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Percutaneous Vertebroplasty in Painful Schmorl Nodes

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Abstract

The Schmorl node represents displacement of intervertebral disc tissue into the vertebral body. Both Schmorl nodes and degenerative disc disease are common in the human spine. We performed a retrospective study, for the period from January 2003 to February 2005, evaluating 23 patients affected by painful Schmorl nodes, who underwent in our department percutaneous transpedicular injection of polymethylmethacrylate (vertebroplasty) in order to solve their back pain not responsive to medical and physical management. Eighteen patients reported improvement of the back pain and no one reported a worsening of symptoms. Improvement was swift and persistent in reducing symptoms. Painful Schmorl nodes, refractory to medical or physical therapy, should be considered as a new indication within those vertebral lesions adequately treatable utilizing Vertebroplasty procedure.

Key words: Schmorl node—Vertebroplasty—Spinal interventional radiology—Back pain

Back pain is an important social problem affecting more than 80% of the adult population who will experience spinal pain at a certain point of their live, either from aging or due to sports activity [1, 2]. As the population increases in age, payment for medical care and indirect costs from loss of productivity will increase [3].

In back pain diagnosis, it is important to distinguish between pain that arises directly from spinal structures, such as paraspinal muscles, intervertebral discs, vertebral bodies, and so forth, and pain referred from other regions. In this last case, back pain might be due to colon disease, pelvic inflammation, or cancer of the ovary, uterus, or prostate. As one might expect, back pain referred from visceral pathologies reveals no signs of stiffness and movement of the back does not increase the pain [4–6].

Musculoskeletal disorders related to fractures, infections, or expanding lesions of the vertebral bodies and other bony elements of the lumbar column have a major impact on society in terms of morbidity, long-term disability, and economics [7]. The most important cause of back pain is vertebral fracture, because, each year, more than 438,750 vertebral collapses secondary to osteoporosis are diagnosed in the European Community (EC) (117 of 100,000 individuals each year). Other causes of painful compression fracture include malignant involvement of the spinal column with vertebral disruption or lysis (metastasis, myeloma, and lymphoma), hemangioma, and vertebral osteonecrosis [8]. To manage these symptoms, some therapies, either medical or surgical, are utilized. Percutaneous vertebroplasty is a new alternative option for the treatment of back pain associated with vertebral compression fractures [9, 10] not responding to conservative therapy.

A back pain cause that is often not adequately considered is the fracture of the vertebral endplate that might extend to a degree that allows nuclear material to extrude into the vertebral body—a real ''vertebral disk herniation,'' named the Schmorl node (Figs. 1a and 1b). Although, in the past, Schmorl nodes have been considered to be clinically insignificant, clearly they might be an active symptomatic process and etiology of pain in some patients [11, 12].

The purpose of our study was to determine the efficacy of percutaneous vertebroplasty in the treatment of back pain associated with painful vertebral body Schmorl nodes.

Materials and Methods

We performed a retrospective study of the period from January 2003 to February 2005, evaluating 163 patients who underwent in our department percutaneous transpedicular injection of polymethylmethacrylate (vertebroplasty) in order to solve their back

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Fig. 1. Pretreatment sagittal MRI (T2-weighted TSE and T2-weighted TSE with fat suppression sequence) in symptomatic L3 vertebra shows increased signal intensity in the vertebral body bone marrow surrounding the node.

pain not responsive to medical and physical management [13–15]. In these 163 patients, the total amount of vertebral bodies treated was 216. Of these patients, a subgroup of 23 had assessed painful Schmorl nodes.

The study included 23 patients, 7 men (30.5%) and 16 women (69.5%) of a mean age of 72.5 years (range: 61–84 years), presenting back pain for at least 6 months (range: 4–7 months), refractory to conservative therapy consisting of analgesics, bed rest, external bracing, and physical therapy. All women at admission had a diagnosis of osteoporosis, performed in other hospitals by bone densitometry examination executed by DEXA at the lumbar and femural levels. All of these patients had a singular localization of a painful Schmorl node at lumbar vertebral bodies.

Patients included in our study underwent a plain X-ray, magnetic resonance imaging (MRI), and multislice computed tomography (MSCT) to evaluate the main cause of pain and in order to plan the treatment. MSCT was performed also to study the vertebral structures before the vertebroplasty procedure.

A plain radiograph of the spine, performed using double orthogonal projection, was made at the first examination to assess the presence of bone abnormalities in patients with back pain resulting from musculoskeletal troubles. An MR examination was reserved for patients suspected of suffering from a painful Schmorl node on the basis of the absence of other major vertebral body abnormalities. All patients who underwent an MR examination in our department were examined with a Gyroscan Intera Master, 1.5 Tesla (Philips, Holland), adopting an exam protocol based on T1 (TR 450 ms, TE 13 ms, NSA 4, FOV 325, Matrix 256), T2 (TR 2952 ms, TE 120 ms, NSA 6, FOV 325, Matrix 512), and STIR T2 (TR 1650 ms, TE 22 ms, NSA 3, FOV 325, Matrix 304) sequences to show altered signal intensity [16–18].

Before the vertebroplasty procedure, all patients underwent a MSCT examination utilizing a 16-row MSCT (Light-Speed, GE) to evaluate preprocedural vertebral body structures and, in particular, the posterior wall in those cases in which the Schmorl node was located in the posterior third of the vertebral body.

Procedure

Informed consent was obtained from all patients prior to the procedure. Vertebroplasty was performed under local anesthesia, with patient placed in the extended prone position with padding beneath the upper chest and pelvic regions [19, 20].

After confining the vertebra and its corresponding pedicles to be treated, a small cutaneous incision was made in the lumbar area toward which a bone biopsy needle of 11/13 gauge was introduced monolaterally through the posterior portion of the pedicles [21–23]. The needle tip was pushed forward carefully and placed close to the painful Schmorl node within the vertebral body, with the beveled part directed toward the apex of the Schmorl node (Figs. 2a and 2b). Cement was prepared by combining a liquid monomer and a powder polymer and this was amalgamated to obtain an adequate thickness. The procedure is concluded with injection of polymethylmethacrylate (PMMA) into the

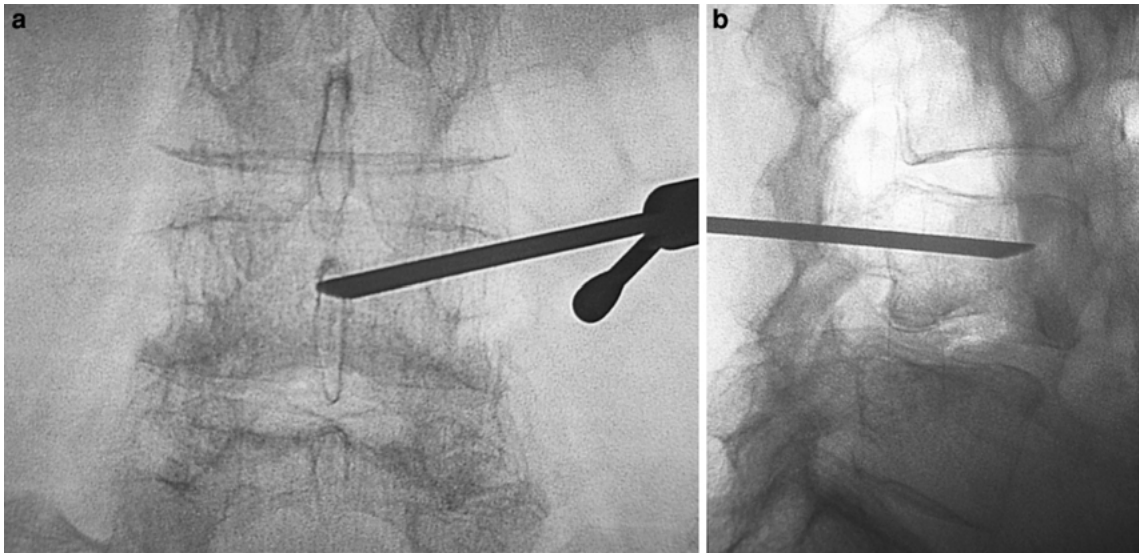

Fig. 2. Intraoperative antero-posterior and latero-lateral fluoroscopic images of vertebroplasty treatment performed at the L4 level, positioning of the needle within vertebral body with the beveled part directed toward the apex of the Schmorl node.

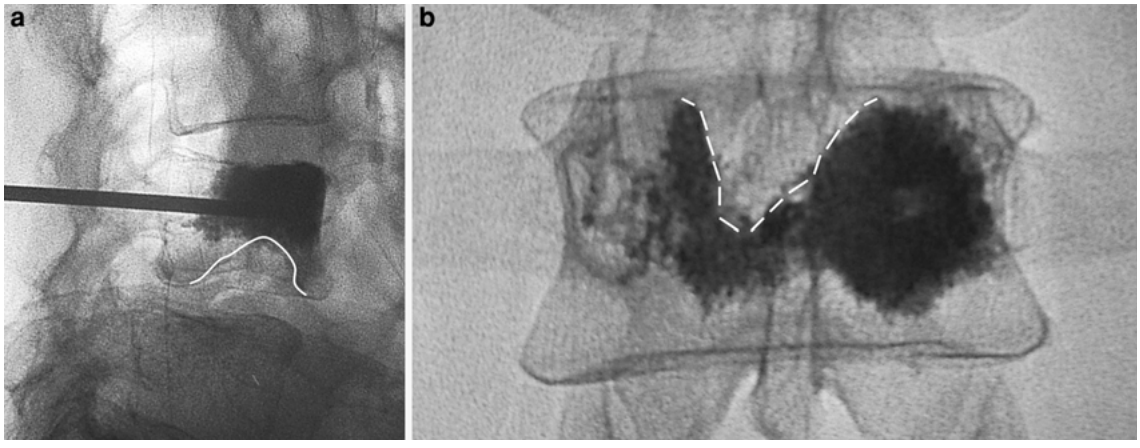

Fig. 3. Intraoperative latero-lateral fluoroscopic images of deliver of bone cement into the vertebral body and postoperative antero-posterior fluoroscopic images of PMMA distribution exactly following the profile of the Schmorl node (white dashes).

vertebral level and around the profile of the Schmorl node. With removal of the biopsy needle and skin closure, the procedure was completed; the patient was instructed to remain supine in bed for the next 4 hours [24]. The length of the process for each vertebra is around 20–25 min.

Results

In all patients, preprocedural radiological findings confirmed the presence of painful Schmorl nodes in absence of other causes of back pain, such as herniated intervertebral disc, body vertebral fracture, or body malignant lesions. In particular, MR in the sequences with suppression of fat was, in all cases, a valuable aid both in the evaluation of the location and dimension of Schmorl nodes and in the delineation of the amount of perilesional intraspongious suffering.

The vertebroplasty procedures were technically successful in all patients. PMMA leakages beyond the confines of the vertebral body were not observed. In particular, contrary to our preliminary hypothesis, no outflow of PMMA cement into the herniated vertebral disc was noted. The PMMA delivered within the vertebral body followed the inner profile of the Schmorl nodes, placing exactly upward the hyper-intense area (T2 and STIR sequences) observed in MRI evaluation (Fig. 3 a, b).

Clinical examination of the patients was performed 4 hours after the procedure, evaluating the presence and degree of back pain (improved, unchanged, or worse in respect before treatment). Eighteen patients reported improvement of the back pain, whereas five patients reported unchanged back pain. No one reported a worsening of symptoms. Improvement was swift and persistent in

reducing symptoms, decreasing from an average of 8.4 points of VAS to 2.3 (VAS of Huskisson = visual analog scale, a pain score with points assigned subjectively from patients preprocedure and postprocedure in a range between 0 (absence of pain) and 10 (maximum pain)).

Discussion

The International Association for the Study of Pain (IASP) has defined pain as ''an unpleasant sensory and emotional experience associated with actual or potential tissue damage'' [25]. This rather broad description implicates both sensory and emotional factors involved in the pain experience. The emotional part is a complex signal system with cognitive, emotional, and behavioral components and occurring subsequent to nociceptive stimulation [26]. Actual and potential tissue damage refers to the fact that pain can occur in the absence of tissue damage and, therefore, is not invariably linked to a damaging stimulus.

Any structure in the lumbar spine possessing a nerve supply can become a source of pain when affected by pain-producing tissue damage [27]. Therefore, the possible sources of pain can be determined by reviewing the innervated structures and the lesions that might affect them. Innervated structures of the lumbar spine are the vertebral venous plexuses and the dura mater, the zygapophysial joints, the ligaments of the vertebral arches, the back muscles and their fascia, the vertebral bodies and their covering periosteum, the vertebral laminae, the longitudinal ligaments, and the discs.

In the case of vertebral endplate fracture and nucleus polposus herniation (as in case of Schmorl nodes), nociceptors located in the outer third of the anulus fibrosus as well in the periosteum of the vertebral bodies were probably activated [28]. It must be emphasized that for a Schmorl node to be considered symptomatic or active subsequent to trauma, the MRI should demonstrate the T1 and T2 signal changes typical of an inflammation area.

In a study by Hamanishi et al. [16], the MRI examinations findings of lumbar spine in 400 patients with low back pain and a control group of 106 patients were compared; a significantly higher frequency of Schmorl nodes was found in the symptomatic group (19%) in comparison with the control group (9%). Schmorl nodes that show enhanced signal intensity after intravenous administration of a gadolinium-based contrast agent and those accompanied by bone marrow changes were found to be more frequently in patients with back pain than in asymptomatic patients [12].

Also, Takahashi et al. [29], in a more recent study, found a correlation in symptomatic and asymptomatic patients with MR evidence of Schmorl nodes. Patients with symptomatic Schmorl nodes had pain on percussion and manual compression of the vertebra. They found no differences in the two groups on plain radiographic evaluation, but on MRI, in symptomatic cases, vertebral body bone marrow surrounding the node was characterized by a low-intensity signal on T1-weighted sequences and a high-intensity signal on T2-weighted images. The signal changes on MRI are reflective of bone marrow edema and inflammation often seen in cases of fracture. The MRI findings in Takahashi et al.'s study were confirmed by histological section in two cases where surgery was performed.

Even if Schmorl nodes are frequent findings in persons without back pain and typically are asymptomatic and do not require treatment, sometimes they are related to spinal tenderness. Symptomatic Schmorl nodes should represent a fresh fracture of the vertebral endplate, frequently in the posterior portion, which allows vertical disc herniation and nuclear migration, and this might cause diffuse lower back pain without associated radicular findings often seen in transverse-type herniations [11].

In symptomatic cases, actually the first therapeutic approach is conservative therapy with analgesic drugs, bed rest, and bracing; in those cases in which medical therapy is ineffective, some authors propose surgical treatment. In fact, Hasegawa et al. [30] reported a case of the eradication of an intervertebral disc containing a Schmorl node and lumbar interbody fusion to solve the painful Schmorl node.

Vertebroplasty, minimal invasive percutaneous injection of acrylic cement within the vertebral body, might be a possible alternative approach in treating a painful Schmorl node refractory to conservative therapy. Our study demonstrates that vertebroplasty generates back pain relief in a high number (18/23) of patients without complications. Moreover, contrary to our preliminary idea, there was no PMMA leakage into the intervertebral space. During the procedure, if the beveled part of the needle is directed toward the apex of the Schmorl node, PMMA delivered tends to dispose in correspondence with the inner profile of the Schmorl nodes, placing exactly upward the hyper-intense area (T2 and STIR sequences) observed in MRI evaluation, without surpassing vertebral body margins.

We could hypothesize that the particular disposition of PMMA is related whether to the pressure of the herniated disc into the vertebral cavity or to the presence of the marginal bone sclerosis. Vertebral osteosclerosis is determined by bone trabecular impaction into the vertebral body cancellous bone and their increasing thickness. Pain, ineffective medical or physical therapy, and quality life impairment, make painful Schmorl nodes lesions adequately treatable by using vertebroplasty, growing in this way the list of indications of this interventional radiology procedure.

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