

# EVALUATION OF CLINICAL RESULTS OF SURGICAL RESECTION OF SYNOVIAL OSTEOCHONDROMATOSIS IN THE SHOULDER: A RETROSPECTIVE STUDY

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**Abstract**— Synovial osteochondromatosis of the shoulder is a rare condition. Our study was conducted to evaluate the clinical results of surgical resection histopathological characteristic of SOC. Ten shoulders with SOC were retrospectively assessed for demographic characteristic, history of trauma, presence of osteochondral loose bodies, inferior humeral osteophytes and acromial spurs. Visual analog scores for pain and functional scores using Constant scores were compared pre and post operatively. Resected lesions were histo-pathologically differentiated between primary and secondary SOC. Average duration of symptoms was 11.5+/-8.11 months. Three shoulders has osteochondral lesion in subacromial space (30%) and seven in glenohumeral joint (70%). Five shoulders (71%) show inferior humeral osteophytes out of seven shoulders with lesion in glenohumeral joint. All three shoulder(100%) with SOC in the subacromial space had spur formation. One shoulder have primary SOC while other nine had secondary SOC. Average Visual analog scale pain score graded from 0 (no pain) to 100 mm(maximal pain) was 47.5+/-11.32 mm. The Constant score was improved from 51.6+/-8.34 to 78.7+/-11.62 post operatively. No case show recurrence of new loose bodies, acromial spur and inferior humeral osteophytes. Our study showed that resection of SOC successfully relieved the pain and clinical symptoms. Primary SOC is less common than secondary SOC and histopathological identification is needed to differentiate between both types. Thus further investigations required to determine long term prognosis SOC in the shoulder.

**Keywords**— Osteochondromatosis, Shoulder Joint, Synovium

## 1 Introduction

Synovial osteochondromatosis is a rare condition that may affect any cavity lined with synovium<sup>1</sup> and characterized by the presence of osteo-cartilaginous loose bodies

in articular joints, bursae or tendon sheaths and occurs most commonly in the knee followed by the hip, elbow, wrist and ankle and least commonly in the shoulder<sup>1</sup>. SOC is more common in men than women & most frequently affects patients in the third to fifth decades of life. Patients with SOC of the shoulder often present with pain, swelling and a slowly progressing limited range of motion (ROM)<sup>5</sup>.

Due to insidious onset of clinical features, the diagnosis of SOC of the shoulder is typically delayed for months to years. The classic treatment for SOC of the shoulder is open arthrotomy, synovectomy, and complete removal of loose bodies<sup>1</sup>. Recently due to improved arthroscopic technique, enhanced visualisation of the surgical fields and shoulder rehabilitation periods, arthroscopic treatment for SOC of the shoulder has been reported to be a good treatment option. The rate of post-operative recurrence after open or arthroscopic therapy ranges from 3% to 23%<sup>2</sup>. Malignant transformation may also occur post-operatively.

The definitive etiology remains unknown, yet it can be classified as primary or secondary SOC. Secondary causes of SOC include trauma, osteochondral dissecans, osteoarthritis(OA) and osteochondral fractures. Milgram et al<sup>3</sup> classified excised loose bodies into three categories: (1) due to synovial osteochondromatosis, (2) due to osteochondral fractures; and (3) due to degenerative arthritis or avascular necrosis that cause fragmentation of joint surfaces. The term synovial chondromatosis and synovial osteochondromatosis used synonymously but synovial osteochondromatosis is less common because lesions are neither related to osteochondroma nor ossified.<sup>2</sup>

Chondromatosis is a benign metaplastic chondroid proliferation that arise from primary chondrometaplasia of the synovium.<sup>3,4</sup> Villacin et al<sup>5</sup> classified synovial chondrometaplasia on the basis of histopathological characteristics (1) Primary synovial chondromatosis in which foci of chondrometaplasia present in the synovium and loose bodies have disorganised pattern with many binucleate, plump chondrocyte and patchy diffuse calcification. (2) Secondary synovial chondromatosis has fragments of articular cartilage or subchondral lamellar bone in the loose bodies as a nidus with pattern of calcification is zonal and ring like with uniform evenly distributed chondrocytes.

Synovial chondromatosis most commonly affects the knee and rarely affects the shoulder girdle. Previous case reports and case series shown that synovial chondromatosis could occur both in the glenohumeral joint and in the subacromial space. However no case series differentiates between primary and secondary synovial chondromatosis. Thus differences of incidence, location of occurrences, clinical symptoms, radiographic findings and results of surgical resection between primary and secondary chondromatosis in shoulder joint remains unclear.

So purpose of this study was to evaluate clinical results of surgical resection and reviewing past reports of synovial osteochondromatosis in the shoulder.

## **2 Material and Methods**

A multicentre survey was conducted to collect the data of patients diagnosed with SOC of the shoulder for this retrospective study. The inclusion criteria were as follows:

patients who had undergone open arthrotomy or arthroscopic treatment with a synovectomy and removal of loose bodies from August 2019 to January 2024 and patients who were diagnosed with SOC of the shoulder with histopathological confirmation after surgical management.

All patients complained of shoulder pain and an uncomplicated feeling during movement. Two patients have locking with catching sensation of the shoulder in one patient, it is due to lesion in the glenohumeral joint and in one patient have lesion in subacromial spaces. Exclusion criteria are (a) recurrent glenohumeral instability with more than one traumatic episode (b) glenohumeral osteoarthritis with greater than grade 2 on the Kellgren-Lawrence grading system on plain radiographs. These patient have loose bodies in joint but excluded from study.

The requirement of written informed consent was waived as only pre-existing data were used for this study and the confidentiality of the patient was maintained.

A total of 15 shoulders from five institution met the inclusion criteria, the final analysis included 10 shoulders from 5 tertiary hospitals ( six men and four women) who could be followed for more than two year ( mean +/-standard deviation), 3.53+/-0.63 year ; range 2.5-4.5 years, were retrospectively reviewed.

At the time of surgery, the patient average age was 39.8 year+/- 15.7 year ( range 15-62 year) , one patient had a history of trauma with glenohumeral dislocation 15 year back but he did not have recurrent instability other nine shoulder did not have any traumatic episodes or past illness involving the ipsilateral shoulder girdle. The average duration of symptoms was 11.5+/-8.11 months ( range 2-25 month) and average visual analog scale pain score graded from 0 (no pain) to 100 mm( maximal pain) was 47.5+/- 11.32 mm( range 32-65) ( see **Table 1**)

Table 1: Clinical and Histopathological details of the Patients with Synovial Chondromatosis

No.	Age (years)	Sex	Duration of symptoms(months)	Preoperative VAS score <sup>a</sup> (mm)	Preoperative Constant score	Histopathological findings	Follow up period(year)	Recurrences	Post operative Constant score
1	46	M	8	35	58	Secondary	4.5	-	84
2	15	M	7	61	43	Secondary	3.7	-	75
3	23	F	20	45	44	Secondary	2.5	-	96
4	30	M	6	58	41	Secondary	2.6	-	88
5	62	M	25	32	65	Secondary	4.2	+	64
6	53	M	22	65	56	Secondary	2.8	-	84
7	28	F	12	52	62	Secondary	3.9	-	74
8	43	M	3	41	47	Primary	3.5	-	60
9	39	F	10	38	52	Secondary	4.0	-	72
10	59	F	2	48	48	Secondary	3.6	-	90

VAS : Visual analog scale, M: Male, F: Female, <sup>a</sup>Pain is graded from 0 to 100 mm

Primary diagnostic modality to diagnose osteochondral lesion is plain radiographs on anteroposterior view and Y view of shoulder in neutral rotation in which all cases show lesion on radiographs. Additionally lesion was also identifies on CT scan , USG and MRI also done to determine presence and location of loose bodies( see **Figure 1**). Three shoulder has osteochondral lesion in subacromial space (30%) and seven shoulders had in glenohumeral joint (70%) ( see **Table 2**)

Table 2: Imaging finding and Intraoperative details of the patients with Synovial Chondromatosis

No.	Location of Osteochondral lesion	Inferior humeral osteophytes	Acromial spur formation	Cartilage status of Humeral Head	Cartilage status of glenoid	No. of lesion	Maximum size of lesion(mm)
1	GHj	+	-	Intact	Fibrillation	>20	30
2	GHj	-	-	Cartilage loss	Cartilage loss	>20	28
3	GHj	+	-	Intact	Intact	12	15
4	SA	-	+	Intact	Intact	10	13
5	SA	-	+	Intact	Intact	5	18
6	GHj	+	-	Intact	Intact	6	24
7	GHj	+	-	Cartilage loss	Fibrillation	>20	16
8	GHj	+	-	Fibrillation	Intact	18	8
9	SA	-	+	Intact	Intact	14	10
10	GHj	-	-	Cartilage loss	Intact	15	17

GHj: glenohumeral joint,SA: subacromial space

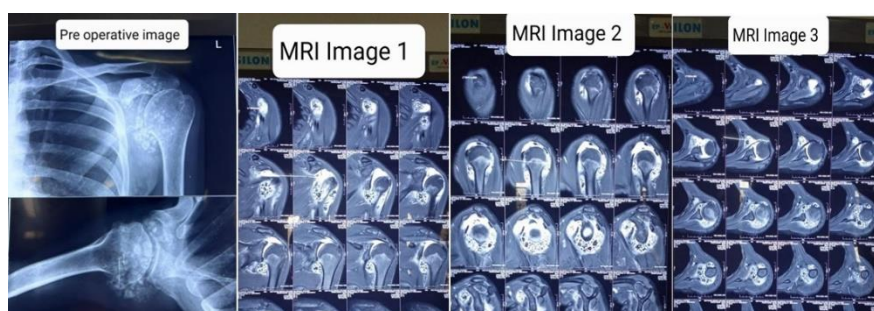


Figure 1:Preoperative X-ray and MRI showing multiple SOC lesions in Glenohumeral joint

The osteochondral lesions were resected with synovectomy. Open resection was performed in the eight cases ( four cases with lesion in glenohumeral joint and four

cases with lesion in subacromial space) and arthroscopic surgery performed in two cases ( both cases with lesion in glenohumeral joint). All cases operated in beach chair position and image intensifier was not used. During open resection, the anterior approach between the pectoralis major and deltoid for glenohumeral lesions and the lateral approach between the anterior and middle portion of the deltoid muscle for subacromial lesions were used. Most cases had multiple lesions in the bicipital groove and they were evaluated and removal through the glenohumeral joint and then subscapularis tendon was repaired. For removal of osteochondral lesions from subacromial space, subacromial spur resection and acromioplasty done with partial detachment of the anterior deltoid.



Figure 2: Intra operative pictures depicting multiple SOC lesions(>20) and post-operative X- ray showing clear joint space after removal of lesions

Differential diagnosis between primary and secondary osteochondromatosis was made on histological criteria proposed by Villacin et al.<sup>5</sup> All patients had been clinically assessed at initial presentation and histopathological evaluation was performed. Constant scores were scored before resection and at final follow-up for operated shoulders. The presence of osteochondral lesions, inferior humeral osteophytes and acromial spurs were assessed by radiographs before resection just after resection and at final follow-up.

Statistical analysis was carried out using IBM SPSS ver. 23.0 (IBM Corp., Armonk, NY, USA). The patients demographic data were summarized using means and standard deviations for continuous variables and numbers and percentage for categorical variables. Chi- square tests were used to determine the difference of categorical variables between the groups. Range of motion in shoulder elevation and external rotation and the Constant scores compared before resection and at final follow-up with Wilcoxon signed rank tests using a significance level of  $p < 0.05$ .

### 3 RESULTS

#### **Clinical outcomes:**

Before osteochondral lesion resection, the patient average ROM was elevation of  $130^{\circ} \pm 25^{\circ}$ , external rotation of  $32^{\circ} \pm 22^{\circ}$  and internal rotation upto spinous process of the 12<sup>th</sup> thoracic vertebrae. At final follow up elevation improved ( $140^{\circ} \pm 24^{\circ}$ ;  $p=0.688$ ), external rotation ( $37^{\circ} \pm 23^{\circ}$ ;  $p=0.156$ ) and mean internal rotation to spinous process of 8<sup>th</sup> thoracic vertebrae. The mean preoperative Constant score was  $51.6 \pm 8.34$  (range 41-65 points). Postoperatively mean Constant score was significantly improved to  $78.7 \pm 11.62$  (range 60-96). The values of individual parameter of the Constant score (pain, activity, mobility and strength) were higher postoperative: pain, from 5.7 to 12.2; activity, from 2.5 to 5.7; mobility, from 26.4 to 31.8, and strength from 9.8 to 16.9.

#### **Imaging findings:**

Before surgical resection osteochondral lesion present in glenohumeral joint in seven cases and subacromial space in three cases. Five shoulders (71%) show inferior humeral osteophytes out of seven shoulder with lesion in glenohumeral joint. All three shoulder (100%) with synovial chondromatosis in the subacromial space had spur formation. (Table 2)

Postoperatively osteochondral lesions were successfully removed in all shoulders (see **Figure 2**). At the final follow up no case show recurrence of new loose bodies, no recurrence of resected acromial spur, and no progression of inferior humeral osteophytes.

#### **Histopathological findings:**

One osteochondral lesion in glenohumeral joint of 43 year male found primary synovial chondromatosis with 18 in number and show disorganised pattern with cloning of cartilage cells (see **Figure 2**). In other nine cases lesion are secondary synovial chondromatosis which shows metaplastic cartilage nodule and uniform appearance of chondrocytes. Six cases with secondary synovial chondromatosis shows lesions in glenohumeral joint while three cases show lesion in subacromial space. In cases of secondary chondromatosis three cases present with more than 20 lesions, four cases shows lesions between 10 to 20, and two cases shows lesions less than 10 in number.

(see **Table 1** and **2**)

### 4 DISCUSSION

Synovial chondromatosis occurs rarely in the shoulder. The presence of loose bodies in several spaces including glenohumeral joint, subacromial spaces and sheath of long head of Biceps tendon is unique characteristic of SOC of the shoulder. Surgical removal

of osteochondral lesion provide significant pain relief with satisfactory clinical outcomes. Histopathological findings suggest that primary synovial chondromatosis is less common than secondary synovial chondromatosis in the shoulder.

The pathology of SOC is poorly understood, however it has been described as synovial membrane proliferation and metaplasia with development of cartilaginous nodules.<sup>2,6</sup> These nodules are pedunculated and detached from synovium to form loose bodies that continuously grows and ossified. These loose bodies causes articular erosions and may cause secondary OA.<sup>7</sup>

Early diagnosis of SOC of the shoulder is important to prevent the progression to OA and a rotator cuff tear. The clinical manifestations of SOC in the shoulder are non – specific and include pain, limited ROM , joint blockade and palpable masses.<sup>8</sup> In our study patient with both glenohumeral and subacromial chondromatosis showed similar symptoms of pain, uncomfortable feeling and locking with catching sensation and surgical removal of osteochondral lesions relieved these clinical symptoms. On radiographical imaging in our study inferior humeral osteophytes present in five cases eith glenohumeral lesions and all three cases of subacromial space lesions had acromial spur formation. These results shows that glenohumeral lesions might be related to glenohumeral arthritis and subacromial space lesions might be related to acromial space formation.<sup>9</sup>

Secondary synovial chondromatosis cases have no definitive traumatic episodes or radiographic evidences of joint disease.<sup>5</sup> In our study , one patient had previous episode of glenohumeral dislocation 15 year back. Although most of cases in our study were clinically determined to be primary chondromatosis, only one case was histopathologically proven as primary synovial chondromatosis. This suggests that histopathological identification is needed to differentiate between primary and secondary synovial chondromatosis.

Primary synovial chondromatosis is less common in shoulder than secondary synovial chondromatosis. Malignant transformation to chondromatosis rarely occurs in primary synovial chondromatosis.<sup>5</sup> Primary synovial chondromatosis is aggressive and associated with a high incidence of recurrence while secondary synovial chondromatosis is non aggressive.(**Table 3**)

Table 3: Various other studies of Synovial chondromatosis in shoulder

Study	Number of case	Mean age(y ear)	Location of lesion		Inferior humeral osteophytes		Acromial spur formation		Histopathological examination		Recurrence (%)
			Glenohumeral joint	Subacromial space	Present	Absent	Present	Absent	Primary	Secondary	
Milgram <sup>3</sup>	4	39.5	Not listed		Not listed		Not listed		0	4	0
Villacin et al <sup>5</sup>	7	Not listed	Not listed		Not listed		Not listed		0	7	0
Lunn et al <sup>9</sup>	15	33.3	15	0	11	4	Not listed		Not listed		13.3
Neumann	1	39	+	+	Not listed		Not listed		Not listed		0

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and Garri gues <sup>6</sup>											
Utash ima et al <sup>10</sup>	10	40.7	6	4	5	5	4	6	1	9	10.0
Our study	10	39.8	7	3	5	5	3	7	1	9	0

The present study has several limitations. The first limitation was the small number of cases and various follow up periods. Synovial chondromatosis is rare entity in the shoulder and our study included surgically resected cases with minimum 2 year follow up period retrospectively. The periods of 2 year is too short to clarify recurrence rate of the disease or morphologic alteration of arthritic changes third limitation was that this study could not able to differentiate between primary and secondary synovial chondromatosis as only one cases of primary synovial chondromatosis was included in our study. In case which have more than 10 lesions at least 10 lesions were evaluated histopathologically to differentiate primary and secondary synovial chondromatosis. However all the loose bodies could not be evaluated so existence of unchecked lesions might be a possible limitation of this study.

## 5 CONCLUSIONS

Our study showed that resection of SOC successfully relieved the pain and clinical symptoms. Primary SOC is less common than secondary SOC and histopathological identification is needed to differentiate between both types.

Thus further investigations required to determine long term prognosis in synovial chondromatosis in the shoulder.

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