BIOMECHANICAL COMPARISON OF STRAIGHT MEDIAN STERNOTOMY AND INTERLOCKING STERNOTOMY

Fatih Küçükdurmaz¹, MD, İsmail Ağır², MD, E Nuh Mehmet¹, Murat Bezer³, MD,
¹Clinic of Orthopaedics and Traumatology, Bezmi Alem Foundation University School of Medicine, Istanbul, Turkey
²Clinic of Orthopaedics and Traumatology, Bismil State Hospital, Diyarbakir, Turkey
³ Department of Orthopaedics and Traumatology, Marmara University School of Medicine, Pendik, Istanbul, Turkey

CORRESPONDING AUTHOR
İsmail Ağır, MD, Clinic of Orthopaedics and Traumatology, Bismil State Hospital, 21500, Bismil, Diyarbakir, Turkey
Phone: +90(412)4157065
Fax: +90(412)4155787
Email: iagir@hotmail.com
**Purpose:** The transsternal approach by sternotomy is the best route to gain access to lesions localized within the vertebral bodies of the upper thoracic spine. Sternotomy is used to access upper vertebral bodies in orthopaedic surgery and intrathoracic structures in other surgical specialities so it is the most common osteotomy worldwide. The complications due to sternotomy is usually fatal. Therefore more than 40 different techniques have been described for sternal closure. However, no biomechanical study has been done comparing the different configurations of median sternotomy which may dramatically increase the sternotomy reduction and stability. In this biomechanical study, interlocking sternotomy is performed to increase the sternal stability and compared to median straight sternotomy.

**Material methods:** Tests were performed on 20 fresh sheep (*O. ammon aries*) sterna which were isolated from the sterno-costal joints of the ribs. Median straight (Figure 1) and interlocking sternotomies (Figures 2) were performed on 10 sterna each, set as group 1 and group 2, respectively.
Figure 1: Median straight sternotomy is seen.
Figure 2: Interlocking sternotomy is seen, anterior view.

Interlocking sternotomy was created with 3 zig-zag osteotomy lines approximately 150 degrees to each other in coronal plane (Figures 3).
Figure 3: Sternotomy planes of interlocking sternotomy is seen

Median sternotomy is performed as a straight osteotomy line in cranio-caudal direction. Both sternotomies were performed with an oscillating saw and closed at three points with a No. 5 straight stainless-steel wiring. Fatigue testing was performed in cranio-caudal (CC), anterio-posterior (AP) and lateral direction by a computerized materials-testing machine (High Capacity 8802, Instron™, USA) cycling between loads of 1 and 400 Newtons per 5 seconds (0.2 Hz) for distraction and release.
The amount of displacement in AP, lateral and CC direction after biomechanical test were measured and also the opposing bone surfaces were calculated by measuring the sides of osteotomy at the two halves of sternum.

**Results:** The displacement in AP and CC directions is less in group 2 and it is statistically significant. Displacement in lateral direction in Group 1 is less but it is statistically not significant (Figure 4).

**Figure 4:** Comparison of displacement in anterior-posterior, cranio-caudal and lateral direction in two groups.

Surface area in Group 2 is significantly wider than Group 1 (Figure 5).
Figure 5: Comparison of opposing bone surface areas at sternotomy site is seen in two groups.

Conclusion: In our biomechanical study, it has been shown that performing interlocking sternotomy makes the sternotomy line significantly more stable and provides a wider osteotomy surface area. These increases will be an advantage in primary osseous healing in clinical practice.
EuroSpine Abstract Submission 2010

I have created and I am the current copyright holder of a paper/poster/e-poster presentation and all contents therein (hereinafter referred to as the "Work"). I hereby license the Work to EuroSpine, the Spine Society of Europe ("ES") according to the following terms:

1. The license shall begin on the date I sign this Agreement.
2. I hereby grant ES a non-exclusive, perpetual license for use by ES of the Work. ES is not obligated to use the Work in any way.
3. I am giving this license to ES as a contribution. I specifically release ES from any obligation to pay money or otherwise perform services for this license.
4. ES may use the Work in fulfillment of its organizational purposes only. I understand and agree that such use may include, but is not limited to, the sale and advertisement of the Work, printing, exhibition, broadcast, internet use, publication, reproduction, distribution and use of excerpts or abstracts of the Work on a stand-alone basis or in combination with other material on any and all audio and visual media, whether paper-based, film or electronic.
5. I represent to you that I am the sole author of the Work and that the Work does not contain any material that is copyrighted by any other person or entity that, if the Work does contain material copyrighted by others, that I have obtained written permission to utilize same in the Work and to license the Work as provided hereby, and that such third party copyrights are acknowledged in the Work. I warrant that the Work does not infringe the copyright, trademark or any other intellectual property right of any other person or entity. I agree to indemnify ES, its directors, officers, employees, and agents against any and all loss, cost or damages (including, without limitation, liability for payment of claims, judgments or settlements, for violation or infringement of the copyright, the trademark or other intellectual property rights of another) arising out of the granting of his license or ES' use of the Work, including, without limitation, any attorney's fees and costs that ES incurs in connection therewith.
6. I hereby grant ES a non-exclusive, perpetual license to the performance rights in my presentation of the Work. I confirm that no third party has any performance rights in my presentation of the Work.
7. I hereby warrant and represent that neither I nor any co-authors of the Work or our family members have any financial relationship with any commercial entity that has an interest in the subject matter or materials discussed in the Work (e.g. receipt of research funding, shareholdings, employment or advisory roles, rights to patent royalties or licensing fees, lecture fees, fees for production of promotional materials or receipt of trips, travel or gifts), except as disclosed in the Work (at the end of the abstract).

I have read the foregoing license and agreement before signing below, and I fully understand the contents.

Signed: Ismail ABR, MD