SONOGRAPHY

CASE SERIES

Compression neuropathy as a cause for painful shoulder

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Introduction

Shoulder pain has been reported to be the third most common cause of musculoskeletal presentation and often leads to significant disability.[1] Supraspinatus tendon lesions and subacromial bursitis have been shown by multiple studies to be the most common cause of shoulder pain in the primary care setting.[1–3] This article presents three cases of unilateral shoulder pain where the rotator cuff and bursa appeared normal on ultrasound. Case one and two illustrate the presence of a spinoglenoid notch (SGN) cyst and suprascapular notch (SSN) cyst, respectively, which are considered likely causes of compression of the suprascapular nerve. The third case describes an insidious onset of pain leading to a diagnosis of suspected neuralgic amyotrophy. The cases highlight the importance of the sonographer including an evaluation of SGN, SSN and looking for signs of muscle atrophy when performing a shoulder scan.

Case descriptions

Case one—Spinoglenoid notch cyst

A 36-year-old male presented for an ultrasound of his right shoulder to assess for rotator cuff pathology. He complained of having had 2 weeks of posterior shoulder pain and muscle weakness. The ultrasound study demonstrated no evidence of bursitis or rotator cuff pathology; a large septated ganglion cyst was seen in the SGN (Figure 1A) which is located on the superior and posterior aspect of the scapula. The patient underwent magnetic resonance imaging (MRI) which revealed a complex ganglion and partial tear of the posterior labrum (Figure 1B). The ganglion was subsequently aspirated, and the patient reported an improvement in his symptoms (Figure 1C).

Case two—Suprascapular notch cyst

A 45-year-old female presented for an ultrasound of her right shoulder to exclude rotator cuff pathology. She complained of 4 weeks of right posterior shoulder pain; the rotator cuff appeared normal, and there was no evidence of bursitis. Ultrasound revealed a large ganglion cyst in the SSN adjacent to the subscapular nerve (Figures 2 and 3). The SSN is located on the superior anterolateral aspect of the scapular. Ultrasound assessment of the SSN and SGN requires appropriate settings of focal zone and far field magnification due to their deep location and distance from the rotator cuff tendon. The patient's hand may be positioned onto the opposite shoulder as this will decrease the depth being imaged making this area easier to examine.

Case three—Neuralgic amyotrophy

A 21-year-old male presented for an ultrasound of his left shoulder to exclude rotator cuff pathology. He complained of sudden-onset left shoulder pain without history of any trauma. His symptoms begin insidiously but quickly amplified in severity, and then there was gradual improvement over the following 2 weeks. Ultrasound showed no abnormality in the rotator cuff and bursa. In the region of the superior posterior shoulder, the muscle bellies of the supraspinatus and infraspinatus demonstrated a profound reduction in volume and significant increase in echogenicity (Figures 4 and 5). There was no evidence of any cyst present in either notch. A MRI proton density scan was performed, and the images demonstrated signal hyperintensity in the supraspinatus and infraspinatus muscle bellies

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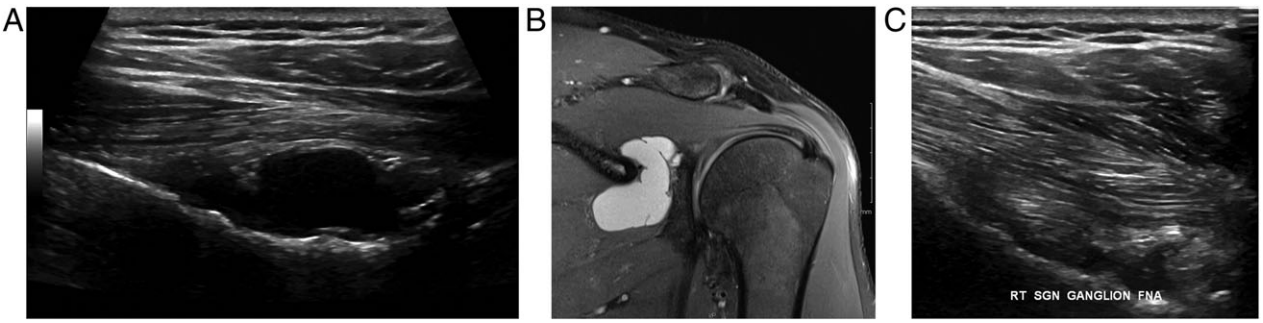

Figure 1 (A) Large septated ganglion cyst in the spinoglenoid notch. (B) Magnetic resonance image of a complex ganglion with a partial tear of the posterior labrum. (C) Ultrasound of the region after aspiration of the ganglion.

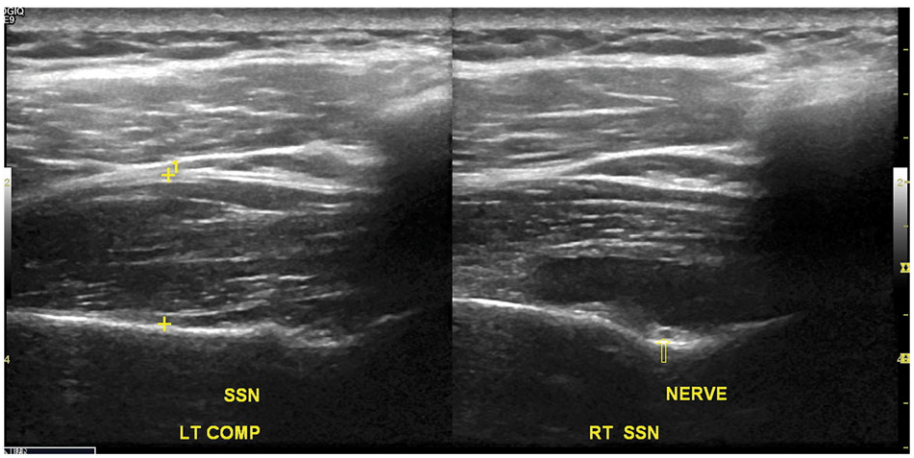

Figure 2 Ultrasound image demonstrating a large gangion cyst in the suprascapular notch adjacent to the subscapular nerve.

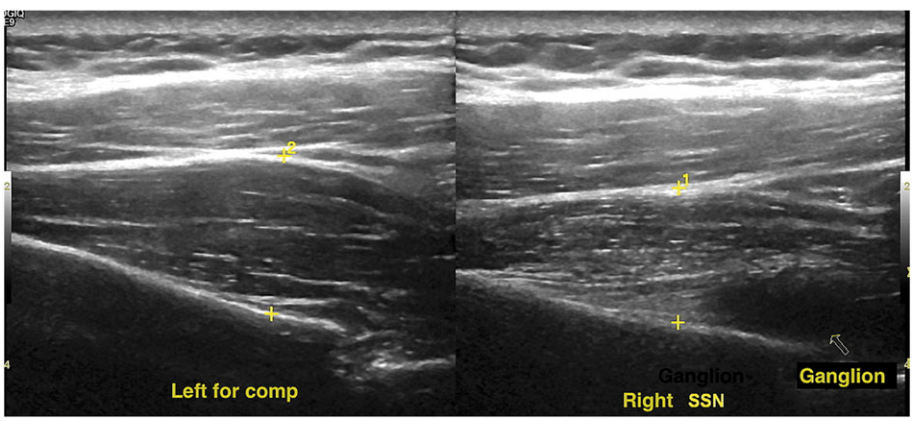

Figure 3 Large ganglion cyst in the suprascapular notch.

(Figure 6A–6C). Considering the clinical presentation, including sudden onset of pain intensity and atrophy of the supraspinatus and infraspinatus muscle bellies, the findings were thought to be suggestive of neuralgic amyotrophy, and a specialist review was recommended.

Discussion

Painful shoulder often leads to significant disability.[1] The prevalence of shoulder pain in the overall population has been reported to range from 7% to 14%.[3] Shoulder pain

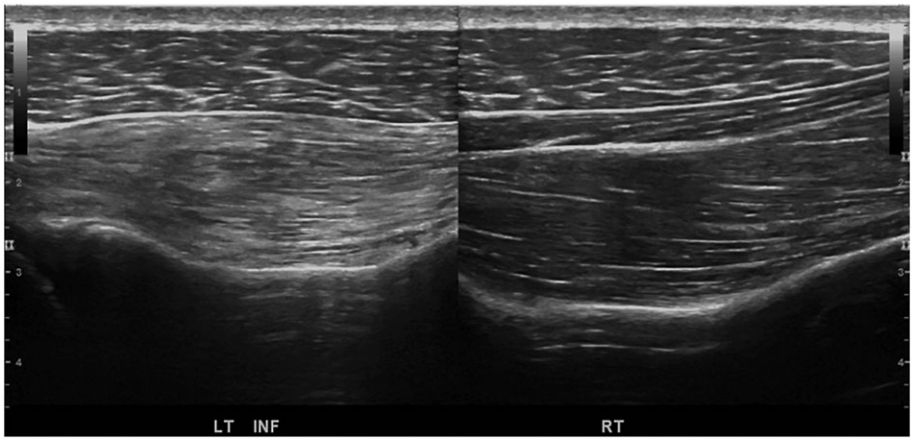

Figure 4 Muscle bellies of the supraspinatus and infraspinatus demonstrate reduced volume and increased echogenicity.

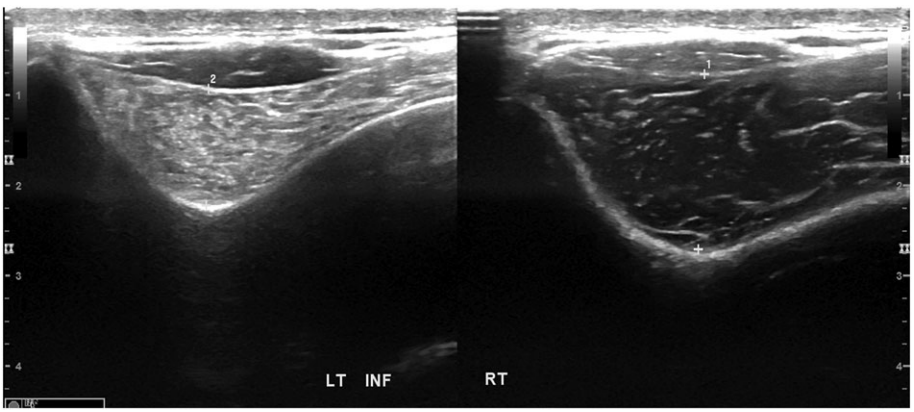

Figure 5 Muscle bellies of the supraspinatus and infraspinatus demonstrate reduced volume and increased echogenicity.

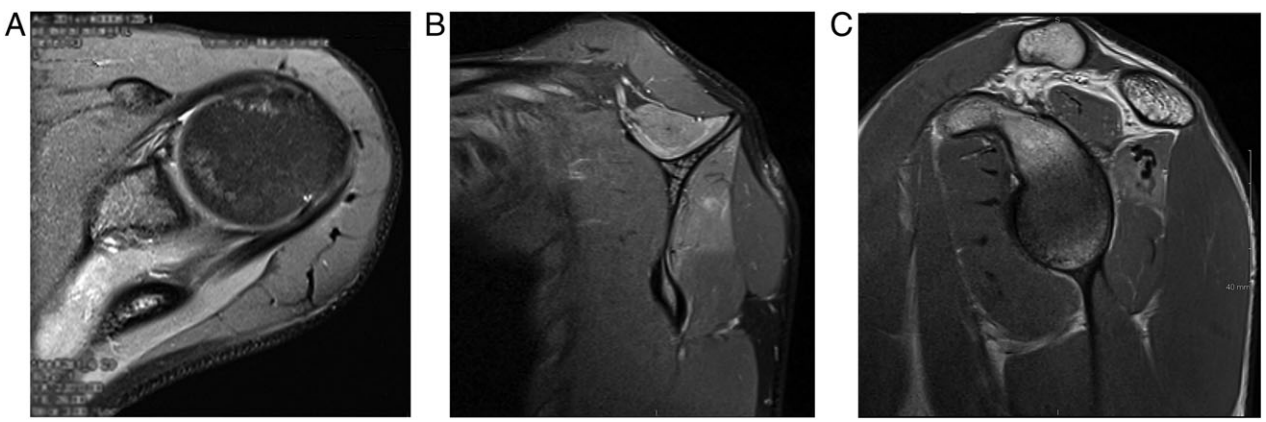

Figure 6 (A) Magnetic resonance image of the shoulder shows signal hyperintensity in the supraspinatus and infraspinatus muscle bellies. (B) Magnetic resonance image of the shoulder shows signal hyperintensity in the supraspinatus and infraspinatus. (C) Magnetic resonance image of the shoulder shows signal hyperintensity in the supraspinatus and infraspinatus muscle bellies.

is due to a range of causes—from direct trauma, causing a sprain or strain to the shoulder stabiliser muscles, to chronic pain from impingement syndrome, adhesive capsulitis, calcified tendinosis and glenohumeral osteoarthritis.[1–3] Among the many causes of shoulder pain, supraspinatus tendon lesions and subacromial bursitis have been shown by multiple studies to be the most common source of shoulder pain in the primary care setting.[1–3] In contrast, as described in this series of cases, there may simply be no relationship between pain in the shoulder and rotator cuff pathology and the inflammatory reaction.[3] For this reason, shoulder ultrasound should always include an assessment of the suprascapular region for possible suprascapular neuropathy or neurologic compression.

Patients with suprascapular neuropathy or nerve compression can experience pain or weakness in the shoulder and arm, which may mimic rotator cuff pathology.[4] Ultrasound can demonstrate muscular atrophy and elucidate the potential presence of a ganglion cyst, which can cause compression on the nerve.[5] Although ultrasound may or may not show nerve change or apparent nerve compression, it still serves as an important marker to trigger further investigation. The ability to correlate the imaging findings and the symptoms is essential as misdiagnosis can lead to inappropriate conservative management or unsuccessful surgical procedure.[4]

The suprascapular nerve is a mix of motor and sensory peripheral nerves. Suprascapular neuropathy can present as pain and weakness in the posterolateral aspect of the shoulder.[6,7] Entrapment of the suprascapular nerve is one of the causes of poorly explained shoulder pain and is often misinterpreted as pathology of the rotator cuff.[8,9]

Kopell and Thompson first described suprascapular nerve entrapment in 1959.[9] The condition is rare and often seen in individuals who participate in strenuous overhead activities which require substantial load on the shoulder.[10] Epidemiologic studies have demonstrated that suprascapular neuropathy causes 1–2% of all shoulder pain although has been reported as high as 33% in the athletic populaton.[10]

Entrapment of the suprascapular nerve can have a wide range of aetiologies including ligamentous hypertrophy, excessive traction on the suprascapular, scapular fractures, anatomical variations and morphology of the notch. Among the many reported cases of suprascapular nerve entrapment, the most common is ganglion (para-labral) cyst compression leading to suprascapular nerve palsy.[5,6,10–12]

Research suggests that the formation of the ganglion cyst relates to a ball-valve mechanism where synovial fluid develops outside the joint through tears of the superior and posterior labrum.[13] The ganglion cyst tends to progressively enlarge due to a one-way valve mechanism between the cyst and the joint fluid.[14] As the cyst expands, it usually spreads into the SGN, SSN or both.[15]

A preoperative MRI study has revealed that 24 of 28 patients had a SGN ganglion associated with a superior labral tear from anterior to posterior (SLAP) lesion.[16] Another study by Piatt et al.[7] reported that the incidence of ganglion cyst and SLAP lesion is 89%. A correlation was found between the onset of denervation symptoms and the size of the ganglion, the larger the ganglion results in more significant muscle denervation.[15]

Sonographically, ganglion cysts present as simple or complex cyst and may be rounded or oval hypoechoic lesions, with a well-circumscribed border at the SGN, SSN or both.[14,15] Ganglion cysts can be varied in size and are often mobile remaining unchanged in shape during both active and passive shoulder movements.[14] The differential diagnosis for ganglion cysts includes varicosities in the SGN.[17] Varicosities in the SGN typically increase in size during external rotation and reduce in size during internal rotation.[14] Due to low flow velocity in the vein, colour Doppler does not demonstrate flow signals in these lesions.[14] The patient often reports an improvement in symptoms after cyst aspiration as was seen in Case one. This finding is supported by a study constructed by Chiou et al.[18] indicating symptom relief in 86% of patients post ganglion cyst aspiration and repetitive disruption of the cystic wall. The suprascapular nerve is susceptible to entrapment at the level of SSN and SGN but more commonly in the SSN.[5] If the trapped nerve occurs in the SSN, both the supraspinatus and infraspinatus muscles are usually denervated; however, when compression occurs at the level of SGN, then the infraspinatus muscles alone is typically involved.[19] The potential locations of ganglion and the pattern of the suprascapular nerve innervation to the supraspinatus and infraspinatus muscles are demonstrated in Figure 7.

When sudden onset of pain occurs in a normal rotator cuff and bursa, the presence of atrophy of the supraspinatus, infraspinatus muscle bellies and absence of SGN or SSN cysts, one should suspect neuralgic amyotrophy. In that instance, the entire length of the brachial plexus nerve should be examined. Assessment of the morphology of the nerve including the size, shape, position and echotexture will yield meaningful information. The examination should start from the level of the nerve roots as they exit the C5, C6 and C7 neural foramina. Figure 8 demonstrates the formation and distribution of the brachial plexor nerve. The sonographer should be aware of multiple anatomical variants as the nerve roots can pass through the anterior scalene muscle instead of the traditional location between the anterior and middle scalene muscle bellies. [20–22] Tracing the

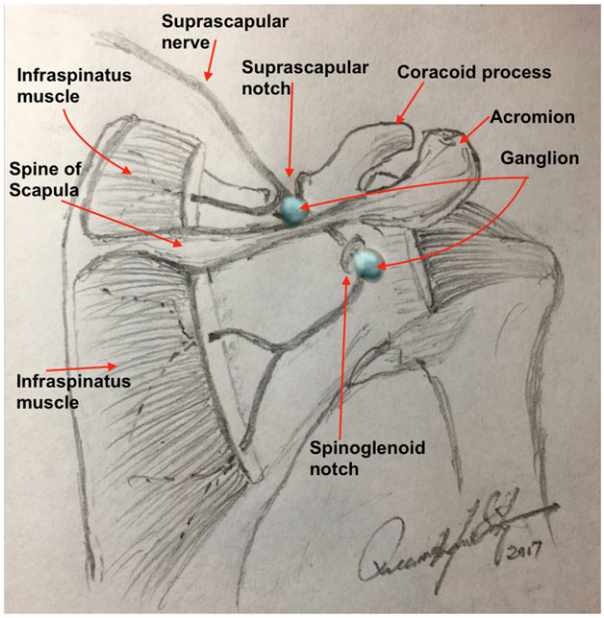

Figure 7 Locations of gangion and the pattern of the suprascapular nerve innervation to the supraspnatus and infraspinatus muscles.

nerve distally will lead to the identification of the nerve trunks, in the supraclavicular area and the initial portions, and the divisions of the cords can be visualised alongside the posterior aspect of the subclavian artery.[20,21] Over the first rib and the apical pleura, the suprascapular nerve arises from the upper trunk.[20,21] As the nerve roots merge to form trunks and then divisions, they resemble a 'honey-comb' appearance.[20] These divisions subdivide into three cords, lateral, posterior and medial lying adjacent to the axillary artery, and emerge as three discrete hypoechoic fascicles of comparable size.[23] Sonographically, the nerve roots are mono-oligo fascicles, appearing hypoechoic, oval or round. They are enclosed by thin hyperechoic epineurium and connective tissue. Abnormal nerve roots appear hypoechoic, focally enlarged and have a loss of fascicular pattern.[24] Neural fibrosis, as a result of trauma, will show additional signs of tethering on dynamic scan while the arm is abducted.[20]

Neuralgic amyotrophy is also referred to as Parsonage–Turner syndrome (PTS) or brachial neuritis. The condition was described by Dreschfeld in 1887;[25] however, it was Parsonage and Turner who explicitly

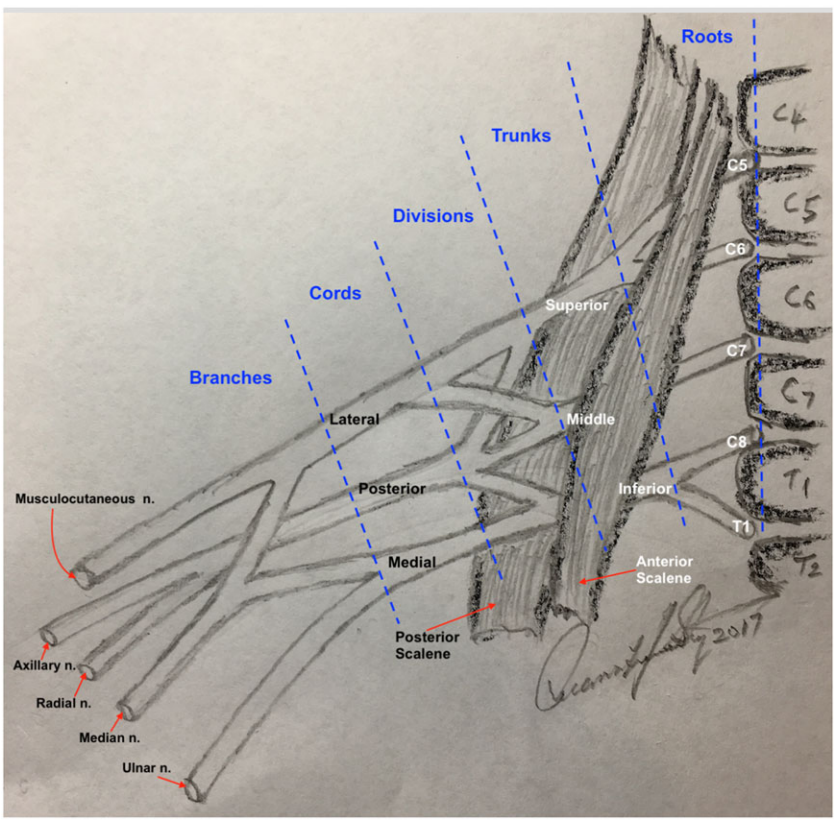

Figure 8 Formation and distribution of the brachial plexor nerve.

detailed the clinical aspects of the condition in 1948.[25] Neuralgic amyotrophy is a rare occurrence in otherwise normal and healthy individuals.[26,27] The patient often describes the pain in the shoulder or arm region begins gradually but increases in severity and intensity within a few hours.[26,27] It is characterised by a late, acute onset of severe pain in the shoulder girdle musculature and may extend to the trapezius ridge, proximal upper arm and hand. As the pain subsides, patients report that there are weakness and sensory deficits in the region.[26,28]

Aetiogically, neuralgic amyotrophy has not been exactly delineated, but both viral infection and autoimmune progress have been proposed as the cause of this condition.[29] Neuralgic amyotrophy can be categorised in two forms: idiopathic amyotrophy and hereditary neuralgic amyotrophy. The latter has an autosomal dominant inheritance pattern and is the rarer of the two forms, whilst hereditary neuralgic amyotrophy presents at an earlier age.[30] Other researchers believe that certain individuals are genetically predisposed to developing neuralgic amyotrophy, but the condition may not present with the usual characteristic symptoms unless it is triggered by certain circumstances, such as due to immunologic factors or environment.[31]

Traditionally, neuralgic amyotrophy was thought to affect approximately two to three cases per 100 000 people, but studies have shown that the true incidence is postulated to be 20–30 cases per 100 000. The inconsistency is believed to be due to under-recognition of the disease process.[26,27] Neuralgic amyotrophy predominantly affects males, with male-to-female ratios ranging from 2:1 to 11.5:1. The highest incidence occurs between the third and seventh decades.[31,33,34] It usually presents unilaterally, but according to one study of 246 cases of neuralgic amyotrophy, which analysed the characteristics of the condition, it found 28.5% of patients reported to have bilateral involvement.[26] There is no evidence suggestive of a tendency for the right or left arm and no correlation with hand dominance.[32,33] The condition had been known to be self-limiting, showing good recovery without specific treatment.[34] The most significant finding that raises suspicion for identifying neuralgic amyotrophy relies on elucidating the pattern of denervation of the muscles.

Conclusion

This case series serves to highlight the importance of including an evaluation of SGN, SSN and sign of muscle atrophy when performing shoulder ultrasound. This is particularly important when the patient presents with a painful shoulder and ultrasound shows no pathology in the rotator cuff or bursa. The presence of a cyst in the SGN or SSN can potentially cause compression of the suprascapular nerve and result in shoulder pain. Sonographically, it is rare to see change of the nerve structure or appearance in these conditions. Ultrasound can elucidate the pattern of involvement by illuminating denervation of the muscles, demonstrating the loss of muscle bulk and hyperechoic appearance of the affected muscles. An early diagnosis allows pain management and therapy which can ease the patient's symptoms.

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