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Percutaneous Transforaminal Endoscopic Decompression in Lumbar Discal Cyst

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Background: Discal cyst is a rare pathology causing lumbar radiculopathy. Conventional open and microsurgical resection is the most commonly reported surgical treatment for discal cyst. Full-endoscopic surgeries are an efficient but sparsely reported modality.

Case Presentation: This is a retrospective study that presents the outcomes of 2 patients with lumbar discal cyst (with radiculopathy in the legs and Visual Analog Scale (VAS) scores of 10 out of 10, classic clinical-radiological presentation features) who were treated with Percutaneous transforaminal endoscopic lumbar discectomy (PTELD) under local anesthesia (LA). Validated Oswestry Disability Index (ODI) and MacNab scores were used for clinical outcome assessment. Additionally, we conducted a review of the literature on full-endoscopic approaches for discal cyst, namely PTELD, percutaneous interlaminar endoscopic lumbar discectomy (PIELD), and transsacral epiduroscopic decompression (SELD).

Conclusion: PTELD for lumbar discal cyst is an excellent method to yield a positive long-term out-come, and one of the most minimally invasive full-endoscopic approaches.

Key words: Decompression, disc, discal cyst, full endoscopy, lumbar, stenosis, surgery, transforaminal

BACKGROUND

Discal cysts are one of the unusual causes of chronic back pain and radiculopathies. Discal cysts are defined as intraspinal, extradural cysts with attachment to the corresponding intervertebral disc (1). The etiology and pathology of discal cysts are not clearly established in the literature and there is a lack of large series and long-duration follow-ups. Clinically, discal cyst symptoms are indistinguishable from those of herniated lumbar intervertebral disc.

The discal cyst treatment varies from conservative management, aspiration (with or without steroid injection), open surgical excision, microsurgical lumbar discectomy/microendoscopic-resection (MLD), percutaneous transforaminal endoscopic lumbar discectomy (PTELD), and percutaneous interlaminar endoscopic

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lumbar discectomy (PIELD) (2-3). Conventional open and micro-surgical resection is the most commonly reported surgical treatment for discal cyst (3). Use of PTELD for treatment of the discal cyst is reported sparsely in the existing literature. Discal cyst is a rare spinal pathology, and the number of patients a surgeon will see in his or her lifetime will be quite low. Therefore, the literature lacks large case series and management guidelines. It is likely that large series from single centers will remain elusive. The authors report 2 cases of discal cyst that were successfully treated by PTELD.

CASES

Both patients requested for an endoscopic procedure. They were operated on with full informed consent regarding the unavailability of standard recommendations for transforaminal endoscopy. No ethical committee approval was required as it was a retrospective study. The authors checked medical records between August 2009 and August 2019. All the demographic, clinical, radiological, and operative details were reviewed from the records, including those for follow-up visits. There were 2 patients with discal cyst who were operated on by PTELD.

Case 1

A 30-year-old male patient with a body mass index (BMI) of 23.87 presented with low back pain (4 out of 10 on the Visual Analog Scale [VAS]) of 6 months'duration. There was radiating left lower leg pain for 1.5 months which had increased in the past 7 days (VAS 10 out of 10). The patient walked crouched, stooped, and listed. On physical examination, his straight leg raising test (SLRT) was positive at 10 degrees. L5 dermatome and myotome distribution of soreness and pain with tingling was noted. Trendelenburg's test was pathological on the left side with restricted range of movement (ROM) of the lumbar spine. The Oswestry Disability Index (ODI) score was 88.89. The patient had been treated conservatively with medicines, heat therapies, traction, and epidural steroidal injection.

Plain and dynamic radiographs were normal. Magnetic resonance imaging (MRI) showed an intraspinal extradural cystic mass adjacent to the L5 upper end plate and pedicle, paracentrally located on the left side (Fig.1).

The PTELD inside-out technique was done under local anesthesia (LA) with the patient under conscious sedation in the prone position on a bolster frame. The optimal location for cannula insertion was selected 11 cm from the midline. After the use of LA at the point of puncture, an 18-gauge needle was introduced under fluoroscopic image guidance to the medial pedicular line. With additional LA of 2 cc at the posterolateral corner of the disc, insertion of the needle into the disc was completed under image intensifier fluoroscopy. Railroading of the trocar, working sheath, and the endoscope were done sequentially. After that, a subannular clearance of the disc material was done. The working sheath and endoscope were withdrawn to a half-in/half-out position. Then the annulus and posterior longitudinal ligament were cut and hemostasis was achieved. The subposterior longitudinal ligament (PLL) part of the extruded disc was removed. After clearing the endoscopic visualization, the endoscope was angulated caudally in the epidural space and the discal cyst was removed piecemeal with a crab-eating technique. One small part of the cyst wall that was adhered to the dura was left behind, because it gave radicular pain to the patient on pulling repeatedly. The traversing nerve root was successfully decompressed, and the result was confirmed by visualization, probing, pulsation, irrigation flutter, and cough impulse. The patient was discharged on the same day without any complications. Post-operative MRI (Fig. 2) showed complete removal of the cyst and extruded disc. The biopsied cyst lacked synovial cell lining on histopathological examination.

There was improvement in pain and SLRT immediately after surgery (VAS 0 out of 10) and improvement in lower back pain (VAS 3 out of 10). The patient resumed his job after 2 weeks, and at 4 weeks' follow-up his VAS score for lower back and leg pain was 0 out of 10. The ODI score improved to 4.44 at 6 weeks and was maintained at final follow-up. At 77 months' follow-up, the patient was clinically normal and reported an excellent MacNab score. The MacNab score is a validated functional disability score. The 4 outcome scores are excellent (no pain; no restriction of activity), good (occasional back or leg pain of sufficient severity to interfere with the patient's ability to do his normal work or his capacity to enjoy himself in his leisure hours), fair (improved functional capacity, but handicapped by intermittent pain of sufficient severity to curtail or modify work or leisure activities), and poor (no improvement or insufficient improvement to enable increase in activities; further operative intervention required).

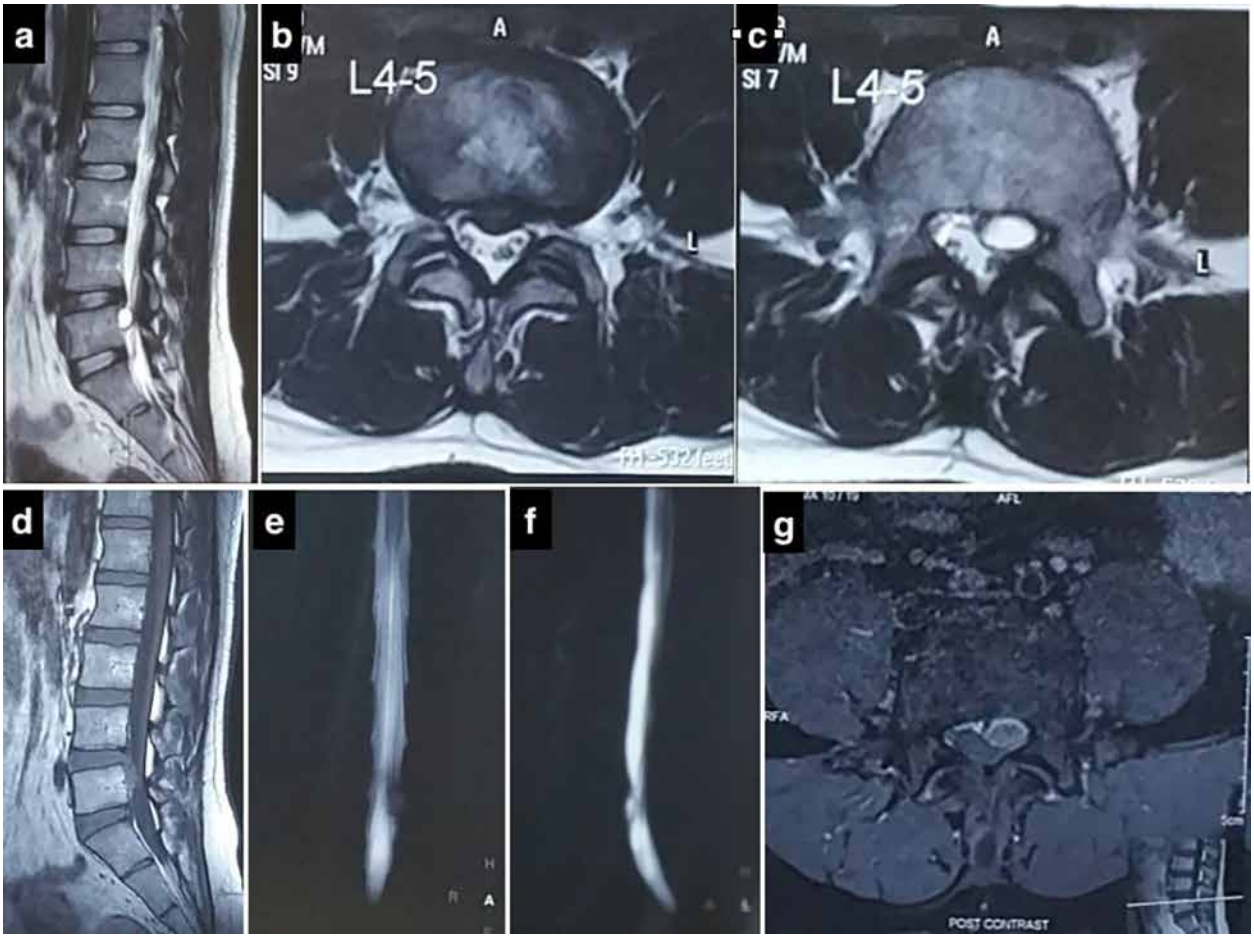

Fig. 1. Preoperative MRI: (a,d) Parasagittal T2- and T1-weighted image showing 15X12X8.5-mm uniloculated discal cyst located in left paracentral down-migrated-like position. (b,c) Middiscal T2-weighted axial image showing a central-to-paracentral disc in subligamentous location, with a left juxtapedicular paracentral location of cyst in axial section at pedicle level. (e,f) Magnetic resonance (MR) myelogram showing the cyst with contrast MRI axial image (g) showing rim enhancement.

Case Study 2

A 28-year-old male patient with a BMI of 32 presented with low back pain (VAS 6 out of 10) with radiating right lower leg pain of 3 months' duration which had increased in the last 3 days to a VAS score of 10 out of 10. On physical examination, the SLRT was positive at 20 degrees on the right side with bilateral valgus knee. Limping gait was present with restricted ROM and spasm. The ODI score was 95.56. The patient was treated conservatively with physiotherapy, and epidural steroidal injection for 3 months. MRI showed an intraspinal extradural multiloculated cystic lesion adjacent to the L4-L5 intervertebral disc on the right side with little central-to-opposite side and upward extension (Fig. 3). The PTELD inside-out technique was done under LA with an entry at 14 cm from the midline. This was a far lateral flat entry for epidural and contralateral side access. Both the traversing nerve root and dural sac were optimally decompressed. The rest of the other steps were the same as in the first case and decompression was ascertained. The patient was discharged on the same day. Postoperative MRI showed removal of multiloculated cyst with only one small residual cyst visible (Fig. 3). The removed cyst lacked synovial cell lining on histopathological examination.

There was immediate improvement in leg pain, SLRT after surgery (VAS 0 out of 10), and improvement in lower back pain (VAS 2 out of 10). The patient resumed his job after 2 weeks. At the 6-week follow-up, the

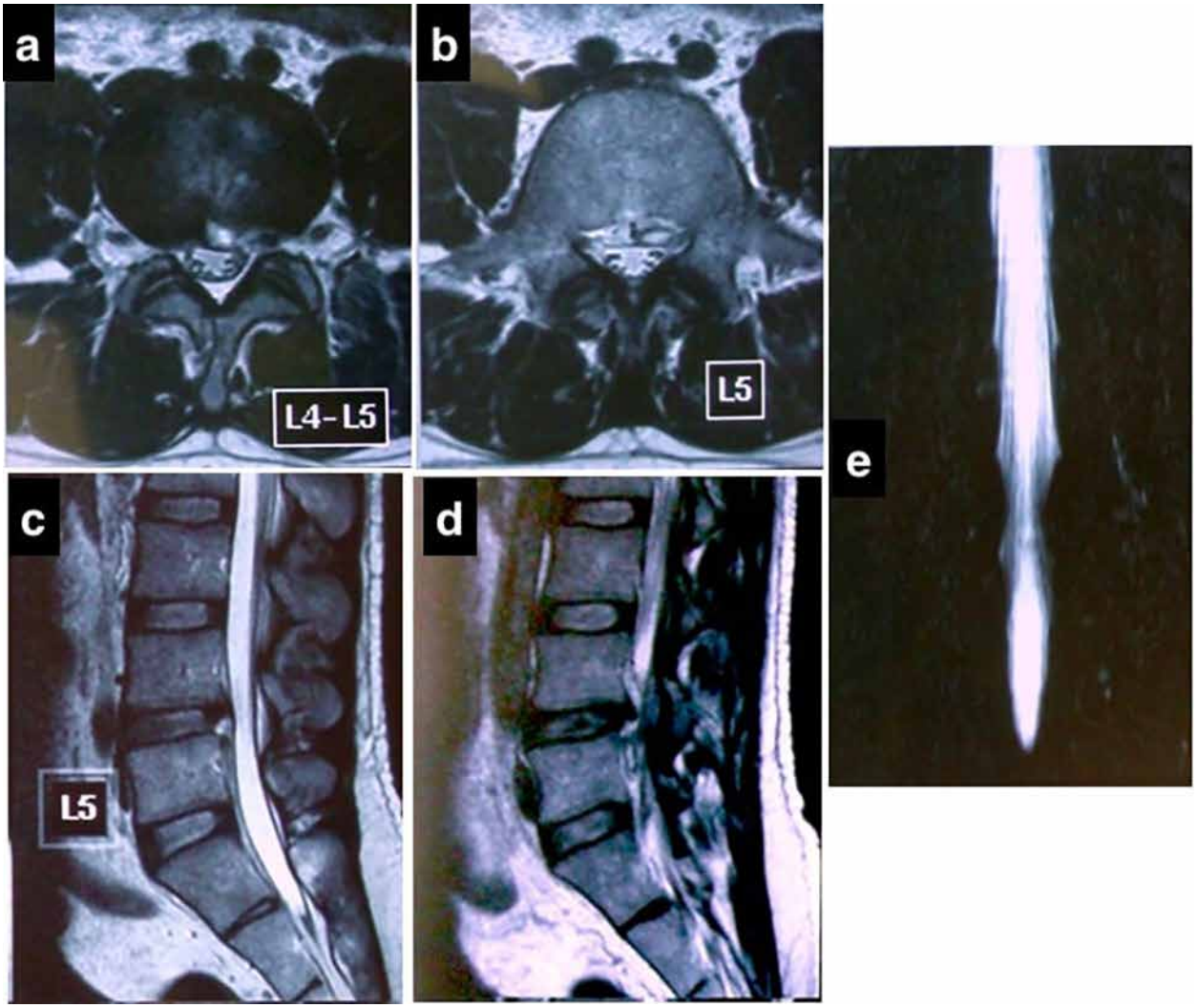

Fig. 2. Immediate postoperative MRI: (a,c) T2-weighted image, axial coplanar at disc level & T2-weighted midsagittal image showing the central-to-paracentral subannular disc fragment completely removed. (b,d,e) T2-weighted image, axial-at-pedicle level, parasagittal image & MR myelogram showing the disc cyst removed. Clinically at 6-year follow-up the patient is symptom-free.

VAS score for lower back and leg pain was 0 out of 10. The ODI score improved to 6.66 at 6 weeks and was maintained at follow-up. At 31 months' follow-up, the patient was normal with no MRI evidence of cyst remnants. An excellent MacNab score was noted.

DISCUSSON

The discal cyst was first described in 2001 by Chiba et al (1). Aydin et al (2) reported the mean age for occurrence of discal cyst as 33.5 ± 12.6 years. Most patients with a discal cyst are active, relatively young, and more likely to be Asian (2). Both of our patients were young and one patient was obese.

The discal cyst etiology and pathogenesis is controversial. Two possible hypotheses are suggested. Chiba et al (1) proposed that hemorrhage from the epidural venous plexus due to underlying disc injury may be the cause of the discal cyst. Histologically, this theory is supported by hemosiderin deposits in the cysts (3). A second theory is the reactive pseudo membrane theory proposed by Kono et al (4), in which focal degeneration of the posterior disc wall, followed by fluid collection,

results in subsequent development of a discal cyst with no synovial lining cells in its wall. In both of our cases, there was a lack of synovial lining cells in the cyst wall, which supports the second hypothesis. In our first case, disc prolapse was also present along with discal cyst (Figs. 1b,1c), which favors hematoma theory.

The clinical symptoms of discal cysts are like those of patients with a typical disc prolapse or patients having other spinal cysts. They are sciatica, low back pain, and compression of cauda equina (2). Radiological features of discal cysts are usually unremarkable (2). Discography and/or computed tomography (CT) discography have shown the flow of contrast medium into the cyst and the corresponding intervertebral disc. This finding is pathognomic for discal cysts (2,3,5,6). Other intraspinal cysts besides discal cyst are the ganglion cyst, tarlov cyst, arachnoid cyst (associated with the subarachnoid space in myelography), synovial cyst and the ligamentum flavum cyst which have connection to facet joints and ligamentum flavum, respectively. All these cysts lack communication with the corresponding disc (2-3). Lee et al (5) described the MRI features of discal cysts: a ventrolateral, extradural cystic mass attached to a lumbar intervertebral disc; rim enhancement of cyst's wall on contrast-enhanced MRI; and occasional spread of the mass into the lateral recess. There is little use of traditional myelography and CT myelography compared to MRI scans for visualizing radiological characteristics (3). Both cases presented with classical radiological features, as well as an odd multilocular feature in the second case. Cyst location is usually central or paracentral and may be migrated down (2,3). In one case, its location was down-migrated, unilateral, and unilocular. In the other case, the cyst had a multilocular, low up-migrated, and central/paracentral bilateral location.

Discal cyst treatment is not established in the literature. Conservative management, including epidural injections, leading to spontaneous regression are reported (3). Most cases of discal cysts are successfully managed by surgical resection of the cyst via open or MLD methods (2,3). An alternative approach to conservative management of discal cysts is percutaneous CT-guided aspiration (7). Also, there are reports of transsacral epiduroscopic (with Nd:YAG laser) decompression (SELD) (8). Other treatments include PTELD and PIELD (3,9,10). Full-endoscopic surgeries are those surgeries where the working endoscope carries washing saline and working instruments inside the body (11-13). The literature shows only one systematic methodological review of discal cyst management which reported traditional methodologies with few endoscopy articles as well. The cases reported in this article, and all other reported full-endoscopic PIELD, SELD, and PTELD, are tabulated to understand the current level of evidence (Table 1).

Open surgeries involve big incisions, midline structural damage, blood loss, longer hospital stays, general anesthesia-related complications, and chances of iatrogenic instability. Although MLD techniques do substantially decrease the morbidity of open surgery, postoperative complications of discal cyst in disc herniation surgery using MLD techniques are also reported (14). In PIELD, damage to posterior parts of the spine is minimal for all posterior approaches. However, PIELD still has the downside of being performed under general anesthesia, and retraction can potentiate the chance of iatrogenic neural injury (15).

SELD is performed via the transsacral route and is also a technique that uses a smaller and more flexible endoscope. This technique is less effective in mechanical decompression and more effective in ablative decompression. So, there is a risk of intraoperative neural injury. Incomplete decompression, recurrent herniation, epidural hematoma, dural tear, and subchondral osteonecrosis are reported complications of SELD (16).

On the other hand, reports of use of PTELD for discal cyst in the literature are also sparse (17-19). Additional advantages of PTELD are the nonuse of general anesthesia and speedy postoperative recovery (15,17-19).

We removed discal cysts in both of our cases via the PTELD approach and outcomes included improved VAS, ODI, and MacNab scores postoperatively as well as resumption of previous activities. In the literature review, 31 months is the maximum duration of follow-up available and long-term outcomes are not reported (Table 1). So, it cannot be concluded if there were more recurrences later or if resolution occurred, as no follow-up studies were done. Also, it is difficult to decide the need for additional excision of the corresponding disc along with the cyst. In the absence of knowledge of the precise mechanism of pathogenesis and the natural history of discal cysts, it is difficult to predict the recurrence risk and the long-term outcome. More radical excision decreases the risk of recurrence (3). For the same reason we also removed the subannular part of the disc and the cyst. In the first case, a steeper entry from 11 cm was taken. In the second case, due to the central, bilateral location of compression and obesity, a shallow entry was taken at 14 cm. These are

Table 1. Comparative chart showing data from the only available systematic review and all short series reports of full endoscope-assisted surgeries in lumbar discal cyst.

Series No.	Author (yr)	No. of Patients	Treatment Subdivision of patients (n)	Main Complications	Follow-up (mos)
1	Certo et al (3) (2014) review article	105	OP (70)	Recurrence in one	Min 3 Max 31
			MLD (8 patients)		
			CT-guided aspiration ± steroid injection (11)	Recurrent disc herniation in one	
			Epidural injection (1)		
			Percutaneous fluoroscopy-guided steroid injection (1)		
			Conservative (3)		
			PTELD (Kim et al [17], Ha et al [18]* (2+8)		
			PIELD (Kim et al [9]#(1)	Persistent symptoms in one	
2	Kim et al (9) (2009)#	1	PIELD using a side-firing Ho:YAG laser	No	N/A
3	Kim et al (17) (2009)*	2	PTELD	No	N/A
4	Ha et al (18) (2012)*	8	PTELD	Persistent symptoms in one	6
5	Jha et al (19) (2015)	1	PTELD	No	2
6	Sanjeevan et al (10) (2018)	1	PIELD	No	10
7	Yudoyono et al (8) (2018)	9	SELD	No	12
8	Present case series	2	PTELD	No	77, 31

*# These articles are repeated in the table individually and in the first review article. Abbreviations: MLD, microsurgical resection/microendoscopic discectomy; N/A, not available; OP, open surgery; PIELD, percutaneous interlaminar endoscopic lumbar discectomy; PTELD, percuta-neous transforaminal endoscopic lumbar discectomy; SELD, transsacral epiduroscopic-assisted, 1,414-nm Nd:YAG laser decompression

technical modifications needed to reach the pathology more effectively in the epidural space and to reach the contralateral side using the unilateral uniportal approach (12,13). The differentiation of the cyst from PLL was not always clearly possible (Fig. 3) because the cyst is thin-walled; cutting of the PLL invariably involves cutting both the PLL and the cyst wall. This is not the case with MLD and PIELD. In these techniques, because the surgery is done through a wider available window and space, morphologically the entire cyst can be seen before excision. This may be a reason why we failed to remove a small locule of cyst in the multiloculated cyst of our second case. But, this did not interfere with its final outcome and there was no evidence of residual cyst in follow-up MRI.

PTELD is an outpatient minimally invasive spine surgery. The need to improve positive outcomes of discectomy has led to skill-technology evolution and extrapolation of acquired knowledge into other possible applications like discal cyst, stenosis, and fusion (12,20). But, at the same time, failure of outcomes and complications will ensue with any technique. Minimally invasive surgeries can be successful and become the future of spine surgery only if the end point of decompression is similar to what is achieved in open surgery. Systematic multi-centric collection of data is required to define the gold standard for the management of discal cyst, though sporadic reports of PTELD suggest its superiority.

CONCLUSION

Open surgeries do achieve the objectives of the surgery; minimally invasive spine surgeries are the future of discal cyst treatment, with added advantages specifically for PTELD.

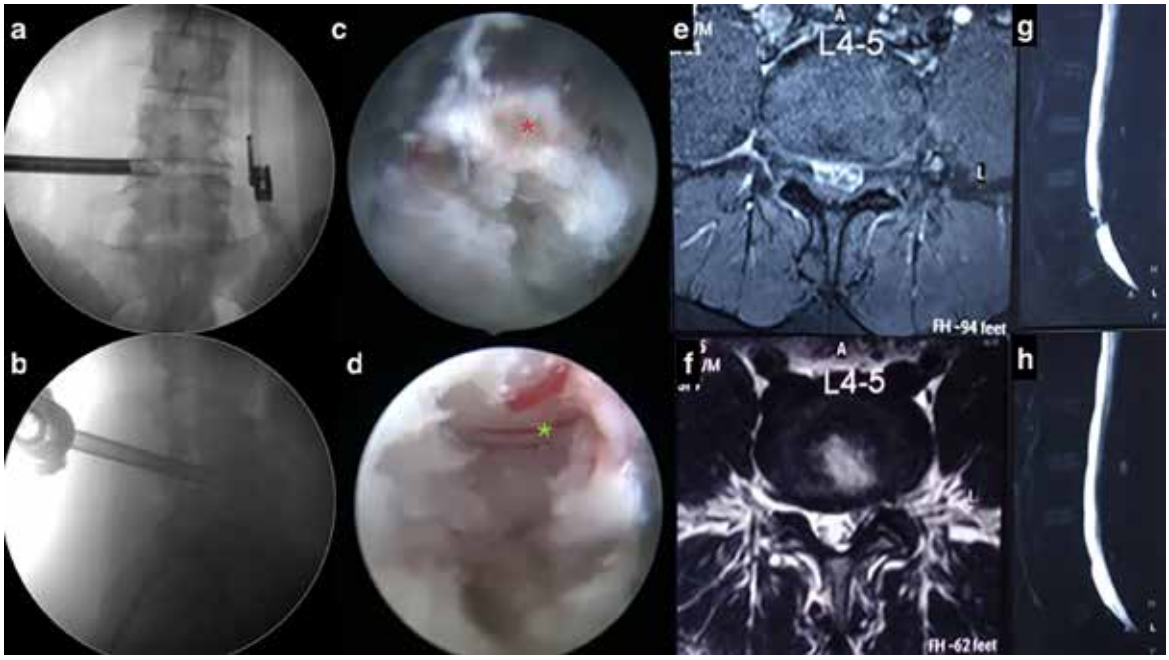

Fig. 3. In the second patient (a,b) Paracentral location of endoscope & working channel combination in antero-posterior and lateral fluoroscopy. (c,d) After cutting the annulus the posterior longitudinal ligament and the cyst (red asterisk) protrude into the working channel. After complete crab-eating of the cyst, the decompressed dural sac and traversing root are visible (green asterisk). (e) Pre-operative contrast axial MRI demonstrating rim enhancement of multi-loculated cyst. (g) Pre-operative MR myelogram demonstrating a block at the same level. (f,h) postoperative MR imaging demonstrating removal of cyst and no block in the MR myelogram.

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