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Severe idiopathic scoliosis with respiratory insufficiency treated with preoperative traction and staged anteroposterior spinal fusion with a 2-level apical vertebrectomy

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Abstract

BACKGROUND CONTEXT: Severe adolescent idiopathic scoliosis with respiratory insufficiency is infrequently seen in North America currently.

PURPOSE: To present the case of a teenager from Moscow, Russia who was referred to our center with a severe scoliosis and respiratory compromise.

STUDY DESIGN/SETTING: A case report on the evaluation and surgical treatment of a severely deformed teenager.

METHODS: A 14+10-year-old was referred to our center for treatment of a 149° thoracic scoliosis. Preoperative pulmonary function tests (PFTs) revealed severe restrictive disease with a forced vital capacity (FVC) of 1.3 L (34% predicted) and a forced expiratory volume in 1 second (FEV_1) of 0.99 L (31% predicted). She underwent a 2-stage anterior and posterior 2-level vertebral column resection (VCR) with preoperative and in between anterior and posterior stage perioperative halo-gravity traction.

RESULTS: Her thoracic scoliosis was corrected to 48° over 3 years postoperative. Her 3-year follow-up PFT revealed an FVC of 1.85 L (52% predicted) and an FEV_1 of 1.6 L (50% predicted).

CONCLUSIONS: A staged anterior and posterior VCR with intervening halo-gravity traction is a viable option to treat severe scoliosis in patients with restrictive pulmonary function.

Keywords: Adolescent idiopathic scoliosis; Restrictive lung disease; Anterior and posterior vertebrectomy; Vertebral column resection; Halo-gravity traction

Introduction

Severe idiopathic scoliosis that is complicated by cardiorespiratory impairment results in significant morbidity and mortality. The degree of impairment has been shown to correlate with the severity of the spinal deformity, with clinically relevant pulmonary impairment generally occurring once curves progress beyond 100° [1]. More recently, Newton et al. [2] showed that moderate to severe pulmonary impairment is present in 20% of individuals with curve magnitudes between 50° and 70°, and that no clear threshold value exists. However, with appropriate surgical intervention, severe idiopathic scoliosis with impending cardiorespiratory failure is now rarely seen in the United States.

The effect of scoliosis surgery on pulmonary function has been shown to vary depending on chest cage disruption. Patients with chest cage disruption during scoliosis surgery exhibit a decline in pulmonary function at 3 months postoperative, whereas those without chest cage disruption show an improvement in pulmonary function. However, scoliosis surgery generally prevents progression of respiratory insufficiency with most patients at least returning to baseline values by 2 years postoperative [3,4]. Patients with respiratory insufficiency because of scoliosis are also at an increased risk of postoperative pulmonary complications including pneumonia and reintubation [5].

This report presents a case of juvenile-onset adolescent idiopathic scoliosis (AIS) with a severe curvature that was complicated by severe restrictive pulmonary disease.

FDA device/drug status: not applicable.

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The patient was successfully managed with preoperative traction and a staged anteroposterior spinal fusion with pedicle screw fixation and a 2-level apical vertebrectomy. Three-year and 4-month clinical, radiographic, and pulmonary function follow-ups are presented.

Case report

The patient was a 14+10-year-old female from Russia who was presented to Shriners Hospital for the evaluation of idiopathic scoliosis. She was initially diagnosed with scoliosis at the age of 5 by a screening examination performed because of a family history of mild nonprogressive scoliosis in the patient's mother and brother. At the age of 7, her curvature was reported to have increased to 29°. At this time, she entered a boarding school for children with scoliosis, where she was treated with conservative measures including a brace. By the age of 12, her brace no longer fit because of progression, noted as a right 79° thoracic curve and a 45° compensatory lumbar curve. Given the rapid progression of her deformity, she was referred to Shriners Hospital for further care.

At the time of presentation to Shriners Hospital 2 years later, she had started to experience dyspnea with minimal walking or running. Pulmonary function testings (PFTs), standardized by arm-span length, showed an forced vital capacity (FVC) of 1.21 L (34% predicted) and an forced expiratory volume in 1 second (FEV_1) of 0.99 L (31% predicted), with an FVC/FEV_1 ratio of 82%, consistent with severe restrictive pulmonary disease. Arterial blood gas analysis (at rest on room air) showed a pO_2 of 79 mm Hg consistent with mild hypoxemia, with a pH of 7.37, a pCO_2 of 41 mm Hg, and oxygen saturation of 97% on room air. She had no other significant medical problems, including no history of pneumonia or asthma. Her menses started approximately 2 years before presentation. On physical examination, she weighed 41.3 kg (91 lb) and was 150.7 cm (59.3″) tall. She had a slightly elevated right shoulder, significant right thoracic rib hump, and mild pelvic obliquity with measured discrepancy of 0.5 cm (Fig. 1). Her scoliometer measurements were >30° in the thoracic region and 5° in the lumbar region. Her neurological examination was normal in both the upper and lower extremities. Radiographic examination showed a right 149° thoracic curvature and a left 66° lumbar curvature (Fig. 1). Side bending radiographs showed 33% flexibility of her thoracic curve, which decreased to 100° (Fig. 1). The patient was Risser 4. A total spine magnetic resonance imaging revealed no vertebral or spinal cord abnormalities.

Because of the patient's severe deformity and restrictive pulmonary disease, she was placed in approximately 34 lb of halo-gravity traction for 1 month with daily ambulation, after which her thoracic curvature measured 120°. PFTs showed improvement with an FVC of 1.54 L (47% predicted) and an FEV_1 of 1.32 L (45% predicted).

After 1 month in traction, she underwent an open anterior spinal fusion and release from T5 to L1 with a 2-level apical corpectomy (T8 and T9). The surgery was performed via a right-sided thoracotomy with a sixth rib harvest, which was used as autograft bone for fusion. Intraoperatively, small bursae were observed over the vertebral bodies and intervertebral discs at the apex of her curve where they abutted her chest wall. Postoperative radiographs (Fig. 2) in 34 lb of halo-gravity traction showed

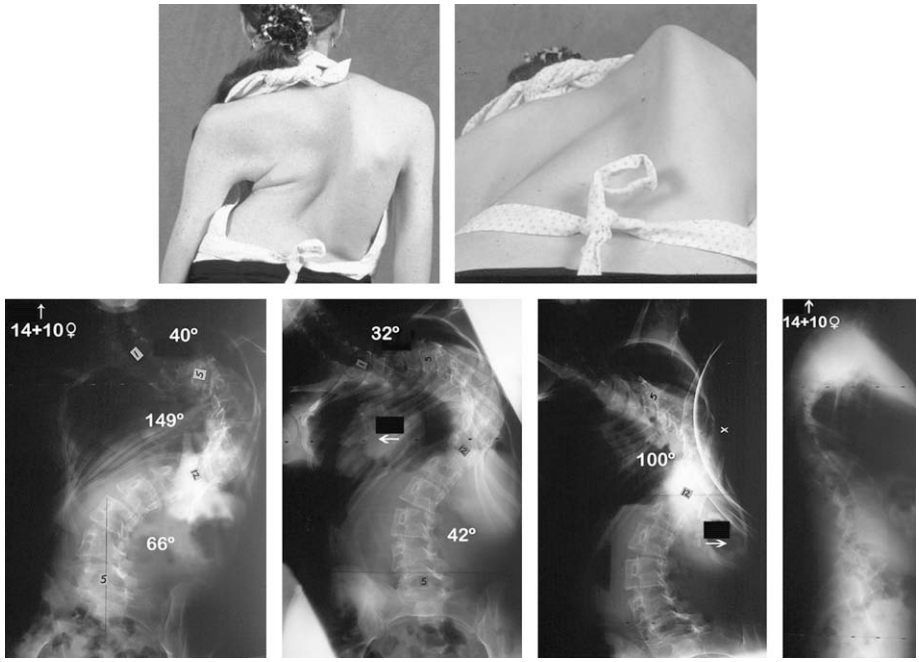

Fig. 1. Preoperative clinical photos and preoperative radiographs (anteroposterior, left and right side bending, and lateral).