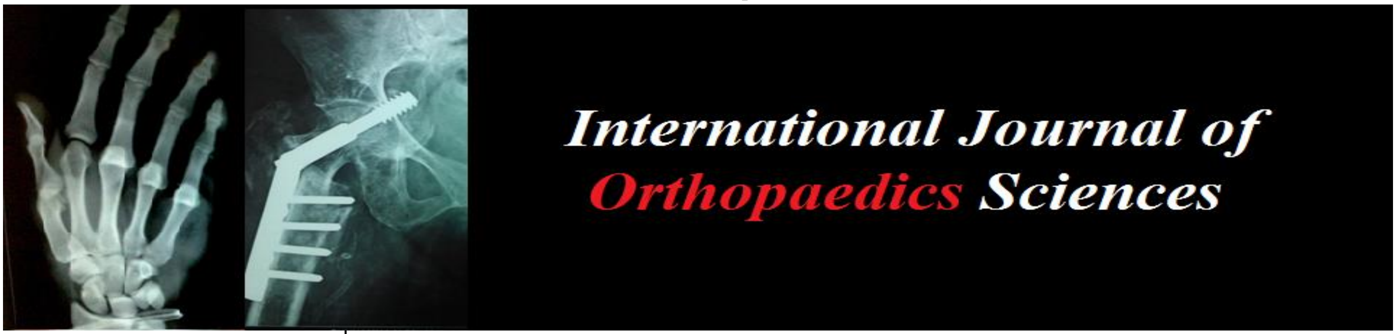

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Predictors of gleno-humeral bone loss in traumatic anterior shoulder instability

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Abstract
Purpose: Is to predict the risk factors causing gleno-humeral bone loss and affecting its size in patients with traumatic anterior shoulder instability.
Patients and methods: At a median follow-up of 26 months, 60 patients having unilateral traumatic anterior shoulder instability were included in the study. The proposed risk factors for gleno-humeral bone loss were recorded. All patients underwent clinical evaluation and scoring. True AP radiography and CT scan of the shoulder were done to all patients to detect and quantify gleno-humeral bone loss. The collected data were analyzed to detect the factors correlating with the presence of gleno-humeral bone.
Results: The number of dislocations was a significant risk factor for the presence of glenoid bone loss and large glenoid defect (P value: 0.023 and 0.001 respectively). Moreover, it was a significant risk factor for longer and deeper Hill-Sachs lesions (P value: 0.002 and 0.004 respectively). The age of 1st dislocation < 20 years was a significant risk factor for critical glenoid bone loss of 20% and large glenoid defect (P value: Nil and 0.028 respectively). While age at 1st dislocation >20 years showed a negative correlation against larger Hill-Sachs lesions. *Contact sports* were a significant risk factor for the presence of glenoid bone loss and deeper Hill-Sachs lesions (P value: 0.002 and 0.003 respectively). Smoking was another but weak risk factor for large glenoid defects and longer Hill-Sachs lesions (P value: 0.050 and 0.034 respectively). The glenoid and humeral head bone loss showed highly significant correlation between each other.
Conclusion: The number of dislocations, young age at 1st dislocation, contact sports and smoking are considered risk factors and predictors for gleno-humeral bone loss in traumatic anterior shoulder instability.
Level of evidence: Case series study; Level of evidence, 4.

Keywords: Glenoid bone loss - Hill-Sachs lesions - anterior shoulder instability

1. Introduction

Anterior shoulder instability (ASI) is commonly associated with gleno-humeral bone loss (GHBL) [1]. Glenoid bone loss (GBL) has been found in 22-40% of patients after initial dislocation [2] and increases in recurrent cases reaching from 46 to 86% [3]. Hill-Sachs lesion has been found in 65% to 67% of patients after initial dislocation and up to 100% after recurrent dislocations [4, 5].

Large bone defects if neglected may be a cause of recurrent instability or even failure of treatment. The engaging Hill-Sachs lesions and/ or the inverted pear glenoid (in which the inferior glenoid diameter less than superior glenoid diameter with greater than 25% loss of inferior glenoid articular arc) have an increased rate of recurrence after arthroscopic soft tissue repair [6].

The measurement of bone defect is important to decide whether it will need reconstruction or not. Three dimensional (3D) CT measurement of GHBL has become well established in the literature with various methods. 3D CT imaging using the Pico Method [7] has proven excellent accuracy in detecting and quantifying GBL and now is widely considered to be the gold standard but the radiation exposure remains a shortcoming of its use [8-11].

Some risk factors may predict the occurrence of GHBL. Determination of these risk factors helps in patient selection to do 3D CT and so helps in the proper management. In the literature little information exists regarding the risk factors causing those bony defects.

One study performed by Milano *et al*. 2011 found that the young age at first dislocation and number of recurrences are significant risk factors of GBL [12].
The hypothesis of this study is that some risk factors could be predicted in patients with traumatic anterior shoulder instability that may be significantly associated with GHBL. The aim of the study is to predict these risk factors for proper patient evaluation and management.

2. Patients and methods
This study included 60 patients having unilateral traumatic anterior shoulder instability presented to outpatient clinic unit of knee surgery - arthroscopy and sports injuries unit. The median follow-up period was 26 months. Informed verbal consent was obtained from the patients and the study protocol was previously approved by the Institutional Research Board (IRB) of faculty of medicine.
Patients with unilateral traumatic anterior shoulder instability with at least one episode of dislocation were included. Patients with fracture dislocation of the shoulder, atraumatic instability, bilateral instability and patients with previous shoulder surgery were excluded.
Assessment of the demographic data and proposed risk factors was done. The studied factors included: age, sex, occupation, arm dominance, epilepsy, smoking, tramadol addiction, sports participation, age of 1st dislocation, number of dislocations and time interval between dislocations.
Clinical shoulder examination of the patients was done to ensure the diagnosis of anterior instability. Clinical tests for instability included: apprehension and relocation test, load and shift test and anterior drawer test. All patients underwent evaluation using instability severity index score (ISIS), Oxford shoulder instability score (OSIS) and Constant scoring systems.
True AP view (fig. 1) was done as the basic radiographic view. All patients underwent a CT scan of both shoulders with spiral multi-slice CT to detect and quantify bone loss. For the glenoid, en-face view of both glenoid in the 3D reformat was made by humeral head subtraction then rotating the scapula till viewing the glenoid from the lateral aspect (en-face) with the same magnification power and viewing planes for both sides.

Fig. 1: true AP view of the affected right shoulder of a male patient 30 years, had right (dominant side) ASI with history of 20 times dislocations. The view is done while patient standing with the injured shoulder inclined 15 degrees posteriorly and the hand in anatomic position (palm facing forward). There is no apparent glenoid or humeral defect.

Measurement of *the glenoid defect* with en-face view was done using Pico method (a best-fit circle surface area based on the contralateral glenoid) (fig. 2). Manual tracing of the defect on digital software was done followed by calculating the percentage of defect area to the inferior glenoid circle. Critical glenoid defect was considered to be 20%.

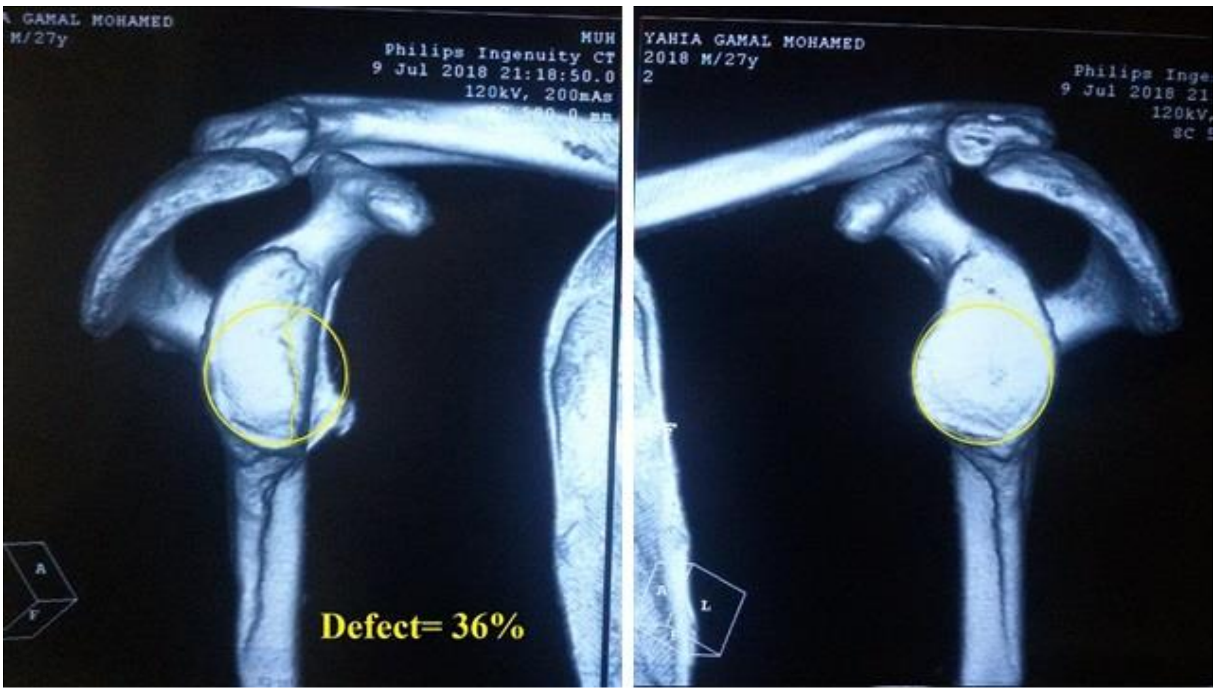

Fig 2: 3D CT scan view shows measurement of glenoid bone defect (36%) using Pico method. A best fit circle (yellow circle) was drawn on the inferior glenoid of the healthy side. The circle was transferred to the injured side and the defect was traced and outlined. The defect was calculated by dividing the defect area by the inferior glenoid circle and expressed as a percentage.

For the humeral bone defect, it was measured using 2D axial CT view (fig. 3) of the humeral head at or above the level of the coracoid process with both sides measured at the same level for each patient. Length and depth of the lesion were measured in centimeters.

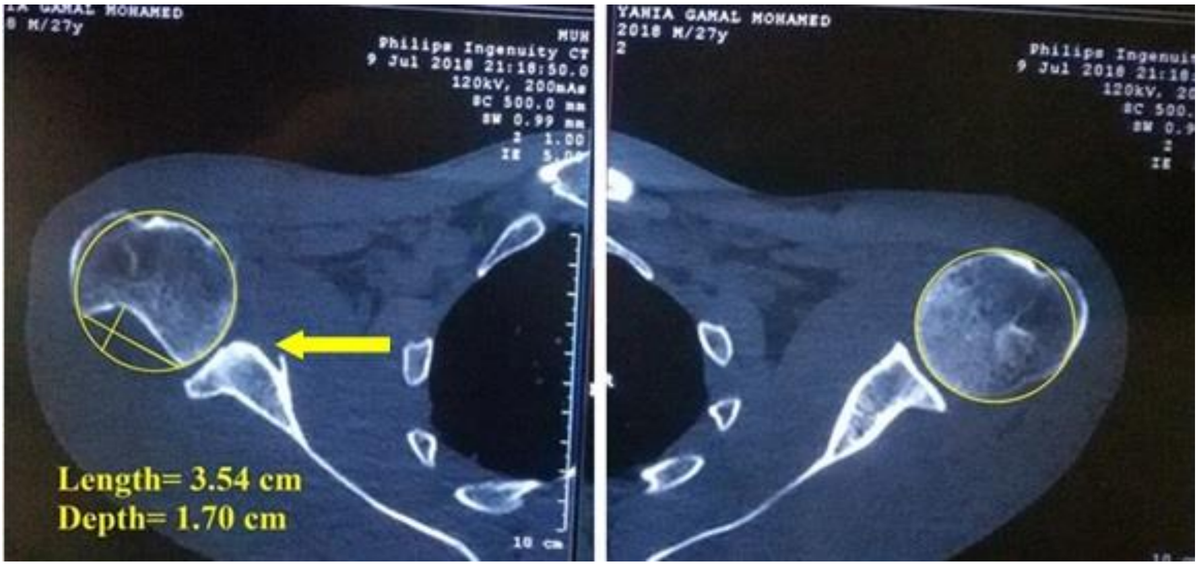

Fig 3: axial 2D CT scan view shows measurement of Hill-Sachs lesion at or above the level of coracoid process (cut showing the largest lesion). Length and depth of the lesion were measured in centimeters (3.54 cm and1.7 cm respectively). Note the bony loss of the anterior glenoid (yellow arrow). The contralateral healthy side was used as a reference for the normal morphology in that level.

The collected data were analyzed to detect the factors correlating with the presence of GHBL and its size and the correlation between bone loss and patients clinical scores. After detection of the significant factors correlating with GHBL, patients were divided into pairs of groups according to the detected significant variables to assess the effect of each predictor on each group using another set of tests.

2.1 Statistical analysis

IBM's SPSS statistics (Statistical Package for the Social Sciences) for windows (version 24) was used for statistical analysis of the collected data. Shapiro-Wilk test was used to check the normality of the data distribution. Normally distributed continuous variables were expressed as mean ± SD while categorical variables and the abnormally distributed continuous ones were expressed as median and inter-quartile range or number and percentage.

Bivariate Correlations were assessed using Pearson's or Spearman's correlation coefficient depending on the nature of data. P (probability) value < 0.05 was considered statistically significant. Student t-test and Mann-Whitney were used for normally and abnormally distributed continuous data respectively. *Chi square test* was used for categorical data using the cross tabs function. All tests were conducted with 95% confidence interval.

3. Results

At the end of this study, 60 patients suffering from ASI who fulfilled the inclusion criteria were evaluated and the data was analyzed. Demographic data showed that 51 (85%) patients were males and 9 (15%) were females. The mean age at the time of assessment was found to be 27.22 years while mean age at 1st dislocation was 24±8.4.

According to the age at 1st dislocation the patients were classified into 2 groups; younger and older than 20 years. 26 (43.33%) patients were ≤ 20 years and 34 (56.67%) patients were above 20 years at 1st dislocation. The mean age of patients' ≤ 20 years at 1st dislocation was 17.9±1.3, while that of patients above 20 years was 28.7±8.4. Anterior instability affected the dominant arm in 36 (60%) patients.

3.1 Hypothesized risk factors

The proposed risk factors of GHBL including; patient age, occupation, sports participation, smoking, tramadol abuse, history of epileptic fits, number of dislocations, number of patients having > 5 dislocations, time interval between recurrent episodes and clinical scoring were recorded (Tab. 1).

Table 1: Proposed risk factors and correlations of GHBL (no. = 60)

1.	No. of patients ≤ 20 years at 1st dislocation		43.33% (26)
2.	manual workers		40% (24)
3.	contact /overhead sports		17% (10)
4.	smoking		45% (27)
5.	tramadol abuse		32% (19)
6.	epileptic fits		15% (9)
7.	**mean number of dislocations± SD**		11.37±10.0
8.	Number of patients having > 5 dislocations and their mean number of dislocation		53.33% (32), 17.9±8.9
9.	time interval between recurrent episodes	Days - weeks	37% (22) - 27% (16)
		Months - years	28% (17) - 3% (2)
10.	Clinical scores	Constant score	85 (31-100)
		ISIS - OSIS	0 (0-6) - 34.5 (14-55)

GHBL in the study population (n= 60)	
Patients with GHBL (of any type)	95% (57 patients)
Patients with no GHBL (of any type)	5% (3 patients)
Patients with glenoid bone loss **only**	3.33% (2 patients)
Patients with Hill-Sachs lesion **only**	6.67% (4 patients)
Patients with bipolar lesions	85% (51 patients)
Measurements and type of GHBL	
glenoid defect size	9.28% (2.69% - 36%)
glenoid defect (*erosion type*)	47% (25 patients)
glenoid defect (*fragment type*)	53% (28 patients)
humeral head defect length (cm)	2.1 (1.3 - 3.5)
humeral head defect depth (cm)	0.6 (0.51 – 1.7)

3.2 Analysis of GHBL in the study population

GBHL due to traumatic ASI was assessed. The bony defects were found to affect the glenoid only (fig. 4-A) or the humeral head only (fig. 4-B) or affect both the glenoid and the humeral head (fig. 5-A) or no GHBL at all (fig. 5-B).

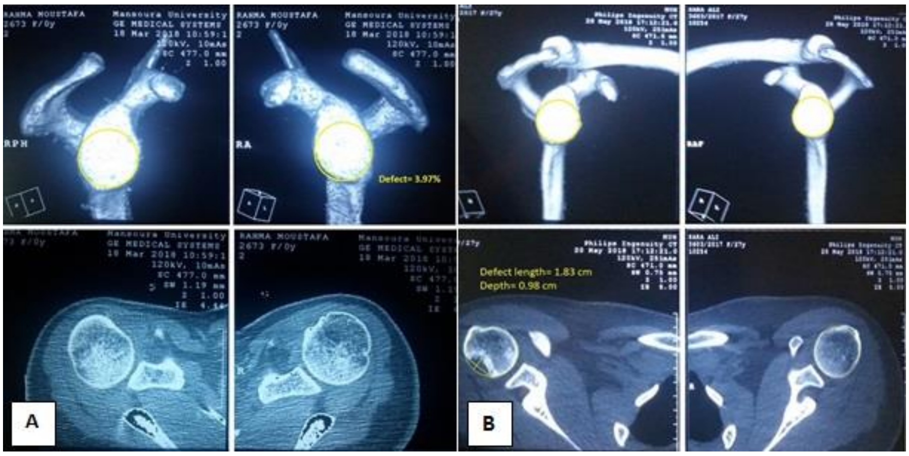

Fig 4-A: CT female patient 17 years who was student had no special habits or history of epileptic fits. She did not practice contact sports. She had left (non-dominant side) ASI with 3 episodes of dislocation. The view shows GBD of 3. 97% and shows no Hill- Sachs lesion.
Fig. 4-B: CT scan view of a female patient, 27 years who was housewife, had no special habits and did not practice contact sports. She was epileptic. She had right ASI (dominant side) with 2 episodes of dislocation. The view shows no glenoid defect but Hill- Sachs lesion of 1.83 cm width and 0.98 cm depth.

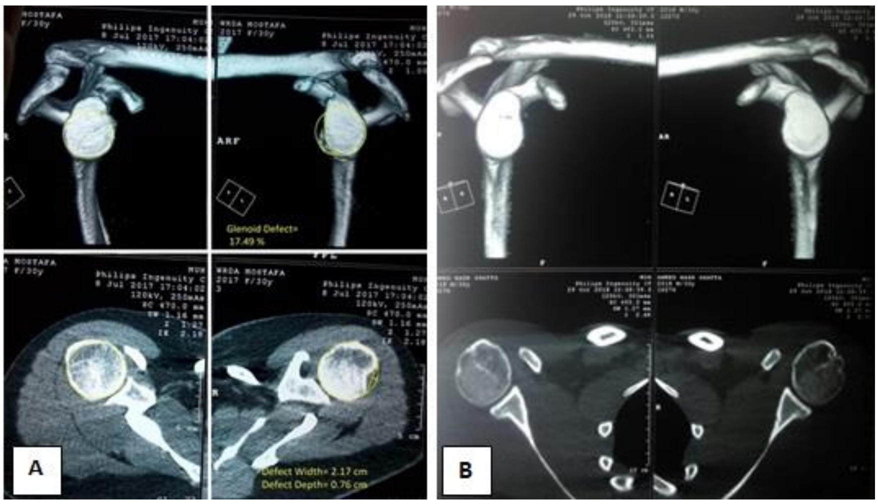

Fig 5-A: CT scan view of a female patient 36 years old who was a housewife, had no relevant special habits or history of epileptic fits. She did not practice contact sports. She had left (non-dominant side) ASI with 3 episodes of dislocation. The view shows GBD of 17.49% and Hill-Sachs lesion of 2.17 cm width and 0.76 cm depth.
Fig 5-B: CT scan view of a male patient 30 years old who was a manual worker, had no special habits or epileptic fits. He did not practice contact sports. He had right (dominant side) ASI with 10 episodes of dislocation. The view shows no GBD or Hill- Sachs lesion.

The data showed that 2 patients had isolated glenoid defect, 4 patients had isolated humeral head defect, 51 patients had bipolar lesions and 3 patients were found without any bony defects. The overall bony defects were found in 57 patients, the glenoid defect was found in 53 patients and the Hill-Sachs lesion was found in 55 patients (Tab. 1).

The measurements and types of GHBL were collected. Glenoid defect was measured using Pico method and was found to be either erosion type or fragment type, while humeral head defect length and depth was measured using 2D axial CT. The median glenoid defect size was 9.28% with the type of glenoid defect as erosion type in 25 patients and fragment type (bony Bankart) in 28 patients. On the other side, the median humeral defect length was 2.1 cm and the median depth was 0.6 cm (Tab. 1).

3.2 Correlation between significant risk factors and GBL (Tab. 2)

The measurements of the glenoid and humeral bone loss size were plotted against all the above proposed risk factors as well as against each other using Spearman bivariate correlations and the significant correlations were reported. A significant correlation was found between some risk factors and the presence of glenoid bone loss, large glenoid defects, critical glenoid loss and humeral head defect length and depth. A highly significant correlation was found between the glenoid defect and humeral head bone loss.

The presence of glenoid bone loss was found to be significantly correlated with the number of dislocations (P value: 0.023), contact sports (P value: 0.002) and these patients had higher ISIS score (P value: 0.001) using linear regression and variance inflation factor. The size of glenoid defect was found to be significantly correlated with the number of dislocations (P value: 0.001) and the age at 1st dislocation (P value: 0.028) using Spearman co-efficient. Smoking was another but weak risk factor for large glenoid defects (P value: 0.050) (Tab. 2).

Table 2: Correlation between the significant risk factors and GBL

GBL		
Significant risk factors	**Variance inflation factor**	**P value**
1. number of dislocations	1.614	0.023
2. contact sports	3.4	0.002
3. ISIS	2.6	0.001
GBL size		
Significant risk factors	Spearman co-efficient	P value
1. number of dislocations	+ 0.418	0.001
2. age at first dislocation	+ 0.145	0.028
3. Smoking	+ 0.259	0.050
4. ISIS	+ 0.261	0.050
Critical GBL		
Significant risk factors	Spearman co-efficient	P value
• age at 1st dislocation	-0.493	0.32
age at 1st dislocation ≤ 20 years	1	Nil
age at 1st dislocation >20 years	-0.211	0.8

The presence of critical GBL was evaluated in the study population. The critical defect cut-off value was considered to be 20% [13], which was observed in 6 patients. Younger age of 1st dislocation (< 20 years) was the absolute risk factor for critical glenoid bone loss of 20% (P value: Nil). The studied clinical scores showed no significant correlation with the GHBL with the exception of ISIS score that was significantly correlated with glenoid defect size (P value: 0.050) (Tab. 2).

3.3 Correlation between significant risk factors and Hill-Sachs lesion (Tab. 3)

Correlation between *humeral head defect size* and the hypothesized risk factors were evaluated as well. Number of dislocation was a significant risk factor for longer and deeper defects (P value: 0.002 and 0.004 respectively).

Table 3: Correlation between the significant risk factors and Hill-Sachs lesion

Hill-Sachs lesion size		
Defect Length	**Spearman co-efficient**	**P value**
number of dislocations	+ 0.408	0.002
age at first dislocation	-0.139	0.31
age at 1st ≤ 20 years	0.329	0.1
age at 1st >20 years	-0.491	0.006
Smoking	+ 0.284	0.034
Defect Depth	Spearman co-efficient	P value
number of dislocations	+ 0.380	0.004
age at first dislocation	-0.141	0.3
age at 1st ≤ 20 years	0.371	0.05
age at 1st >20 years	-0.344	0.05
contact sport	+ 0.385	0.003
GBL and Hill-Sachs lesion sizes		
GBL and Hill-Sachs lesion sizes	Spearman co-efficient	P value
glenoid and humeral defect length	+ 0.521	< 0.0001
glenoid and humeral defect depth	+ 0.404	0.002
humeral length and depth	+ 0.540	< 0.0001

Contact sports were significant risk factors for deeper humeral defects (P value: 0.003) and smoking was a predictor of longer defects (P value 0.034). On the contrary, age at 1st dislocation >20 years showed a negative correlation against larger Hill-Sachs lesions.

The glenoid and humeral head bone loss showed highly significant correlation between each other, that the presence of a larger glenoid defect was associated with the presence of a significant humeral defect (whether length or depth) and vice versa (Tab. 3).

3.4 Effect of risk factors on GHBL in the study population (Tab. 4)

The study population was further divided into 4 pairs of groups according to the significant risk factors that were concluded from the Spearman bivariate correlations. The effect of these risk factors on the outcome measures of the study was studied. Mann-Whitney and Chi-squared tests, depending on the type of data, were used to assess if there is significant statistical difference between each two groups regarding the outcome measures of GHBL.

3.4.1 Number of dislocation

Comparison between patients who had > 5 dislocations and those having < 5 dislocations was done regarding the outcome measures of the study. The 1st group, >5 dislocations, developed larger glenoid defects and longer Hill-Sachs lesions, while there was no statistical difference regarding critical glenoid defect and humeral defect depth.

3.4.2 Age at 1st dislocation

The study divided population into two groups regarding the age at 1st dislocation whether more than or less than 20 years and a comparison was done between the 2 groups. In the study, there was no significant statistical difference between those who were older or younger than 20 years at 1st dislocation regarding the outcome measures of the study when using the Mann-Whitney and Chi-squared tests.

3.4.3 Smoking

Another comparison was done between smokers and non-smokers and the results were reported. The smokers showed higher risk of developing larger glenoid defects (P value: 0.05) and longer Hill-Sachs lesion (P value: 0.035) compared to non-smokers, while there was no difference regarding presence of glenoid defect, critical glenoid loss and humeral defect depth.

3.4.4 Contact/overhead sports

The study population was divided into two groups according to the type of sports; those who practice contact sports and those who do not. Players of contact/overhead sports showed deeper Hill-Sachs lesion than those who did not practice these kinds of sports. There was no statistical difference as regard the other outcome measures.

Table 4: Effect of risk factors on GHBL

number of dislocation	**≤ 5 (n: 28)**	**> 5 (n: 32)**	**Test value**	**P value**
Presence of GBL	75% (21)	97% (31)	X= 5.7	0.017
Glenoid defect size	4.5	9.5	Z= 2.5	0.012
Critical glenoid bone loss	4%	4.5%	X= 2	0.16
Humeral defect length (cm)	1.9	2.2	Z= 2.5	0.012
Humeral defect depth(cm)	0.5	0.7	Z= 2.5	0.57
age at 1st dislocation	**≤ 20 (n; 26)**	**> 20 (n: 34)**	**Test value**	**P value**
Presence of GBL	96% (25)	82% (28)	X= 3.2	0.08
Glenoid defect size	8.4	7.9	Z= 0.7	0.49
Critical glenoid bone loss	8% (2)	12% (4)	X= 0.41	0.52
Humeral defect length (cm)	2.1	2	Z= 2.5	0.57
Humeral defect depth (cm)	0.7	0.6	Z= 0.76	0.45
smoking	**No Smoking (n: 30)**	**Smoking (n: 27)**	**Test value**	**P value**
presence of GBL	87% (26)	89% (24)	X= 0.07	0.8
glenoid defect size	10 ± 7.5	9.3 ± 8.6	Z= 1.9	0.05
Critical glenoid bone loss	3% (1)	19% (5)	X= 3.5	0.06
humeral defect length (cm)	1.9	2.1	Z= 2	0.035
humeral defect depth (cm)	0.5	0.7	Z= 1.7	0.09
contact/ overhead sports	**No contact (n: 50)**	**Contact (n: 10)**	**Test value**	**P value**
Presence of GBL	88% (44)	80% (8)	X= 0.7	0.41
Glenoid defect size	7.9	8.4	Z= 0.4	0.68
Critical glenoid bone loss	10%	0%	X= 1.2	0.28
Humeral defect length (cm)	2	1.9	Z= 0.2	0.83
Humeral defect depth (cm)	0.7	0.4	Z= 2.9	0.004

4. Discussion

GHBL in patients with ASI is an important but highly debatable topic. Arthroscopic soft tissue repair only may be associated with high failure rate in the presence of bony deficiencies [6]. So, the meticulous pre-operative assessment then management of significant bony defects is important to avoid recurrent instability.

There are many studies in the literature that concluded accurate methods for quantifying GHBL and as well as setting a cut-off value. Griffith *et al*. 2008 reported the overall incidence of GBL in ASI to be 71% with the incidence after single dislocation to be 41% rising to 86% in recurrent dislocations [3]. Milano *et al*.2011 reported GBL in 72% of their study population [12].

The Hill-Sachs lesions were reported to have higher incidence than glenoid defects. Kim *et al*. 2010 detected Hill-Sachs lesion in 94.5% of patients with recurrent ASI [14], while Yiannakopoulos *et al*. 2007 detected Hill-Sachs lesion in 93.26% of patients with recurrent instability [5].

In the present study, the GBL was detected in 88% of the patients included. Meanwhile, the Hill-Sachs lesion was present in 92% of the study population. The higher incidence of glenoid defects than reported in the literature was due to that fact that 95% of patients included in the present study had recurrent instability.

As regard the size of the GHBL, Gottschalk *et al*. 2017 reported that the mean glenoid defect size in ASI to be 10.8% (4.8% to 14.9%) [15]. Saito *et al*. 2009 studied the Hill-Sachs lesion and reported the average width to be 22 ± 6 mm and the average depth to be 5.0 ± 4.0 mm [16].

In the present study, the median glenoid defect size was 9.28% (2.69% to 36%) and the Hill-Sachs lesion median defect width was 21 mm and the median depth was 6 mm. These findings are close to that reported in the literature.

There are scarce studies in the literature that determine the risk factors for occurrence GHBL in ASI. The determination of these risk factors is a guide when to do radiological survey, as it is quite unpractical to do radiological survey to every case with gleno-humeral instability. The radiological survey to assess bony defects is expensive and carries the risk of radiation exposure.
Milano *et al*. 2011 studied the association between GBL detected on CT scans and some proposed risk factors in ASI, but they did not evaluate risk factors for Hill-Sachs lesion. They reported that increasing number of dislocations was the strongest predictor for the presence of GBL in recurrent cases. They also reported that contact sports and male sex to be other risk factors with a weaker effect [12].
The present study is designed to detect and analyze the risk factors for GBL as well Hill-Sachs lesion in traumatic ASI. The number of dislocations was the key risk factor for the presence of glenoid defects and the contact sports to be another factor. On the contrary, the male sex had no significant correlation with the presence of glenoid defect.
Another study by Griffith *et al*. 2003 reported a significant relationship between number of dislocation and glenoid defect size [17]. Although number of dislocation was found to be highly influential on glenoid defect size, it is not the only indicator for a large glenoid defect. Griffith *et al*. 2008 detected a modest correlation between frequency of dislocation and severity of glenoid defect [3]. They reported that some of their patients with single or few dislocations had severe glenoid loss.
In the present study, increasing number of dislocation was the most influential risk factor for larger glenoid defects. This can be explained with the fact that increasing number of dislocations and GHBL together represents a vicious circle, where the repetition of dislocation represents further injury to the gleno-humeral articulation resulting in enlarging the bony defect, which by turn will permit further instability.
In the present study, *5* episodes of dislocation were used as an approximate number over which significant glenoid defect may occur. The difference between patients who had ≤ 5 dislocations and those who had >5 episodes was investigated. There was a significant rise in the glenoid defect size and humeral defect length after 5 times dislocation.
Although 5 dislocations seems to be a small number especially when keeping in mind that many patients have uncountable dislocations, this may be explained by the fact that bone loss will proceed more quickly initially through the thinner, peripheral parts of the glenoid and then more slowly through the thicker, central parts of the glenoid [3]. However, some patients in this study with large defects had few attacks of dislocation.
Milano *et al*. 2011 concluded that age at first dislocation and numbers of dislocations were significant predictors of a *critical glenoid defect* (20% or more) [12]. Yiannakopoulos *et al*. 2007 and Kim *et al*. 2010 in two separate studies found that patients with recurrent instability were at much higher risk of having an inverted pear glenoid, which indicates a bone loss >25%, compared to those with single dislocation [5, 14].
In the present study, young age at first dislocation (≤ 20 years) was the absolute risk factor for critical glenoid defect to occur. This finding can be justified that in the young and skeletally immature patients the initial trauma would cause more damage to the already thin peripheral glenoid rim.
Regarding Hill-Sachs lesions, in the present study, the most important predictor for larger defects was number of dislocation, which affected both length and depth of the lesion. Furthermore, contact sports practitioner and those ≤ 20 years at 1st dislocation had higher risk for deeper lesions. On the contrary, older age at 1st dislocation (>20 years) showed to have a significant negative correlation against large Hill-Sachs lesions.
One of the most important findings of the present study is that glenoid and humeral defect sizes were highly correlated to each other. This finding has its practical application, that the glenoid should be investigated carefully for significant bony defects using CT scan when a large humeral head defect is detected (which can be seen easily on x-ray). Thus, Hill-Sachs lesion can be used as a simple indicator for glenoid defects.
The previous results can be interpreted according to the hypothesis that natural course of *the unstable shoulder* tends toward a progressive GHBL. This can be caused by trauma and disturbed joint mechanics, with progressive bone erosion as a result of the increased contact forces at the antero-inferior glenoid [12]. This could explain the association between the glenoid bone loss not only with number of dislocations, but also with the duration of the disease (age at first dislocation) and physical activities involving repetitive use of the shoulder (manual work and contact sports).
Shaha *et al*. 2015 in an attempt to link the glenoid bone loss with patient function conducted a study to redefine the word “critical” regarding the functional outcomes [18]. They concluded that glenoid loss above 13.5% led to a clinically significant decrease in WOSI scores consistent with a poor functional outcome after soft tissue surgery even if the patient had no recurrence of dislocation.
On the contrary, the present study did not show any statistical correlation between patient function and GHBL. This result was the same whether when assessing patient function using a totally subjective patient-reported instability score (OSIS) or using a general shoulder score combing both objective and subjective assessment (Constant score).
This conflict between our result and that reported by Shaha *et al*. 2015 can be attributed to the difference in the study population between both studies. Shaha e al. 2015 conducted their study in a US military institution where the patient population was active duty military personnel and had an obligatory high demand of heavy occupational activity, in contrast to our study patients who were all civilians with the ability to adapt or limit their daily activity as needed [18].
This finding has its unique, yet serious, importance in the practical field. Patient functional scores may carry a concealed risk of misdiagnosis if used to decide whether the patient has significant bony defect or not. A sedentary patient may have a good subjective score combined with a significant bony defect, whereas a manual worker, would complain if any of his heavy daily activates is affected even if he has minor bone loss. In the present study, the ISIS score was found to be correlated with glenoid defect size. This was expected as the presence of significant glenoid defect represents part of the ISIS scoring system.

5. Conclusion
the number of dislocations, young age at 1st dislocation, contact sports and smoking are considered risk factors and predictors for gleno-humeral bone loss in traumatic anterior shoulder instability.

Disclosure: the authors reported that there is no any conflict of interest.

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