

Introducing the Preoperative Landing Zone Concept: Implications of Listhesis and Spinopelvic Inclination of the Upper Instrumented Vertebral Region on Proximal Junctional Kyphosis

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INTRODUCTION:

PJK is a common failure mode after adult spinal deformity (ASD) surgery. The quality of the UIV and the Landing Zone (UIV-1 to UIV+2) could be one of the factors affecting the rate of PJK. The aim of this study is to preoperatively assess the radiographic properties of the Landing Zone and how this affects the rate of PJK.

METHODS: Patients with ASD were included if they: (1) had a native thoracolumbar junction at baseline, (2) had a postop UIV at T9-T12 and LIV at the pelvis, and (3) had clinical and radiographic follow-up at 2 years postop. Landing zone was assessed on preoperative images by two spine surgeons. Comparative analyses of demographics, baseline and 2 yr radiographic parameters, and the rate of PJK were performed comparing patient individually and collectively using: UIV zone listhesis, UIV spino-pelvic inclination (UIV SPI) (Figure), and ideal segmental alignment at (L4-S1 and T10-L2). Multivariable regression controlling for listhesis, UIV SPI, PJK prophylaxis, age, osteoporosis, radiographic UIV quality (bridging osteophytes/degenerative disc disease) and change in PI_LL and SVA was used to identify independent predictors of PJK.

RESULTS:

245 patients included, groups showed no significant differences in age, sex, BMI, comorbidities, invasiveness index, prior spine surgeries, and PJK prophylaxis. 30% of patients had preop listhesis at the landing zone, and 42% had UIV SPI >15°. Listhesis patients had higher PJK rates at 2y FU (32.9% vs. 20.5%, p=0.04) with similar baseline and 2yr radiographic alignment. Of the 104 patients with UIV SPI>15°, 61 (59%) were iatrogenic and 43 (41%) had it at baseline. Those with UIV SPI>15° had higher PJK rates (14.2 vs 37.5%, p<.001) and revision for PJK (5.8% vs. 16.3%, p=0.006), despite comparable postop alignment. At 2 years, patients with listhesis and SPI>15° had the highest PJK rate (45.5%, p=0.03). Multivariate regression model (R²=0.33) identified landing zone listhesis (B=1.0, p=0.01) and UIV SPI (B=-0.22, p<.001) as significant predictors of PJK.

DISCUSSION AND CONCLUSION: This investigation found that both Landing Zone listhesis and UIV SPI are independent predictors of PJK at 2 year follow up. This study highlights the importance of vigilant selection of the UIV Landing Zone with great caution regarding listhesis and SPI.

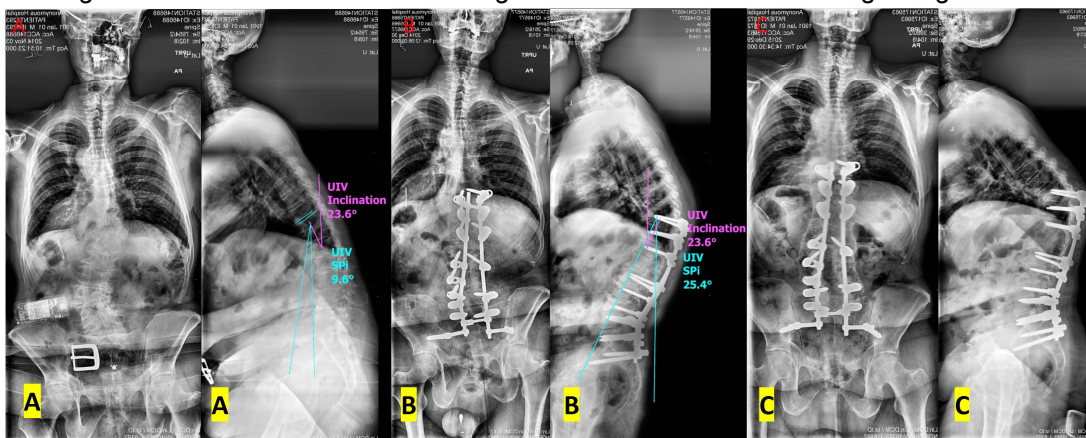


Figure 1: (A) Baseline, (B) 6 weeks, and (C) 1 year anteroposterior and lateral standing radiographs of a patient with preoperative Landing Zone listhesis, iatrogenic UIV SPI, and PJK/PJF.