THE SEVERAL FACES OF SCHMORL’S NODE: PICTORIAL ESSAY

AS DIVERSAS FACES DO NÓDULO DE SCHMORL: ENSAYO PICTÓRICO

INTRODUCTION

Schmorl’s nodes (SNs) represent intervertebral disk tissue that has been displaced through the cartilaginous endplate into the vertebral body. These cartilaginous nodes are most frequently observed in the lumbar and lower thoracic spine, a common finding among asymptomatic patients. However, when an SN is depicted, its radiographic and tomographic appearance is usually typical, with a small, focal, rounded form, and radiolucency in the subchondral bone of the vertebral body, broad-based at the vertebral plateau. SNs may be difficult to detect on conventional radiographs when they are small. However, when an SN is depicted, its radiographic and tomographic appearance is usually typical, with a small, focal, rounded form, and radiolucency in the subchondral bone of the vertebral body, broad-based at the vertebral plateau and with varying degrees of adjacent reactive sclerosis. Vacuum phenomena in the intervertebral disc space or within the SN, may also be seen. (Figures 2 and 3)

Weakening of the cartilaginous endplate and subchondral bone, believed to be the cause of SNs, might be related to pathologic conditions such as Scheuermann’s disease, metabolic diseases and neoplastic disorders of spine. A previous study with histological evaluation suggested that SNs may be the result of ischemic necrosis beneath the cartilaginous endplate, and that disc herniation into the vertebral body is a secondary phenomenon. The occurrence of SNs has also been linked to trauma and vertebral fractures; these are often described as acute SNs, especially in symptomatic cases, which have been associated with acute trauma or microtrauma. Acute SNs have recently been documented as a rare complication.

Keywords: Spine; Intervertebral disc displacement; Radiography; Magnetic resonance imaging.
In clinical practice, non-acute SNs are commonly depicted as incidental findings in imaging assessment, and are usually considered idiopathic. In magnetic resonance imaging (MRI), enhancement of SNs may be observed after intravenous gadolinium administration in patients with and without back pain. This enhancement was shown to be present in larger SNs, which are believed to be more frequently associated with surrounding bone marrow edema in patients with back pain, as compared to asymptomatic patients.

The purpose of this review is to present imaging patterns of symptomatic SN caused by different etiologies, including findings derived from radiographs, computed tomography (CT), and magnetic resonance imaging (MRI).

**TRAUMATIC SNS**

SNs may be the result of acute trauma, as commonly observed in subjects with back pain. Another possible presentation of traumatic SNs is a large vertebral body cystic lesion associated with focal endplate disruption. This type of presentation may potentially lead to a misdiagnosis of more aggressive pathologies, such as infection or neoplasm. Zones of weakness in the endplate cartilage may predispose to SNs following subclinical trauma. In such cases, the trauma episode may not be well documented, and the radiological changes at the discovertebral junction may be atypical, and easily misinterpreted as evidence of other conditions. Acute and subacute SNs associated with trauma may exhibit a pattern of surrounding bone marrow edema in MRI.

**Hemispherical spondylosclerosis or discogenic bone sclerosis with SNs**

Hemispherical spondylosclerosis has initially been described on conventional radiographs as a dome-shaped sclerosis of the vertebral body, being broad-based at the discovertebral junction. This term was first used by Dihlmann, and degenerative disk disease is considered the most common cause of this condition, though it may also occur in conjunction with infection or metastasis.

Before the term hemispherical spondylosclerosis was used, a series of cases thought to be related to subclinical trauma showed a similar pattern of broad-based bone sclerosis in about half of all cases. Histopathologic evaluation showed only reactive granulation tissue and microscopic bone fragments. CT with multiplanar reconstructions may be useful to identify small SNs associated with reactive subchondral broad-based bone sclerosis. (Figures 5 and 6)
Calcific discitis with intravertebral migration

Calcification of the intervertebral disk represents a common incidental finding on radiographic examination. Painful disc calcification has been more often reported in the pediatric population, and symptoms may include torticollis, fever, leukocytosis and elevated erythrocyte sedimentation rate. The cause of calcific discitis in childhood is not known, but the prognosis is excellent, as the pain resolves within a few days or weeks with conservative treatment, in most cases. Acute calcific discitis may, in rare cases, involve the adult population. (Figure 7) On radiographs, symmetrical calcifications typically involve the nucleus pulposus and the cervical spine. Such disk calcifications may migrate into the vertebral bodies following an SN, often associated with adjacent reactive bone sclerosis. Other sites of migration include the intervertebral foramina, the spinal canal, and the adjacent soft tissues. The MRI features of calcific discitis were recently described, and include disc swelling and bulging in the early stages, which may be seen before calcifications are visible on plain films. Changes in signal intensity may also occur within the adjacent vertebral bodies.

Vertebral metastasis with SNs

Any disorder that weakens the subchondral bone of the vertebral body may lead to endplate disruption and intravertebral disc herniation. The association between SN and vertebral metastasis has been described in cadavers with prostatic cancer. Vertebral metastases from other primary neoplasms may also be seen in conjunction with SNs. (Figures 8 and 9)
Inflammatory/infectious diseases with SNs

Weakening of the endplate and SNs may, in sporadic cases, be related to infectious spondylodiscitis (Figure 10) or to other inflammatory spine diseases, such as ankylosing spondylitis.16 (Figure 11)

REFERENCES


Figure 9. 35-year-old man with back pain and biopsy-proven thymus carcinoma vertebral metastasis. (A) Sagittal T1-weighted MRI after intravenous gadolinium administration showed pathologic bone marrow enhancement adjacent to SNs at the superior T12 endplate and the inferior L2 endplate (arrows). A nodular metastasis is also observed at L5 (arrowheads). (B) Sagittal T2-weighted MRI revealed pathologic fractures associated with SNs at the superior T12 endplate and the inferior L2 endplate (arrows).

Figure 10. 11-year-old girl with low back pain and spine infection. Percutaneous biopsy with a positive culture proved Staphylococcus aureus spondylodiscitis. (A to C): initial MRI. (D): 6-month follow-up MRI. A Sagittal T2-weighted MRI depicted a SN (arrow) at the superior endplate of the L3 vertebral body. Note the paravertebral inflammatory collection, consistent with an abscess (arrowheads, A,D). T1-weighted sagittal, B) and axial, C) T1-weighted MRI after intravenous gadolinium administration also showed the SN (arrow), with diffuse marrow enhancement in the L3 vertebral body. The note the pathologic fracture adjacent to SNs at the superior T12 endplate and the inferior L2 endplate (arrows).

Figure 11. 39-year-old man with ankylosing spondylitis (AS) and low back pain. Biopsy was necessary to rule out infection since destructive and inflammatory changes were observed. Changes were progressive in L5-S1 discovertebral transitions; the biopsy addressed this region. Sagittal T2-weighted fat-suppressed (A) and T1-weighted (B) MRI with arrows pointing at a small SN at the superior endplate of S1 and a larger SN at the L5 endplate. (C) Sagittal T1-weighted fat-suppressed MRI after intravenous administration of gadolinium showed inflammatory peripheral enhancement at the SNs (arrows).

FINAL CONSIDERATIONS

SNs represent a relatively common finding in spinal imaging. This condition is usually asymptomatic, and its etiology remains unclear. Even though SNs are almost always related to benign pathology, its presence does not rule out the possibility of coexistent malignant disease in the vertebral body. Radiologists and spine surgeons must be aware of uncommon conditions that might be associated with SNs, as well as related radiological findings, in order to avoid misdiagnosis.

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