

Peer review file

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Reviewer A

Comment 1: The authors present a very well written and described case series using BioMet's SternaLock Blu plating for their Ravitch procedure. Their results are excellent and they properly discuss limitations including possible underestimation of malunion. The manuscript is excellent and I have no criticisms.

Reply 1: Thank you for your thorough review of our manuscript and the overwhelming number of compliments given.

Changes in the text 1: No changes were made.

Reviewer B

Comment 1: It is a fundamental topic on the usage of sternal plate for pectus anomalies. You suggest that “SternaLock Blu plates are deemed to be safe and effective in providing adequate rigid fixation of the sternal osteotomy during the modified Ravitch procedure”. These sternal lock plates are primarily used for fixation after median sternotomy because they reduce the complications associated implantations. We doubtlessly agree of effectiveness of the sternal lock plate using the modified Ravitch procedure because sternal lock plates originally show excellent outcomes during median sternotomy. We generally use sternal lock plates for median sternotomy, fixation of sternal fracture, and other sternal procedures. We agree that sternal lock plates are safe and effective on all procedures for sternum. Although this study is the first to investigate the use of SternaLock Blu plates for rigid sternal fixation during the modified Ravitch procedure, I am sorry to comment that the findings on this study are nothing new. I have several comments on this case series.

Reply 1: First of all, thank you for your thorough review of our manuscript and the constructive comments raised. We acknowledge that SternaLock Blu plates are used for other sternal procedures, but primarily for sternal closure following sternotomy. This has also been stated in the introduction section. However, the fact that it provides

excellent outcomes, as stated by you, was missing. The introduction section was amended accordingly and an additional reference stressing these outcomes was added as proposed by reviewer C (Allen K. Randomized, multicenter trial comparing sternotomy closure with rigid plate fixation to wire cerclage. The Journal of Thoracic and Cardiovascular Surgery 153 (4), 888-896, 2017).

Changes in the text 1: line 95-96 on page 6.

Comment 2: Except special cases, Nuss procedure is the first choice for the pectus excavatum. You should show the indication of the modified Ravitch procedure. This issue is important for exclusion of the bias.

Reply 2: Thank you for your comment. We fully agree that it is of paramount importance to stress the indications for the modified Ravitch procedure in the current study, given that the first choice is a minimally invasive Nuss procedure. The methods and results section were amended accordingly.

Changes in the text 2: line 120-123 on page 7 and line 179-184 on page 10.

Comment 3: When I perform the modified Ravitch procedure, I regularly use rib fixation plates such as the “MatrixRIB® Fixation System” as well as sternal lock plates. Do you think that sternal lock plates are enough for correction of pectus excavatum without rib fixation?

Reply 3: Thank you for your comment. Prior to the use of SternaLock Blu plates, we utilized locking compression plates for fixation of the sternal osteotomies during modified Ravitch procedures. In our experience, solitary sternal plate fixation with either locking compression plates or the current SternaLock Blu plates provides sufficient sternal stability, without the need for extra anterior support by means of additional rib plates or retrosternal support by for example mesh or struts. The primary rationale to use additional support methods (eg. fixation plates) is the presence of an unstable situation. This usually occurs upon extensive proximal cartilage resection. In our center, we solely resect the severely deformed cartilage, aiming to minimize the levels of resection. Using this method, we have, up until now, never encountered sternal instability.

Based on your comment we feel that this information is essential to add to the surgical technique section which was amended accordingly.

Changes in the text 3: line 120-121 on page 5.

Comment 4: I think that your reported case can be corrected by the Nuss procedure (the sandwich technique). Can you show the reason why you choose the modified Ravitch procedure?

Reply 4: Thank you for your comment. We agree that nowadays minimally invasive procedures, such as the Nuss, Abramson and sandwich technique are the treatment of first choice. This has, based on your comment, been emphasized in the introduction section. However, the modified Ravitch procedure may still occasionally be indicated based on patient's age, severity or type of the deformity, prior thoracic surgery, experience of the surgical team and patient preference (Ersen et al., *Wideochir Inne Tech Maloinwazyjne*. 2016;11(2):98–104.) However, we agree that our manuscript did not reflect the choices made. Therefore, we have also amended the patient selection criteria. Moreover, we stressed the indication to perform a modified Ravitch procedure instead of a minimally invasive approach in the results section.

Changes in the text 4: line 120-123 on page 7 and line 179-184 on page 10.

Comment 5: Can you show the postoperative outcomes such as the Haller index. These outcomes are essential to studies on the procedures.

Reply 5: Thank you for your comment. The Haller index is generally used as an objective marker for pectus severity. Despite it is considered as gold standard in pectus excavatum, it is not applicable for pectus carinatum and pectus arcuatum. Given the fact that patients with either type of deformity were included, we deliberately refrained from reporting the Haller index values for patients with pectus carinatum and pectus arcuatum. However, a routine postoperative lateral plain radiograph was acquired during the first postoperative days in order to assess whether an anatomical position of the sternum was achieved. In addition, during follow-up (median: 25 months; IQR: 16-28; range: 15-29), no recurrent cases were observed. We have added this to the methods section, and have, moreover, added the results of the postoperative lateral radiograph to the results section. In addition, re-reading our manuscript we noticed that the postoperative Haller index was missing for patients with pectus excavatum which has been amended in the results section.

Changes in the text 5: line 150-152 on page 8-9, line 185 on page 10, line 187-189

on page 10 and line 194 on page 10.

Comment 6: When you decide the time of removal if you should remove the plates due to complication? Do you consider the time associated with stability of correction?

Reply 6: Thank you for your comment. Answering this question and incorporating it in the manuscript will be enlightening for the readers. If patients present with complications urging plate removal, removal is at all times postponed until adequate union is likely (at least 6 months after initial surgery) and moreover confirmed by cross-sectional imaging. If plate removal is indicated based on plate prominence, removal is advised to be postponed until adequate union is likely (at least 6 months after initial surgery) and moreover confirmed by cross-sectional imaging. In the presence of an infection, ideally the plates remain in situ and the infection is treated by drainage and antibiotics.

Changes in the text 6: line 213-215 on page 11.

Comment 7: I am sorry to comment that the findings in this study are found during the adoption of the sternal lock plates.

Reply 7: Thank you for your comment with which we fully agree. We have added this statement to the limitations section of the discussion.

Changes in the text 7: line 264-266 on page 14.

Reviewer C

Comment 1: This paper describes the experience of SternaLock Blu in 9 cases with anterior chest wall deformity. According to the results of the pilot study, sternal fixation with this device looks safe and effective.

I think this paper is worthy of being accepted. However, I'd like to clarify a few points.

Reply 1: First of all, thank you for your thorough review of our manuscript and the constructive comments raised. In addition, thank you for the compliments.

Changes in the text 1: No changes were made.

Comment 2: Regarding surgical procedure, SternaLock Blu is used for fixing transected sternum. To obtain a good fusion of the sternum, curved sternum has to be cut in a wedge shape to fit the separation surface. Please add a more detail for the surgical procedure.

Reply 2: Thank you for your comment. It is indeed of paramount importance that the wedge cuts are made in such fashion that the separation surfaces touch upon correction of the deformed sternum to allow for proper sternal union. Although performed in every patient included in the present study, this detail was missing in the description of the surgical technique. The surgical technique section was amended accordingly.

Changes in the text 2: line 141-143 on page 8.

Comment 3: SternaLock Blu was primarily designed for sternotomy closure with cardiac surgery. It should be better to cite the related paper. I found a paper listed below showing an appropriate data for sternal healing after sternotomy. The conclusion of the results are as follows: Sternotomy closure with rigid plate fixation resulted in significantly better sternal healing, fewer sternal complications, and no additional cost compared with wire cerclage at 6 months after surgery.

"Allen K. Randomized, multicenter trial comparing sternotomy closure with rigid plate fixation to wire cerclage. The Journal of Thoracic and Cardiovascular Surgery 153 (4), 888-896, 2017"

Reply 3: Thank you for your comment and proposing the article by Allen and colleagues as useful reference. The reference was incorporated in the article. Thank you for assisting!

Changes in the text 3: line 95-96 on page 6 and reference 9 on page 17-18.

Comment 4: The sentence in the 247 line in the last paragraph of discussion is difficult to comprehend. Is the decision making of surgical procedures among cases with complex and severe deformity different? Please make clear about this sentence.

Reply 4: Thank you for your just comment. Severe cases often pose surgical challenges and may therefore be complex. However, we meant to solely stress about severe cases since complexity may also be subjective to surgeon's experience. The sentence has been amended accordingly

Changes in the text 4: line 276-277 on page 14.

Comment 5: In the references, literature 8 is incomplete.

Reply 5: Thank you for your attentiveness. Reference number 8 was indeed incomplete and has been amended.

Changes in the text 5: reference 8 on page 17.

Reviewer D

Comment 1: Authors present a pilot study of use fo SternalLock Blu plate during modified Ravitch procedure. The study is interesting but the number of patient in the study is too small to support any of the conclusions. The group of patients who is at the highest risk of failure are pectus excavated. In this study, there were only 4 patients who were treated for this indication. The authors should continue to collect their experience and resubmit when their study is adequately powered to provide any of the conclusion.

Reply 1: Thank you for your thorough review of our manuscript and the comments raised. The rationale of conducting a pilot study is to evaluate preliminary results on safety and feasibility as a step-up approach for larger, adequately powered studies. We therefore, agree that adequate power is desired, however, not applicable for a pilot study, such as the presented study.

Re-reading our conclusions we agree that some of the words used may have been too firm and the conclusion was rephrased. In addition, the issue of power and the fact that patients with pectus excavatum are at higher risk for failure was added to the discussion section.

Tempering our conclusions and stressing the issues raised we feel that the manuscript has been adapted in such a way that careful interpretation is allowed without providing conclusive evidence. Given that this study is the first to use SternalLock Blu plates for sternal fixation in pectus deformities, the primary message of being safe and feasible is in our opinion valuable to other experts which encounter the same issues using current fixation methods (e.g., bulky plates which often require removal due to complaints) and are seeking for an alternative method. Our preliminary results form a

fundamental basis for future research.

Changes in the text 1: line 245-246 on page 13, line 266-267 on page 14, line 280 on page 14 and line 283-285 on page 15.