

## Dysphagia after C2-7 *in situ* Posterior Fusion in a Patient with Diffuse Idiopathic Skeletal Hyperostosis: Case Report of a Rare Presentation

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Dysphagia has been recognized as a complication after occipitocervical fusion, enlargement of C2-7 lordosis, or anterior cervical approach<sup>1-4)</sup>. However, there are only a few reports of dysphagia after *in situ* middle-to-lower cervical posterior fusion.

Herein, we report the case of a patient with diffuse idiopathic skeletal hyperostosis (DISH) who developed dysphagia after *in situ* posterior C2-7 fusion with preoperative halo-vest use.

A 74-year-old male with no medical history suffered from hand clumsiness, numbness, and difficulty in walking. Computed tomography showed C2-7 ossification of the posterior longitudinal ligament and C5/6 anterior spur. Furthermore, continuous ossification of the anterior longitudinal ligament (OALL) was observed at C7-L3 and continuous ossification of the supra-spinous process ligament at T4-L1. Magnetic resonance imaging revealed stenosis from C3/4 to C6/7 (Fig. 1). The O-C2 angles were 16° (neutral), 6° (flexion), and 31° (extension). The C2-7 angles were 28° (neutral), 15° (flexion), and 33° (extension). The C2-7 sagittal vertical axis (SVA) was 32.5 mm, and the pharyngeal tilt angle (PTA) was 84° (Fig. 2).

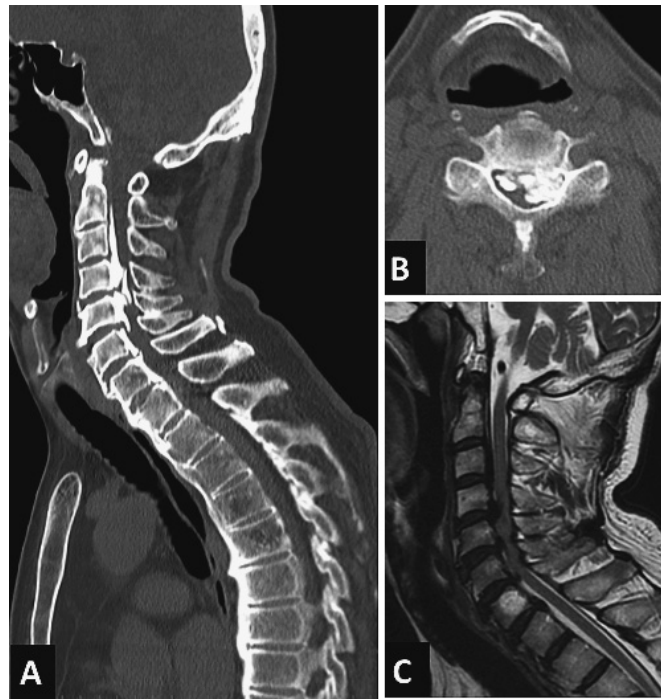
Two days preoperatively, halo-vest fixation was performed in the neutral position (O-C2 angle 23°, C2-7 angle 25°), and the patient experienced slight dysphagia with no disturbance. However, the patient could not move his cervical region freely under the halo-vest. Therefore, C2-7 posterior fusion with free O-C2 was considered to improve his

dysphagia. The clumsiness and numbness of the hands moderately improved. Under general anesthesia, the patient was placed in the prone position with a halo-vest. There was no difference between the preoperative and prone-positioned C2-7 alignments as recognized on the X-ray. C3-7 laminoplasty and C2-7 posterior fusion were performed uneventfully. Subsequently, the halo-vest was removed and changed into a Philadelphia neck collar before the patient could awaken. The endotracheal intubation and extubation were done smoothly. However, the patient experienced severe dysphagia on the next day. The O-C2 angles were 16° (neutral), -2° (flexion), and 24° (extension). The C2-7 angle was 28°. The C2-7 SVA was 36 mm, and the PTA was 94° (Fig. 2). At postoperative day (POD) 9, barium esophagography revealed an occlusion at the C5/6 level osteophyte, whereas initiation of the pharyngeal swallow response was normal in the videofluoroscopic swallowing study. Anterior C5/6 osteophyte resection was performed, but dysphagia persisted. At POD 14, the barium was still clogged up on esophagography. The hyoid moved vertically but not anteriorly because of the weakness of the laryngeal muscle and difficulty in moving the neck forward (Fig. 3). The O-C2 was free; however, C2-7 posterior spinal fusion and C7-L3 OALL did not allow the patient to assume the sniffing position. Instrument removal or laryngeal suspension was planned if there was no improvement. However, dysphagia improved to moderate grade<sup>5)</sup> 6 weeks after surgery. The hand clumsiness, numbness, and walking status also im-

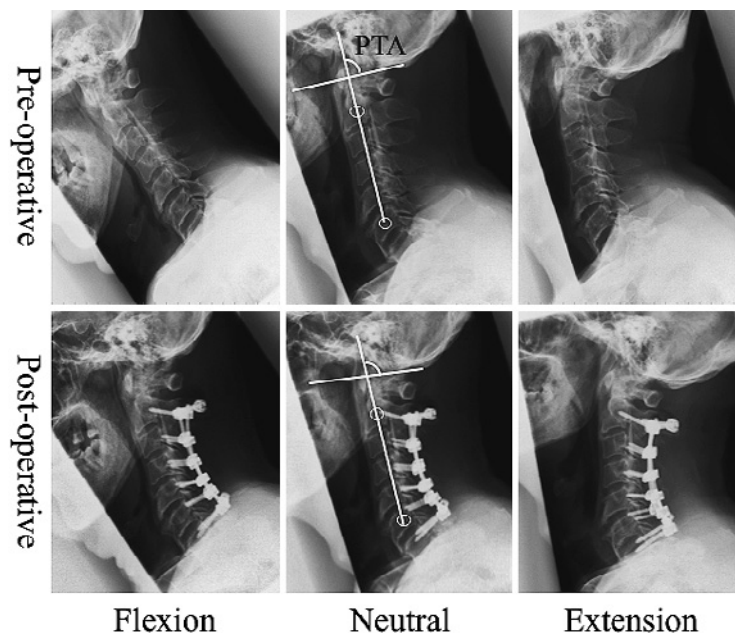
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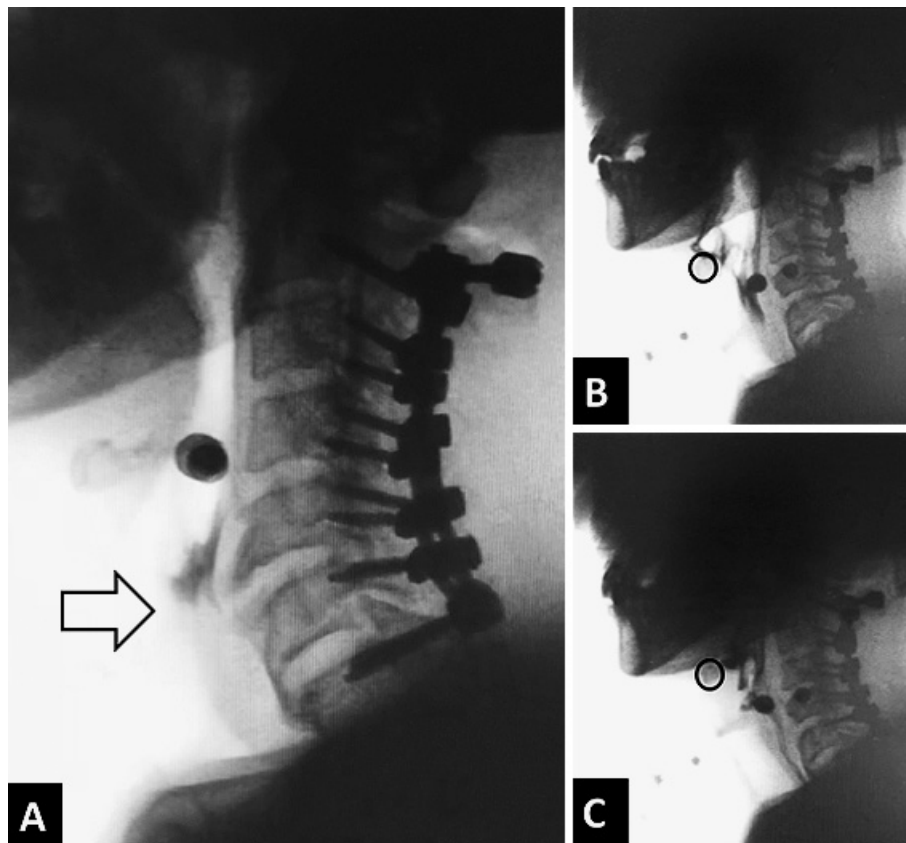
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**Figure 1.** A) Computed tomography showed C2-7 ossification of the posterior longitudinal ligament. The most stenotic level was at C4-5. Furthermore, continuous ossification of the anterior longitudinal ligament was observed at C7-L3 and continuous ossification of the supra-spinous process ligament at T4-L1; C7-L3 was fused and had no motion segment. B) Axial CT slice of C4-5. C) Magnetic resonance imaging revealed spinal cord compression at C4-7.



**Figure 2.** Preoperatively, the O-C2 angles were 16° (neutral), 6° (flexion), and 31° (extension); the C2-7 angles were 28° (neutral), 15° (flexion), and 33° (extension). Postoperatively, the O-C2 angles were 16° (neutral), -2° (flexion), and 24° (extension). The C2-7 angle was 28°, which showed no change, and the pharyngeal tilt angle (PTA) changed from 84° to 94°. The PTA was described as the angle between the McGregor's line and the line that links the center of the C2 pedicle and the center of the vertebral body at the apex of the cervical sagittal curvature.



**Figure 3.** A) Barium esophagography revealed an occlusion at the C5/6 level osteophyte (arrow).

B, C) The barium was still clogged up on esophagography despite C5/6 anterior osteophyte removal. The hyoid (black circle) moved vertically but not anteriorly because of the weakness of the laryngeal muscle and difficulty in moving the neck forward.

proved.

Mechanical stenosis of the oropharyngeal space due to a reduced O-C2 angle was thought to be one explanation for dysphagia<sup>6-8</sup>). Therefore, the decrease in the preoperative and postoperative O-C2 angles was proposed to be a predictive factor<sup>1,9,10</sup>). Additionally, it was found that a dC2-7 angle of  $> 5^\circ$  was a risk factor for dysphagia<sup>3</sup>). The PTA, the angle between the McGregor's line and the line that links the center of the C2 pedicle and the center of the vertebral body at the apex of the cervical sagittal curvature, is thought to reflect anterior protrusion of the mid-cervical spine. A decreased PTA may induce dysphagia<sup>9</sup>); however, in our case, the O-C2 was not fused, the C2-7 angle did not change, and the PTA increased by  $10^\circ$  postoperatively.

In our case, immediate improvements were not observed after surgical resection of the C5/6 anterior osteophyte. The original weakness of the laryngeal muscle of the patient and posterior cervical fusion with long OALL, which makes it difficult to assume the sniffing position, have been considered as the reasons for the persisting symptom. The sniffing position, i.e., protrusion, which consists of upper cervical extension and lower cervical flexion, significantly improves the laryngeal space compared with the neutral neck position<sup>11,12</sup>). Thus, if the C2-7 posterior fusion has positioned in

a more kyphotic or sniffing position, dysphagia may not occur. However, these positions result in the deterioration of spinal cord compression due to OPLL. In conclusion, patients with less mobile segments due to DISH should beware of the difficulty in assuming the sniffing position, which could cause dysphagia, even after middle-to-lower cervical *in situ* posterior fusion.

**Conflicts of Interest:** The authors declare that there are no relevant conflicts of interest.

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