



## Quadrilateral space syndrome: a review

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Quadrilateral space (QS) syndrome (QSS) is a relatively rare condition in which the axillary nerve and the posterior humeral circumflex artery are compressed within the QS. Fibrous bands are most commonly implicated as the cause, with true space-occupying lesions being less common. QSS is characterized by poorly localized shoulder pain and paresthesia over the lateral aspect of the shoulder and arm in a nondermatomal pattern. These symptoms are aggravated by shoulder abduction and external rotation. Point tenderness is typically present over the QS; however, diagnosis on physical examination can be difficult. Pain relief after lidocaine block of the axillary nerve within the QS is a useful finding in the evaluation of patients with suspected QSS. No definitive diagnostic imaging exists, making diagnosis difficult, although radiographs and magnetic resonance imaging are recommended to rule out other pathology. Nonoperative treatment, including nonsteroidal anti-inflammatory drugs, activity modification, and physical therapy, for at least 6 months is recommended before pursuing operative intervention. Small case series have shown that surgical decompression of the QS has good outcomes, with resolution of pain and return to sport.

**Level of evidence:** Narrative Review

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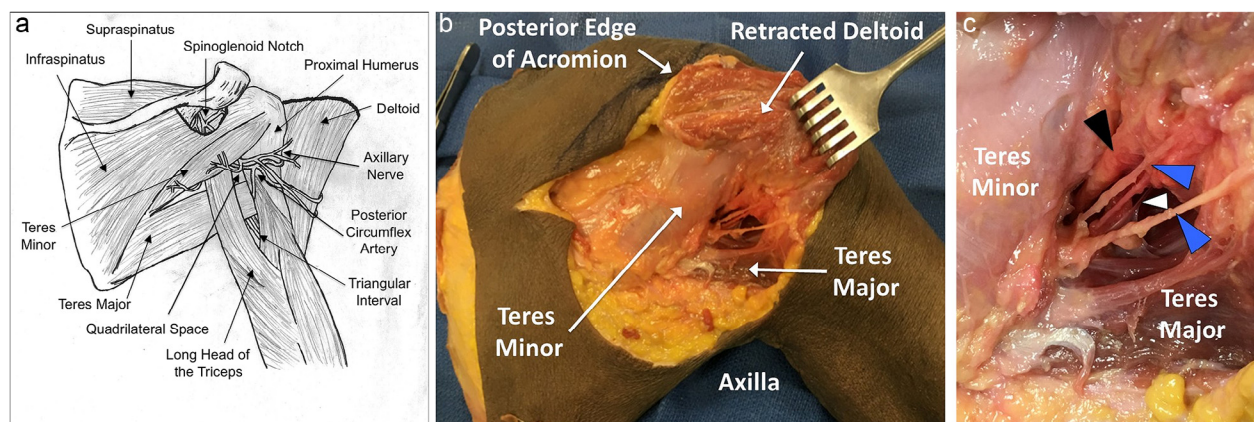
Quadrilateral space (QS) syndrome (QSS) was first described by Cahill and Palmer<sup>6</sup> in 1983 as compression of the posterior humeral circumflex artery and axillary nerve or 1 of its major branches in the QS. This rare syndrome can lead to poorly localized shoulder pain, discrete tenderness to palpation over the QS, and possible teres minor and deltoid denervation.<sup>6,22</sup> These symptoms are typically exacerbated by abduction and external rotation or forward flexion of the shoulder.<sup>6</sup> The vague symptoms and lack of definitive imaging make the diagnosis difficult and require diligence on the part of the clinician for accurate assessment.

### Anatomy

The QS is located in the posterior aspect of the shoulder, bounded by the long head of the triceps medially, the medial edge of the surgical neck of the humerus laterally, the teres major and latissimus dorsi muscles inferiorly, and the teres minor muscle or the glenohumeral capsule superiorly (Fig. 1, A and B). The QS contains the posterior circumflex humeral artery and the axillary nerve (Fig. 1, A and C). A study of 50 cadaveric specimens found the axillary nerve originated from the posterior cord of the brachial plexus in all cadavers, traveled obliquely over the anterior aspect of the subscapularis tendon, passed under the axillary recess of the glenohumeral joint, and entered the QS. The axillary nerve then divided into anterior and posterior branches within the QS in 88% of specimens and within the deltoid muscle in the remainder of specimens.<sup>24</sup>

Institutional Review Board approval was not needed for this study because it was a review of prior published articles.

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**Figure 1** (A) Schematic of the quadrilateral space (QS) from the posterior view. (B) Cadaveric dissection of the QS from the posterior view. (C) Magnified cadaveric dissection of the QS and its contents, including the posterior humeral circumflex branches (*blue arrowheads*), axillary nerve (*black arrowhead*), and fibrous bands (*white arrowhead*). Lateral is on the right of the image.

In all specimens in 2 cadaveric studies, the anterior branch of the axillary nerve traveled with the posterior circumflex humeral vessels, with the nerve lying superior.<sup>24,30</sup> The posterior branch is responsible for innervating the teres minor and the skin over the distal two-thirds of the posterior deltoid via the superolateral brachial cutaneous nerve.<sup>16</sup> The posterior circumflex artery also divides after entering the QS into branches similar to the anterior and posterior branches of the axillary nerve. Fibrous bands are commonly found in the QS in cadaveric studies<sup>22,30</sup> (Fig. 1, C). The study by McClelland and Paxinos<sup>22</sup> found fibrous bands in 14 of 16 cadaveric shoulders originating from the thick fascial layer of the long head of the triceps and attaching to the teres major, adjacent to the axillary nerve in the QS.

## Etiology

QSS can be caused by any condition that decreases space and causes compression of the QS contents. The most common reason cited for compression of the axillary nerve and posterior circumflex humeral artery is fibrous bands.<sup>5,19,21,24</sup> One cadaveric study noted that the fibrous bands caused a decreased cross-sectional area of the QS when they tightened during shoulder abduction and external or internal rotation and postulated that this may cause compression of the QS contents.<sup>22</sup> Compression of the axillary nerve within the QSS is often dynamic or positional, which can make diagnosis difficult. Space-occupying lesions in the QS have also been implicated as the cause of cases of QSS in the literature, including paralabral cysts,<sup>5,15,27,28</sup> bony fracture fragments,<sup>1</sup> benign tumors, such as lipomas, humeral osteochondromas,<sup>10</sup> and axillary schwannomas.<sup>18</sup> Venous dilation has been described as a cause of QSS.<sup>20</sup> Muscle hypertrophy has been cited as a causative agent for compression in competitive overhead athletes.<sup>6,25,26</sup>

The exact pathophysiology of QSS is unclear. One theory is that QSS is caused by compression or irritation of the branches of the axillary nerve (neurogenic), whereas another

common theory is that it is caused by compression leading to decreased perfusion of the posterior circumflex artery (vascular). Patients with combined nerve and vascular compression confirmed with imaging and surgery have been reported.<sup>5</sup> Irritation of the posterior circumflex artery can cause arterial thrombosis or aneurysm, with reported emboli causing distal ischemia.<sup>5</sup>

## Epidemiology

QSS is most commonly seen in patients aged 20 to 40 years and most commonly involves the dominant shoulder.<sup>3</sup> Men are more commonly affected than women.<sup>5</sup> QSS usually affects active patients, especially overhead athletes.<sup>3</sup> Sports most commonly associated with QSS involve significant use of abduction and external rotation such as volleyball, swimming, and baseball.<sup>5,21,25</sup> The true frequency of QSS is unknown given the difficult and often incorrect diagnosis.

## History

The typical presentation of a patient with QSS is slow-onset, intermittent, and poorly localized shoulder pain without trauma. Pain has been described as posterior as well as over the lateral shoulder and arm. Paresthesias of the affected upper extremity in a nondermatomal distribution, usually over the posterior or lateral aspect of the shoulder and arm, or both, without diminished sensation to light touch are commonly seen. These symptoms are typically aggravated by abduction and external rotation of the affected shoulder.<sup>11</sup> Throwing athletes may describe pain with the late cocking phase of throwing and shoulder fatigue in the overhead position.<sup>2</sup>

## Physical examination

Other causes of shoulder pain should be ruled out on physical examination, most commonly rotator cuff pathology, labral

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