Subcoracoid Bursa: Imaging Diagnosis and Significance

YI-HSUAN LEE1  GINGER H.F. SHU2  CHING-JUEI YANG3  WEN-SHENG TZENG3  CLEMENT KUEN-HUANG CHEN3

Department of Radiology1, Chi Mei Medical Center, Liouying, Tainan, Taiwan
Department of Radiology2, Chi Mei Medical Center, Jiali, Tainan, Taiwan
Department of Medical Imaging3, Chi Mei Medical Center, Tainan, Taiwan

ABSTRACT

The aim of this study was to retrospectively evaluate the cases in which a subcoracoid bursa had been detected using various imaging tools, to discuss imaging features among the different modalities, and to correlate our findings with those of associated shoulder joint disorders.

In total, 23 cases of subcoracoid bursa diagnosed imaging studies were retrospectively analyzed. Five of these cases underwent bursography, among which four were inadvertently performed and one was a planned bursogram. Three cases underwent an arthrogram, one was a shoulder arthrogram alone, one was an immediate arthrogram performed after an inadvertent bursogram, and the other one was a follow-up arthrogram performed one month later after an inadvertent bursogram. Three of the cases underwent CT bursography, and all had first undergone subcoracoid bursography. Twenty-one of these cases underwent MRI, and six of these had undergone MR arthrography for the routine evaluation of internal derangements involving the glenohumeral joint. Eleven cases had undergone two or more than two separate imaging studies.

In 18 cases, subcoracoid bursa communication with the subacromial–subdeltoid bursa was observed (18/23, 78.3%), and a rotator cuff tear was present in 17 of these 18 cases. A complete rotator cuff tear was present in a total of 18 cases; 16 involved an anterior supraspinatus tendon tear, and two involved tear of the posterior portion of the supraspinatus or infraspinatus tendon tear. Communication between the subcoracoid bursa and subacromial–subdeltoid bursa was demonstrated in 17 of the 18 cases with a complete rotator cuff tear. However, none of the cases exhibited communication between the subcoracoid bursa and the glenohumeral joint.

If an inadvertent subcoracoid bursography is performed, contrast medium may fill the subacromial–subdeltoid bursa via a potential communication. Delayed, post-exercise imaging or repeated arthrography is necessary to ascertain the presence or absence of a rotator cuff tear. On MRI, MR arthrography, and CT bursography, the condition of the rotator cuff must be carefully assessed if subcoracoid bursal distention is present.

INTRODUCTION

The subcoracoid bursa (SCB) is a normal variant of the glenohumeral joint. It has been reported to occur in nearly 90% of gross specimens [1], although only 0.6%-0.7% of this number is observed in MRI studies [2-3] and 27.7% in MR arthrograms [4]. This structure is located between the anterior surface of the subscapularis muscle and the coracoid process; it does not communicate with the glenohumeral joint [1] (Fig. 1). However, it had been reported to be connected with the subacromial–subdeltoid bursa (SASDB), a condition that may lead to a false-positive diagnosis of a rotator cuff tear [5]. SCB is sometimes confused with the subscapularis recess (SSR). The latter is a recess of the glenohumeral joint that lies between the subscapularis muscle and the anterior surface of the scapula. It extends...
above the superior margin of the subscapularis tendon, over which it may hang akin to a saddle-bag (Fig 2).

In this study, we retrospectively evaluate cases in which SCB has been detected using various imaging tools, discuss imaging features among the different modalities, and attempt to correlate our findings with those related to associated shoulder joint disorders.

**MATERIALS AND METHODS**

A total of 23 cases with SCB diagnosed using imaging studies were retrospectively analyzed. Eighteen cases had been gathered in the past 2 years from two hospitals. And the remaining five cases had been gathered via the teaching films from one of the hospital.

Of these 23 cases, 12 cases are males and 11 are females. Their ages range from 44 to 76 years.

**Arthrography/bursography**

Five of our cases underwent bursography, among which four were inadvertently performed during shoulder arthrography and one was deliberate.

Three cases underwent arthrography, two of which were performed after inadvertent bursograms and one was a shoulder arthrogram alone.

The procedures in all cases were performed via an anterior approach by employing a 22-gauge spinal needle and targeting the inferior third glenohumeral joint space under fluoroscopic guidance. The exception was the deliberate bursogram, which was performed under sonographic guidance and targeted only SCB. A total of 13 cc of contrast medium was injected.

**CT bursography**

Three of our cases underwent CT bursography, and all 3 had first undergone subcoracoid bursography. The protocol of performing a CT bursogram included obtaining axial images of 2-mm slide thickness and subsequent coronal/sagittal multiplanar reconstruction (MPR).

**MR/MR arthrography**

Twenty-one of our cases underwent MRI, of which 6 had undergone MR arthrography for the routine evaluation of internal derangements involving the glenohumeral joint.

The imaging studies were performed on a 1.5-T scanner. The MR protocol involved imaging in an axial plane with T1W1 (450-650/11-16; TR/TE) and fat-suppressed PDW1
Subcoracoid bursa

Figure 2

Shoulder MRI of a 63-year-old male. The fat-suppressed PDWI sagittal imaging (a, b, c) shows the saddlebag-like subscapularis recess (SSR) and the subcoracoid bursa (SCB). Separation, or at least the presence of a septum (long arrow), is noted between the structures. The communication site (star) between SCB and the subcoracoid portion of the subacromial bursa (white arrow) is also identified in the sagittal series (c). The fat-suppressed PDWI axial and coronal imaging (d, e) demonstrate the location of SCB and SSR, which are separated by the subscapularis tendon (T).

Table 1. Imaging modalities

<table>
<thead>
<tr>
<th>Imaging modality</th>
<th>Case Number (total 23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI</td>
<td>21</td>
</tr>
<tr>
<td>MR arthrography</td>
<td>6</td>
</tr>
<tr>
<td>Bursography</td>
<td>4 i-bursogram</td>
</tr>
<tr>
<td></td>
<td>1 d-bursogram</td>
</tr>
<tr>
<td>Arthrography</td>
<td>1 i-arthrogram</td>
</tr>
<tr>
<td></td>
<td>1 f-arthrogram</td>
</tr>
<tr>
<td></td>
<td>1 arthrogram alone</td>
</tr>
<tr>
<td>CT bursography</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: i-bursogram: inadvertent bursogram; d-bursogram: deliberate bursogram; i-arthrogram: immediate arthrogram; f-arthrogram: follow-up arthrogram

Combine technique

Eleven cases had undergone two or more than two separate imaging studies (Table 1).

(1717-2317/27-41); a sagittal plane with T1WI; an oblique-coronal plane with T2WI (3740-6117/101-127), PDWI, and fat-suppressed PDWI; and an oblique-sagittal plane with fat-suppressed PDWI. The slice thickness was 4 mm. The MR arthrography was performed after the routine MRI, with the injection of 13 cc of a mixture of gadopentetate dimeglumine and saline solution (1:200 dilution). After administration of the contrast solution, fat-suppressed T1WI (467-500/9-11) imaging was performed in axial, oblique-coronal, and oblique-sagittal planes with a 3 mm slice thickness.
Fat-suppressed PDWI sequence was employed to determine the dimensions of SCB. In the two cases without MR imaging, the bursal size was evaluated using a CT bursogram.

Subcoracoid bursal distention refers to a fluid-filled SCB that can be readily visualized, particularly using conventional MRI. The degree of distention was classified based on the largest dimension of the bursa. According to Schraner and Major, a small bursa was classified as the largest dimension of a bursa < 1 cm, a moderate bursa was classified as the largest dimension of 1-2 cm, and a large bursa was classified as the largest dimension of >2 cm [2].

Other shoulder disorders such as a rotator cuff tear or synovitis were also documented and correlated with the subcoracoid bursal size and interbursal communication.

RESULTS

A total of 18 cases demonstrated subcoracoid bursal distention (small to large) that can be observed on MRI. The remaining five SCB were not distended that can be delineated using an MR arthrogram or a CT bursogram.

Arthrography/bursography

The SCB on the bursogram is a cystic structure located anterior to the glenohumeral joint and beneath the coracoid process (Fig. 1).

Communications with SASDB were detected in three out of five bursograms. Among these three cases, combined rotator cuff tears were present in two cases, and delayed, post-exercise bursogram demonstrated retrograde filling of contrast medium into the glenohumeral joint from SASDB (Figs. 3, 4), thus establishing true positive diagnoses of full-thickness rotator cuff tears. In one case, there was communication between SCB and SASDB, but there was no contrast material between SASDB and the glenohumeral joint, indicating a false-positive diagnosis of a rotator cuff tear (Fig. 5).

The remaining two bursograms showed no communication with SASDB; ensuing that the arthrography and CT

Table 2. Summarizes the case profiles and the results

<table>
<thead>
<tr>
<th>Full-thickness Rotator Cuff Tear</th>
<th>Size of SCB</th>
<th>Communication between SCB and SASDB</th>
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</thead>
<tbody>
<tr>
<td>+ 18</td>
<td>None: 3/18</td>
<td>+ 17/18</td>
</tr>
<tr>
<td></td>
<td>Small: 3/18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate: 1/18</td>
<td>- 1/18</td>
</tr>
<tr>
<td></td>
<td>Large: 11/18</td>
<td></td>
</tr>
<tr>
<td>- 5</td>
<td>None: 2/5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small: 2/5</td>
<td>+ 1/5</td>
</tr>
<tr>
<td></td>
<td>Moderate: 1/5</td>
<td>- 4/5</td>
</tr>
<tr>
<td></td>
<td>Large: 0/5</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: About the bursa size:
Small: largest dimension of the bursa < 1cm; Moderate size: largest dimension 1-2cm; Large size: largest dimension > 2cm.
Note 2: SCB: subcoracoid bursa; SASDB: subacromial-subdeltoid bursa.
Note 3: +: positive; -: negative.
Figure 4. Deliberate bursogram and CT bursogram in a 55-year-old male. The bursogram (a, b.) shows communication of the subcoracoid bursa (SCB) with the subacromial-subdeltoid bursa (SASDB, white arrows). The delay, post-exercise image (c.) demonstrates retrograde filling of the contrast medium (black arrow) into the glenohumeral joint (J), indicating a true positive diagnosis of a rotator cuff tear. The CT bursogram (d. e.) confirms the communication between SCB and the subcoracoid portion of the subacromial bursa (star). In addition, a complete tear of the supraspinatus tendon is also demonstrated in the CT bursogram (black arrow).

Figure 5. Inadvertent bursogram (a) and CT bursogram after needle position adjustment (b, c) in a 55-year-old female. The inadvertent bursogram a. shows communication of the subcoracoid bursa (SCB) with the subacromial-subdeltoid bursa (SASDB, white arrows). The CT bursogram (b. c.) shows communication (star) between SCB and SASDB (white arrows). No evidence of rotator cuff tear is observed. There is no distention of SCB. The faint contrast medium within glenohumeral joint (J) is due to adjustment of the needle position during the procedure.
Busography confirmed the absence of a rotator cuff tear.

One of the arthrographic studies performed on a patient with rheumatoid arthritis was a sole, conventional shoulder arthrography and showed filling of contrast medium from the glenohumeral joint into SASDB through a full-thickness rotator cuff tear. The contrast material then appeared in SCB (Fig. 6). Pannus formation was conspicuous in the glenohumeral joint and SSR but scarce in SASDB and SCB.

The other two arthrograms were performed after bursograms to assess the presence of a rotator cuff tear. One was positive, and the other was negative for a rotator cuff tear.

**CT bursography**

CT bursography provides more detailed information regarding the location of SCB with better visualization of the surrounding soft tissue compared to that provided by a bursogram/arthrogram.

One case exhibited no communication with SASDB; neither evidence of a rotator cuff tear nor other intra-articular lesions were observed.

One case (Fig. 5) demonstrated communication between SCB and SASDB but no evidence of a rotator cuff tear.

The last case (Fig. 4) clearly exhibited the defect of the rotator cuff with communication between SCB, SASDB, and the glenohumeral joint, which had been made visible by the contrast material.

**MR/MR arthrography**

MRI/MR arthrography as well as CT bursography are reliable imaging tools that provide detailed information of the shoulder anatomy.

SCB is located between the anterior surface of the subscapularis muscle and the coracoid process. In contrast, SSR, which is located between the subscapularis muscle and the anterior surface of the scapula, extends above the superior margin of the subscapularis tendon, and resembles a saddlebag. These two structures are normally separate with no communication between them (Fig. 2).

In the 21 MR or MR arthograms, 17 cases exhibited a communication between SCB and SASDB, which was clearly demonstrated on the obtained images (Figs. 5, 6).

**Figure 6**

6a 6b 6c

Figure 6, Arthrogram and shoulder MRI in a 75-year-old female. Arthrogram demonstrates pannus formation (arrow heads) in the axillary recess. Contrast medium leakage into subacromial-subdeltoid bursa (SASDB, white arrows) is noted, indicating a complete rotator cuff tear. A faint contrast medium is present in the subcoracoid bursa (SCB), which is confirmed on MRI and is believed to have originated from SASDB. The fat-suppressed PDWI axial view shows the communication (star) between the distended SCB and SASDB (white arrows) with a relative clear fluid in the structures. The fat-suppressed PDWI sagittal view shows conspicuous pannus formation (arrowheads) within the glenohumeral joint (J) and subscapularis recess (SSR) compared with the relative clear fluid within SCB, which is circumstantial evidence for the lack of communication between SCB and SSR and the glenohumeral joint.
A concurrent rotator cuff tear was confirmed in 18 cases, two of which also exhibited synovitis with conspicuous pannus formation in the glenohumeral joint and SSR, but not in SASDB and SCB (Fig. 6).

Table 2 summarizes the case profiles and the results of our study.

In 18 cases, there was SCB communication with SASDB (18/23, 78.3%), and a rotator cuff tear was present in 17 of these 18 cases.

A complete rotator cuff tear was present in a total of 18 cases; 16 involved an anterior supraspinatus tendon tear, and two involved a posterior (the posterior portion of the supraspinatus or infraspinatus tendon) rotator cuff tear. Communication between SCB and SASDB was demonstrated in 17 of the cases with complete rotator cuff tears. However, none of the cases exhibited communication between SCB and the glenohumeral joint.

DISCUSSION

SCB is an anatomic structure located between the subscapularis muscle and the coracoid process; it does not communicate with the glenohumeral joint. However, communication with SASDB is possible. The communication site may exist between the subcoracoid portions of both SASDB and SCB [1]. A cadaver study reported an incidence of about 11% [1], while other studies employing subacromial bursography reported an incidence of 10.7% [6]. Studies using MRI reported incidence rates of 23%-55% [2, 3]. The rate in our study is 18/23 (78.3%), which is much higher than that demonstrated in all previous reports. Our logical explanation to this is that because our cases are patients with shoulder pain and a high rate of a complete rotator cuff tear, it may result in a higher incidence of communication. This communication may be the cause of the previously reported false-positive diagnosis of rotator cuff tears when, in reality, an inadvertent subcoracoid bursography is performed (Fig. 5) [5].

Grainger et al advocated that there is an association between large subcoracoid effusions and rotator cuff tears especially tears of the anterior rotator cuff and the rotator interval [3]. In our study, a total of 18 cases had complete rotator cuff tears, 16 of which involved the anterior supraspinatus tendon or the rotator interval. The 11 cases with large subcoracoid effusions had complete rotator cuff tears. These results indicate that subcoracoid effusions often accompany rotator cuff tears. Therefore, when inadvertent bursography results in contrast medium filling from SCB to SASDB, it is not always a false-positive diagnosis of a rotator cuff tear. A delayed, post-exercise bursogram or repeated arthrography for detecting possible retrograde contrast opacification from SASDB to the glenohumeral joint is necessary when inadvertent bursography is performed to ascertain the presence or absence of a rotator cuff tear (Figs. 3, 4).

We encountered 2 cases with synovitis that presented with distended SCB. Our observation is that the pannus formation is much more pronounced within the glenohumeral joint, including SSR, than in SCB. This is circumstantial evidence of the absence of direct communication between SCB and the glenohumeral joints (Fig. 6).

Some authors surmise that subcoracoid impingement syndrome can also accompany subcoracoid effusion [3, 7]. Subcoracoid impingement syndrome is diagnosed clinically or on MRI as a coracohumeral interval less than 11 mm in the internal rotation position [8]. However, our cases had no clinical complaint related to subcoracoid impingement and all the MRI studies in our series employ the protocol for rotator cuff tears with the humerus in the neutral or external rotation position. Therefore, the possible combination of subcoracoid impingement cannot be evaluated in our study.

Another problem we encounter is the fact that inadvertent subcoracoid bursographies are usually performed by young, relatively inexperienced residents in the process of training. In our study, young residents were responsible for all 4 of the inadvertent subcoracoid bursographies. This is due to the anterior location of the SCB in relation to the glenohumeral joint (Fig. 1). The young resident will usually stop pushing the needle when he/she feels a resistance during the procedure, thus increasing the chances of inadvertently performing a subcoracoid bursography.

There are some limitations in our study. Selection bias is a problem because the sample size is small, and all are symptomatic patients with an inherently higher rate of rotator cuff tears and subcoracoid effusion.

In summary, SCB is demonstrated on bursography and arthrography as a filling of contrast medium anterior to the glenohumeral joint. Sometimes, communications between SCB and SASDB are observed. If a combined rotator cuff tear is present, retrograde filling of the contrast material into the glenohumeral joint from SASDB is observed. On the CT bursogram and/or MR/MR arthrogram, detailed anatomic information is made available, and elucidation of the precise location of the communication site between SCB and SASDB, if present, is possible. Furthermore, it is also possible to distinguish SSR from SCB by its saddlebag-like appearance in the sagittal plane or the severity of pannus formation if synovitis is presented.

Therefore, if an inadvertent subcoracoid bursography is performed, contrast medium may fill SASDB via a potential communication. Delayed, post-exercise imaging (to detect retrograde filling of the glenohumeral joint, if present) or repeated arthrography is necessary to ascertain the presence or absence of a rotator cuff tear. On MRI, MR arthrography, and CT bursography, the condition of the rotator cuff must be carefully assessed if subcoracoid bursal distention is present.
REFERENCES


