CLINICAL REPORT

Tamponade following sternoclavicular dislocation surgical fixation

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Summary The authors report a case of posterior sternoclavicular dislocation surgically reduced and stabilized with tenodesis, according to the Burrows technique completed by temporary wire fixation. The patient presented postoperative pericardiac tamponade appearing progressively from brachiocephalic blood vessels bleeding. Emergency drainage was surgically placed associated with removal of the material, thus curing the patient. This complication, although exceptional, formally contraindicates the use of wire fixation in surgery of the sternoclavicular joint.

Introduction
The very close proximity of the trachea, the esophagus, and the vascular and nerve structures behind the sternum explains the possible visceral compression complications [1–3] in cases of posterior sternoclavicular dislocation (SCD). The violence of the injury and the displacement of the medial end of the clavicle are sometimes such that they can result in major lesions of the mediastinal structure, notably the blood vessels [4], even compromising the immediate vital prognosis [2–5]. They therefore require extremely urgent specialized surgical management [4] to literally save the patient’s life. Fortunately, however, when present, in less than one case in four [6], compression signs are limited to moderate dyspnea, dysphagia, or venous return discomfort, which regress after reduction of the dislocation.

Of all the complications associated with posterior SCDs or their treatment, vascular complications are the most frequent [7]. They are actually rarely secondary to the injury itself (fewer than a dozen published cases) [4] but instead, occur as complications of surgery [8–20]. Here also, all the mediastinal structures can be injured [1,7].

We report the case of cardiac tamponade complicating the reduction and wire fixation stabilization of a posterior sternoclavicular dislocation.

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Case study

A 27-year-old man, with no particular medical history, was admitted to the emergency unit after having presented an isolated injury to the left shoulder occurring as a result of a motorcycle accident. The emergency examination revealed a contusion of the posterolateral side of the left shoulder associated with pain on the anterior side of the sternoclavicular joint, with no signs of compression. A left posterior SCD was suspected. A CT scan with contrast injection was performed in the emergency unit, which confirmed the diagnosis of left posterior SCD (Fig. 1). Given the absence of clinical or radiological signs of compression or perforation of the mediastinal structures, the patient was cared for in semi-emergency the day after his admission. Since the injury was less than 48-hour-old, primary reduction using external maneuvers under general anesthetic was attempted. When this failed, surgical reduction was decided. The absence of stability after reduction then required stabilization by tenodesis with the Burrows technique (Fig. 2) using the subclavius muscle [21]. To protect the healing of the tenodesis, we decided to place two 2-mm-diameter wires for six weeks. Postoperative X-rays were deemed satisfactory (Fig. 3). There were no postoperative complications. The patient was able to return home on the third day. The instructions for rehabilitation were immobilization with a shoulder guard for three weeks followed by passive joint mobilization for the following three weeks. However, on the 11th postoperative day, the patient was readmitted to the emergency unit after losing consciousness for a short period. Questioning the patient revealed progressively worsening dyspnea since the intervention associated with nausea and pronounced hypotension. The electrocardiogram showed sinus tachycardia with a low-voltage electrogram in all the derivations. Emergency echocardiography confirmed the diagnosis of tamponade with compression of the right cardiac cavities. An emergency CT scan with contrast injection did not show active cardiac or mediastinal vessel bleeding. Plain follow-up X-rays (Fig. 4) demonstrated that the osteosynthesis material was in place, with no signs of significant rupture or migration of the wires compared to the post-operative X-ray. However, we noted a direct contact of the wires with the brachiocephalic vessels on the CT scan (Fig. 5a–c). With this picture of cardiogenic shock, emergency pericardial—peritoneal window surgery was decided to drain the tamponade. The wires were removed during the same operation via the original supraclavicular approach. Progression was rapidly favorable with normalization of the cardiac parameters. Shoulder rehabilitation was successfully carried out within the previously defined timeframe and modalities. Radiographic and clinical follow-up showed no recurrence of the dislocation. The patient was able to return to work as an electrician and resume his sports activities by the end of the third month.

Two years after the injury, the clinical results were excellent. The shoulder mobilities were normal and painless. The sternoclavicular joint appeared stable. There were no cardiac sequelae.
Discussion

The need to reduce a posterior SCD goes without question. In cases of early management, before 48 hours, orthopaedic reduction using external maneuvers under general anesthesia is possible [6,22]. However, if this fails, surgery is necessary. Intraoperatively, if the reduction seems stable, isolated reduction with no additional intervention can be discussed [22]. Instability, however, requires stabilization. Several therapeutic options are available and they aim to reconstruct the costoclavicular ligament, the main stabilizer [22,23].

This is a risky surgery in which iatrogenic complications can occur [8–20] because of the proximity of the mediastinal structures, immediately behind the sternoclavicular joint and the sternum. All the mediastinal structures can theoretically be injured:

- the brachiocephalic arteries and veins, resulting in sometimes very serious hemorrhagic problems or potentially compressing hematomas;
- nerve structures, resulting in sensory and/or motor deficits;
- the upper airway and digestive tract (trachea and esophagus) with the risk of respiratory distress;
- lungs and pleura with constitution of effusion, most often pneumothorax but also hemothorax;
- as well as the aorta and the cardiac cavities whose lesions can lead to shock.

The most frequent complications are vascular lesions [7]. They most often result from inappropriate surgical management, most notably using wires to stabilize the joint [8,9,14]. These wires can break or migrate [8–13], perforating the large blood vessels or the cardiac cavities. Approximately 30 cases of iatrogenic lesions of the cardiac cavities or large mediastinal vessels (thoracic aorta, pulmonary artery, brachiocephalic vessels) have been reported in the French-, English-, and German-language literature [10–20]. Of these cardiovascular complications, approximately 15 cases of cardiac tamponade were reported in the international literature between 1960 and 2009 [10–12,14,16–19]. In all these published cases, tamponade occurred late, in the postoperative period, long after surgery (between five weeks and several years), complicating the migration or breakage of wires that had not been removed. The clinical picture is relatively stereotypical, associating respiratory distress and cardiogenic shock with rapidly progressive onset. The etiological diagnosis is easy after an AP chest X-ray, which shows the migration of the osteosynthesis material projecting into the cardiac area or in the mediastinum, with the lateral image showing the wire in the anterior mediastinum. Tamponade can occur earlier in the postoperative period in cases of poor operative technique with wires that have not been bent. The use of a threaded wire could reduce the risk of migration but does not eliminate it, notably if the material breaks. Not strictly respecting immobilization instructions (elbow against the body in the first weeks, then elevation and abduction of the shoulder, which should never exceed 90°, to limit mobilization of the sternoclavicular joint) can also favor wire

Figure 4 Plain X-ray of emergency lateral sternoclavicular region. Comparison with immediate postoperative X-ray showed no significant wire migration.

Figure 5 CT with reconstructions in the sagittal plane (a), frontal section (b), and oblique section through aorta arch (c) showing voluminous pericardiac effusion (white arrow) and close proximity of wires with mediastinal involvement.
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mation. Patients should therefore receive clear instructions. These precautions are sometimes difficult to accept by young and athletic subjects who do not understand this danger and wish to resume their activities as early as possible.

Very exceptionally, there is an intraoperative lesion caused by non-optimal control of the risk factors. Our review of the literature in French, English, and German [15] did not turn up a single published case of this type of event. Smolle-Juettner et al. [15] reported the case of a 17-year-old manual worker who had presented with a right posterior SCD, with no signs of compression, caused by a bicycle accident. After failure of an initial attempt at closed reduction, a new reduction using external maneuvers was attempted, associated with percutaneous placement of two wires to stabilize the sternoclavicular joint. The intervention was completed with no particular incident, but the postoperative radiograph showed the most distal wire projected into the cardiac area. No other imaging studies were done and two hours later, the patient developed serious hemorrhagic shock, complicating abundant hemothorax, with poor response to resuscitation measures. A lateral chest X-ray was taken eight hours after the end of the intervention, which raised the suspicion of an iatrogenic cardiovascular lesion before the discovery of a wire coming out of the anterior mediastinum. The patient was helicoptered to a specialized center with extracorporeal circulation equipment for emergency surgery. A pericardiac and right auricle wound was discovered and repaired but the patient died from the sequelae of cerebral anoxia. In this case, there was not a clinical picture of tamponade because of the wide pericardial opening with blood draining into the pleural cavity. In our patient, the clinical picture was one of dyspnea and cardiogenic shock with progressive onset in the days following surgery, indicating a diagnosis of cardiac tamponade. Since the patient had shown rapid satisfactory progression after drainage of the tamponade with the pericardial—peritoneal window, the mediastinal lesion could not be formally confirmed. The early postoperative initiation and the absence of significant material breakage and migration argue in favor of an intraoperative accident during wire placement, after bleeding reduction of the dislocation caused by a wound in the brachiocephalic vessels with mediastinal bleeding.

Fortunately, these complications remain very rare and are only reported as case studies. Any reliable estimation of the frequency of this type of event is consequently impossible. However, it should be recognized that, given the rarity of posterior SCDs (only a few hundred published cases), the frequency of this type of complication, probably underestimated, should be considered very significant. The thin-walled right cardiac cavities are the most vulnerable, particularly in cases of operated right SCDs [10,12–16], because they are directly in the wire fixation axis. It would seem that very high-energy injuries (traffic accidents rather than sports accidents), often the cause of posterior SCDs with greater displacement and therefore the source of more severe ligament lesions, are associated with a higher frequency of iatrogenic complications. The cause may be the increasing use of wire stabilization.

These data should encourage greater caution during management of such injuries and to a better-informed choice in terms of the surgical techniques used. Once again, this leads us to contraindicate the use of wire fixation in surgery of the sternoclavicular joint and particularly, to formally prohibit any percutaneous wiring, placed blindly, in a region that is rapidly deformed by edema and where the anatomic landmarks are no longer reliable, with isolated ligament reconstruction used instead [6]. Litigation for negligence and malpractice has been reported following such complications [19]. One should suspect an intraoperative lesion with any abnormal clinical sign in the early period after surgery in young subjects otherwise in excellent health. Breakage and/or migration of the osteosynthesis material resulting in complications show up later, within a highly variable timeframe, often after several weeks. Informing the patient of the potential dangers is particularly important to encourage strict and close monitoring as well as caution.

Conflict of interest statement
None.

References