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Case Report

Tracheal compression due to straight back syndrome: successful treatment with partial manubrium sterni resection

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ABSTRACT

Straight back syndrome is an uncommon clinical entity characterized by tracheal compression resulting from loss of the normal dorsal curvature of the thoracic vertebrae and a reduced distance between the manubrium and the thoracic vertebrae. Herein, we present a case in which respiratory distress developed secondary to tracheal compression attributable to straight back syndrome, and partial manubrium sterni resection was performed utilizing a minimally invasive technique.

Keywords: straight back syndrome, tracheal stenosis, dyspnea, sternum, tracheal compression

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Introduction

The trachea is anatomically situated within the mediastinum, posterior to the sternum. Under normal circumstances, an adequate distance between the trachea and the sternum permits unimpeded tracheal expansion and contraction during respiration. Nevertheless, certain rare chest wall and spinal deformities, traumatic injuries, or malignancies may reduce this distance, resulting in tracheal compression [1,2]. Such compression can lead to airway obstruction and manifest as severe clinical symptoms, including exertional dyspnea, stridor, and, in extreme cases, respiratory failure.

Straight back syndrome (SBS), among these anomalies, is a rare clinical entity characterized by loss of the normal dorsal curvature of the thoracic vertebrae and a decreased distance between the manubrium sterni and the thoracic vertebrae [3,4]. These anatomical alterations may result in cardiac manifestations secondary to compression of the heart and great vessels such as cardiac murmurs, mitral valve insufficiency, and pulmonary hypertension or precipitate respiratory complications due to tracheal compression [5].

Tracheal compression secondary to straight back syndrome (SBS) may significantly impair patients' quality of life. Timely diagnosis and the implementation of appropriate therapeutic interventions are essential for alleviating respiratory symptoms attributable to tracheal compression and for preventing associated complications.

This case report describes a patient who developed respiratory distress as a result of tracheal compression secondary to SBS, and who was managed with partial manubrium resection utilizing a minimally invasive approach.

Case Report

An 18-year-old female patient presented with a two-year history of progressively worsening exertional dyspnea. Her medical history was unremarkable for any known comorbidities. The dyspnea was classified as Grade 1 according to the Modified Medical Research Council (mMRC) Dyspnea Scale. Physical examination revealed no appreciable deformities.

Imaging findings

Thoracic computed tomography (CT) revealed that, distal to the left brachiocephalic artery's origin, the manubrium produced anterior compression of the trachea, thereby decreasing the anteroposterior diameter of the trachea. The minimal anteroposterior diameter was measured at 10 mm, whereas the normative range is 16 to 20 mm. The distance between the posterior cortex of the manubrium and the anterior surface of the vertebral body was 26 mm. The manubrium sterni measured 18 mm in thickness and 60 mm in width (Figures 1,2).

Preoperative evaluation

Fiberoptic bronchoscopy revealed compressive narrowing of the anterior wall starting 2 cm after the tracheal inlet. However, no tracheomalacia was detected.

Surgical method

With the patient in the supine position, a 3 cm incision was performed on the manubrium, commencing at the incisura jugularis. The segment of the manubrium exerting compression on the trachea was excised utilizing a V-shaped wedge resection technique (Figure 3). This intervention alleviated tracheal compression, and the resultant defect was reinforced with a titanium plate. The procedure was concluded upon achieving hemostasis.

Postoperative course

The patient was extubated postoperatively and mobilized two hours postoperatively. Marked improvement in respiratory function was observed promptly.

At the six-month follow-up, computed tomography demonstrated resolution of tracheal compression, with a tracheal diameter of 15.2 mm and a manubrium-to-vertebral distance of 46–47 mm (Figure 4). Written informed consent was obtained from the patient for the use of medical data in academic research.

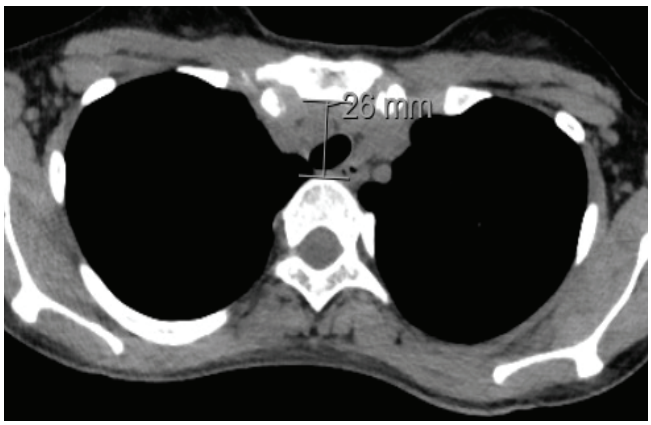

Figure 1. Measurement of the minimal distance between the posterior aspect of the manubrium and the anterior surface of the vertebral body on the axial section of the patient's preoperative thoracic computed tomography (CT) scan.

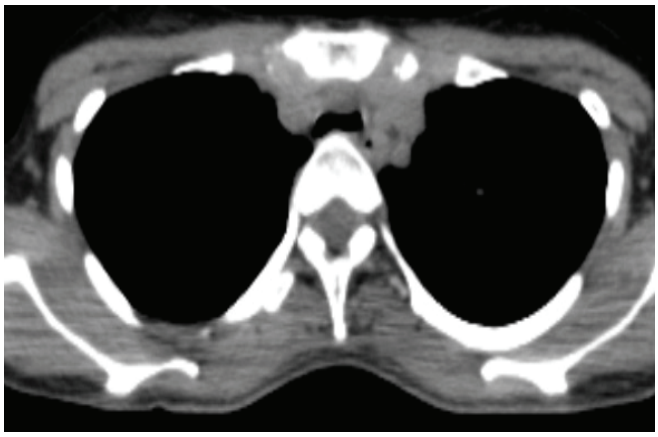

Figure 2. The shortest anterior and posterior diameter of the trachea in the axial section of the thorax CT.

Figure 3. Operative appearance demonstrating compression of the trachea by the manubrium sterni following V-shaped wedge resection.

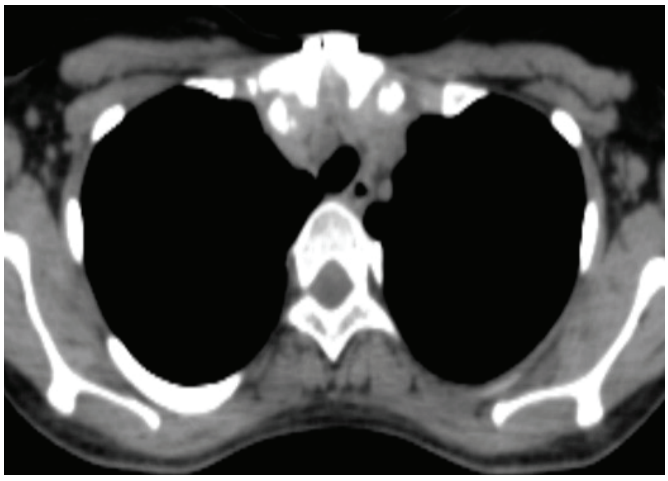

Figure 4. The shortest distance between the posterior manubrium and the anterior vertebra in the axial section of the patient's 6th-month postoperative thorax CT.

Discussion

In cases of tracheal compression secondary to straight back syndrome (SBS), the primary objective is to achieve adequate decompression by creating sufficient mediastinal space. Surgical interventions may include resection of the posterior manubrium, sternoplasty, correction of concomitant pectus excavatum, or displacement and reconstruction of major vessels contributing to the compression, in order to optimize the available space within the upper mediastinum [5].

In a study conducted by Grillo et al, four patients presenting with tracheal compression secondary to SBS were evaluated. Two patients underwent partial manubrial resection in conjunction with re-transposition of the brachiocephalic artery, which was rerouted from the aorta to the right side of the trachea utilizing a graft. Another patient received pectus repair via a modified Ravitch procedure. The remaining patient was managed by placement of a methylmethacrylate plate to preserve the distance between the sternoclavicular joints following partial manubrial resection [6].

Liu et al. reported a case of SBS with tracheal stenosis in which resection of the sternum, costal cartilage, and thymic tissue was undertaken. The resultant chest wall defect was reconstructed, and tracheal compression was alleviated through the application of digitally fabricated material utilizing three-dimensional (3D) technology [7]. In the present case, tracheal compression was similarly attributable to a reduced distance (26 mm) between the posterior aspect of the manubrium and the vertebral bodies. The observation of an abnormally increased transverse diameter of the manubrium indicated that symptomatic relief could be achieved via a less invasive approach, thereby preserving chest wall integrity and avoiding disruption of the sternoclavicular joints. Accordingly, a V-shaped wedge resection of the manubrium was performed. Postoperatively, tracheal compression was effectively resolved. Follow-up computed tomography performed at six months demonstrated an increase in the distance between the posterior surface of the manubrium and the anterior surface of the vertebral bodies to 46-47 mm, as well as an increase in the tracheal anteroposterior diameter to 15.2 mm.

In conclusion, in patients presenting with a decreased anteroposterior thoracic diameter and an increased transverse diameter, tracheal compression should be included in the differential diagnosis of exertional dys-

pnea. Following early diagnosis and appropriate surgical intervention, significant improvement in respiratory function and quality of life may be achieved. In the present case, tracheal compression was effectively alleviated through a V-shaped wedge resection of the manubrium, utilizing a minimally invasive technique that preserved both patient posture and chest wall integrity. This approach may optimize surgical outcomes and contribute to favorable long-term prognoses.

Declaration of conflicting interests

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Authors' contribution

VK; organized the article and wrote the paper, EK,FM; contributed to the data collection, VK,EK,FM; revised the article. All authors revised the manuscript. The authors read and approved the final manuscript.

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