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Commentary: How best to quantify an uplifting pectus operation?

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Pectus excavatum (PE) is the most common congenital chest wall deformity,¹ and Ravitch reported his technique of surgical correction for PE in 1947. In recent years, minimally invasive approaches, in particular the Nuss procedure, have gained popularity.² The passage of the Nuss bar is associated with a risk of injury to retrosternal structures, and although very rare, the outcomes are devastating when they do occur.³ To reduce the risks of potentially fatal complications, it is imperative to maximize the substernal space for better visualization while performing dissection and to lessen the risk of intercostal stripping during the implantation of the Nuss bar.⁴

Crane elevation is one such technique that increases the substernal space, and reports have been published with an agreeable safety profile and clinical effectiveness. Hitherto, there has been a lack of quantitative data evaluating the use of this technique. In this issue of the *Journal*, de Loos and colleagues⁵ report the first quantitative analysis and objective evaluation of the crane technique in sternal elevation and pectus reduction. This study comprises a well-designed methodology with a clear illustration of the crane technique and the 3-dimensional (3D) imaging system used for data acquisition. Their methodology appears readily replicable for quantitative evaluation of different sternal elevation techniques, which opens the possibility of comparison between different techniques.

The authors used the point of deepest excavation of the anterior chest wall as the point of reference to determine the maximum distance altered by the “lift” of the chest wall as a result of the combined elevation from the crane,

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3D imaging allows quantitative analysis of the crane technique in the Nuss operation. Future studies may investigate volumetric changes in the chest wall and measurement of the lifting force required.

ie, lifting of the entire chest wall combined with the reduction of the PE. This is determined by comparing 3D images taken before incision and after crane application. However, PE represents a spectrum of anatomical deformities ranging from the symmetrical to the highly asymmetrical. A linear measurement taken at the deepest depth of the deformity may not provide the full picture of the changes following the application of the crane. Alternative measurement techniques have been described in PE. For example, Uemura and colleagues⁶ used superimposed 3D images from pre- and postoperative images to measure the external sternal angle and elevating distance in both the axial and sagittal planes. Measurements such as 3D volumetric or area calculation may provide more accurate assessments of the changes in the shape and depth of the deformity, which in turn may correlate better than a linear measurement with the actual postprocedural cosmetic effect.

The authors did not investigate the lifting force required to adequately elevate the sternum. It is known that in patients with PE from different age groups, the amount of force required to elevate the chest wall can vary significantly.⁷ It would be helpful to document this information to improve calibration of the amount of lift required and to determine how best to improve this technique in the future.

Overall, this paper is an important step toward quantitative analysis of sternal elevation and pectus correction using

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the crane technique, which will help both clinicians and researchers in the management of this condition.

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