Symptomatic coracoclavicular joint: incidence, clinical significance and available management options

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Abstract

Purpose Coracoclavicular joint (CCJ) is a rare anomalous joint occasionally found between the coracoid process of scapula and the conoid tubercle of clavicle. The articulation has been extensively studied by means of anatomical, osteological and radiological investigations. Most cases are discovered incidentally, with the symptomatic variety remaining an exceptional rarity. Our aim was to review all reported symptomatic CCJ to increase the level of evidence and formulate a treatment algorithm to aid clinicians in management planning.

Methods A thorough literature search was performed, and data from 17 ($n=17$) symptomatic cases of CCJ were analysed.

Results CCJ is a rare finding and mostly an incidental discovery, which is rarely symptomatic. However, when symptomatic, the most common symptom is shoulder pain. The mean age at presentation is 42 years, with a male:female ratio of 1.4:1. Brachial plexus involvement was the most common pathophysiological explanation provided. First-line treatment was conservative, with a very low success rate of 5.9%. Surgical intervention in the form of

excision of anomalous joint by osteotomy had success rate of 100%.

Conclusions Symptomatic CCJ is rare, and its rarity leads to lack of awareness in the general orthopaedic community. When symptomatic, CCJ may lead to delayed diagnosis or inappropriate management due to lack of evidence and poor description in most orthopaedic textbooks. Despite its low success rate, conservative treatment is advocated before embarking upon surgical intervention.

Introduction

Coracoclavicular joint (CCJ) is a rare but well-established cause of shoulder pain and upper-limb paresthesia [1–3]. However, the actual incidence of symptomatic cases is grossly underestimated. Most authors report only two or three symptomatic cases [1–3]. None of the available recent literature describes the actual number of symptomatic cases. Clinical papers available today are limited to case reports, with no apparent effort to include the other reported symptomatic cases [1–3]. Due to lack of inclusion of all reported symptomatic cases in a single paper, the conclusions drawn by different authors may not represent the true characteristics of the cohort. CCJ is not described in most orthopaedic textbooks, leading to lack of awareness in the general orthopaedic community. In order to generate qualitative scientific evidence, a critical appraisal of cumulative data derived from all reported cases is required, as the lack of cumulative data forces the orthopaedist to rely on class five evidence when planning CCJ management. We conducted a thorough literature search to find all reported cases of symptomatic CCJ from 1915 to 2010 to increase the level of evidence and develop an algorithm for appropriate management.

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Table 1 Symptomatic coracoclavicular joint (CCJ): symptoms, management and outcomes

Author(s)	Case No.	Year	Cases	Age Sex	Clinical Features	Side	Proposed Pathology	Conservative Trial	Management	Outcome
Myer AW	1.	1915	2	34/M	Severe Shoulder Pain	-	-	Failed	Excision of CCJ -Subclavicular approach	Improved resolution
Frassetto	3.	1921	1	F	Bilateral fractures of surgical neck of humerus	Bilateral	Due to reduced mobility of clavicles, increased strain on humerus	NA	NA	NA
Possati	4.	1926	1	63/M	Pain, limitation of shoulder movements	Unilateral	Osteoarthritis of CCJ	NA	NA	NA
Timpano	5.	1934	1	63/M	Shoulder pain	Unilateral	Osteoarthritis of CCJ	NA	NA	NA
Del Valle et al.	6.	1943	1	35/F	Pain Lt shoulder, radiating to breast, arm and neck	Left	Compression of brachial plexus	Failed	Excision of CCJ -Trans Deltoid approach	Complete resolution
Wertheimer	7.	1948	1	37/M	Pain Lt Shoulder radiating to left arm, limitation of shoulder movement	Left	Compression of brachial plexus	Failed	Excision of CCJ -Trans Deltoid approach	Complete resolution
Hall	8.	1950	1	38/M	Pins/ needles/ numbness/ pain forearm/ weakness in hand	Right	Compression of brachial plexus	Failed	Excision of CCJ Trans Deltoid approach	Improved
Cooper WJ ^a , Reported	9.	1957	1	19/M	Pain left shoulder especially increased by movement	Left	NA	NA	Excision of CCJ	Complete resolution
Moore et al.	10.	1967	1		Shoulder pain, reduced movements, painful arc		Supratoracoid impingement			
Pillay VK	11.	1979	1		Thoracic outlet syndrome		Compression of brachial plexus			
Cockshott WP	12.	1993	1	38/F	Swelling & tenderness right coracoid process+pins & needles in right hand	Right	Compression of brachial plexus/ Thoracic Outlet Syndrome due to CCJ and subclavius muscle	Failed	Excision of CCJ and subclavius muscle -Subclavicular approach	Complete resolution
Faraj	13.	2003	1	71/F	Bilateral shoulder pain+painful arc 60–100°	Bilateral	Bilateral supra-coracoid impingement	Failed	Excision of CCJ	Complete resolution
Cheung et al.	14.	2006	1	44/F	Pain Lt Shoulder/ limitation of movements	Bilateral	Impingement of both articular surfaces of CCJ	Failed	Excision of CCJ Trans Dello-pectoral approach	Complete resolution
Nikolaides et al.	15.	2006	1	42/F	Shoulder pain+painful arc >110°	Right	Degeneration of CCJ	Failed	Local injections of steroids in CCJ	Complete resolution
Ma et al.	16.	2006	1	26/M	Pain, numbness Left hand (C7/8)	Left	NA	Failed	Excision of CCJ	Complete resolution
Singh et al.	17.	2009	1	45/M	Shoulder pain/ arm paresthesia	Bilateral	Dynamic Compression of brachial plexus	Successful	Rest/ analgesics life style modifications/ physiotherapy	Complete resolution

NB: ^a The case of Cooper, WJ, reported by Moore et al., * the paper is in press; NA, not available

Methods and material

A thorough search of different medical and nonmedical databases was conducted: PubMed, Cochrane Library, Medlar and National Library for Health (through Athens). General-purpose search engines such as Google, Google-Scholar and Altavista were also used to generate leads, which were further followed by searching specific medical databases. Strings from bibliographies and references used by different authors of the published papers were also followed to retrieve articles. The full-text articles were sourced through Epsom and St. Helier Hospital, British Library, British Medical Association Library and British Museum, UK. The full text of some of the required articles was obtained from the concerned journals. The authors of one paper were contacted directly after an unsuccessful attempt to retrieve the paper. Professional translators translated foreign-language articles into English. Key words used for the search were coracoclavicular and joint and symptomatic; coracoclavicular and articulation; coracoclavicular.

Results

Myer described the first two cases of symptomatic CCJ in 1915 [4]. Another 15 cases were reported by different authors over the next 95 years (Table 1). A total of 16 full-text articles were retrieved, reporting 17 cases with 21 symptomatic CCJ [1–16]. The anomalous joint was right-sided in three (17.64%), left-sided in four (23.52%) and bilateral in four (23.52%) cases, whereas laterality was not mentioned in six (35.29%) patients. The mean age at presentation was 42 (range 19–71) years. Nine (52.94%) were men and six (35.29%) were women, with a ratio of 1.4: 1. Gender identification was not available in two (11.76%) cases. The most common presenting feature was shoulder pain in 12 (70.58%) patients, followed by limitation of shoulder movements associated with painful arc in five (29.41%). The other associated complaints were upper-limb paresthesia four (23.53%) cases, brachialgia and radiation pain to the ipsilateral side three (17.65%), one (5.9%) patient each had localised swelling and tenderness at the site of anomalous joint, bilateral fractures of the humeral neck and hand weakness. The exact symptomatology was not available in two (11.76%) patients.

The pathophysiological explanation was provided by authors in 13 of 17 (76.4%) cases. The most common was involvement of the brachial plexus by the CCJ in six (35.29%) cases. Of these, three had a frank thoracic outlet syndrome and one case had bilateral brachial plexus involvement. Symptoms were ascribed to osteoarthritis of anomalous CCJ in three (17.65%) patients and supracoracoid impingement in three (17.65%). No pathophysio-

logical explanation was provided in four (23.53%) cases. Treatment details were available in 11 of 17 (64.7%) cases. Conservative treatment was initiated prior to other interventions in all 11 cases. The success rate of conservative treatment remained low, with only one (9.09%) case being successful. In six (35.29%) cases, details regarding conservative treatment were not clearly described.

Of the 17 reported cases, ten (58.82%) were ultimately treated surgically. Of these, one (5.9%) patient was managed by conservative and local steroid injections, respectively, in the anomalous joint. No treatment details were available in five (29.41%) patients. Operative intervention and CCJ excision had a success rate of 100%. Three patients (17.65%) each were operated via a transpectoral major infraclavicular and transdeltoid approach. The joint was exposed via the deltopectoral approach in one (5.9%) patient. Excision of anomalous CCJ by osteotomy is performed as a rule of thumb in all surgical cases. In one case an abnormal subclavius muscle was also excised as an additional procedure. Irrespective of treatment mode, the outcome remained excellent in all cases. Outcome was available in 12 (71.6%) of 17 cases and not mentioned the remaining five (29.41%). Ten (58.82%) patients had complete symptom resolution, whereas two (11.76%) were reported to have improved symptoms.

Discussion

CCJ is a rare anomalous joint found between the coracoid process of the scapula and the conoid tubercle of the clavicle (Figs. 1 and 2). A true synovial diarthroidal coracoclavicular joint in humans is rare. Gruber was first to describe the entity in 1861 [17]. Since then, different authors have extensively studied the joint by osteological, cadaveric and radiological methods [13, 18–21]. Depending upon the mode of investigation and the population sample, a wide variation is noted in prevalence [13, 18–21]: from 0.7% to 10% in osteological studies, 1.7% to 30% in cadaveric dissections and 0.04% to 3.0% in radiological studies [13, 18–21].

Fig. 1 Radiograph showing bilateral well-formed coracoclavicular joint

Fig. 2 Coned plain radiograph showing coracoclavicular joint

Irrespective of study method, incidental discoveries constitute the majority of CCJ cases to date. All authors have accepted the rarity of symptomatic cases [1–3]. However, the actual incidence has been underreported in recent literature, leading to a gross underestimation of the actual incidence of symptomatic cases, with different authors quoting figures ranging from two to four in number [1–3]. Also, because of its rarity, the actual number of symptomatic cases might be underdiagnosed owing to a lack of awareness about CCJ pathology as the cause of shoulder pain. After conducting a thorough literature search, we retrieved 17 symptomatic cases. The incidental variety has been hypothesised to show geographical variations in prevalence. It is thought to be more common in Asian than in European or African populations [18–20]. However, the symptomatic variety does not seem to follow any particular geographical pattern. Of 17 cases described here, all were from Europe and the USA. The origin of CCJ is still debated, but many theories have been postulated. Pillay stated that it is an inherited variant with an autosomal-dominant trend [12]. Lane postulated it to be acquired because of occupational stress [22]. Cho and Kang in their cadaveric study suggested the joint is present due to ageing [23]. Kaur and Jit proposed that the joint appears after first decade of life [24]. Saunders indicated that the joint is a hyperostotic nonmetric skeletal variant that does not follow Mandelian pattern [25]. Rockwood described this joint as an anatomical variant with little clinical significance [26]. CCJs are more common in nonhuman primates than in humans [27, 28].

The question is still open to discussion as to whether the CCJ can predispose neighbouring joints to arthritis by alteration/restriction of normal joint movements or can itself undergo osteoarthritis. The mechanisms involved in causing symptoms are either due to altered shoulder-joint mechanics or to primary pathology of the joint itself [5]. Human shoulder movements are the result of a complex dynamic interplay of many forces, ligamentous constraints and bony articulations. These stabilisers allow the shoulder

the greater range of motion than any other joint in the body [5, 16]. Alteration in any of these factors may affect normal shoulder mechanics. Normally, the coracoclavicular ligament complex joins the coracoid process and clavicle. The ligament complex has two distinct parts: trapezoid and conoid [16]. These span between the coracoid to insert on the trapezoid ridge and conoid tuberosity of the clavicle, respectively. The stout ligament suspends the shoulder girdle from the clavicle at an average distance of 13 mm [29]. The clavicle participates in all shoulder-joint movement all directions, including up, down, forward and back [29]. Movements are obviously greater at the lateral end, with the sternoclavicular end being relatively fixed. During shoulder abduction, the coracoclavicular ligament complex serves two important functions: on the one hand, it prevents undue upward displacement of the clavicle; on the other hand, due to its inherent laxity, it provides the clavicle with sufficient freedom to permit reasonable physiological movement in the upwards direction [29]. This generosity of the coracoclavicular ligament complex prevents impingement of underlying neurovascular structures by creating a sufficient safe space underneath. Normally, the clavicle moves in all directions, with the scapula participating freely in movements of the shoulder joint [29].

The presence of a CCJ hampers normal movements of bones in the shoulder girdle, which are otherwise possible to a greater degree due to normal laxity of the coracoclavicular ligament complex [5]. It is proposed that downwards pull on the coracoid process generated by the anomalous CCJ restricts the free upward movement of the acromion and leads to decreased space between the acromion and supraspinatus. This reduced functional space creates undue friction between these two structures, leading to impingement of the supraspinatus muscle [15, 16]. Undue repeated friction produced in this congested space can thus produce impingement of the supraspinatus, leading to shoulder pain and typical painful arc [15, 16]. Clavicular fixation and altered shoulder mechanics due to the presence of a fully formed CCJ has also been implicated as a cause of proximal humerus fracture after a fall on an outstretched hand [5]. According to Nahme et al., the radiograph used to diagnose CCJ should be taken with the patient in a standing position, with both hands lying over the lateral aspect of each corresponding thigh [18]. In this position, the length of the conoid tubercle should be at least 3 mm, with either one or two sharp edges at the inferior aspect of the clavicle, to be considered as CCJ [18].

As discussed, CCJ is mostly and an incidental finding and is rarely symptomatic. After a literature review of the all the symptomatic cases, we made an algorithm for diagnosing and managing symptomatic CCJ (Fig. 3). Treatment can broadly be divided into two major types: surgical and nonsurgical [16]. Nonoperative interventions

Fig. 3 Treatment algorithm showing approach to a coracoclavicular joint evaluation

include anti-inflammatories, physiotherapy, lifestyle modification or local corticosteroid injection under fluoroscopy. Operative intervention involves surgical excision of the joint [1–3]. Asymptomatic cases should be managed by masterly inactivity with a presumption of all of them being “purely incidental”. However, there are suggestions that alteration in shoulder mechanics by the anomalous articulation may accelerate osteoarthritis in the joints of the shoulder girdle, including the CCJ itself (Gumina 2002, Timpano 1943, Possati 1926), due to extremely low

incidence of symptomatic cases a routine follow-up cannot be justified [6, 7, 19]. Occasionally, it is difficult for the clinician to decide whether CCJ is the cause of symptoms or it is just an incidental finding. In this diagnostic dilemma, injecting local anaesthetic under image guidance may help locate the cause (Fig. 3). Symptomatic improvement after the targeted injection indicates CCJ as the pathological site. However, if symptoms are due to dynamic neurovascular impingement as a result of altered shoulder mechanics, local anaesthesia may not be helpful. In this

situation, dynamic magnetic resonance imaging (MRI) is investigation of choice. Dynamic MRI not only gives detailed anatomy of the joint and nearby structures, it highlights any undue traction/impingement of neurovascular structures in different arm positions, which may not be obvious in static MRI.

Nonsurgical treatment may be the treatment of choice in a select group of patients: the elderly, with low functional demand; patients with high American Society of Anesthesiologists (ASA) score who are high surgical risk; patient unwilling to undergo surgery. Although conservative treatment has shown low success rates in the literature, it should always be the first-line of treatment. Failure of nonsurgical measures warrants operative excision of the joint. Whereas different approaches have been used, we recommend the deltopectoral approach for CCJ excision, as it is easy, safe, extensile and familiar to most of the orthopaedic surgeons. Arthroscopic excision of CCJ has not been reported but is a valuable option if the surgeon has the necessary skills. In this study, we aimed to increase the level of evidence for symptomatic CCJ by analysing data from all available symptomatic cases. The suggested management algorithm is based on a small number ($n=17$) of symptomatic CCJ, which limits its strength. However, due to the condition's rarity, we expected the numbers to be low; however, we believe that despite the obvious limitation, the study provides essential information and guidance to the clinician planning treatment for symptomatic CCJ.

Conclusions

CCJ is a rare, anomalous joint that is mostly asymptomatic and diagnosed by incidental radiological findings but which should be considered in the differential diagnosis for unexplained shoulder pain. A high index of suspicion is mandatory for timely diagnosis and management. Conservative treatment should be attempted before embarking upon surgical intervention.

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