

Reply to Letter to the Editor

Combined Anterior-Posterior Surgery is the Most Important Risk Factor for Developing Proximal Junctional Kyphosis in Idiopathic Scoliosis

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The posterior tension band complex, as articulated so clearly by Dr. Yoshihara, in my opinion makes an important contribution to the etiology of proximal junctional kyphosis (PJK). However, my hesitation in attributing the posterior tension band as the most important risk factor is largely owing to the lack of supportive data in the current literature. This lack of data lies partially in the difficulty of measuring the preservation of the posterior structures and lack of consistency with which the data often are presented. For example, if the dissection of the posterior muscular attachments to transverse processes of the upper thoracic vertebrae plays a pivotal role in the development of PJK, studies should consistently show upper instrumented vertebrae of T1–T6 having a higher incidence of PJK [1]. More recent literature comparing PJK rates in those with upper thoracic (T1–T3) versus lower thoracic (T10–T12) instrumented vertebrae [4, 8] have determined that upper instrumented vertebrae in the lower thoracic spine had a higher PJK rate. In addition, some studies [4–8] have failed

to show a difference in PJK rates between different upper instrumented vertebrae.

The etiology of PJK is clearly multifactorial and therefore, studies should focus on conducting multivariate analyses when identifying risk factors associated with the development of PJK. We did not investigate the posterior soft tissue integrity. As mentioned by Dr. Yoshihara, the difficulty in including this as a risk factor lies in the inability to reliably quantify the extent of soft tissue dissection and facet capsule disruption at the time of the index operation. One point mentioned by Dr. Yoshihara is that pedicle screw instrumentation damages the supraadjacent facet capsule owing to the footprint of the screw head. Although I agree this is theoretically possible, this has not been supported consistently in the literature [2, 4, 7, 10]. If this were true, one would expect constructs using hooks at the upper instrumented vertebrae to have lower rates of PJK. In fact, reports are inconsistent when it comes to instrumentation type at the upper instrumented vertebrae and PJK, with one report [2] showing a difference and others [4, 7, 10] showing no difference whether a pedicle screw or a hook is used at the upper instrumented vertebrae.

As our understanding of the etiology of PJK improves, the spectrum of pathologic features encompassing PJK is becoming more transparent. Earlier studies have described PJK to be a pure radiographic finding [1, 6] while more recent studies [4, 5] suggest differences in Scoliosis Research Society outcomes scores between those with and without PJK. In studies such as those referenced by Dr. Yoshihara [2, 3, 9], no differences in health-related quality of life questionnaires were noted between patients with and without PJK and therefore, the amount of increase in PJK angle noted may be of questionable clinical importance (if it is attributed solely to the posterior approach).

(Re: Kim HJ, Yagi M, Nyugen J, Cunningham ME, Boachie-Adjei O. Combined anterior-posterior surgery is the most important risk factor for developing proximal junctional kyphosis in idiopathic scoliosis. *Clin Orthop Relat Res.* 2012;470:1633–1639.)

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This shows the necessity in distinguishing purely radiographic PJK versus progressive PJK causing pain versus catastrophic PJK which often can present with myelopathy and spinal cord impingement. Studies that focus on differences between these subsets of patients with PJK will be useful in determining clinically important risk factors since it is entirely plausible that the inclusion of less severe cases of PJK with more severe cases in a study cohort can have an umbrella effect and dilute otherwise important findings.

At the recent Hibbs Society Meeting held during the 2012 Annual Scoliosis Research Society Meeting in Chicago, Illinois, USA, a group of surgeons met with interest on the topic of PJK. It is clear that our understanding of PJK has improved since it was first described [1] but much work remains in understanding the cause and optimal method for treating severe cases. I believe these questions will be answered in future studies and will help us tailor methods for the prevention of PJK.

References

1. Glattes RC, Bridwell KH, Lenke LG, Kim YJ, Rinella A, Edwards C 2nd. Proximal junctional kyphosis in adult spinal deformity following long instrumented posterior spinal fusion: incidence, outcomes, and risk factor analysis. *Spine (Phila Pa 1976)*. 2005;30:1643–1649.
2. Helgeson MD, Shah SA, Newton PO, Clements DH 3rd, Betz RR, Marks MC, Bastrom T; Harms Study Group. Evaluation of proximal junctional kyphosis in adolescent idiopathic scoliosis following pedicle screw, hook, or hybrid instrumentation. *Spine (Phila Pa 1976)*. 2010;35:177–181.
3. Hollenbeck SM, Glattes RC, Asher MA, Lai SM, Burton DC. The prevalence of increased proximal junctional flexion following posterior instrumentation and arthrodesis for adolescent idiopathic scoliosis. *Spine (Phila Pa 1976)*. 2008;33:1675–1681.
4. Kim HJ, Bridwell KH, Lenke LG, Park MS, Ahmad A, Song KS, Piyaskulkaew C, Hershman S, Fogelson J, Mesfin A. Proximal junctional kyphosis results in inferior SRS pain sub-scores in adult deformity patients. *Spine(Phila Pa 1976)*. 2012 Dec 10 [Epub ahead of print].
5. Kim YJ, Bridwell KH, Lenke LG, Glattes CR, Rhim S, Cheh G. Proximal junctional kyphosis in adult spinal deformity after segmental posterior spinal instrumentation and fusion: minimum five-year follow-up. *Spine (Phila Pa 1976)*. 2008;30:2179–2184.
6. Kim YJ, Bridwell KH, Lenke LG, Kim J, Cho SK. Proximal junctional kyphosis in adolescent idiopathic scoliosis following segmental posterior spinal instrumentation and fusion: minimum five-year follow-up. *Spine (Phila Pa 1976)*. 2005;30:2045–2050.
7. Kim YJ, Lenke LG, Bridwell KH, Kim J, Cho SK, Cheh G, Yoon J. Proximal junctional kyphosis in adolescent idiopathic scoliosis after three different types of posterior segmental spinal instrumentation and fusions: incidence and risk factor analysis of 410 cases. *Spine (Phila Pa 1976)*. 2007;32:2731–2738.
8. O'Shaughnessy BA, Bridwell KH, Lenke LG, Cho W, Baldus C, Chang MS, Auerbach JD, Crawford CH. Does a long-fusion “T3-sacrum” portend a worse outcome than a short-fusion “T10-sacrum” in primary surgery for adult scoliosis? *Spine (Phila Pa 1976)*. 2012;37:884–890.
9. Rhee JM, Bridwell KH, Won DS, Lenke LG, Chotigavanichaya C, Hanson DS. Sagittal plane analysis of adolescent idiopathic scoliosis: the effect of anterior versus posterior instrumentation. *Spine (Phila Pa 1976)*. 2002;27:2350–2356.
10. Yagi M, Akilah KB, Boachie-Adjei O. Incidence, risk factors and classification of proximal junctional kyphosis: surgical outcomes review of adult idiopathic scoliosis. *Spine (Phila Pa 1976)*. 2011; 36:E60–68.