



Post-meniscectomy spontaneous osteonecrosis of the knee (SPONK): etiology, clinical presentation and treatment

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Abstract: Osteonecrosis of the knee is a disease that generates important limitations to the patient, but is still poorly understood. More recently, with the increasing number of arthroscopies, a new category of osteonecrosis was identified after meniscectomies. The purpose of this article is to review the concepts of the possible causes, clinical and radiological presentation of post-meniscectomy osteonecrosis.

Keywords: Osteonecrosis; meniscectomy; post-meniscectomy; knee

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Osteonecrosis of the knee is a disease that generates important limitations to the patient, but is still poorly understood. It was originally described as a single pathology Ahlbäck and colleagues in 1968 (1). Currently, it is recognized as distinct conditions, it can present some different classifications between authors but it has some more classic types (2-4).

The first, spontaneous osteonecrosis of the knee (SPONK) that occurs mainly in elderly patients, unilaterally and usually affects a single condyle. The second, secondary osteonecrosis, on the other hand, occurs in younger patients after exposure to some risk factor, such as corticosteroid or alcohol, affecting more than one condyle and often both knees. The third, postarthroscopic osteonecrosis, is worse characterized, usually affects a single condyle after arthroscopic surgeries.

Postarthroscopic osteonecrosis was first described in 1991 by Brahme *et al.* (5) after a routine meniscectomy. Since then, more cases have been described with the terms “postarthroscopic” and “post-meniscectomy”. As osteonecrosis was observed after some procedures not involving meniscectomy such as chondroplasty and reconstruction of the anterior cruciate ligament,

the condition is often referred to as post-arthroscopic osteonecrosis.

Due to the low incidence of the disease, there is still no consensus on the pathophysiology, but several etiological factors have already been discussed, such as the use of radiofrequency, laser or simple meniscal resection (6). However, with the increase in the number of arthroscopies and consequently meniscectomies, the relation between the performance of meniscectomies and the development of osteonecrosis is now clear (6-8).

The purpose of this article is to review the concepts of the possible causes, clinical and radiological presentation of post-meniscectomy osteonecrosis.

Meniscectomy

The meniscectomy generates important biomechanical changes in the knee, the most relevant being the change in the load distribution at the femorotibial joint, with a significant increase in the contact pressure in this joint. Such changes occur in both the lateral and medial tibiofemoral compartments, but it is larger in the lateral compartment due to the biconvex bone format of this compartment. The



Figure 1 Magnetic resonance imaging in T2-weighted in the coronal view of the right knee with osteonecrosis of the medial femoral condyle with large high signal area associated with the low-signal fracture line in the subchondral bone and discrete contour alteration.

increased load is recognized as one of the causes of chondral degeneration after meniscectomies (9).

The same phenomenon can occur after meniscal lesions that reduce meniscal load distribution capacity. The radial lesions or lesions of the meniscus root eliminate the capacity of containment of the meniscus with consequent extrusion. This scenario generates an increase in contact pressure such as a total meniscectomy (10).

Etiology

The etiology of post-meniscectomy osteonecrosis has not yet been fully elucidated. However, one of the main theories is the increase in contact pressure after resection of the meniscus.

Resection of the meniscus causes an abrupt load increase that could lead to an overload of the subchondral bone, with consequent fracture of the subchondral bone. The presence of a degeneration of the cartilage in the compartment could facilitate this process, due to the already reduced capacity of absorption of impact. Such a theory was initially proposed by Yamamoto and Bullough (11) as the etiology of primary osteonecrosis after the histological evaluation of bone cuts of patients with SPONK undergoing arthroplasties. Thus, it is possible that SPONK and post-meniscectomy osteonecrosis have similar etiologies.

Some authors also suggest that such subchondral bone fractures are associated with chondral degeneration that causes a leakage of synovial fluid into the subchondral bone with increased local pressure and consequent necrosis (12).

Clinical presentation

The patient presents an acute worsening of pain associated with increased joint effusion, after an initial improvement of symptoms after the meniscectomy. Pain is usually located in the affected compartment, being more frequent in the medial compartment. Not infrequently, the patient can identify the different pain characteristics in relation to the symptoms prior to meniscectomy, with a location different from the joint line and generally greater intensity. However, often the symptoms may be confused with failure of the resolution of the meniscal symptoms, failure of the surgery (4,8,13).

Image

If suspected post-meniscectomy osteonecrosis, new imaging examinations should be requested including X-rays and magnetic resonance imaging (MRI). Often the radiographs will not show changes, especially in more initial cases. More advanced cases may present the classic changes with planing of the contour of the femoral condyle, radiolucency area or even progression to subchondral bone collapse.

Alternatively, MRI will present changes in much more earlier stages, with the most classic being the T2-weighted high signal often identified as bone marrow edema, corresponding to a low signal area at T1 weighting. However, bone edema is a very frequent alteration in MRI, especially after meniscectomy (14) and with a benign course in most cases. However, Lecouvet *et al.* (15) identified three risk factors for poor outcome in these lesions, being a low signal area in the subchondral bone at T2 weighting, a focal depression of the joint contour and deeper lower signal lines in the affected condyle (*Figure 1*). It is important to note here that for the diagnosis of post-meniscectomy osteonecrosis, an MRI prior to meniscectomy without subchondral bone changes is essential, excluding the presence of a previous SPONK.

In the absence of alterations in MRI with a suspected post-meniscectomy osteonecrosis, an option may be bone scintigraphy that is able to identify changes in a smaller diagnostic window, even before changes in MRI.

Natural history and prognostic factors

Considering the most recent description of such pathology, it is still difficult to define a natural evolution or factors of poor prognosis. Thus, they generally carry factors used in SPONK for prognostic considerations in post-meniscectomy osteonecrosis.

One possible factor is the size of the lesion that is usually measured by the method described by Lotke *et al.* (16) as a percentage of the condyle diameter, with poor prognosis when the lesion corresponds to more than 50% of the diameter.

In any case, it is important to closely monitor these patients in order to avoid the progression and collapse of the joint contour with a rapid evolution to knee arthroplasty.

Treatment options

Initial treatment is non-surgical with removal of the weight bearing of the affected limb with the use of a pair of crutches, associated with the use of analgesics. The rationale for this treatment is to remove stress or load from the affected condyle, allowing a physiological consolidation of the local fracture, in an attempt to avoid changes in the joint contour (2,4,6).

The elderly population may find it very difficult to use crutches for a longer period of time, mainly due to frequent association with rotator cuff symptoms or weakness of the upper limbs.

Non-surgical treatment has higher success rates in smaller lesions and in earlier stages, without alterations of the subchondral bone contour or more advanced degeneration of the joint. Close monitoring of the treatment is important with new MRI, mainly with the objective of identifying the failure of the non-surgical treatment.

In patients in whom conservative treatment fails, one option is the core decompression, but there are no published results for post-meniscectomy osteonecrosis. A second option in the attempt to preserve the joint, indicated for selected cases, is the high tibial osteotomy with the objective of reducing the load in the affected compartment and consequently reducing the symptoms, in an attempt to delay arthroplasty.

The final treatment in the failure of the previous modalities is replacement of the joint with the knee arthroplasty, which may be unicompartmental in less advanced cases in which the rest of the joint is preserved or total when other compartments are involved.

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Footnote

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