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Oral Presentation Abstract Submission

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Title of Presentation Hardware Performance for Anterior Chest Wall and Costal Cartilage Injuries: A Single Center Experience

Background

Blunt chest trauma causing severe chest wall injury (CWI) contributes to a high degree of morbidity and pulmonary complications. Surgical stabilization of rib fractures (SSRF) has been shown to improve many critical outcomes for patients sustaining severe CWI for both flail and non-flail fracture patterns. SSRF is performed using titanium hardware (plates, screws) that are indicated for placement on bone. The unique anatomy of the chest wall includes a large portion of cartilage anteriorly that then interfaces with the sternum. Often missed, costal margin or costal cartilage injuries can also cause chest wall instability and refractory pain and deformity. In a particular fracture pattern, anterior (or sternal) flail chest, stabilization of costal cartilage injuries or bridging of hardware to the cartilaginous component of the respective rib level is required to achieve appropriate stabilization. The surgical management of these injuries is an area of focus as the currently available literature is limited. Notably there is only a small amount of evidence regarding hardware performance when applied to costal cartilage. In a prior multi-center study by Sarani et al, hardware failure rate was found to be approximately 3% following SSRF for all fracture locations. The aim of the current study is to evaluate hardware performance for costal cartilage injuries.

Methods

All patients undergoing SSRF performed at our institution from 2016 to 2022 were queried, including

both acute and chronic injuries, and those undergoing cartilage fixation were included. Hardware bridged to the sternum was excluded. Multiple fixation systems were used. Both radiographic and clinical follow-up were retrospectively reviewed to evaluate for hardware failure (plate fracture, malposition, screw migration). Radiographic follow-up included chest X-ray and CT imaging. Hardware failure, when identified, was categorized as appropriate and details included if re-operation was required.

Results

After screening 380 patients, 43 were included for analysis. Mean age was 64 years old and 67% of patients were male. Mean number of fractures per patient was 7.8 with 60% of patients sustaining a flail chest injury pattern. Median total plates per operation was 7 and median costal cartilage plates was 3. In total, 144 plates were applied to the costal cartilage, often with bridging to the bony segment of the rib. Mean follow-up was as follows: clinical 88 days, chest X-ray 184 days, and chest CT 184 days. Hardware failure was observed in 3 of 144 plates (2.1%), in three separate patients. This included screw migration and partial plate pull-out. Two cases were asymptomatic and did not require intervention. One patient required revisional operation in the acute setting.

Conclusion

Cartilaginous chest wall injuries are problematic in both acute and chronic injuries. In our single center experience, hardware performance for costal cartilage fractures was observed to be 2.1%. This aligns with prior reports of hardware performance during SSRF for all injury locations. Surgical stabilization with appropriate plate contouring and fixation technique appears to provide adequate stabilization with a relatively low rate of hardware malfunction.