Symptomatic Gas-Containing Herniated Disc With the Vacuum Phenomenon: Mechanism and Treatment
—Case Report—

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Abstract

A 76-year-old woman presented with an extremely rare case of symptomatic gas-containing disc herniation manifesting as left posterolateral thigh pain and ankle dorsiflexion motor weakness. The diagnosis was L3-4 vacuum disc associated with epidural pneumorrhachis. The patient underwent partial hemilaminectomy and cyst incision. After incising the cyst, the thecal sac and root were decompressed sufficiently. Vacuum disc is a common phenomenon in the elderly rarely associated with pneumorrhachis and is usually asymptomatic. Symptomatic epidural gas-containing herniated discs with the vacuum phenomenon are very rare. Gas aspiration should be considered, but excision of the gas-containing herniated disc should be performed in patients with neurological deficits, frequent recurrence, or difficult location to approach.

Key words: intervertebral disc, vacuum phenomenon, pneumorrhachis, gas-containing disc
Introduction

The vacuum phenomenon is a finding of the intervertebral disc space filled with air, first described in 1910,9) and first named vacuum intervertebral disc by Magnusson.12) Vacuum is something of a misnomer because the space is filled with gas. The vacuum phenomenon is due to creation of a space in a degenerative intervertebral or apophyseal joint due to motion.6) However, almost all patients presenting with the vacuum phenomenon do not imply any other clinical importance.7) The vacuum phenomenon is only a radiological finding of degenerative disc change in elderly. However, the gas in vacuum disc can move to the intraspinal canal (also called pneumorrhachis) and cause clinical manifestations in rare cases. The pathogenetic mechanisms of the gas-containing lesion are still unknown. Only a few symptomatic cases with both the vacuum phenomenon and pneumorrhachis have been unrelated to trauma or medical procedures. The patients suffered radiculopathy and myelopathy due to mass effects such as herniated disc. This herniated disc is encapsulated with annulus fibrosus or posterior longitudinal ligament (PLL), and has no connection with diseases of the adjacent organs such as multilevel gas or pneumothorax. We report a rare case with radiculopathy relieved by only gas removal, and discuss the plausible mechanisms and adequate treatments.

Case Report

A 76-year-old female presented to our outpatient clinic with a 10-year history of back and left lateral thigh pain and numbness. The symptoms waxed and waned for 8 years. The leg pain was aggravated 2 years ago, and she recently developed ankle dorsiflexion weakness. Neurological examination demonstrated left L4 radiculopathy. Computed tomography (CT) showed an 8.0×8.0 mm round paracentral lesion deviated to the left in the spinal canal, with a density of −1000 Hounsfield Units and was suspected to be air or gas. Vacuum discs were also observed and appeared to be linked to the pneumorrhachis lesion (Fig. 1A, B). Magnetic resonance imaging showed severe disc space narrowing at L3-4 with left subarticular disc herniation and downward migration, and a round signal void lesion at the left paracentral portion of the L3-4 level. This gas-containing cystic lesion was compressing the left L4 nerve root (Fig. 1C, D). The neuroimaging findings were consistent with the neurological symptoms.

Surgery was planned because of the persistent and progressive radiculopathy at the left L4-5 which was refractory to nonsurgical treatment. A left partial hemilaminectomy was performed at L3-4. The herniated disc was the subligamentary type. Bulging PLL was visualized over the ventrolateral aspect of the thecal sac adjacent to the posterior surface of the L3-4 disc. After the PLL was incised, high-pressure gas gushed out (Fig. 2). After residual gas was removed, the thecal sac and lumbar root were almost completely decompressed. The probe could freely move through the foramens and roots. The gas-containing disc was covered with fibrous material-like annulus. An additional flavectomy was performed. Her postoperative course was uneventful and her pain and motor dysfunction were remarkably improved. She had no residual symptoms at the 6-month follow-up examination.

Discussion

The vacuum phenomenon of an intervertebral disc is commonly noted in the elderly,3,4) and about 50% of patients are aged >40 years.8) Gas chromatography showed that nitrogen combined with oxygen, carbon dioxide, and other trace gases accounts for 90–92% of the gas in the lesion,21 indicating that the aspirated gas is not the same as atmospheric air. Age-related changes have been found in
protein polysaccharides from the nucleus pulposus and annulus fibrosus, and are both morphologically and chemically much more in the nucleus pulposus than in the annulus fibrosus. The changes in the nucleus pulposus from a thick liquid state in younger people to a fibrous solid state in older people lead to a decrease of one-third of total mucopolysaccharides and a 20% decrease in water content. Age-related changes influence the water content as well as the proportion of proteins such as glucosamine, galactosamine, and hexosamine. If the protein contents of the disc decrease during the aging process, nitrogen gas can be generated as a by-product. Another study has suggested that extracellular fluid produces gas in a vacant space. However, there is no strong supporting evidence.

The vacuum phenomenon is relatively common, but epidural gas-containing disc associated with the degenerative vacuum phenomenon is rare. Furthermore, only a few symptomatic patients have presented with nerve root compression associated with intraspinal gas. The mechanism of gas-containing disc herniation is still unclear. Intraspinal gas is generally located posterolateral to the disc, as in our case, suggesting that the gas originates at the disc space and moves to the intraspinal space through weak points. The key question is the condition of the annulus. If the annulus is ruptured, gas might disperse to the third space. In our experience, another fibrous wall is present under the PLL. We guessed that the wall of the gas-containing disc herniation was the annulus.

Percutaneous intradiscal aspiration of the vacuum disc gas resulted in immediate symptomatic improvement and complete relief of radicular pain after the procedure. However, CT-guided aspiration of pneumorrhachis has limitations, as epidural gas recurred and was subsequently removed by surgical treatment in one case. We performed not only gas removal, but also flavectomy because this patient had spinal stenosis. Fortunately, the patient has not experienced recurrent disc. However, we would recommend total removal of the gas-containing disc. If the cyst is easy to approach, aspiration may be recommended. However, removal of the gas-containing herniated disc should be performed in patients with neurological deficits, frequent recurrence, or difficult locations to approach.

Symptomatic epidural gas-containing herniated discs with the vacuum phenomenon are very rare. Surgeons should consider gas aspiration in such patients. However, excision of the gas-containing herniated disc should be performed in patients with neurological deficits, frequent recurrence, or difficult location to approach. The mechanism of gas production in the human body is still unclear and requires further investigation.

Disclaimer
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References

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