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REVIEW ARTICLE

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ABSTRACT

Coracoid pain is not a common presenting symptom in the shoulder clinic, however a small minority of patients do present complaining of pain well localised to the coracoid. To aid clinicians we present the findings of a review of the literature on coracoid pain. We divide the causes of pain into soft tissue and bony causes. We review and discuss the literature and present the evidence on diagnostic investigations and treatments.

INTRODUCTION

Coracoid pain is not a common presenting symptom in the shoulder clinic; however, a small minority of patients do present complaining of pain well localized to the coracoid. A slightly larger group of patients appear to have poorly localized tenderness in the region of the coracoid, which may be isolated or mixed with other signs and symptoms. This systematic review looks at the literature available for causes of coracoid pain and presents each anatomical pathology that should be considered. Symptoms and signs that help differentiate the causes are discussed.

ANATOMY

The coracoid process is a small hook-like structure similar to a ravens beak (Greek 'Korax' = Raven), which arises from the upper border of the scapula at the base of the glenoid. It is bent sharply and projects forward and laterally. When the arm is by the side, the coracoid process points almost straight forward and its enlarged tip can be palpated through the skin [1]. The inferior aspect of the process is smooth and helps to complete the coraco-acromial arch. It serves as an attachment for many soft tissue structures (Fig. 1).

The coraco-acromial ligament arises from the lateral coracoid at a mean of 7.8 mm posterior to the tip. The posterior edge of the ligament is 25.7 mm from the tip of the coracoid [2]. The coraco-clavicular ligaments have three elements to them: the classically described conoid and the trapezoid ligaments and the recently reported medial coraco-clavicular ligament [3]. The conoid and trapezoid originate from the dorsum of the coracoid at the point where it changes direction, with the anterior edge of their footprint being a mean of 28.5 mm posterior to the tip of the coracoid [2]. Medial to this attachment, the medial coraco-clavicular ligament originates and inserts on the clavicle next to the costoclavicular ligament [3]. The mean ± SD length of the trapezoid ligament is 20.2 mm ± 1.9 mm and the mean length of the conoid ligament is 17.6 mm ± 0.9 mm [4]. The clavipectoral fascia blends with the coraco-clavicular ligaments as it attachs to the coracoid [1]. The portion from the coracoid to the first rib is thickened and is called the costocoracoid ligament [1]. The coracohumeral ligament is a substantial trapezoidal structure with its origin on the lateral coracoid from the base to 1 cm from its tip [5,6]. The coracohumeral ligament blends with the capsule of the shoulder at the base of the coracoid, although it is distinct from the capsule more distally. As a result, the ligament forms a bridge-like anterior leading edge over the rotator interval [7].

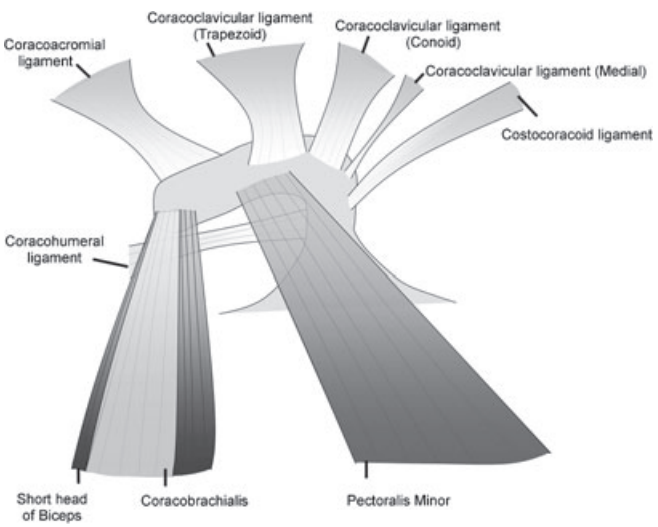

Fig. 1 Ligamanetous and tendionous attachments of the coracoid process.

The pectoralis minor muscle inserts on to the medial aspect of the coracoid tip with its anterior footprint a mean distance of 4.6 mm from the tip and its posterior footprint edge 17.7 mm from the tip [2]. Both the short head of biceps brachii and the coracobrachialis arise from the tip itself, with the biceps being lateral to the coracobrachialis. The attachment of biceps brachii is described as a direct muscular attachment with an aponeurosis lying over the top of it. It does not have a discrete tendon [8].

Soft tissue causes for pain

Damage to the pectoralis minor insertion has been reported in patients associated with bench-pressing [9–11]. 'Bench-presser's shoulder' is postulated as an overuse insertional tendinopathy of pectoralis minor and a series of seven patients has been described who all had isolated pain and tenderness around the medial aspect of the coracoid [9]. Pain on provocation in the bench press position against the resistance of the examiner was felt to be diagnostic. All had an intact pectoralis minor on clinical examination and, on ultrasound assessment, the integrity of the tendon was confirmed. Local anaesthetic and steroid was injected around the insertion under ultrasound guidance. All the patients had immediate relief of pain on injection of the local anaesthetic and returned to sporting activities after 12 weeks of reduced activity and stretching exercises.

An isolated tear of pectoralis minor has been reported during bench pressing [10]; however, the patient had 2 weeks of preceding pain after a tackle in American football. Magnetic resonance imaging (MRI) confirmed the tear and, after conservative treatment, the patient was pain-free by 3 months and was back at his pre-injury level of function 12 months later. Tears have also been reported during American Football [12]. Both of these were treated with conservative management and playing was resumed 3 weeks after presentation.

Pectoralis minor syndrome can give coracoid and anterior chest wall pain mixed with other symptoms such as paresthesia, weakness, swelling or colour change in the upper limb. It can also give pain in the neck or, occasionally, occipital headaches. It is caused by the compression of the axillary neurovascular bundle under a tight pectoralis minor muscle [13]. The brachial plexus is the most common structure compressed, with the vascular structures involved in only 10% of cases [13]. This syndrome presents with neurogenic thoracic outlet syndrome in 70% of cases and on its own in 30%. It is described as differing from thoracic outlet syndrome as a result of the clinical findings of anterior chest wall tenderness and the response to an injection of local anaesthetic into the maximum area of tenderness in the pectoralis minor muscle. If patients receive good relief from the injection of local anaesthetic into the pectoralis minor, then they may benefit from a pectoralis minor tenotomy. This differs from 'bench-pressers shoulder' because it also has anterior chest wall pain and neurovascular symptoms in the arm.

An ectopic insertion of the pectoralis minor diagnosed on an MRI arthrogram has been a cause of pain over the coracoid [14]. In this case, the tendon coursed over the coracoid, through the rotator interval and inserted onto the bursal surface of the supraspinatus, and was symptomatic with painful snapping over the coracoid. These anomalous insertions can be to the coracoaromial ligament, the capsule or the tubercles [15] and up to 30% may give symptoms [16]. Their prevalence in the general population is not known, although it is likely to be extremely rare.

The short head of the biceps and pectoralis minor attachments to the coracoid have also been implicated in the pathogenesis of coracoid pain in the SICK scapula syndrome (Scapular malposition, Inferior medial border prominence, Coracoid pain and malposition and dysKinesis of scapular movement) [17]. In this syndrome, the scapula tilts anteriorly, protracts and abducts. As it does so, the coracoid tilts antero-inferiorly and moves laterally from the midline. The pectoralis minor and short head of the biceps become adaptively tight causing pain. This can often be relieved on physical examination by correcting the tilted scapula by means of the scapular retraction test [17]. The SICK scapula is treated with a scapular rehabilitation programme. Rehabilitation consists of both stretching and strengthening. Strengthening consists of exercises to regain control of scapular protraction, retraction, depression, elevation and rotation. Anterior tightness is treated by placing a rolled towel between the shoulder blades of the supine patient and steadily pushing posteriorly on the shoulders to stretch the pectoralis minor. Posteroinferior capsular tightness is treated by 'sleeper stretches' in which the patient lies on their side with the shoulder in 90° flexion and the elbow in 90° flexion. The shoulder is passively internally rotated by pushing the forearm toward the table around a fixed elbow, which acts as the pivot point [17]

The conjoint tendon has been postulated to assist in anterior stabilization of the shoulder [18,19] and, in cases of instability, may play a much more important role. It could be envisaged in this situation that forceful contractions lead to tractional tendinopathy at the coracoid.

Tendinopathy in the conjoined tendon has been reported after an axillary node clearance [20], preceeding minor trauma leading to a rupture [21] or with no known cause [22]. All of these cases had peri-coracoid pain on presentation. All the cases with no known cause had a dramatic relief of symptoms after the injection of local anaesthetic and steroid under ultrasound guidance [22]. Although no single provocative test was identified, there was a suggestion that pain was brought on by adduction.

After reverse shoulder replacement, it is well documented that arm length is increased [23,24], which will increase the tension on the conjoint tendon attachment to the coracoid. This is reflected by the fact that coracoid fractures have been reported after reverse shoulder replacements [25] and tractional tendiopathy of the conjoint tendon may be a cause of coracoid pain after a reverse shoulder arthroplasty.

Coracoid tenderness has also been suggested to be pathognomonic for adhesive capsulitis with a sensitivity and specificity of 99% and 98%, respectively, compared to a group of controls [26]. This study included over 1000 patients with a mixture of common shoulder pathology and 85 who had adhesive capsulitis. Unfortunately, this has not been reproduced elsewhere and the contra-lateral shoulder was not used as a control.

Coracoid impingement is a well described syndrome presumed to occur when the subscapularis impinges between coracoid and

Table 1 Causes of pain

	Presenting complaint	Clinical sign	Diagnostic test	Treatment
Soft tissue causes				
Insertional tendinopathy of pectoralis minor	Insidious onset pain and tenderness on medial aspect of the coracoid	Pain on provocation in the bench press position	MRI/US to confirm tendon intact	Conservative with injection and physiotherapy
Tear of pectoralis minor tendon	Sudden onset pain and tenderness on medial aspect of the coracoid	Lateral chest wall brusing	MRI/US	Conservative with physiotherapy
Pectoralis minor syndrome	Coracoid and chest wall pain. Neck pain. Headache	Paresthesia, weakness, swelling or colour change in the upper limb	Local anaesthetic injection	Pectoralis minor tenotomy
Ectopic insertion of pectoralis minor	Anterior shoulder pain with clicking	Snapping on shrugging	MRI arthrogram/US	Tenotomy – very limited evidence
Tendinopathy in the conjoined tendon	Pericoracoid pain	Pain on resisted adduction	US guided injection	Conservative with injection and physiotherapy
SICK scapula	Most commonly anterior shoulder pain in the region of the coracoid	The scapular retraction test	Clinical examination	Physiotherapy
Adhesive capsulitis	Stiffness and coracoid pain	Coracoid pain	Clinical examination	Physiotherapy, hydrodilatation, capsular release
Coracoid impingement	Tenderness inferior to coracoid	Modified Hawkins–Kennedy test	MRI	Conservative with injection and physio. Surgical with coracoplasty or coracoid decompression

	Presenting complaint	Diagnostic imaging	Treatment
Bony causes			
Fractures	Coracoid tenderness	Plain radiograph/MRI	Dependent on fracture pattern
Tumours	Coracoid tenderness and mass	Plain radiograph/MRI	Staging, excision or radiotherapy
Degenerative disease of coracoclavicular joint	Coracoid pain	Plain radiograph	Conservative or osteotomy

MRI, magnetic resonance imaging; US, ultrasound; SICK, Scapular malposition, Inferior medial border prominence, Coracoid pain and malposition and dysKinesis of scapular movement.

the lesser tuberosity [27,28]. Patients have pain in the soft tissues around their coracoids, rather than directly on the coracoid itself. A modified Hawkins–Kennedy test with the patient placed in a more adducted and internally rotated position is the test used to confirm the diagnosis [27]. Post-traumatic cases have been reported after fractures of the humeral neck, coracoid or glenoid [29] and idiopathic causes are considered to be a result of variations in the size of the coracoid [30] or overuse hypertrophy of the subscapularis [31]. Treatment options are initially conservative for at least 3 months, followed by surgical options [27]. There is little evidence in the literature for conservative management, although this consists of starting a rehabilitation programme focusing on scapular stabilization and rotator cuff strengthening. The patient should also be assessed for postural abnormalities, pectoralis minor tightness and limitations in thoracic spine mobility. These should be corrected if possible. Injection of local anaesthetic and steroid should also be tried and some success is reported, although the techniques have not been thoroughly evaluated [27]. Surgical options can be open or arthroscopic, with the ultimate aim being to provide more space for the subscapularis under the coracoid either by removing some of the inferior coracoid or by resecting bursal tissue inferior to the coracoid. The arthroscopic technique has been evaluated by computed tomography and found to be safe [32]. It has also been found to produce good results, with a significant improvement noted between operative and non-operative groups [33], although this was a small study.

Bony causes for pain

Coracoid fractures from direct trauma are well described and classified [34,35]. Adult avulsion fractures have also been reported [36].

Avulsion fractures in children have also been described [37,38]. This has either involved the epiphyseal plate as a type I Salter–Harris fracture [38] or at the base of the coracoid but not involving the epiphyseal plate [37]. This was associated with a displaced acromioclavicular joint in one of these cases [37]. It has been speculated that direct trauma to the shoulder girdle may lead to a sudden contraction of the conjoined tendon or pectoralis minor leading to an avulsion type injury [39].

Insidious onset stress fractures at the base of the coracoid have been described in professional shotgun shooters [40] and medium-pace cricket bowlers [41]. The diagnosis was easily demonstrated on an axillary radiograph in one case [40] and on MRI in another [41]. Again, it was speculated that these injuries were a type of traction injury from the insertions of coracobrachialis, the short head of biceps and pectoralis minor [40,41].

As with all fractures, the treatment will be guided by the pattern of the fracture. All undisplaced fractures and displaced type 1–3 fractures can be treated conservatively. Displaced type 4 and 5 fractures involved the articular surface of the glenoid and therefore required fixation [34]. This theory has not been trialled but similar conclusions have been drawn in other studies [40].

Both benign and malignant primary bone tumours of the coracoid process have been reported as a rare cause of coracoid pain [42], usually presenting with a painful mass.

The coracoclavicular joint was initially described in 1861 [43] and has been isolated as a cause for pain in 17 patients from the worldwide literature [44]. The suggestion from this small collection of patients is that operative osteotomy carried a 100% success rate, whereas conservative management had a success rate of approximately 5%. The incidence of coracoclavicular joints on plain chest radiographs was 0.8% in 2192 patients and 1.8% of 392 paired museum skeletal shoulders [45]. From the skeletal study, 60% were unilateral and 40% were bilateral. The aetiology of this anatomical variant is not clear. However, occupational stress [46] and old age [47,48] have been rejected by the discovery of these joints in children on chest X-rays [45]. It has been further proposed that the joints are a hyperostotic non-metric skeletal variant that requires a genetic abnormality and a physiological threshold to be passed before the phenotype is expressed [49]. Coracoclavicular joints do not appear to be symptomatic in the vast majority of the cases described, although they may still be subject to the various pathological conditions that can affect other joints such as osteoarthritis.

SUMMARY

In summary, this review has demonstrated that isolated causes for coracoid pain are rare. In the context of trauma, a fracture should be sought. However, in the nontraumatic cases, it is more difficult to isolate pathology. A detailed history of the patient's activities and associated symptoms may point to a possible cause. There are a limited number of provocation tests that can aid in the diagnosis, and tractional tendinopathy of one of the tendons attaching to the coracoid is a possibility. In the small number of cases in the literature, there may be some overlap regarding which tendon attachments are implicated, especially because the treatment appears to be steroid and local anaesthetic for all cases. Histopathological information is minimal, with one case of tendon rupture in a histological sample showing evidence of chronic inflammation and necrosis [21]. Coracoid pain may also be a secondary phenomenon to another primary pathology, such as SICK scapular syndrome or instability and a primary pathology should be considered. Table 1 summarises the findings of this review article.

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