

CAUSES AND METHODS OF TREATMENT OF THE PHENOMENON OF VACUUM IN THE SPINE

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Abstract: A diseased lumbar intervertebral vacuum disc void of any structurally intact tissue may be vertically unstable. A primary standalone endoscopic decompression and interbody fusion surgery in the treatment of vertical instability in patients with a vacuum disc may be a more reliable treatment than decompression alone.

Keywords: intervertebral vacuum phenomenon, degenerative disc disease, percutaneous cement discoplasty, vacuum classification.

Introduction Degenerative disc disease is an age-related condition that has been extensively analyzed in the literature.¹⁻⁵ Vacuum phenomenon (VP), defined as the presence of gas within the joints, has been associated with multiple clinical situations such as advanced degenerative changes, fractures, and abscesses.⁶ This anatomical finding can be demonstrated on X rays, computed tomography (CT), and/or magnetic resonance imaging and its clinical significance is still not well understood. Intervertebral VP is a common finding in advanced degenerative disc disease, especially in the lumbar spine and has been associated with low back pain.⁷ However, the role of this phenomenon as a pain source has not been clearly established. Minimally invasive spinal surgery techniques (MISST) and endoscopic spinal fusion techniques, in particular, have received some attention recently as a means to further simplify spinal surgery for patients and to facilitate their transition into outpatient ambulatory surgery center (ASC) setting. Various applications of endoscopic spinal surgery techniques in the delivery of interbody fusion cages in combination with percutaneous bilateral or unilateral pedicle screw constructs or as standalone endoscopic fusion have been demonstrated, proposed by different surgeons and stakeholders. The authors of this article were explicitly interested in better understanding the opinions of the surgeons surveyed. Some opinions reflect the use of fusion regarding indications and patient selection criteria for a standalone endoscopic decompression and interbody fusion surgery .

The well-accepted indications for open lumbar decompression and spinal fusion surgery include spondylolisthesis with motion on dynamic lateral extension-flexion views and decompression induced instability for severe spinal stenosis dictating

aggressive resection of the posterior spinal elements. However, these traditional indications for open translaminar lumbar fusion surgery may not be ideal for the successful application of endoscopic spinal surgery techniques. While advances in endoscopic decompression technologies with motorized burrs and more effective larger-diameter endoscopic rongeurs equaling those used in open surgeries have certainly allowed expanding the indications of endoscopic surgery, treating patients with end-stage degenerative disc- and facet disease with associated severe central stenosis or greater than Grade I spondylolisthesis may be pushing the limits of endoscopic surgery. Instead, patients with less severe forms of spinal stenosis affecting predominately the lateral recess or the foramina are more likely to be chosen for the endoscopic decompression procedure. Many of these patients may be successfully treated in such a way with favorable long-term outcomes, even up to five years postoperatively . However, some patients—particularly those with end-stage lumbar disease and persistent or progressive postoperative vertical or anterolateral instability—may require additional surgeries for recurrent symptoms in spite of initial functional improvements. A vacuum phenomenon on preoperative imaging studies has been recognized as a radiographic sign of end-stage degenerative disc disease . It correlates with a dysfunctional delaminated, fissured, cavitated or entirely hollow lumbar intervertebral disc often directly visualized during routine endoscopy .

Degenerative disc disease is a common, age-related phenomenon that represents a normal evolution of disc degeneration. Pfirmann et al¹⁵ developed a magnetic resonance imaging classification system for disc disease that shows the degenerative changes in normal population; however, degenerative changes in the vertebral disc unit continues and the presence of VP could be considered an advanced stage of disc degeneration. This change in elderly patients has been associated with the presence of back pain. However, the role of VP as a source of pain remains unclear. The objective of this study was to develop a new classification based on CT scan characteristics, useful to select better candidates for percutaneous discolplasty. Treatment strategies in elderly patients with low back pain that do not respond to conservative treatment are challenging due to some risk factors such as increased medical comorbidities and therefore, a higher surgical risk.¹⁶⁻¹⁸ In addition, the higher prevalence of osteoporosis in this population increases the risk of fracture and implant loosening with standard fusion treatments. After initial compression during a fracture, the vertebral trabecular bone becomes partially distracted when the patient is lying in the supine position by the effect of the paraspinal muscles of the back . This phenomenon produces the development of a cavity or cleft in the

spongy bone of the vertebral body. With good vascularisation – typically among young healthy patients but also in most tumoral vertebrae – this cleft is quickly filled with blood, plasma and tissular fluid. Maldague et al first stated that the presence of VP or gas within the vertebral body was only possible with an absence of fluid or tissue to fill the cleft, a condition indicative of absence of bleeding and thus advocating the presence of ischemia. Elderly patients with osteoporosis are more prone to this condition because of a lower bone marrow vascularisation and probably more extensive vertebral trabecular damages.

Conclusion. We developed a simplified tomographic classification of the air distribution in advanced degenerative vertebral discs in both the scoliotic and nonscoliotic spine. Our study showed substantial inter- and intraobserver reliabilities. To our knowledge, this is the first classification of intervertebral VP, and it could be a useful tool when considering percutaneous cement discoplasty as a treatment option. More studies are required to assess the utility of this classification and the usefulness of percutaneous discoplasty as a minimally invasive therapy in elderly patients.

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