Acetabular Dysplasia and Posterior Wall Fractures: The Missing Link
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Purpose: Posterior wall (PW) acetabular fractures (AO/OTA 62-A1) are the most common acetabular fracture type. We still have not clearly defined the relationship between PW size and hip stability for fractures involving less than 50% of the wall, even when using CT scans along with standard radiographs. This necessitates an examination under anesthesia (EUA) with fluoroscopy to determine stability. Specific risk factors contributing to hip instability have not been identified, but acetabular dysplasia may contribute. We sought to quantify acetabular dysplasia solely based on axial CT imaging using a novel "Slice" system (SS), then evaluate its relationship to hip instability, with the goal of creating a CT metric that can be used to avoid the necessity of an EUA. Our hypothesis is that shallower acetabular domes and increased dome to femoral head distance correlate with hip instability.

Methods: Patients >18 years old with a fracture <50% of the PW that underwent an EUA at our institution were retrospectively identified. Measurements were taken at 3 axial levels (Figure 1): 0, cranial CT slice at the dome; 1, cranial slice of lateral acetabular opening; and 2, cranial slice demonstrating femoral head vertex. Distance between levels: 0-1 (dome height; DH), 1-2 (head height; HH), and dome-head difference (HH–DH; DHD) were calculated. Other variables included conventional dysplasia metrics (eg, Tonnis angle). Statistical analysis was performed with STATA (Wilcoxon rank-sum testing).

Results: 37 EUA patients were identified; 27 patients were stable and 10 were unstable. Unstable hips had lower DH, higher HH, but equivalent DHD. Unstable hips had a lower acetabular depth at level 1 and 2, and less change in acetabular radius between level 1 and 2. No statistically significant differences were found with standard dysplasia metrics. Unstable hips were more likely to be dislocated on presentation ($P = 0.004$). Level 2 was more likely to be cranial to level 1 among stable hips. All data are available in Figure 1.

Conclusion: Unstable hips had shallower acetabula and higher distances between the domes and femoral head vertices. These measurements can be used to help orthopaedic surgeons evaluate for instability without the need for an EUA.

Figure 1

Variable	Stable (n=27); mean (SD)	Unstable (n=10); mean (SD)	P-Value
Age	30.8 (11.71703)	30.48 (8.833374)	0.6678
Gender	8F, 19M	3F, 7M	
Dislocation on Presentation	1/27	4/10	**0.004**
DH	2.962963 (1.285466)	3.5 (1.649916)	0.4276
HH	-0.5185185 (1.369176)	0.1 (2.18327)	0.3175
DHD	3.407407 (2.205923)	3.4 (3.470511)	0.3925
Level 1 Cranial to Level 2			
Length at Level 1	17.51481 (7.366071)	15.47 (6.9181)	0.3925
Length at Level 2	9.796296 (10.56123)	8.54 (10.40899)	0.7298
Delta L	-7.718518 (11.66101)	-6.93 (15.2133)	0.9454
Angle at Level 1	67.17037 (24.78632)	65.31 (22.57912)	0.9183
Angle at Level 2	38.44444 (40.76506)	36.05 (46.96822)	0.7573
Delta A	-28.72593 (41.59405)	-29.26 (49.7088)	0.9181
Radius at Level 1	16.11481 (4.759501)	14.98 (4.850613)	0.5725
Radius at Level 2	14.08148 (2.787477)	14.74 (2.795314)	0.4725
Delta R	-2.033333 (3.615246)	-0.24 (3.881065)	0.3118
Depth at Level 1	28.38889 (6.633327)	26.08 (7.337847)	0.4314
Depth at Level 2	26.56667 (4.637556)	25.19 (8.320583)	0.8912
Delta D	-1.822222 (4.467174)	-0.89 (8.076777)	0.4823
% Fragment Size	0.7553505 (0.1175114)	0.7235259 (0.1246255)	0.4940
% Femoral Head Coverage	0.3797774 (0.1280359)	0.354154 (0.1326714)	0.5158
Anterior Acetabular Sector Angle	67.1963 (10.02395)	67.81 (11.22779)	0.9319
Posterior Acetabular Sector Angle	81.84444 (9.526494)	78.72 (9.336643)	0.4416
Sharp's Angle	38.4037 (4.85097)	38.18 (4.857251)	0.9591
Center Edge Angle	34.78519 (8.750811)	33.54444 (5.762836)	0.6878
Tonnis Angle	13.05556 (5.835655)	9.85 (4.548076)	0.1366

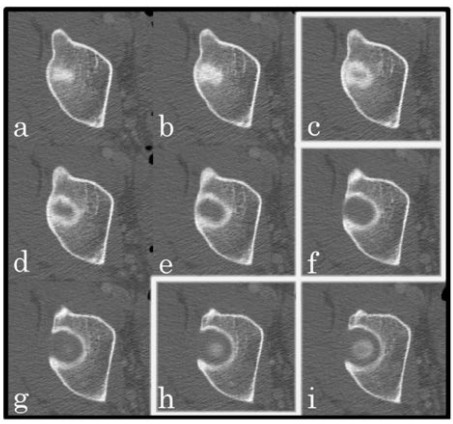

Figure 1: Consecutive axial CT slices throught the right acetabulum demonstrates Level 0 (c), Level 1 (f) and Level 2 (h). Dome height (DH) is 3 in this example while head height (HH) is 2. Dome-head difference (DHD) is therefore 1.

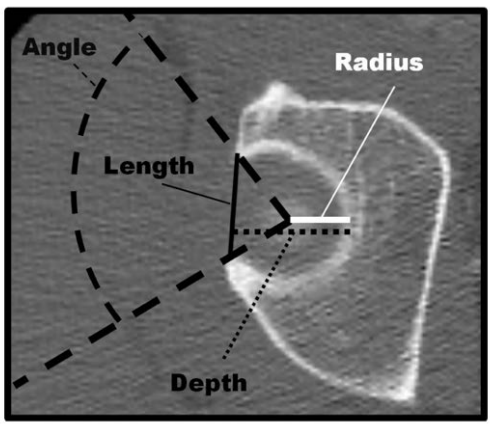

Figure 2: The experimental measurements (length, angle, depth and radius) at Level 2. Similar corresponding measurements were also obtained at Level 1 (not pictured here).