Review

Aseptic spondylodiskitis in rheumatic diseases

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ABSTRACT

Aseptic diskitis is relatively common. Several rheumatic diseases involving the spine may have this complication. As this condition mimic infectious diskitis, it is important to recognize it. Clinically, it is characterised by vertebral pain of an inflammatory nature, occasionally accompanied by fever and an increase in the erythrocyte sedimentation rate. Radiologically, the decrease in the articular space and the irregularity of the vertebral plates are of particular importance. Although uncommon, it is necessary to bear in mind this possibility when the etiological search for a possible infectious diskitis proves fruitless. A MEDLINE (1986-2000) and PUBMED (1966-2000) search of relevant articles was performed. Descriptors used were aseptic diskitis, spondylodiskitis, pseudodiskitis and pseudoarthrosis.

Introduction

Pseudodiskitis or aseptic spondylodiskitis is an entity that behaves clinically and radiologically like an infectious diskitis, but has a non-infectious aetiology. Clinically, it is characterised by vertebral pain of an inflammatory nature, occasionally accompanied by fever and an increase in the erythrocyte sedimentation rate (ESR). Radiologically, the decrease in the articular space and the irregularity of the vertebral plates are of particular importance. Although uncommon, it is necessary to bear in mind this possibility when the etiological search for a possible infectious diskitis proves fruitless. Several diseases involving the spine occasionally simulate infectious diskitis (Table I). We begin by detailing DISH and ankylosing spondylitis, in addition to the spondyloarthropathies, as they share some of the etiopathogenic theories concerning this particular complication. The remaining diseases are subsequently explained.

Aseptic diskitis in diffuse idiopathic skeletal hyperostosis (Forestier-Rotes' disease)

DISH is a rheumatic disease that consists of a proliferative ossification of the periosteum, ligaments and tendons, predominantly affecting the axial skeleton. Although most common in older patients, the disease has been noted in younger patients. Its frequency in males is double that for females. DISH has been found in 6% of individuals over 40, and in 12% of those over 70 (1). Radiologically it can be described by the following criteria: exuberant cacification and ossification in the anterior or anterolateral face from at least four adjacent vertebral bodies; preservation of intervertobral disks; and absence of alterations in the sacroiliac joints (2).

In spite of the high incidence of DISH in the population, vertebral fractures after trauma have rarely been reported. The low frequency of fractures is due to the fact that in DISH there are extensive regions without ossification, the osseous bridge is sometimes incom-

Table I. Different causes of aseptic diskitis.

Disease of the spine
Diffuse idiopathic skeletal hyperostosis (DISH) or Forestier-Rotés disease
Osteochondrosis
Spondyloarthropathies
Ankylosing spondylitis
Psoriatic arthritis
SAPHO's syndrome
Haemodialized
Systemic diseases
Sarcoid
Behçet's disease
Rheumatoid arthritis
Microcrystalline arthritis
Cancer
Miscellaneous
Paget's bone disease
Post-surgical
Foreign body synovitis

plete, and there is no participation of the interapophysiary joints. This facilitates the spine in DISH being more flexible (2, 3).

Paley *et al.* described two types of fractures that occur in patients with DISH following a minimal trauma. The first and most frequent fracture crosses the vertebral body along the ankylosed segment of the spine: in DISH, an exuberant formation of bone is produced, which includes the fibrous ring and the anterior longitudinal ligament. These osseous bridges cause the disk space to be the strongest and largest, leaving the vertebral body as a weaker area. The second type of fracture crosses the final disk of a long fused segment (3) (Fig. 1).

Apart from the fractures described by Paley, small stress microfractures without prior traumatism have also been described. Stress microfractures are explained by means of the theory of the mobile segment. This will be described in more detail in the section on ankylosing spondylitis. In DISH, at least in its initial stages, and occasionally throughout the whole process, the ossification is established irregularly and distributed in segments. This frequently gives rise to ankylosed zones existing next to disks or free mobile segments. In such areas a dynamic overcharge of the free segments is produced, possibly resulting in microfractures (4).

In a recent review of DISH by Mata *et al.* (5), some 30 fractures were counted in the literature (3, 6-8), and a third of them presented neurological complications. It is important to emphasize that both types of fractures and the stress microfractures can simulate infectious diskitis. Quagliano *et al*. have described 2 patients with DISH whose clinical and radiological characteristics simulated spondylodiskitis. Neither of them presented neurological complications and they were cured with rest and antiinflammatory drugs (9).

Fig. 1. DISH, showing increase in the articular space and erosions in the vertebral plates.

Aseptic diskitis in ankylosing spondylitis

Ankylosing spondylitis is a chronic inflammatory disease of unknown aetiology which mainly affects the sacroiliac joints and which ossifies and calcifies various vertebral ligaments (10).

Diskovertebral lesions in ankylosing spondylitis (AS) were described for the first time in 1937 by Anderson (11), who reported the destruction, with erosions and sclerosis, of some of the thoracic and lumbar vertebral plates. Since Anderson's initial description of aseptic diskitis in AS, many other cases have been reported (12-19). It is estimated that between 1% and 10% of patients with AS will sustain an aseptic diskitis.

Cawley and colleagues (20) suggested that there are three types of erosive and destructive lesions in the diskovertebral union. Type I lesions affect the peripheral regions of the diskovertebral union and appear in the early phases of the disease. Type II lesions affect the central zones (Fig. 2). In contrast, type III lesions extend throughout the diskovertebral union and appear later.

Various mechanisms have been suggested to explain these diskovertebral lesions. The destructive lesions located in the peripheral area as well as in the central zone usually appear in the earliest phases of the disease and are considered to be caused by the inflammatory process. It is postulated that the inflammatory entesitis extends from around the intervertebral disk towards the inside of the periosteum and the cortex (20).

In contrast, the most extensive lesions (type III) – those which radiologically resemble a spondylodiskitiis – are explained by the appearance of fractures. In AS, as opposed to DISH, the disks with their thin syndesmophytes are the weakest zone in the spine. If a trauma is present, the line of fracture will cross the disk. This will cause callus formation, fibrosis proliferation and destruction of the articular space (20).

On the other hand, the theory of the mobile segment allows us to explain lesions without a prior trauma or fracture. Schmorl and Junghans developed the concept of the mobile segment as comprising the entire system of soft structures that join two adjacent vertebrae (disk, ligaments) (21). The presence of a relatively mobile segment in a completely rigid spine provokes abnormal movements and this stress produces an irregular destruction of the vertebras. It is believed that daily movements of flexion and extension transmit mechanical stress, provoking

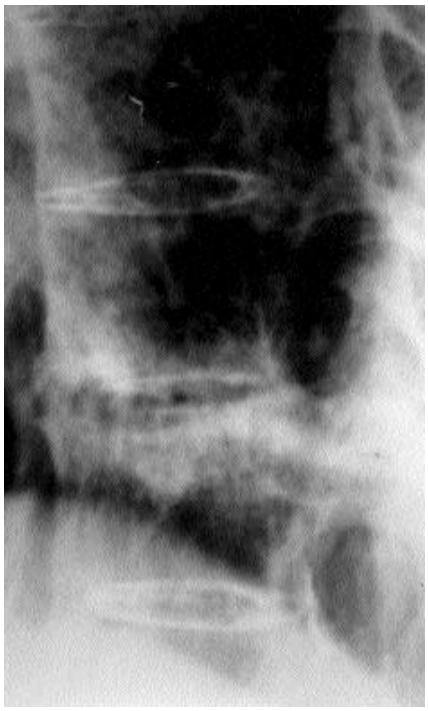

Fig. 2. Ankylosing spondylitis: type I lesion showing eripheral erosion.

microfractures, and that these may eventually develop into diskitis. In these cases, the biopsy specimens show a granulation tissue in which inflammatory cells are almost absent, and there is evidence of weak callus formation, rarely reactive bone in the fibrous tissue, and oedema in the marrow spaces with scattered perivascular collections of lymphocytes and plasma cells (20).

All of these theories continue to be debated, as reviewed in Rasker *et al.* (19).

Clinical manifestation can vary from asymptomatic to medullar compression, which is exceptional. Type I and II lesions are clinically silent. On the contrary, type III lesions usually manifest with pain in the spine. The onset is abrupt and is localised in the involved segment. Interestingly enough, the pattern of pain is mechanical. Patients observe a clear change in spinal pain from that to which they have become accustomed. Exceptionally, neurological complications exist due to the proliferation of the granulation tissue inside the epidural space (22, 23).

The prognosis is generally good. Conservative treatment including rest, antiinflammatory drugs, physiotherapy and sometimes a corset is sufficient. In cases of instability or neurological complications, surgery will be necessary (22, 23).

Aseptic diskitis in the SAPHO syndrome

The acronym SAPHO represents a syndrome characterised by osteoarticular and cutaneous alterations. The initials stand for each of the characteristics defining the syndrome: Synovitis, Acne, Pustulosis palmoplantaris, Hyperostosis and Osteitis (24). The main characteristic is a pseudo-infectious osteitis, which above all involves the anterior part of the chest and the sacroiliac joints, and which is often associated with cutaneous lesions such as pustulosis palmoplantaris, acne and psoriasis. Follow-up of these patients is crucial and will define if disease is a syndrome belonging to the spondyloarthropathies, or rather a form of psoriatic arthritis (25, 26).

Fig. 3. SAPHO syndrome:osteosclerosis (ivory vertebrae).

The spine may be involved (24). Pain and stiffness, usually localised, may draw attention. In other cases there are no symptoms and lesions can only be detected by a radiography The following different types of spinal involvement may be observed, often in combination:

- Pure vertebral osteosclerosis, usually starting from an anterior corner, involving one or several anterior vertebral bodies (Fig. 3).
- Development of paravertebral ossification with massive bridging, similar to that seen in DISH.
- Vertebra plana (especially in children).
- Osteosclerosis may be combined with diskitis in a way similar to that observed in AS. The frequency of these lesions is in the range of 9-20%. They are associated with pustulosis palmoplantaris though rarely with acne. Two or more foci may be present at the same time. Radiologically, there is a decrease in the disc space and erosions in the central or anterior portions of the diskovertebral union. They are frequently accompanied by osteophytes or hyperostosis that lead to changes of reparation more rapidly than infectious diskitis. Toussirot *et al.* (27) carried out a retrospective study of 25 patients diagnosed with SAPHO, and found 8 cases of aseptic diskitis. All cases presented lumbar discomfort, without fever and with elevated acute phase reactants. None of them presented neurological signs, and they all improved after treatment with antiinflammatory drugs, without recurrence of the discomfort.

Aseptic diskitis in psoriatic arthritis

Psoriatic arthritis, as well as other spondyloarthropathies, may affect the spine (28). Paravertebral ossification usually appears in the form of syndesmophytes parallel to the vertebral bodies. Unlike AS these syndesmophytes are larger and asymmetrical. Spondylodiskitis is estimated to occur in 22% of psoriatic arthritis, though in association with other lesions such as syndesmophytes, ligamentous ossification, apophyseal joint narrowing or fusion, facilitating the differential diagnosis with respect to infectious spondylodiskitis (29). It is therefore rare that it only produces a decrease in the articular space, sclerosis and osseous ankylosis. However, some cases of aseptic diskitis in patients with psoriatic arthritis and suffering from Crohn's disease have been described (30).

Osteochondrosis

Osteochondrosis is one of the types of degenerative disease that occurs in the spine. Ageing results in dehydration and loss of tissue resiliency in the intervertebral disc, particularly in the nucleus pulposus. Even in the relatively early stage of intervertebral osteochondrosis, radiographic findings of the disease may be apparent. Particularly characteristic is the appearance of linear or circular radiolucent collections – the vacuum phenomena – which overlie the intervertebral discs. The lucent areas are produced by gas, principally nitrogen, accumulating in the clefts. This finding is accentuated in extension. Vacuum phenomena are a reliable indicator of disk degeneration; they are rare in the presence of disk infection. As the process of intervertebral osteochondrosis progresses, the intervertebral disk diminishes in height. The cartilaginous end-plates reveal concomitant degeneration. Radiographically, at this stage disk space loss and bone

Fig. 4. Ostechondrosis:decrease of the articular space, sclerosis, bone eburnation and irregularity of the vertebral plates (due to subchondral cysts).

eburnation are characteristic. The sclerosis is generally well defined, is linear or triangular in shape, and extends to the intervertebral disk. Subchondral condensation of bone in both vertebral bodies bordering the intervertebral disk is typical. (31)

Osteochondrosis may be apparent at any level in the spine, although abnormalities are particularly prominent in the lower lumbar and cervical regions (31).

The radiological characteristics of decreased disk space, sclerosis and, at times, erosions of the vertebral plates are similar to the changes caused by infectious diskitis, particularly when these changes are produced in short period of time (32-35) (Fig. 4). In these cases, the vacuum phenomenon acquires its maximum importance, since its presence in the intervertebral space almost excludes the possibility of infection (32-35).

Aseptic diskitis in haemodyalisis

Kuntz *et al*. (36) first described spondyloarthropathy suffered by patients in treatment with hemodialysis in 1984. This spondyloarthropathy (HS) can initially appear to be vertebral osteochondrosis but later becomes clearly destructive and erosive, resembling an infectious diskitis (Fig. 5). It is believed that between 5% and 10% of patients in hemodialysis present such arthropathy, the majority of them after 4 years of dialysis. (37-39).

Several factors seem to be related to the pathogenesis:

- Crystalline arthropathy: This was the first cause included in the work of Kurtz *et al.* Hydroxyapatite and pyrophosphate calcium crystals have been described. It has been linked to the hyperparathyroidism that these patients suffered, which presumably induced crystal deposition. Further studies will be required in order to confirm the role of pyrophosphate calcium deposits in this type of diskitis (36).
- Hyperparathyroidism (HPT): This is the factor that has been most closely associated with HS. Such patients frequently suffer from serious HPT. In addition, subtotal parathyroidectomy can rapidly reduce the symptoms and progression of the discal lesion. However, HS can be present in patients without hyperparathyroidism. Furthermore, there are haemodialysed patients with HPT who do not suffer from HS. It is probable that HPT predisposes to spondyloarthropathy, but there are other factors involved (40).
- Amyloidosis of haemodialysed patients: Currently this would seem to be the cause with the greatest degree of involvement. Various studies have found amyloid deposits in biopsies taken from patients with HS. Furthermore, the deposits are more frequent in the cervical spine, as is the case with HS (41-43).

Bindi *et al*. (44) reviewed 100 patients on haemodialysis and found that 11% suffered from HS. The cervical spine was affected in 84%, the lumbar spine in 16% and the thoracic spine in 8%. In 37% of the cases, two segments were involved at the same time. Thirty-five of the patients were asymptomatic. Pain was present in 50% of the cases and sciatica and radiculopathy in 15%.

Fig. 5. Spondyloarthropathy in haemodyalisis: decrease of the articular space an osseous erosions in the C6-C7 space.

However, in hemodialyzed patients consulting for vertebral pain, 30% had an aseptic diskitis and more than 50% presented neurological symptoms (42). Severe cases in which the spinal canal is affected, resulting in medullar compression, have been reported with relatively frequency. In some cases therefore, these patients needed surgical decompression and verteral stabilisation (45, 46).

Post-surgical aseptic diskitis

Postsurgical spondylodiskitis is not particularly frequent, but it has been well described. It may be post-surgical, post-diskographic, or postchemionucleolisis. Its presence must be suspected when there is an increase in lumbar pain after the operation. There are two types: infectious diskitis and 'chemical' or 'mechanical' or 'aseptic' diskitis. The first type is the most frequent, since the microrganism can be introduced during the operation. It is therefore necessary to seek a possible ethiological microrganism. There have been studies which emphasize that there are almost no clinical or radiological dif-

ferences to distinguish between the two groups.

The diagnosis is based on analytic data and biopsy of the involved disc. Data in favour of a non-infectious diskitis are: a normal C-reactive protein (ESR is increased during first 2 weeks following surgery), normal fibrinogen, and a histology with fibrotic changes. This type of aseptic diskitis has a good prognosis, with a total recovery following a few weeks of rest (47, 48).

Microcrystal aseptic diskitis

Although crystal diseases are very common, spine involvement is very rare. Microcrystal may be deposited in the spine and soft tissues. Although asymptomatic, occasionally a myelopathy or radiculopathy may be produced. Radiologically, they simulate an infectious diskitis.

- Pyrophosphate calcium crystals: Chondrocalcinosis affects the spine in 4-10% of cases (49). Most of the time it is asymptomatic. Pyrophosphate calcium crystals may induce a destructive lesion in the vertebral body and in the intervertebrals disks that can be confused with an infectious diskitis (49-51). These lesions may cause instability and therefore a truly aseptic diskitis. Pyrophosphate calcium crystals can also deposit in the flavum ligament or the atlanto-occipital ligament (52, 53). Several cases of myelopathy and cervicomedullar compression have also been described requiring neurological decompression (54).
- Hydroxyapatite crystals: In addition to being linked to the spondyloarthropathy of haemodialyzed patients, hydroxyapatite may cause aseptic diskitis (Milwaukee back). There is a single reported case of asymptomatic destructive universal diskitis. Pathology examination revealed hydroxyapatite crystals. The fact that hydroxyapatite crystals may be found in non-inflammatory synovial fluid or in joints destroyed by other causes makes it difficult to establish its etiopathogenical role. However, a chronic destructive joint disease accompanied by some cartilage loss and bone erosion in association with hydroxyapatite crystals in the synovial fluid is well described. This has been observed in the shoulder, knee, finger joints and elsewhere (55).
- Uric acid crystals: Some 20 cases of gout involving the spine have been described. These are patients suffering from polyarticular chronic tophaceous gout. Urate deposits may be found in the epidural space or intradurally in the ligament flavum, the pedicles or in the intervertebral space. In the latter, radiologically they simulate an infectious diskitis. Clinically they can only cause chronic back but this is mostly accompanied by neurological deficits such as radiculopathy, paraparesis or tetraparesis. Surgical decompression is therefore necessary (56-58).

Pagetic vertebral block

Paget's bone disease is a localised disorder of bone remodelling. It has been shown that Paget tissue can directly invade the articular cartilage. When this extraosseous invasion of Paget's disease comes from the vertebra toward the disc space, the so-called vertebral block is formed (59) (Fig. 6).

Fig. 6. Paget's bone disease: increase of the density and the size of the vertebras. Decrease of the articular space.

Pagetic vertebral block (also called vertebral Paget ankylosis or Paget synostosis) is present in 4.45% and 12% of cases and is more frequent in males over 70 years of age with polyostotic disease. Its etiathogeny is unknown. Some authors suggest that DISH (Forestier-Rotes' disease) is a factor that would favour the progression of Paget's disease through the vertebral bodies by means of the invasion of the hyperostosic osseous bridges (60). Nevertheless, other authors believe that the cause of the block lies in the aggressiveness of the disease, or in the existence of a previous diskopathy (61).

In 1995 Marcelli defined Pagetic block using the following criteria: a) anterior or lateral fusion of the vertebral bodies with osseous bridges among the platforms of two or more Paget vertebrae; b) radiological osseous ankylosis among two or more Paget vertebrae with total or partial disappearance of the intervertebral disks and a decrease in the height of the vertebral body; and c) anterior convexity of the vertebral ankylosis (60).

Pagetic block may be radiologically and clinically confused with an infectious diskitis (61, 62) or with a cancer (63). The vertebral block involves, in order of frequency, the dorsal, lumbar and cervical spine. It is very often symptomatic and can manifest itself as back pain or cruralgia, sometimes accompanied by neurological complications (62,64-66). Treatment is usually with calcitonin or biphosphonates. Very occasionally surgery may be required (66).

Aseptic diskitis in cancer

Cancer disc infiltrations are extremely rare. The relative preservation of the disk is explained by the absence of disk vascularization and by the qualities of the cartilaginous plate that inhibit tumorous proliferation (67).

However, occasionally cancer disc infiltration has been described, as well as neoplasias which, without invading the disk, can radiologically simulate an infectious diskitis. Lymphoma, and especially Hodgkin's disease, is the commonest cause. It manifests in a pure osteosclerotic vertebra (ivory vertebra) or

with a mixed pattern of sclerosis and osteolysis. (67-70)
The presence of metastasis in other vertebrae or the existence of a known primary tumor can help in the diagnosis (70).

Aseptic diskitis in sarcoidosis
Sarcoidosis is a granulomatous disease of unknown etiology that infiltrates a multitude of organs, affecting above all young adults, and manifesting mainly in the form of bilateral hilar adenopathies, infiltrations in the lung, and ocular and cutaneous lesions.
The spine is not usually affected by sarcoidosis; the vertebral region most affected is the thoraco-lumbar spine. The lesions are osteolytic or osteosclerotic simulating metastatic cancer. One or several adjacent vertebrae may be involved. Unlike in other locations, this sarcoidosis is usually symptomatic. The interverterbal space is rarely affected, but when it does happen the differential diagnosis with an infectious diskitis becomes practically impossible, and a biopsy is required (71-76).

Aseptic diskitis in rheumatoid arthritis
When rheumatoid arthritis affects the spine, it does so mainly in the cervical spine (77). Atloaxoid subluxation is the most characteristic lesion. Other types of lesions in the spine are considerably less frequent. Destructive lesions in the vertebral bodies and changes in the interapophisary joints, in addition to aseptic diskitis at different levels of the spine, have nevertheless been described (78-79). These diskovertebral changes may be related to the extension toward the intervertebral space of the synovitis that affects neighbouring joints such as the interpophysiary or costovertebral joints. The erosions may produce instability of the spine and so bring about neurological symptoms.
Collet *et al*. (78) reviewed cervical spine involvement in rheumatoid arthritis. Interestingly enough, they found vertebral blocks in 8% of the patients. Furthermore 14% of their patients exhibited a decrease in the articular space as well as erosions simulating an infectious diskitis. Heywood *et al*. (79) described 12 symptomatic cases involving the thoracic and lumbar spine, most with histological confirmation. A number of these simulated infectious diskitis, and a third of them presented neurological complications requiring surgical decompression.

Aseptic diskitis in Behçet's syndrome
Behçet's syndrome is a disease of unknown etiology that was first described in 1937 as a triad of oral aphthae, genital aphthae and uveitis of a recurring character (80). Arthropathy in the form of arthritis and/or arthralgia is an important feature of Behçet's syndrome. The frequency of arthritis is approximately 50%. The pattern of arthritis is usually oligoarticular and asymmetrical. The knee is the most commonly affected joint, followed by the ankle, wrist, and elbow. Although any joint can be affected, involvement of the spine is unusual (80).
Nevertheless, the cervical spine is occasionally involved – atlantoaxial subluxation has been described (81). Furthermore, Rozadilla *et al*. described a patient whose X-ray showed images compatible with cervical aseptic diskitis at the moment the diagnosis. The patient presented cervical pain without neurological compromise, and his condition was controlled with anti-inflammatory drugs (82).

Aseptic diskitis induced by a foreign body
Gertzbein *et al*. presented an anecdotal case in which, after a gynaecological operation for a cystocele, back pain appeared with fever, although acute phase reactants were not elevated. The pain was refractory to treatment. Radiographs showed signs of diskitis in L5-S1, together with the presence of two foreign bodies corresponding to two surgical clamps. The symptoms disappeared after the surgical material was removed. Histology showed granular tissue around the clamps and the cultures were negative (83).

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