

## MAGNETIC RESONANCE IMAGING ARTHROGRAM FINDINGS IN RECURRENT DISLOCATION OF SHOULDER

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### ABSTRACT

#### BACKGROUND

Shoulder joint is the most commonly dislocated joint and it is most commonly dislocated anteriorly. Based on aetiology and age, there are associated injuries like injury to anterior-inferior labroligamentous restraints (in young people with traumatic aetiology) and to bony restraints (in elderly people). Injury to labroligamentous structures are best visualised using MRI and MR arthrography. Instability can be anterior, posterior and inferior or multidirectional. Anterior instability are associated with Bankart's lesion and variants of it and injuries to anterior part of Inferior Glenohumeral Ligament (IGHL). With posterior instability lesions expected are reverse Bankart's and reverse Hill-Sachs lesions.

#### MATERIALS AND METHODS

Twenty five patients who presented with recurrent dislocation of shoulder to casualty and op of orthopaedics of Govt. Medical College, Kozhikode from January 2015 to August 2016 were taken for study. Conventional MRI were taken and arthrography was done with USG guidance and MR arthrogram sections were taken.

#### RESULTS

Majority of patients with recurrent dislocation of shoulder were in age group between 15 - 30 years. Majority were males and right side was the most common side involved. Labroligamentous lesions were found in 100% of patients with both bony and labroligamentous lesions were more common than isolated labroligamentous lesions. About 44% of patients were having Bankart's lesion and 40% of patients had Hill-Sachs lesion. Glenoid avulsion of glenoid labrum (GAGL- 40%) and SLAP (36%) were also common.

#### CONCLUSION

Imaging findings in recurrent dislocation of shoulder are variable, which mainly depends on aetiology and age of patients. In recurrent dislocation of shoulder MR arthrography is the investigation of choice, which is needed for early intervention. However, large scale study with large sample size are needed for definite conclusion.

#### KEYWORDS

Recurrent Dislocation of Shoulder, MR Arthrogram, Bankart's Lesion, GAGL and SLAP.

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#### BACKGROUND

Anatomy of shoulder is unique with greatest range of motion than other joints. Disadvantage for this greatest range of motion is its vulnerability to dislocation. The contact surface of head of humerus with glenoid cavity is about 30%, which infers that joint has limited bony constraint. So primary stability is dependent on soft tissue components. Anterior labrum is more important for antero-posterior stability by

deepening, if glenoid cavity is upto 50%. Dynamic and passive restraints provide stability to shoulder joints by maintaining perfect rotation of head of humerus over centre of glenoid fossa. Dynamic stabilisers include rotator cuff, long head of biceps, latissimus dorsi, pectoralis muscle and periscapular muscles. Passive stabilisers include rim of glenoid, glenoid fossa and labroligamentous structures. Shoulder joint instability can be classified by aetiology and treatment response into two major items. TUBS (Traumatic, Unidirectional, Bankart's lesion, responds to surgery) and AMBRII (Atraumatic, multidirectional, bilateral, rehabilitation, inferior capsular shift, interval closure).

MR imaging of shoulder joint for evaluation of labroligamentous injuries is a challenging task even for musculoskeletal radiologists. Many investigators have reported with varying results on accuracy of conventional MR imaging. MR arthrography extends the advantages of conventional MR imaging, because contrast distends the

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capsule and outline the intraarticular structures and extends abnormalities. Joint can be distended using normal saline or diluted contrast solution.

### Aims and Objectives

- 1) To study the prevalence of labroligamentous injury using MR arthrogram in recurrent dislocation of shoulder.
- 2) To quantify relative proportion and different grades of injury using MR arthrogram in recurrent dislocation of shoulder.

### Relevance of Study

Shoulder joint is the most common joint in the body to get dislocated, both traumatic and atraumatic aetiology. Younger age group are most vulnerable to shoulder dislocation. Bony and ligamentous injuries, even though are treated conservatively are more prone for recurrent dislocation. Hence, early diagnosis of ligamentous injury will be helpful for proper management of recurrent dislocation of shoulder. Studies regarding the prevalence of labroligamentous injury in recurrent dislocation are less in Kerala, hence this study was planned to study the prevalence of labroligamentous injuries in recurrent dislocation of shoulder.

### MATERIALS AND METHODS

#### Study Design

Descriptive study.

#### Study Setting

All cases coming to orthopaedic OP and casualty with symptoms of recurrent dislocation of shoulder, Govt. Medical College Kozhikode, Kerala, India.

#### Study Period

January 2015 - August 2016.

#### Study Method

##### MR Imaging with Wipro GE 1.5T Signa Machine

MR imaging evaluation of the shoulder which include oblique coronal, oblique sagittal and axial views: T1- and T2-weighted fat-saturated images for pathologic evaluation and often a proton density-gradient echo for the labrum. Gadolinium contrast MR arthrography is to be performed through an anterior approach with a dedicated shoulder coil between two were studied.

#### Sample Size

25. All patients fulfilling inclusion criteria were included.

#### Inclusion Criteria

Patients who present with recurrent dislocation of shoulder to Ortho OP and casualty.

Patient's age, who belong to age 15 - 45 years.

#### Exclusion Criteria

Patients who are not willing to participate for the study.

Patients who had past history of allergic reactions to gadolinium.

#### MRI Protocols and Imaging

##### Wipro GE 1.5T Signa Machine

##### Imaging Planes and Pulse Sequences-

- Preliminary Scout Localizer in axial, sagittal, coronal.
- Fat-suppressed T1-weighted axial (SE 600 – 800/15 – 20 TR/TE).

Fat-suppressed T1-weighted oblique coronal.

(SE 600 – 800/15 – 20 TR/TE).

Fat-suppressed T1-weighted oblique sagittal.

(SE 600 – 800/15 – 20 TR/TE).

T2-weighted FSE (fast spin echo) oblique coronal (SE 3500/90 TR/TE).

Shoulder surface coil.

16 – 18 cm FOV.

256'256 or 256'192 matrix.

3 mm slice thickness interleaved or 4 mm thick with 1 mm gap.

#### MR Arthrogram was done under USG Guidance

The patient should be scanned with MRI during max. 30 mins of injection. The same surface coil is used and all pulse sequences are done with T1 fat suppression (TR 924, TE 17, FOV 15, NEX 3) in axial, coronal and sagittal planes.

#### Statistical Analysis

Conventional MR images and MR arthrographic images are analysed and lesions are identified and lesions are graded.

#### Grading the Severity

Grading the severity, the degree of tear or defect of the Anterior Glenoid Labrum (AGL) as recorded independently using a three-point scale:

Grade 1- for normal (when evidence of an AGL tear was equivocal).

Grade 2- for probable tear (diagnosed when subtle increased signal intensity of the labrum was observed).

Grade 3- for definite tear/defect (when a definite contrast material-filled gap between the labrum and the glenoid rim or deficient labrum was apparent).

The data entered in MS Excel and analysed using SPSS version 18.

#### Ethics Committee

Study protocol was submitted to Institutional Ethics Committee, Government Medical College, Kozhikode and got approved.

#### Representative Case 1

Patient presenting with recurrent traumatic anterior dislocation involving right side.

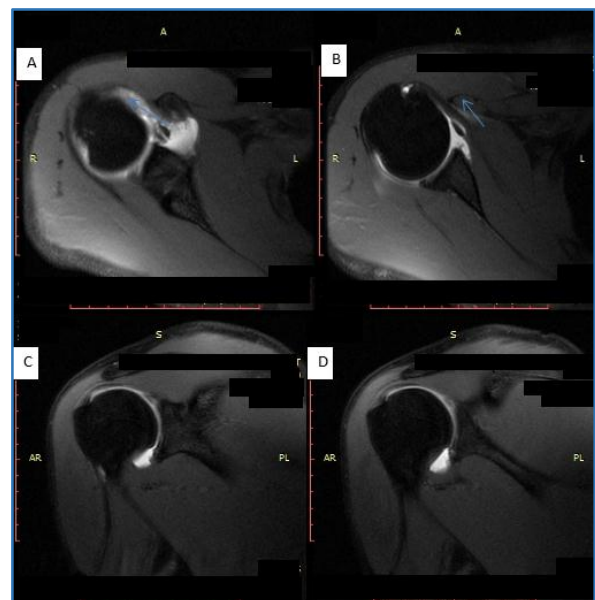
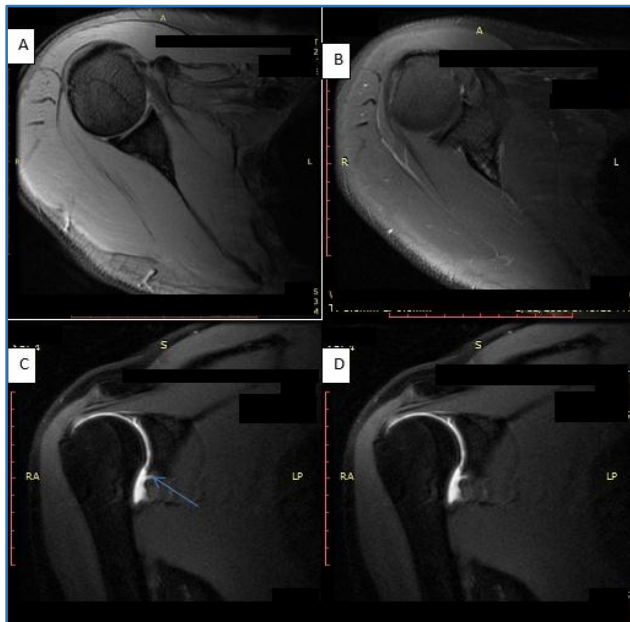


Figure 1A, B, C, D

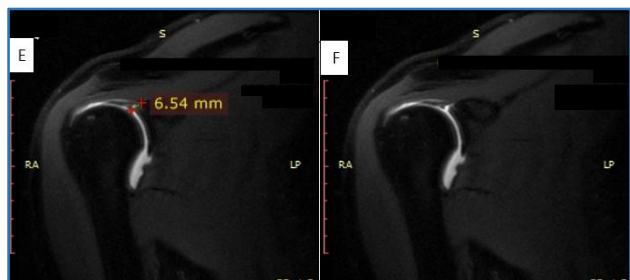
**Figure 1A.** Depression in postero-superior aspect of humeral head – Hill-Sachs lesion; **Figure 1B.** Tear of antero-inferior glenoid labrum without rupture of periosteum – Perthes lesion. **Figure 1C and 1D.** Showing tear of superior labrum with extension of tear in antero-posterior direction – SLAP.

**Representative Case 2**

Patient presenting with recurrent traumatic anterior dislocation involving right side.



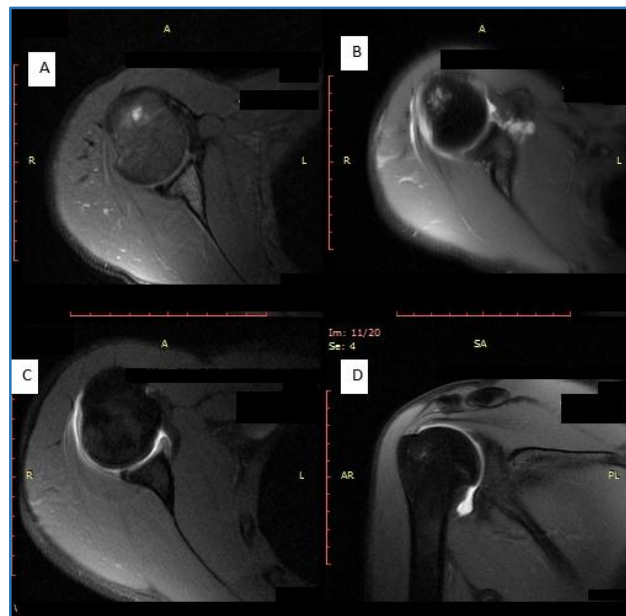
**Figure 2A.** Apparently Normal looking Labrum in Plain; **Figure 2B.** Depression in Postero-Lateral Aspect at the and above the Level of Coracoid Process; **Figure 2C.** Tear of Antero-Inferior Labrum with Tearing of Periosteum – Bankart’s Lesion; **Figure 2D.** Avulsion of Anterior Band of IGHL – GAGL Lesion.



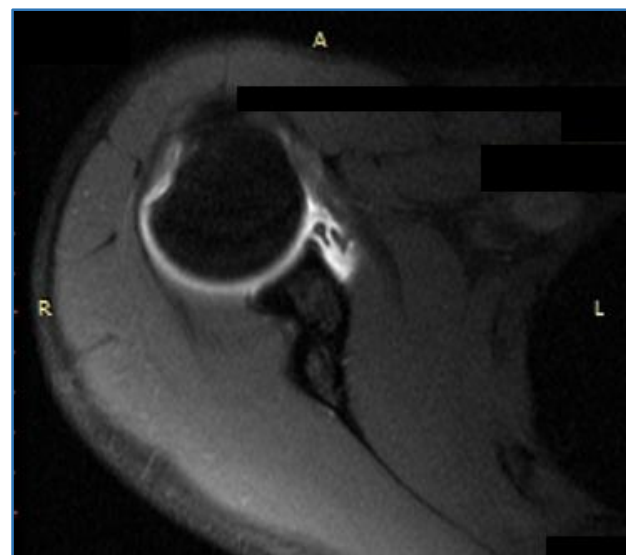
**Figure 2E & 2F.** Tear involving Antero-Superior Labrum with Antero-Posterior Extension with Depth of Tear measuring 6.5 mm (DD: Sublabral Recess, a normal variant in 1 to 3’o Clock Position, Depth extending medially and not more than 3 mm in Depth)

**Representative Case 3**

Patient presenting with recurrent traumatic anterior dislocation involving the right side.



**Figure 3A.** Plain Study showing Hill-Sachs Lesion and possible Bankart’s Lesion; **Figure 3B.** MRA showing Hill-Sachs Lesion; **Figure 3C.** Showing Bankart’s Lesion, i.e. Tear of Antero-Inferior Labrum with Stripping of Periosteum; **Figure 3D.** Coronal T1 Image showing Tear involving Humeral Avulsion of Anterior Part of Inferior Glenohumeral Ligament.



**Figure 3E.** Axial T1 FS showing Tear of Antero-Superior Labrum with Antero-Posterior Extension (SLAP)

**RESULTS**

A study to assess the prevalence of labroligamentous injuries and to quantify and grade the lesions in patients presenting with recurrent dislocation of shoulder was conducted in Government Medical College Hospital, Kozhikode from January 2015 to August 2016. Patients between 15 - 45 years presenting to OP with recurrent dislocation of shoulder were included in the study.

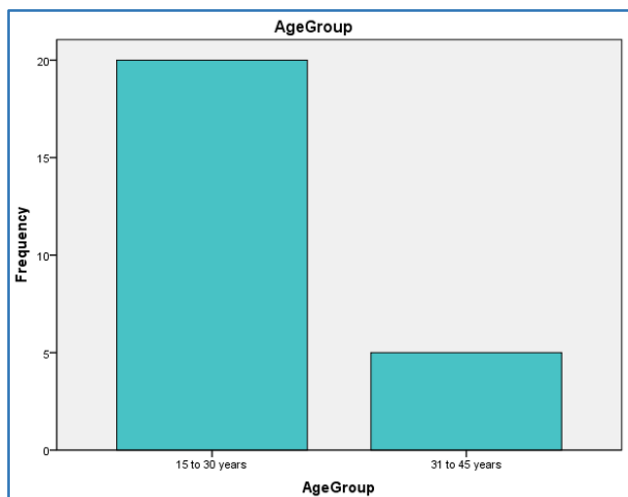
Out of 28 people selected for the study, 25 patients gave consent for undergoing this study and hence the study was proceeded with 25 patients. The response rate was about 89.28%.

**Age**

Minimum age of patient enrolled for study was 17 years and maximum age of patient enrolled for study was 45 years. Mean age was 24.7 years with standard deviation of 7.8; 80% of subjects were between 15 - 30 years and rest were between to 31 - 45 years.

Age Group	Frequency	Percentage
15 to 30 years	20	80.0
31 to 45 years	5	20.0
<b>Total</b>	<b>25</b>	<b>100.0</b>

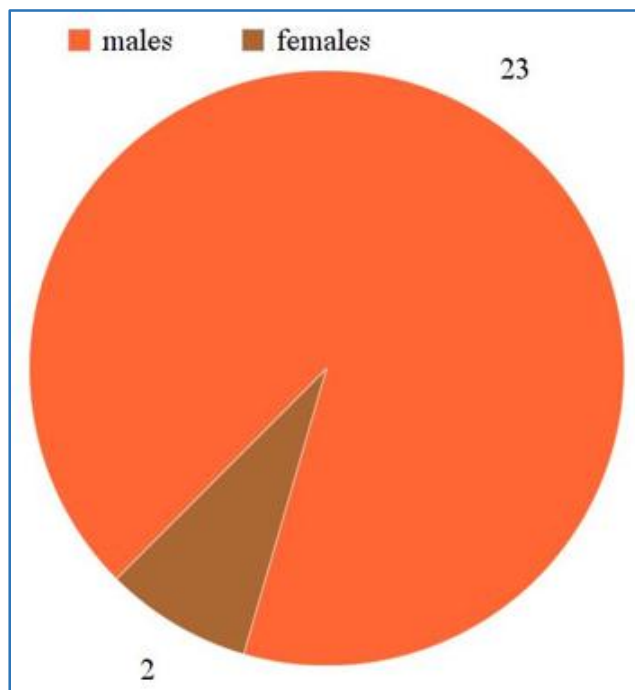
*Table 1. Age Distribution*



**Figure 4. Age Distribution**

**Sex**

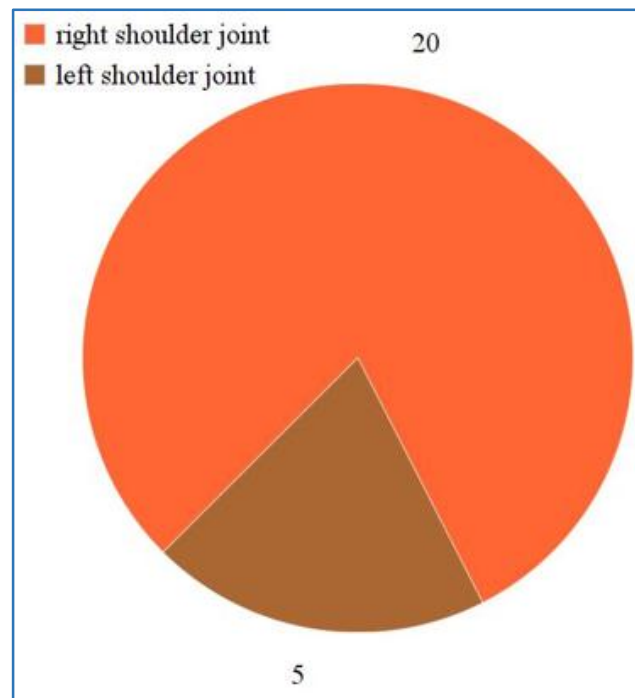
About 92% of patients enrolled for study were males (23/25) and 8% (2/25) were females.



**Figure 5. Sex Distribution**

**Side Affected**

In our study, right shoulder joint was involved for about 80% of patients (20/25 patients). Left shoulder was involved in the rest of the 20% patients.



**Figure 6. Side Affected**

**Aetiology**

Aetiology of recurrent dislocation can be traumatic (most commonly anterior dislocation) and atraumatic (multidirectional). In our study, all patients had dislocation due to traumatic aetiology.

**Direction of Dislocation**

In our study, all patients had recurrent dislocation of shoulder in anterior direction.

**Chronicity**

Almost all patients had multiple episodes of dislocation with first dislocation being traumatic and of average about > 3 dislocations per patient.

**Lesions**

In our study, most commonly detected lesion (11 out of 25, about 44%) was Bankart’s lesion. Our study had Hill-Sachs lesion of about 10 patients out of 25 patients (about 40%).

Type of Lesion	Number of Lesions	Percentage
Classic Bankart’s lesion	11/25	40%
Hill-Sachs lesion	10/25	44%
Perthes lesion	8/25	32%
ALPSA lesion	2/25	8%
GLAD lesion	5/25	20%
SLAP	9/25	36%
HAGL	3/25	12%
GAGL	10/25	40%

*Table 2. Type of Lesions*

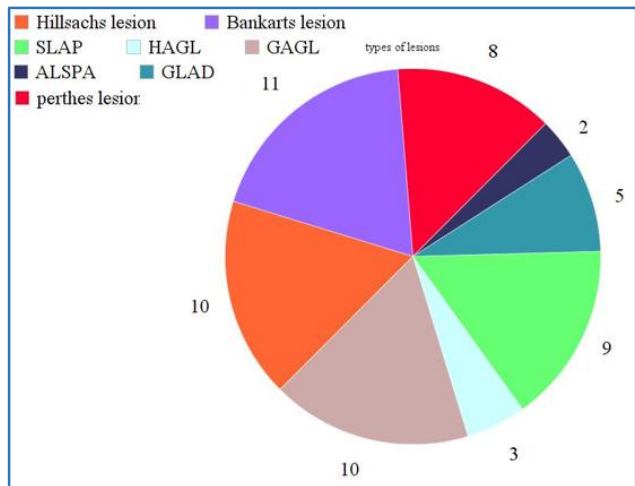


Figure 7. Type of Lesions

Avulsion of glenoid part (GAGL) and humeral part (HAGL) of inferior glenohumeral ligament were seen with recurrent dislocation of shoulder with GAGL seen more frequently about 40% (10/25). Next most common lesion was SLAP with 36% (about 9/25).

Perthes, GLAD and HAGL were found in 8/25 (32%), 5/25 (20%) and 3/25 (12%) patients respectively. Least commonly detected lesion is ALPSA (Anterior Labroligamentous Periosteal Sleeve Avulsion) in about 2/25 (8%) patients.

**Number of Lesions**

In our study, one patient had only one lesion. About 11 patients had 2 and 3 lesions each and one patient had 4 lesions.

Number of Lesions	Frequency	Percent
1	1	4.0
2	11	44.0
3	11	48.0
4	2	4.0
<b>Total</b>	<b>25</b>	<b>100.0</b>

Table 3. No. of Lesions

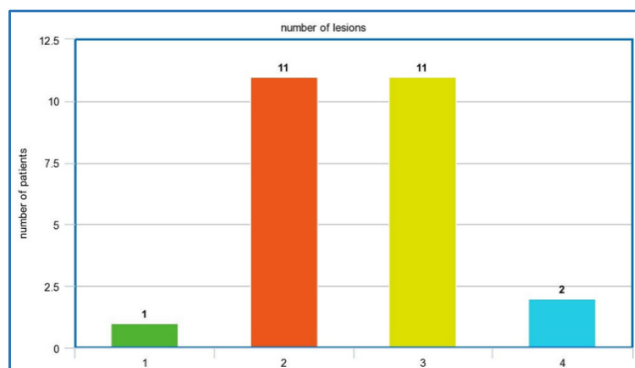


Figure 8. No. of Lesions

**Grading the Lesions**

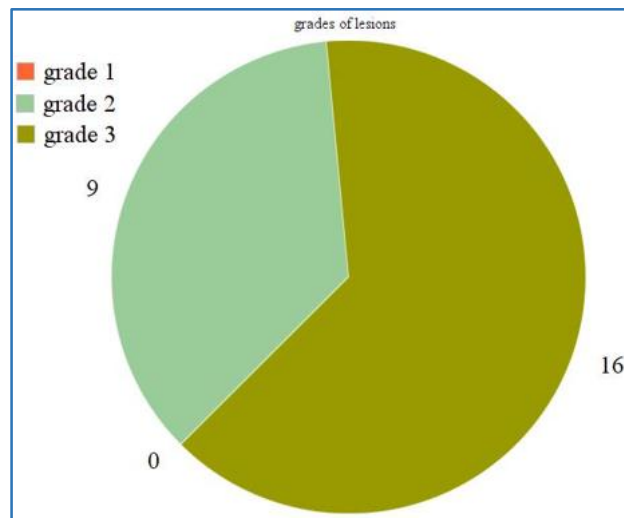


Figure 9. Grading of Lesions

Most of the labroligamentous lesions detected were of grade 3 severity (16/25).

Rest of the lesions were of grade 2 severity (9/25).

**DISCUSSION**

We studied different labroligamentous injuries associated with recurrent dislocation of shoulder in patients who presented to Ortho OP/casualty in Govt. Medical College, Kozhikode during the study period. Out of 28 participants, 25 participants gave consent for the study, response rate was 89.28%.

Minimum age of patient enrolled for study was 17 years and maximum age of patients enrolled for study was 45 years. Mean age was 24.7 years with standard deviation of 7.8. Most of the patients were between 15 - 30 years. Recurrent dislocation of shoulder was found in about 92% of athletic and young patients after first time anterior shoulder dislocation without operative treatment.<sup>[1,2]</sup> Various studies have found that patient's age, gender and athletic involvement were reliable predictors for recurrence with age during initial dislocation appearing to be the most common predisposing factor.<sup>[3]</sup> Rowe et al showed that the rate of recurrence of shoulder dislocation got decreased as patients got old with 83% of patients below age 20, 63% between 20 and 40, and 16% of patients older than 40 likely to have recurrent dislocation.<sup>[4]</sup> Teslaa et al found that there was a 71% recurrence rate in patients less than 18 years of age at 5-year followup period when compared with the overall group of 16- to 39-year-old patients who demonstrated a recurrence rate of about 55%.<sup>[5]</sup> Ramsey et al<sup>[6]</sup> found that traumatic anterior instability of shoulder was associated with a higher rate of recurrence in young patients. Marans et al<sup>[7]</sup> found about 100% redislocation rate in twenty-one skeletally immature patients who were treated non-operatively (sling).

In accordance with other studies,<sup>[8]</sup> men were more likely to dislocate than women. In our study out of 25 patients, 23 patients were males and 2 were females.

In our study, right shoulder was involved for about 80% of patients (20/25 patients). This may be attributed to the point that most people were right handed.

Aetiology of recurrent dislocation can be traumatic (most commonly anterior dislocation) and atraumatic (Multidirectional). In our study, almost all patients had dislocation as post-traumatic aetiology. Trauma accounts for about 90% of first-time anterior shoulder dislocations and usually it is fall on an outstretched hand, or FOOSH. In contact sports, dislocation also results from a direct posterior blow to the shoulder or forced ABER.

Dislocation can be anterior, posterior and inferior and multidirectional. The anterior dislocation, most frequently encountered shoulder dislocation, comprising approximately 95% to 97% of cases.<sup>[9,10]</sup> Posterior dislocations occur in 2% to 4% of cases, and inferior dislocations are rare.<sup>[9,10,11]</sup> In our study almost all patients had recurrent dislocation of shoulder in anterior direction, since it is the most commonly dislocated direction.

Lesions in recurrent dislocation of shoulder can be divided broadly into bony injuries and labroligamentous injuries. Common bony lesions are Hill-Sachs and bony Bankart's lesion. Labroligamentous injuries can be classified into labral injuries (Bankart's and its variants) and ligamentous injuries (injuries to SGHL, MGHL, IGHL).

In our study most common lesion (11 out of 25, about 44%) is Bankart's lesion, since it is the most common lesion associated with anterior dislocation. Hill-Sachs lesion was found in 10 patients out of 25 patients (about 40%). A Hill-Sachs lesion was demonstrated as high as 90% to 100% of the patients with shoulder instability.<sup>[12,13,14]</sup> The prevalence of Hill-Sachs defects increases from 25% in first-time dislocators to 40% - 90% in repeat dislocators.<sup>[15,16]</sup> However, in a study conducted by Mahmoud Agha et al, which involved 30 consecutive patients with shoulder microinstability, identified labrocapsular injuries were Perthes in 6 patients, ALPSA in 3 patients, GLAD in 2 patients and SLAP in about 11 patients. In the same study, ligamentous injuries to MGHL were detected in about 2 patients and IGHL in about 4 patients.<sup>[17]</sup>

Avulsion of glenoid part (GAGL) and humeral part (HAGL) of inferior glenohumeral ligament are seen with recurrent dislocation of shoulder with GAGL seen more frequently about 40% (10/25). Next most common lesion is SLAP with 36% (about 9/25). In a recent study series, SLAP lesions were found in about 36% of patient population with history of instability or chronic shoulder pain, who had MR arthrography prior to arthroscopy or open surgery.<sup>[18]</sup>

Hence, in our study, common type of lesions detected in order of frequency was Bankart's > Hill-Sachs = GAGL > SLAP > Perthes > GLAD > HAGL > ALPSA.

In our study Perthes lesion, GLAD and HAGL were found in 8/25 (32%), 5/2 (20%) and 3/25 (12%) patients respectively. Least commonly detected lesion is ALPSA (Anterior Labroligamentous Periosteal Sleeve Avulsion) of about 2/25 (8%). According to study conducted by N. El-Liethy et al with 60 patients with shoulder injuries, they detected 32 Bankart lesions, 2 Osseous Bankart, 2 Reversed Bankart, 2 Perthes, 1 ALPSA, 1 GLAD, 3 SLAP lesions, 4 MDI, 8 RCT pathology; 5 patients had normal MRI and MRA.<sup>[19]</sup>

Most of the labroligamentous lesions detected were of grade 3 severity (16/25), since most of the patients had recurrent dislocation of shoulder of average more than 10 times. Incidence of laxity increases with subsequent dislocations and consequently less force needed to dislocate the shoulder as laxity increases. Rest of the lesions were of grade 2 severity (9/25).

## CONCLUSION

Majority of patients with recurrent dislocation are in younger age group 15 - 30 years with incidence of recurrent dislocations more common among males. Almost all patients had traumatic aetiology with most common direction of recurrent dislocation being anterior. Most common lesions detected were Bankart's and Hill-Sachs lesions. Least common detected lesions were GLAD, HAGL and ALPSA and most of the lesions detected were of Grade 3.

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