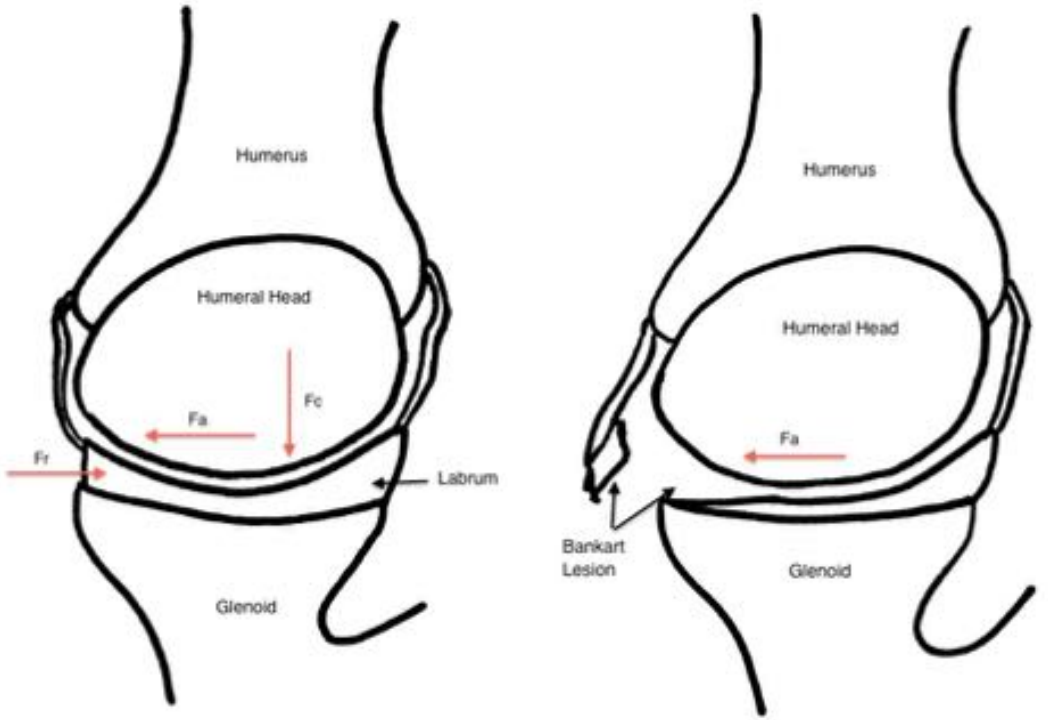


Figure 1-7. Glenohumeral Joint Concavity-Compression Effect.

Failed Bankart and Bone loss

The relationship between bone loss and failure of Bankart repair was first noted in a 1978 report by Rowe and colleagues.

Burkhart and DeBeer demonstrated that isolated arthroscopic Bankart repair has a significantly higher failure rate in the setting of anterior bone loss in contact athletes.

Traumatic Glenohumeral Bone Defects and Their Relationship to Failure of Arthroscopic Bankart Repairs: Significance of the Inverted-Pear Glenoid and the Humeral Engaging Hill-Sachs Lesion

Stephen S. Burkhart, M.D., and Joe F. De Beer, M.D.

Instability Severity Index Score

JBJS 2007

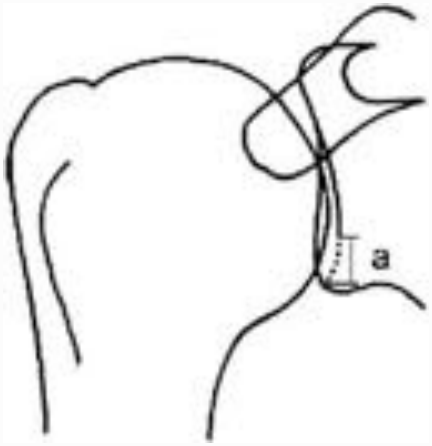
Boileau et al. stated that there is no simple method to identify patients in whom recurrent instability will develop after arthroscopic Bankart.

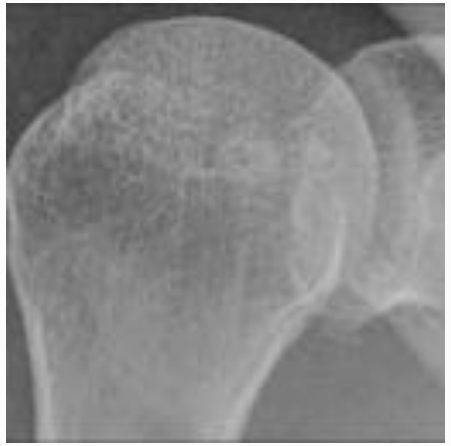
The following risk factors were identified:

1. Patient age under 20 years at the time of surgery;
2. Involvement in competitive or contact sports or those involving forced overhead activity;
3. Shoulder hyperlaxity;
4. A Hill-Sachs lesion present on an anteroposterior radiograph of the shoulder in external rotation and/or
5. Loss of the sclerotic inferior glenoid contour.

20º

80º





Instability severity index score is based on a pre-operative **Questionnaire, Clinical examination, and Radiographs**

Prognostic factors	Points
Age at surgery (yrs)	
≤ 20	2
> 20	0
Degree of sport participation (pre-operative)	
Competitive	2
Recreational or none	0
Type of sport (pre-operative)	
Contact or forced overhead	1
Other	0
Shoulder hyperlaxity	
Shoulder hyperlaxity (anterior or inferior)	1
Normal laxity	0
Hill-Sachs on AP* radiograph	
Visible in external rotation	2
Not visible in external rotation	0
Glenoid loss of contour on AP radiograph	
Loss of contour	2
No lesion	0
•	Total (points) 10

Instability Severity Index Score

IMPLICATIONS

Patients with a score of 6 points or less have an acceptable recurrence risk of 10%, and are therefore potentially good candidates for Bankarts repair.

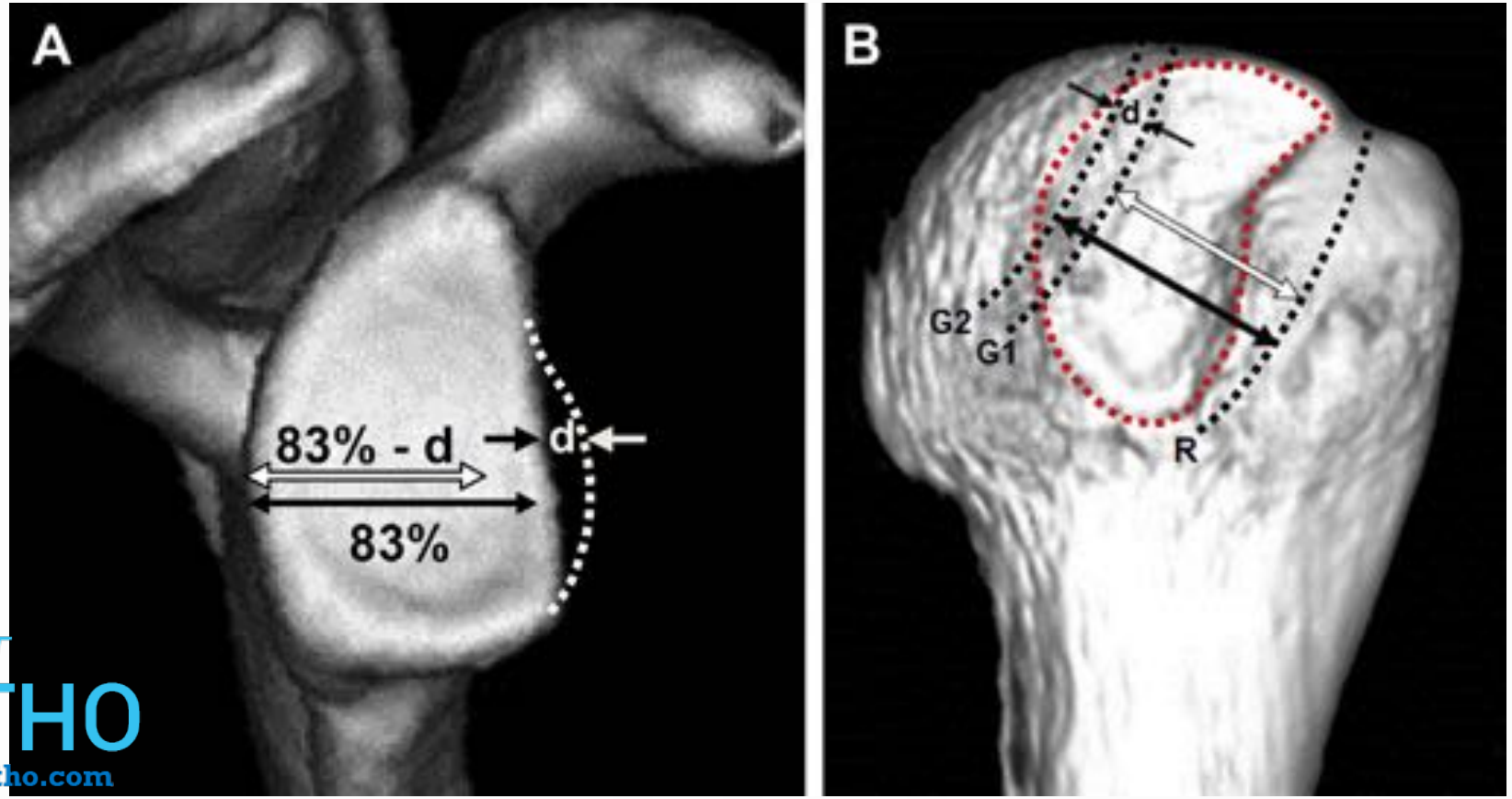
By contrast, those patients with > 6 have an unacceptable recurrence risk of 70% and should be advised to undergo bony procedures (e.g. Latarjet procedure).

Ignored in the Scoring

- Location of bone loss
- Quantification of bone loss

Glenoid Track Instability Management Score

Incorporates glenoid track concept into ISIS !



MANAGEMENT OF BONE LOSS IN **COMPLEX** SHOULDER INSTABILITY

TARGET ORTHO

Rx of Glenoid Bone Loss

Bony procedures

- Bristow/ Latarjet procedure
- Iliac crest bone grafting (Eden-Hybinette)
- Allograft reconstruction of glenoid

Helfet (1958) described the Bristow procedure, where the tip of the coracoid was osteotomized and transferred to the glenoid neck just medial to the rim.

This procedure was nonanatomic and largely relied on the glenohumeral restraint offered by the sling effect of the coracobrachialis with the arm in abduction and external rotation.

Michel Latarjet, 1954

The Latarjet procedure, on the other hand, requires removal of a much larger portion of the coracoid (2-3 cm) with transfer along its long axis to the anteroinferior glenoid neck . This allows for the sling effect provided by the coracobrachialis but also attempts to reconstruct the osseous anatomy of the glenoid

Three processes work together to improve anterior shoulder stability.

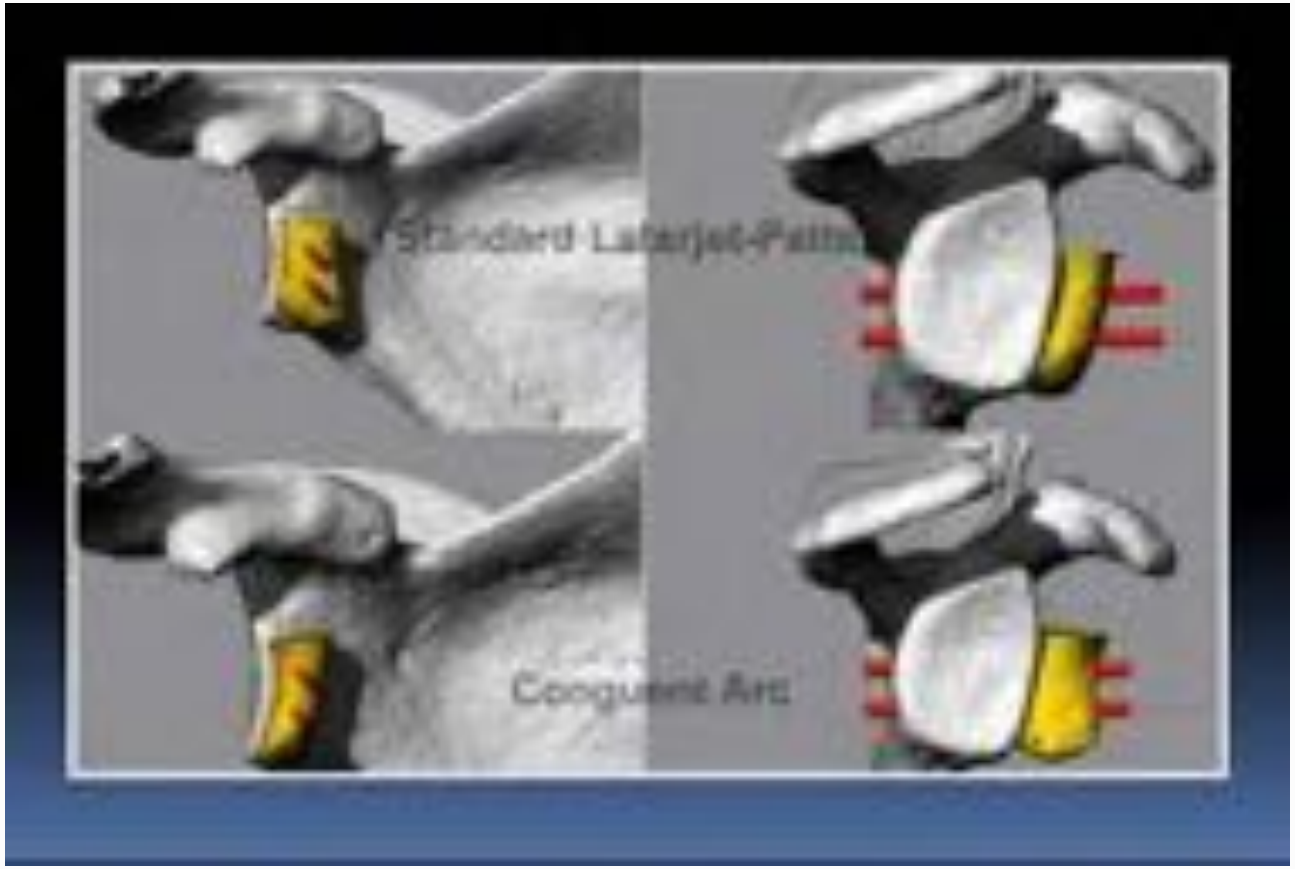
Patte

1.The osseous block serves to extend the glenoid rim and enhances the “safe arc” available for translation prior to dislocation.

2. Second, the conjoined tendon functions as a sling to resist anterior humeral translation when the arm is abducted and externally rotated.

3. Finally, the transferred coracoid and conjoined tendon over the lower subscapularis tendon create a tenodesis effect that reinforces a deficient anteroinferior aspect of the capsule.

CONGRUENT ARC LATARJET



The rate of recurrent instability after a Latarjet procedure is reported to be around 1 %.

Overall complication rate in the open Latarjet procedure of 15 %.

Meticulous surgical technique and a good understanding of the local anatomy help reduce the complications of the Latarjet procedure.

LATARJET THE GOLD STANDARD

Screws directed towards scapular spine

- Vessel or Nerve injury: Suprascapular > Axillary > Musculocutaneous

Delayed at times

- Graft fracture/ Screw breakage
- Osteolysis/ Non union (2-9%)

Superior osteolysis

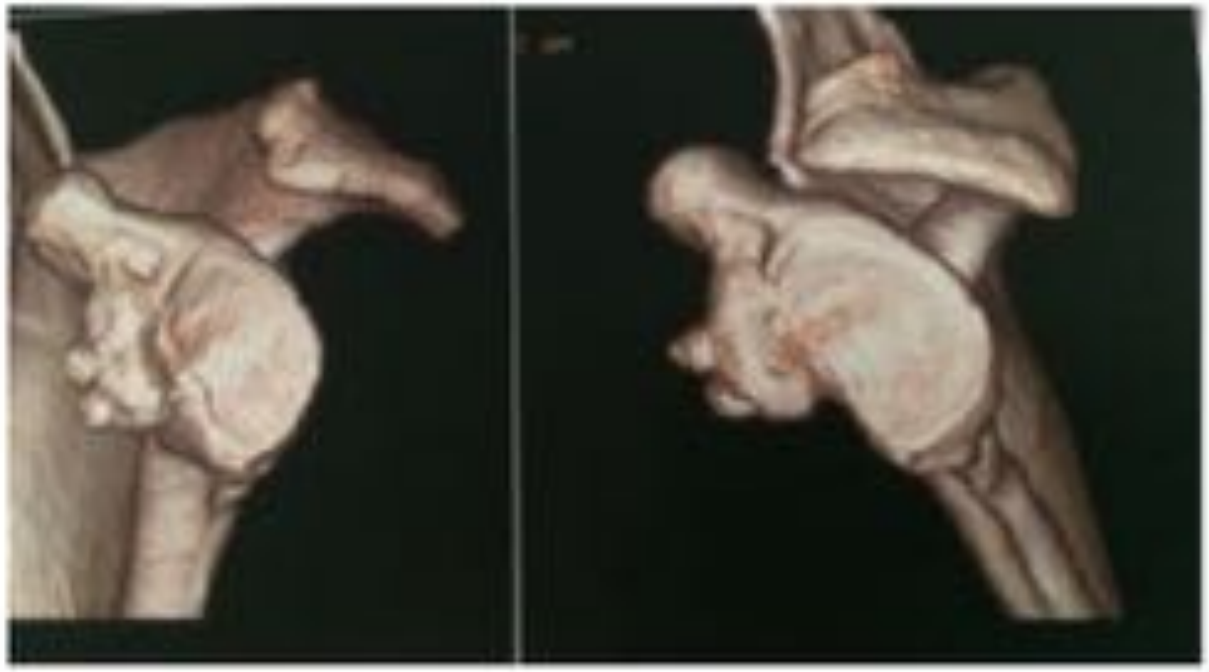
Massive osteolysis

- **Causative factor**: Decortication of under surface of coracoid as well as the anterior inferior glenoid rim!
- Two screws should be placed parallel to the glenoid face to minimize the risk of nonunion.

GRAFT MALPOSITION

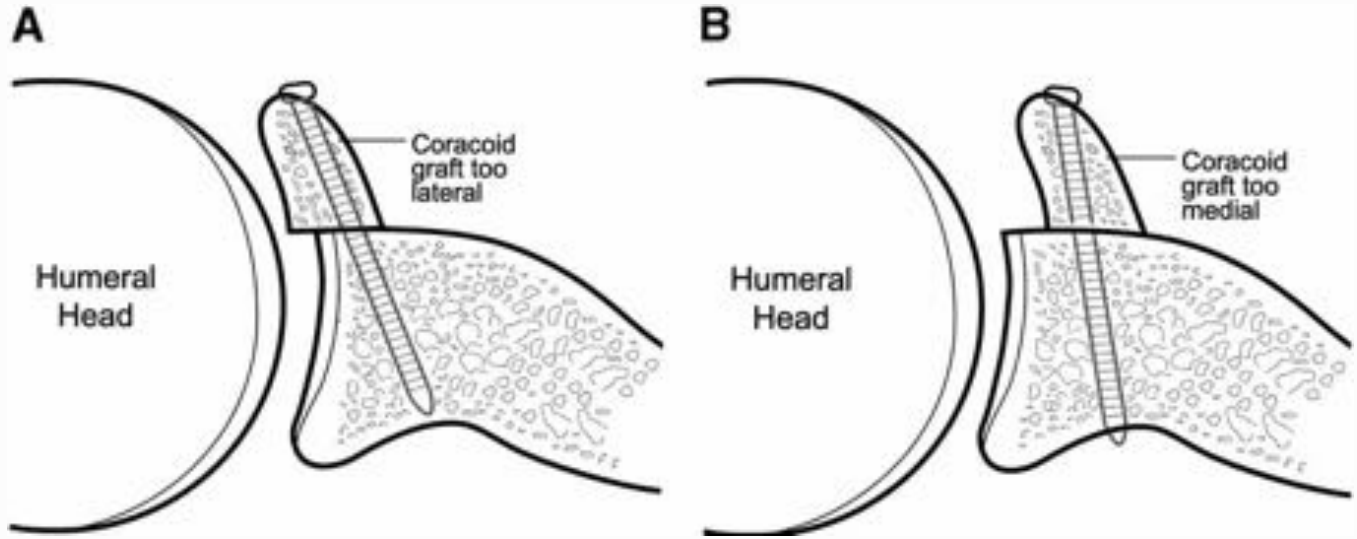
TOO LOW

TOO HIGH



Biomechanical study, Ghodadra et al.

Grafts placed 2 mm medial to the glenoid face led to increased edge loading and grafts placed 2 mm lateral to the glenoid face resulted in an increased shift of contact pressure to the posterosuperior quadrant of the glenoid.



Screws distance – 7.8+/- 1.9mm

Graft position: 2 o'clock and 5 o'clock position (right shoulder)

Arthroscopic Latarjet

Because an arthroscope is used, the procedure allows excellent visualization of the coracoid graft's position, thereby decreasing the risk of anterior bone-block overhang.

First described by Lafosse et al.,

The arthroscopic Latarjet procedure consists of five stages:

- exposure,
- coracoid preparation,
- coracoid drilling and osteotomy,
- coracoid transfer,
- and finally fixation of graft.

Arthroscopic Latarjet

RESULTS

In a prospective review of 100 consecutive shoulders that had undergone an all arthroscopic Latarjet procedure, Lafosse and Boyle noted excellent scores in 91% of those followed at 26 months.

Computed tomography imaging demonstrated that 80% of the patients had a coracoid graft that was placed flush, 8% had a graft that was too medial, and 12% had a graft that had lateral overhang.

It is notable that 69% of the patients had no arthrosis at the time of final follow-up.

Iliac Crest Bone Grafting [ICBG]

May result in a better articular arc match than the coracoid transfer; this is due to the anatomic orientation of the iliac crest graft, which allows the inner table of the iliac crest to become congruent with the glenoid surface.

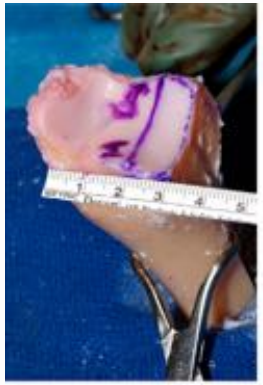
The inner table of the iliac wing is concave and fits the native glenoid curvature well.

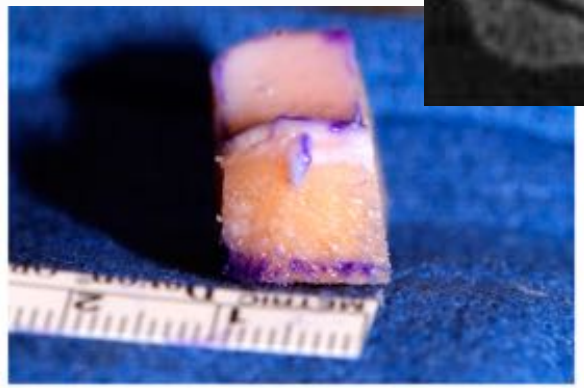
The iliac crest bone graft is especially helpful in patients with extensive glenoid bone deficiency as the iliac crest provides an adequate supply of bone to reconstruct large defects.

Reports there on use of Distal clavicle autograft also!!

ALLOGRAFT RECONSTRUCTION (Distal Tibial Allografts)

The lateral aspect of the distal tibial allograft is an excellent fit for the glenoid, providing a nearly anatomic match of the radius of curvature, glenoid and tibial cartilage thickness, and dense corticocancellous weight bearing bone.





A B

Concerns

- decreased healing
- increased resorption arises when an allograft bone is used

C D

Algorithm: Glenoid Bone Loss

Procedures

- Bone loss < 10%: Ignore (Bankart)
- Bone loss 10-25%: Grey Zone → ISIS
- Bone loss 25-40%: Latarjet > ICBG
- Bone loss > 40%: ICBG/ Allografts

Categories of Glenoid bone loss

- Mild bone loss: less than 15%
- Moderate bone loss: 15%-25%
- Severe bone loss: greater than 25%

Itoi et al. (2000) (33) performed a cadaveric study looking at the stability provided with a standard Bankart repair in the setting of increasing glenoid defects. They found that once a critical defect value of 21% of the width of the glenoid was surpassed, that an isolated Bankart repair was insufficient in restoring stability and that alternative procedures to address the glenoid defect would be required.

Humeral bone loss

The earliest description appeared in 1861 by Flowers, but it was not until 1940 when Hill and Sachs published a concise review that the lesion adopted their names!

Hill and Sachs reported this finding in their classic 1940 article,

"The grooved defect of the humeral head: A frequently unrecognized complication of dislocations of the shoulder joint."

While other authors had previously described this pathology, Hill and Sachs correctly described it as a compression fracture produced by the relatively osteopenic humeral head resting on the dense anterior glenoid.

Franceschi and colleagues proposed a classification based upon surface involvement. Grade I is strictly cartilaginous, grade II has superficial bony scuffing, and grade III lesions are described as a "hatchet fracture."

Flatow and Warner felt that the significance of the lesion is related to the percentage of the articular cartilage involved. They described the following: clinically insignificant involved less than 20% of the articular surface, variably significant had 20% to 40%, and clinically significant were lesions with more than 40% articular involvement

Rx of Glenoid Bone Loss

Five main types of operative procedures are used:

(1) humeral head disimpaction,

(2) osseous/soft tissue transfer procedures (Remplissage),

(3) osseous allograft reconstruction,

(4) rotational osteotomy of the proximal humerus, and

(5) partial or total humeral head arthroplasty.

Humeral Head Dis-impaction/ Humeroplasty

best indicated for defects < 3 to 4 weeks old and involve <40% of the articular surface.

The procedure involves the creation of a cortical window in the mid greater tuberosity just lateral to the bicipital groove and proximal to the location of the axillary nerve.

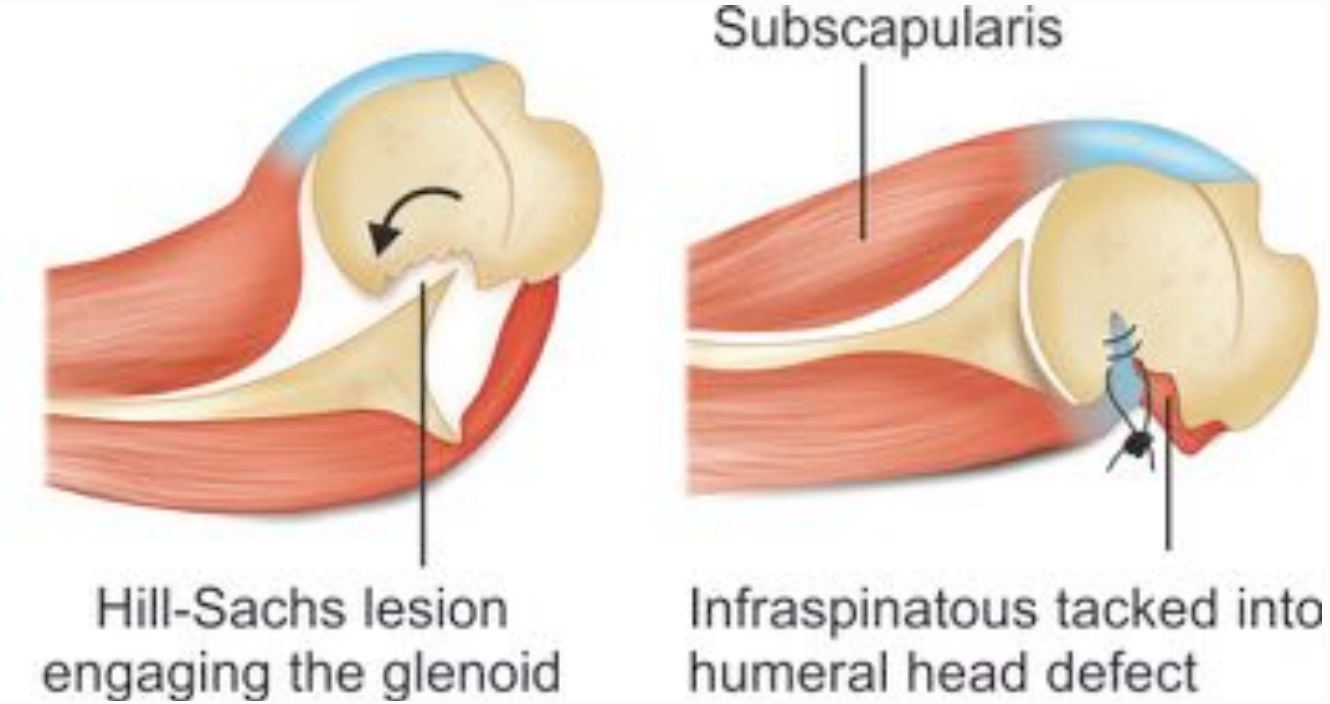
A bone tamp is inserted retrograde and a mallet is used to elevate the impacted column of bone until anatomic reduction is obtained as confirmed by direct visualization and fluoroscopy.

Re and colleagues published on a variation of this technique using an anterior cruciate ligament (ACL) drill guide to localize the lesion, elevated it with retrograde bone tamping, and filled the defect with cancellous bone graft.

Osseous/ Soft tissue transfers

The **Connolly procedure** has been successfully used to fill humeral head defects by converting them into extra-articular lesions.

Originally described in 1972, this open procedure involves transfer of the infraspinatus tendon with a portion of the greater tuberosity into the humeral head defect to successfully fill defects smaller than 40% of the articular surface



REMPLISSAGE

The term “Remplissage”, French for filling, is a surgical technique in which a bony intra-articular defect is converted to an extra-articular defect with soft-tissue coverage, with the goal of preventing engagement.

Originally described by Wolf et al. (2004) the technique involves arthroscopic posterior capsulodesis and infraspinatus tenodesis, with fixation of the tissue to the surface of the Hill-Sachs defect.

In 2009, the technique was modified by Koo et al., who described a double-pulley suture technique in which two anchors were used to insert the infraspinatus tendon into the entire Hill-Sachs defect.

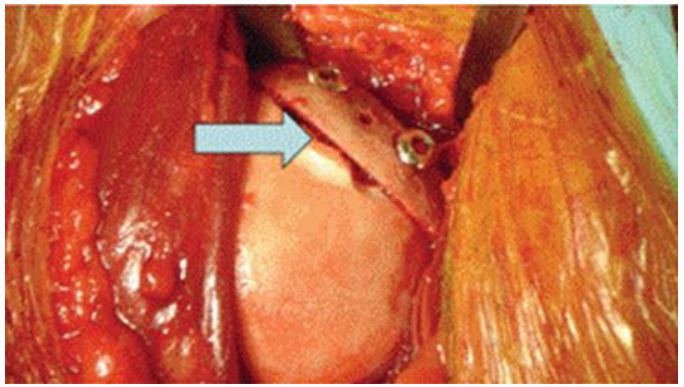
Potential **disadvantages** associated with remplissage are decreased postoperative range of motion and sequelae of a nonanatomic repair construct.

Remplissage Results

In the original article, Purchase and Wolf experienced a 7% (2/ 24) recurrence rate of instability on follow-up, with both occurring secondary to traumatic events, with full restoration of motion. They reported no loss of shoulder motion following this procedure

In 2008, Deutsch and Kroll described a case of significant postoperative loss of external rotation following remplissage

Allograft Reconstruction



The osseous allograft bone plug technique was introduced by Kropf and Sekiya as a novel approach to filling a moderate Hill-Sachs defect .

This procedure has the advantage of being a resurfacing technique that can be performed in stages or at the time of anterior repair

Humeral Rotational Osteotomy

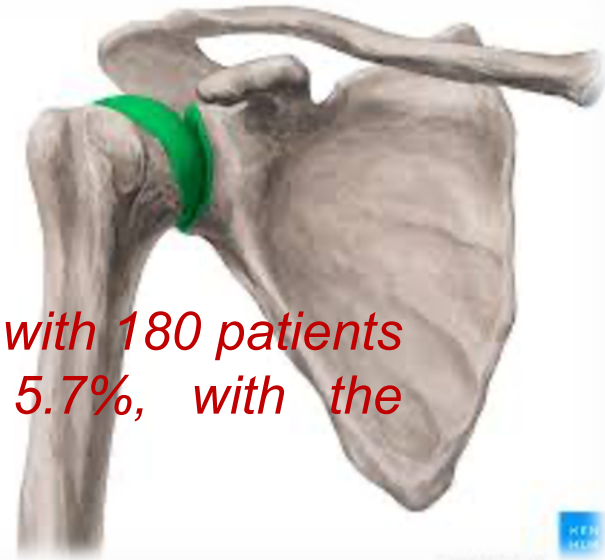
Described to deal with large humeral head defects in younger patients to delay the need for prosthetic replacement.

First described by Weber in 1969.

A standard deltopectoral approach is utilized to expose the proximal humerus and an oscillating saw is then used to complete a transverse osteotomy through the surgical neck.

The humeral head is rotated 25 degrees medially.
The osteotomy is then secured using a plate.

Weber has accounted for a total of 207 of these procedures performed with 180 patients being followed. During this period, the redislocation rate was 5.7%, with the nontraumatic dislocation rate being 1.1%.



Humeral head Resurfacing/ Hemiarthroplasty

Complete humeral head resurfacing or hemiarthroplasty has been described as being indicated in older patients with impression fractures greater than 40% of the articular surface and younger patients with chronic defects and significant articular cartilage degeneration.

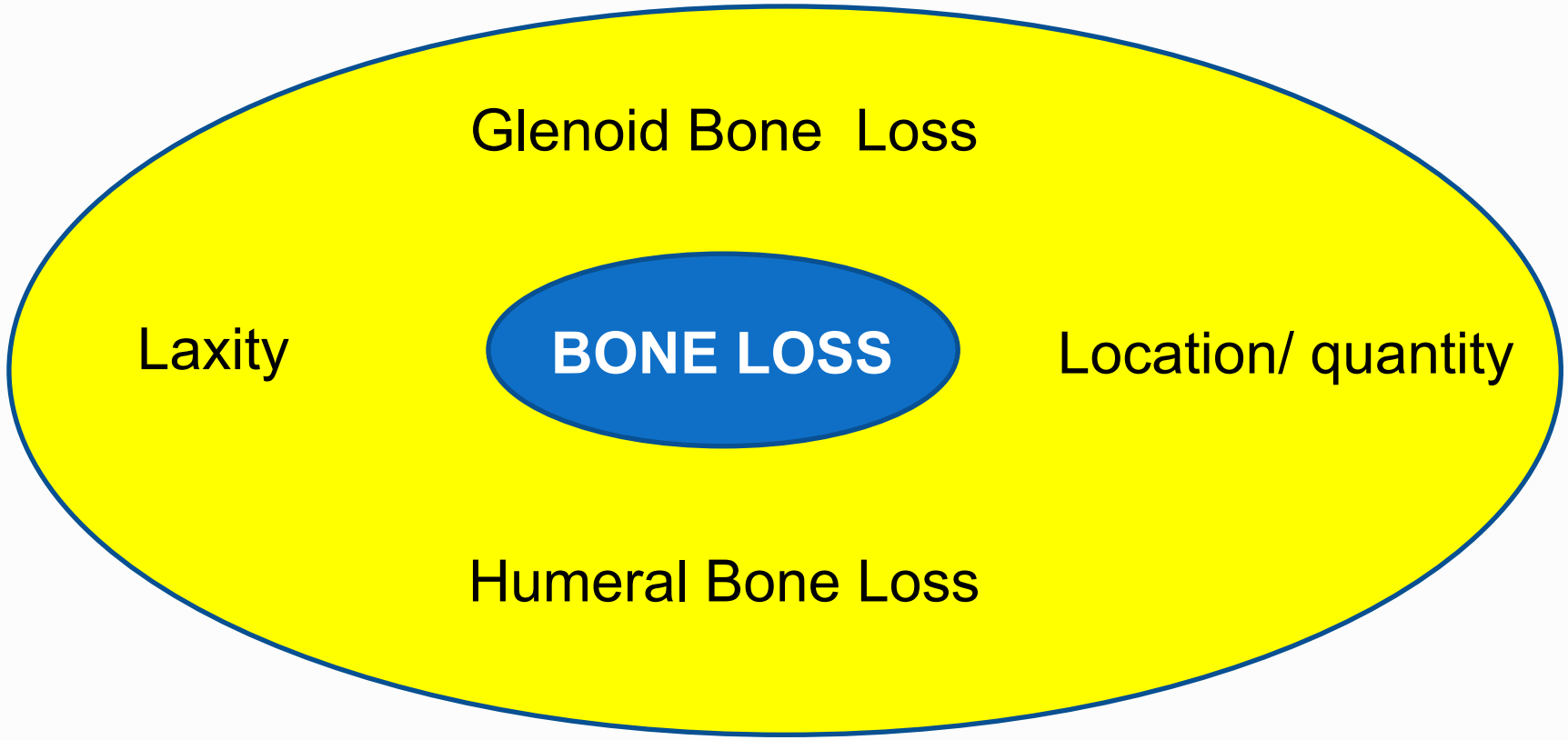
Any residual instability or glenoid articular wear needs to be addressed through either glenoid-sided bone grafting, total shoulder arthroplasty, or soft tissue imbrication.

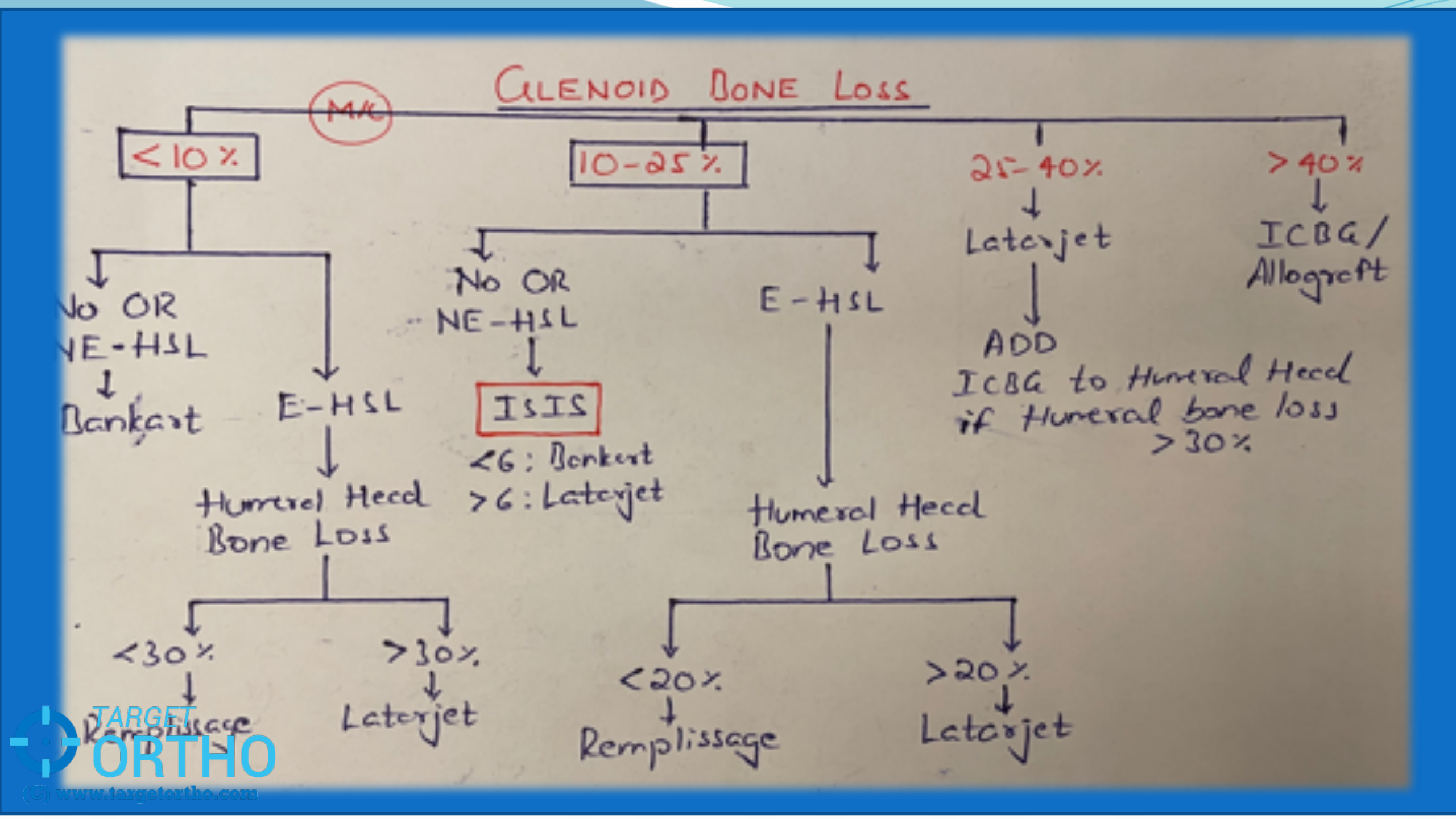
Algorithm: Humeral Bone Loss

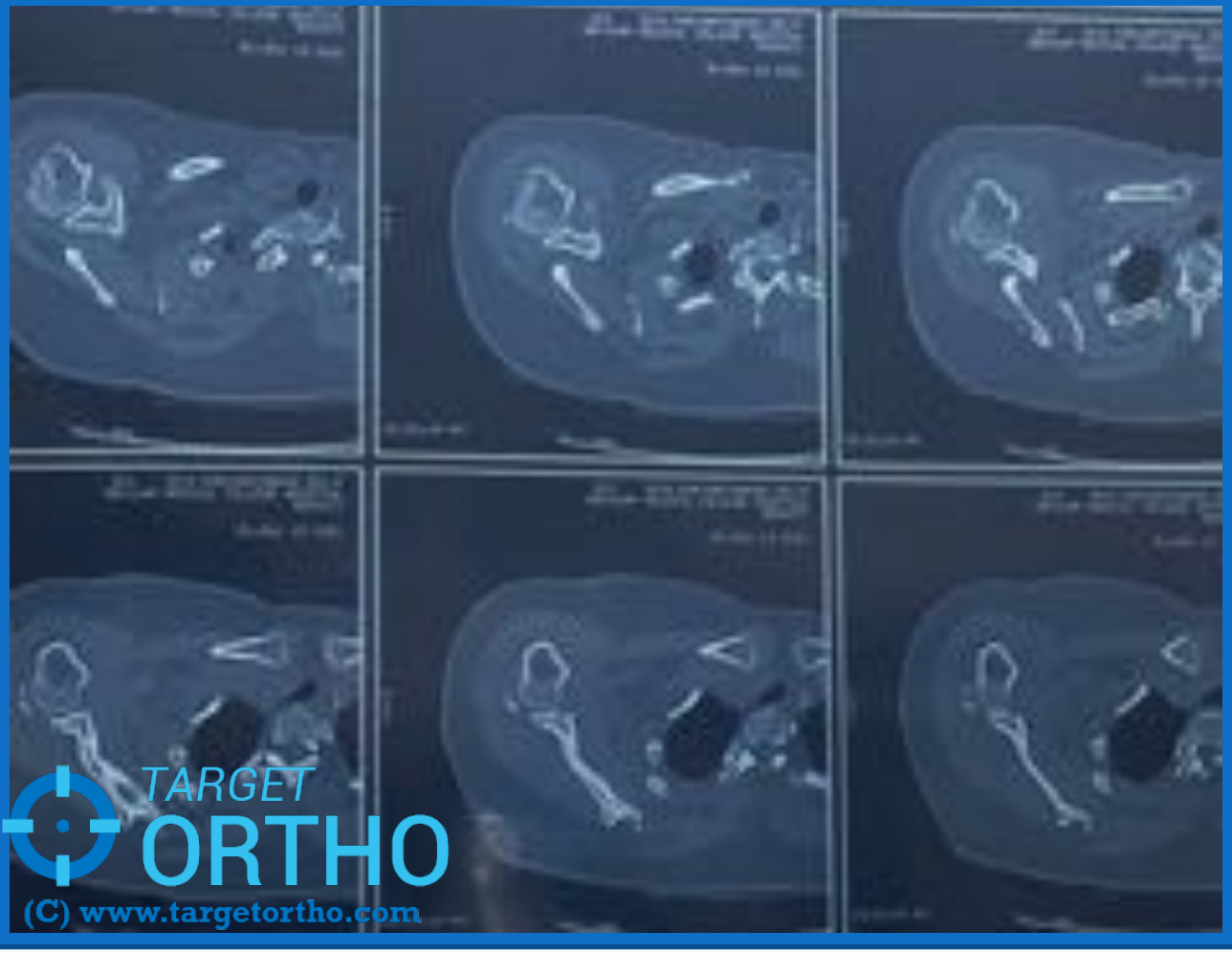
Procedures

- Bone loss < 10%: Ignore (Bankart)
- Bone loss 10-30%: Remplissage
- Bone loss 30-40%: ICBG/ Latarjet
- Bone loss > 40%: Resurfacing

BIPOLAR BONE LOSS







Giovanni Di Giacomo, M.D., Eiji Itoi, M.D., Ph.D., and Stephen S. Burkhart, M.D.

Anterior Instability Categories

Group	*Glenoid Defect*	*Hill-Sachs Lesion*
1	<25%	On track
2	<25%	Off track
3	>25%	On track
4	>25%	Off track

1. Arthroscopic Bankart repair
2. Arthroscopic Bankart repair plus remplissage
3. Latarjet procedure
4. Latarjet procedure with or without humeral-sided procedure (humeral bone graft or remplissage), depending on engagement of Hill-Sachs lesion after Latarjet procedure

THANKS