Insufficiency Fracture and Spontaneous Osteonecrosis of the Knee (SONK) are a Result of a Rapid Onset Focal Osteoarthritis

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Introduction: In 1968 Ahlbbeck introduced the term spontaneous osteonecrosis of the knee (SONK) 1. This process is separate from secondary avascular osteonecrosis (AVN) where there is a known cause such as high dose steroids. AVN more typically occurs in the 3rd through 5th decade. The population at risk for SONK has none of the risk factors for AVN, has rapid onset of severe knee pain, and rarely has hip or other major joint involvement.

Insufficiency fractures of the knee are seen in a population similar to that affected by SONK. Initial radiographs are typically normal or that of early osteoarthritides (OA). Many progress to rapid changes that can lead to bone collapse and articular cartilage loss. Like SONK, the medial femoral condyle and/or tibial plateau predominate. A remarkable number of these patients have large areas of “bone edema” on MRI. The term “bone edema” is used for regions of increased signal on the T2 weighted image. A previous study stated that these patients are osteoporotic 2.

We present the outcome of 3 IRB approved projects. The primary purpose was to determine if SONK and insufficiency fractures are related. The second purpose was to determine if patterns of bone edema seen in advanced disease has any similarity to the patterns seen on MRI in rapid onset cases.

Materials and Methods: 1.) We prospectively followed all patients with rapid onset knee pain where initial radiographs were normal or early OA and where focal knee lesions developed on imaging within months of the onset. Demographics, risk factors for AVN, and time to joint replacement were reviewed.

2.) A retrospective review of 57 knees in 54 patients with an MRI diagnosis of “insufficiency fracture” was done in the same fashion. DEXA (bone density) with T and Z scores were available in 18 of these 54 patients.

3.) Bone sections were saved from 14 total joint patients who had 3 Tesla MRI’s just prior to surgery. Bone sections for histology was correlated to regions for MRI “bone edema changes”. Using a multiple ocular microscope two orthopaedic surgeons, a radiologist, a pathologist, and a cartilage matrix biologist reviewed the histology sections simultaneously to interpret the activity in bone seen in the sections taken based on areas of bone edema on MRI.

Results: 1.) These patients ranged in age from 43 to 91 with an average of 63. None had risk factors for AVN. The patterns of patient history, MRI findings, and radiology changes were similar for the prospective “rapid focal OA group” and the retrospective “insufficiency fracture” group. Histology on two patients diagnosed with “SONK” revealed no large area of dead bone. In 13 prospective cases where an MRI had been obtained and the diagnosis insufficiency fracture was used, 12 had an extruded meniscus in the region of the insufficiency fracture.

Discussion: All evidence indicates that the central process for “SONK” and “insufficiency fracture” is rapid bone absorption associated with a variety of tissue types replacing the absorbed bone. In the 14 patients studied by MRI there was variation in the focal distribution of replacement tissue with new bone, cartilage, and myxomatous tissue. The radiology terminology “SONK” and “insufficiency fracture” that has been used for decades does not match the findings in these three studies. Bone densitometry makes it more likely that the “insufficiency fractures” have sufficient bone made insufficient by a rapid turnover. Both the terms SONK and “insufficiency fracture” imply comorbidities that do not exist in this population. We will now study the histology with immunohistochemistry to define processes that are associated with the wide variety of changes.

The terms “SONK” and “insufficiency fracture” should be changed to “rapid onset focal bone response associated with osteoarthritis”. Future investigations will give insight into the biologic mechanisms of bone and articular cartilage change related to selecting OA sub populations.


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