MINIREVIEWS

8808   Ear, nose, and throat manifestations of COVID-19 and its vaccines
       Al-Ani RM

8816   Potential influences of religiosity and religious coping strategies on people with diabetes
       Onyishi CN, Eseadi C, Ilechukwu LC, Okoro KN, Okolie CN, Egbule E, Asogwa E

ORIGINAL ARTICLE

Case Control Study

8827   Effectiveness of six-step complex decongestive therapy for treating upper limb lymphedema after breast
cancer surgery

Retrospective Study

8837   Hospital admissions from alcohol-related acute pancreatitis during the COVID-19 pandemic: A single-
centre study
       Mak WK, Di Mauro D, Pearce E, Karran L, Myintmo A, Duckworth J, Orabi A, Lane R, Holloway S, Manzelli A,
       Mossadegh S

8844   Indocyanine green plasma clearance rate and 99mTc-galactosyl human serum albumin single-photon
       emission computed tomography evaluated preoperative remnant liver
       Iwaki K, Kathara S, Kita R, Kitamura K, Hashida H, Uryuhara K

8854   Arthroscopy with subscapularis upper one-third tenodesis for treatment of recurrent anterior shoulder
       instability independent of glenoid bone loss

8863   Evaluation of the prognostic nutritional index for the prognosis of Chinese patients with high/extremely
       high-risk prostate cancer after radical prostatectomy
       Yang F, Pan M, Nie J, Xiao F, Zhang Y

Observational Study

8872   Chlorine poisoning caused by improper mixing of household disinfectants during the COVID-19
       pandemic: Case series
       Lin GD, Wu JY, Peng XB, Lu XX, Liu ZY, Pan ZG, Qiu ZW, Dong JG

8880   Mental health of the Slovak population during COVID-19 pandemic: A cross-sectional survey
       Kralova M, Brazinova A, Sivcova V, Izakova L
# Contents

## Prospective Study

8893  
Arthroscopic anatomical reconstruction of lateral collateral ligaments with ligament advanced reinforcement system artificial ligament for chronic ankle instability  
Wang Y, Zhu JX

## SYSTEMATIC REVIEWS

8906  
How to select the quantitative magnetic resonance technique for subjects with fatty liver: A systematic review  
Li YW, Jiao Y, Chen N, Gao Q, Chen YK, Zhang YF, Wen QP, Zhang ZM

8922  
Lymphocytic choriomeningitis virus: An under-recognized congenital teratogen  
Ferenc T, Vujica M, Mržljak A, Vilibić-Cavlek T

## CASE REPORT

8932  
Alagille syndrome associated with total anomalous pulmonary venous connection and severe xanthomas: A case report  

8939  
Colo-colonic intussusception with post-polypectomy electrocoagulation syndrome: A case report  
Moon JY, Lee MR, Yun SK, Ha GW

8945  
Portal vein gas combined with pneumatosis intestinalis and emphysematous cystitis: A case report and literature review  
Hu SF, Liu HB, Hao YY

8954  
Quadricuspid aortic valve and right ventricular type of myocardial bridging in an asymptomatic middle-aged woman: A case report  
Sopek Merkaš I, Lakušić N, Paar MH

8962  
Treatment of gastric carcinoma with lymphoid stroma by immunotherapy: A case report  
Cui YJ, Ren YY, Zhang HZ

8968  
Gallstone associated celiac trunk thromboembolisms complicated with splenic infarction: A case report  
Wu CY, Su CC, Huang HH, Wang YT, Wang CC

8974  
Extracorporeal membrane oxygenation for lung cancer-related life-threatening hypoxia: A case report  
Yoo SS, Lee SY, Choi SH

8980  
Multi-disciplinary treatment of maxillofacial skeletal deformities by orthognathic surgery combined with periodontal phenotype modification: A case report  
Liu JY, Li GF, Tang Y, Yan FH, Tan BC

8990  
X-linked recessive Kallmann syndrome: A case report  
Zhang P, Fu JY

8998  
Delayed complications of intradural cement leakage after percutaneous vertebroplasty: A case report  
Ma QH, Liu GP, Sun Q, Li JG
Coexistent Kaposi sarcoma and post-transplant lymphoproliferative disorder in the same lymph nodes after pediatric liver transplantation: A case report

Misdiagnosis of pancreatic metastasis from renal cell carcinoma: A case report
Liang XK, Li LJ, He YM, Xu ZF

Discoid medial meniscus of both knees: A case report
Zheng ZR, Ma H, Yang F, Yuan L, Wang GD, Zhao XW, Ma LF

Simultaneous laparoscopic and arthroscopic excision of a huge juxta-articular ganglionic cyst compressing the sciatic nerve: A case report
Choi WK, Oh JS, Yoon SJ

One-stage revision arthroplasty in a patient with ochronotic arthropathy accompanied by joint infection: A case report
Wang XC, Zhang XM, Cai WL, Li Z, Ma C, Liu YH, He QL, Yan TS, Cao XW

Bladder paraganglioma after kidney transplantation: A case report
Wang L, Zhang YN, Chen GY

Total spinal anesthesia caused by lidocaine during unilateral percutaneous vertebroplasty performed under local anesthesia: A case report
Wang YF, Bian ZY, Li XX, Hu YX, Jiang L

Ruptured splenic artery aneurysms in pregnancy and usefulness of endovascular treatment in selective patients: A case report and review of literature
Lee SH, Yang S, Park I, Im YC, Kim GY

Gastrointestinal metastasis secondary to invasive lobular carcinoma of the breast: A case report
Li LX, Zhang D, Ma F

Post-bulbar duodenal ulcer with anterior perforation with kissing ulcer and duodenocaval fistula: A case report and review of literature
Alzerwi N

Modified orthodontic treatment of substitution of canines by first premolars: A case report
Li FF, Li M, Li M, Yang X

Renal cell carcinoma presented with a rare case of icteric Stauffer syndrome: A case report
Popov DR, Antonov KA, Atanasova EG, Pentchev CP, Milatchkov LM, Petkova MD, Neykov KG, Nikolov RK

Successful resection of a huge retroperitoneal venous hemangioma: A case report
Qin Y, Qiao P, Guan X, Zeng S, Hu XP, Wang B

Malignant transformation of biliary adenofibroma combined with benign lymphadenopathy mimicking advanced liver carcinoma: A case report
# Contents

## Thrice Monthly Volume 10 Number 25 September 6, 2022

### 9112 Congenital hepatic cyst: Eleven case reports
*Du CX, Lu CG, Li W, Tang WB*

### 9121 Endovascular treatment of a ruptured pseudoaneurysm of the internal carotid artery in a patient with nasopharyngeal cancer: A case report
*Park JS, Jang HG*

### 9127 Varicella-zoster virus meningitis after spinal anesthesia: A case report
*Lee YW, Yoo B, Lim YH*

### 9132 Chondrosarcoma of the toe: A case report and literature review
*Zhou LB, Zhang HC, Dong ZG, Wang CC*

### 9142 Tamsulosin-induced life-threatening hypotension in a patient with spinal cord injury: A case report
*Lee JY, Lee HS, Park SB, Lee KH*

### 9148 CCNO mutation as a cause of primary ciliary dyskinesia: A case report
*Zhang YY, Lou Y, Yan H, Tang H*

### 9156 Repeated bacteremia and hepatic cyst infection lasting 3 years following pancreatoduodenectomy: A case report
*Zhang K, Zhang HL, Guo JQ, Tu CY, Lv XL, Zhu JD*

### 9162 Idiopathic cholesterol crystal embolism with atheroembolic renal disease and blue toes syndrome: A case report
*Cheng DJ, Li L, Zheng XY, Tang SF*

### 9168 Systemic lupus erythematosus with visceral varicella: A case report
*Zhao J, Tian M*

## LETTER TO THE EDITOR

### 9176 Imaging of fibroadenoma: Be careful with imaging follow-up
*Ece B, Aydin S*
ABOUT COVER
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CASE REPORT

Delayed complications of intradural cement leakage after percutaneous vertebroplasty: A case report

Qiu-Hong Ma, Guang-Ping Liu, Qi Sun, Ji-Gang Li

Abstract

BACKGROUND
Intradural cement leakage following percutaneous vertebroplasty is a rare but acute and devastating complication that usually requires emergent treatment. Here, we report a delayed complication of intradural leakage after percutaneous vertebroplasty.

CASE SUMMARY
A 71-year-old female patient with an L1 osteoporotic compression fracture underwent percutaneous vertebroplasty in 2014. She was referred to our hospital 5 years later due to complaints of progressive weakness and numbness in both legs combined with urinary incontinence and constipation. Initially, she was suspected to have a spinal meningioma at the level of L1 according to imaging examinations. Postoperative pathological tests confirmed that cement had leaked into the dura during the first percutaneous vertebroplasty.

CONCLUSION
Guideline adherence is essential to prevent cement from leaking into the spinal canal or even the dura. Once leakage occurs, urgent evaluation and decompression surgery are necessary to prevent further neurological damage.

Key Words: Vertebroplasty; Kyphoplasty; Cement leakage; Complication; Case report

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Core Tip: Intradural cement leakage following percutaneous vertebroplasty is a rare complication. Usually, it causes acute neurological deficit and require emergent decompression. Here presents a case who did not suffer acute neurological impairment when cement leaked into intradural space, but gradually developed neurological symptom 5 years after the first vertebroplasty. This case highlights the ultimate importance of adherence to operation specification to avoid such complications.

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INTRODUCTION
Percutaneous vertebroplasty is widely used for the treatment of osteoporotic vertebral compression fractures and certain pathological vertebral fractures, but it is not without complications, including adjacent fractures, radiculopathy, spinal cord compression, pulmonary embolism, infection and rib fractures, typically related to cement leakage[1]. Although most complications are asymptomatic or clinically insignificant, extravasation of cement into the dura can be disastrous. Fortunately, the rate of this complication is extremely low, with only 6 reported cases to date[2-7]. In all reported cases, the associated neurological deficits developed after vertebroplasty, and the patients lived with residual functional impairment even after timely decompression surgery. Usually, intradural cement leakage is an urgent condition requiring timely intervention. This report describes 1 case of delayed intradural leakage that occurred at another hospital; 5 years later, the patient was referred to us for further management.

CASE PRESENTATION

Chief complaints
A 71-year-old woman was referred to our hospital complaining of progressive weakness and numbness of both legs combined with urinary incontinence and constipation.

History of present illness
The patient’s symptoms started 2 mo before admission to our hospital. Initially she felt weak and numb of both legs. After taking medicine and rest, the symptoms did not relieve but progressively aggravated. In the last 2 wk, she could not stand and walk on her own. She also developed urinary incontinence and constipation at this time.

History of past illness
The patient underwent percutaneous vertebroplasty due to an L1 osteoporotic vertebral compression fracture at another hospital in 2014 (Figure 1).

Personal and family history
The patient has no relevant family history.

Physical examination
Physical examination revealed atrophy of the left quadriceps, bilateral hypoesthesia below the level of the inguen, loose anal tone and diffuse weakness in both legs (grade 3).

Laboratory examinations
Blood analysis, serum C-reactive protein, and urine analysis were normal.

Imaging examinations
X-ray imaging showed the L1 vertebroplasty with cement only on the left side of the vertebral body. Magnetic resonance imaging (MRI) demonstrated the presence of an intradural mass, which caused the majority of the cauda equina to deviate to the right (Figure 2). A computed tomography (CT) scan revealed calcification of the mass, which, however, was connected to the cement that had extravasated into the anterior space of the spinal canal (Figure 3). This abnormality led us to suspect that the intradural mass might be cement that leaked into the dura during the vertebroplasty procedure.
Ma QH et al. Complications of intradural cement leakage after vertebroplasty

Figure 1 Postoperative X-ray of the first vertebroplasty. A: Cement diffused only in the left side of L1 vertebral body; B: Lateral view showing compressed vertebral body with cement.

FINAL DIAGNOSIS
Pathologic examination proved our suspicion, showing focal chronic inflammatory cell infiltration on the cement surface (Figure 4).

TREATMENT
L1 Laminectomy, mass resection and instrumentation from T11 to L3 with pedicle screws augmented with cement were performed. Upon inspection, the left lateral epidural space had adhered to the posterior wall of the vertebra. A midline durotomy was made. Two pieces of the intradural mass that had caused the majority of the cauda equina to deviate to the right were identified (Figure 5). Soft tissue-like scars covered the surface and had adhered to the arachnoid and nerve. A microscope was used to separate and resect the mass completely.

OUTCOME AND FOLLOW-UP
After the operation, the patient was referred to the rehabilitation department. After 2 years of follow-up, she began to walk with assistance. Her urinary incontinence improved but had not completely resolved.

DISCUSSION
It has been reported that the rate of cement leakage following vertebroplasty ranges from 38% to 87.9% [8]. Cement can leak into the paravertebral, intradiscal, epidural, foraminal and venous areas. A small amount of leakage is usually nonneurological and transitory, but large amounts may cause local or radicular pain and severe neurologic complications [9]. Leakage into the spinal canal is potentially associated with neurologic deficits. The most common location of intraspinal leakage is the epidural space. Epidural leaks may be more common than expected if careful postoperative CT is performed. Ryu et al. [10] found leakage of cement into the epidural space in 40.3% of patients according to postoperative CT. However, cement leakage into the intradural space has rarely been reported. No cases
of intradural cement leakage were reported during percutaneous vertebroplasty until 2003[2]. To date, only 6 incidents of intradural leakage have been described in the literature. The case presented here marks the seventh. The essential condition underlying this rare complication is rupture of the dura. Typically, cement leakage occurs through the basivertebral plexus, bone defect or posterior wall of the vertebra into the epidural space. If the dura, cement can subsequently extravasate into the subdural area through the perforation. This complication could be explained by medial wall perforation and dura penetration during needle insertion through the pedicle, especially when a unilateral approach is used [5,7]. To avoid this technical error, the needle tip should not cross the medial border of the pedicle on the anteroposterior view before it has reached the posterior cortex of the vertebral body on the lateral view[4,7]. Surgical expertise should be emphasized to decrease the risk of cement leakage into the spinal canal. First, adequate opacification of the cement enables immediate monitoring of the distribution by fluoroscopy[3]. In the present case, the cement was not sufficiently radiopaque and may have been injected in liquid mobile form, making it difficult to detect leakage into the spinal channel. Second, from our experience, cement should be injected into the anterior 2/3 of the vertebral body and must be
stopped when flow of cement into the posterior 1/3 of the vertebral body is observed. Zhang et al.[11] suggested that cement should not reach the posterior 1/6 of the body in the middle and lower thoracic regions because of the concave structure of the posterior wall of this region. In the literature, all patients with leakage into the dura undoubtedly developed varying degrees of neurologic deficits in the lower extremities and urinary and stool disturbances. Fortunately, they all received timely decompression surgery, except for one patient due to poor physical condition. This is the only case in which salvage surgery was delayed for an extended period. Once new-onset neurologic deficits occur during the procedure, immediate surgical removal of the cement should be considered. Surgery under local, rather than general, anesthesia has been recommended for the early detection of neurologic compromise during the procedure[12]. Direct mass effects and thermal injury are the main causes of neurological deficits[4,6,13]. Early surgery probably improves new-onset neurological deficits and is not difficult to perform. If surgery is delayed, it becomes difficult to remove the cement due to adhesions caused by the late thermal effect of chronic inflammation and fibrosis, which may cause further damage to the nerve. In the present case, the gross surgical and microscopic findings of fibrosis and adhesion on the cement surface were indicative of the delayed effects of the thermal injury.

**CONCLUSION**

To increase safety, surgery should be performed by well-trained, experienced surgeons. Good quality image monitoring, clear visualization of the cement, avoidance of a medial wall breach and cessation of injection once the cement reaches the posterior one-third of the vertebral body are recommended. Prompt CT or MRI exploration and urgent surgical decompression are necessary if cement leakage is detected due to neurological deficits that develop during the procedure.
FOOTNOTES

Author contributions: Liu GP and Li JG were the patient’s spine surgeons, reviewed the literature and contributed to manuscript drafting; Ma QH and Sun Q performed the microbiological analyses and interpretation and contributed to manuscript drafting; Sun Q analyzed and interpreted the imaging findings; Li JG was responsible for the revision of the manuscript for important intellectual content; all authors issued final approval for the version to be submitted.

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