Intraoperative Anterior Migration of the Prestige-LP Cervical Disc Owing to an Inappropriate Implantation Sequence During Continuous 2-Level Artificial Cervical Disc Replacement: A Case Report with 8-Year Follow-Up

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Key words
- Cervical disc replacement
- Cervical functional exercise
- Disc migration
- Implantation sequence
- Surgical complication

Abbreviations and Acronyms
ACDR: Artificial cervical disc replacement
ROM: Range of motion

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BACKGROUND: **Owing to its unique advantages, 2-level artificial cervical disc replacement (ACDR) is gaining attention. Among artificial discs designed for use in ACDR, the Food and Drug Administration–approved Prestige-LP Cervical Disc is widely used. There are no standard implantation sequences for 2-level ACDR using the Prestige-LP disc, and complications resulting from inappropriate implantation sequences remain unknown.**

CASE DESCRIPTION: **A 45-year-old woman underwent continuous 2-level ACDR using the Prestige-LP disc and experienced anterior migration of a previously inserted artificial disc after secondary disc implantation at an upper segment owing to an inappropriate implantation sequence during surgery. Intraoperative radiographs showed stable index levels and artificial discs. We tapped the migrated disc back into its correct position and recommended a postoperative functional exercise plan to the patient. We followed the patient for 8 years to verify the safety of our solution. We developed an implantation strategy for 2-level ACDR to avoid this complication in the future.**

CONCLUSIONS: **During 2-level ACDR, a top-down sequence should be used to implant prostheses. When anterior disc migration occurs, intraoperative radiographs should be obtained to ensure stability of the index levels. If there is no instability, the migrated tab can be tapped back into its correct position. In addition, limiting motion rather than allowing intermittent movement of the neck for at least 3 months is important to promote union between bone and prosthesis.**

INTRODUCTION

Two-level cervical degenerative disease is defined as the degeneration of 2 cervical vertebral segments; this disease can cause cervical myelopathy or cervical radiculopathy and reduce quality of life. With the increasing incidence of this disease, different surgeries have been developed for treatment. Two-level artificial cervical disc replacement (ACDR) is gaining attention because of its advantages in preserving the segmental range of motion (ROM) and decreasing the concentration of stress and compensated ROM at adjacent segments.[1-3] Compared with anterior cervical discectomy and fusion, 2-level ACDR has the advantage of improving scores, such as the Neck Disability Index and 36-Item Short-Form Health Survey, and shows similar recovery of neurologic function.[4-6] Among the artificial discs designed for use in ACDR, the Prestige-LP Cervical Disc (Medtronic, Minneapolis, Minnesota, USA) is approved by the U.S. Food and Drug Administration and is widely used. The Prestige-LP disc is a semiconstrained artificial disc with a ball-trough design, which mimics the physiologic movement and motion of normal cervical vertebrae.[7]

Studies have indicated the safety of using the Prestige-LP disc in 2-level ACDR.[8,9] However, there are no standard implantation sequences for continuous 2-level ACDR using the Prestige-LP disc, and complications resulting from an inappropriate implantation sequence remain unknown. We report a patient who underwent continuous 2-level ACDR using the Prestige-LP disc and experienced anterior migration of a previously implanted artificial disc after secondary disc implantation at an upper segment owing to an inappropriate implantation sequence during surgery. We analyzed the mechanism of this condition and generated a solution. Furthermore, we followed the patient for 8 years to verify the safety of our solution. We also developed an implantation strategy for continuous 2-level ACDR to avoid this complication.

CASE DESCRIPTION

Medical History

A 45-year-old woman had numbness of the left arm for 10 months. The numbness progressively increased, and she experienced weakness in both upper limbs for 6 months. On examination, muscle strength of biceps and triceps and wrist extensors on both sides was grade 4, and diminished protopathic sensation of the radial forearm into the thumbs and index fingers on both sides was observed.

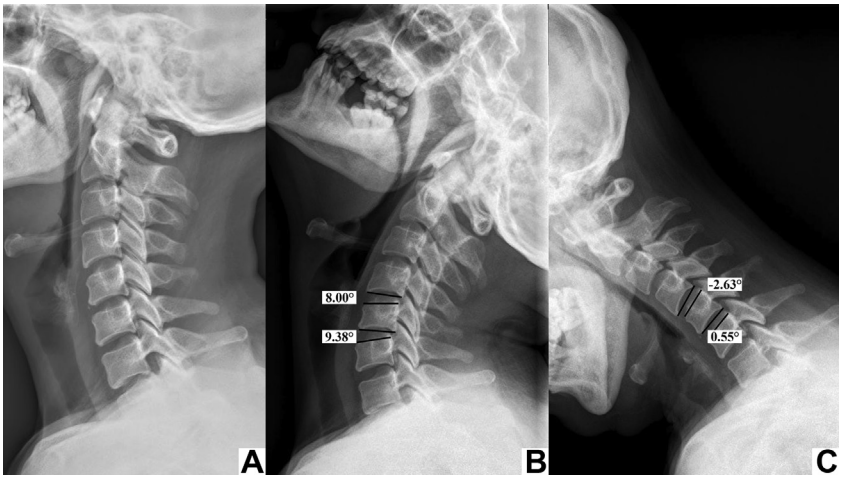

Figure 1. (**A**–**C**) Lateral radiographs obtained before surgery show that the intervertebral heights at C4-5 and C5-6 are not obviously decreased; range of motion at C4-5 is 10.63° and 9.93°, respectively.

However, normal function was preserved in both lower limbs. Positive Hoffmann sign was observed on both sides. Lateral radiographs showed that the ROM at C4-5 and C5-6 was 10.63° and 9.93°, respectively, and reduction of the intervertebral disc height at both levels was <30% (Figure 1A–C). Reconstructed computed tomography scans showed mild degeneration of intervertebral disc spaces at both C4-5 and C5-6 without facet joint degeneration (Figure 2A–C). Magnetic resonance imaging demonstrated severe disc herniation of the central part at C4-5 and lateral part at C5-6 (Figure 2D and E). Considering the medical history and examination findings, both 2-level anterior cervical discectomy and fusion and 2-level ACDR were suitable for the patient. However, the patient was middle-aged, and the compression of spinal cord and nerve root was caused by the soft tissue. Moreover, 2-level ACDR could maintain segmental ROM and reduce the complementary increment of adjacent segmental ROM caused by 2-level anterior cervical discectomy and fusion. Therefore, after discussion with the patient, we performed 2-level ACDR using the Prestige-LP Cervical Disc.

Surgical Procedure

After general anesthesia induction and positioning of the patient, a standard right-sided anterior cervical approach and exposure was used. Complete discectomy and decompression were performed first at both index levels with removal of the disc tissue and posterior longitudinal ligament. The endplates and disc space at C5-6 were then well prepared by using a burr, Implant Trial, and Rail Cutter Guide following the manufacturer's instructions. Next, a properly sized Prestige-LP disc was inserted along with channels in the endplates. An appropriately sized implant trial was then left at C4-5 to maintain the intervertebral height, and implantation of the Prestige-LP disc at C5-6 was completed. Then we moved to the C4-5 disc space and finished the endplate preparation and prosthesis implantation following the same procedure.

We obtained lateral and anteroposterior intraoperative radiographs to verify the position of prostheses after implantation of the 2 prostheses. We noticed that the upper tab of the prosthesis at C5-6 had migrated forward (Figure 3A). By reviewing and checking the lateral intraoperative radiographs of rasping, cutting, and drilling processes at C4-5, we found that the upper tab of C5-6 had migrated during the rasping process, and the anterior migration had improved during the cutting process (Figure 3B). To test whether the bony track of the upper tab at C5-6 was loosened and whether the index segments were stable, we obtained intraoperative flexion-extension radiographs and found that the ROM at C4-5 and C5-6 was 4° and 10°, respectively, and the anterior migration of the upper tab did not improve during flexion or extension (Figure 3C and D). Thus, we tapped the migrated tab back into the correct position (Figure 3E). Finally, a drain was inserted before closure of the incision.

Follow-Up and Outcomes

After surgery, the patient's symptoms were significantly relieved. Lateral radiographs showed that the prostheses were in good condition. We recommended that the patient intermittently exercise her neck 3 times a day and wear a collar the rest of time during the first 3 weeks after surgery and limit the motion of her neck from the 4th week postoperatively for 3 months. The patient was instructed to perform functional exercises 3 times a day in the morning, afternoon, and evening. The patient was instructed to wear a collar when not doing the neck exercises. Detailed instructions for neck exercise were as follows: flex the neck to the utmost extent, hold for 10 seconds, and finish the extension; perform lateral bending and lateral rotation movement in the same way; repeat 10–15 times. A lateral radiograph obtained 1 week after surgery did not show any migration of the upper tab at C5-6 and showed that both artificial discs were in good positions (Figure 4A). Therefore, we suggested that the patient continue the above-described rehabilitation program for the neck. At 1-month follow-up, the upper tab of the prosthesis at C5-6 had migrated forward again to the same degree as the migration during surgery (Figure 4B). Flexion-extension radiographs did not show any aggravation of the migration, and both the C4-5 and the C5-6 segments were stable (Figure 4C and D). The patient denied feeling any discomfort; thus, we did not offer any treatment and suggested that the patient completely limit the motion of her neck and maintain regular follow-up. Compared with radiographs obtained at the 1-month follow-up, the lateral and flexion-extension radiographs at the 3-month follow-up showed that the upper tab of the prosthesis at C5-6 did not improve. Furthermore, there was no indication of instability for the C4-5 and C5-6 segments