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Artificial disc replacement at L_{1-2} through an anterolateral approach: Report of two cases and review of surgical techniques

Anterolateral yaklaşımla L_{1-2} segmentinde disk replasmanı: İki olgu sunumu ve cerrahi tekniklerin değerlendirilmesi

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Artificial disc replacement (ADR) is usually performed through anterior midline approaches from L_5-S_1 up to L_{2-3} segment. However, in the L_{1-2} segment, ADR through a midline approach is often difficult due to the existence of renal vessels. We report two patients with juxtafusional degeneration syndrome at the L_{1-2} segment. Artificial disc replacement was performed through an anterolateral approach and was completed without any intraoperative complications. The patients were allowed to ambulate on the first postoperative day with a light corset. Artificial disc replacement through an anterolateral approach may be useful in the upper lumbar segments when kidney and renal vessels preclude a direct anterior approach.

Key words: Intervertebral disk displacement/surgery; lumbar vertebrae/surgery; prostheses and implants; spinal fusion/methods.

Yapay disk replasmanı (YDR), L_5-S_1'den L_{2-3} segmentine kadar genellikle anterior orta hat yaklaşımlarla yapılmaktadır. L_{1-2} segmentinde, renal damarların varlığı nedeniyle orta hat yaklaşımla YDR genellikle zordur. Bu yazıda, L_{1-2} segmentinde jukstafüzyonal dejenerasyon sendromu görülen iki olgu sunuldu. Bu olgularda YDR anterolateral yaklaşımla uygulandı ve ameliyat sırasında hiçbir komplikasyon meydana gelmedi. Ameliyattan sonra ilk günde, hastaların hafif bir korse ile yürümelerine izin verildi. Anterolateral yaklaşımla YDR, böbrek ve renal damarların direkt anterior yaklaşımı engellediği durumlarda, üst lomber segmentlere ulaşmada yararlı ve etkili olabilir.

Anahtar sözcükler: İntervertebral disk deplasmanı/cerrahi; lomber vertebra/cerrahi; protez ve implant; spinal füzyon/yöntem.

Artificial disc replacement (ADR) is a relatively new method of restoring the stability of the anterior column. It is usually performed through anterior midline retroperitoneal/transperitoneal approaches that allow a direct, unobstructed access to the anterior surface of the disc space.[1-3] The anterior midline approach for disc replacement is usually possible from L_5-S_1 up to L_{2-3} segment using a retroperitoneal route. However, for the L_{1-2} segment, anterior midline approach is often difficult due to the existence of renal vessels. For the pathology in the L_{1-2} segment, an anterolateral retroperitoneal approach through a modified flank incision may be used as an alternative route for disc replacement. We present treatment with ADR through an anterolateral approach in two patients with juxtafusional degeneration syndrome at the L_{1-2} segment.

CASE REPORT

Case 1– A 63-year-old male patient presented with back pain, neurogenic intermittent claudication and progressive weakness of the right lower extremity that developed a year ago. Three years prior to the visit, he had been subjected to posterior decompression, segmental pedicle screw fixation, and posterolateral fusion at L_2-L_5 for spinal stenosis. Following this surgery, the patient noted some improvement in intermittent claudication, but big toe extensor weakness did not get any better. Two weeks prior to presentation, he had had

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two epidural injections, after which the weakness of the right lower extremity became more pronounced.

Physical examination revealed absence of muscle power in the extensor hallucis longus, tibialis anterior, and the peroneii on the right side. The triceps surae and flexor hallucis longus were grade 3. Knee extensors and hip flexors were grade 4. Muscles of the left lower extremity were all grade 5. Decreased deep tendon reflexes were elicited on both sides. Review of the radiological studies revealed juxtafusional degeneration with instability at L_{1-2} with huge disc herniation at L_{1-2} (Fig. 1). Artificial disc replacement was performed using the left anterolateral approach. The operation was completed without any intraoperative complications. The total operating time was 330 minutes with blood loss of 900 ml. The patient was allowed to ambulate on the first postoperative day with a light corset. Following surgery, the patient showed significant improvement in neurological symptoms. At 6 months, muscle power on the right side was all grade 5, except the extensor hallucis longus which did not show any recovery. Preoperative Oswestry Disability Index score[4] of 74% decreased to 6% six months after the operation (Fig. 2).

Case 2– A 67-year-old male patient presented with back pain, neurogenic intermittent claudication and progressive weakness of both lower extremities that started two years ago. He had undergone posterior decompression and instrumented posterolateral fusion at L_2-S_1 with a diagnosis of spinal stenosis one and a half year prior to his visit, which failed to relieve his symptoms, but rather, aggravated his back pain.

Physical examination findings were hip flexors 4/3, knee extensors 4/3, tibialis anterior 4/4, extensor hallucis longus 4/3, and triceps 5/5. Paresthesia was present along the L_5 dermatome on both sides. Review of the radiological studies showed nonunion at the levels L_{4-5} and L_5-S_1 with gross motion, inadequate foraminal decompression at L_{2-5}-S_1 and junctional instability at L_{1-2} with retrolisthesis, foraminal stenosis, and left-sided foraminal disc herniation (Fig. 3).

He was treated by a posterior-anterior-posterior procedure that consisted of ADR at L_{1-2}, anterior decompression and fusion at L_2-S_1, and posterior repeat decompression and revision of instrumentation. The total operating time was 630 minutes with transfusion of 4,000 ml (Fig. 4). Following the operation, the patient developed weakness of the left big toe and the peroneii. Magnetic resonance imaging was performed to explore the cause of the weakness. As there were no compressive lesions on the roots, it was thought that a traction palsy had occurred during dissection of the scar bound roots, and a decision was made to observe the evo-

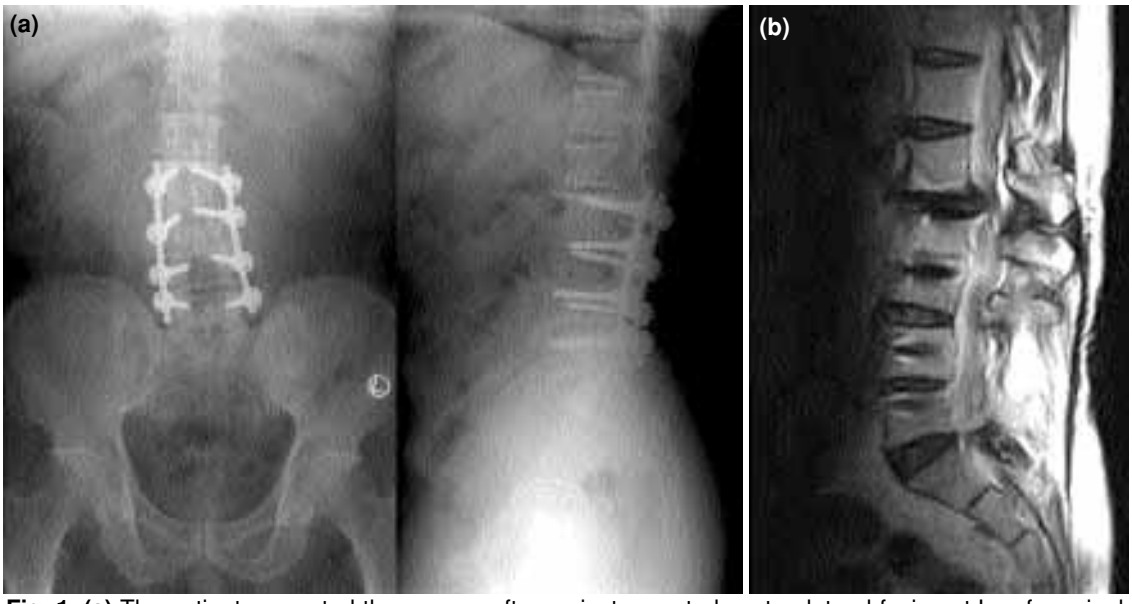

Fig. 1. (a) The patient presented three years after an instrumented posterolateral fusion at L_{2-5} for spinal stenosis. Degenerative changes were noted at L_{1-2}. **(b)** Magnetic resonance imaging showed junctional degeneration with huge disc herniation (Case 1).

lution of the weakness. The patient was allowed to ambulate on the first postoperative day with a light corset and a plastic ankle foot orthosis. At the end of one month, muscle power on the right side was grade 5. It was also grade 5 on the left side, except for peroneii and extensor hallucis longus, which remained grade 2.

Surgical technique

The patient was placed in the semi-supine position with the left side slightly elevated with towel rolls. An oblique left side flank incision was made along the eleventh rib and the lateral border of the rectus abdominis. The dissection was deepened and the L_{1-2} disc space was exposed using blunt retroperitoneal dissection, with the peritoneal contents and the kidney being retracted medially. With ligation of the segmental vessels of L_1 and $_2$, the great vessels were bluntly dissected off the anterior surface of the L_{1-2} disc. Protecting the vessels with a blunt retractor, an annular incision was made from the midline to the left diaphragmatic crus and discectomy was carried out. Then the patient was brought to full right lateral decubitus position to remove the right side annulus with a Kerrison punch to the medial border of the right diaphragmatic crus. On completion of the discectomy, the patient was brought to the supine position and a spreader was introduced into the disc space to compare the ligament tension on both sides. After determining the size of the implant, SB Charité III end plates (Link, Germany) were mounted on the insertion forceps and were inserted from the left anterolateral side until the end plate margin was flush, with the retractors holding the vessels. Then the polyethylene core was inserted between the two end plates with distraction of the forceps. The insertion forceps were removed and the position of the implant was adjusted with grooved drivers and impactors under fluoroscopic guidance until the implant was located in an acceptable position, in both the sagittal and coronal planes.

DISCUSSION

Artificial disc replacement is rarely used in the upper lumbar segments. Compared to the lower lumbar segments, the upper lumbar segments have a smaller intervertebral disc which render them less frequently affected by degenerative vertical instabilities. By the same reason, these segments also contribute much less to the total motion of the lumbar spine and lordosis, making disc replacement not significantly different from a well-done fusion.[5,6] However, in some patients with juxtafusional segment problems following a lengthy fusion to the upper lumbar segment, ADR may be

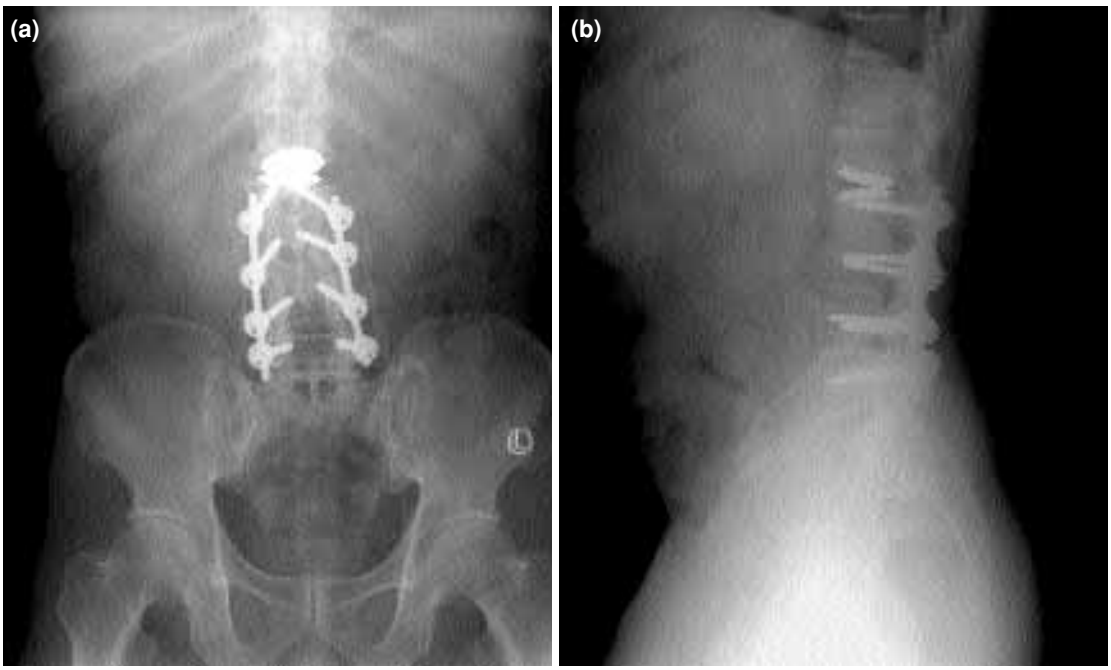

Fig. 2. (a, b) Four months after artificial disc replacement, the patient showed significant improvement in back pain and neurological symptoms (Case 1).

chosen, as it may be more advantageous than the conventionally employed method of neural decompression and extension of fusion.[7-10] The greatest obstacle for ADR in the upper lumbar segment is the renal vessels, which traverse the upper lumbar segments. The possibility of using an anterolateral approach for exposure of the anterior aspect of the upper lumbar spine for ADR was suggested by Lazennec et al.,[11] but to our knowledge, there has been no clinical report of ADR performed at L_{1-2} through this approach. Our surgical technique differs slightly from the previously described method, in that the patient's position is changed during the operation. Bringing the patient to a full right lateral decubitus position during the operation facilitates the resection of the right side annulus than that in the supine position. We feel that this is an important advantage, as balancing the ligament tension by adequate release of the annulus fibrosus on both sides of the midline is important for stabil-

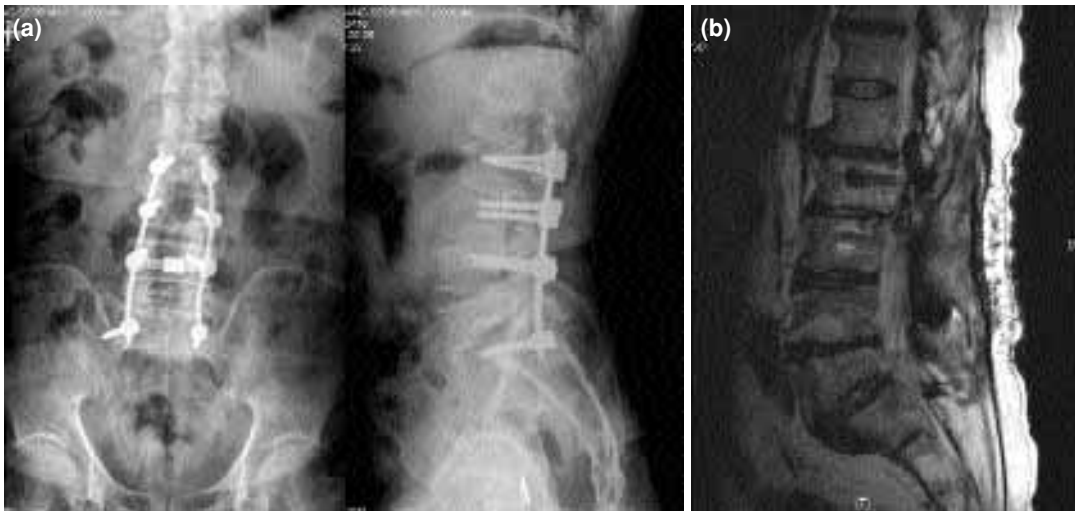

Fig. 3. (a) The patient presented 1.5 years after two surgeries for spinal stenosis. There was nonunion at L_{4-5}-S_1 with degeneration of L_{1-2}. **(b)** Magnetic resonance imaging showed degeneration at L_{1-2} with lateral recess stenosis (Case 2).

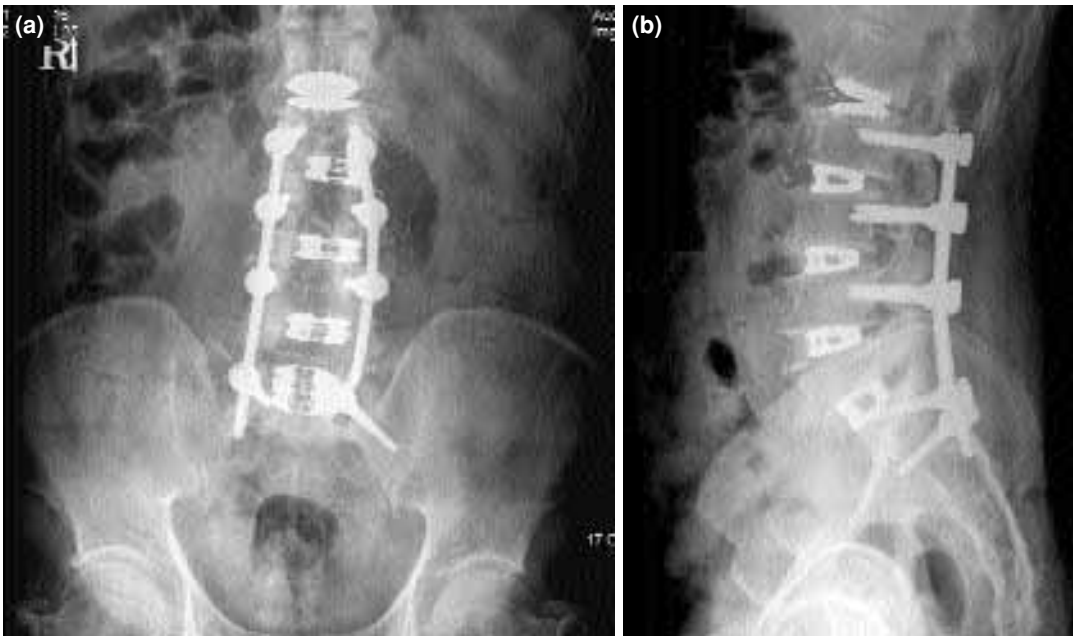

Fig. 4. (a) One month after artificial disc replacement at L_{1-2}. **(b)** Anterior posterior revision of L_2-S_1 (Case 2).

ity of the artificial disc. Our modification also allows less dissection and mobilization of the left kidney and the renal vessels. Using the anterolateral approach and the technique described, implantation of an acceptably positioned artificial disc was feasible without extensive dissection to mobilize the kidney and the renal vessels. Artificial disc replacement for juxtafusional segment upper to long fusion is helpful to avoid extension of fusion and preservation of motion segment.

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