

# Symptomatic epidural gas accumulation originating from vacuum phenomenon in the intervertebral disc: CT imaging findings

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## Abstract

Gas production as a part of disc degeneration can occur but rarely causes nerve compression syndromes. We report a case of symptomatic epidural free gas accumulation originating from vacuum phenomenon in the intervertebral disc, causing lumbosacral radiculopathy. A 74-year-old woman suffered from sciatica for 6 months. The condition worsened in recent days, and a slight motor deficiency of the right S1 had developed. CT images demonstrated intradiscal vacuum phenomenon with degenerative disc disease, and accumulation of gas in the lumbar epidural space compressing the dural sac and nerve root. The patient treated conservatively and symptoms gradually resolved within 15 days.

## INTRODUCTION

The presence of gas in the intervertebral disc space, known as the vacuum

phenomenon, is a relatively common radiological finding, especially on computed tomographic investigation [1,2,3,4,5]. Gas production as a part of disc degeneration can occur [6,7,8], and on occasion, it could cause clinical nerve compression syndromes [9]. Free air in the spinal canal has been reported in a number of situations—including craniocervical trauma, epidural anesthesia, and spinal surgery—and is usually not symptomatic [10]. The vacuum phenomenon is the most common source of gas release into the epidural space through the tears of annulus fibrosus [11]. Gas within the spine can produce sciatica via two pathophysiological mechanisms: gas can accumulate either within a herniated disc or within the epidural space in the absence of disc herniation [12]. The clinical features are similar to those of common sciatica, with mechanical monoradicular pain, antalgic posture, and a positive straight leg-raising test. Lumbar spine radiographs can show disc height loss and gas in the middle of the disc space [13]. CT scan is very useful in the detection of epidural gas accumulation and nerve root compression.

## CASE REPORT

A 74-year-old woman presented with low back pain that

radiated to her right leg. She had had this problem for 6 months, but the pain had become significantly worse during walking in the several days before presentation. There was no history of trauma. Neurological examination revealed hypoesthesia in the right sided S1 dermatome, restricted right plantar flexion, and hypoactive Achilles reflex. Straight leg-raising test was positive on the right at 45 degree. Lateral radiography of the lumbar spine showed L4-5 and L5-S1 degenerative disc disease (narrowing of the intervertebral spaces) and central vacuum phenomenon. The CT scan of the lumbar spine showed a gas bubble in the right anterolateral portion of the epidural space at L5-S1 and gas accumulation in the disc space at this level. Epidural gas accumulation was compressing the dural sac and right S1 nerve root (Figure 1a-c). There was no evidence on the CT scan of disc bulging or herniations directly compressing the affected root.

**Figure 1**

Figure 1: Consecutive axial CT scans (A, B, C) of a 74-year-old woman at the level of L5-S1 disc which reveal vacuum phenomenon of the disc and a gas bubble in the right anterolateral portion of the epidural space. Epidural gas accumulation compresses the dural sac and right S1 nerve root.



The patient was treated conservatively with bed rest combined with analgesics, anti-inflammatory and muscle relaxant drugs. The pain began to subside on the first four days, and the symptoms continued to resolve gradually until full recovery was achieved on day 15.

**DISCUSSION**

Gas in the intervertebral disc space is a relatively common radiologic finding, seen in 46% of cases on CT examinations [14]. Accumulation of gas in the epidural space is an unusual cause of radiculopathy. In most cases of degenerative disc disease, gas composed of nitrogen and carbon dioxide is produced within the disc [15,16]. If the annulus fibrosus ruptures, this air is released and collects in the epidural space. Trauma, pyogenic infections, pneumothorax, and iatrogenic instrumentation such as percutaneous vertebroplasty and spinal surgery are the other less-common underlying mechanisms [10]. Epidural gas is sometimes present in asymptomatic patients.

Yoshida et al [16] described those gas pockets as free gas bubbles that originated in the intervertebral disc and eventually because of the motion of lumbar spine had migrated outside to the epidural space along a pressure gradient because of the motion of the lumbar spine. Tsitouridis et al [17] reported that this theory may justify the exacerbation of symptoms on standing, sitting and lifting and its relief when changing positions or lying down and sleeping.

CT is the investigation of choice for the diagnosis. The scans not only show that the collection within the spinal canal is composed of gas but also provide useful information on the condition of the disc and of the rest of the lumbar spine. The typical findings include degenerative disc disease with central vacuum phenomenon and, at the same level, a

collection of epidural gas in contact with the nerve root corresponding to the distribution of the pain. This last point is important because epidural gas is sometimes present in asymptomatic patients. The gas collection can range in size from a few millimeters to 1 centimeter and in density from -200 to -900 Hounsfield units. Rim enhancement can be seen. MRI yields similar findings, with low signal on T1- and T2-weighted images and postgadolinium rim enhancement [12].

Gas in the epidural space may be absorbed spontaneously. Therefore, in patients with gas-related neurologic symptoms, conservative treatment with nonsteroid anti-inflammatory drugs and muscle relaxants should be the first choice. Percutaneous, intravenous, and oral steroids have also been reported as treatment options. Aspiration of the gas under fluoroscopic guidance has also been used. Surgery is the preferred treatment in chronic encapsulated lesion, which does not resolve with conservative management [12,18,19].

In conclusion, epidural gas collection when located near a nerve root may exercise a compression phenomenon that may cause symptoms such as low back pain and radiculopathy. CT is the best imaging method of the evaluation of the gas in the lumbar spine due to the heavily negative Hounsfield units of the gas.

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