Posterior Sternoclavicular Dislocation: Reinforced Autograft Reconstruction. A Case Report

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ABSTRACT
Post-traumatic posterior sternoclavicular dislocation is a rare injury that typically occurs in young men following high-energy trauma. It can cause potentially life-threatening complications due to compression of mediastinal structures and therefore requires treatment that achieves a stable reduction. Computed tomography (CT) plays a crucial diagnostic role, determining the type and degree of displacement and the anatomical relationship with mediastinal and cervical structures. We present the case of a 25-year-old man with post-traumatic posterior sternoclavicular dislocation who underwent ligament reconstruction using a modification of the classic figure-of-8 technique with a palmaris longus autograft.
Keywords: Posterior sternoclavicular dislocation; sternoclavicular reconstruction; palmaris longus tendon graft.
Level of Evidence: III

Luxación esternoclavicular posterior: reconstrucción con autoinjerto reforzado. Reporte de un caso

RESUMEN
La luxación esternoclavicular posterior postraumática es un cuadro infrecuente que ocurre típicamente en varones jóvenes, por traumatismos de alta energía. Puede acarrear complicaciones potencialmente letales por compresión de estructuras mediastínicas; por lo tanto, requiere un tratamiento que aporte una reducción estable. La tomografía computarizada tiene un rol crucial en el diagnóstico, determinando el tipo y el grado de desplazamiento, así como la relación anatómica con estructuras mediastínicas y cervicales. Presentamos a un hombre de 25 años con luxación esternoclavicular posterior postraumática, que fue sometido a una reconstrucción ligamentaria mediante una modificación de la técnica clásica en "figura de 8" con autoinjerto de palmar menor.
Palabras clave: Luxación esternoclavicular posterior; reconstrucción esternoclavicular; injerto de tendón palmar menor.
Nivel de Evidencia: III

INTRODUCTION

Post-traumatic sternoclavicular dislocation is a rare entity, accounting for 1% of all dislocations and 3% of upper-extremity dislocations. It occurs mainly in young men as a consequence of high-energy trauma. Thirty percent of posterior dislocations are associated with tracheal, esophageal, or neurovascular compression, and the mortality rate is 3–4%.[1-4]

Surgical treatment is indicated after failure of closed reduction or for unstable dislocations. Multiple surgical procedures have been described for sternoclavicular joint reconstruction, and there is no single reference procedure for comprehensive management.[5,6]

The aim of this article is to describe a simple, safe, and reproducible modification of the surgical technique for reconstruction of posterior sternoclavicular dislocation using a figure-of-eight palmaris longus autograft, illustrated with a case and 2-year postoperative follow-up.

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CLINICAL CASE

A 25-year-old man sustained direct trauma to the shoulder and left upper hemithorax during rugby. After discharge from an emergency trauma unit and two prior orthopedic consultations, he was evaluated in our clinic 30 days after the event with sternoclavicular pain and functional limitation of the left shoulder. Physical examination revealed depression of the left sternoclavicular joint (Figure 1A), and limitation of flexion and abduction greater than 90° due to sternoclavicular pain, with marked exacerbation on adduction greater than 10°, without neurovascular or respiratory abnormalities.

Radiographs showed no signs of osseous injury. Given the examination findings and suspicion of a sternoclavicular injury, CT was obtained, which confirmed the diagnosis and demonstrated proximity of the medial clavicle to the great vessels of the neck (Figure 1B). Neck MR angiography (Figure 1C) was subsequently performed to delineate the relationship with mediastinal and cervical structures in detail.

With the diagnosis of posterior sternoclavicular dislocation and considering chronicity as an unfavorable factor for closed reduction, surgery was scheduled.

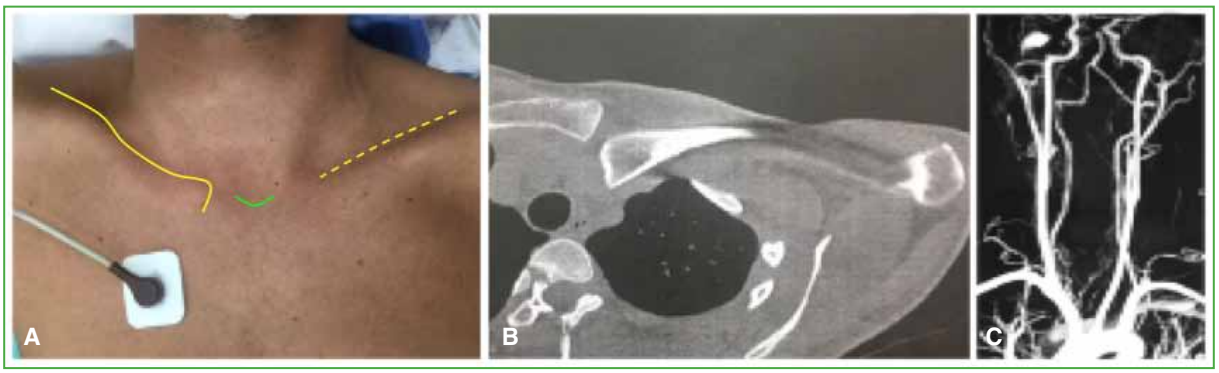

Figure 1. **A.** Normal silhouette of the right clavicle (solid yellow line) with depression of the medial epiphysis of the left clavicle at the sternoclavicular joint (dashed yellow line). The central green line highlights the contour of the sternal manubrium. **B.** CT of the sternoclavicular joint, axial view, showing posterior sternoclavicular dislocation with mediastinal displacement of the medial clavicular epiphysis. **C.** Neck MR angiography, normal.

Surgical Technique

Under general anesthesia and with a vascular surgeon present, standard closed-reduction maneuvers were attempted with the patient supine on a scapular bolster, applying traction and shoulder abduction, without success, so open reduction was performed.

With the patient in the beach-chair position, an ipsilateral palmaris longus tendon graft was harvested using a tendon stripper (Figure 2). An L-shaped skin incision was made over the left sternoclavicular joint to expose the medial clavicle and sternal manubrium. An empty space was first noted where the medial clavicular epiphysis should have been (Figure 3A). With the clavicle dislocated, the free space was used to drill two oblique tunnels in the sternal manubrium, starting on the anterior surface 1 cm from the articular margin and exiting at the posterolateral angle of the sternal joint. The dislocated clavicle acted as a protective barrier, shielding posterior structures from the drill bit (Figure 3B). Adhesions were released, the posterior aspect of the medial clavicular epiphysis was gently debrided with gauze, and reduction was achieved by gentle anterolateral traction on the clavicle. Two parallel oblique bone tunnels were then drilled from anterior to the posteromedial border of the medial clavicular epiphysis (Figure 3C). The articular disc was preserved by drilling small posterior perforations to allow passage of the graft and suture. The graft was paired with a No. 2 ultra-strong flat braided UHMWPE suture tape with a braided polyester jacket, and a thick PDS suture was used as a shuttle (Figure 3D). The construct was passed in a figure-of-eight through the tunnels (Figure 4A), crossing the two free graft ends on the anterior

aspect of the joint (Figure 4B). The suture tape was first tensioned and tied to maintain reduction, functioning as a temporary stabilizer until graft ligamentization. The free graft ends were then crossed anteriorly and sutured to themselves (Figure 4B).

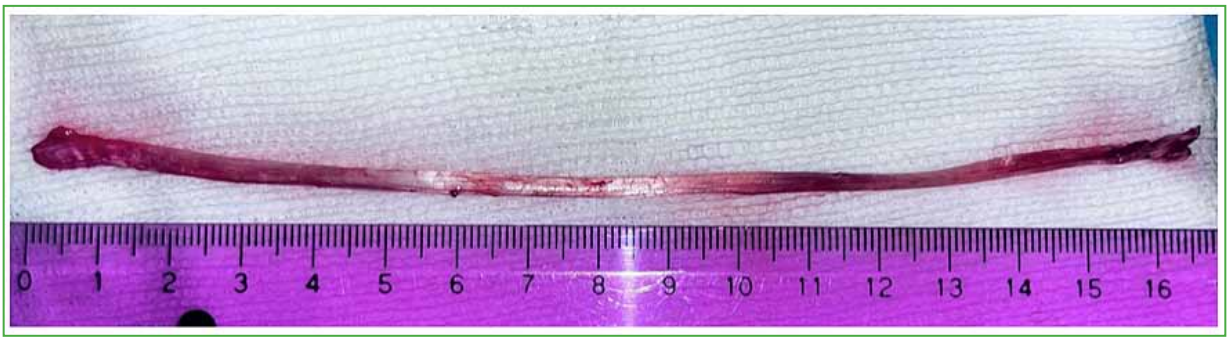

Figure 2. Palmaris longus autograft.

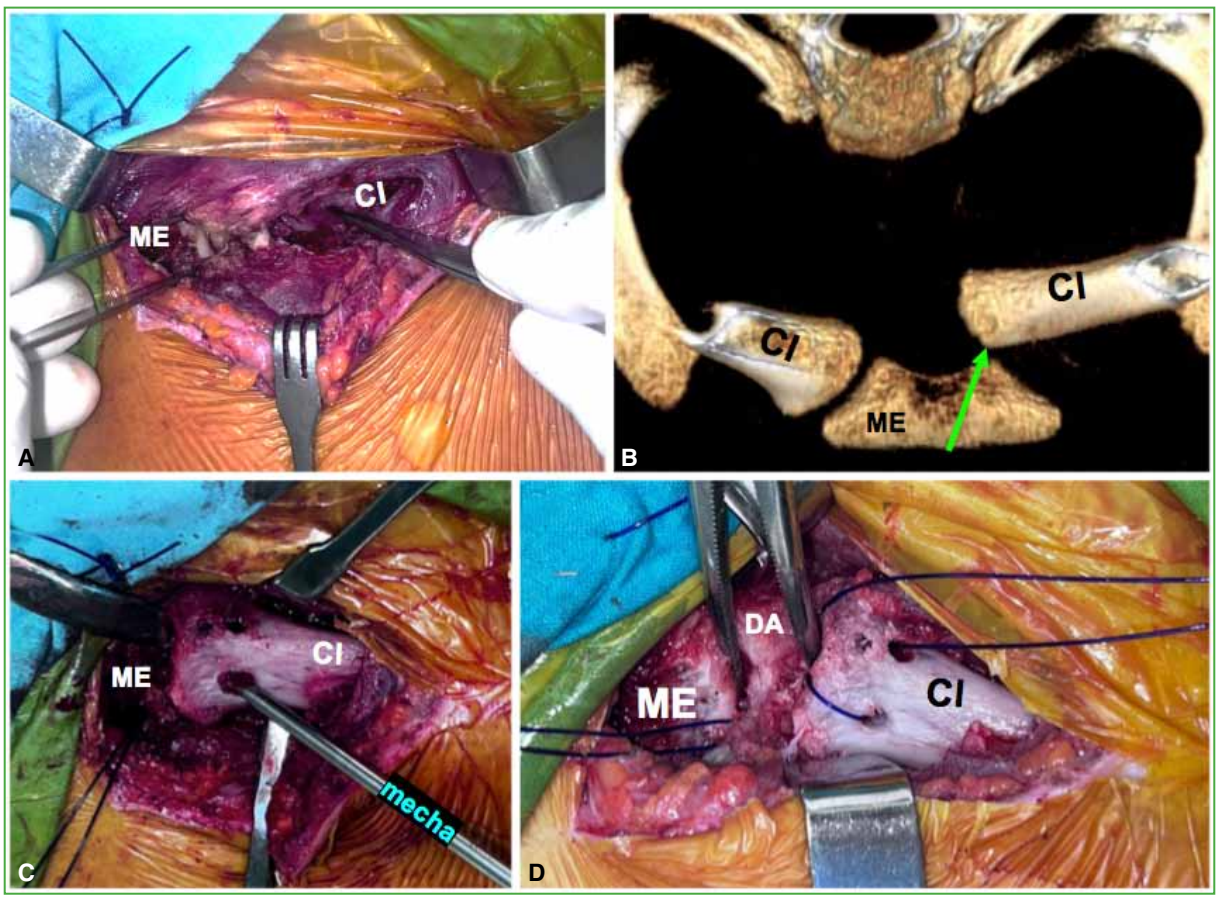

Figure 3. **A.** Surgical exposure after sternoclavicular approach, marking the posteriorly dislocated medial clavicular epiphysis (Cl) with a closed clamp. Before joint reduction, tunnels are drilled in the sternal manubrium (ME), indicated by an open clamp. **B.** CT with 3-D reconstruction, craniocaudal view. The green arrow shows the direction of the manubrial tunnels with the clavicle dislocated posteriorly, which facilitates visualization and protects mediastinal structures from the drill bit. **C**. Clavicle reduced and tunnels drilled. Note the oblique trajectory of the drill. **D.** Thick PDS suture passed through the holes to shuttle the palmaris longus autograft and the high-strength suture tape. The articular disc (AD) is marked with a Crile forceps; it was preserved by creating posterior perforations for passage of the graft and suture.

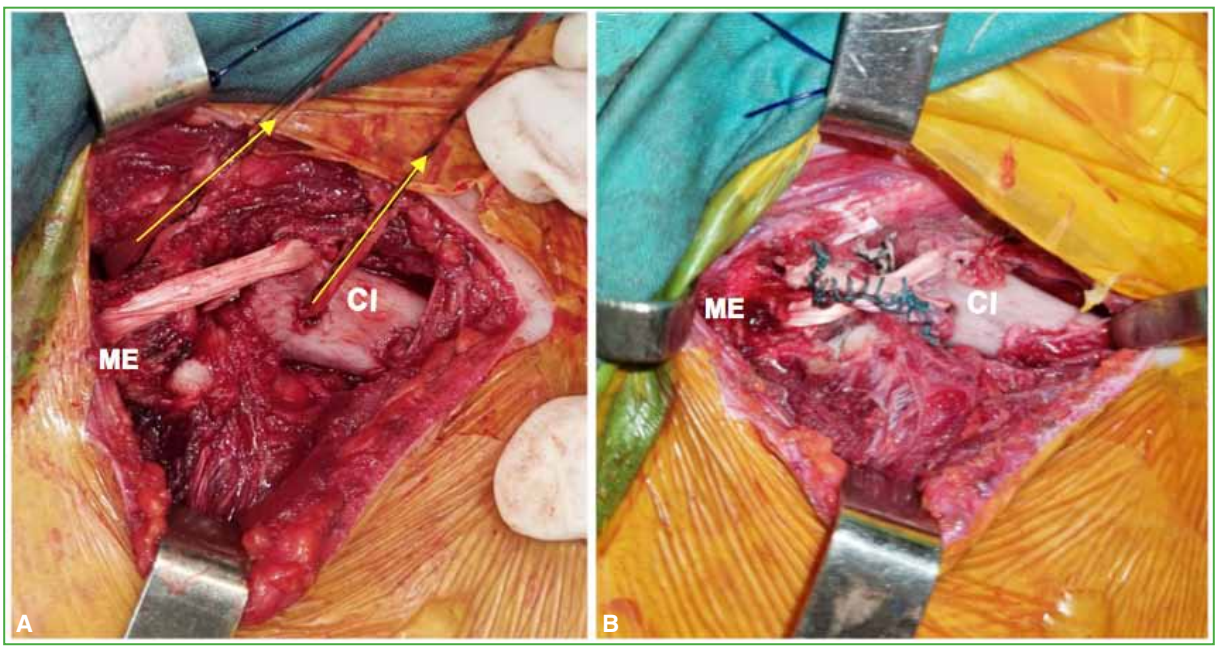

Figure 4. **A.** Passage of the graft and ultra-strong flat braided suture tape through the holes in the sternal manubrium (ME) and the medial clavicular epiphysis (Cl). Yellow arrows indicate the traction direction that maintains reduction. **B.** Completed figure-of-eight with the braided suture tied posteriorly and both graft ends sutured to themselves anteriorly.

Postoperative Protocol

Postoperative management consisted of sling immobilization for 40 days and immediate elbow flexion–extension and pronation–supination exercises. At 2 weeks, the patient began physical therapy and pendulum exercises, with complete restriction of adduction and flexion/abduction less than 90°. After 6 weeks, the sling was removed and range of motion was released; resisted strengthening began at 3 months. At 6 months, CT was normal (Figure 5) and the patient was cleared for contact sports.

Figure 5. CT at 6 months after surgery confirming adequate sternoclavicular alignment.

At the 2-year evaluation, shoulder range of motion was full (Figure 6), pain on the visual analog scale was 0/10, and the QuickDASH score was 6.8. He had returned to his previous sport without limitations.

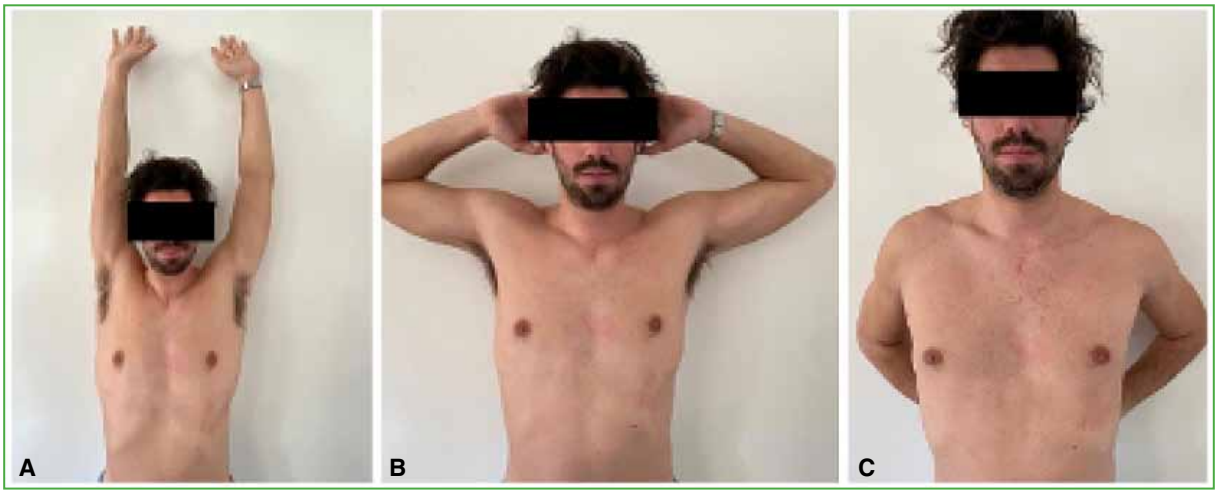

Figure 6. Normal range of motion 2 years after the procedure. **A.** Flexion and abduction. **B.** Abduction and external rotation. **C.** Internal rotation.

DISCUSSION

Posterior sternoclavicular dislocation is rare, but prompt diagnosis is critical because consequences can be severe, including pneumothorax, dysphagia, hoarseness, vascular injury, and brachial plexus injury.[4] The brachiocephalic vein usually lies directly behind the sternoclavicular joint. Other structures commonly in close proximity include the carotid arteries, subclavian veins, superior vena cava, aortic arch, internal mammary arteries, and trachea.[2]

Diagnosis is challenging because of rarity and variable signs and symptoms, so the condition is often overlooked. Diagnostic suspicion based on trauma history, a careful physical examination, and appropriate imaging is essential.[2,3] Radiographs are difficult to interpret due to overlapping structures and are often inconclusive (Figure 7A). CT is the most useful diagnostic tool because it visualizes the joint injury and involvement of cervical and mediastinal structures (Figure 7B). MR angiography helps characterize possible vascular injuries (Figure 1C).

Closed reduction is usually effective in acute cases. If closed maneuvers fail or instability persists after reduction, open reduction with ligament reconstruction using tendon grafts is indicated, since direct repairs do not usually yield effective results.[2,5]

Biomechanically, the sternoclavicular joint allows about 35° of tilt in both the coronal and horizontal planes and about 45° of rotation, contributing to both mobility and stability of the shoulder girdle. Treatment should achieve a stable reduction to restore biomechanics successfully.[7,8] Because this is an infrequent condition, only small case series have been published.[5] The large number of described reconstruction techniques reflects the lack of consensus on optimal treatment. These approaches can be grouped into techniques with joint resection and techniques that preserve the joint. In the former, auto- or allograft hamstring tendons have been used with resection of the medial articular surfaces of the clavicle and sternal manubrium, an option indicated when joint deterioration is evident. Among joint-preserving techniques, the classic figure-of-eight with anteroposterior tunnels in the proximal clavicle and manubrium has shown superior biomechanical stability compared with other graft configurations.[8] Our modification with oblique tunnels (Figure 8) facilitates the procedure, reduces the risk of mediastinal injury, shortens the graft path by approximately 10% so a shorter graft suffices, and simplifies and shortens the surgery by requiring less bone surface preparation with minimal posterior marginal joint damage.

We also recommend drilling the manubrial tunnels before clavicular reduction, which improves visualization and reduces the risk to posterior structures because the dislocated medial clavicle acts as a barrier for the drill. Although these modifications reduce iatrogenic risk, the procedure remains in close proximity to vital vascular structures, so it should be performed in a center with appropriate support and immediate availability of a vascular surgeon.

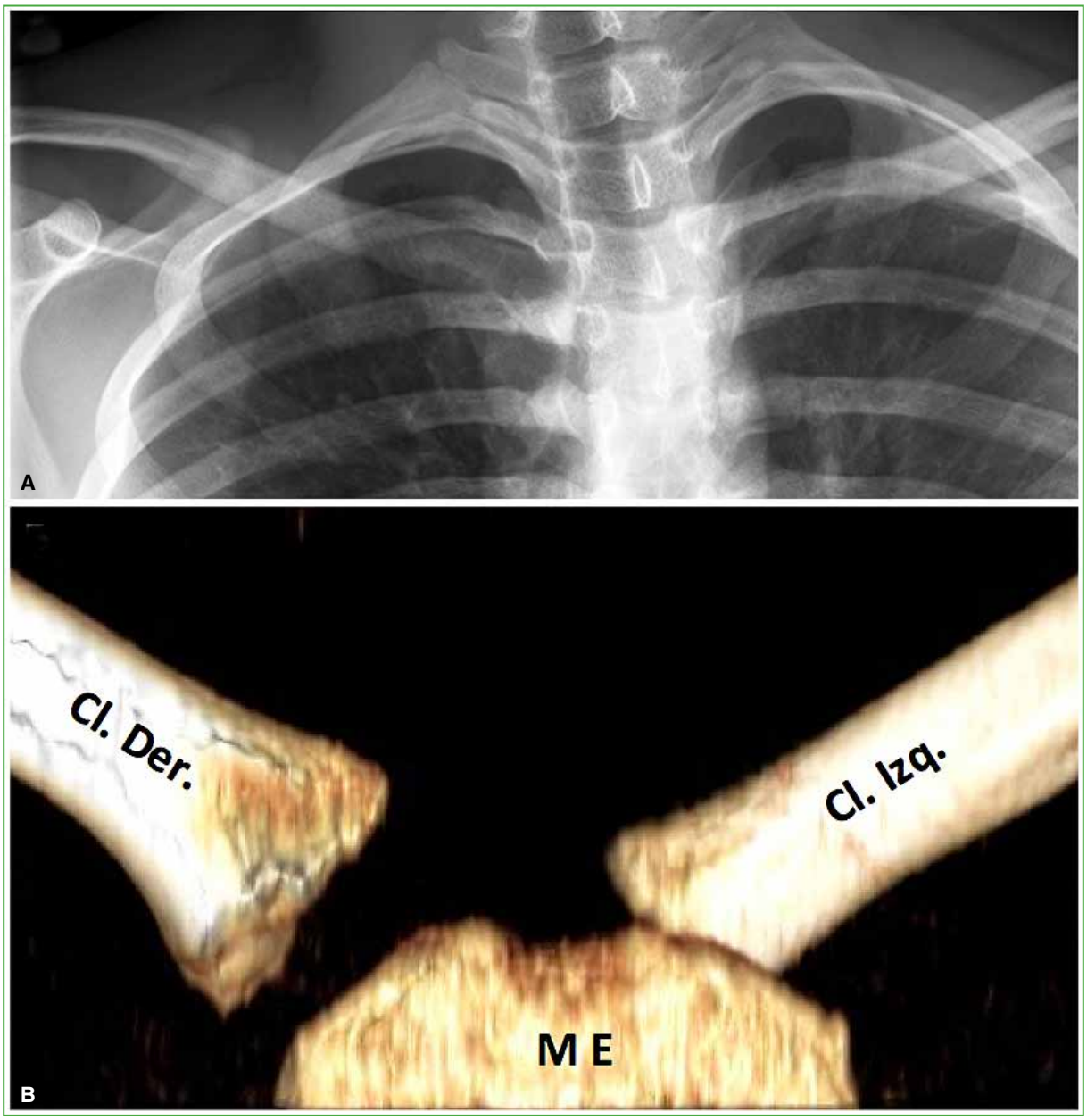

Figure 7. A. Chest radiograph, anteroposterior view. May be suggestive but is not conclusive. **B.** CT of both sternoclavicular joints with 3-D reconstruction, anterior view, showing posterior dislocation of the left sternoclavicular joint. ME = sternal manubrium; Cl Rt = right clavicle; Cl Lt = left clavicle.

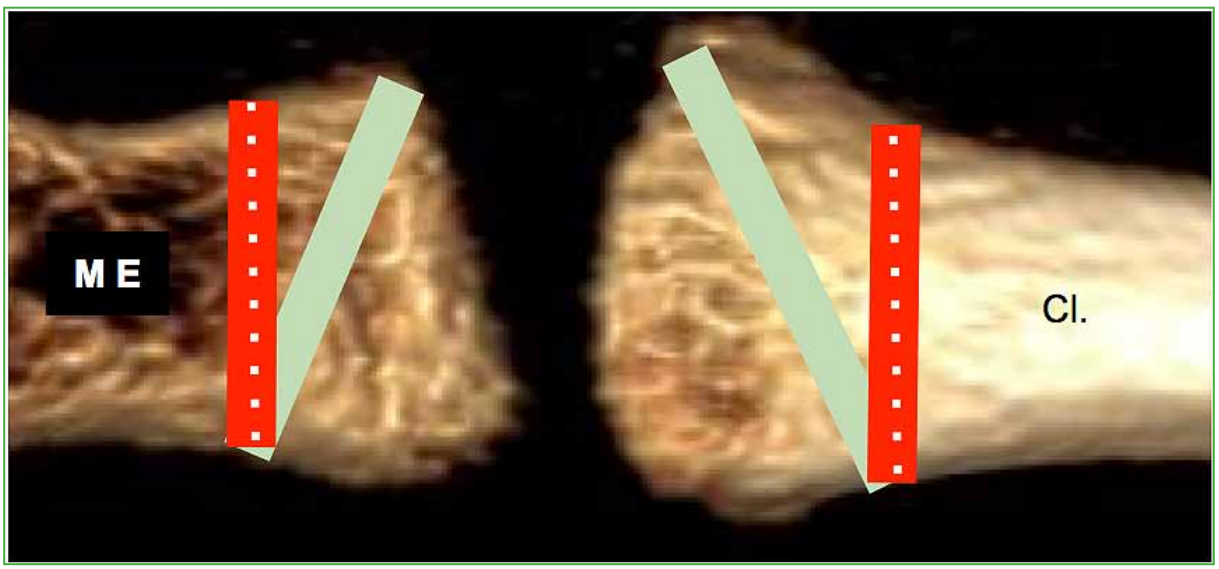

Figure 8. CT of the sternoclavicular joint with 3-D reconstruction, craniocaudal view. The red line with white dots shows the direction of the classic figure-of-eight reconstruction with perpendicular anteroposterior tunnels. The solid green line shows our modification with oblique tunnels, which facilitates and shortens the procedure, decreases the graft path and offers greater length for anterior closure, and reduces risk and tissue damage without significant injury to the articular surface.

We prefer autograft to avoid the rare but catastrophic risk of disease transmission, to maximize tissue incorporation, and to reduce costs. Among autograft options, we favor the ipsilateral palmaris longus tendon if present because harvest is simple, morbidity is negligible, and the graft can be obtained within the same operative field.

Given the risk of hardware failure and migration with severe complications, Steinmann pins, wire cerclage, and Kirschner wires are contraindicated.[9] High-strength flat suture tape can provide additional temporary stability until graft ligamentization.[2,8]

Return to sport at a level similar to preinjury, as in our case, is common after ligament reconstruction.[10]

CONCLUSION

Figure-of-eight sternoclavicular ligament reconstruction using palmaris longus provided a stable reduction with a simplified, effective, and durable technique and low morbidity.

Conflicts of interest: The authors declare no conflicts of interest.

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