Systematic Review on the Heterogeneity in the Definitions of Proximal Junctional Kyphosis and Failure in Spinal Deformity Literature: A Tower of Babel

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INTRODUCTION:

Proximal junctional kyphosis or failure (PJK/PJF) is among the most common complication after long-segment fusions, but there is no consensus on their definitions. This presents challenges in understanding risk factors, management, and prevention strategies. The objective of our study is to describe, categorize, and track the use of various definitions of PJK and PJF used in spinal deformity literature.

METHODS:

A systematic literature review was performed on **s**tudies defining PJK and/or PJF. PJK definitions were categorized as radiographic vs non-radiographic and PJK criteria including threshold for proximal junctional angle (PJA), change in PJA, vertebra selection for PJA measurement, and follow-up timepoints were collected. PJF definitions were categorized as structural failure, need for revision, symptomatic failure, and radiographic (angular).

RESULTS:

359 studies defining PJK and/or PJF were identified. While 56% of studies used the definition PJA>10° and PJA change from baseline>10°, the remainder expressed significant heterogeneity with respect to criteria for magnitude of PJA and degree of PJA change (Table 1). The most common vertebrae assessed were UIV/UIV+2 (74%) and most common minimum follow-up (mFU) listed was 2 years (60%). Mean FUs for studies varied considerably even in studies with the same mFU, from 2.1-8.9 years (2-year mFU) and 1.1-4.0 years (1-year mFU). PJF definitions were most commonly structural (58%) or defined as a need for revision (48%), with a much less common use of PJA thresholds (23%).

DISCUSSION AND CONCLUSION:

The challenges faced in preventing proximal junctional complications are mired in the heterogenous groundwork by which PJK/PJF are defined. Most definitions of PJK use radiographic thresholds without consideration of clinical relevance and variations in individual alignment. Conversely, definitions of PJF are based on clinical criteria, which are often subjective. Future research should focus on understanding the mechanisms of PJK/PJF, as only then will we be able to accurately define and prevent these complications.

Table 1 – Summary of the number of papers reporting each of the identified definitions of proximal junctional kyphosis (PJK). PJA = proximal junctional angle. NRS = Numerical Rating Scale (pain)

		Measurement	Angle (°)	Studies
PJK (320)	Radiographic PJK (315)	PJA>10 & Preop PJA change>10 (Glattes)		179
		Absolute PJA (64)	5-10	1
			10	40
			15	7
			20	16
			25	1
		Preop Change PJA (55)	10	45
			15	3
			20	7
		Postop Change PJA (22)	10	20
			15	1
			20	2
		Other (10)	PJA>28 & Preop PJA change>22	4
			Summed angulation>10	2
			UIV+/-2 & Preop PJA change>10	1
			PJA>20 & Preop PJA change >20	1
			PJA>5 & Preop PJA change>10	1
			PJA>10 & Postop PJA change>10	1
			Averaged Preop Cobb angle	1
			PJA>Preop PJA	1
	Non-Radiographic PJK (17)	Category	Type	Studies
		Need for Revision		10
		Mechanical (13)	Fracture	8
			Soft Tissue	1
			Fixation	4
		Symptomatic (4)	Myelopathy	3
			NRS decline	1
		Other (3)	Schwab Classification	2
			Proximal junctional breakdown	1