Isolated Pectoralis Minor Rupture – Case Report and Systematic Review

Furkan Genel* and David C Kieser**

*Department of Orthopaedic Surgery and Musculoskeletal Medicine, Christchurch Hospital, 2 Riccarton Avenue, Christchurch, New Zealand. **Department of Orthopaedic Surgery and Musculoskeletal Medicine, University of Otago, 2 Riccarton Avenue, Christchurch, New Zealand.

ABSTRACT

Background: Isolated Pectoralis Minor ruptures are a rare and comprehensive review of its presentation and management is lacking. Our objective is to describe a case of an isolated pectoralis minor rupture and systematically review the literature for its prevalence, mechanism of injury, presentation, appropriate investigations and treatment. Methods: After presenting the case, we performed a systematic review of the English literature on PUBMED and MEDLINE from inception to June 2018 with the MeSH search terms of “pectoralis minor” AND “isolated” AND “rupture” OR “tear”. Results: Our case was a healthy non-elite male who sustained the injury from forced shoulder abduction and extension while playing rugby league. He presented with anterior shoulder and chest pain, with subpectoral swelling. An MRI confirmed the diagnosis, and he was successfully treated non-operatively with a resolution of symptoms and return to full work activities within nine weeks. The systematic review identified six cases of isolated ruptures. Most injuries were sustained during contact sport with forced shoulder abduction and extension or direct impact to the chest wall causing anterior shoulder pain. MRI confirmed the diagnosis in all cases, and non-operative treatment successfully resulted in symptom resolution within three months. Conclusions: Isolated pectoralis minor injuries are rare. Affected patients are usually young fit individuals who sustain the injury following a direct blow to the shoulder or hyper-abduction and extension injury of the arm. They typically present with tenderness over the anterior shoulder with limitation in shoulder ROM. MRI is the optimal diagnostic modality, and the treatment is non-operative.

KEYWORDS Myofascial pain, Duane SyndromeReview, Orthopaedics, Contact Sports, MRI, Rugby

Introduction

Pectoralis significant ruptures are common and well documented in the literature [1, 2, 3, 4, 5, 6]. In contrast, rupture of the pectoralis minor, which lies deep to the pectoralis major, is rare and infrequently reported in the literature. The pectoralis minor originates from the second to fifth ribs and inserts medially onto the coracoid process[7]. It is innervated by the medial and lateral pectoral nerves and receives the majority of its blood supply from the thoracoacromial artery. Its main function is thought to be a rotation of the scapula anteriorly and inferiorly over the thoracic wall contributing to the stabilisation of the scapula[7]. By originating on the ribs, it is also thought to contribute to rib movement and respiration.

This muscle can be injured in thoracic and shoulder trauma in association with other injuries[8]. However, isolated pectoralis minor injuries are rare and thus their mechanism of injury, and functional outcomes remain unclear. What is known is that people with a congenital absence of pectoralis minor have no
significant functional limitations[9, 10]. Furthermore, patients who have their pectoralis minor harvested for a surgical donor in reconstructive surgery don’t have significant functional sequelae[11]. Thus, it is suggested that patients with isolated pectoralis minor injuries will have minimal to no long-term dysfunction.

We present an intriguing case of an isolated pectoralis minor rupture in a non-elite sportsman, who was a manual labourer and who sustained the injury while playing rugby league. Also, we perform the first systematic review on isolated pectoralis minor ruptures to determine the patient demographic at risk, the common mechanisms of injury, presentation, diagnostic modalities, treatment and prognosis.

Case Report

Consent was obtained from the patient to present his case. A 27-year-old fit and well male, who is a scaffolder by trade, was playing rugby league when he sustained a hyper-abduction and extension injury to his right upper limb during a tackle. There was no direct impact to the chest or right upper limb. He felt a tearing sensation and immediate pain in his anterolateral thorax and axilla. He did not experience any symptoms of shoulder instability and was able to continue playing the rest of the match. He then presented to the hospital with persistent pain in the same region. His initial visual analogue pain score (VAS) was 8/10 and disability of arm shoulder, and hand score (DASH) was 86.7.

His clinical examination revealed diffuse tenderness to palpation of the anterolateral thorax and axilla. He had no visible bruising but had deep-seated swelling expanding his right pectoral region (Figure 1). His inferior border of the pectoralis major was palpable but tender. His shoulder range of motion (ROM) was limited by pain. Shoulder protraction and stressing his pectoralis major worsened this pain. His rotator cuff was intact, and he had no neurological deficits.

An x-ray of his right shoulder was unremarkable (Figure 2).

An MRI scan was then performed (Figure 3). This revealed a complete rupture of the pectoralis minor tendon at the musculotendinous junction with 5-7cm retraction of the muscular fibres and a large haematoma (3 x 4.5 x 7.5cm) within the defect. There were no other injuries identified.

He was treated non-operatively with a broad arm sling for comfort and encouraged a range of motion as comfort permitted. By two weeks his pain, function and range of motion had significantly improved (VAS 5, DASH 47.5). He was able to elevate his arm to shoulder height, had a symmetrical internal rotation of his shoulder but a lack of external rotation (75 degrees on the right compared to 90 degrees on the left). He had minor swelling evident over the superolateral aspect of pectoralis muscles with associated tenderness to palpation. Resisted internal rotation and adduction caused pain, but no other resisted movements induced any discomfort. At six weeks, he had full passive and active ROM at the shoulder. The pain was exacerbated with shoulder elevation and palpation of the medial coracoid (VAS 2, DASH 10.8). There was no pain on stressing of the rotator cuff. However, there was subtle wasting over the deltopectoral region. By eight weeks he commenced part-time work, by nine weeks he was asymptomatic and returned to full-time work.

Figure 1: Representative clinical photographs of the patient. A) Neutral position showing symmetrical pectoral muscle bulk, but deep-seated swelling, without bruising. B) Resisted adduction showing that there is no gross change in muscle symmetry except the absence of the anterior axillary crease due to swelling. C) Right shoulder abduction, showing the limitation due to pain. D) Posterior thorax, showing symmetrical posterior muscle bulk and scapulae positioning.

Figure 2: Antero-posterior and lateral x-rays of the right shoulder revealed no abnormality.

Systematic Review

Methods

We performed a systematic review of the literature from inception to 08 June 2018 by PRISMA guidelines[12]. We included journal articles, communications and conference proceedings. Observational studies (prospective cohort, nested case-control, or case-control, retrospective cohort), case series, non-randomised studies, and randomised controlled trials (RCTs) were searched in PUBMED and MEDLINE. The computer-based searches combined free and MeSH search terms and a combination of keywords related to the diagnosis (e.g. “pectoralis minor” AND “isolated” AND “rupture” OR “tear”). Only articles published in English were considered and were restricted to humans. Reference lists of relevant articles were manually scanned for additional studies likely to have been missed by the electronic search.
Study selection

Our PICOS criteria were patients with isolated pectoralis minor ruptures in any empirical study design. We excluded studies that (i) had associated skeletal or musculotendinous injuries; (ii) had neurological injuries causing pectoralis minor dysfunction without rupture or tear; and (iii) had cases of post-operative pectoralis minor dysfunction without rupture or tear. We did not utilise a minimum follow-up as an exclusion criterion.

Data screening and extraction

One author (FG) performed the initial screening of titles and abstracts to retrieve potentially relevant articles. A detailed evaluation of the full texts of these relevant articles was conducted to determine whether they met all inclusion criteria and both authors conducted this independently.

Results

Initial searches identified 1130 articles. After exclusion criteria were implemented and duplicates removed, five articles (six cases) were identified that reported isolated pectoralis minor ruptures (Figure 4).

The patient demographics and risk factors, as well as mechanism of injury, are shown in Table 1. The reported treatment and prognosis are shown in Table 2. Patient 1 was a professional female football league player[13]. Patient 2 and 3 were professional male NFL players[14]. Patient 4 was a professional male ice hockey player[15]. Patient 5 was a high-school male football player[16], and patient 6 was an elderly patient with end-stage renal disease on haemodialysis[17].

Discussion

Isolated pectoralis minor ruptures are rare. They usually present with anterior shoulder or chest wall pain after direct impact or a shoulder abduction injury during contact sport. Patients typically present with local tenderness medial to the coracoid, with sub-pectoral swelling and no cutaneous bruising. MRI scanning is the diagnostic modality of choice and conservative management with physiotherapy appears to enable patients to return to elite sport within a month. Non-elite athletes take longer to return to play but rapidly improve their pain and function with a resolution of symptoms by three months.

Our patient experienced a similar injury to others previously reported in the literature. He experienced a shoulder abduction and extension injury without direct shoulder or chest wall impact. In all cases, we feel that the mechanism of injury is likely to be forced scapula retraction either indirectly by shoulder abduction and extension, or directly by direct impact. This movement tractions the pectoralis minor and therefore risks rupture.

Our patient presented with anterior shoulder pain similar to all other previously reported cases. His pertinent examination findings included tenderness medial to the coracoid process and the anterolateral thorax, axilla and inferior border of the pectoralis major. He also had sub-pectoral swelling expanding his right pectoral region, but no cutaneous bruising. This is expected considering the anatomical location of the pectoralis minor being deep to the pectoralis major. Furthermore, MRI imaging reveals the confined sub-pectoral location of the haematoma.

With the clinical suspicion of an isolated pectoralis minor rupture, all previous reports advocate an MRI scan to diagnose the injury[13, 14, 15, 16, 17]. Our patient underwent an MRI scan, which identified a complete isolated rupture of his pectoralis
Table 1 Summarised information of the previously reported cases of isolated pectoralis minor injuries.

|                  | Patient 1 | Patient 2 | Patient 3 | Patient 4 | Patient 5 | Patient 6 |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| **Age**          | 40        | Late 20s  | Late 20s  | 25        | 17        | 59        |
| **Sex**          | F         | M         | M         | M         | M         | M         |
| **Comorbidities**| None      | None      | None      | None      | None      | None Type 1 diabetes mellitus with end stage renal failure on dialysis. |
| **Aetiology (MOI)** | Direct impact to anterior shoulder | Whilst practicing blocking drills, Injury occurred when shoulder was in abduction and flexion and arms in extension. | Whilst practicing blocking drills, Injury occurred when shoulder was in abduction and flexion and arms in extension. | Direct impact with shoulder in abduction, extension and external rotation. | Direct impact to anterior shoulder and chest | Non-traumatic |
| **Symptoms**     | Anterior shoulder pain | Anterior shoulder pain with loss of strength. | Anterior shoulder and chest wall pain | Anterior shoulder and chest wall pain | | |
| **Signs**        | Tenderness over coracoid process and pain with resisted shoulder adduction | Tenderness over coracoid process and sternal margin of pectoralis major. Pain with shoulder abduction and external rotation. | Tenderness over coracoid process and sternal margin of pectoralis major. Pain with shoulder abduction and external rotation. | Pain and weakness of shoulder adduction. | Ecchymosis at inferior margin of pectoralis major with tenderness over coracoid process. | |
| **Investigations** | MRI | MRI | MRI | MRI | XR, MRI | XR, MRI |
We advised pendulum exercises and shoulder range of motion (17) (see Table 2). In professional athletes, physical therapy, neuromuscular training (control drills), cross friction massage and scapula stabilisation exercises have resulted in patients returning to contact sport in 2-4 weeks[13, 14, 15]. In non-professional players, the time to play is longer. Based on the information available, we opted for non-operative treatment in our patient. We advised pendulum exercises and shoulder range of motion (ROM) within the range of comfort for the first two weeks. He then underwent progressive supervised ROM from 2-6 weeks, including scapulothoracic motion. After six weeks, progressive strength training was undertaken.

The systematic review of the literature suggests excellent functional outcomes with a return to pre-injury activity within a few weeks. It should be noted that although earlier literature indicated a relatively short recovery time for the professional athletes who sustained pectoralis minor ruptures, there is no data on the clinical sequelae in non-elite athletes and manual labourers. Our patient improved his symptoms by six weeks and returned to full work duties by nine weeks post-injury.

Irrespective of fitness level, there is an absence of long-term data regarding the prognosis of this injury. This is predominantly due to the rarity of this injury and paucity of literature. However, reports of patients with Poland Syndrome (congenital absence of pectoralis minor) indicate minimal to no functional limitations due to the muscle’s absence[9]. Cybex and colleagues studied two wrestlers with Poland’s Syndrome and found a 20-30% decrease in shoulder horizontal adduction strength, without functional limitation[10]. Similarly, harvesting the pectoralis minor during reconstructive procedures do not appear to cause significant functional limitations[11]. This information, in addition to the rapid return to elite sports, suggests that these injuries should not cause longer-term functional deficits.

This study is limited by the paucity of literature on the topic and the inclusion of a single case. Furthermore, the optimal non-operative treatment protocol for these patients is not well defined in the literature. Finally, objective muscle strength testing was not performed in our case and has not been performed previously, as seen in the literature. Despite these limitations, this study offers a comprehensive review of the currently available literature to aid the diagnosis and treatment of patients affected by isolated pectoralis minor ruptures.

### Conclusion

Isolated pectoralis minor injuries are rare. Affected patients are usually young fit individuals who sustain the injury following a direct blow to the shoulder or hyper-abduction and extension injury of the arm. They typically present with tenderness over the coracoid and the pectoral muscle belly with limitation in the shoulder ROM. Although basic investigations are used in the workup, an MRI is optimal to confirm the diagnosis. Treatment is non-operative with physical therapy, NSAIDs, ROM limitations as well as scapular stabilisation exercises. The expected prognosis is promising with a return to pre-injury functional levels and return to play within a few weeks following the injury.

### Acknowledgements

We would like to express our thanks to the staff at Christchurch Hospital Bone Shop Department as well as the Radiology Department who with their hard work, facilitated the production of this article.

### Competing Interests

There were no financial supports or relationships between authors and any organization or professional bodies that could pose any conflict of interest.

### Funding

None.

### References

1. Fleury AM, Silva AC, de Castro Pochini A, Ejnisman B, Lira CA, Andrade Mdos S. Isokinetic muscle assessment after treatment of pectoralis major muscle rupture using surgical or non-surgical procedures. Clinics (Sao Paulo). 2011;66(2):313-320.
2. Hanna CM, Glenny AB, Stanley SN, Caughey MA. Pectoralis major tears: comparison of surgical and conservative treatment. Br J Sports Med. 2001;35(3):202-206.

3. Bak K, Cameron EA, Henderson IJ. Rupture of the pectoralis major: a meta-analysis of 112 cases. Knee Surg Sports Traumatol Arthrosc. 2000;8(2):113-119.

4. He ZM, Ao YF, Wang JQ, Hu YL, Yin Y. Twelve cases of the pectoralis major muscle tendon rupture with surgical treatment-an average of 6.7-year follow-up. Chin Med J (Engl). 2010;123(1):57-60.

5. Shindle MK, Khosravi AH, Cascio BM, Deune EG, McFarland EG. Surgical treatment of a tear of the pectoralis major muscle at its sternal origin. A case report. J Bone Joint Surg Am. 2007;89(9):2040-2043.

6. Zeman SC, Rosenfeld RT, Lipscomb PR. Tears of the pectoralis major muscle. Am J Sports Med. 1979;7(6):343-347.

7. Cordova AJ, Azizi HF, Rand S. Pectoralis Major and Minor Strains and Tears. In: Kahn SB, Xu SY, eds. Musculoskeletal Sports and Spine Disorders: A Comprehensive Guide. Cham: Springer International Publishing; 2017:159-165.

8. de Castro Pochini A, Eijvisman B, Andreoli CV, et al. Pectoralis major muscle rupture in athletes: a prospective study. Am J Sports Med. 2010;38(1):92-98.

9. Suzuki T, Takazawa H, Koshino T. Computed tomography of the pectoralis muscles in Poland’s syndrome. Hand. 1983;15(1):35-41.

10. Mysnyk MC, Johnson DE. Congenital absence of the pectoralis muscles in two collegiate wrestling champions. Clin Orthop Relat Res. 1991(265):183-186.

11. Scevola S, Cowan J, Harrison, DH. Does the removal of pectoralis minor impair the function of pectoralis major? Plast Reconstr Surg. 2003;112(5):1266-1273.

12. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097.

13. Mehallo CJ. Isolated tear of the pectoralis minor. Clin J Sport Med. 2004;14(4):245-246; discussion 247.

14. Zvijac JE, Zikria B, Botto-van Bemden A. Isolated tears of pectoralis minor muscle in professional football players: a case series. Am J Orthop (Belle Mead NJ). 2009;38(3):145-147.

15. Kalra K, Neri B. Isolated pectoralis minor tendon tear in a professional ice hockey player–radiographic findings and presentation. Skeletal Radiol. 2010;39(12):1251-1253.

16. Li X, Gorman MT, Dines JS, Limpisvasti O. Isolated tear of the pectoralis minor tendon in a high school football player. Orthopedics. 2012;35(8):e1272-1275.

17. Örücü M, Kutlay S, Güneş S, Gök H. Isolated spontaneous pectoralis minor tendon rupture in a patient with chronic renal failure. Ankara Üniversitesi Tip Fakültesi Mecmuasi. 2016;69:117-120.