a nine year history of rheumatoid arthritis presented with prolonged morning stiffness and stiffness after physical activity, as well as bilateral involvement of shoulder girdle joints and upper arms. Oral medication prescribed by the rheumatologist, included a low dose of prednisone, NSAID's and amitriptyline, occasionally combined with the administration of gold compounds and physical therapy. During the last two years, the patient suffered three attacks of severe bilateral shoulder girdle pain. For two weeks, she complained of deep muscular aches concentrated in the posterior deltoid area, extending medially over the scapula and down the posterior aspect of the arm. She rated the intensity of the pain as 7/10 on the VAS scale. Administration of morphine sulfate did not bring any relief.

After obtaining informed consent, we performed subscapularis nerve blocks, infiltrating the subscapularis trigger points bilaterally with 10 mL of 0.20-0.375% ropivacaine and 4 mg dexamethasone on each side. Eight to twelve injections in a series of blocks (two to three blocks weekly), were required to break the acute pain attacks. We added dexamethasone only to the first and the second block.

#### DISCUSSION

A frozen shoulder may be a common stage of many disorders affecting the shoulder (2), or an independent, idiopathic condition (23). Current clinical nomenclature uses three categories of frozen shoulder (23): idiopathic frozen shoulder (2), adhesive capsulitis (2), and subacromial fibrosis (2,

3, 15). Additional proposed etiologies of the frozen shoulder include acromio-clavicular joint irritation (2), entrapment of the suprascapular nerve (15), prolonged immobilization of upper extremity (4), cervical radiculopathy (4), hemiplegia (12), myocardial infarction (4), bicipital tendinitis (2) and muscle spasm.

There are several references in the literature that assume frozen shoulder to be an algoneurodystrophic process (8, 18). Recent publications have pointed out similarities with Dupuytren's contracture (9). This scenario develops insidiously, beginning with pain and tenderness usually over the deltoid insertional area in the upper outer humerus. Motion aggravates the pain, and gradually a limitation of both active and passive motion develops. What at first hampers daily activities gradually interferes with sleep. The usual stages of evolution are pain, gradual restriction of motion, and ultimately marked limitation without pain. The last stage is a stiff, useless but painless shoulder which hurts only when forcefully moved to ensure or to determine limitation (3). The condition widely claimed to be a frozen shoulder still remains an enigma as to the exact origin, tissue involvement, causative mechanism and the ideal forms of prevention and treatment. The numerous concepts are evident when the diagnostic labels applied to this condition are reviewed (2, 3, 4). It appears that many tissues, mainly synovial, are involved in the ultimate frozen shoulder (3). Mc Laughlin stressed the importance of the subscapularis muscle in the etiology of the frozen shoulder (17).

Patients with idiopathic frozen shoulder are most likely to be females in their 40-50s. (23). X-ray evaluation may reveal no specific diagnostic findings other than some osteopenia or cystic changes in the lateral aspect of the humerus (3). An arthrogram depicts the presence and degree of adhesive capsulitis. An MRI may rule out other abnormalities but is not specifically diagnostic of adhesive capsulitis with regard to the exact tissues involved or the severity of involvement. Treatment for the frozen shoulder varies widely with experienced clinicians and currently there is no standardized treatment (3). Started early and with a frequent intensity – before there is significant adhesion – active physical therapy is more applicable and is advocated by most clinicians who are studying and treating this conditions. Pain relief is achieved by local ice, heat, ultrasound application (3), TENS-application, oral NSAID's, electroacupuncture (5), oral and local corticosteroids, and even oral analgesic medication.

Mobilization and gentle manipulation may also be advisable in the early stage (21). Rhythmic stabilization exercises have also proven to be of value (3). Some of the nerve blocks e.g. suprascapular (6) or subscapular nerve block (12) have been recently recommended. The main problem in patients with shoulder pain is that physical therapy aggravates pain, therefore could not be performed efficiently. We found that a subscapular nerve block and subscapularis trigger points infiltration could be very valuable in producing pain relief in the affected shoulder. Shortly after each block, intensive, physical therapy could be successfully performed. We injected routinely 10-15 mL of a local anesthetic solution with or without the addition of a corticosteroid. We believe that the volume of local anesthetic injected, may produce a better diffusion in order to reach the subscapular nerve complex and subscapularis trigger points. In our experience the separate injection of the subscapular nerve or the subscapularis trigger points infiltration, is not possible in routine clinical practice. Injection of corticosteroids especially in a depot form, is common practice in the treatment of regional and local pain syndromes e.g. painful trigger points. We added corticosteroids to the local anesthetic solution only for the first and the second injection, routinely 40 mg of triamcinolone acetate or 4 - 8 mg of dexamethasone. The total volume guarantees adequate spread of the corticosteroid. The mechanism by which corticosteroids have been suggested to modify pain include reduced prostaglandin synthesis (19), a week local anesthetic action (22), a change of activity in the dorsal horn cells (11), and reduced ectopic discharge from neuromas (7).

Corticosteroids have also been shown to induce a reversible block of normal C-fibers in an animal model (14). Much has been written about the use of corticosteroids in patients with various pain problems. The results are sometimes contradictory, and the studies are frequently open-labelled. Some authors believe that much of the corticosteroids is absorbed to produce a systemic effect that relieves pain on motion (23). Although corticosteroid injection have been reported to be effective in capsulitis of the shoulder, the optimal dose has never been established.

We assume that in our patients, the addition of corticosteroids to the local anesthetic solution helped to reduce swelling and irritation of subscapular nerve complex while the subscapularis muscle injection helped to relax the muscle and reduce nerve compression. However, in clinical

practice, it is difficult to place corticosteroids close to the site where pain is generated. Repetitive injections are an alternative but would risk unwanted side effects and needle trauma (16). A bilateral subscapular nerve block can also be performed, e.g. in rheumatic conditions. We injected half of the recommended dose of the local anesthetic solution (e.g. 7-10 mL) on each side. In our patients with a two week to four month history of pain we performed a series of 7 to 15 blocks (mainly 2-3 injections weekly). We only recommend this schedule when there is evidence of improvement.

After each block, attention needs to be put on reestablishing a larger range of motion in the affected shoulder and strengthening the soft tissues in the area. All our patients were able to undergo physical therapy after performing this injection. We could not observe any side effects or possible complications after injection of local anesthetic with corticosteroid (1) or local anesthetic alone. The mixture with local anesthetics dilutes the corticosteroids preservative to an acceptable level (13).

Having used the described block technique no potential complication (e.g. pneumothorax or intravascular injection) were seen. We believe that this new block technique could give a very important contribution in the treatment of various pain conditions in the shoulder area.

## CONCLUSION

A selective subscapularis fossa nerve block with subscapularis trigger points infiltration eliminate shoulder pain of various origins. The new technique effectively blocks the subscapular nerves, including the longest and most important of the subscapular nerves, i.e. the thoracodorsal nerve. The technique presented may be a good option to use after unsuccessful trials of conventional therapy (NSAIDs, physical therapy, shoulder manipulation, intra-articular local anesthetic-corticosteroid injection) prior to open surgical intervention. The subscapular and suprascapular nerve block techniques are often combined, which is desirable because they block nearly all nerves supplying the rotator cuff. The excellent results of this block in painful situations of various origins in shoulder region shows the importance of the subscapular muscle in the etiology of the frozen shoulder syndrome. The block is easy to perform, is highly effective and safe, has a quick onset, may be a valuable diagnostic and therapeutic tool in patients with pain problems in the shoulder region and possibly

prevents progression to chronic pain. Adjuvant physiotherapy is essential for prevention of progression to a chronic stage of shoulder pain.

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