

CASE REPORT

Foraminoplastic transforaminal percutaneous endoscopic discectomy at the lumbosacral junction under local anesthesia in an elite rugby player

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Abstract : Percutaneous endoscopic discectomy (PED) is the least invasive disc surgery available at present. The procedure can be performed under local anesthesia and requires only an 8 mm skin incision. Furthermore, damage to the back muscle is considered minimal, which is particularly important for disc surgery in athletes. However, employing the transforaminal (TF) PED approach at the lumbosacral junction can be challenging due to anatomical constraints imposed by the iliac crest. In such cases, foraminoplasty is required in addition to the standard TF procedure. A 28-year-old man who was a very active rugby player visited us complaining of lower back and left leg pain. His visual analog scale (VAS) score for pain was 8/10 and 3/10, respectively. MRI revealed a herniated nucleus pulposus at L5-S level. TF-PED was planned ; however, the anatomy of the iliac crest was later found to prevent access to the herniated mass. Foraminoplasty was therefore performed to enlarge the foramen, thereby allowing a cannula to be passed through the foramen into the canal without causing exiting nerve injury. The herniated mass was then successfully removed via the TF-PED procedure. Pain resolved after surgery, and his VAS score decreased to 0/10 for both back and leg pain. The patient returned to full rugby activity 8 weeks after surgery. In conclusion, even with an intracanalicular herniated mass at the lumbosacral junction, a TF-PED procedure is possible if additional foraminoplasty is adequately performed to enlarge the foramen. *J. Med. Invest.* 62 : 238-241, August, 2015

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INTRODUCTION :

A herniated nucleus pulposus (HNP) in the lumbar spine is prevalent in comparatively young individuals. This disorder is also a common pathology of back pain in athletes (1-5). In some cases, surgical intervention is required, especially in athletes hoping for an early return to full sporting activity (1-5).

Percutaneous endoscopic discectomy (PED) is the least invasive disc surgery available at present, especially for back muscles (6-8). This technique originated from the percutaneous discectomy technique introduced by Hijikata and colleagues in Japan (9). After further efforts in this field (10, 11), PED was developed as a single-portal endoscopic system (6-8). It follows a transforaminal (TF) approach, with the spinal endoscope passing through the intervertebral foramen (12). However, limitations and shortcoming remain in cases of HNP at the lumbosacral junction with a high iliac (12).

In such cases, the interlaminar (IL) approach is recommended (13, 14). To remove the HNP fragment using the IL approach, general or epidural anesthesia is essential since the nerve root needs to be retracted during surgery. Choi *et al.* (15) reported a unique technique to access the HNP at the lumbosacral junction. They made a small bone tunnel at the ilium, thus allowing the cannula

to smoothly pass the intervertebral foramen. This technique is possible under local anesthesia but is technically very demanding. An alternative approach does exist, namely, the foraminoplastic technique with TF (16-18). Following foraminoplasty, the foramen is enlarged, allowing the endoscope to be passed through the foramen without damage of the exiting nerve root. Thanks to development of a very thin high-speed drill for PED, foraminoplasty can be conducted smoothly and safely. The drill has been applied in a variety of PED surgeries (13, 19, 20).

In this report, we describe a case of HNP at the lumbosacral junction which was successfully removed via the TF approach following foraminoplasty under local anesthesia.

CASE REPORT

A 28-year-old man who was an elite rugby player was referred to our institution for minimally invasive endoscopic surgery. Two years prior, he noticed low back and left leg pain that became aggravated during the rugby season and alleviated during the off season. Three months prior, his pain increased during the last game of the season. A local orthopedic physician, who was the team doctor, was treating him with conservative care. Diagnosis of a HNP at L5-S1 was made. At first presentation in our institution, the visual analog scale score for low back and leg pain was 8/10 and 3/10, respectively. As a result of the pain, his activities of daily living were strongly disturbed in addition to his sporting activity. Because of his position as a rugby player on a top team in Japan,

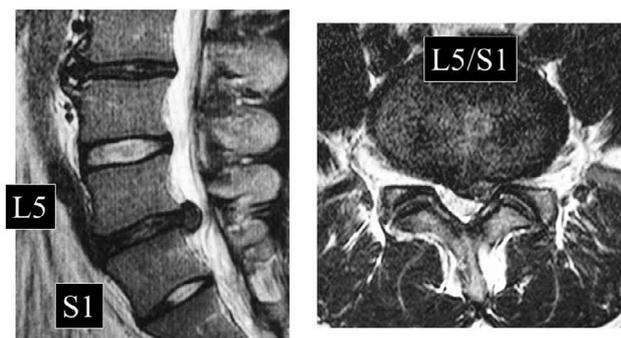
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the team doctor recommended minimally invasive disc surgery with particular care taken toward the back muscles.

Neurologically, muscle strength in the left TA and EHL was weakened, with a score of 4/5 in a manual muscle test, indicating L5 nerve root involvement. Remaining muscle strength was normal. Deep tendon reflexes such as the patellar tendon and Achilles tendon reflexes were normoactive. Sensory was also intact. The straight leg raise test was positive at 80° on the left side and negative on the right side. Femoral nerve stretching test was normal bilaterally.

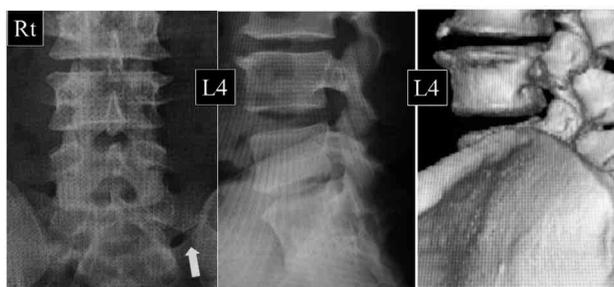
Figure 1 shows results of magnetic resonance imaging (MRI). The HNP visible at the level of L5 and S1 (Figure 1A). The HNP was located on the left side and compressed the S1 nerve root (Figure 1B). Between S1 and S2, the space for the intervertebral disc was visible. Anteroposterior X-ray showed lumbarization of S1, with segmentation on only the left side (arrow in Figure 2A). Plain lateral X-ray (Figure 2B) and three-dimensional computed tomography (CT) (Figure 2C) showed the height of the iliac crest, with the level of the L5-S1 disc obviously covered by the iliac crest. Figure 3 shows results of a CT scan after discography. Due to the iliac crest, removal of the intracanalicular HNP via a TF approach on the left side was deemed difficult (arrow in Figure 3B).



(A) T2-WI right paramedian sagittal image

(B) T2-WI axial image through L5-S1 disc

Figure 1 : Magnetic resonance imaging (MRI) at first presentation. HNP was confirmed at the level of L5 and S1 (Figure 1A). The herniated nucleus pulposus (HNP) was located at the left side compressed the S1 nerve root (Figure 1B).

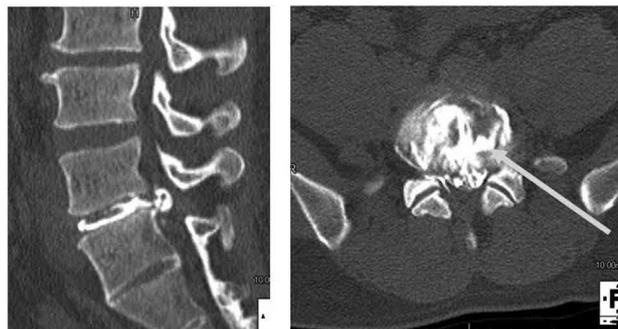


(A) Plain anteroposterior X-ray

(B) Plain lateral X-ray

(C) Three-dimensional CT scan

Figure 2 : Plain X-ray and three-dimensional computed tomography (CT). Anteroposterior X-ray shows lumbarization of S1 ; the arrow indicates the segmentation on the left side only (Figure 2A). Plain lateral X-ray (Figure 2B) and three-dimensional CT (Figure 2C) show the height of the iliac crest. The L5-S1 disc level is obviously covered by the iliac crest.



(A) Left mid-sagittal

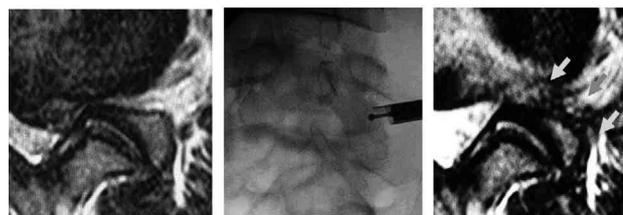
(B) Axial through L5-S

CT discography

Figure 3 : CT discography. Due to the anatomy of the iliac crest, removal of the intracanalicular HNP was deemed difficult by the transforaminal approach on the left side (arrow in Figure 3B).

Neurological diagnosis was L5 nerve root involvement ; however, S1 nerve root impingement confirmed radiologically. In cases involving lumbarization of the spine, the level of the nerve root can vary ; thus, in the current case, the anatomical S1 nerve root played the neurological role of the L5 nerve root. Minimally invasive PED was therefore planned.

Under local anesthesia using 1% lidocaine, a cannula was inserted from the posterolateral side of the back. First, the base of the HNP was removed ; however, the HNP could not be completely observed. Additional foraminotomy using an ultra-thin high-speed drill was therefore conducted to enlarge the intervertebral foramen, allowing the cannula to be inserted closer to the HNP fragment. Figure 4 shows the area of the foramen that was removed. Using the ultra-thin high-speed drill (Figure 4B), the facet joint was then shaved and drilled, enlarging the foramen. After the foraminotomy, the cannula could be passed through the foramen without touching the exiting nerve root, allowing successful removal of the intracanalicular HNP. Figure 5B demonstrates the results of MRI taken 2 weeks after surgery. Slight bulging of the disc was noted ; however, the internal signal of the bulge was very high, indicating no remaining disc fragment. Immediately after surgery, his low back and leg pain almost completely resolved. The patient began physical therapy within 4 weeks after surgery, focusing on trunk muscle exercises and stretching of tight hamstrings. From 4 to 8 weeks after surgery, he was able to begin jogging and body conditioning, and 8 weeks after surgery, he returned to rugby practice. Four months after surgery, he was able to compete without any



(A) Pre-OP

(B) foraminoplasty

(C) Post-OP

Figure 4 : MRI of the intervertebral foramen : (A) before and (C) after surgery. Using an ultra-thin high-speed drill (Figure 4B), the facet joint was shaved and drilled, thus enlarging the foramen. Arrows in (C) indicate the location of removal.

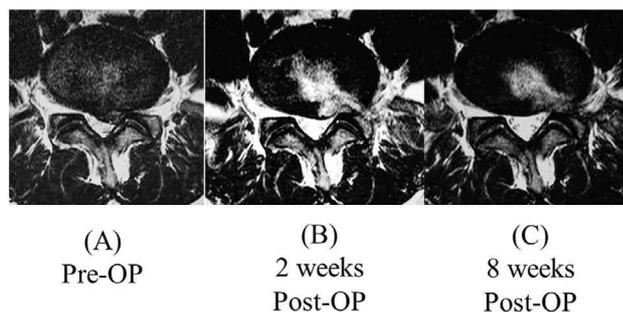


Figure 5 : Time course of MRI findings before and after surgery. (B) MRI taken 2 weeks after surgery. Slight bulging of the disc is visible ; however, the internal signal of the bulge is very high, indicating no remaining disc fragment. (C) MRI taken 8 weeks after surgery. Bulging of the disc was reduced, and no compression of the neural tissue was seen.

symptoms. Figure 5C shows an MRI scan taken 8 weeks after surgery. Bulging of the disc was reduced and no compression of the neural tissue was seen.

DISCUSSION :

Transforaminal percutaneous endoscopic discectomy :

This technique can be conducted under local anesthesia with minimal damage of the back muscle. It is thus considered the least invasive disc surgery at present. The PED procedure originated from Hijikata's percutaneous technique (9), with the cannula for the percutaneous endoscope inserted from the posterolateral aspect of the back. The intracanalicular HNP can be removed using this procedure at L1-2 to L4-5, since the cannula can pass through the foramen in most cases (12). However, due to the anatomical location of the iliac crest, insertion of the cannula is sometimes difficult into the level of the lumbosacral junction (6-8, 12). Thus, to remove the HNP at the lumbosacral junction (e.g., L5-S), we need an additional or alternative technique. Three options have been described : the IL approach, transiliac approach, and foramino-plastic approach.

Interlaminar percutaneous endoscopic discectomy :

The IL approach (13, 14) follows the same route as the traditional Love's procedure (1-5) or microendoscopic discectomy technique (21, 22). IL-PED requires only an 8 mm skin incision and is less invasive than the traditional approach. Dezawa and Sairyo (13) utilized an ultra-thin high-speed drill for IL-PED and reported safer access to the epidural space. One of the greatest benefits of the traditional PED procedure is that in most cases it can be performed under local anesthesia. Most IL-PED cases cannot be performed easily under local anesthesia because exposing the disc fragment requires retracting the nerve root, resulting in significant pain (13, 14).

Transiliac percutaneous endoscopic discectomy

In the literature, only one article could be found describing the trans-iliac PED technique. In 2009, Choi *et al.* (15) reported two cases of L5-S intracanalicular HNP successfully removed using TF-PED after creating a bone hole in the ilium. They named this procedure transiliac PED. Indeed, the cannula can access the intracanal at L5-S by passing smoothly through the intervertebral foramen and bone tunnel in the ilium. However, additional complications can occur while making the bone tunnel such as injury of the superior gluteal vessels and superior cluneal nerves. Furthermore, the technique can be very demanding. After their report, there have been very few articles describing use of this procedure.

Foraminoplasty transforaminal percutaneous endoscopic discectomy

The final option is to perform TF-PED after foraminoplasty. Because of the anatomy of the iliac crest, the cannula cannot be inserted from an appropriate site on the skin. That is, the insertion point needs to be close to the midline or slightly cranial compared to the optimal insertion point in TF-PED. Consequently, exiting nerve root injury is a concern (23) and standard TF-PED is sometimes contraindicated for intracanalicular HNP at the lumbosacral junction. Thanks to the development of an ultra-thin high-speed drill for use with the PED cannula (13, 19), bone removal such as laminectomy, facetectomy, pediculotomy, and foraminotomy have become easier and safer. Using this technique, Lee *et al.* (16) describe successful removal of an intracanalicular HNP at L5-S. They describe use of foraminoplasty to widen the intervertebral foramen, reducing the occurrence of exiting nerve root injury. In the current case, following foraminoplasty, the cannula was able to pass through the foramen without compressing the exiting nerve root.

Percutaneous endoscopic discectomy in an elite athlete

In the literature, there is no consensus on the timing of return to full sporting activity following disc surgery. It varies from 1 to 6 months (1, 2). According to our schedule, the patient should concentrate on trunk muscle core exercises and stretching of tight hamstrings for 4 weeks. Subsequently, following appropriate conditioning, players should be able to return to non-contact and contact sports at 6 and 8 weeks after surgery, respectively. In this case, the patient was able to return to regular practice 8 weeks after surgery and participated in a competitive game at 4 months after. Recurrence remains an issue of disc surgery among athletes. A recurrence rate of about 10% has been reported following microdiscectomy in athletes (1, 3, 4). In the present case, the patient has been recurrence free for 9 months.

In conclusion, foramino-plastic TF-PED for intracanalicular HNP at the lumbosacral junction is a minimally invasive and useful procedure. Following efficient enlargement of the intervertebral foramen, the HNP can be safely removed without the complication of nerve injury. Moreover, since it is minimally invasive with regards to the back muscles, it is of particular merit in elite athletes like the one in our case.

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