



Proximal Junctional Failure



Causes and Solutions

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ISSG Definition

- Post-op fracture of UIV or UIV+1
- UIV implant failure
- PJK increase > 15 degrees
- Proximal extension needed within 6 months





Risk Factors

- Increased age at operation
- Severity of pre-operative sagittal plane deformity
- Extent of sagittal plane realignment
- Poor bone quality
- Construct stiffness
- Fixation to the pelvis
- Violation of soft tissue envelope at UIV
- Combined anterior-posterior approaches
- Sub-optimal choice of levels





Probably NOT Risk Factors

- Shorter fusion constructs – UIV below L2
- Post-op sagittal alignment not a factor
 - Hart/ISSG
- No difference between UT and LT/TL UIV
 - Hart/ISSG
 - Fujimori and Hu
 - Ha and Berven
 - Different failure modes noted



Possible Solutions

Risk Factors	Technique for Prevention
Surgical	
Disruption of Posterior Soft Tissues	Careful Dissection at UIV; protect facet capsule above
Rigidity of Instrumentation	Proximal hooks vs screws Leave screw threads proud proximally Transition rods
Choice of Vertebral Levels	UIV in UT may increase risk of kyphosis or subluxation UIV in LT may increase risk of fracture and PJF LIV in pelvis may increase risk of PJF
Choice of Approach	Avoid anterior/posterior approaches if possible MIS does not appear to confer benefit thus far
Degree of Correction	Optimize global sagittal alignment based on individual

Possible Solutions

Risk Factors	Technique for Prevention
Radiographic	
Increased Pre-operative thoracic kyphosis	Cannot be modified
Proximal Junctional Angle > 5	Include any such level in construct
Patient specific	
Age > 55	Cannot be modified
High BMI	Weight loss; nutritional counseling
Osteopenia/osteoporosis	Optimize pre-operatively Cement augmentation especially at UIV and UIV +1

Predictive Model

Spine
DEFORMITY

Development of Validated Computer-based Preoperative Predictive Model for Proximal Junction Failure (PJF) or Clinically Significant PIK With 86% Accuracy Based on 510 ASD Patients With 2-year Follow-up

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TABLE 5. List of all 13 Variables Used in the Model in Order of Predictor Importance

Order of Importance	Variable
1	Age
2	LIV
3	SVA
4	UIV implant type
5	UIV
6	PT
7	PLL
8	BMI
9	No. of levels fused
10	Gender
11	Presence of 3CO
12	TK
13	Primary vs. revision

Note that this list is generated in a univariate fashion. The actual variable predictor importance may vary in the model because during model deployment, the variables are considered in the context of the others as they may influence one another.
