Peer review file
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Reviewer A
Abstract and Title
Comment 1: What is does NI-TI stand for in the abstract (line 10)?
Reply 1: NI-TI stand for a memory alloy embracing fixator used in our research, and It has good biocompatibility and shape memory effect. It can deform at a certain temperature.

Comment 2. In the abstract, please add what statistical analysis was used to compare the three groups and what statistical significance was set at.
Reply 2: We added the statistical analysis in the text.
Changes in the text: (See Page1, line: 21-24).

Comment 3. In the "Results" section of the abstract, you discuss advantages in bleeding and patient satisfaction, however, you don't include this in your "Methods" section. Please elaborate more on exactly what you compared in the "Methods" section.
Reply 3: Difference of the clinical index included duration of surgery, blood loss, hospitalization, wound healing, hospitalization expenses, VAS scores and patient satisfaction scores between the three groups was compared.
Changes in the text: (See Page1, line: 19-21).

Comment 4. The abstract is a little misleading. The title of the manuscript is "Surgical treatment of sternum comminuted fracture with Memory alloy embracing fixator" yet the conclusion of the abstract does not discuss this. It needs to be clear what you are trying to show in this study. Are you trying to show that Memory alloy embracing fixator is a superior method of sternal fixation? If so, you need to demonstrate that in both the results and conclusion as you currently do not. Also, I would add a hypothesis to your "Methods" section to better clarify this. Are you trying to show that sternal fixation with a plate is better than with wires or no surgery at all? If this is the case, that needs to be better clarified. Or is your hypothesis that sternal fixation surgery in general is better than non-operative management? If that is the case, it needs to be better clarified and discussed. You should also adjust the title of your manuscript to better clarify this. From the title, I thought the study would be about how the Memory alloy embracing fixator is a superior way to repair a sternal fracture, but I cannot tell from the abstract if that is actually what you are trying to say.
Reply 4: In our study, we trying to show that Memory alloy embracing fixator is a superior method of sternal fixation, and in the "Conclusion" section, corresponding modification has been made. Sternal fixation surgery in general is better than non-operative management is also one of the conclusion from our study. Some patients with simple sternal fractures and displacement, there were two therapeutic options can be selected, so we compared the surgical treatment and non-surgical treatment.

Changes in the text: (See Page1, line:32-34).

Introduction

Comment 1. In your introduction, you state sternal fractures are not difficult to diagnose. I would argue this as I find radiologist miss sternal fractures on CT scans all the time. Given the fact that sternal fractures are so rare, incidence of 0.5% based on current literature (Klei DS, de Jong MB, Öner FC, et al. Current treatment and outcomes of traumatic sternal fractures – a systematic review. Int Orthop 2018 Apr 26. doi: 10.1007/s00264-018-3945-4), please elaborate on why the authors feel this injury is not difficult to diagnose.

Reply 1: The diagnose of sternal fractures is a complicated process, but for the displacement fracture is less difficult. And 3D reconstruction is widely used in our hospital. We also reviewed the literature Klei DS, de Jong MB, Öner FC, et al. Current treatment and outcomes of traumatic sternal fractures – a systematic review. Int Orthop 2018 Apr 26. And the conclusion of this literature is Treatment of traumatic sternal fractures and dislocations is an underexposed topic.

Comment 2. Again, there is no hypothesis in your introduction. Please add one to help guide the reader's thoughts while reading your manuscript. Do you think surgical fixation is going to be better than non-operative management? Also, you don't speak of the Memory alloy embracing fixator in the last paragraph of your introduction. Do you feel this is a superior surgical option then other surgical options?

Reply 2: We added the relevant content in the manuscript. We think surgical fixation is going to be better than non-operative management. The Memory alloy embracing fixator has good biocompatibility and shape memory effect. It is a superior surgical option then other surgical options.

Changes in the text: (See Page2, line:20-21).

Materials and Methods

Comment 1. The "Methods" section should describe exactly how your study was conducted and organized as well as what data was collected and how it was analyzed. The first sentence of your "Methods" section states "A total of 81 cases of sternal fractures patients…" Information like this needs to be moved to your "Results" section.

Reply 1: Thanks for the review, we have modified the relevant content.

Changes in the text: (See Page2, line:24-44).

Comment 2. Could you please elaborate on how the nitinol memory alloy works and why it was chosen? This is a new technology for sternal fixation as most surgeons use titanium or titanium alloy plates for their fixation. Why does it need to be put in ice water, then the hot compress, etc? This is very interesting but most readers are likely not sure how this works and why.

Reply 2: Nitinol memory alloy was widely used in our hospital. It is an shape memory alloy, it can shaped into different shapes at low temperatures, and restore its plastic deformation to its original shape at a given temperature. It was first found by Buehler

in 1963.

Comment 3. Why were some patients fixated with steel wires? It has been shown that plates are a superior methodology for fixating sternal fractures (Klei DS, de Jong MB, Öner FC, et al. Current treatment and outcomes of traumatic sternal fractures – a systematic review. Int Orthop 2018 Apr 26. doi: 10.1007/s00264-018-3945-4).
Reply 3: Thanks for the comments. For all the the patients, we offer different treatments for select, and the expense of steel wires is cheaper than plates. Some patients choose steel wires as internal fixator for the surgery. We also reviewed the literature (Klei DS, de Jong MB, Öner FC, et al. Current treatment and outcomes of traumatic sternal fractures – a systematic review. Int Orthop 2018 Apr 26).

Comment 4. When doing the manual reduction of the sternal fractures, what guarantees the fracture will stay in a reduced position? Were there any patients that needed fixation after manual reduction because the fracture did not stay reduced? How did you assess and follow these patients?
Reply 4: When doing the manual reduction of the sternal fractures, we help patients wear chest strap in the first time. Also, there were no patients needed fixation after manual reduction until now, but re-displacement was happened for a little of patients, and the re-displacement is mildly, and can choose non-fixation treatment.

Comment 5. How did you assess bone healing? Repeat chest X-ray? Repeat CT scan? It would be hard to assess bone healing without a CT scan to better assess these bones?
Reply 5: We assess bone healing by repeat chest CT scan. The main standard of fracture healing we used in clinical practice include: 1. There is no tenderness or percussion pain in the fracture area, 2. X-rays showed a blurred fracture line with a continuous callus passing through the fracture line.

Results
Comment 1. The authors need to go back and significantly clean up the “Methods” and “Results” sections of the manuscript. The “Methods” section needs to be how the study was conducted and data analyzed. It is very confusing and hard to follow the “Methods” section as there is a ton of data in the “Methods” section that needs to be removed and put in the “Results” section. Much of this data is then presented again in the “Results” section in a different way making this portion of the manuscript very challenging to read and understand. This requires substantial revisions if this manuscript is to be published.
Reply1: Thanks for comment, and we have delete the “results” data, and explain how the study was conducted and data analyzed.
Changes in the text: (See Page2, line:24-44;Page 3,line:29-40).

Comment 2. Great job with the follow-up of these patients.
Reply 2: Thanks for comment.

Discussion

Comment 1. In lines 3 and 4 of the "Discussion" section you state the fracture site is always located in the body of the sternum. This is an incorrect statement as I personally have repaired several fractures of the manubrium. You may want to adjust this statement.

Reply1: Yes, we reviewed more literature and corrected in the manuscript.

Changes in the text: (See Page6, line:18-19).

Comment 2. Please elaborate on what you mean by "external fixation" as a "conservative treatment." I have never seen a sternal be external fixated and wonder what this looks like. Also, I would change your wording from "conservative treatment" to "non-operative treatment" throughout the manuscript.

Reply2: The external fixation of sternal fracture includes thin pillow which were used to raise the backside and fixed the chest with chest strap.

We have changed wording from "conservative treatment" to "non-operative treatment" throughout the manuscript.

Comment 3. You state it is easy to injure retrosternal organs placing plates on a patient's sternum. How frequent is this? Please use literature to quote a number or state that this is just your opinion. I would argue that it is extremely hard to injure retrosternal organs as long as your technique is appropriate. Are you implying that the authors are not using an appropriate technique?

Reply 3: It rarely happens for the injury of retrosternal organs when placing plates on a patient's sternum. Vascular injury and pleura injury was reported in literature.

Collins J. Chest wall trauma. J Thorac Imaging. 2000 Apr;15(2):112-9. doi: 10.1097/00005382-200004000-00006. PMID: 10798630.

Comment 4: The paragraph starting with "Individualized medical treatment for sternal fracture is necessary…" does not make sense. I'm not sure if that paragraph is necessary as it rambles on about things not related to sternal fracture fixation. I recommend removing this paragraph or re-wording it so it is better in line with the rest of the discussion.

Reply 4: Thanks for this comment. The paragraph is emphatically introducing the new technical used for sternal fracture in medical diagnosis and treatment. We also re-wording it in the manuscript.

Changes in the text: (See Page 8, line:24-26).

Comment 5: You state sternal fractures are a common disease in chest trauma. I would argue just the opposite based on the article I included earlier in this review. I recommend revising this claim.

Reply5: Traumatic sternal fractures are relatively uncommon injuries that occur in approximately 3% to 8% of all blunt trauma patients [1]. And many traffic accident victims were transported to our hospital in our province.

[1] (Athanassiadi K, Gerazounis M, Moustardas M, Metaxas E. Sternal fractures: retrospective analysis of 100 cases. World J Surg. 2002;26: 1243–1246).

Comment 6: In the last paragraph of the "Discussion" section you start talking about autologous stem cells. This is very confusing as to why since you haven't talked about it at all throughout the rest of the manuscript. I recommend elaborating on this or removing it so it not confusing to the reader since you are discussing sternal fractures and sternal fixation throughout the manuscript's entirety.
Reply 6: Autologous stem cells may be helpful to wound repair of sternum, and we elaborated in the manuscript.
Changes in the text: (See Page 9, line:16-17).

Comment 7: You need to have a separate paragraph discussing the limitations of your study in the "Discussion" section. Also, your overall conclusion is very confusing. How should this manuscript change my practice or make me think differently about sternal fracture management?
Reply 7: Thanks for comment, and we adjust the structure of the "Discussion" section. Main conclusion of our research is about surgical treatment for sternal fracture and the superiority of memory alloy embracing fixator. Also, we looking forward the new technical for the treatment of sternal fracture.

Overall, this manuscript needs major revisions. There are many grammatical errors throughout the manuscript, making if very challenging to read and follow along. I recommend going through this manuscript in a very detailed manner and correcting all these grammatical errors. Furthermore, it is overall very confusing as to what the authors are advocating for. Are your just recommending sternal fracture fixation over non-operative management? Are you recommending Memory alloy fixation over steel wires? It is very difficult to tell and this needs to be revised. I personally find the Memory alloy very interesting and would make that the focus of this manuscript, but I leave that up to the authors discretion. Lastly, the manuscript needs to be organized in the following format so readers can follow:
Introduction (including hypothesis)
Methods and Materials (no data but what statistical analysis is used)
Results (all the data and statistical analysis)
Discussion (including a study limitations section and conclusion)
Reply: Thanks for the general evaluation, and the manuscript was modified according to the comment.

Reviewer B
Comment1: Introduction: The author need to hire a Native-English speaker for grammar check for more fluent and eloquent writing. The article in current state is acceptable for publication. i.e Manuscript line 3 to line 10 do not make sense with multiple grammatical errors and erroneous idiom usage.
Reply1: We found the grammatical errors of Manuscript line 3 to line 10. And we have modified it.

Changes in the text: (See Page 2, line:3-7).

Comment 2: Method: Author noted that he displacement degrees of fractured sternum were different in operation group and conservative group so the conservative group should not be used as control. Three groups are too heterogeneous to be compared. Again, need grammatical correction and spelling error. T-test is likely not suitable for age comparison (Not normally distributed).

What is the definition of underlying conditions? does not describe comorbidity well. I.e. Just hypertension versus someone with diabetes, hypertension, and end stage renal disease.

Reply 2: thanks for the comment. For the patients with simple sternal fractures and displacement, both surgical treatment and non-surgical treatment can be selected. Heterogeneity was also exited.

T-test is likely not suitable for age comparison, we use chi-square tests for it.

Comment 3: Result: Grammatical errors. Tables are not well received. Confusing to look at when the grouping and variables are switched back and forth from column to rows.

Reply 3: Thanks for the comment, and we have modified in the manuscript.

Changes in the text: (See Page 4, line:18-40).

Comment 4: Discussion: Need grammatical corrections. Well described current literature. Author provides limitation to their study. The low sample size and inappropriate method of study are the major weakness of the project. I recommend authors to redesign the study. I do not believe the current manuscript will have any major contribution to literature.

Reply 4: Thanks for the comment, there were some limitation in our research, and we have made major revision for it.

Reviewer C

Comment1: In your figure 2 which revealed a transverse fracture or dislocation at the junction of manubrium and body, not a comminuted fracture.

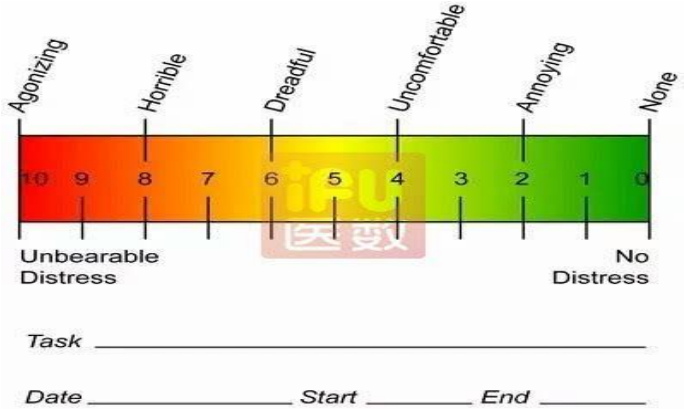
Reply1: Yes, our research focuses on the patients with simple sternal fractures and displacement. Because both surgical treatment and non-surgical treatment can be selected for this type of chest trauma.

Comment2: Memory alloy embracing fixator is a new implant but we must know the manufacture and trade.

Reply2: Ni-ti memory alloy was widely used in our hospital. It is an shape memory alloy, it can shaped into different shapes at low temperatures, and restore its plastic deformation to its original shape at a given temperature. It was first found by Buehler in 1963. It's expansion rate is more than 20%, the fatigue life of 107 times, it's corrosion

resistance is better than the medical stainless steel now, so it can meet many kinds of medical application needs, is a very excellent functional material.

Comment3: Table 4. Satisfaction score. How do you define the satisfaction score? Reference?
Reply3: Visual analogue scale (VAS) pain assessment is most used in our country, this way is simple, convenient and practical. Accurate and timely assessment of pain can provide guidance and help for clinical treatment. The basic method is to use a scale about 10cm long, and "0" to "10" points were marked. 0 points means no pain and 10 points means the most intense pain which is unbearable. Instead of filling out a cumbersome questionnaire, patients look at the pain ruler and say a number between 0 and 10.



Reviewer D
Comment1: Authors performed retrospective cohort study of patients who had treatment for sternal fracture in their study "Surgical treatment of sternum comminuted fracture with Memory alloy embracing fixator."
Overall the results are presented in the methods section. The methods section should provide information about the study design instead of data on the patient in the study. Please revise the methods and results section.
Reply1: Thanks for the review, we have modified the relevant content.
Changes in the text: Method (See Page2, line: 24-44). Result (Page4, line: 18-40).

Comment2: In the methods section of abstract – please remove "there were 42 patients . . "This should be in the results section. In the methods please describe how the study was done. Not a place for the results.
-Methods section – please move the results to results section. "34 patients with . . . "
Reply2: In the methods section of abstract –we have removed "there were 42 patients.
- Methods section –we have moved the results to results section. "34 patients with …"
Changes in the text: Method (See Page2, line: 24-44).

Comment3: Methods section – please describe the inclusion and exclusion criteria of the study. Methods section should describe how the study was performed not the details

of the results of the study.
Reply3: Thanks for the comment. Case excluded stand: undisplaced sternal fracture, internal bleeding and severe multiple injury. And we added in the manuscript.
Changes in the text: Method (See Page2, line: 26-27).

Comment4: Results section – please perform univariate and multivariate analysis for outcomes.
Results Please compare the fracture. i.e. amount of displacement. Location of the fracture among different groups.
Please have language review of the manuscript.
Please provide the questionnaire that was used for patient satisfaction in the supplement.
Reply4: Thanks for the comment, we have made univariate and multivariate analysis for outcomes. Clinical outcome of two surgery groups showed in table2. There was no statistically significance among different groups.
Questionnaire that was used for patient satisfaction:

Follow-up and satisfaction survey for sternal fracture patient
(The full mark is 10 points for each item)

Q1: Are you satisfied with the attitude of the medical workers, for the time in hospital or outpatient? (You can select 0-10potints)
Q2: Do you still feel uncomfortable after the hospital? (Yes for 5 points, No for 10 points)
Q3: Whether the trauma affected your work or excise? (Yes for 5 points, No for 10 points)
Q4: Are you satisfied with the chest wall appearance now? (Yes for 10 points, No for 5 points)

Q5: Are you always feel chest tightness? (Yes for 5 points, No for 10 points)
Q6: Do you know how to do rehabilitation training after hospital? (Yes for 10 points, No for 5 points)
Q7: Are satisfied with your recent recovery? (Yes for 10 points, No for 5 points)
Q8: Whether there were failure fixation or displacement occurred again during follow-up period? (Yes for 5 points, No for 10 points)
Q9: Do you have some Knowledge about sternal fracture? (2 points for a little, 5points for rudimentary knowledge, 10 points for a thorough understanding.)
Q10: Whether the doctors tell you the attention points about sternal fracture? (Yes for 10 points, No for 5 points)