



Spinal balloon nucleoplasty: A hypothetical minimally invasive treatment for herniated nucleus pulposus

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Summary Low back pain is the most common cause of disability under the age of 45. The annual incidence of back pain is estimated to be 5% and the lifetime prevalence is 80%. Majority of the patients with persistent symptoms are suffering from radiculopathy that is mainly caused by a herniated nucleus pulposus (HNP). HNP can heal spontaneously due to spontaneous resorption. Besides pressure nucleus pulposus, without any compression, may induce similar changes when applied epidurally to the nerve roots. Nevertheless, combination of chronic mechanical compression and application of nucleus pulposus causes a more pronounced nerve injury. When dual pathophysiology (pressure and inflammatory reaction), spontaneous resorption, and natural course of HNP are taken into account, any treatment modality that eliminates both the pressure and contact of the nucleus pulposus with the nerve root via creating extra time for healing to take place might prove beneficial. These requirements can be provided by spinal balloon nucleoplasty (SBN), which can be used in combination with other treatment modalities such as chymopapain injection. In this hypothetical method, epidural access to the subarachnoid space is established via epidural needles, thereafter a specially designed balloon tipped catheter is advanced. When the catheter is ideally placed with the help of CT or MRI, the balloon at the tip is inflated to relieve pressure and to prevent contact of the nerve root with HNP. The answer to the question, will SBN find a place in clinical practice? is obscure. But a homology can be established with uterine fibroid embolization, which has found clinical use in a period of 30 years approximately.
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Introduction

Low back pain is the most common cause of disability under the age of 45. And sciatica, caused by a lumbar

herniated disc, is the most common cause of radicular leg pain in adult working populations [1]. Although most patients improve over several weeks, surgical treatment is frequently considered for patients with symptoms that are persistent or severe. The recurrence rate after surgery is approximately 10% [2]. However, with conservative treatment 20–30% of the patients complain of back pain at one-year follow-up [3]. The course of HNP induced

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symptoms is usually benign because of spontaneous resorption [4]. The majority of patients suffering from a radiculopathy caused by a herniated nucleus pulposus (HNP) can heal spontaneously. Regarding the natural history of HNP and recurrence of symptoms after surgical management, some novel treatment modalities that can be used to create extra time for spontaneous resorption to occur via relieving patient complaints and these kinds of approaches might find important clinical use.

Spinal balloon nucleoplasty: A hypothetical minimally invasive treatment

In this technique a midline spinal puncture is performed via a needle like 16G Tuohy epidural needle and access to subarachnoid space is established between adjacent spinous processes. The interspinous area is identified by palpation as in the conduction of spinal anesthesia. After entering to the subarachnoid space, a specially designed balloon tipped catheter is advanced (Fig. 1). The curved needle tip is used to deliver the catheter to the level of herniation, either downwards or upwards. And again curved needle tip can be used for right to left manipulation of the catheter tip. The location of the catheter tip can be determined with either computerized tomography or magnetic resonance imaging. When the catheter is ideally placed (Fig. 2), the balloon at the tip is inflated (Fig. 3). So that pressure is exerted both on the HNP and the

spinal nerve. Probable benefits of the pressure in this confined area may include:

- Forcing the HNP back into annulus fibrosus. Complete retraction may not be accomplished, but partial retraction of the nucleus pulposus (NP) might also create significant effects.
- Displacement of the nerve route. Although complete or effective retraction of HNP may not be obtained, displacement of the spinal nerve route to the distal or proximal part of herniated part can help to relieve symptoms also.

Retraction of HNP and displacement of spinal nerve route may help to relieve pressure on the nerve root and prevent contact of the NP with spinal nerves. After achievement of the desired effects, which can be documented with imaging, the catheter is pulled back (Fig. 4). Then the access needle is rolled back to the level of epidural space. At this point a sealing material is applied such as a thrombocyte patch or a specially designed equipment homologous with the Angio-Seal® (St. Jude Medical, Stratford Upon Avon, UK) that is used in arteriography may be used, and the needle is withdrawn (Fig. 4).

When to use spinal balloon nucleoplasty

This minimally invasive treatment primarily was planned to be used for herniations at the level of cauda equina. Because the balloon tip, when

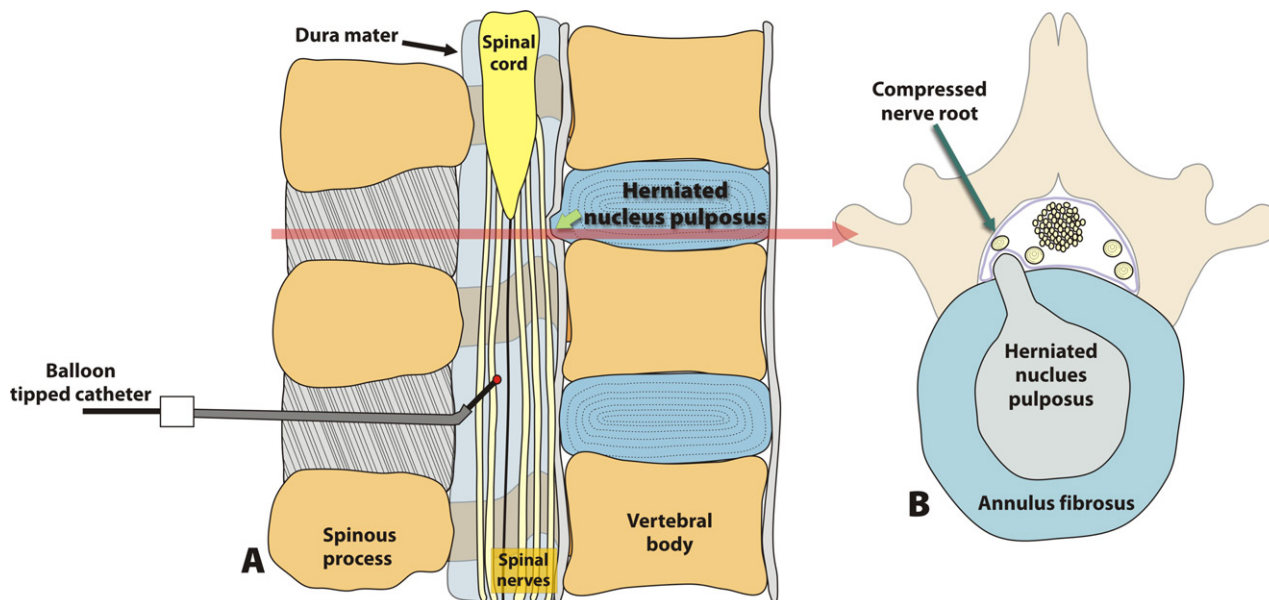


Figure 1 Herniated nucleus pulposus exerts pressure on the nerve roots and access of the catheter to the subarachnoid space: (A) longitudinal view and (B) transverse view.

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