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Post-Operative Adding-On in Adolescent Idiopathic Scoliosis, A Particular Etiology: Conflict Between the Upper Articular Process and the Instrumentation Material : A Case Report

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Abstract

The aim of surgical treatment of adolescent idiopathic scoliosis (AIS) is to achieve a balanced spine. Distal addingon is a postoperative phenomenon in AIS, which is characterized by a progressive correction loss. A 13-Year-old girl with AIS who underwent posterior arthrodesis showed aggravation of the disequilibrium under the last instrumented vertebra (LIV) 30 months post operatively and an increase of the lumbar curvature with no evident cause. Extension surgery was made and per operatively we noticed that the distal end of the arthrodesis was disengaged and that the left rod was conflicting with the upper left articular process of L2. Among the causes of adding-on we report in this article a particular etiology that consists in a conflict with the instrumentation material. This conflict has to be looked for postoperatively if an adding-on phenomenon is suspected in addition to a distally protruding rod, and could motivate a CT scan imaging for diagnosis.

Keywords: Scoliosis; Idiopathic; Adolescent; Adding-On; Conflict; Instrumentation; Posterior Arthrodesis

Introduction

The aim of surgical treatment of adolescent idiopathic scoliosis (AIS) is to achieve a balanced spine in the coronal and sagittal planes without listing (deviation in C7-center sacral vertical line) or truncal shifting. In the selection of fusion levels, an ideal fusion mass requires parallel top and bottom endplates without substantial coronal shift, and appropriate sagittal alignment. Distal adding-on is a postoperative phenomenon in AIS, which is characterized by a progressive correction loss due to an increase in either vertebral deviation of the lumbar spine or disc angulation below the instrumentation. Distal adding-on is often accompanied by unsatisfactory clinical outcome and a high risk of reoperation, the incidence of adding-on has been reported to be 2% to 13% [1-3]. Adding-on has been observed in patients, especially those with remaining growth potential, with residual shoulder imbalance, inappropriate lowest instrumented vertebrae (LIV), and residual apical translation [4].

We report a particular etiology of adding-on and post-operative imbalance due to a conflict between the distal end of the rod and the upper articular process of the lower adjacent vertebra (LIV+1).

Case Report

A 13-year-old girl with AIS was planned for surgery. Preoperative Cobb angle were 60° thoracic, and 31° lumbar (Figures 1 and 2). On bending Cobb angle were respectively 60° thoracic and 7° lumbar on the left bending and 41° thoracic and 53° lumbar on the right bending. According to Lenke criteria [5,6], instrumentation was T4 to L1 using hooks, screws and rod (Legacy, Medtronic* Dublin, Ireland) and sub laminar clamps (Implanet* Martillac, France) at the apex. We didn't have any postoperative complication and the patient was discharged 8 days after surgery. Nevertheless, on the post-operative X-ray, (Figure 3) we noted imbalanced spine and decided to do a conservative treatment with physiotherapy.

At 6 months postoperatively, sports were authorized and return to normal activity without any limitation was achieved. Regular follow up until 30 months showed aggravation of the disequilibrium under the LIV (Figure 4) and an increase of the lumbar curvature with no evident cause. That was only partially corrected with 3 points cast



Figure 1: AP and lateral spine X-ray prior to surgery.

therefor indicating an extension of the arthrodesis. So we decided to extend the instrumentation to the lumbar curve. Per operatively we noticed that the distal end of the arthrodesis was disengaged and that the left rod was conflicting with the upper left articular process of L2 (Figure 5). This explained the inclination of the vertebra responsible for the lumbar deviation and adding-on. The extension consisted in the ablation of L1 material and screwing L3 and L4 bilaterally and then

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Figure 2: Lateral bending spine X-ray prior to surgery.



Figure 3: AP and lateral spine X-ray immediate post-operative.



Figure 4: AP and lateral spine X-ray at 30 months Follow-up.

extending with two shorts rods and two connectors. Post-operative X ray showed correction of lumbar curve and a good balance of the spine (Figure 6). We didn't have postoperative complication and patient was discharged 5 days after surgery.



Figure 5: Pre-operative view and fluoroscopy of the adding-on phenomenon due to the conflict.



Figure 6: AP and lateral spine X-ray after adding-on surgery.

Discussion

The adding-on phenomenon is a complication that can occur after surgery in AIS patients [7] and is defined as a progressive increase in the number of vertebra included in the main curvature of a scoliosis combined with an increase in the deviation of the first vertebra below the LIV or an increase in the angulation of the first disc below the LIV [8,9]. Parisini and Sponseller an co-authors [10,11] both verified the adding-on phenomenon after selective thoracic surgery and can be caused by a wrong choice of LIV in selective thoracic fusion, especially if the patient presented skeletal immaturity [3,12,13]. Adding-on often leads to the progressive loss of curve correction and unsatisfactory clinical outcomes, as well as a high risk of reoperation [3].

A contradiction exists between increased spine fusion to prevent scoliosis progression and preservation of more of the segment to obtain better lumbar activity. In this report the limits chosen to the spinal construct were correct according to the Lenke criteria [1,2] and following authors [6,14] we explain the mechanical conflict between the arthrodesis material lower end and the upper articular process of the LIV+1 that was repulsed causing the LIV to rock as another possible etiology.

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Conclusion

Among the causes of adding-on we report in this article a particular etiology that consists in a conflict with the instrumentation material. This conflict is to be looked for postoperatively if an adding-on phenomenon is suspected in addition to a distally protruding rod, and could motivate a CT scan imaging for diagnosis.

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