



Sternoclavicular dislocation as a possible complication for surgical Scheuermann's deformity correction: a case report

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Abstract

Objective We present a sternoclavicular dislocation as a non-reported complication after spinal kyphotic deformity surgical correction.

Background The sternocostal complex seems to have an important role in the pathology of Scheuermann's kyphotic deformity. A role for the sternoclavicular complex has never been reported in association with Scheuermann's disease pathology but could explain anterior sternoclavicular dislocation after spinal kyphotic deformity correction.

Methods A 19-year-old male patient underwent surgery for a 74° thoracic kyphosis associated with a 35° thoracic and a 50° lumbar scoliotic curve. In the early post-operative period, the patient developed pain over the left sternoclavicular joint articulation, with a very obvious lump. An X-ray disclosed an anterior sternoclavicular dislocation. After surgical treatment failed, the dislocation was repaired in a second surgical procedure with a flexion and lengthening osteotomy of the middle third of the clavicle followed by capsular repair reinforced with sternocleidomastoid fascia.

Results At an 8-year follow-up after his spine procedure and 6 years after his clavicular surgery, the patient had full shoulder range of motion and no joint pain, despite the presence of a new sternoclavicular anterior dislocation.

Conclusion Sternoclavicular dislocation after spine kyphotic deformity correction is presented for the first time; however, it is not possible to establish a causative association. Additional studies are necessary to delineate the role of the sternoclavicular complex in Scheuermann's disease.

Keywords Scheuermann's kyphosis · Pathogenesis · Sternocostal complex · Sternoclavicular dislocation · Sternoclavicular complex

Introduction

Scheuermann's disease was first reported as a rigid thoracolumbar kyphosis, which usually developed before puberty and became prominent during the adolescent growth spurt [1, 2]. The diagnosis for Scheuermann's disease, also known as Scheuermann's kyphosis, is essentially made both clinically and radiologically. In 1964, Sorensen established radiographic criteria for diagnosis: a minimum of three adjacent vertebrae with at least 5° of wedging [3]. Later, Bradford redefined Sorensen's criteria using a lower number of wedged vertebrae to radiographically diagnose

Scheuermann's kyphosis [4, 5]. Clinical findings are of a rigid kyphosis, more evident with the Adams test and absence of significant correction during thoracic spinal hyperextension.

Management for Scheuermann's disease is still controversial, and surgical indications are not fully established [6]. For large curves, particularly above 70°, or for deformity-related pain, surgery should be considered. Nonetheless, corrective surgery for Scheuermann's kyphosis is not a benign procedure and a high risk of complications should be anticipated [7]. In this setting, sternoclavicular dislocation has never been reported as a complication for Scheuermann's kyphotic surgical correction. The authors report the case of a young adult male diagnosed with thoracic Scheuermann's disease, who developed an anterior sternoclavicular dislocation after surgical correction of the deformity.

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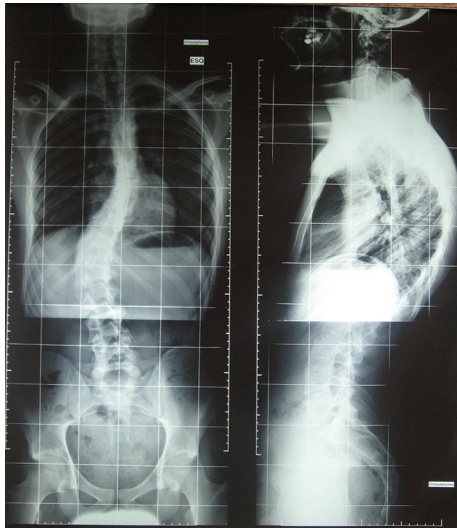
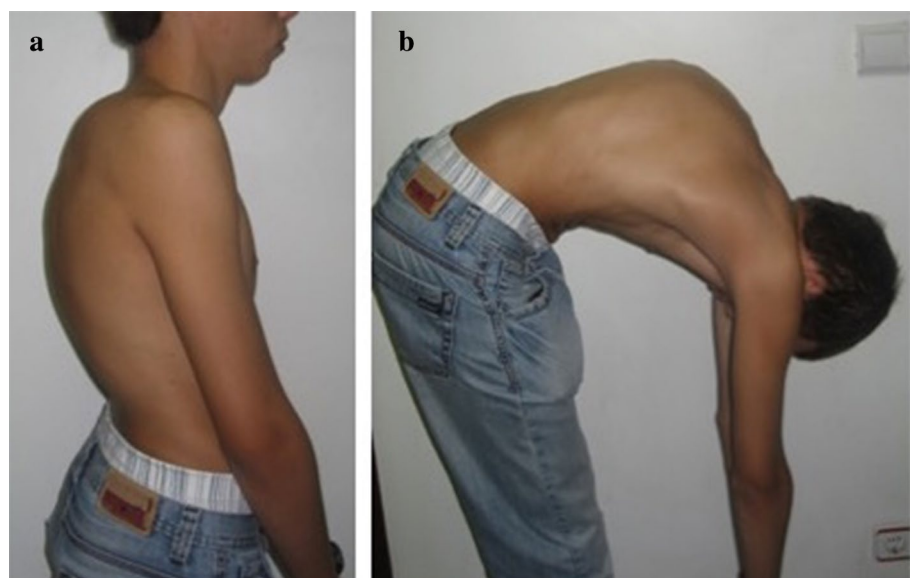


Fig. 1 Patient initial AP and lateral X-rays showing a 74° thoracic kyphosis associated with a 35° thoracic and a 50° lumbar scoliotic curve

Case illustration

This is the case of a 19-year-old young male who underwent surgery for a 74° thoracic kyphosis associated with a 35° thoracic and a 50° lumbar scoliotic curve (Figs. 1, 2). The senior author (P.S.F.) chose to perform the correction through two different surgeries. The first surgical procedure included an anterior left thoracotomy to allow a T5–T11 discectomy and anterior longitudinal vertebral ligament section; there were no reported complications. One week after the first procedure, a posterior surgical approach was used for a T2–L3 posterior spine fusion using a hybrid construction (Figs. 3, 4, 5); this was also uneventful.

Fig. 2 Patient pre-operative clinical photographs (a, b)



In the early post-operative period, the patient began having pain over the left sternoclavicular joint with an obvious local deformity and instability (Fig. 6). The physical examination and additional X-rays identified a left anterior sternoclavicular dislocation. No trauma history could be elicited. Direct ligamentous repair to the joint was first attempted in a local hospital with early failure. Definitive treatment was then performed at our institution by the author S.M. A flexion and lengthening osteotomy at the middle third of the clavicle was performed (Fig. 7), followed by capsule repair and reinforcement with sternocleidomastoid fascia. No further complications occurred. Four years after the last surgery, the patient underwent a new surgery to remove the clavicular implants for aesthetic reasons (Fig. 8).

At this point, the patient is now 8 years out from his spinal procedure, 6 years out from his second shoulder surgery, and is a marathon runner. Despite a new sternoclavicular dislocation 2 years after the implant removal, the patient reports no symptoms and has full range of shoulder motion with no joint instability (Fig. 9).

Discussion

Scheuermann's kyphosis is an interesting disease characterized by a thoracic or thoracolumbar rigid deformity associated with wedged vertebral bodies [1]. Despite the great interest generated in the orthopaedic community since Scheuermann's kyphosis was first reported, we still do not have an established etiopathogenesis for this disease [1]. There are several theories for causation including an abnormal release of growth hormone, defective formation of collagen fibrils, osteoporosis, trauma or a vitamin A deficiency. A biological predisposition has also been proposed to explain this clinical condition [8].

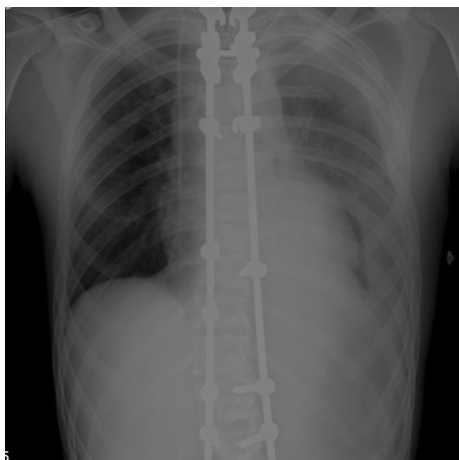


Fig. 3 Chest X-ray after posterior spine fusion showing both sternaloclavicular articulations in place

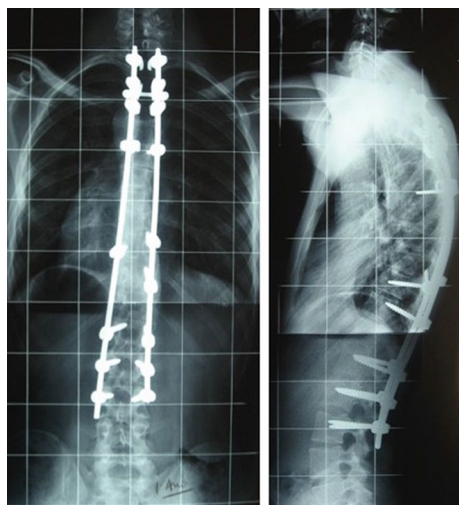


Fig. 4 AP and lateral post-operative X-rays showing a T2–L3 posterior spine fusion using a hybrid construction

The natural progression of Scheuermann's kyphosis also remains controversial, but it seems to have a benign course [9]. The disease is known to cause some functional limitation, usually not severe, though it can also cause a greatly impaired quality of life [9]. Surgery can be recommended on a case-by-case basis, usually when the thoracic kyphosis progresses beyond 70° or there is a pain and/or respiratory compromise [9]. Although it is very rare, the presence of a neurological deficit is an absolute surgical indication [6].

In 2009, Coe et al. [7] reported on the morbidity and mortality associated with spinal fusion for Scheuermann's kyphosis and identified a 14% complication rate in 683 spinal fusions, with infection as the most frequent complication. Lonner et al. reported a 15.4% complication rate in the same setting in their series. Hosman et al. [10] found an

18.8% complication rate, highlighting more complications in patients with an additional anterior procedure along with posterior fusion. In contrast, Papagelopoulos et al. [11] could not find additional complications in those patients where an anterior approach was used to complement a posterior surgical approach. Nonetheless, it seems that posterior surgical approach for Scheuermann's kyphosis should be favoured over combined surgery to minimize complication rates [12].

The sternoclavicular joint is one of the less considered articulations in the shoulder girdle [13]. Instability in this joint could result from injury, osteoarthritis, infection or inflammatory diseases [13]. Dislocations of the sternoclavicular joint are more frequent in young and active male patients, mainly as the result of high-energy trauma. To our knowledge, there are no reports of sternoclavicular joint dislocation associated with spinal deformity surgical correction.

Elias et al. [8] reported on a possible role for the sternum in the etiopathogenesis of thoracic Scheuermann's disease. Association between sternum size and thoracic kyphosis is based on mechanical factors, which according to several authors could be responsible for Scheuermann's pathogenesis [14, 15]. Elias et al. [8] also found a statistically significant difference in sternum length between the normal population and a group of patients with Scheuermann's disease. This author believes there is an association between increased compressive forces at the anterior portion of the vertebral bodies and an accelerated fusion of the sternal segments [8]. In addition, some investigations have noted thickening of the anterior longitudinal vertebral ligament and partial reversal of vertebral wedging with the use of a brace, lending credence to mechanical factors playing some role in Scheuermann's pathogenesis [5, 16]. In 2013, Sugrue et al. [17] published a clinical case of an adolescent who developed severe and rapidly progressive Scheuermann's disease after sternum bar placement to treat pectus excavatum, supporting mechanical factors as a main cause for kyphotic deformity development.

Our patient suffered an anterior sternoclavicular dislocation after correction—by approximately 40%—of a rigid thoracic kyphotic deformity. No other cause could be discovered as being responsible for this phenomenon. We believe this complication occurred after kyphotic deformity correction surgery, due to a relatively short clavicle. Theoretically, there could have been some overstretching of the sternoclavicular joint capsule and ligaments, induced by clavicle shortening during skeletal development which occurs with severe kyphosis deformities. Overcorrection of kyphotic deformities may dislocate the clavicle causing pain and deformity. This idea is supported by the immediate failure of reduction and a sustained congruent joint, after sternoclavicular joint manipulation. Only with a clavicular lengthening osteotomy and anterior ligament reconstruction could

Fig. 5 Patient post-operative clinical photographs (**a**, **b**)

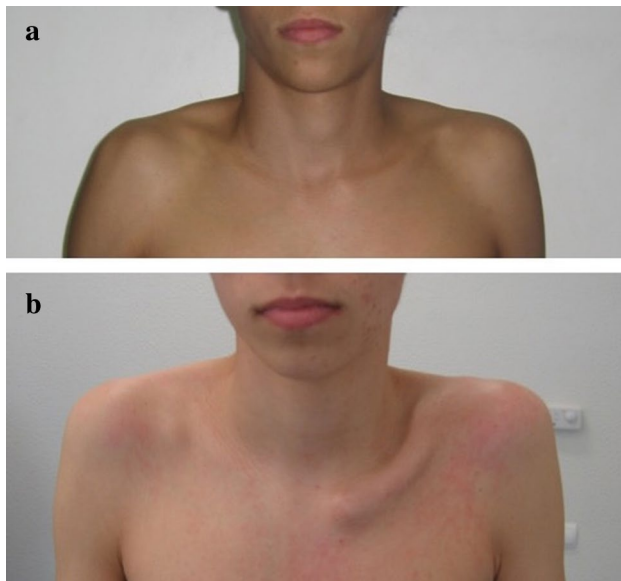
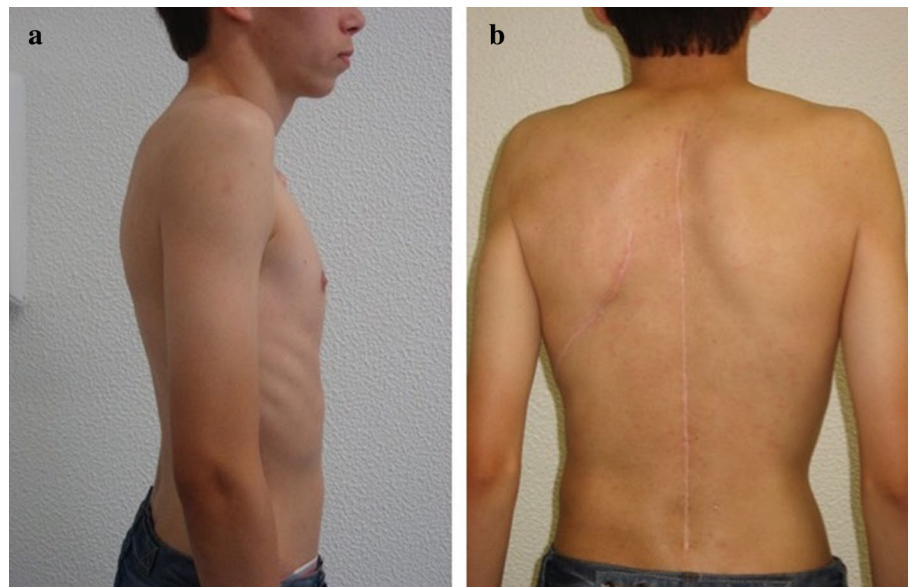


Fig. 6 Photograph demonstrating clinical deformity and evidence of anterior instability of the left sternoclavicular joint (**a**—before surgery, and **b**—after surgery)

we achieve a stable sternoclavicular joint reduction with no further complications, at least for some years. Despite a new sternoclavicular anterior dislocation a few years after the implant removal, we believe this event represents a natural progression for an unstable articulation corrected by surgical means. Nonetheless, the patient reported no pain, discomfort or range of motion limitations after this new dislocation.



Fig. 7 Post-operative X-ray after flexion and lengthening osteotomy at the middle third of the clavicle (note the plate proximal end prominence)

Conclusion

We have reported upon an unusual complication following kyphosis correction—anterior sternoclavicular dislocation. This was apparently a benign event but caused significant impact in the patient's quality of life, justifying surgical repair. It was finally recognized that the clavicle was too short and too high above its joint. Correction was

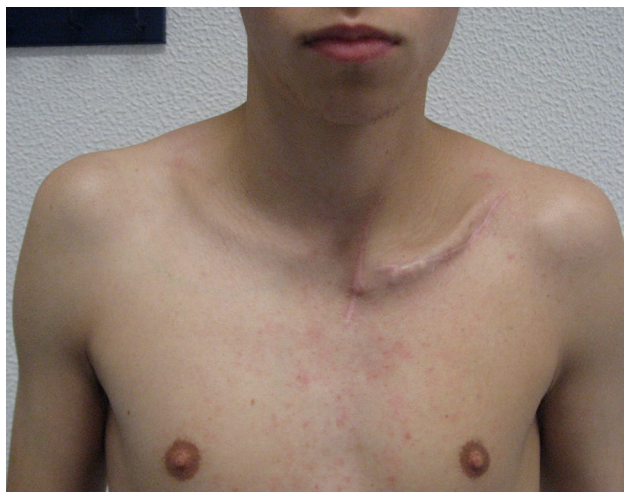


Fig. 8 Clinical photograph showing hardware prominence at 4 years post-op



Fig. 9 Sternoclavicular X-ray at the latest follow-up showing recurrent anterior sternoclavicular dislocation

accomplished via lengthening osteotomy and relocation. This is the first report of this Scheuermann's complication and requires awareness when dealing with such correction in the future. However, we must stress that this was an event without a demonstrated causative association. Further studies are necessary to disclose the role of the sternoclavicular complex in Scheuermann's disease pathogenesis.

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Compliance with ethical standards

Conflict of interest None of the authors has any potential conflict of interest.

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