CASE REPORT

Arthroscopic Retrieval of over 100 Loose Bodies in Shoulder Synovial Chondromatosis: A Case Report and Review of Literature

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Synovial chondromatosis is a rare and benign condition of unknown cause. It is also known as synovial osteochondromatosis. It is characterized by involvement of the synovial tissue, which lines various joints of our body. Initial symptoms range from pain in the joint, locking of the joint at times, especially the knee, to arthritis of the joint that is a late feature of this condition. Although large joints such as the knee are commonly affected, involvement of the shoulder joint is a rare occurrence. Historically an open arthrotomy was preferred for removal of loose bodies coupled with a thorough synovectomy. However, arthroscopy for loose body retrieval has gained popularity over the past two decades. Arthroscopic surgery is an extremely skilled procedure and there is a learning curve for operating in certain anatomical areas such as the shoulder. However, not only does an arthroscopy provide the surgeon with an excellent view of the shoulder but the patient also has a faster recovery. We report a rare case of shoulder synovial chondromatosis in which more than 100 loose bodies were successfully retrieved by an arthroscopy in an individual who had an excellent outcome post-surgery, reaffirming our faith in the procedure. A detailed literature review of arthroscopic procedures is also presented.

Key words: Arthroscopy; Loose body; Synovial chondromatosis

Introduction

Synovial chondromatosis is a benign condition that affects the synovial tissues lining various joints. The affected synovium grows abnormally and produces small clumps or nodules of cartilage. These nodules eventually break off and present as loose bodies in the joint. The size of the loose bodies can vary from being as tiny as a few millimeters to being as large as a coin. Small bodies lead to locking episodes, whereas larger bodies cause erosion of the cartilage, leading to early onset of arthritis. In advanced cases the loose bodies may become embedded in the surrounding tissue. The amount of loose bodies and their enormous size as compared to the relatively small joint space can at times lead to them occupying the entire joint. Synovial chondromatosis is most commonly reported in relation to the knee joint¹. Locking of the knee joint is a common symptom and can be at times extremely distressful, especially when it is an

episode of true locking wherein the patient is unable to completely extend his or her knee. Arthroscopy of the knee and removal of the loose body provides instant symptomatic relief to the patient in such instances. Other joints such as the hip, elbow, shoulder, and wrist are also affected. However, of all these joints the involvement of the shoulder joint is relatively rare as compared to the knee. Classically an open arthrotomy and synovectomy was the treatment of choice in the past; however, arthroscopic surgery has been reported by some authors in recent years. Arthroscopy of the shoulder is not only an extremely skilled surgery, but also requires a lot of perseverance and patience when it comes to technically challenging procedures such as retrieval of multiple loose bodies of varying sizes. In the present study, we report a unique case of arthroscopic retrieval of more than 100 loose bodies in a case of synovial chondromatosis of the shoulder.

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Case Report

Clinical Presentation and History

A 52-year-old right-hand-dominant man, an information technology professional, presented to our upper limb clinic with symptoms of pain in his left shoulder. The shoulder pain started 3 years previously and has progressively worsened, with associated clicks and a grinding sensation when he consulted us. His symptoms were bad enough to disturb his sleep at night; however, because his job was sedentary, he had no major issues at work, apart from a feeling of tiredness towards the end of the day.

Examination

On examination, his range of motion was restricted when compared to the other side. Flexion was 110° , abduction was 120° and external rotation was limited to 10° as compared to 40° on the other side. Internal rotation was up to the point where the patient's hand touched his back at the level of the fifth lumbar vertebra (L_5), as compared to first lumbar vertebra (L_1) on the other side; similarly, internal rotation was restricted with the patient's arms in abduction. Clinical examination of the rotator cuff did not reveal any abnormalities and cuff power was normal. A cross-arm adduction test did not elicit any pain in the acromioclavicular (AC) joint.

Investigations and Procedure

Initial radiographs revealed that this gentleman had multiple loose bodies in his left shoulder (Fig. 1). The diagnosis was confirmed by magnetic resonance imaging (MRI) (Figs 2–3).

Fig. 1 Anteroposterior radiograph of left shoulder showing multiple intra-articular loose bodies.

Fig. 2 Magnetic resonance image (MRI) of left shoulder (axial view) showing multiple loose bodies embedded in the anterior and posterior synovium.

Options were discussed with the patient and he was keen to get his shoulder symptoms improved. Arthroscopic removal of loose bodies was offered to the patient. A left shoulder

Fig. 3 Magnetic resonance image (MRI) of left shoulder (sagittal view) showing multiple loose bodies embedded in the synovium as well as along the proximal humerus.

arthroscopy was performed, with the patient under general and regional anesthesia, and in the beach chair position. Standard posterior, anterior and, anterosuperior portals were used in performing the arthroscopic procedure. An additional posterolateral portal was needed to retrieve some of the posterior inferior loose bodies.

Multiple loose bodies were retrieved using a grasper. The loose bodies ranged from a few millimeters to over a centimeter in diameter. The larger loose bodies were removed first because of ease of retrieval. A tip for removal of smaller loose bodies is to keep the grasper in an open position and let the loose body engage itself. The loose bodies engage in this way because of the flowing lavage water. A total of 126 loose bodies were successfully removed (Figs 4–5). A synovectomy was performed using a motorized shaver and the shoulder was irrigated thoroughly with normal saline before concluding the procedure.

Postoperative Management and Follow-up

Post-operatively the shoulder was placed in a sling, primarily for comfort. Range of movement exercises were started as soon as the patient was comfortable. This patient was followed up in the upper limb clinic at 3 months. At his follow-up, he had a pain-free range of left shoulder movement as compared to the other side and no preoperative symptoms.

The patient was informed that data from the case would be submitted for publication and he consented for the same.

Discussion

Synovial chondromatosis is a rare and benign disorder of unknown aetiology. It is primarily monoarticular and is known to affect bursae, tendon sheaths, and synovial joints^{1,2}. The knee joint is most commonly involved,

Fig. 4 Arthroscopic image of multiple loose bodies along with arthritic changes of the humeral head.

Fig. 5 Multiple loose bodies of varying sizes after retrieval.

followed by the hip, elbow, shoulder, and wrist^{3,4}. In a review of 191 cases of synovial chondromatosis in the literature, carried out by Bloom and Pattinson, only 10 cases were identified with shoulder involvement⁵. According to Small and Jaffe (1981), 25 cases of shoulder chondromatosis have been reported in the literature⁶. Only 5 cases of shoulder chondromatosis were identified in a collection of 95 cases, as observed in three different studies^{7–9}.

Histological studies have shown that synovial cells undergo a metaplastic change to chondrocytes. These chondrocytes then produce multiple clusters of cartilage, thus giving rise to synovial chondromatosis¹. Paul and Leach state that the loose bodies occur in the zone where synovium transforms into cartilage¹⁰. Reactivation of the pluripotent cells and bone morphogenic protein-induced aggravation of synovial chondromatosis have been implicated by other studies^{6,11}.

Hamada *et al.* report on a case of a 14-year-old girl who was treated with luteinizing hormone-releasing hormone (LH-RH) analogue for central precocious puberty. She was also an active participant in Japanese archery, which required her to use her right limb repetitively. Prolonged use of hormones coupled with repetitive stress on the limb could have caused the articular cartilage to break down, giving rise to small cartilaginous loose bodies in the shoulder joint¹². Repeated micro trauma can lead to metaplasia, and recurrent synovial chondromatosis is believed to be associated with clonal karyotypic abnormalities on chromosome 6^{13,14}. Although largely a benign condition, rare cases of oncogenic

transformation to chondrosarcoma have been reported in the literature^{15,16}.

Synovial chondromatosis has a higher prevalence in the male sex and occurs between the third and the fifth decade^{17,18}. Plain radiographs are not helpful in cases where no calcification has occurred and this may lead to a delay in diagnosis¹⁹. Computerized tomography can be helpful in diagnosing loose bodies in places like the sub-coracoid recess; however, it does not provide any added advantage over a plain radiographic examination²⁰. MRI is the imaging modality of choice in cases where no calcification has occurred; similarly, MRI facilitates diagnosis of chondroma in the biceps tendon sheath, sub-acromial bursa, and acromioclavicular joint^{17,18,21,22}. A follow-up MRI is equally important and there have been instances where a chondroma was missed because a follow-up MRI was not conducted¹⁷.

In a classic paper by Milgram, synovial chondromatosis has been identified to present in three distinct stages. In stage one there is active intrasynovial disease, with no loose bodies; stage two has transitional lesions, with both active intrasynovial proliferation and free loose bodies; and stage three presents with multiple osteochondral loose bodies, with no active intrasynovial disease⁸.

There has been considerable argument over whether an arthroscopic procedure is better than an open procedure for retrieval of loose bodies; however, there is no clear evidence that an open procedure, with or without synovectomy, offers any advantage²¹. A disadvantage of arthroscopy is that the synovectomy is limited; however, the recurrence rate is no higher in those treated with synovectomy as compared to those who had only loose body removal^{23,24}. Lunn *et al.*, favor an open approach because in their opinion an

arthroscopic decompression of the bicipital groove is difficult²⁰. Buess and Friedrich argue that removal of chondromas from subscapular recess and the biceps tendon sheath would be difficult arthroscopically; hence arthroscopy coupled with an open radical excision is their preferred modality¹. In contrast, Fowble and Levy report successful arthroscopic removal of loose bodies from the subscapular recess and within the substance of the biceps tendon²⁵. In the opinion of Jeon *et al.*, arthroscopic removal of loose bodies from the biceps tendon can be performed using straight forceps and with practice this skill can be mastered²⁶. Arthroscopic removal has been stated to have no recurrence, as per the observation of Chillemi *et al.*²⁷

The first case of arthroscopic retrieval for loose bodies in shoulder synovial chondromatosis was reported by Richman and Rose in 1990²⁸. Over the years many authors have written about arthroscopic treatment of shoulder synovial chondromatosis, with varied causes ranging from rheumatoid arthritis to chondromatosis formation secondary to surgery for shoulder instability^{19,29}. To the best of the authors' knowledge, this is the only case where over 100 loose bodies were retrieved arthroscopically from the shoulder of an adult patient diagnosed with synovial chondromatosis.

Conclusion

Arthroscopic treatment of shoulder synovial chondromatosis is recommended, due to its advantages of lesser morbidity, early rehabilitation, and faster recovery in patients. Arthroscopic retrieval of loose bodies in the shoulder is an excellent surgical option to offer to a patient presenting with synovial chondromatosis of the shoulder.

References

1. Buess E, Friedrich B. Synovial chondromatosis of the glenohumeral joint: a rare condition. *Arch Orthop Trauma Surg*, 2001, 121: 109–111.
2. Bruggeman NB, Sperling JW, Shives TC. Arthroscopic technique for treatment of synovial chondromatosis of the glenohumeral joint. *Arthroscopy*, 2005, 21: 633.
3. Crotty JM, Monu JU, Pope TL Jr. Synovial osteochondromatosis. *Radiol Clin North Am*, 1996, 34: 327–342, xi.
4. Miranda JJ, Hooker S, Baechler MF, Burkhalter W. Synovial chondromatosis of the shoulder and biceps tendon sheath in a 10-year-old child. *Orthopedics*, 2004, 27: 321–323.
5. Bloom R, Pattinson JN. Osteochondromatosis of the hip joint. *J Bone Joint Surg Br*, 1951, 33: 80–84.
6. Small R, Jaffe WL. Tenosynovial chondromatosis of the shoulder. *Bull Hosp Jt Dis Orthop Inst*, 1981, 41: 37–47.
7. Murphy FP, Dahlin DC, Sullivan CR. Articular synovial chondromatosis. *J Bone Joint Surg Am*, 1962, 44: 77–86.
8. Milgram JW. Synovial osteochondromatosis: a histopathological study of thirty cases. *J Bone Joint Surg Am*, 1977, 59: 792–801.
9. Imhoff A, Schreiber A. Synoviale chondromatose. *Orthopäde*, 1988, 17: 233–244.
10. Paul GR, Leach RE. Synovial chondromatosis of the shoulder. *Clin Orthop Relat Res*, 1970, 68: 130–135.
11. Iwata H, Ono S, Sato K, Sato T, Kawamura M. Bone morphogenetic protein-induced muscle- and synovium-derived cartilage differentiation in vitro. *Clin Orthop Relat Res*, 1993, 296: 295–300.
12. Hamada J, Tamai K, Koguchi Y, Ono W, Saotome K. Case report: a rare condition of secondary synovial osteochondromatosis of the shoulder joint in a young female patient. *J Shoulder Elbow Surg*, 2005, 14: 653–656.
13. Ogawa K, Takahashi M, Inokuchi W. Bilateral osteochondromatosis of the subacromial bursae with incomplete rotator cuff tears. *J Shoulder Elbow Surg*, 1999, 8: 78–81.
14. Buddingh EP, Krallman P, Neff JR, Nelson M, Liu J, Bridge JA. Chromosome 6 abnormalities are recurrent in synovial chondromatosis. *Cancer Genet Cytogenet*, 2003, 140: 18–22.
15. Perry BE, McQueen DA, Lin JJ. Synovial chondromatosis with malignant degeneration to chondrosarcoma. Report of a case. *J Bone Joint Surg Am*, 1988, 70: 1259–1261.
16. Sah AP, Geller DS, Mankin HJ, *et al.* Malignant transformation of synovial chondromatosis of the shoulder to chondrosarcoma. *J Bone Joint Surg Am*, 2007, 89: 1321–1328.
17. Urbach D, McGuigan FX, John M, Neumann W, Ender SA. Long-term results after arthroscopic treatment of synovial chondromatosis of the shoulder. *Arthroscopy*, 2008, 24: 318–323.
18. Gasbarrini A, Biscaglia R, Donati D, Casadei R, Picci P. Synovial chondromatosis of the shoulder. A review of the literature and description of a clinical case. *Chir Organi Mov*, 1997, 82: 73–81.
19. Jung KA, Kim SJ, Jeong JH. Arthroscopic treatment of synovial chondromatosis that possibly developed after open capsular shift for shoulder instability. *Knee Surg Sports Traumatol Arthrosc*, 2007, 15: 1499–1503.
20. Lunn JV, Castellanos-Rosas J, Walch G. Arthroscopic synovectomy, removal of loose bodies and selective biceps tenodesis for synovial chondromatosis of the shoulder. *J Bone Joint Surg Br*, 2007, 89: 1329–1335.
21. Covall DJ, Fowble CD. Arthroscopic treatment of synovial chondromatosis of the shoulder and biceps tendon sheath. *Arthroscopy*, 1993, 9: 602–604.
22. Cellerini M, Grasso A, Fidecicchi F, Spaccapeli D. Diagnostic imaging of idiopathic synovial osteochondromatosis. *Radiol Med*, 1995, 89: 761–765.
23. Shpitzer T, Ganel A, Engelberg S. Surgery for synovial chondromatosis: 26 cases followed up for 6 years. *Acta Orthop Scand*, 1990, 61: 567–569.
24. Ranalletta M, Bongiovanni S, Calvo JM, Gallucci G, Maignon G. Arthroscopic treatment of synovial chondromatosis of the shoulder: report of three patients. *J Shoulder Elbow Surg*, 2009, 18: e4–e8.

- 25.** Fowble VA, Levy HJ. Arthroscopic treatment for synovial chondromatosis of the shoulder. *Arthroscopy*, 2003, 19: E2.
- 26.** Jeon IH, Ihn JC, Kyung HS. Recurrence of synovial chondromatosis of the glenohumeral joint after arthroscopic treatment. *Arthroscopy*, 2004, 20: 524–527.
- 27.** Chillemi C, Marinelli M, de Cupis V. Primary synovial chondromatosis of the shoulder: clinical, arthroscopic and histopathological aspects. *Knee Surg Sports Traumatol Arthrosc*, 2005, 13: 483–488.
- 28.** Richman JD, Rose DJ. The role of arthroscopy in the management of synovial chondromatosis of the shoulder. A case report. *Clin Orthop Relat Res*, 1990, 257: 91–93.
- 29.** Witwity T, Uhlmann R, Nagy MH, Bhasin VB, Bahgat MM, Singh AK. Shoulder rheumatoid arthritis associated with chondromatosis, treated by arthroscopy. *Arthroscopy*, 1991, 7: 233–236.