A 33-year-old male with a strenuous occupation and gradual inability to lift, pull, and push heavy weights during working: diagnosis and discussion

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Diagnosis

Paresis of the serratus anterior muscle due to long thoracic nerve overuse injury

Keywords Long thoracic nerve · Injury · MRI

Discussion

Scapulothoracic stabilization and motion is mainly carried out by the synergic and antagonistic action of three muscles: the serratus anterior, the trapezius, and the rhomboid [1, 2]. The serratus anterior is innervated by the long thoracic nerve (LTN), the trapezius by the spinal accessory nerve, and the rhomboid muscles by the dorsal scapular nerve [1–3]. Direct or indirect trauma, iatrogenic injuries, or idiopathic processes such as the Parsonage–Turner syndrome may result in nerve injury and eventually paresis of the affected muscle [1–3].

The LTN is formed from the anterior rami of the 5th, 6th, and 7th cervical nerves. It passes between the clavicle and the first rib and then enters a fascial sheath and descends along the lateral aspect of the thoracic wall innervating the muscle fibers

of serratus anterior [4]. Due to its lengthy course (24 cm in average), its delicate and thin nature (2–3 mm) and the fact that it traverses the middle scalene muscle and descends between the clavicle and the first rib, the nerve is easily susceptible to injuries [4]. In the vast majority of cases, the mechanism of traumatic nerve injury is either overstretching-traction or compression and constriction of nerve fascicles and the clinical result is serratus anterior muscle denervation, which is demonstrated as medial scapular winging [1–4].

Clinical examination provides valuable information for a correct diagnosis. Serratus anterior paresis results in medial scapular winging whereas lateral winging is the consequence of trapezius and rhomboid paresis [1–5]. In our case, the physical examination revealed medial winging of the right scapula, which became more pronounced when the patient was asked to perform active forward or upward elevation and abduction of his arms (Fig. 1). Since the diagnosis is easily made during clinical examination and visual inspection of the scapula, the need for MR imaging evaluation is limited [6–9]. MR imaging was requested in order to exclude a disk disease-radiculopathy and rule out a possible mass lesion either in the spinal canal or more peripherally. The anatomical distribution of the signal changes on MR aided in the correct diagnosis. The MR imaging findings of uniform muscle edema and the absence of fatty infiltration correlated well with the onset of symptoms and suggested a subacute phase of aponeurosis. This finding is considered essential in treatment planning. Due to imaging findings, electromyographic testing and nerve conduction studies were not performed. The electromyographic testing could have provided the degree of denervation, but according to the literature, the initial degree of denervation cannot be used to predict the extent of nerve recovery [10].

The isolated serratus anterior paresis and the associated medial scapular winging has been shown to respond well to

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Fig. 1 Photographs of the patient during clinical evaluation show right-sided scapular winging (*open arrows*). **a** Resting position. The findings are more pronounced and exacerbated when the patient performs active forward (**b**) or upward (**c**) elevation and abduction (**d**)

conservative treatment [9]. However, the recovery time may be prolonged, ranging from 1 to 24 months. Avoidance of overhead movements of the affected extremity and preclusion of sports activities is the main treatment guidance [1–5, 7–9]. Physical therapy of the affected extremity could also provide pain relief and functional restoration [9]. The use of a scapular brace that keeps the scapula placed against the thorax and prevents stretching of the serratus anterior muscle has been advocated by some authors with good clinical outcome [9]. In cases of failure of a conservative treatment, a surgical approach is the next therapeutic option and MR imaging findings may contribute to treatment planning depending on the presence or not of fatty infiltration of the anterior serratus muscle.

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