Reply to the Editor:

We appreciate the opinions of Vincenzo de Paoli and colleagues and agree,1 as outlined in our article,2 that surgeon experience is indispensable for successfully repairing patients with a more complex higher Haller index (HI). Without the proper experience in surgery, complications are inevitable.

We recognize their group contributions and applaud their published 20-year series involving more than 2000 patients with pectus excavatum.3 Several factors render direct comparison and interpretation of their findings to ours less than ideal. Foremost, the populations included substantially differed. Their study predominantly involved young patients (mean age 18.5 years, with 90% aged 12-25 years), and the majority had lower HIs with only 1% (21 patients) being greater than 8. The method to calculate the HI also differed. They used plain radiographs to perform those calculations, a method suboptimal to computed tomography or magnetic resonance imaging. Surgical approaches further differed. Media and colleagues used 1 bar to correct most cases (73%).3 We strongly believe that multiple bars are necessary to properly repair older adults and higher HI cases. Last, their approach to reporting complications differed fundamentally from ours. de Paoli and colleagues repeatedly compared their complication rates with ours.1 In a single-surgeon center, we have performed more than 1300 cases that are primarily adult. During our early learning curve, more complex cases and older adults experienced higher complication rates, particularly bar migration. However, this has been mitigated over the years with experience and improved fixation techniques including the “Hammock” stitch.

Media and colleagues3 adopted a “compounded” approach for their publication, highlighting the lack of this approach as a primary weakness in our article. To apply the compounded complications analysis, each complication could occur only once, thus potentially leading to underestimation if a single patient had multiple complications. Although we respect their choice of data presentation, we opted against a similar approach believing it may be clinically misleading to the patients and medical community. By focusing on the compounded figure, minor and major complications are given equal weight (eg, a patient administered diuretics for pleural effusion is counted the same as a patient reoperated on for bleeding), which makes assessing clinical risk severity for a procedure challenging and could unnecessarily concern patients.

In their correspondence,1 they misapply our data to calculate a “compounded” complication rate for our cohort, which is incorrect and inapplicable for several reasons. Each of our complications was reported individually instead of selecting 1 complication per patient. Thus, adding our reported outcomes overestimates the complication rates in our cohort because some patients had more than 1 complication. We respectfully suggest not applying estimations and calculations to data that authors are unfamiliar with, because this practice can highly distort results from other colleagues, wrongly skewing conclusions.

The authors expressed concerns regarding the transparency of our described complications.1 We have diligently reported our complications, including even the most minor ones (eg, pleural effusion requiring diuretics and prolonged [≥3 days] hospital stay due to residual pain),2 which were overlooked in Media and colleagues’ compounded approach.3 Notably, minor complications represented most complications in our cohort. We did not list complications that did not occur in our patients, including infections. We observed no instances of infection even after long-term follow-up.

Additionally, Vincenzo de Paoli and colleagues1 raised concerns about our failure to report late-onset complications, all of which were addressed in our long-term results. In our cohort, 53% were eligible and underwent bar removal, with 82% having a median follow-up of 5.1 years. None experienced regression, and only 1 patient, with a history of chronic pain, reported significant persistent discomfort, obviating the need for further reporting.2

We acknowledge their rationale behind the nonstandard reporting of combined complication rates from both insertion and removal surgeries.3 However, we opted for a surgical standardized approach with this article, focusing on surgical repair while also reporting bar removal percentage of our cohort. We agree with Vincenzo de Paoli and colleagues’ confirmation1 that bar removal is safer than insertion. Consequently, our primary emphasis was on delineating bar insertion complications; however, we have previously published a detailed series dedicated to outcomes of 1555 patients who underwent bar removal with a 2% risk of bleeding and no mortalities reported.4

As a final comment, the authors criticize our approach for “dichotomizing” the HI value,1 yet they acknowledge that according to their findings (“...”) risk of complications was related to HI exhibiting a more biphasic nature, with complications dynamic from 4.5 to 5.5.”3 This inconsistency in the message conveyed was further evident in their results, because their own multivariable analysis suggested that the risk of complications increased with each unit increase in HI. However, their analysis and bar chart from Figure 5F3 show that complications remained constant until HI 4.5, with a substantial increase between 4.5 and 5.5, followed by another plateau (with a small decrease at HI ≥ 6.5).
As additional concerns, the multivariable analysis was based on 6 clinically relevant variables subjectively decided on by the authors and 11% of their cohort were excluded from the initial analysis, exposing the results to potential bias. In our own institution’s experience of more than 1300 primarily adult patient pectus repairs, the HI has not been identified as an independent variable predisposing to complications, apart from risk for conversion to a hybrid procedure due to fractures needing stabilization with plating. Other large series publications have not found HI to be a complication risk factor.5

We respectfully disagree with Vincenzo de Paoli and colleagues1 in their interpretation of our article. It is pivotal to clarify that our article’s scientific objective was not to evaluate the overall association between HI and complications but rather the outcomes within a highly specific subgroup characterized by adult patients with extreme HI values.2 This specific subgroup of patients is still widely considered inoperable by many using minimally invasive repair of pectus excavatum, and we hypothesize that this could be related to lack of experience and information regarding their outcomes. To answer this scientific question, the highest feasible cutoff value for the HI while ensuring statistical power was estimated. Further enlarging the cohort size would have steered us away from our primary scientific inquiry.

Last, in their letter, Vincenzo de Paoli and colleagues1 asked what to believe in the matter of HI and outcomes in pectus excavatum. Regarding this question, we do believe that experience and application of key surgical techniques are crucial to repair these patients successfully and safely (specifically those with more difficult deformities). This includes the use of multiple bars to balance the defect, forced sternal elevation to improve visualization and procedure safety, “hammock” reinforcement of the intercostal spaces to prevent muscle stripping and posterior-lateral bar migration, and multipoint fixation to secure bars and prevent bar rotation. Research efforts are of the highest value in this field, and constructive collaborations are always positive; therefore, we value the feedback from de Paoli and colleagues and their contributions to the pectus field and research.

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References

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