CASE REPORT

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Modification of mandibular plates as an alternative for sternal fixation

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ABSTRACT

Introduction: The use of metallic wires for sternal closure after coronary artery bypass grafting (CABG) is standard practice, but it can lead to rare complications such as subsequent sternal wound dehiscence. These complications necessitate surgical revisions, prolong hospital stays, and increase the risk of morbidity and mortality. The following case report presents a patient who underwent modification of mandibular plates as an alternative for Sternal Fixation.

Cases: A 55-year-old female patient with a history of severe coronary artery disease (CAD 3VD) underwent coronary artery bypass grafting (CABG). Postoperatively, she developed a sternal dehiscence, resulting in a sternal fracture. The patient underwent two revisions. The first revision concerns potential damage to the internal mammary artery with the Robicsek technique led to multiple fixations using PDS and large PGA 1 sutures. In the 2nd revision, consequently, the sternum was stabilized with three plates and screws on the ribs in the healthy rib area (sternochondral junction) combined with wire. Additionally, the patient had a history of hypertension, type 2 diabetes mellitus, refractory hypoalbuminemia, postmenopausal osteoporosis, and potential hormonal imbalances. In a recent presentation, a clinical examination revealed a fully conscious patient with stable vital signs and minimal drainage from the sternotomy wound. The treatment plan included close observation of the surgical wound, administration of Amikacin (antibiotic), and supportive therapies such as pain management, glycemic control, and inhalation therapy. She was scheduled for outpatient follow-up with a cardiologist for further cardiac monitoring.

Conclusion: The case study highlights the complexities of managing sternal wound complications in cardiac surgery patients with additional health concerns. Innovative solutions like mandibular plates may be particularly beneficial for stabilizing the sternum and promoting recovery in post-CABG patients with crushed sternums and complicating factors such as hypertension, diabetes, and refractory hypoalbuminemia, along with postmenopausal osteoporosis and potential hormonal imbalances.

Keywords: Sternal wound dehiscence, sternal rewiring, mandibular plate.
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INTRODUCTION

The use of metallic wires for sternal closure after coronary artery bypass grafting (CABG) is standard practice, but it can lead to rare complications such as subsequent sternal wound dehiscence. The potential for complications, particularly in high-risk patients, necessitates the exploration of alternative closure techniques. The case report mentioned highlights the challenges associated with sternal wound dehiscence and the need for innovative solutions. The use of a modified mandibular plate for sternal fixation, in this case, represents a unique approach to addressing sternal instability. Mandibular plates are typically employed in oral and maxillofacial surgery for reconstructing jaw defects. They offer rigid fixation and stability, crucial factors in promoting bone healing. The adaptation of such a plate for sternal closure is innovative and demonstrates the potential for cross-disciplinary solutions in medicine.[1-3]

The challenges faced during the patient's second revision, where extensive adhesions prevented the use of the Robicsek closure technique, underscore the complexity of managing sternal wound dehiscence. The successful use of the mandibular plate in this scenario suggests its potential utility in cases where traditional closure methods are not feasible. The concept of utilizing orthopedic principles to guide sternal closure is gaining traction in cardiac surgery. The sternum, like any other bone, requires stability, compression, and approximation for optimal healing. Rigid fixation techniques, such as sternal plating, have been shown to reduce complications and improve patient outcomes. The use of a mandibular plate, although unconventional, aligns with these principles.[1,4]

The modification of the mandibular plate for sternal fixation is a testament to the adaptability and innovation in

surgical practice. The surgeon's ability to modify existing tools and techniques to address unique challenges is crucial in achieving optimal patient care. The successful outcome in this case report suggests that modified mandibular plates may be a valuable addition to the surgeon's armamentarium for managing complex sternal wound dehiscence.[1]

Further research is needed to evaluate the long-term outcomes and potential complications associated with the use of modified mandibular plates for sternal closure. Larger studies comparing this technique to traditional sternal wiring and other rigid fixation methods are necessary to establish its efficacy and safety. Additionally, the development of standardized protocols for the modification and implantation of mandibular plates for sternal closure would be beneficial in ensuring consistent and reproducible outcomes.[1]

The use of a modified mandibular plate for sternal fixation in this case report highlights the importance of innovation and adaptability in surgical practice. It also underscores the need for continued research and development of alternative sternal closure techniques, particularly for high-risk patients and those with metal allergies. As the field of cardiac surgery evolves, the integration of orthopedic principles and the exploration of novel solutions will be crucial in improving patient outcomes and enhancing recovery after sternotomy.[1,4]

Figure 1. Wound dehiscence

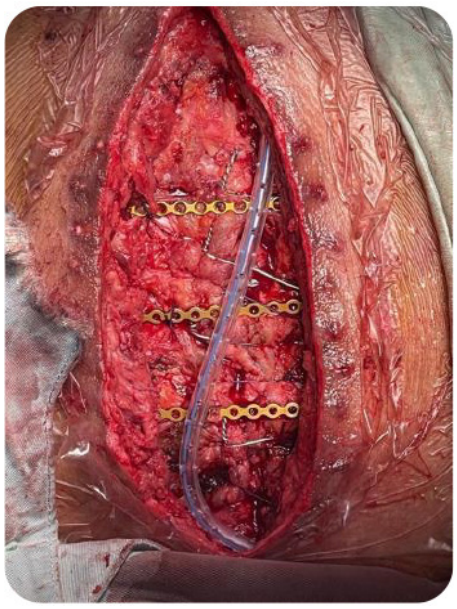

Figure 2 . Sternal fixation with mandibular plate

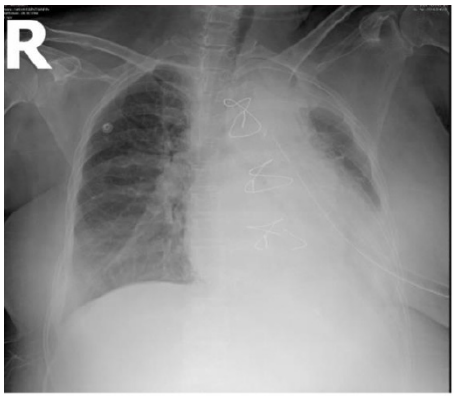

Figure 3. Before mandibula plate

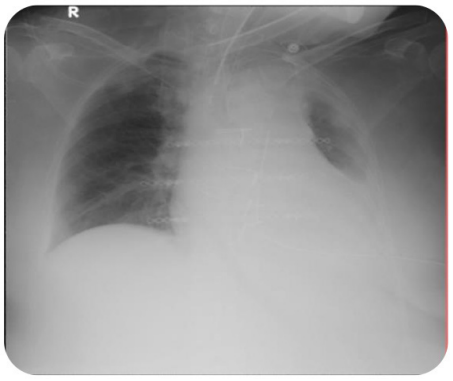

Figure 4. After mandibula plate

CASE PRESENTATION

A 55-year-old female patient with a history of severe coronary artery disease (CAD 3VD) underwent coronary artery bypass grafting (CABG). Postoperatively, she developed a sternal dehiscence, resulting in a sternal fracture. The patient underwent two revisions. In the first revision, the wire was found intact, but there was a cut on the sternum, likely due to osteoporotic bone affecting the wire. The first revision concerns potential damage to the internal mammary artery with the Robicsek technique led to multiple fixations using PDS and large PGA 1 sutures. However, dehiscence recurred, the bone remained fragile, and a new incision from the sutures appeared on the sternum. In the 2nd revision, consequently, the sternum was stabilized with three plates and screws on the ribs in the healthy rib area (sternochondral junction) combined with wire.

Additionally, the patient had a history of hypertension, type 2 diabetes mellitus, refractory hypoalbuminemia, postmenopausal osteoporosis, and potential hormonal imbalances. In a recent presentation, a clinical examination revealed a fully conscious patient with stable vital signs and minimal drainage from the sternotomy wound. Recent laboratory results showed an improvement in albumin levels to 3.0 g/dL, but leukocytosis (10.27 x 10^3/uL) persisted, indicating ongoing inflammation or infection. The treatment plan included close observation of the surgical wound, administration of Amikacin (antibiotic), and supportive therapies such as pain management, glycemic control, and inhalation therapy. She was scheduled for outpatient follow-up with a cardiologist for further cardiac monitoring.

DISCUSSION

The presented case highlights the challenges associated with managing sternal wound complications following cardiac surgery, particularly in the context of sternal dehiscence and comorbidities that can impede wound healing. The patient's history of hypertension, diabetes, refractory hypoalbuminemia, postmenopausal osteoporosis, and

potential hormonal imbalances are all factors that could have contributed to delayed healing and increased vulnerability to sternal fracture and dehiscence. The presence of persistent leukocytosis despite improved albumin levels suggests ongoing inflammation or infection, necessitating close monitoring and continued antibiotic therapy.[5-8]

The surgical team's decision to proceed with rewiring and wound debridement was pivotal in addressing the sternal dehiscence and fostering wound healing. The utilization of alternative materials, such as titanium wires or sternal plates, emerges as a crucial consideration in patients. The patient's ongoing management will necessitate a collaborative effort between the surgical team, cardiologists, and infectious disease specialists to optimize her recovery and mitigate the risk of further complications. The importance of early identification and aggressive treatment of sternal wound infections, encompassing surgical debridement and targeted antibiotic therapy, cannot be overstated in enhancing patient outcomes.[1,9]

The selection of an appropriate sternal closure technique is paramount in mitigating the risk of complications. Traditional wire cerclage, while simple and cost-effective, falls short in providing adequate fixation and stability, potentially leading to sternal instability and dehiscence, particularly in high-risk patients. The use of rigid plate fixation has emerged as a promising alternative, demonstrating superior sternal stability, reduced pain, and lower rates of sternal wound complications. The recently introduced SternaLock 360 system, combining rigid plates with a flexible sternal band, offers further potential to minimize mechanical stress on the sternum and promote optimal healing. The choice of closure technique should be individualized based on the patient's specific risk factors, comorbidities, and preferences.[10,11]

The use of a modified mandibular plate for sternal fixation in this case report highlights the importance of innovation and adaptability in surgical practice. It also underscores the need for continued research and development of alternative sternal closure techniques, particularly for high-risk patients. As the field of cardiac surgery evolves, the integration of orthopedic principles and the exploration of novel solutions will be crucial in improving patient outcomes and enhancing recovery after sternotomy.[1,4]

CONCLUSION

The case study highlights the complexities of managing sternal wound complications in cardiac surgery patients with additional health concerns. Innovative solutions like mandibular plates may be particularly beneficial for stabilizing the sternum and promoting recovery in post-CABG patients with crushed sternums and complicating factors such as hypertension, diabetes, and refractory hypoalbuminemia, along with postmenopausal osteoporosis and potential hormonal imbalances.

DISCLOSURE

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This study did not receive any funding.

Conflicts of Interest
There are no conflicts of interest from the authors.

Author Contribution
The contribution of each author in writing this article is equal.

Consent for Publication
The patient gave written informed consent for the publication of this report and any related photos.

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