

Case Report

Latissimus muscle sparing approach to subscapular rib fracture plating

Ian A. Makey*, Samuel Jacob, Magdy M. El-Sayed Ahmed, Si Pham, Kevin Landolfo, Mathew Thomas

Department of Cardiothoracic Surgery, Mayo Clinic Florida, Jacksonville, FL, USA

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ABSTRACT

Surgical stabilization of fractured ribs has been shown to improve trauma related outcomes, however the procedure itself can be a source of morbidity. This report details two cases of latissimus dorsi muscle sparing sub-scapular multi-rib fracture plating. We combined several techniques to make this possible. The first technique was use of a vertical skin incision along the anterior border of the latissimus muscle. The second was the use of a mammary retractor to provide adequate and sustained retraction of the latissimus and scapula. The third was utilization of a right angle screwdriver to allow placement of the posterior screws. Sparing the latissimus muscle for sub-scapular fractures is possible but requires planning and extra equipment to perform. Minimizing rib fixation related morbidity makes it a more appealing treatment.

1. Introduction

Surgical stabilization of rib fractures (SSRF) has been shown to improve trauma related outcomes [1], however the procedure itself can be a source of morbidity. The chest wall is encased by multiple muscles including the latissimus dorsi, serratus anterior and posterior, pectoralis, rhombus, trapezius, and paraspinous. Exposure of the fractured rib(s) can require division of these muscles which may result in functional deficits. Most surgeons recommend a muscle sparing approach whenever possible [2]. Muscle sparing SSRF has been described before [3,4], however we describe a trio of techniques that makes sub-scapular, latissimus-sparing SSRF easier to perform.

2. Cases

Case 1 is a 73-year-old man who fell onto the railing of his boat while crossing the wake of another boat. He presented the day of the accident with severe chest pain particularly with respiration. He underwent a primary and secondary trauma survey and a CT scan of the chest, abdomen, and pelvis. His chest CT revealed a hemothorax and non-flail, displaced, left, lateral fractures from the 3rd to the 7th rib. These were the only injuries found. In the operating room, we drained 300ml sanguineous fluid with thoracoscopic guidance and resected an intra-pleural rib shard. Using the described technique, ribs 4–7 were exposed (Fig. 1) and plated (Fig. 2) (Ribfix Blu, Zimmer Biomet, Jacksonville, FL). An epidural, placed pre-operatively, was continued for an additional three days. He was discharged on postoperative day 6. Case 2 is a 78-year-old man who fell from his horse and landed on his left side. He presented

Abbreviations: Surgical stabilization of fractured ribs (SSRF), Computerized tomography (CT)

* Corresponding author. Department of CT Surgery, Mayo Clinic Florida, 4500 San Pablo Rd S, Jacksonville, FL 32224, USA.

E-mail address: Makey.ian@mayo.edu (I.A. Makey).

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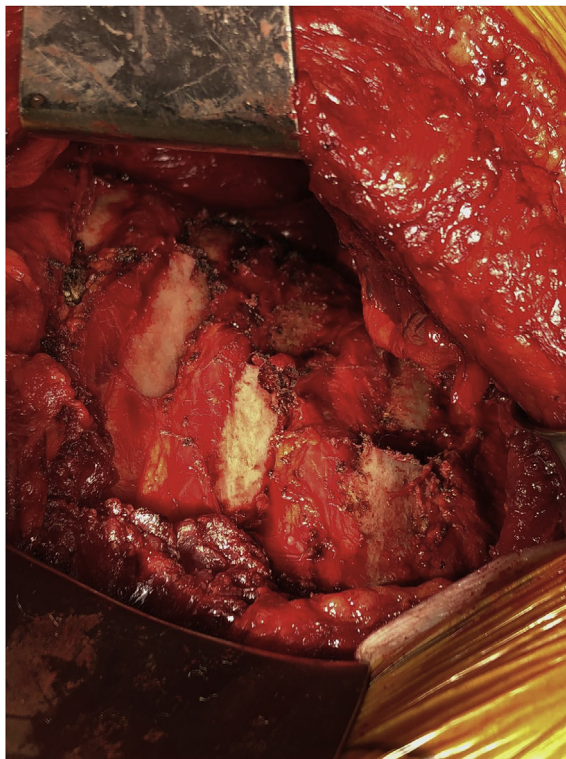


Fig. 1. Displaced fractures of ribs 4-7.

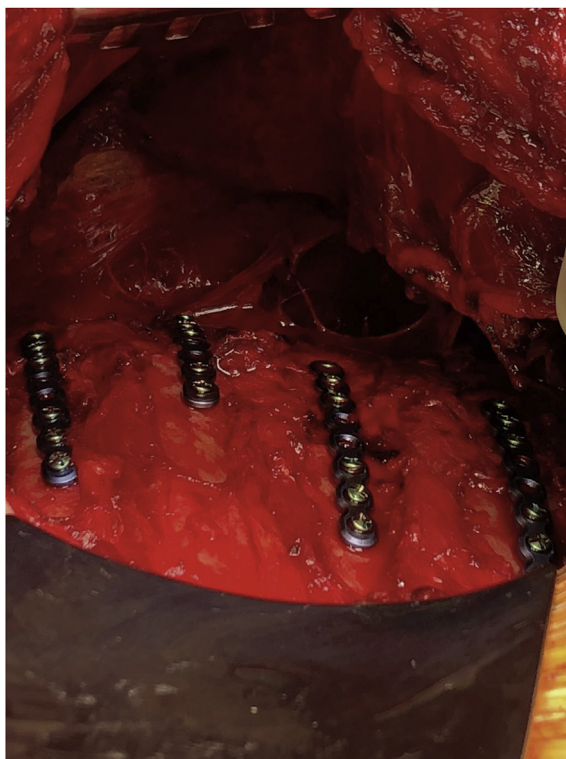


Fig. 2. Same fractures after plating.

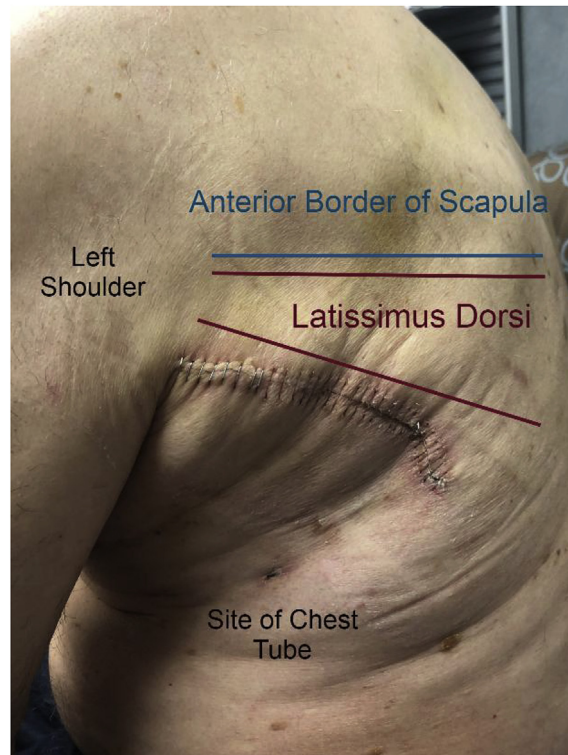


Fig. 3. Post-operative image demonstrating the placement of the vertical incision in relation to the shoulder and latissimus dorsi.

to our emergency room, from home, a week after the trauma with persistent severe pain. His pain was improved with an epidural, but movement or coughing still caused ten out of ten pain. Chest CT demonstrated a moderate hemothorax and displaced, left, lateral fractures of ribs four and five and non-displaced fracture of rib six. With thoracoscopy, we evacuated 1 L of serosanguineous fluid. Next, through the technique described, ribs 4 and 5 were fixed with plates. He was discharged to home on postoperative day three. By post-operative day one, both patients became more mobile and were able to breath and cough without splinting. Two weeks after surgery, both patients required minimal narcotics and did not suffer functional deficits of the shoulder. One year later, the patients had no residual pain or complications from the surgical fixation. Informed consent for this manuscript was obtained from both patients.

3. Technique

We typically start these cases with a 5mm thoracoscopy to confirm complete evacuation of hemothorax and identify the location of the rib fractures. Next, we make a vertical incision along the anterior border of the latissimus muscle (Fig. 3). We identify and free the anterior edge of the latissimus muscle. After dissection under the latissimus, we connect the scapula retractor to a sky-hook retractor (Fig. 4)(Rultract, Cleveland, OH). This provides sustained elevation and posterior retraction which exposes the serratus anterior muscle bundles and long thoracic nerve. The serratus anterior muscle branches are divided to expose the fractured ribs. Once the rib fractures are identified, 2cm on either side are cleared to allow for plate apposition. The fractures are reduced. The appropriately curved rib plates (Zimmer Biomet, Jacksonville, FL) are selected and cut so that at least three screw holes are positioned on either side of the fracture. The contra - angled driver is necessary to place the more posterior screws. The serratus anterior muscle branches are approximated. Pleural and subcutaneous drains are left in place.

4. Discussion

Indications for surgical fixation of *flail chest* fractures are well defined with evidence from three randomized controlled trials [1,5,6]. Indications for fixation of *non-flail* fractures are not well defined as the evidence comes from retrospective case series [1,5]. Despite the lack of randomized and prospective evidence for fixation of non-flail fractures, many experts still recommend its use [2,7]. Three general indications include: acute respiratory insufficiency despite optimal medical therapy, uncontrolled pain despite optimal medical therapy, and anticipated chronic pain/impaired pulmonary mechanics [4]. Pieracci et al. discuss the barriers to a randomized control for SSRF and the areas of equipoise [6].

The downside to rib plating is that it requires at least 4 cm of exposure per rib fracture. The traditional approach to exposure of the lateral chest wall is a horizontal incision through the latissimus muscle and superior retraction of the scapula. This may require



Fig. 4. Scapula retractor connected to a sky-hook retractor for sub-scapular rib exposure.

division of both the anterior and posterior serratus muscles to successfully lift the scapula. The latissimus sparing approach described can provide exposure for a majority of rib fractures amenable to rib fixation. First, certain rib fractures are not amenable to fixation. Ribs 1 and 2 are generally not repaired unless extenuating circumstances are present such as vascular impingement [2]. Floating ribs 11 and 12 are also rarely repaired because they do not support pulmonary mechanics [2]. Many experts do not recommend repair of fractures within 2.5 cm of the transverse process because of the need to preserve the para-spinous muscle and ligaments [2]. Thus a portion of posterior rib fractures are not repaired. Second, nearly half of rib fractures occur in the lateral third of the rib [8]. This approach provides exposure to the chest wall approximately 6cm posterior to the anterior border of the latissimus muscle which includes the lateral third of ribs 3–8. Because of the diagonal course of the latissimus muscle, posterior fractures of the lower ribs are easier to access. For example, exposure of the posterior third of ribs 3–6 would require a traditional posterolateral thoracotomy incision. More inferiorly, ribs 7–10 can generally be approached with less morbidity because of less overlying muscle coverage – the latissimus is more posterior and the inferior border of the serratus anterior originates from rib 8.

The benefit of providing rib stabilization must be balanced with the morbidity of the exposure. There are no studies evaluating the functional impairment from division of the latissimus muscle without the inclusion of a thoracotomy. However, Lee et al. in a meta-analysis found patients suffered functional shoulder impairment after a latissimus dorsi flap for breast reconstruction [9]. We make the assumption that functional impairment after a latissimus flap would be similar to latissimus muscle division. If feasible, reasonable effort should be made to spare the latissimus during SSRF.

Several of the techniques we describe have been reported before in isolation, but not in combination. The vertical skin incision along the anterior border of the latissimus muscle was first described for thoracotomy and lung resection in 1976 [10]. It is particularly well suited for rib fixation since it allows for better access to multiple rib levels than does the traditional horizontal lateral incision. The skyhook retractor is easy to set-up and enables retraction far superior to hand-held retraction. The sustained retraction facilitates additional dissection and exposure of the ribs as needed. Finally, the contra-angled driver (Zimmer Biomet, Jacksonville, FL) is necessary to place the more posterior screws [4].

5. Conclusion

SSRF becomes more beneficial as surgical morbidity is decreased. We describe a trio of techniques to help achieve this goal.

Declaration of competing interest

No conflicts of interest from any of the authors.

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