A 48-year-old man with chronic right shoulder pain and weakness after a fall: diagnosis and discussion

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Diagnosis

Post-traumatic chronic axillary nerve injury (Fig. 1).

Discussion

Rotator cuff tears following shoulder dislocation are the most common cause of prolonged shoulder pain. However, 9 to 18% of patients who have anterior dislocation actually suffer from prolonged pain due to axillary nerve injury [1].

The axillary nerve (C5, C6) is a branch of the posterior cord of the brachial plexus and exits the axilla to enter the quadrilateral space. This space is bounded by the teres minor muscle superiorly, the teres major muscle inferiorly, the long head of the triceps muscle medially, and the surgical neck of the humerus laterally. The anterior branch of the axillary nerve supplies the anterior deltoid muscle

and overlying skin, while the posterior branch supplies the teres minor muscle, the posterior deltoid muscle, the skin overlying the distal deltoid muscle, and proximal triceps [2]. In an anterior shoulder dislocation, axillary nerve injury presumably occurs because of inferior displacement of the humeral head causing compression of the quadrilateral space [1].

Clinical symptoms of axillary nerve injury include vague shoulder pain, decreased strength on abduction, and abnormal sensation in the cutaneous distribution of the axillary nerve.

The definitive diagnostic test used to confirm the clinical diagnosis of axillary nerve injury is electromyography (EMG). However, EMG is painful and operator-dependent. MR imaging, on the other hand, is a noninvasive technique that can help provide a diagnosis, especially when other diagnoses besides axillary nerve injury are being considered [3].

Anatomical distribution of the signal changes on MR distinguishes nerve injury from direct traumatic injury of muscles. With axillary nerve injury, some or all of the muscles supplied by the axillary nerve will be affected, depending on the location of the injury along the path of the axillary nerve [1]. MR signal from acute denervation within the first 24 h may manifest as increased short tau inversion recovery (STIR) signal and as increased apparent diffusion coefficient (ADC) [4, 5]. Absence of edema of overlying soft tissues allows distinction of acute denervation from acute traumatic muscle injury. Subacute muscle denervation causes uniform muscle edema in approximately 2–4 weeks. Shifting of water from the intracellular to the extracellular space causes increased MR signal in the fluid-sensitive

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Fig. 1 **a** Proton density (PD; repetition time ms/echo time ms, 1,618/20) sequence coronal oblique image; **b** T2-weighted spectral presaturation with inversion recovery (SPIR; repetition time ms/echo time ms, 3,142/60) sequence coronal oblique image; **c, d** T2-weighted (repetition time ms/echo time ms, 1,542/62) sequence sagittal oblique images. Increased signal and fatty atrophy is seen in the deltoid (white arrows) and the teres minor (black arrows). *Sup* supraspinatus muscle, *I* infraspinatus muscle, *Sub* subscapularis muscle

sequences. If normal innervation is restored, MR findings ultimately return to normal. However, if innervation is not restored, atrophy with fatty infiltration develops after a period of months, indicating irreversible muscle injury [6]. Our case illustrates this MR appearance of chronic axillary nerve injury.

Axillary nerve injury can also occur with fracture of the proximal humerus or a stretching injury of the brachial plexus. A nontraumatic cause of axillary nerve injury is quadrilateral space syndrome, caused by axillary nerve compression from fibrous bands in the quadrilateral space, which produces selective denervation of the teres minor muscle, with or without denervation of the deltoid muscle. Following surgical lysis of these bands, clinical improvement often ensues [7].

Identification of MR changes of chronic axillary nerve injury can prompt targeted management such as transcutaneous electrical nerve stimulation (TENS) and directed physiotherapy to strengthen deltoid and teres minor muscles [8].

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