Contemporary Guidelines for Acetabular Positioning in Hip Arthroplasty May Jeopardize Hip Dislocation for Select ASD Patients

Mohammad Daher¹, MARC ELIE BOUTROS, Ayman Assi², Gilles Prince, Mohammad Ibrahim Karam³, Christopher Ames, Robert Shay Bess, Alan Daniels¹, Munish C Gupta⁴, Richard A Hostin, Michael Patrick Kelly, Han Jo Kim, Eric O Klineberg⁵, Lawrence G Lenke⁶, Pierce Dalton Nunley⁷, Peter Gust Passias⁸, Christopher I Shaffrey⁹, Justin S Smith¹⁰, Renaud Lafage¹¹, Bassel Diebo, Virginie Lafage¹¹, International Spine Study Group

¹Brown University, ²Faculty of Medicine, University of Saint-Joseph, ³Laboratory of Biomechanics and Medical Imaging, Fa, ⁴Dept. of Orthopedics, ⁵Uthealth Houston, ⁶Columbia University/Allen Hospital, ⁷Spine Institute Of Louisiana, ⁸NY Spine Institute / NYU Medical Center-Hjd, ⁹Duke University, ¹⁰University of Virginia, ¹¹Lenox Hill Hospital INTRODUCTION:

Lewinnek et al. defined a safe zone for cup inclination $(40^\circ \pm 10^\circ)$ and anteversion $(15^\circ \pm 10^\circ)$ to reduce dislocations after total hip arthroplasty (THA). Despite the Lewinnek safe zone being respected, higher rates of prosthetic dislocation are found in ASD patients undergoing THA. This study aims to investigate if ASD patients with high PT need a specific safe zone for acetabular positioning.

METHODS:

ASD patients with moderate to severe sagittal deformity underwent full-body xrays and a detailed 3D reconstruction of the pelvis and lower limbs in standing position pre-op. The PI-adjusted PT was calculated using Vialle et al formula (adj.PT=0.37*PI-7°) and patients with PT> adj.PT were grouped as HighPT, otherwise as NormPT. Spino-pelvic, 3D acetabular parameters were compared between the groups. PT offset from adj.PT was calculated. The number of patients falling outside the Lewinnek safe zone between the 4 quartiles of PT offset was compared. The relationship between PT and acetabular parameters was assessed with linear regression. RESULTS:

132 patients were included (HighPT:86, NormPT:46) with no differences in age, sex, comorbidities, and hip OA grades between the groups. HighPT had higher PI-LL (32.1, 12.4°), SVA (79.7, 59.0 mm), T1PA (31.2, 19.5°), SFA (209.1, 199.3°), pelvic Shift (50.3, 17.2 mm), GSA (7.6, 4.5°), and L4-S1 lordosis (26.2, 34.5°; all p<0.05). HighPT had higher acetabular abduction (60.5, 58.4°), acetabular anteversion (23.4, 20.1°), acetabular tilt (36.5, 29.8°) and posterior coverage (102.6, 98.6°, all p<0.05). The % of patients falling outside of the anteversion safe zone increased with PT offset (Q1:32%, Q2:47, Q3:57, Q4:75%, p=0.003) without being significant for abduction. The equation to determine acetabular anteversion in function of PT was derived: 16.582 + 0.215*PT (SE:6) (Figure). Anteversion of 21, 23, 25, 27 was associated with PT of 20, 30, 40 and 50°.

DISCUSSION AND CONCLUSION:

This is the first study to investigate impact of severe spinal deformity on pelvic tilt and acetabular anteversion in nativehips. It also proposes an equation to calculate safe zone for acetabular component position and establishes thresholds ofPTadjustedacetabularanteversion(Figure).

