

# Ultrasound-Guided Trigger Point Injection for Serratus Anterior Muscle Pain Syndrome: Description of Technique and Case Series

Grisell Vargas-Schaffer, MD,\*†‡ Michal Nowakowsky, MD,\* Marzieh Eghtesadi, MD,‡§|| and Jennifer Cogan, MD, FRCPC\*¶||#

Chronic chest pain is a challenge, and serratus anterior muscle pain syndrome (SAMPS) is often overlooked. We have developed an ultrasound-guided technique for infiltrating local anesthetics and steroids in patients with SAMPS. In 8 patients, the duration of chronic pain was approximately 19 months. Three months after treatment, all patients had experienced a significant reduction in pain. Infiltration for SAMPS confirms the diagnosis and provides adequate pain relief. (A&A Case Reports. 2015;5:99–102.)

Chronic chest pain of noncardiac origin is a heterogeneous disorder, and myofascial pain syndrome is often an overlooked cause that can affect a single muscle or several functional muscle units; it is characterized by taut bands, commonly described as trigger points.<sup>1,2</sup> Direct perpendicular pressure on these trigger points reproduces the patient's pain, including the referred pain, which is the hallmark of the disorder.<sup>1</sup> There can also be associated muscle weakness, limited range of motion, and signs of autonomic dysfunction.<sup>3</sup>

The purpose of this case report was 3-fold: (1) to understand the anatomy and pain pathways of serratus anterior muscle pain syndrome (SAMPS), (2) to describe an ultrasound-guided infiltration technique used to administer steroids and local anesthetics for the treatment of this pain, and (3) to evaluate the response to treatment among the 8 patients who underwent the technique.

The syndrome includes a constellation of symptoms one of which is pain overlying the fifth to seventh ribs in the midaxillary line. Referred pain may radiate toward the anterior chest wall, the medial aspect of the arm, and finally, toward the ring and little finger on the ipsilateral side.<sup>4</sup> The pain of SAMPS can be intermittent or constant. SAMPS may be confused with intercostal nerve neuralgia but can be differentiated through palpation. In a patient with SAMPS, palpation of the trigger point overlying the fifth to seventh ribs in the midaxillary line will reproduce the pain that occurs

spontaneously. In a patient with intercostal neuralgia, palpation will not produce pain or referred pain because the pain of intercostal neuralgia is situated along a dermatome.

The anterior serratus muscle originates from the lateral aspects of the first 8 to 9 ribs. The fibers from the upper 4 ribs attach to the scapula on its superior angle, as well as to the costal surface of its medial border. The fibers from the lower ribs attach to the inferior angle of the scapula on its costal surface. The serratus muscle is involved in scapular movement and assists in abduction, aids the trapezius in scapular rotation, and acts to keep the medial border of the scapula stabilized against the thorax during movements of the upper limb. Injury to the serratus muscle can lead to scapular winging and loss of ability to raise the affected arm overhead.<sup>5,6</sup>

Innervation of the serratus anterior muscle is via the long thoracic nerve of Bell, which originates at the anterior rami of the C5 to C7 spinal nerves, and sometimes C8.<sup>7</sup> It travels inferiorly along the surface of the serratus anterior muscle entering the axilla posterior to the rest of the brachial plexus and lies on the serratus anterior muscle. Of particular interest is nerve vulnerability during surgery of the anterolateral thorax, for example, during axillary dissection or radical mastectomy,<sup>8,9</sup> and can lead to chronic denervation of the serratus anterior muscle, prominent continuous muscle contraction, with accumulation of toxic metabolites, and pain pathways causing central sensitization.<sup>10</sup> In addition, the serratus anterior muscle is at risk of injury if it is dissected together with the pectoralis muscles to make the pocket needed for breast expanders.<sup>11</sup> Although pathophysiologic explanations for the development of trigger points are lacking, there is some evidence for acute trauma or repetitive microtrauma, lack of exercise, and prolonged poor posture. The trigger points and the path of pain radiation when pressing the serratus muscle are shown in Figure 1. All patients provided consent for publication of this case series.

## CASE DESCRIPTION

Twelve patients with a diagnosis of chronic thoracic pain were referred to our clinic. Each patient had been thoroughly investigated to exclude nonmusculoskeletal causes of chest pain after which, 8 patients remained with a diagnosis of SAMPS (Table 1); the remaining 4 patients did not have SAMPS. The same physician managed all patients with SAMPS, and their progress was assessed every 3 months.

From the Departments of \*Anesthesiology and †Pharmacology, University of Montreal, Montreal, Quebec, Canada; ‡Centre Hospitalière Université de Montréal, CRCHUM, Montreal, Quebec, Canada; §CHUM Pain Center, Montreal, Quebec, Canada; ||Department of Family Medicine, University of Montreal, Montreal, Quebec, Canada; ¶Montreal Heart Institute, Montreal, Quebec, Canada; and #Montreal Heart Institute Research Center, Montreal, Quebec, Canada.

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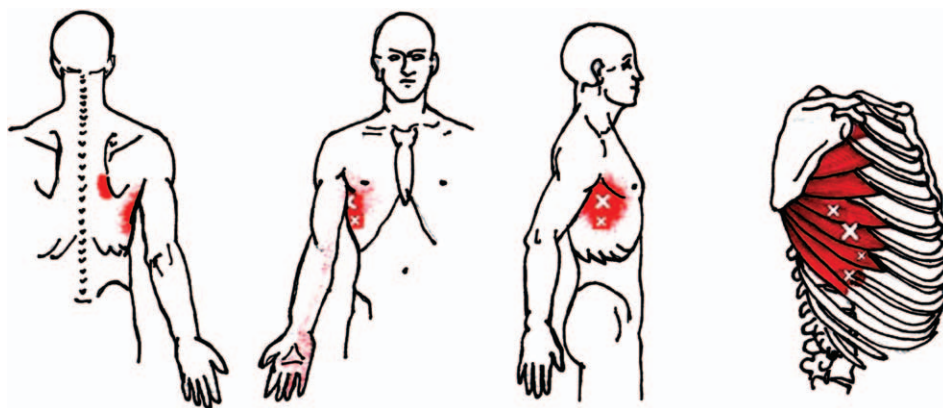
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Address correspondence and reprint requests to Grisell Vargas-Schaffer, MD, Department of Anesthesiology, University of Montreal, Pain Center at CHUM, 3840 Rue Saint Urbain, Hospital Hotel-Dieu du CMUM, Pavillon Jean-Mance, Clinique antidouleur, Montreal, Quebec, H2W 1T8 Canada. Address e-mail to grisellvargas@gmail.com.

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**Figure 1.** The path of pain radiation represented by the area of red spots; serratus anterior muscle and trigger points represented by X.

**Table 1. Patient Characteristic Pain and Pain Relief Scores**

| Sex | Age (y) | Time (in mo) with pain before evaluation at pain center | NRS before first injection | NRS after first injection | SPR 3 months after last injection <sup>a</sup> | NRS 3 months after last injection | Number of injections |
|-----|---------|---------------------------------------------------------|----------------------------|---------------------------|------------------------------------------------|-----------------------------------|----------------------|
| F   | 65      | 12                                                      | 10/10                      | 4/10                      | 60%                                            | 3/10                              | 3                    |
| F   | 74      | 12                                                      | 10/10                      | 3/10                      | 70%                                            | 2/10                              | 3                    |
| M   | 54      | 10                                                      | 8/10                       | 3/10                      | 60%                                            | 3/10                              | 2                    |
| F   | 50      | 12                                                      | 9/10                       | 4/10                      | 50%                                            | 3/10                              | 1                    |
| F   | 49      | 21                                                      | 9/10                       | 4/10                      | 70%                                            | 4/10                              | 3                    |
| F   | 47      | 36                                                      | 9/10                       | 3/10                      | 30%                                            | 3/10                              | 3                    |
| F   | 59      | 12                                                      | 7/10                       | 3/10                      | 50%                                            | 3/10                              | 3                    |
| F   | 50      | 36                                                      | 8/10                       | 3/10                      | 50%                                            | 3/10                              | 3                    |

NRS = Numerical Rating Scale; SPR = Scaling Pain Relief.

<sup>a</sup>Patient follow-up: all patients were seen every 3 months for 9 to 12 months. Pain medication was reduced when possible and when stable, patients were returned to their family physician or the referring doctor for continued care.

As a part of the evaluation of patients for SAMPS, an examination of the patient's neck, shoulders, upper back, and chest wall was completed. The lateral insertions of the serratus anterior muscle were systematically palpated over the midaxillary line in an effort to reproduce the patient's pain and locate the taut bands. When trigger points were found, the patient was informed of the procedure, its risks, benefits, and alternative treatment options. If the patient agreed to the procedure, written consent was then obtained.

With the patient in a lateral decubitus position, the trigger points are located and marked at the muscle's insertion in the midaxillary line over the fifth to the seventh ribs (Fig. 2). With the ultrasound probe covered with sterile gel and sheath, and using the transverse plane, the ultrasound probe must be angled to bring the intercostal space, the pleura, and the rib with the serratus anterior muscle insertion superiorly (Fig. 3) into view. At this time, the needle can be advanced between the probe and patient's skin at a 45° angle and the medication injected inside the serratus anterior muscle at the trigger point site. We use a mixture of 2% (4mL) lidocaine, 0.5% (4mL) bupivacaine, and 1 mL (40mg) triamcinolone and place 3mL of this mixture at each infiltration point.

The ultrasound-guided infiltration was performed using a GE LOGIQ e® Ultrasound machine (GE Healthcare, Mickleton, NJ) equipped with a 12-MHz high-frequency transducer. Pain scores were measured using the 11-point Numerical Rating Scale. In addition, the Scaling Pain Relief scale was used to measure pain relief 3 months after the infiltration. The Scaling Pain Relief measurement has been used in spinal cord stimulation trials and therapy programs and

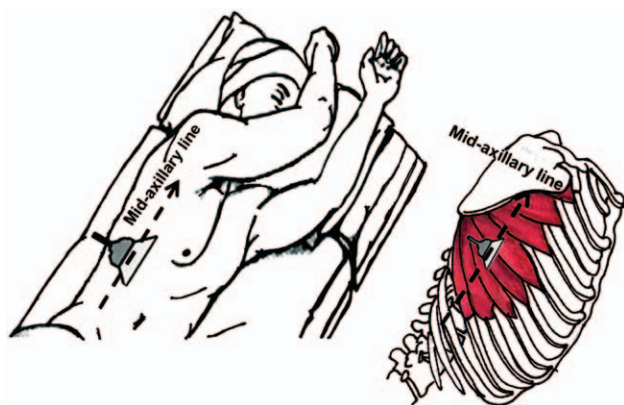
is a direct rating of pain relief. It is obtained from the patient and expresses a percentage of pain relief when patients are asked to estimate the percentage of pain relief they experience.<sup>12</sup> Patients had 1 to 3 injections over a 3-month period, depending on whether they obtained adequate pain relief.

The use of an ultrasound-guided technique for serratus anterior muscle trigger point injection significantly decreases the risk of pneumothorax. The use of ultrasound is also greatly appreciated by residents and colleagues who perform these procedures only infrequently, because it changes a blind technique to one in which visual cues are provided, thus both increasing the probability of success and decreasing the likelihood of iatrogenic complications.

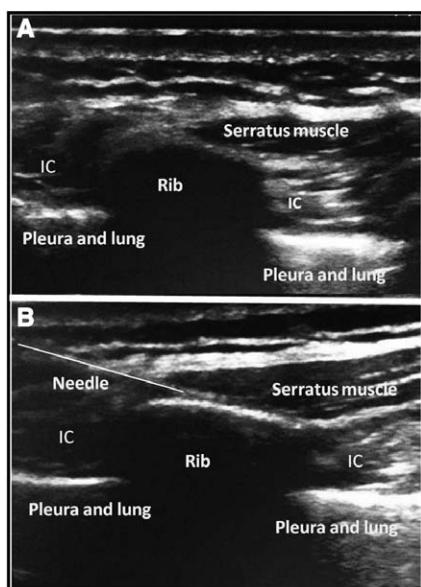
## RESULTS

We included 8 patients in our protocol; 7 women and 1 man with a mean age of 56 years and a range from 47 to 74 years. The duration of chronic pain before infiltration was from 12 to 36 months. All patients had developed chest wall pain after a surgical procedure; 2 after lung cancer surgery, 2 after cardiac surgery, and 4 after total mastectomy. One patient reported bilateral symptoms after a double mastectomy. The pain was described as a tightness that was constant for 6 of the women and intermittent for 1. The pain was referred to the ipsilateral arm and was exacerbated by exercise.

All patients had received first-line treatment from their primary care physician or oncologist, notably opioids. They had also been treated with neuropathic pain adjuvants, none of which provided optimal pain relief. The pain medications used were tapentadol (both long- and



**Figure 2.** Diagram of the probe position a lateral view of the thorax.



**Figure 3.** Ultrasound-guided infiltration of the serratus anterior trigger point technique showing in (A) the anatomical structures: the intercostal space (IC), the lungs and pleura, and the rib with the serratus muscle insertion on its top. B, The infiltration of the serratus muscle.

short-acting), fentanyl, oxycodone (long- and short-acting), hydromorphone (long- and short-acting), as well as pregabalin, gabapentin, and tricyclic antidepressants in combination as coanalgesics in all cases. Seven of the 8 patients also received a few sessions of physiotherapy.

The median pain score before injection was 9 on a scale of 0 to 10 (range of 7–10), and the median pain score 30 minutes after injection was 3 (range of 3–4; Table 1). Patients reported a 55% reduction in pain at the 3-month follow-up visit. Of 8 patients, 1 was able to stop all medications, 1 was able to decrease medication dose by 50%, and another was able to decrease medication dose by 30%. Three patients were able to partially cease medications; for 2 patients, there was no change. In addition, 2 of the 8 patients were able to return to work.

## DISCUSSION

SAMPS is a diagnosis of exclusion and should be considered only after other causes have been excluded.<sup>13</sup> Abnormal

serratus muscle activity can also be seen in cases of chronic mechanical neck pain, glenohumeral instability, and shoulder impingement syndrome.<sup>14,15</sup> Shoulder movement and chest wall mobilization will usually not exacerbate pain, although there can be pain on deep breathing.<sup>16</sup> The etiology of SAMPS remains unknown; however, its incidence has been reported to be approximately 90% in subjects with work-related musculoskeletal disorders.<sup>17</sup>

The ultrasound-guided technique of serratus anterior muscle trigger point injection can be used for chronic chest wall pain related to myofascial pain syndromes after thoracic surgery, as discussed in the poster by Nowakowski, presented at the 8th Congress of the European Federation of International Association for the Study of Pain Chapters, Florence, Italy, 2013. Tighe and Karmakar<sup>18</sup> suggested that this technique, when evaluated against regional analgesic methods, may provide comparable hemithoracic analgesia for early postoperative pain through blockade of the lateral cutaneous branches of the intercostal nerves, for instance, after breast surgery. A recent case report describes almost complete pain relief after “serratus plane block” when a catheter was inserted for continuous infusion of local anesthetic in a patient with traumatic rib fractures.<sup>19</sup> Finally, serratus plane block has also been successfully used in conjunction with regional anesthesia for shoulder arthroplasty.<sup>20,21</sup>

SAMPS should be suspected in patients with postsurgical pain after thoracotomy and mastectomy. Once cardiac-related pain has been excluded, the diagnosis should also be considered when the duration of chest pain exceeds the normal expected duration or intensity of pain after surgery. Other poorly recognized conditions that may lead to the syndrome are postherpetic neuralgia, thoracic vertebral fractures, and athletic shoulder injuries.

Injection of the specific trigger points along the insertions of the serratus anterior muscle not only confirms diagnosis but also provides pain relief and thus a therapeutic advantage. The ultrasound-guided technique that we propose, using anatomical landmarks, is relatively simple to master.

Further research to identify which patients are at greatest risk of developing SAMPS would allow for earlier recognition and more timely treatment. SAMPS is often overlooked and should be suspected after alternative diagnoses of chronic chest pain have been excluded. ■

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