Transforaminal Percutaneous Endoscopic Discectomy for Symptomatic Gas-filled Discal Cysts

Kejun Zhu

Lishui Municipal Central Hospital

Dengwei He (✉ hedengwei9@126.com)

Lishui Municipal Hospital

Research article

Keywords: discal cyst, gas-filled, transforaminal percutaneous endoscopic discectomy, intraspinal

Posted Date: February 17th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-206888/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published at Journal of Orthopaedic Surgery and Research on April 13th, 2021. See the published version at <https://doi.org/10.1186/s13018-021-02403-8>.

Abstract

Objective The aim of this retrospective study is to review our experience in the diagnosis and role of transforaminal percutaneous endoscopic discectomy (TPED) for symptomatic gas-filled discal cysts.

Methods Between May 2014 and June 2017, 3 patients from Lishui Center Hospital (Lishui China), who underwent TPED for symptomatic gas-filled discal cysts, were analyzed. The clinical features, imaging findings, operative findings and treatment outcomes are presented. In addition, relevant literature regarding gas-filled discal cysts were searched using PubMed, and their characteristics, clinical features, therapeutic strategies and survival outcomes were reviewed.

Results The median age of the patients was 56.7 years (range, 55-60 years). In all patients, a discal cyst was located in the lumbar region, and the patients presented with backache and numbness in the lower extremities. The diagnosis was made by lumbar 3 dimensional-computed tomography (3D-CT) or magnetic resonance imaging (MRI). All patients underwent TPED. All patients recovered successfully and were eventually discharged. Eighteen articles were identified from the searches of the database, and a total of 41 patients were included. There were 32 males and 9 females. The mean age was 58.1 years, ranging from 27 to 85 years. Lower back pain was the major symptom. Twenty-four patients underwent surgery, 4 patients underwent percutaneous needle aspiration, and 2 patients underwent drug therapy.

Conclusion TPED for gas-filled discal cysts is feasible, effective and successful, although it should be performed by an experienced surgeon with awareness of the potential risk of severe nerve root injury.

Introduction

Lumbar radiculopathy can be the result of many different and complicated pathogeneses that cause severe compression of the nerve root^[1]. A rare cause of lumbar radiculopathy is discal cyst^[1]. Discal cysts are intraspinal extradural cysts with a direct connection with the corresponding intervertebral disc^[2]. To the best of our knowledge, discal cysts of the lumbar spine are rare lesions. Furthermore, discal cysts that contain gas are extremely rare. Forty-three articles have been published describing approximately 105 cases of discal cysts in the available literature^[3]. There are no detailed case reports concerning clinical course, imaging findings, diagnosis and management strategies of gas-filled discal cysts. The main aim of the present study was to assess TPED of symptomatic gas-filled discal cysts and to systematically review the previously reported cases in the literature.

Patients And Methods

We retrospectively reviewed the records of 3 patients with symptomatic gas-filled discal cysts who had undergone TPED at the department of Spinal Surgery, Lishui Center Hospital, Lishui, China, between January 2014 and January 2018. Age, sex, medical history, location of lesions, clinical presentation, diagnostic methods, intraoperative findings, postoperative complications and outcomes were retrieved from hospital records. Relevant literature and studies regarding gas-filled discal cysts were searched in "PubMed" and "Web of Science" from January 1990 to January 2019. The text words and Mesh terms "gas", "cyst", "disc" and "intraspinal" were used. Disease characteristics, clinicopathologic features, therapeutic strategies and survival outcomes were reviewed, and the data were tabulated.

Surgical strategy

The patient underwent TPED under local anesthesia, in the right lateral decubitus position. To increase the space of the interlaminar window, the hip and knee were flexed at 90 and 45 degrees, respectively. A 7 mm incision was made on the skin. A catheter was inserted into the left intervertebral foramen at the level 4/5, and a c-arm X-ray machine was positioned to obtain the proper views. After placing the dilated catheter, the working channel was established and

connected with the light source of the endoscope. Normal saline flowed continuously to rinse the area. Following hemostasis, a bipolar radiofrequency knife head under the working channel was used to remove the discal cyst with the nucleus pulposus. A lumbar 5 nerve root canal expansion was performed.

Results

Report of Cases

Of the three patients with gas-filled discal cysts at our hospital, two were females and one was male, with a mean age of 56.7 years (range, 55–60 years). Patient No. 2 had a history of hepatitis. The remaining two patients had no history of any disease. All three patients presented with backache and numbness of the left limb (Table1). A physical examination found paresthesia of L5 dermatome of the left foot. The straight leg-raising test was positive in two patients (No. 1 and No. 3). All lesions occurred at the level of L4/5. The preoperative 3 dimensional-computed tomography (3D-CT) with discogram and magnetic resonance image (MRI) showed the cyst connected to the corresponding intervertebral disc in all cases (Fig. 1). Gas-filled discal cysts show low density shadows on 3D-CT. Gas-filled discal cysts are round to oval, extradural masses with low signal intensity on T1-weighted images and T2-weighted images (Fig. 2). Other examinations, including echocardiogram, electrocardiogram, coagulation function and routine blood examination, were normal. All patients underwent TPED. The mean operative duration was 91.6 min (range, 65–115 min), and the mean blood loss was 26.7 ml (range, 10–50 ml). The mean length of hospital stay was 7.3 d (range, 7–8 d). All patients recovered successfully and were eventually discharged. The median postoperative follow-up duration was 26 mo (range, 12–36 mo). An MRI scan three years postoperative showed a complete absence of a gas-filled discal cyst at the site of treatment in one patient (Fig. 3). Two patients were lost to follow-up.

Table 1
Patient characteristics and treatment history in our study.

Features	patient No. 1	patient No. 2	patient No. 3
Gender	Male	Female	Female
Age	55	55	60
Presentation	Backache and left lower limb numbness	Backache and left lower limb numbness	Backache and left lower limb numbness
Previous history	No	Hepatitis	No
Level	L4/5	L4/5	L4/5
Direction	Left	Left	Left
Surgical strategy	TPED	TPED	TPED
Operating time (min)	65	115	95
Blood loss (ml)	20	50	10
Postoperative complication	No	No	No
hospital stay(days)	8	7	7
Follow up (months)	36	30	12
Recurrence	No	No	No
Current status	NED	NED	NED
NED: no evidence of disease; TPED: transforaminal percutaneous endoscopic discectomy.			

Published Case Report Findings

We searched the literature from January 1990 to January 2019. According to the titles and abstracts, a total of 20 articles were related. One article was not included in the analysis because there were no relevant data^[4-5]. One article, a letter to the editor, was not included in the analysis^[6]. In this letter to editor, more than 200 cases of intraspinal gas were described. However, this letter contained little or no clinical outcomes. Because of the lack of data, this letter was not included. Eighteen articles were identified from the database searches, and a total of 41 patients were included^[7-24] (Table 2). There were 32 males and 9 females. The mean age was 58.1 years, ranging from 27 to 85 years. Lower back pain was the major symptom. Twenty-four patients underwent surgery, 4 patients underwent percutaneous needle aspiration, and 2 patients underwent drug therapy. Cysts recurred in 2 patients who underwent percutaneous needle aspiration, and they later underwent surgical treatment.

Table 2
Clinicopathologic features of gassy disc cyst present in the English literature

	Case	Age (Years)	Gender	Site	Symptoms	Treatment	Follow- up (Months)	Status
Cebeci H ^[7]	1	55	Female	L4-L5	Low back pain	Unknown	Unknown	Unknown
Firth RL ^[8]	1	70	Male	L4-L5	Low-back and gluteal pain	Surgical excision	Unknown	Unknown
Jeon CH ^[9]	1	76	Male	L4-L5	Bilateral lower leg pain	Surgery	24	NED
Kakitsubata Y ^[10]	4	57	Male	L5–S1	Pain in the right lower extremity	L5–S1 discectomy	12	NED
		27	Female				14	NED
		73	Female	L4-L5	Right lumbar radiculopathy	Analgesics and oral steroids	Unknown	Unknown
		51	Male	L5–S1		Surgery	Unknown	Unknown
				L4-L5	Pain in the left lower extremity Pain radiating into the right leg	Percutaneous needle aspiration		
Kang SS ^[11]	1	68	Female	L5–S1	lower back and radiating pain	Percutaneous needle aspiration	12	NED
Ambesi Impiombato F ^[12]	1	85	Female	L5–S1	Left lumbar sciatica	Angiographic 5FCatheter	6	NED
Cho HL ^[13]	1	80	Male	L2-L3	Pain in both legs	CT-guided aspiration-Surgery	1–14	Recurred-NED
Yun SM ^[14]	2	83	Male	L4-L5	Back and left radiating pain	Partial hemilaminectomy	6	NED
		72	Female	L5–S1	Pain in the left lower extremity	left L5-S1 discectomy	12	NED
Chiu LJ ^[15]	1	71	Female	L3/L4	Low back pain	Surgical treatment	Unknown	Unknown
Kudo Y ^[16]	2	51	Female	L3/L4	Progressive low-back pain	Surgery	12	NED
		66	Male	L4-L5	Progressive low-back pain	Surgery	Unknown	Unknown

NED: no evidence of disease

	Case	Age (Years)	Gender	Site	Symptoms	Treatment	Follow- up (Months)	Status
Qasho R ^[17]	1	55	Male	L4-L5	Pain in the left lower limb	Surgery	1	NED
Kawaguchi S ^[18]	1	60	Male	L3/L4	Low-back pain	Surgery	12	NED
Harvey AR ^[19]	1	61	Male	L3/L4	Unremitting right sided sciatica	Cyst excision	Unknown	Unknown
Firth RL ^[20]	1	70	Male	L5– S1	Left buttocks pain	Surgical excision	Unknown	Unknown
Fandino J ^[21]	1	48	Male	L5– S1	Back pain	Surgery	Unknown	Unknown
		59	Male	L5– S1	persistent sciatica	Surgery	Unknown	Unknown
Lin RM ^[22]	1	40	Male	L3/L4	Lower back pain	Surgery	Unknown	Unknown

NED: no evidence of disease

	Case	Age (Years)	Gender	Site	Symptoms	Treatment	Follow- up (Months)	Status	
Hidalgo-Ovejero AM ^[23]	19	55	Male	L5–S1	Unknown	Nonoperative	Unknown	Unknown	
		56	Female		Unknown	Nonoperative	Unknown	Unknown	
		58	Male	L5–S1	Unknown	Surgery	Unknown	Unknown	
		36	Male	L5–S1	Unknown	Surgery	Unknown	Unknown	
		36	Female		Unknown	Surgery	Unknown	Unknown	
		52	Male	L5–S1	Unknown	Nonoperative	Unknown	Unknown	
		46	Male	L5–S1	Unknown	Nonoperative	Unknown	Unknown	
		44	Male		Unknown	Nonoperative	Unknown	Unknown	
		41	Male	L5–S1	Unknown	Nonoperative	Unknown	Unknown	
		47	Male	L5–S1	Unknown	Surgery	Unknown	Unknown	
		58	Female		Unknown	Nonoperative	Unknown	Unknown	
		43	Male	L4-L5	Unknown	Nonoperative	Unknown	Unknown	
		60	Male	L5–S1	Unknown	Nonoperative	Unknown	Unknown	
		47	Male	L4-L5	Unknown	Surgery	Unknown	Unknown	
		29	Male	L5–S1	Unknown	Surgery	Unknown	Unknown	
		68	Male		Unknown	Nonoperative	Unknown	Unknown	
		45	Female	L5–S1	Unknown	Nonoperative	Unknown	Unknown	
		66	Male	L4-L5	Unknown	Nonoperative	Unknown	Unknown	
		45	Female	L5–S1	Unknown	Nonoperative	Unknown	Unknown	
						</			

Discussion

Discal cysts are extremely rare lesions, described as cysts with a direct connection with the corresponding intervertebral disc^[2]. Discal cysts that contain gas are even more rare. The etiology and pathogenesis of discal cysts remains unknown but several hypotheses have been proposed^[25]. The vascular theory hypothesizes that it is an organized epidural hematoma result of hemorrhage of the epidural venous plexus resulting from disc herniation or preceding discal injury, which develops acutely and later acquires a pseudomembrane^[2]. Jeong^[26] hypothesized that the formation of discal cysts was not a vascular phenomenon, but resulted from a change in a herniated disc. Some scholars support the theory that a discal cyst is due to focal degeneration or annular injury of an intervertebral disc producing a corresponding herniated disc with subsequent spilling of fluid from the herniated disc tissue that triggers an abacterial inflammatory response, resulting in the formation of a pseudomembrane and development of a discal cyst^[27]. Based on our intraoperative findings, we agree that the underlying etiology and pathogenesis results from an annular injury or focal degeneration, leading to a herniated disc with a subsequent series of reactions resulting in the formation of a reactive pseudomembrane that finally becomes a discal cyst.

Chief complaints, symptoms and signs of discal cysts can be similar to those of patients with typical lumbar disc herniation^[1]. The early stage of discal cyst formation is asymptomatic, and no treatment is necessary because the discal cyst puts only small pressure on the canalis spinalis. However, as the discal cyst grows, patients present with different symptoms, including backache and numbness. Other diseases, which can present with similar clinical symptoms including lower back pain and radiculopathy are perineural or Tarlov cysts, epidural hematomas, ligamentum flavum cysts, arachnoid cysts and synovial cysts^[28].

Imaging examinations, including 3D-CT and MRI, are used for assessing discal cysts. Gassy discal cysts show low density shadows on 3D-CT. The typical findings for fluid discal cysts are round to oval extradural masses with low signal intensity on T1-weighted images and high signal intensity on T2-weighted images^[29]. However, this signal depends on the contents of the fluid. When the discal cysts contain gas and no fluid, masses have low signal intensity on T1-weighted images and T2-weighted images.

According to cases in the literature, partial hemilaminectomy, microscopic excision or endoscopic excision are generally accepted as the definitive and effective treatment of choice for discal cysts. To our knowledge, the largest single center experience describing the surgical treatment of discal cysts was described by Wang^[30]. This author reported the microscopic surgical outcomes of nine patients with symptomatic radiculopathy caused by discal cysts and believed that the operative indications for discal cysts are similar to those of lumbar disc herniation^[30]. Although the majority of cases of discal cysts have been treated with surgical resection, computed tomography-guided aspiration has also been described^[31, 32]. Yoshimi Endo^[28] described a lumbar discal cyst that was treated with computed tomography-guided aspiration and steroid injection. This author believed that corticosteroid injection into the cyst was important for minimizing the risk of recurrence^[28]. However, Kang^[33] performed similar aspirations without steroid injections, and no patients reported any recurrence of the cysts. Meanwhile, Cho HL^[13] described a gas-filled intradural cyst that was treated with computed tomography-guided aspiration. Unfortunately, the patient's symptoms recurred one month later, and the CT showed re-accumulation of gas in the intradural cyst. The patient underwent open intradural surgery via the posterior approach. Therefore, steroid injection for discal cysts is still controversial. In addition, Demaerel et al.^[34] and Takeshima et al.^[35] report cases of spontaneous regression of a discal cyst without intervention. In our study, discal cysts were treated effectively by TPED. However, in order to provide more definitive evidence of standard and effective

treatment for discal cysts, more studies on diagnostic and therapeutic strategies for discal cysts are needed, and careful analysis and long-term follow-up are necessary.

Conclusion

Gassy discal cysts are an extremely rare disease and may manifest with symptoms and signs very similar to lumbar disc herniation. TPED is the standard, feasible, effective and successful treatment of gassy discal cysts, and it should be conducted by an experienced surgeon with awareness of the potential risk of nerve root injury.

Abbreviations

transforaminal percutaneous endoscopic discectomy (TPED);

3 dimensional-computed tomography (3D-CT);

magnetic resonance imaging (MRI).

Declarations

Consent for publication

Written informed consent was obtained from the patient for the publication of this case report. A copy of the consent form is available for review by the editor-in-chief of this journal.

Availability of data and materials

We declare that the materials described in the manuscript, including all relevant raw data, will be freely available to any scientist wishing to use them for noncommercial purposes, without breaching participant confidentiality.

Competing interests

The authors have no competing interests.

Funding

None

Authors' contributions

Author ZKJ drafted the article. ZKJ and HDW performed the surgery. HDW made critical revisions for important intellectual content. All authors read and approved the final article.

Acknowledgements

None

References

1. Cho N, Keith J, Pirouzmand F. Lumbar discal cyst as a cause of radiculopathy: case report. Br J Neurosurg. 2016;30(6):675-677.

2. Chiba K, Toyama Y, Matsumoto M, et al. Intraspinial cyst communicating with the intervertebral disc in the lumbar spine: discal cyst. *Spine*. 2001;26(19): 2112-8.
3. Sahoo SS. Discal cyst A rare cause of lumbar radiculopathy in the pediatric population. *Neurol India*. 2016;64(1):178-80.
4. Steinberg ML, Rose WS, Ruchman RB. Case report: intraspinal synovial cyst containing gas. *N J Med*. 1995;92(3):169-71.
5. Simonetti G, Martino V, Santilli S, et al. Lumbar root compression by a gas-containing cyst in the extradural space. Case report. *J Neurosurg Sci*. 1992;36(2): 101-2.
6. Hidalgo-Ovejero AM, García-Mata S, Otermin-Maya I. Gas-filled cyst. *J Neurosurg Spine*. 2008 Oct;9(4):400-1.
7. Cebeci H, Tekin AF, Sivri M, et al. A rare cause of low back pain: intraspinal synovial cyst containing gas. *Spine J*. 2016;16(8):e495-6.
8. Firth RL. Lumbar intraspinal synovial cyst containing gas as a cause for low-back pain. *J Manipulative Physiol Ther*. 2000;23(4):276-8.
9. Jeon CH, Park JU, Choo HS, et al. Increased size of a gas-filled intradural cyst causing acute foot drop: a case report. *Skeletal Radiol*. 2013;42(12):1747-50.
10. Kakitsubata Y, Theodorou SJ, Theodorou DJ, et al. Symptomatic epidural gas cyst associated with discal vacuum phenomenon. *Spine (Phila Pa 1976)*. 2009;34(21): E784-9.
11. Kang SS, Kim MS, Ko KM, et al. Symptomatic epidural gas cyst treated with epidural block and percutaneous needle aspiration -A case report-. *Korean J Anesthesiol*. 2012;62(4):379-81.
12. Ambesi Impiombato F, Lunghi V, et al. Treatment of a Symptomatic Epidural Gas Cyst Using an Angiographic 5F Catheter in the Epidural Space of the Spinal Cord through the Sacral Hiatus. A Case Report. *Neuroradiol J*. 2011;24(6):914-8.
13. Cho HL, Lee SH, Kim JS. Gas-Filled Intradural Cyst within the Cauda Equine. *J Korean Neurosurg Soc*. 2011;49(3):182-5.
14. Yun SM, Suh BS, Park JS. Symptomatic Epidural Gas-containing Cyst from Intervertebral Vacuum Phenomenon. *Korean J Spine*. 2012;9(4):365-8.
15. Chiu LJ, Tsai PC, Chou PC, et al. A gas filled intradural cyst with intradural disc herniation: a case report. *Acta Neurol Taiwan*. 2008;17(1):36-41.
16. Kudo Y, Nishijima Y, Mochida K, et al. Gas-filled intradural cyst with migration into the nerve root of the cauda equina. *J Neurosurg Spine*. 2008;8(5):482-6.
17. Qasho R, Santoro A, Vangelista T, et al. Nerve root compression by a gas-containing cyst associated with stenotic lateral recess. Case report and review of the literature. *J Neurosurg Sci*. 2001;45(3):181-4.
18. Kawaguchi S, Yamashita T, Ida K, et al. Gas-filled intradural cyst of the lumbar spine. Case report. *J Neurosurg*. 2001;95(2 Suppl):257-9.
19. Harvey AR, Britton JM, Plant GR. A gas filled intradural cyst associated with disc degeneration. *Spinal Cord*. 2000;38(11):708-10.
20. Firth RL. Lumbar intraspinal synovial cyst containing gas as a cause for low-back pain. *J Manipulative Physiol Ther*. 2000;23(4):276-8.
21. Fandino J, Garcia J, Garcia-Abeledo M. Radicular compression by gas in a spinal extra dural cyst. Report on two cases. *Neurochirurgie*. 1994;40(3):179-82.
22. Lin RM, Wey KL, Tzeng CC. Gas-containing "ganglion" cyst of lumbar posterior longitudinal ligament at L3. Case report. *Spine (Phila Pa 1976)*. 1993;18(16):2528-32.

23. Hidalgo-Ovejero AM, Martinez-Grande M, Garcia-Mata S. Disc herniation with gas. Spine (Phila Pa 1976). 1994;19(19):2210-2.
24. Tobback IG, Parizel PM, Milants W, et al. Gas-filled intraspinal synovial cyst. Rofo. 1992;156(3):300-1.
25. Sanjeevan R, Prabu S, Azizul A, et al. Discal Cyst of the Lumbar Spine: Case Report of a Rare Clinical Entity. Malays Orthop J. 2018;12(2):56-58.
26. Jeong GK, Bendo JA. Lumbar intervertebral disc cyst as a cause of radiculopathy. Spine J. 2003;3(3):242-6.
27. Kono K, Nakamura H, Inoue Y, et al. Intraspinal extradural cysts communicating with adjacent herniated disks: imaging characteristics and possible pathogenesis. AJNR Am J Neuroradiol. 1999;20(7):1373-7.
28. Endo Y, Miller TT, Saboeiro GR, et al. Lumbar discal cyst: Diagnostic discography followed by therapeutic computed tomography-guided aspiration and injection. J Radiol Case Rep. 2014;8(12):35-40.
29. Kim SY. Radiculopathy Caused by Discal Cyst. Korean J Pain. 2014;27(1):86-9.
30. Wang ES, Lee CG, Kim SW, et al. Clinical Analysis of Microscopic Removal of Discal Cyst. Korean J Spine. 2013;10(2):61-4.
31. Dasenbrock HH, Kathuria S, Witham TF, et al. Successful treatment of a symptomatic L5/S1 discal cyst by percutaneous CT-guided aspiration. Surg Neurol Int. 2010;10;1.pii:41.
32. Norman ER, Beall DP, Kitley CA, et al. Intervertebral disk cyst: a case report. J Comput Assist Tomogr. 2006;30(2):313-5.
33. Kang H, Liu WC, Lee SH, et al. Midterm results of percutaneous CT-guided aspiration of symptomatic lumbar discal cysts. AJR Am J Roentgenol. 2008;190 (5):W310-4.
34. Demaerel P, Eerens I, Goffin J, et al. Spontaneous regression of an intraspinal disc cyst. Eur Radiol. 2001;11(11):2317-8.
35. Takeshima Y, Takahashi T, Hanakita J, et al. Lumbar discal cyst with spontaneous regression and subsequent occurrence of lumbar disc herniation. Neurol Med Chir (Tokyo) 2011;51(11):809-11.

Figures

Figure 1

Computed tomography scan reveals low density mass (red arrow).

Figure 2

MRI imaging of the lumbar spine demonstrating a discal cyst with hypointense on T2-weighted images (red arrow).

Figure 3

After postoperative twelve months, An MRI scan showed a complete absence of the gas discal cyst at the site of treatment (red arrow).