

PREDICTION OF LUMBAR DISC HERNIATION RESORPTION IN PATIENT WITH ACUTE LEFT SCIATICA: AN MR STUDY

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ABSTRACT

Symptomatic lumbar disc herniations are very common. Hernia resorption can occur through a “self-healing” process, however, this phenomenon remains poorly understood. The Authors present a rare case of a patient suffering from acute left lumbosciatica, in which the results of the Magnetic Resonance Imaging (MRI) suggested a future natural healing of the herniated disc. In regard to the treatment, in particular, thanks to the MRI scans, it was possible to appreciate the concomitance of partial gaseous vacuolization of the hernia with colliquation of the peripheral portion, which are predictive signals of a future complete natural reabsorption of the herniated disc.

KEYWORDS: *disc, herniation, outcomes, prediction, prognosis, resorption*

INTRODUCTION

Almost 80% of sciatica due to herniated discs evolve favorably towards spontaneous healing after about a year; numerous studies have shown that herniated discs can reduce in size or even disappear, simultaneously with the reduction of clinical signs.

To date, it is difficult to formulate a precise prognosis of disc sciatica and, above all, to be able to determine its duration and evolution because various factors come into play, mainly mechanical and enzymatic-inflammatory phenomena. Mechanical factors are those linked to the anatomy of the hernia and the structures that surround it, such as nerve roots, ligaments, veins, meninges, and epidural fat.

In regards to enzymatic and inflammatory factors, it is necessary to underline that although the intervertebral disc is paradoxically the most important avascular tissue in the body, its posterior part is the site of degradation reactions. These reactions are caused by metalloproteases and cytokines, which are responsible for pain but also the degradation and reabsorption of the herniated material.

Thanks to the development of Computed Tomography (CT) and especially Magnetic Resonance Imaging (MRI), regression and even the disappearance of herniated discs, simultaneously with the improvement of clinical signs, could be highlighted in several studies. The clinical improvement has often preceded the radiographic modification of the hernia: the decrease in the volume of the hernia is more important and rapid if it is a voluminous and migrated hernia; small hernias with intact posterior vertebral ligaments are less likely to regress.

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Two types of cells can be involved in the degradation of the intervertebral disc: the disc's own cells and macrophages; morphologically the cells of the annulus and nucleus are very similar to articular chondrocytes. These cells synthesize the extracellular matrix and produce proteoglycans; macrophages and other mononuclear cells come from the neo-vascularization and granulation tissue surrounding the fibro-cartilaginous fragment. This granulation tissue is present around the extra-ligamentous hernias. Furthermore, there are enzymatic factors, such as metalloproteases (collagenase, stromelysin, etc.), which play a major role in the disc degradation process.

Cytokines belong to the other family of enzymes, of which interleukin I is the main pro-inflammatory present in the degenerated disc, as well as TNF, which plays a direct role in the genesis of pain, as it causes lesional edema and demyelination of nerve fibers.

Therefore, as a direct consequence of the presence of herniated material, a true immunological reaction develops: neo-vascularization appears, and the active macrophages produce TNF, which induces the production of stromelysin, which leads to the reabsorption of the disc tissue due to progressive degradation of the extracellular matrix. This mechanism could thus explain the more rapid degradation of large migrated hernias; it is because of this mechanism that ED can regress over time until it disappears spontaneously (1-4).

CASE REPORT

G.A., a 67-year-old male, following the sudden onset of acute left lumbosotalgia, asks for advice from his doctor, who recommends thiocolchicoside 4mg/2ml IM associated with piroxicam 20mg/1ml. In the case of the persistence of the symptoms, the physician asks to carry out an MRI scan. In fact, the symptoms appear to be completely resistant to the established pharmacological therapy so the MRI scan is carried out 20 days after the onset of the symptomatology.

The Magnetic Resonance investigation shows the presence of a herniated extruded disc in the left paramedian area corresponding to L5-S1, with extruded material that migrates caudally, positioning itself behind the posterior wall of S1, imprinting the left S1 root, therefore with a situation of disc-radicular conflict, a finding consistent with the sciatica symptoms in the distribution area of the left S1 complained of by the patient.

The disc herniation presents a dual component of signal hypointensity in T1-dependent sequences with a more cranial area characterized by marked hypointensity, a finding compatible with a partial vacuolization of the hernia and a more cranial portion with disc-like signal hypointensity (Fig. 1). The T2-dependent scans document both in axial and sagittal projections, the presence of a more cranial area in the context of the hernia characterized by signal hypointensity compatible with the partial vacuolization of the hernia and a peripheral "target" portion around the vacuolized portion characterized by signal hyperintensity compatible with a pattern of colliquation of this tissue. In contrast, in the more caudal scans, there is an evident hernial component of disc-like intensity. (Fig 2 a-c).



Fig 1. Sagittal T1 MRI: left paramedian extruded disc herniation. The area of more marked hypointensity (**arrow**) appears to be partially vacuolized.

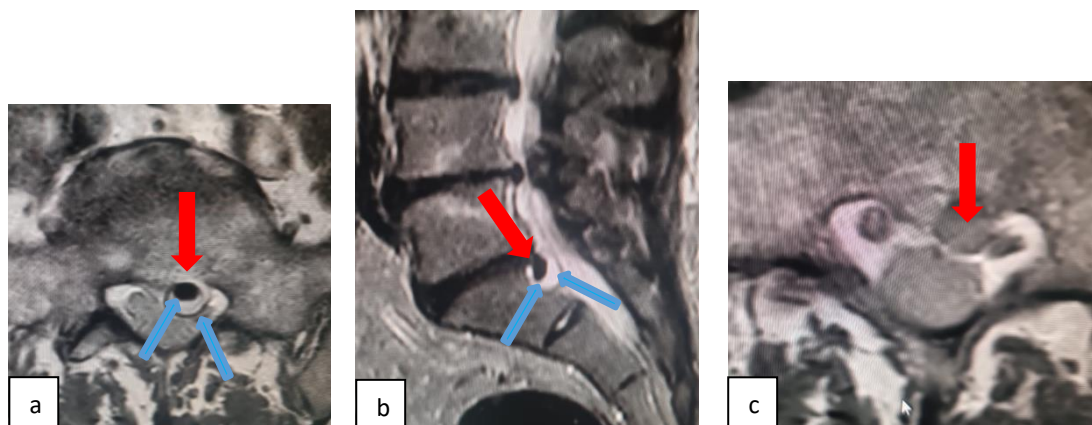


Fig 2. *a): T2 axial scan: Partial vacuolization of the hernia (hypointense signal) (red arrow) with hyperintense "target" peripheral portion with high water content in relation to colliguation phenomena (blue arrows); b): Sagittal T2 STIR MRI: partial vacuolization of the hernia (red arrow), peripheral colliguation (blue arrows); c): More caudal T2 axial MRI scan: the herniated disc presents a disc-like intensity in its most caudal portion (red arrow).*

DISCUSSION

Spontaneous healing of herniated discs was first reported in 1984 (5, 6). In 1990 Saal et al. (7) selected patients diagnosed with herniated discs by Computed Tomography (CT) in order to explore their natural history. This demonstrates that the larger the dimensions of the disc protrusions, the greater the signs of resorption, while the smaller ones had lower resorption ratios.

In recent years, researchers have paid increasing attention to the resorption of herniated discs. A meta-analysis showed that the average incidence of symptomatic resorption of herniated discs was 62-66% in 38 clinical studies reported over the last 30 years (8). A recent retrospective analysis also showed that 59.06% of patients treated conservatively had resorption of the herniated disc (9).

Furthermore, the North American Spine Society's evidence-based clinical guidelines for the diagnosis and treatment of lumbar disc herniation with radiculopathy (10) emphasized that with the advancement of natural history, the herniated disc material of most patients may spontaneously shrink or degenerate. At the same time, as the size of the hernia decreases, the clinical symptoms also improve. The phenomenon of herniated disc resorption is, therefore, not random, and the clinical symptoms of most patients can be alleviated or even disappear without necessarily having to resort to surgery.

It is generally accepted that herniated discs are more prone to regression than other types of disc disease. In 2015, Chiu et al. systematically evaluated the probability of resorption of different types of herniated discs, concluding that the majority of herniated discs can be spontaneously absorbed after conservative treatment and that extruded herniations had higher regression rates (8, 11).

Resorption may be favored when the herniated disc contains most of the nucleus pulposus, while the presence of cartilaginous tissue inhibits the resorption of the herniation. To demonstrate this, Iwabuchi et al. (12, 13) used plain MRI to predict the effect of herniated disc composition on resorption based on signal intensity in T1 and T2 weightings. Failure of spontaneous absorption of herniated discs is mainly related to cartilage protrusion (14).

The effect of the disc component on resorption may depend mainly on whether it promotes vascularization, while hyaline cartilage fragments tend to resist revascularization and resorption. Therefore, if the MRI shows that the herniation is predominantly made up of the nucleus pulposus, this could favor resorption; however, a high percentage of cartilaginous tissue can make conservative treatment of the herniated disc difficult and may not be effective.

It is now known that the intervertebral disc dissociated from the epidural space can cause an autoimmune reaction, which leads to an inflammatory reaction and to the formation of surrounding granulation tissue, which manifests itself as a ring peripheral to the herniated disc tissue. MRI after administration of a paramagnetic contrast medium can perfectly document this mechanism. The evident increase in the edges of the herniated tissue suggests the possibility of spontaneous absorption, which is also considered an important factor in evaluating spontaneous regression of the herniated disc (15-17).

Ring enhancement is believed to be related to the vascularization of the lumbar disc herniation and the formation of inflammatory granulation tissue (18-19), and the neovascularization and inflammatory response of the herniated disc are

the key factors for resorption (20). Therefore, magnification around the protrusion can be used as an imaging manifestation of new blood vessel formation and inflammation in the prominent tissue, which may predict resorption.

Three mechanistic hypotheses have been reported in the literature, which could be jointly involved in the resolution and disappearance of the herniated disc. The first mechanism is the retraction of the protrusion, which can occur without separation of the protrusion from the fibrous ring (21). The second mechanism is the gradual dehydration and contraction of the herniated nucleus pulposus, which causes the retraction of the protuberances in the annulus fibrosus (22). A third mechanism, which has received widespread attention, states that fragments of herniated disc material enter the epidural space, triggering an autoimmune response that includes inflammatory cell infiltration and neovascularization. The autoimmune system recognizes enial protrusions as “foreign” in the vertebral epidural vascular space, which in turn triggers a cascade of inflammatory responses, including neovascularization, matrix protease activation, increased levels of inflammatory mediators, phagocytosis of inflammatory cells and enzymatic degradation (1, 7, 8).

Macrophages are a key immune regulator that triggers the resorption of extruded herniated discs. Macrophage infiltration and activation are critical steps in the resorption process. In herniated disc fragments, there is increased expression of IL-12 and IFN- γ compared to protruded discs (23). IFN- γ produced by Th1 lymphocytes recruits and activates more macrophages (24). Specifically, contact of the extruded hernia tissue with the systemic circulation leads to lymphocyte activation and secretion of IFN- γ , promoting macrophage recruitment. High expression of IFN- γ in herniated disc may represent a specific immune response against the herniated tissue (25). These findings suggested that the mode of immune activation in the extruded hernia involves the infiltration and activation of macrophages.

Vascular growth has been recognized as an essential feature of spontaneous absorption of extruded hernias (26, 27). Histological examination revealed neovascularization at the site of a herniated disc (27, 28). Mediators inducing neovascularization of the extruded hernia mainly include TNF- α , VEGF, basic fibroblast growth factor (bFGF), and platelet-derived growth factor (PDGF) (15, 28).

The activity of different types of macrophages and secreted pro-angiogenic mediators are the main regulators of neovascularization in the inflammatory response. In the case presented, the partial vacuolation of the hernia peripherally to which colliquated tissue is recognizable to signify the ongoing presence of a process of degeneration or organic disintegration of the extruded disc hernia appears to be predictive signs of possible dehydration of the herniated disc extruded with possible resolution of sciatica symptoms without having to resort to surgical intervention, thus giving the possibility of managing the patient conservatively.

These MRI findings appear to be rarely encountered in daily clinical practice. Therefore, we wanted to highlight them in this note as a predictive finding of possible natural healing of an extruded disc herniation in a patient suffering from acute left sciatica.

CONCLUSIONS

Extruded disc herniation is one of the most common vertebral column diseases. With the support of radiological technology, especially MRI, doctors can scientifically and reasonably diagnose the presence of extruded disc herniation and then provide patients with feasible and effective treatment strategies.

The extrusion of the disc material creates conditions favorable to the infiltration of macrophages and neovascularization, leading to possible natural healing. However, if the tissue of the herniated disc contains a greater percentage of cartilage, this does not favor the infiltration of macrophages and the growth of blood vessels, thus preventing the occurrence of reabsorption of the extruded hernia. In the rare case presented by us, the characteristics of the MRI are predictive for possible natural healing of the extruded hernia, therefore clinically addressable with conservative therapy or even without intervening while waiting for healing, thus avoiding the need for surgical intervention.

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