INTRODUCTION

The glenohumeral joint is a major joint of the human body. It is the most commonly dislocated joint because of the large size of the humeral head compared to the small size of the glenoid fossa (1). The glenohumeral ligaments (GHLs), joint capsule, and glenoid labrum are parts of the passive stabilizing mechanisms of the glenohumeral joint. The GHLs are localized thickenings of the glenohumeral joint capsule that extend from the anterior and inferior glenoid margin of the joint to the anatomical neck of the humerus. Three ligaments have been described: the superior glenohumeral ligament (SGHL), the middle glenohumeral ligament (MGHL), and the inferior glenohumeral ligament (IGHL) complex, which are composed of an anterior band, a posterior band, and an axillary recess. The main two functions of the GHLs are to avoid superior-inferior translation and to maintain anterior stability (2). Magnetic resonance (MR) imaging of the shoulder without intraarticular contrast medium can be used to observe some anatomical structures, such as the bony components, biceps tendon, and rotator cuff tendons. However, MR arthography is mostly used for demonstrating abnormal GHLs, and it is the most accurate imaging technique established (3).
Anatomy, Variants, and Pathologies of the Superior Glenohumeral Ligament

The SGHL is the most important structure in the anterosuperior part of the glenohumeral joint capsule (4, 5). It plays essential roles in anterosuperior impingement syndrome and in stabilizing the long head of the biceps tendon (LHBT). Thus, radiologists should observe the SGHL and coexistent pathologies in patients presenting with pain at the anterosuperior section of the shoulder. The purpose of this study was to review the normal MR arthrography anatomy and variants of this important ligament. We also discussed about its basic biomechanics and illustrated examples of injuries involving this ligament.

Arthrography Procedure

Different methods of injections into the glenohumeral joint for diagnostic arthrography have been previously described. These methods involve fluoroscopy, ultrasonography, and computed tomography, as well as techniques other than image-guiding. For sonographic guidance, the use of ionizing radiation and iodinated contrast materials are avoided.

There are various approaches for glenohumeral joint MR arthrography. Although the anterior approach is the most commonly used, the posterior and the rotator interval approaches have recently been preferred (6-8). Both the posterior and rotator interval approaches are used at our institution via ultrasonography guidance. In the posterior approach, a transducer is placed over the long axis of the myotendinous junction of the infraspinatus muscle, and it is angled to show the contours of the posterior glenoid rim, posterior glenoid labrum, and posteromedial portion of the humeral head. The needle is introduced in a lateral to medial direction, obliquely from the skin to the glenohumeral joint space and parallel to the long axis of the transducer (Fig. 1) (7). In the rotator interval approach, the coracoid process and the adjacent superomedial subchondral aspect of the humeral head are observed with a high frequency linear probe in a plane transverse to the joint line. The needle entry point is just superior to the subscapularis tendon and lateral to the coracoid process. The needle is advanced freehand, from medial to lateral, obliquely from the skin surface to the humeral head within the imaging plane of the transducer, until the tip reaches the cartilage of the humeral head (Fig. 2).

Imaging Techniques

A direct MR arthrography of the glenohumeral joint after intraarticular injection of diluted gadolinium chelates is the preferred imaging technique for the evaluation of the labroligamentous complex and joint capsule (9, 10). Observation of the GHLs is difficult when using conventional

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Fig. 1. Ultrasonography-guided posterior injection technique for shoulder MR arthrography.
A. Transverse ultrasonography image shows needle track and intraarticular needle tip in patient with posterior glenohumeral joint puncture for MR arthrography. It also reveals distention of joint capsule with free fluid within joint space. White arrow = needle shaft, white arrowhead = intraarticular needle tip. B. Corresponding schematic drawing shows optimal needle track and placement. White arrow = needle shaft, black arrowhead = intraarticular needle tip. G = posterior glenoid rim, HH = humeral head
shoulder MR imaging, because these ligaments may be poorly visualized or may mimic labral lesions (9, 11).

Chung et al. (12) presented a cadaveric study comparing conventional MR imaging to MR arthrography of the same shoulder joint. In this study, the SGHL was not identified by conventional MR imaging, in all of the cases; however, it was identified by direct MR arthrography, in all of the cases. At our institution, we prefer direct MR arthrography for the identification of the labroligamentous complex.

At our institution, MR arthrography and conventional MR imaging examinations are performed with a 1.5-T or 3-T MR scanner (Magnetom Avanto or Magnetom Skyra; Siemens Healthcare, Berlin, Germany) within 15 minutes after the injection. Our MR arthrography protocol uses fat-suppressed

Fig. 2. Ultrasonography-guided rotator interval injection technique for shoulder MR arthrography.

A. Axial oblique ultrasonography image, obtained at anterosuperior aspect of glenohumeral joint, shows needle track (white arrow) and intraarticular needle tip (white arrowhead) in patient with rotator interval puncture for MR arthrography. Image also shows distention of joint capsule with free fluid within joint space. B. Corresponding schematic drawing shows optimal needle track and placement. White arrow = needle shaft, black arrowhead = intraarticular needle tip. C = coracoid process, G = anterior glenoid rim, HH = humeral head

Fig. 3. Normal arthrographic anatomy of SGHL in 51-year-old male who suffered from shoulder pain.

A. Axial reformatted image of fat-suppressed 3D VIBE sequence shows SGHL (black arrow). B. Oblique sagittal reformatted image of fat-suppressed 3D VIBE sequence shows SGHL (black arrow) underneath coracoid process. C. Oblique sagittal fat-saturated 3D VIBE MR arthrographic image shows normal anatomic appearance of pulley sling. SGHL (white arrow) wraps around horizontal portion of LHBT (black dotted arrow), which is at distance from subscapularis tendon (SSC). LHBT shows normal diameter and signal intensity. LHBT = long head of biceps tendon, SGHL = superior glenohumeral ligament, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination
spin-echo (SE) T1-weighted images. This is performed in the axial, oblique coronal, and oblique sagittal planes, with surface coils placed around the shoulder joint (650/15, echo train length 8 mm, section thickness 3 mm, spacing 0.3 mm, field of view [FOV] 16 cm², matrix 256 x 250, 3 signals acquired). In our clinical practice, a fat-suppressed three dimensional (3D) volumetric interpolated breath-hold examination (VIBE) sequence (repetition time/echo time 13.2/4.7 msec, flip angle 11°, 160 x 160 mm FOV, matrix 512 x 512, one slab of 112 slices with a slice thickness of 0.6 mm, and one acquisition) is also added to the shoulder MR arthrography scanning protocol, after the T1-weighted SE fat-suppressed sequences are acquired. Fat-suppressed 3D VIBE sequence imaging is a relatively new spoiled gradient-echo protocol that provides fast low angle images.

The use of 3D VIBE sequences produces thinner image slices with the thickness of 0.6 mm, which enhances effectiveness of the imaging. Volume acquisition enables multiplanar image reconstruction and volume rendering. It also provides good contrast between the glenoid and surrounding soft tissues in MR arthrography of the glenohumeral joint.

Normal Anatomy of the Superior Glenohumeral Ligament

Anatomical knowledge of the labroligamentous structures is crucial to the diagnosis of abnormalities revealed by MR

Fig. 4. Types of SGHL origination.
A. Drawing (lateral view) shows normal anatomy of glenohumeral ligaments. Figure also shows origination of SGHL from anterior supraglenoid tubercle. B. Drawing shows origination of SGHL from posterior supraglenoid tubercle. C. Drawing shows SGHL originating with LHBT. D-F. Drawings show types of conjugation of SGHL with MGHL. AB-IGHL = anterior band of inferior glenohumeral ligament, BT = long head of biceps tendon, IST = infraspinatus tendon, MGHL = middle glenohumeral ligament, PB-IGHL = posterior band of inferior glenohumeral ligament, SGHL = superior glenohumeral ligament, SSC = subscapularis tendon, SST = supraspinatus tendon, TM = teres minor tendon
arthrography. The glenoid labrum deepens and increases the surface area of the articulation (13). It also serves as a primary anchoring structure for the GHLs, the capsule, and the LHBT (3). Superiorly, the glenoid labrum blends with the SGHL and the LHBT; and anteriorly, it blends with the anterior band of the IGHL (14).

The rotator interval consists of the following structures, in the order from outside to inside: the coracohumeral ligament (CHL), the interval capsule, and the SGHL. The rotator interval capsule is reinforced by the CHL and the SGHL. The CHL arises from the dorsolateral aspect of the base of the coracoid process and courses through the rotator interval to blend with fibers from the SGHL. Its fibers then attach laterally to the greater tuberosity, fusing with the anterior fibers of the supraspinatus tendon insertion and the medial bicipital sheath, before fusing with the superior fibers of the subscapularis tendon insertion (13).

The rotator interval may be thought of as a roof over the intraarticular portion of the LHBT (3) which arises from the anterosuperior labrum (13, 14). The CHL and SGHL are composed of a sling-like band surrounding the LHBT proximal to the bicipital sulcus (13).

The SGHL is a focally thickened band in the glenohumeral joint capsule. It originates from the supraglenoid tubercle anterior to the LHBT attachment, and inserts into the fovea capitis line superior to the lesser tuberosity of the bicipital

Fig. 5. Types of conjugation of SGHL with MGHL in three different patients. 
A. Oblique sagittal fat-saturated 3D VIBE MR arthrographic image shows distal conjugation of SGHL (white arrow) with MGHL (white dotted arrow). B. Oblique sagittal fat-saturated 3D VIBE MR arthrographic image shows conjugation in mid segment of SGHL (white arrow) with MGHL (white dotted arrow). C. Oblique sagittal fat-saturated 3D VIBE MR arthrographic image shows proximal conjugation of SGHL (white arrow) with MGHL (white dotted arrow). MGHL = middle glenohumeral ligament, SGHL = superior glenohumeral ligament, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination

Fig. 6. Origination from posterior supraglenoid tubercle of SGHL with LHBT, in 32-year-old woman who suffered from shoulder pain. Consecutive axial fat-saturated T1-weighted MR arthrographic images show origination of SGHL (black arrow) with LHBT (white dotted arrow) from posterior supraglenoid tubercle. Linear focus of contrast material extending into sublabral sulcus (white arrowhead) is noted. LHBT = long head of biceps tendon, SGHL = superior glenohumeral ligament
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Fig. 7. Origination of SGHL from both anterior supraglenoid tubercle and LHBT, in 29-year-old woman who suffered from shoulder pain.

A, B. Consecutive axial fat-saturated T1-weighted MR arthrographic images show origination (white arrowhead) of SGHL (white arrow) from both anterior supraglenoid tubercle and LHBT (white dotted arrow). C. Oblique sagittal T1-weighted MR arthrographic image shows fan-shaped insertion (white arrowhead) of SGHL (white arrow) into LHBT (white dotted arrow). LHBT = long head of biceps tendon, SGHL = superior glenohumeral ligament.

Fig. 8. Types of variations in shape and size of SGHL.

A. Drawing (lateral view) shows thick SGHL and absent MGHL. B. Drawing shows thick SGHL and thin MGHL. C. Drawing shows double SGHL. D. Drawing shows absent SGHL. AB-IGHL = anterior band of inferior glenohumeral ligament, BT = long head of biceps tendon, IST = infraspinatus tendon, MGHL = middle glenohumeral ligament, PB-IGHL = posterior band of inferior glenohumeral ligament, SGHL = superior glenohumeral ligament, SSC = subscapularis tendon, SST = supraspinatus tendon, TM = teres minor tendon.
Fig. 9. Thick SGHL and absence of MGHL in 47-year-old woman who suffered from chronic shoulder pain. Oblique sagittal and axial fat-saturated 3D VIBE MR arthrographic images showing thick SGHL (white arrow) and absence of MGHL. MGHL = middle glenohumeral ligament, SGHL = superior glenohumeral ligament, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination.

Fig. 10. Thick SGHL and thin MGHL in 43-year-old man who suffered from shoulder pain. Consecutive oblique sagittal fat-saturated 3D VIBE MR arthrographic images show thick SGHL (white arrow) and thin MGHL (black dotted arrow). MGHL = middle glenohumeral ligament, SGHL = superior glenohumeral ligament, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination.

Fig. 11. Double SGHL in 31-year-old woman who suffered from shoulder pain. Consecutive axial fat-saturated T1-weighted MR arthrographic images show double SGHL (white arrows). SGHL = superior glenohumeral ligament.
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sulcus (13, 15). Thus, it contributes to the biceps pulley. The SGHL is identified in 97–98% of the patients through arthroscopic and arthrographic series (16). Macroscopically, the SGHL is U-shaped and this shape lends support to the LHBT in the superior aspect of the bicipital sulcus (13). The SGHL runs parallel to the coracoid process and nearly perpendicular to the MGHL (1, 3, 13, 14, 16).

Using MR arthrography, the SGHL is best visualized in the sagittal oblique and axial planes (Fig. 3). In the axial plane, the SGHL is visualized as a low signal intensity intraarticular structure parallel to the coracoid process. Sagittal oblique MR arthrography shows that the SGHL is located underneath the coracoid process and CHL. A normal foramen exists between the SGHL and the MGHL, allowing communication of the glenohumeral joint cavity through the subscapularis recess (1, 3, 17, 18).

Congenital Variants of the Superior Glenohumeral Ligament

The SGHL usually originates from the supraglenoid tubercle, just anterior to the LHBT attachment. However, its origin may vary (posterior supraglenoid tubercle, superior labrum, LHBT, MGHL, or some combination) (Figs. 4–7)

Fig. 12. Partial tear of undersurface of supraspinatus tendon with SGHL tear in 47-year-old man. A. Oblique coronal fat-saturated T1-weighted MR arthrographic image shows partial tear of undersurface of supraspinatus tendon (white arrowheads). B, C. Oblique sagittal and oblique coronal fat-saturated T1-weighted MR arthrographic images show SGHL tear (black arrow). SGHL = superior glenohumeral ligament

Fig. 13. Habermeyer group 1 lesion in 45-year-old man. Axial fat-saturated T1-weighted and oblique sagittal fat-saturated 3D VIBE MR arthrographic images show isolated superior GHL tear (white arrow). White dotted arrow = LHBT. GHL = glenohumeral ligament, LHBT = long head of biceps tendon, SSC = subscapularis tendon, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination
Although the SGHL may vary in shape and size (Fig. 8), it usually presents as a thick structure when the MGHL is absent or undeveloped (Figs. 9, 10) (16, 18-20). The SGHL is consistently identified as capsular ligament by MR arthrography and arthroscopy examination. It may be absent in arthroscopic and MR arthographic series, in 2–3% of the patients (16). In a recent study by Kask et al. (20), the SGHL was found in all 27 shoulder joint specimens investigated. A longitudinal split or duplicate ligament may reflect a normal variant or a longitudinal tear of the SGHL (Fig. 11).

**Pathologies of the Superior Glenohumeral Ligament**

Magnetic resonance arthrography of the glenohumeral joint is the most accurate imaging technique established, for identifying pathologies of the SGHL and the associated

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**Fig. 14. Habermeyer group 2 lesion in 47-year-old woman.**

A. Axial fat-saturated T1-weighted MR arthrographic image shows partial articular-side supraspinatus tendon tear (white arrowheads). LHBT is slightly dislocated anteriorly (white dotted arrow). B. Oblique sagittal fat-saturated T1-weighted MR arthrographic image demonstrates fraying of SGHL (white arrow). C. Oblique sagittal fat-saturated 3D VIBE MR arthrographic image demonstrates displacement sign. LHBT (white dotted arrow) shows contact with superior border of intact subscapularis tendon (SSC) on midsection through lesser tuberosity. SGHL is invisible. Image also shows partial tear on articular-side supraspinatus tendon (white arrowhead), increased signal intensity, and diameter of LHBT (white dotted arrow). LHBT = long head of biceps tendon, SGHL = superior glenohumeral ligament, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination

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**Fig. 15. Habermeyer group 3 lesion in 38-year-old woman.**

A, B. Consecutive axial fat-saturated T1-weighted MR arthrographic images show superior GHL lesion (white arrow) with partial tear on articular-side of subscapularis tendon (white arrowheads). LHBT (white dotted arrow) shows slight medial subluxation. C. Oblique sagittal fat-saturated T1-weighted MR arthrographic image shows contrast agent entering defect (arrowhead) of superior subscapularis tendon (SSC), consistent with partial tear. LHBT (white dotted arrow) shows contact with superior border of SSC on midsection through lesser tuberosity. LHBT = long head of biceps tendon, SST = supraspinatus tendon
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structures. In a retrospective study comparing MR arthrographic findings with surgical findings, Chandnani et al. (21) determined that MR arthrography had a sensitivity of 100%, a specificity of 94%, and an accuracy of 94% in the diagnosis of SGHL tears. A torn SGHL may be observed in MR arthrography images as increased signal intensity that looks like disruptions and thick, wavy, or irregular structures (19, 22).

The biceps pulley is an important component of the rotator interval. This complex anatomical structure

Fig. 16. Habermeyer group 4 lesion in 55-year-old man.
A. Axial fat-saturated T1-weighted MR arthrographic image shows medial subluxation of LHBT (black dotted arrow) with partial tear on articular-side of subscapularis tendon (white arrowheads). B. Oblique coronal fat-saturated 3D VIBE MR arthrographic image shows partial tear on articular-side of supraspinatus tendon (white arrowhead). C. Oblique sagittal fat-saturated 3D VIBE MR arthrographic image shows partial tears on articular-side of supraspinatus and subscapularis tendons. Displacement sign is shown, with LHBT (white dotted arrow) cutting into superior portion of subscapularis tendon (small white arrowheads). Image also shows partial tear on articular-side of supraspinatus tendon (big white arrowhead), increased signal intensity, and diameter of LHBT (white dotted arrow). LHBT = long head of biceps tendon, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination

Fig. 17. Frozen shoulder of 45-year-old man.
A. Oblique sagittal T1-weighted MR image shows complete obliteration of subcoracoid fat triangle (white arrowheads). B. Axial fat-saturated T1-weighted MR arthrographic image shows thickened SGHL (white arrow). SGHL = superior glenohumeral ligament
consists of the SGHL and the CHL, and it is also in direct contact with the distal fibers of the subscapularis and the supraspinatus tendons. Based on this complex relationship, it has been suggested that the SGHL is the major stabilizing component in the anterosuperior portion of the glenohumeral joint capsule (23-27). It prevents dislocation of the LHBT in the intraarticular course. Therefore, tears in this ligament may lead to medial subluxation or dislocation of the LHBT. Recently, Schaeffeler et al. (28) showed that the prevalence of isolated SGHL tears is 29%.

Biceps pulley lesions can occur due to acute trauma, degenerative changes, repetitive microtrauma, congenital rotator interval defects, or injuries associated with tear in a rotator cuff (13, 24, 28-30). These lesions are thought to be responsible for medial subluxation of the LHBT, and they may result in loss of function in the shoulder and pain in the anterior shoulder (24, 25, 31).

Lesions of the biceps pulley are common in the patients undergoing arthroscopic shoulder surgery. The frequency of lesions on isolated biceps pulley is 29–74% (24, 25, 28). A recent study by Braun et al. (25) prospectively analyzed the prevalence of pulley lesions, which was reported as 32%,
in a consecutive series of patients undergoing arthroscopic shoulder surgery. In this study, tears in the pulley complex were present in 67 of 207 shoulders. Weishaupt et al. (23) reported discontinuity of the SGHL in biceps pulley lesions. The lesions of the biceps pulley, the LHBT, the subscapularis, and the supraspinatus tendon are often closely associated with each other (Fig. 12) (25). The instability pattern of the LHBT and the presence of tears on the rotator cuff tendons adjacent to the rotator interval can be used to diagnose biceps pulley lesions. Walch et al. (31) investigated the rotator interval in a series of 116 patients with isolated lesions of the supraspinatus tendon. Lesion in the biceps pulley and millimetric tears on the superior border of the subscapularis tendon occurred.

Fig. 20. Bony Bankart lesion with SGHL tear in 38-year-old woman who suffered from recurrent shoulder dislocations.
A. Axial fat-saturated 3D VIBE MR arthrographic image shows classic bony Bankart lesion, with avulsion of anteroinferior glenoid bone and labrum (white dotted arrow). B. Upper section of axial fat-saturated T1-weighted MR arthrography shows avulsion of anterior glenoid labrum (white dotted arrow) behind MGHL (white arrowhead). C. Axial fat-saturated T1-weighted MR arthrographic image at level of coracoid process shows SGHL tear (black arrow). MGHL = middle glenohumeral ligament, SGHL = superior glenohumeral ligament, 3D VIBE = three-dimensional volumetric interpolated breath-hold examination

Fig. 21. Susceptibility artifacts caused by inadvertently injected air in 47-year-old man who suffered from anterosuperior shoulder pain.
A. Axial fat-saturated 3D VIBE MR arthrographic image shows small air bubbles (black dotted arrows) distributed at superior part of joint cavity. Susceptibility artifacts may be more pronounced in VIBE MR arthrographic images. B. Axial fat-saturated T1-weighted MR arthrographic image at same level as VIBE sequence shows smaller air bubbles (white arrows) distributed at superior part of joint cavity. 3D VIBE = three-dimensional volumetric interpolated breath-hold examination
in 19 of 116 shoulders. A recent arthrographic study by Schaeffeler et al. (28) concluded that the presence of associated tendinopathy of the LHBT in oblique sagittal MR arthrography images has additional value for the diagnosis of a pulley lesion.

Biceps pulley lesions are difficult to diagnose by routine arthroscopic examination, so they are called “hidden lesions”. These injuries have been arthroscopically classified by Bennett (32), and this arthroscopic classification system is based on lesions involving the SGHL, the CHL, and the subscapularis tendon; however, it is not applicable for MR arthrography (28). Habermeyer et al. (24) subsequently classified biceps pulley lesions into four different patterns, which shows the importance of the SGHL in the lateral rotator interval (28, 31). According to the Habermeyer classification system, Group 1 lesions represent the isolated tears in SGHL, with the subscapularis and supraspinatus tendons intact without biceps tendon instability (Fig. 13). Group 2 lesions involve a biceps pulley lesion in association with a partial tear in the articular-side supraspinatus tendon and a mild medial subluxation of the LHBT (Fig. 14). Group 3 lesions involve a biceps pulley lesion in association with a partial tear on articular-side subscapularis tendon and a subluxation of the LHBT (Fig. 15). Group 4 lesions involve a biceps pulley lesion in association with partial tears on articular-side of both the supraspinatus and subscapularis tendons and a medial dislocation of the LHBT (Fig. 16).

The diseases associated with biceps pulley lesions include internal anterosuperior impingement, instability of the LHBT, biceps tendinopathy, superior labrum anterior and posterior lesions (SLAP), and adhesive capsulitis (13). The SGHL can be thicker in the patients with adhesive capsulitis (Fig. 17) (17). Internal anterosuperior impingement was first described by Gerber and Sebesta (33) as a form of intraarticular impingement responsible for unexplained anterior shoulder pain. Habermeyer et al. (24) subsequently described this disease as an impingement of the LHBT by the anterosuperior glenoid rim. In an arthroscopic study, Habermeyer et al. (24) found partial tears on articular side of subscapularis tendon in 71.8% of the patients with anterosuperior impingement.

Superior labrum anterior and posterior lesions may be associated with lesions of the rotator interval and biceps pulley complex, and this was clearly described by Braun

Fig. 22. Bony Bankart lesion with intraarticular blooming artifacts in 41-year-old man who suffered from shoulder dislocations. In this patient, hemosiderin deposits in synovium have been confirmed by arthroscopy.
A. Axial fat-saturated 3D VIBE MR arthrographic image at level of superior glenoid shows multiple blooming artifacts (black dotted arrows) at superior part of joint cavity. B. Axial fat-saturated T1-weighted MR arthrographic image at same level as A shows smaller blooming artifacts (black arrows). C. Axial fat-saturated 3D VIBE MR arthrographic image at level of axillary recess shows synovial haemosiderin deposits (white arrowheads). D. Axial fat-saturated T1-weighted MR arthrographic image at same level as C does not show evidence of synovial haemosiderin deposits.
et al. (25) in a recent arthroscopic study. Four types of SLAP lesions were classified by Snyder et al. (34) based on arthroscopic findings. This original classification system is still the most widely accepted one, and six additional classifications have been developed. These new classifications represent the combination of SLAP lesions, with extension into different areas of the glenoid labrum and other adjacent capsuloligamentous structures. According to the new classifications, a Type 10 lesion consists of a superior labral tear with extension into the SGHL and MGHL (Figs. 19, 20) (19).

**Diagnostic Pitfalls**

Magnetic resonance arthrography of the glenohumeral joint is sensitive to susceptibility artifacts caused by inadvertently injected intraarticular air bubbles. With advanced sequences, such as fat-suppressed VIBE, even small amounts of air bubbles may produce pronounced susceptibility artifacts (35). Air tends to be located in the uppermost parts of the glenohumeral joint. Therefore, small air bubbles are usually distributed at the anterosuperior part of the joint cavity, next to the SGHL or CHL and the horizontal part of the LHBT (Fig. 21) (35, 36). Air bubbles may occasionally mimic intraarticular loose bodies, chondrocalcinosis of hyaline cartilage, and inflammatory adhesions of the joint capsule. Knowledge of the intraarticular arrangement of gas bubbles would help in avoiding misinterpretation (36).

Haemorrhagic effusion is usually an expected complication after dislocation of the glenohumeral joint. The haemorrhage resolves over time, but the hemosiderin particles may accumulate in the synovium. These particles are usually not visualized by the routine sequences. Concordantly, the VIBE sequence is a sensitive technique that will reveal the hemosiderin particles in the synovium and joint space, as well as intra-articular air bubbles (Fig. 22).

**CONCLUSIONS**

The SGHL is known to be difficult to evaluate based on anatomical structures identified in arthographic and arthroscopic examinations. The assessment of the SGHL is important for the diagnosis of biceps pulley lesions. The SGHL can be ruptured as an isolated form, and it can also be damaged with anterosuperior impingement syndrome, biceps tendon instability, SLAP lesions, and anterior instability of the glenohumeral joint. In addition to routine MR arthrography sequences, advanced MR arthrographic sequences such as VIBE may greatly help in the diagnosis of the SGHL and in identifying its morphology and the associated pathologies.

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