



Editorial



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See the article “Modified Global Alignment and Proportion Scoring With Body Mass Index and Bone Mineral Density Analysis in Global Alignment and Proportion Score of Each 3 Categories for Predicting Mechanical Complications After Adult Spinal Deformity Surgery” via <https://doi.org/10.14245/ns.2142470.235>.



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Commentary on “Modified Global Alignment and Proportion Scoring With Body Mass Index and Bone Mineral Density Analysis in Global Alignment and Proportion Score of Each 3 Categories for Predicting Mechanical Complications After Adult Spinal Deformity Surgery”

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The authors have performed a retrospective review of 203 patients who underwent adult spinal deformity (ASD) surgery with minimum 2-year follow-up.¹ The authors have analyzed the global alignment and proportion (GAP) score, incorporating bone mineral density (BMD) and body mass index (BMI). The authors found that when incorporating BMI and BMD into the GAP score (GAPB), the GAPB score correlates with mechanical failure in patients when they are moderately or severe disproportioned in their alignment.

I commend the authors for their work in incorporating BMI and BMD into the evaluation of mechanical failures in ASD surgery. This represents important work because Bari et al.² had reported that the GAP score alone—without the incorporation of BMI and BMD—has been unable to predict mechanical failure in ASD patients undergoing 4 or more levels of fusion. However, the original GAP score alone does not incorporate the BMI and BMD. Many mechanical failures can be related to poor bone quality because of the implant-bone junction interface failure. In our practice, all patient’s bone densities are checked prior to any fusion surgery, and by incorporating bone density into decision making, we have anecdotally seen fewer screw pull-out failures. Thus, it makes sense that the current authors’ findings of incorporating BMD in the form of the GAPB score create a more accurate predictor of mechanical failure. In addition, the incorporation of BMI as a predictor makes sense. In patients with high BMI, the failure of mainly posterior-based constructs in the face of significant anterior trunk weight can potentially be predicted using the GAPB score instead of the GAP score. By incorporating BMI and BMD into the GAP score, the current authors have shown that incorporation of these 2 elements has made the GAP score more accurate by converting it into the GAPB score.

The original GAP score takes into account age, pelvic incidence, sacral slope (SS), L4–S1

lordosis, L1–S1 lordosis, and the global tilt, as measured from C7 down to the sacrum.³ However, the reliability and accuracy of the GAP score alone have been called into question. Kwan et al.⁴ have recently reported that a higher GAP score does not predict mechanical complications after ASD surgery using 272 patients from the Scolio-RISK-1 prospective trial data. As mentioned above, Bari et al.² also could not find an association with the GAP score and mechanical complications. Given that large studies could not find a direct correlation with the GAP score and mechanical complications, the study performed by the current authors sheds new light and insight onto the GAP score. The current authors' inclusion of BMI and bone density add 2 very important factors that were not originally included in the GAP score. Increasingly, it is becoming clear that bone density is a very important factor in spinal fusion, not just in deformity cases, but also in degenerative conditions. In addition, it makes sense that BMI also plays an important role given the primarily posterior-based support structure in most adult deformity surgery. It stands to reason that a patient with a high BMI and low bone density may have a higher mechanical failure rate than a patient who has a low BMI with high bone density. The authors have taken these 2 factors into consider, improving upon the GAP score.

Another consideration that may be useful in the prevention of mechanical failure is taking into consideration the Roussouly type, spinal shape, and location of the 3-column osteotomy, if performed.⁵ Pizones et al.⁶ showed that placing the pedicle subtraction osteotomy at the natural apex of the Roussouly type was associated with a lower rate of mechanical failure. Based upon this finding, the natural shape of the spine based upon the Roussouly type should ideally be recreated if possible. This may also be a very important factor in patients who are Roussouly types I and II (SS less than 35°). These low Roussouly type patients may not be amenable to large amounts of lordosis induction because of the low SS. Such patients may live with relatively flat backs, and induction of large amounts of lordosis in such patients may increase the propensity for proximal junctional kyphosis (PJK). Xi et al.⁷ showed that as the L1 vertebral body is posteriorly displaced relative to the gravity line, there is an increased risk of PJK. This is consistent with potential over induction of lordosis in low Roussouly type patients with concomitant dorsal L1 displacement. This significant posterior L1 displacement results in reciprocal hyper-kyphosis at the thoracolumbar junction or at the thoracic spine in order for the patient to maintain neutral a sagittal vertical axis. It is this reciprocal kyphosis that results in increased stress at or above the up-

per instrumented vertebra. This increased stress may result in PJK. This combination of a low Roussouly type and over induction of lordosis may be one contribution to PJK.

The authors of this manuscript have done a nice job of showing that the incorporation of BMI and bone density into the GAP score increases the GAP score's validity. This study provides support to the notion that PJK has a multifactorial etiology. It is the totality of these factors that need to be considered, not simply the radiographic measurements. I commend the authors of taking the GAP score to the next level to improve and validate its utility with the incorporation of these non-radiographic elements.

CONFLICT OF INTEREST

The author has nothing to disclose.

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Title: Guitar, glass and bottle of Vieux Marc
Artist: Pablo Picasso
Year: 1912
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