Evaluating significant bipolar bone loss in anterior shoulder instability

P. D. Afonso, C. Azevedo, A.C. Ângelo

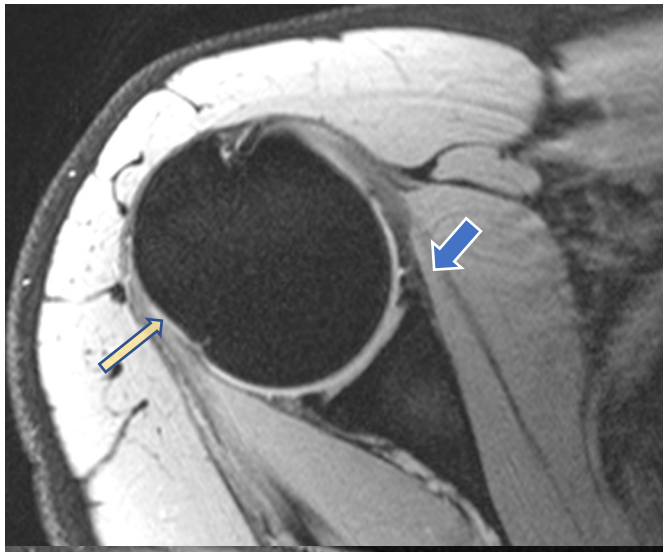
P. Diana Afonso (Radiology)
Hospital Luz Lisboa/Hospital Particular Madeira,
Lisboa, Portugal

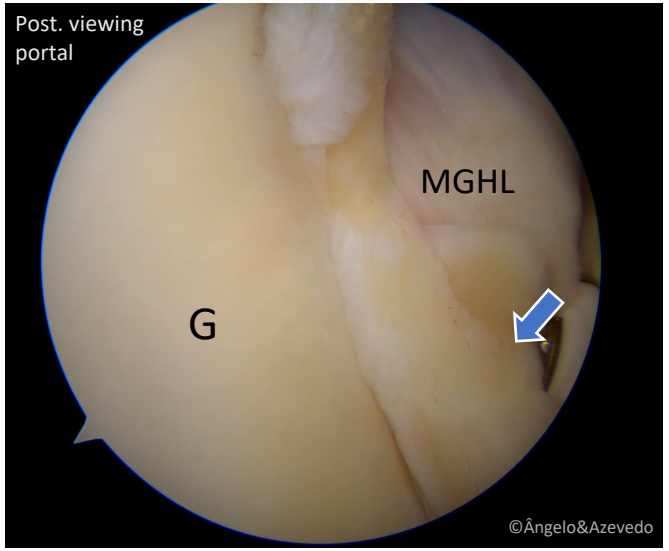
C. Azevedo (Orthopaedic Surgery)
Hospital SAMS / Hospital CUF Tejo
Lisboa, Portugal

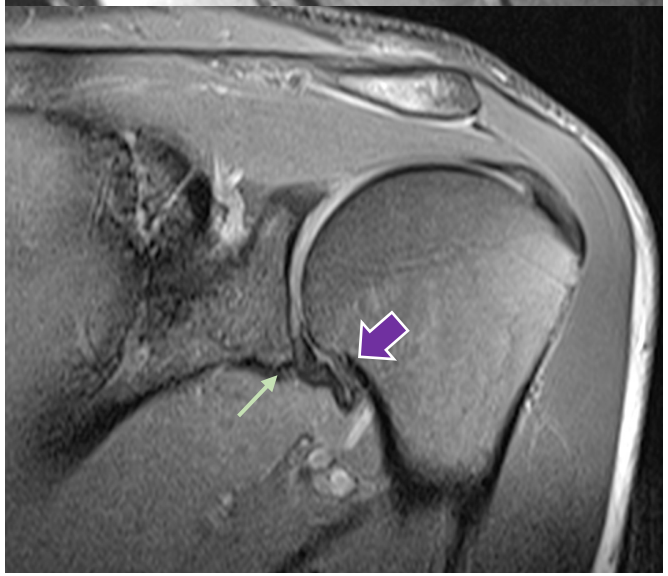
A.C. Ângelo (Orthopaedic Surgery)
Hospital SAMS / Hospital CUF Tejo
Lisboa, Portugal

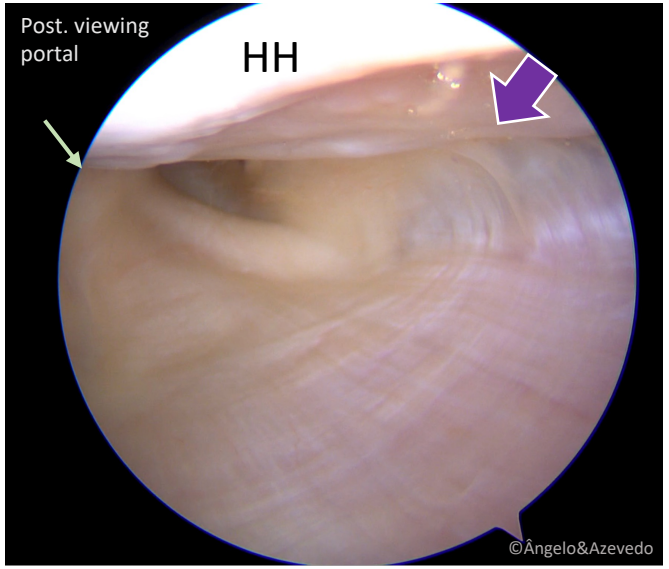
From the ESSR Sports Imaging Subcommittee – Top 5 Tips in Imaging...

Evaluating Significant Bipolar Bone Loss in Anterior Shoulder Instability → **Tip 1: KNOW THE IMPORTANT ANATOMY**









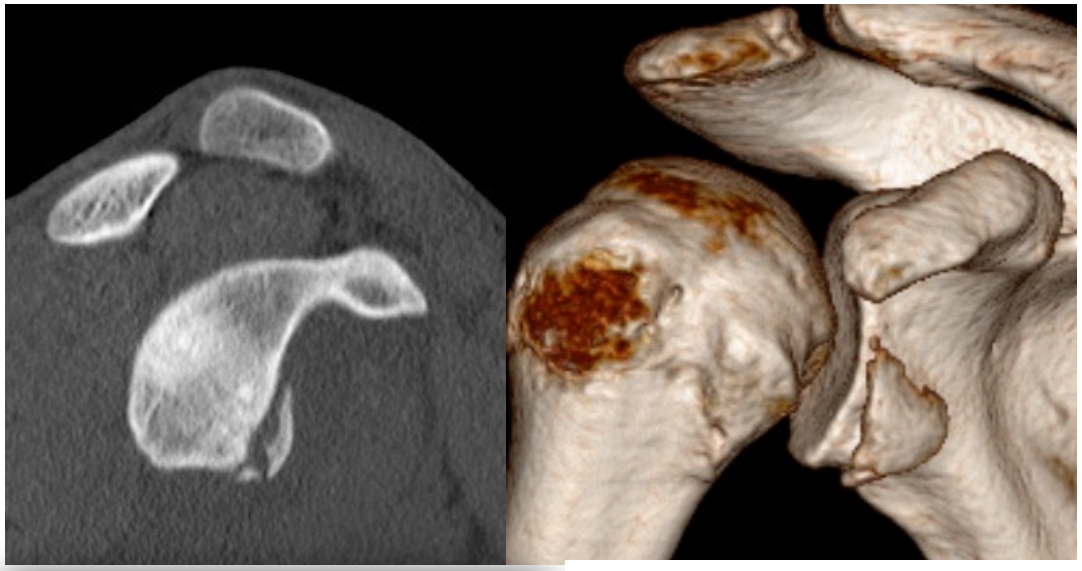
➡	Anteroinferior labral-ligamentous complex (AILLC)
⇨	Bare area and posterior humeral head contour
G	Glenoid
MGHL	Middle Glenohumeral Ligament

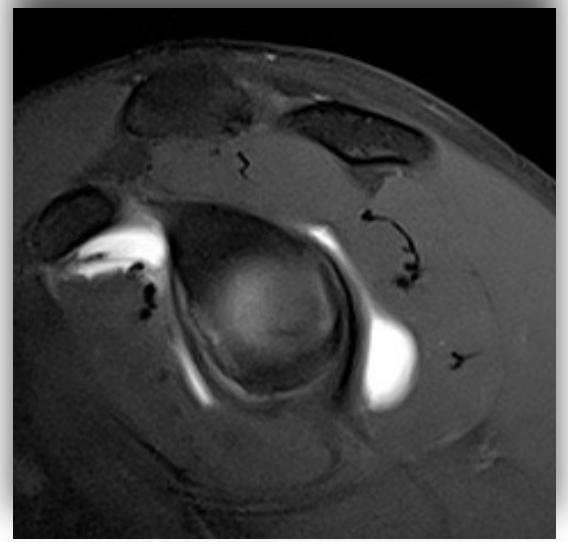
➡	Humeral insertion of the AILLC
→	Glenoid insertion of the AILLC
HH	Humeral Head

From the ESSR Sports Imaging Subcommittee – Top 5 Tips in Imaging...

Evaluating Significant Bipolar Bone Loss in Anterior Shoulder Instability → **Tip 2: KNOW WHICH MODALITY TO CHOOSE**

- MRI (standard or artro) and CT (standard or artro) are all accepted
  - ❑ Literature is heterogeneous
- 3D and 2D imaging are both accurate
  - ❑ 3D better than 2D to measure glenoid bone loss
    - ❑ 3D MD TC / 3D MRI reconstructions
- Radiographs are not accurate



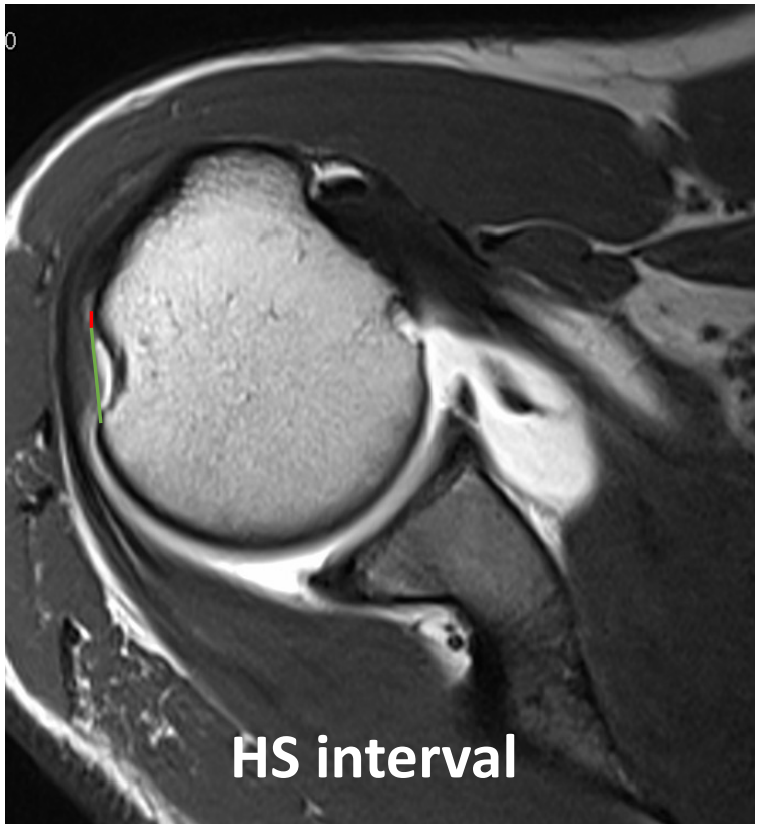


From the ESSR Sports Imaging Subcommittee – Top 5 Tips in Imaging...

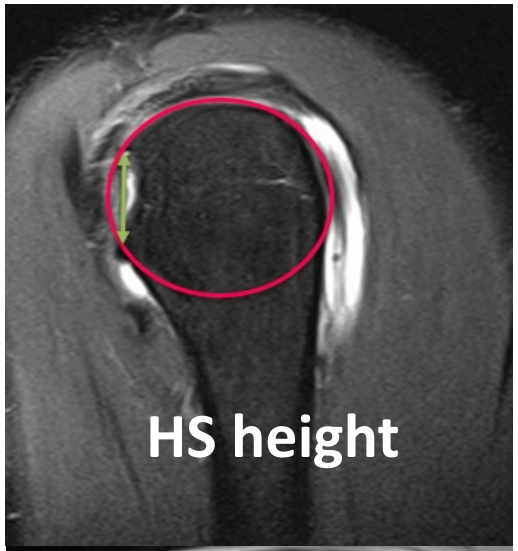
Evaluating Significant Bipolar Bone Loss in Anterior Shoulder Instability → **Tip 3: MEASURE HUMERAL BONE LOSS**

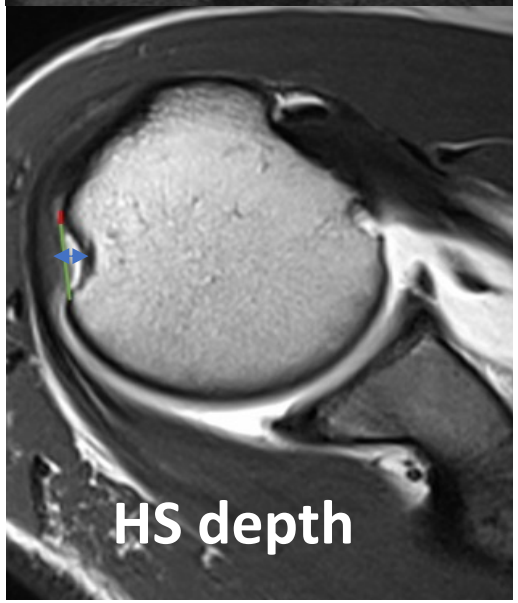
Hill-Sachs (@posterosuperior humeral head, at or above the coracoid)

- Difficult to measure during arthroscopy → Imaging is key
- Different ways to measure → **HS interval** most frequently used



Measure width of the HS (lenght, from medial to lateral)
From here, a line to cuff attachment (bone bridge)
widest part HS + bone bridge = **HS interval**

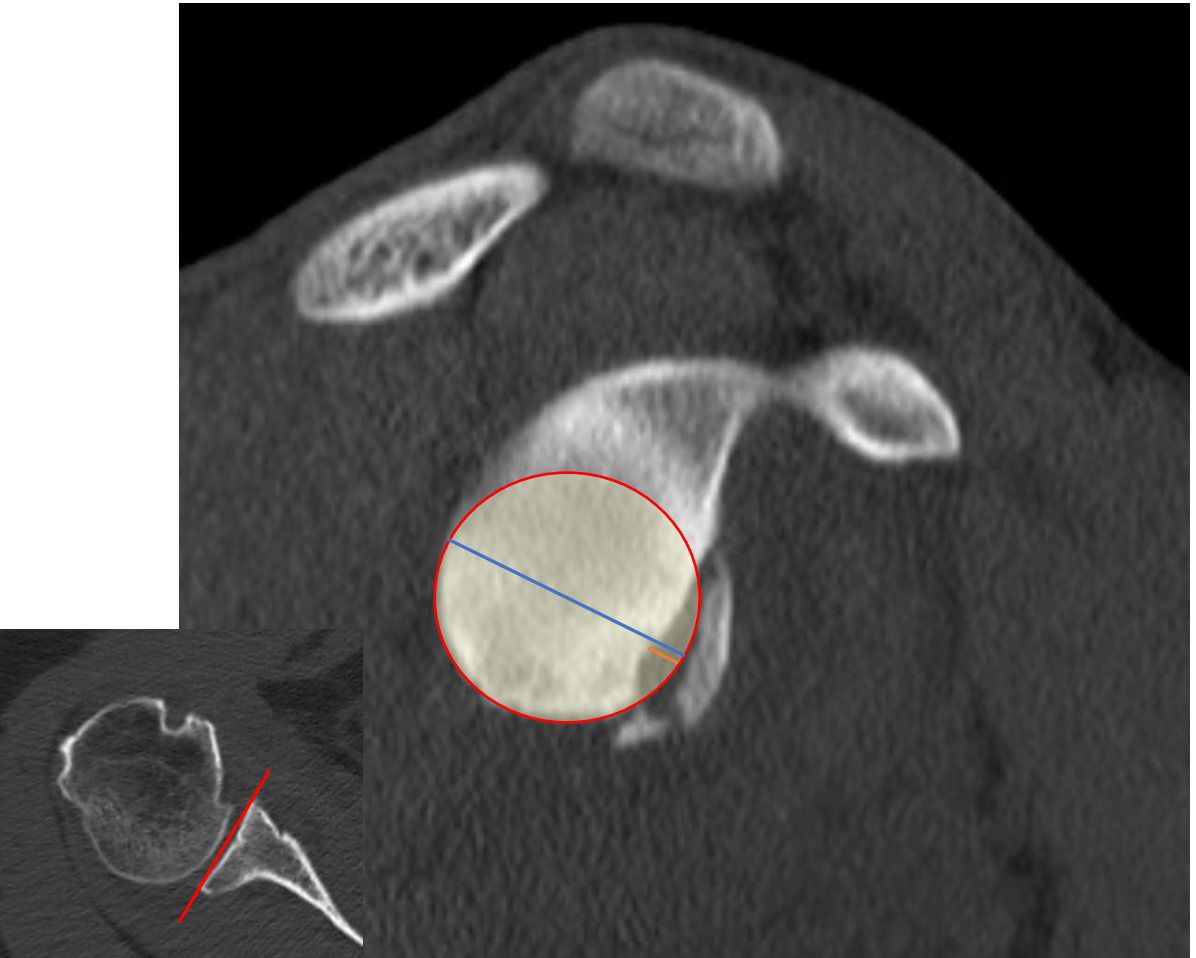




Evaluating Significant Bipolar Bone Loss in Anterior Shoulder Instability → **Tip 4: MEASURE GLENOID BONE LOSS**

Glenoid bone loss:

- Bony bankart with a fragment (*most typical*) vs flattening/impaction of the anterior glenoid impaction (*most common*)



Circle method (glenoid width):
Draw the best fitting **CIRCLE** around inferior half glenoid
(@ the subcondral bone: cross-reference with axials)
Measure the **diameter of the circle**
Measure the **diameter of bone loss**

$$\frac{\text{diameter of bone loss}}{\text{diameter of intact glenoid}} \times 100\ \%$$

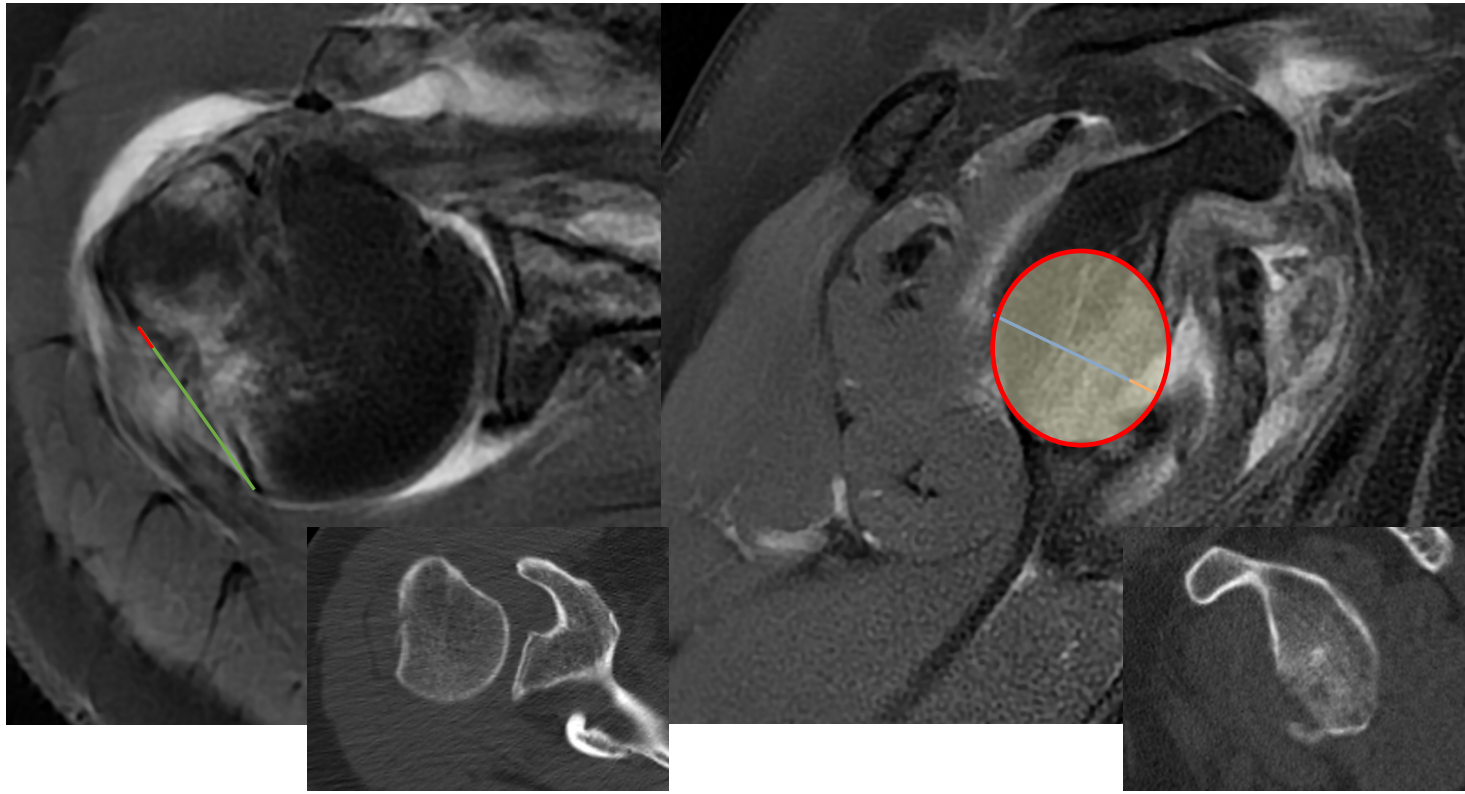
Critical bone loss (current theshold >20%) not effective
"Subcritical" bone loss: 13.5% -20%

Evaluating Significant Bipolar Bone Loss in Anterior Shoulder Instability → **Tip 5: MEASURE GLENOID TRACK**

- Engagement of the HS at the anterior glenoid depends on the sliding movement of the humerus over the articular surface of the glenoid and its width → **quantification of bipolar bone loss is crucial!**
- **Glenoid track** → predicts humeral engagement

HS interval < Glenoid Track =
ON-TRACK (↓ risk of engagement)

HS interval > Glenoid Track =
OFF-TRACK (↑ risk of engagement)

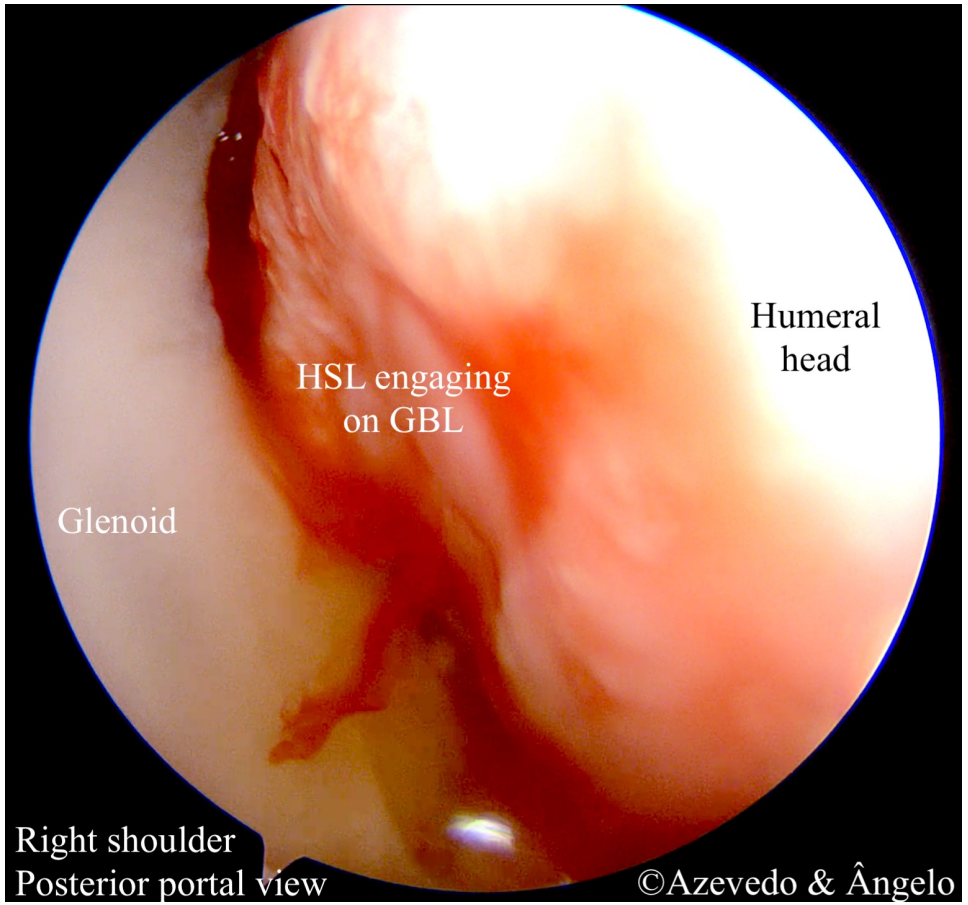


HS interval

Glenoid track
(0,83 X D) -d

From the ESSR Sports Imaging Subcommittee – Top 5 Tips in Imaging...

Evaluating Significant Bipolar Bone Loss in Anterior Shoulder Instability → Bonus Tip from the Surgeon:
IT'S ALL ABOUT THE INTERPLAY!



DECISION-MAKING

What does the surgeon look for? → **INTERPLAY OF LESIONS**

QUANTIFICATION OF BOTH
- GBL % and GLENOID TRACK
- HSL LENGTH and HS INTERVAL

if HS interval < Glenoid track → ON-TRACK = lower risk of engagement

if HS interval > Glenoid track → OFF-TRACK = higher risk of engagement

LOCATION OF HSL
- if MEDIAL = higher risk of engagement
- if LATERAL = lower risk of engagement

Evaluating Significant Bipolar Bone Loss in Anterior Shoulder Instability → **References**

- Walter WR, *et al*. Imaging Quantification of Glenoid Bone Loss in Patients With Glenohumeral Instability: A Systematic Review. AJR Am J Roentgenol. 2019 Mar 5:1-10
- Stillwater L, *et al* M. 3D-MR vs. 3D-CT of the shoulder in patients with glenohumeral instability. *Skeletal Radiol* 2017; 46:325–33
- Vopat BG, *et al*. Measurement of glenoid bone loss with 3-dimensional magnetic resonance imaging: a matched computed tomography analysis. Arthroscopy 2018;34(12): 3141–7
- Griffith JF, *et al*. CT compared with arthroscopy in quantifying glenoid bone loss. AJR Am J Roentgenol 2007;189(6):1490–3.
- Gyftopoulos S, Albert M, Recht MP. Osseous injuries associated with anterior shoulder instability: what the radiologist should know. AJR Am J Roentgenol 2014;202(6):W541–50
- Di Giacomo G, Itoi E, Burkhart SS. Evolving concept of bipolar bone loss and the Hill-Sachs lesion: from “engaging/non-engaging” lesion to “on-track/off-track” lesion. *Arthroscopy* 2014; 30:90–98
- Gyftopoulos S, *et al*. MRI evaluation of bipolar bone loss using the on-track off-track method: a feasibility study. AJR Am J Roentgenol 2015;205(4):848–52.
- Rerko MA, *et al*. Comparison of various imaging techniques to quantify glenoid bone loss in shoulder instability. *J Shoulder Elbow Surg* 2013; 22:528–534
- Shaha JS*, et al*. Clinical validation of the glenoid track concept in anterior glenohumeral instability. *J Bone Joint Surg Am* 2016; 98:1918–1923
- Arciero RA, *et al*. The effect of a combined glenoid and Hill-Sachs defect on glenohumeral stability: a biomechanical cadaveric study using 3-dimensional modeling of 142 patients. Am J Sports Med 2015;43(6):1422–9.