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The Impact Of Glenoid Concavity And Version On Anterior Shoulder Stability In The Clinical Setting

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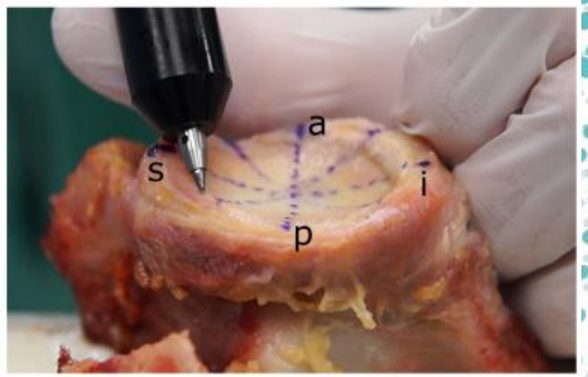
Faculty Disclosure Information

- Nothing to disclose

Background

Glenoid concavity:

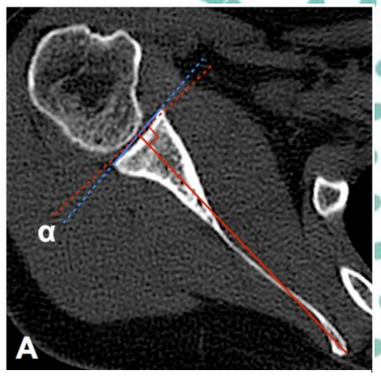
- Biomechanics: **High correlation** between **concavity and anterior stability**[1, 2]
- CT-based bony shoulder stability ratio (**BSSR**) estabilshed considering glenoid radius/depth/concavity [3]



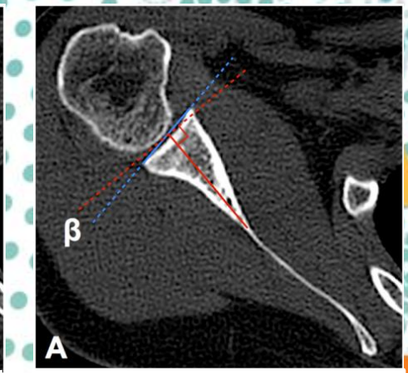
Wermers et al., KSSTA, 2021

Glenoid version:

- Biomechanics: Linear relation: **Retroversion ↓→ anterior stability ↓** [4]
- Confirmed in clinical studies for posterior instability [5, 6]
- Regarding **anterior instability**: only few clinical studies, heterogenous results



Friedman method



Glenoid vault method

Hypothesis

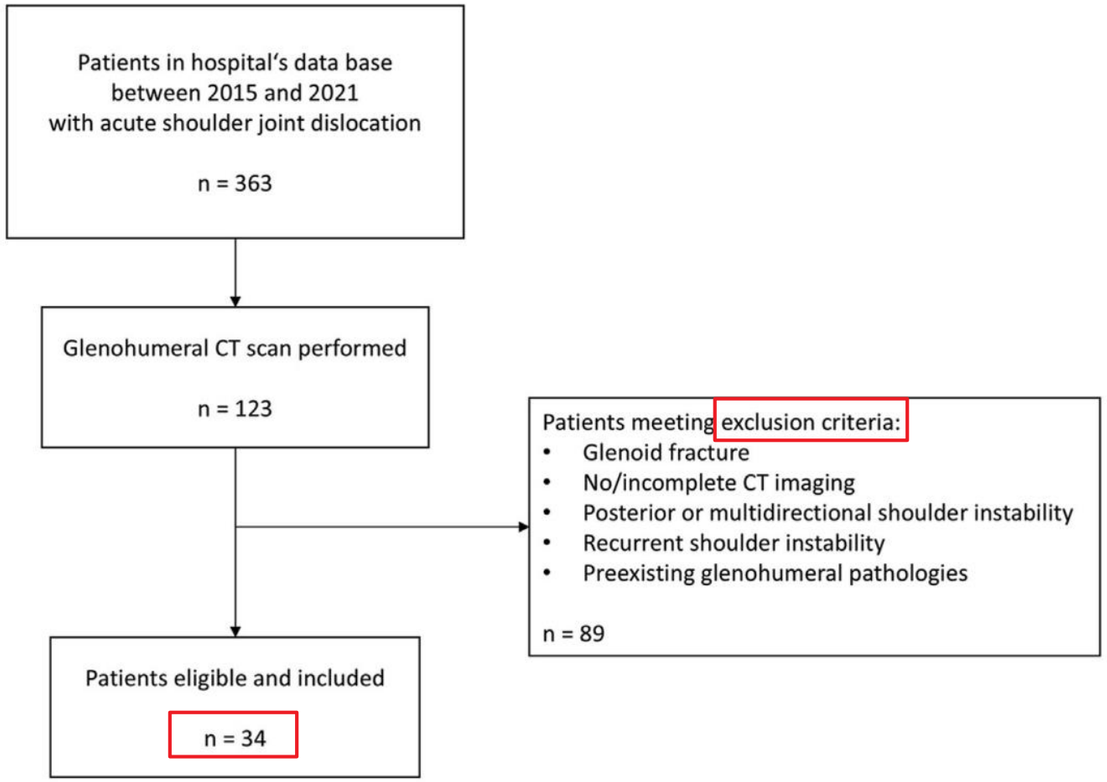
Anterior glenohumeral instability is associated with

- **lower glenoid concavity** and
- **less glenoid retroversion.**

Methods – Study design

Study design: Retrospective case-control study at **level-1-trauma center**

Instability cohort (n=34):



Control cohort (n=68):

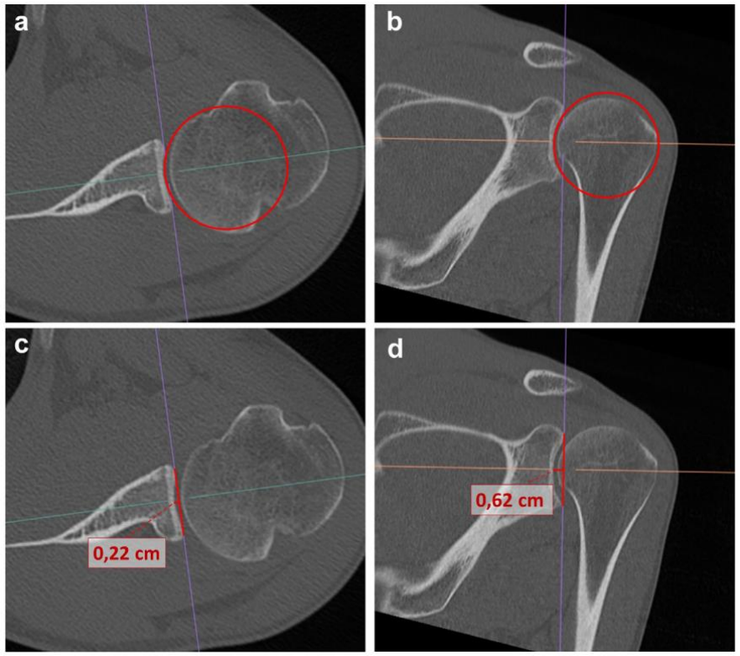
- Derived from hospital's data base of patients with **polytrauma CT scans**
- from 2020 – 2021
- **without acute and chronic shoulder pathologies**

1:2 matching:

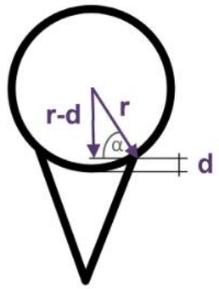
- **same-gender (m/f)** patients' **equal-sided** shoulders
- **Age-matching** with ±2 years in n=20 instability patients; max. difference 6 years

Methods – Radiological measurements

Concavity



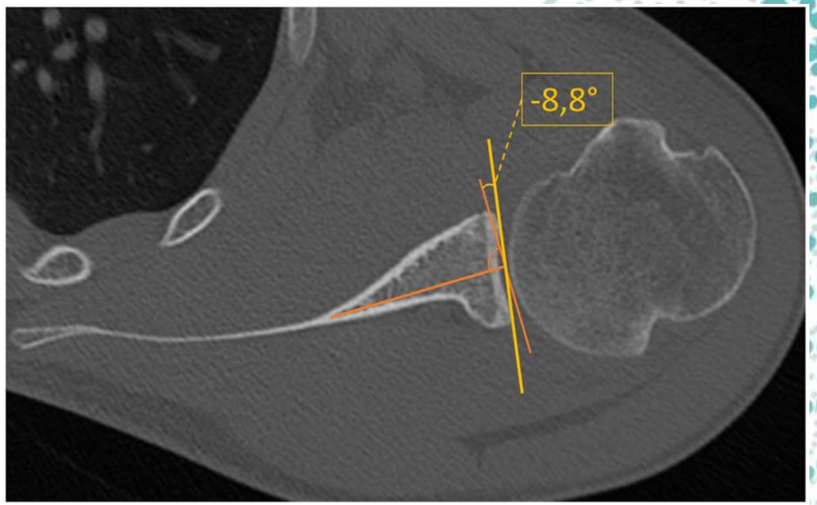
$$BSSR = \frac{1 - \left(\frac{r-d}{r}\right)^2}{\frac{r-d}{r}}$$



Calculation of the **BSSR a.p. and s.i.** by

- Measuring glenoid **radius via best-fit-circle method** (a, b)
- Measuring glenoid **depth** (c, d)

Version

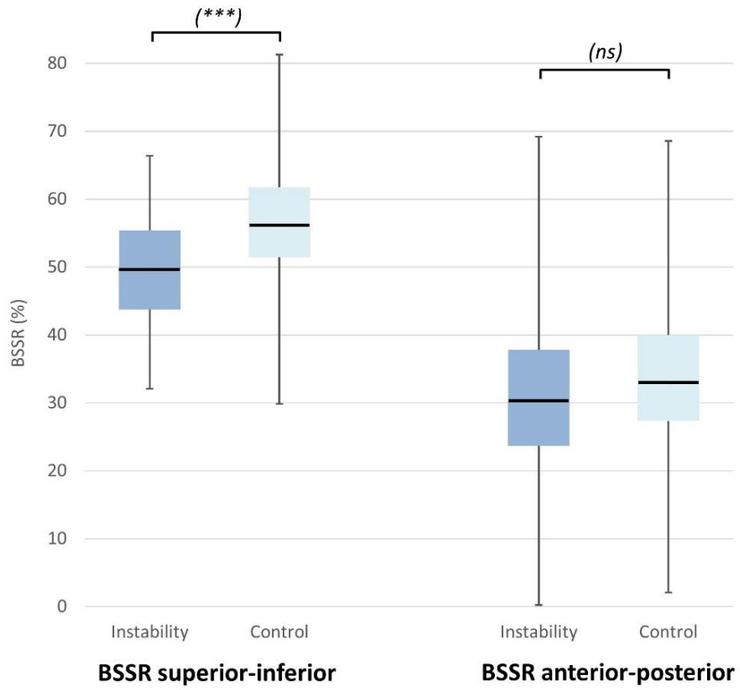


Calculation of glenoid version based on **„glenoid vault“ method** by Matsumura et al

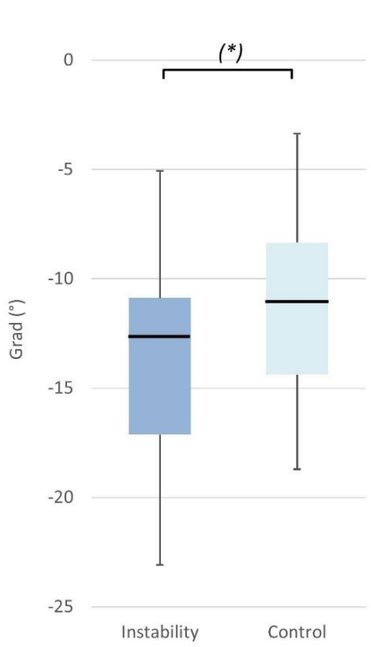
- >0° → anteversion
- <0° → retroversion

Results – Primary outcome

a) Glenoid concavity



b) Glenoid version



	Instability cohort (n=34)	Control cohort (n=68)
Age	46.9 (±20.3)	48.6 (±19.9)
Gender	25 male; 9 female	50 male; 18 female
Side of injury	19 right; 15 left	38 right; 30 left
Trauma mechanism	n=27 adequate trauma (falling, sports injury, traffic accidents) n=5 seizures n=2 atraumatic, hyperlaxity	

Concavity:

- **Lower superior-inferior BSSR in instability cohort**
  - (49.8% (±9.0) vs. 56.9% (±9.0), p=.0007)
  - 1% BSSR(s.i.) ↑ → 8% risk ↓ of anterior shoulder instability *
- **No significant difference** in **a.p.** BSSR
- Low correlation between s.i. and a.p. R^2=0.23 **

Version:

- **Higher retroversion in instability cohort**
  - (-13.14° (±4.38°) vs. -11.44° (±3.66); p=.0407)

*Binary logistic regression // **Linear regression model

Results – Subgroup analyses

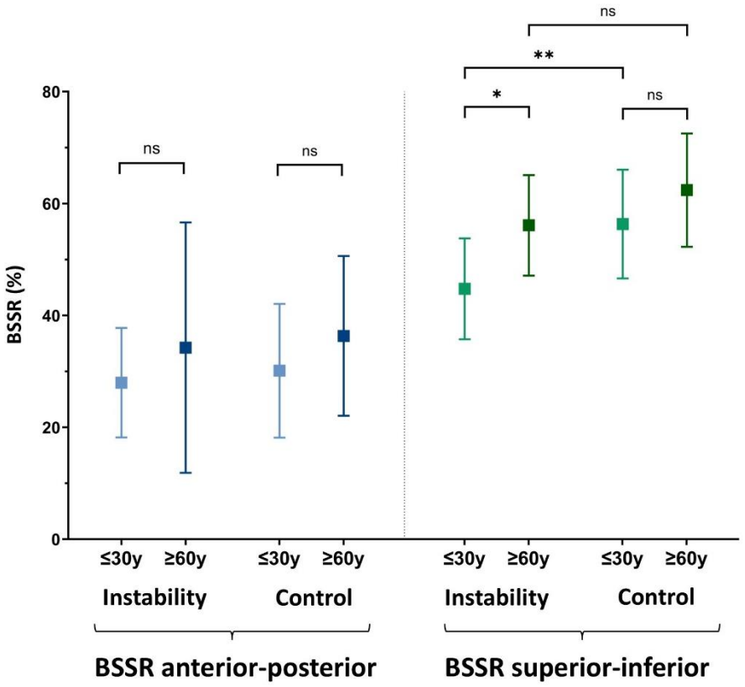
Subgroups within each cohort: **<30-year-old vs. >60-year-old // male vs. female**

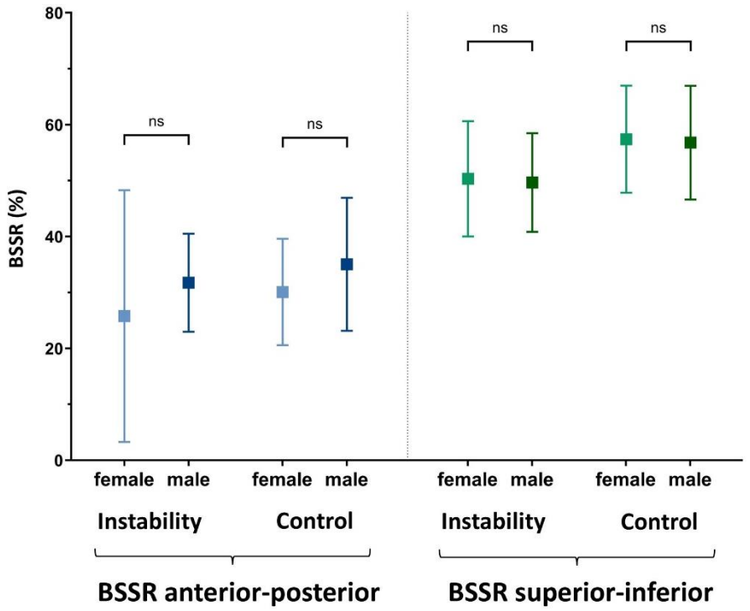
Concavity:

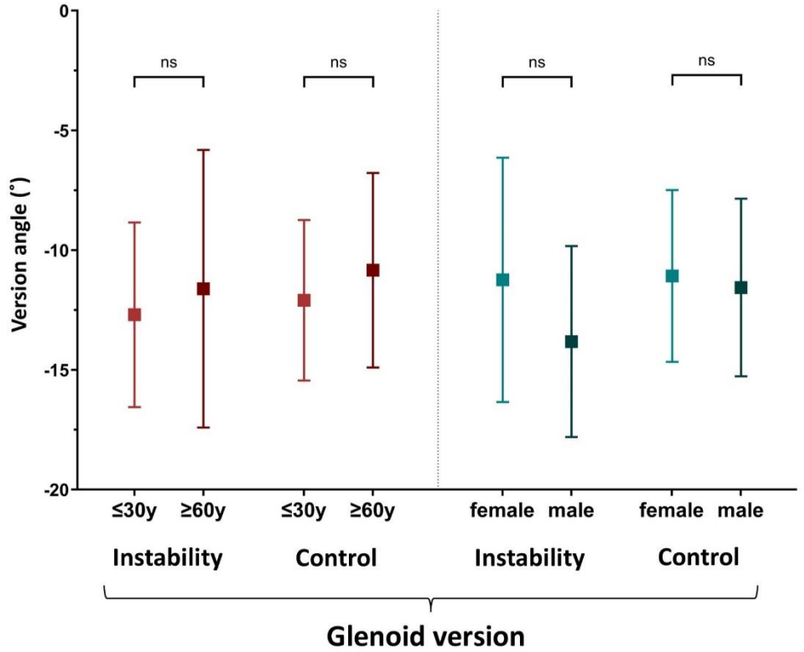
- <30-year-old patients: lower BSSR(s.i.) in instability cohort (p=0.0064)
- >60-year-old patients: no difference between instability and control cohort
- No gender-specific differences (p>0.1157)

Version:

Neither age- nor gender-specific differences were found (p>0.1326)







Discussion

Limitations:

Retrospective study design // CT-slice thickness 1-1.5 mm // mean age 46.9 years: many young patients only received X-ray/MRI, no CT scans

Concavity:

- **Sup.-inf. concavity** ↓ in instability cohort → **consistent with recent literature & biomechanical studies**
- **Ant.-post. concavity**: Same tendencies but no significant difference → larger study population needed?
- Sup.-inf. concavity more important than ant.-post. due to **additional anterior stabilizing structures (e.g. coracoid)?**

Version:

- Higher retroversion in instability cohort
  - **Role of glenoid version remains controversial**; recent literature ambiguous, **not consistent with biomechanical studies**
  - **Intra-individual reciprocal anatomical adaption of glenoid concavity & version?**

Individualized therapeutical approach needed for anterior shoulder instability, focussing on glenoid concavity as a relevant stabilizing factor

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Thank you for your attention

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References:

(1) Moroder et al., Challenging the Current Concept of Critical Glenoid Bone Loss in Shoulder Instability: Does the Size Measurement Really Tell It All? Am J Sports Med. 2019

(2) Wermers et al., Glenoid concavity has a higher impact on shoulder stability than the size of a bony defect. Knee Surg Sports Traumatol Arthrosc. 2021

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