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REVIEW

Transient osteoporosis of the hip

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ABSTRACT

Transient Osteoporosis of the Hip (TOH) is a rare syndrome that Orthopaedic surgeons deal with. This review emphasizes the importance of clinical suspicion that a physician should possess when examining a patient with hip pain and no prior history of trauma. Specific findings like Bone Marrow Edema (BME) play an essential role in discriminating TOH from similar clinical entities with a worse prognosis. Once a definite TOH diagnosis is established, the patient can be treated conservatively with a satisfactory functional outcome.

KEY WORDS: Hip, Pain, Bone Marrow Edema

Introduction

Transient Osteoporosis of the Hip is a rare condition, however more common in middle-aged men [1]. To a lesser extent, it may affect other weight-bearing joints, such as the knee, the ankle, and the foot [1]. Bone Scintigraphy reveals a promoted activity in both the femur and the acetabulum, though not in the surrounding soft tissue. Initially described in third-trimester pregnant women, albeit affects almost all ages and sex groups. The pain typically subsides after six to twelve months, and the radiologic image is gradually restored. The exact etiology is by and large unknown, yet there has been considered proof that local bone marrow edema plays a significant role. Some investigators suggest that TOH is a form of early-stage reversible avascular necrosis of the femoral head [2]. The overwhelming majority of cases do not require a specific treatment regimen, per se. Apart from using over the counter analgesics, extreme pain may be alleviated through femoral drilling.

Pathogenesis

While TOH's etiology remains by and large unclear, several theories have been proposed, the vast majority of which has to do with bone remodeling and vascular phenomena. Curtiss and Kincaid first attempted an explanation with their neurogenic compression theory. They reckoned that the child's head puts pressure over the mother's obturator nerve, as a possible TOH mechanism during the third trimester of pregnancy. According to recent studies [3,1,4], there are three stages in the disease's evolution: the initial fracture or neurovascular attack, the bone resorption, and the resolution. Lately, three new mutations in genes LRP5, COL1A1, and COL1A2 have been related to early-onset osteoporosis of the hip in pregnant women [5]. Another theory, based on the hormonal changes during pregnancy, connects PTHrP with TOH. Nowadays, TOH's common knowledge affects both sexes with a male to female ratio of 3:1 [6, 7]. Patel described cases of BME detected on MRI in patients with the rheumatological disease [8]

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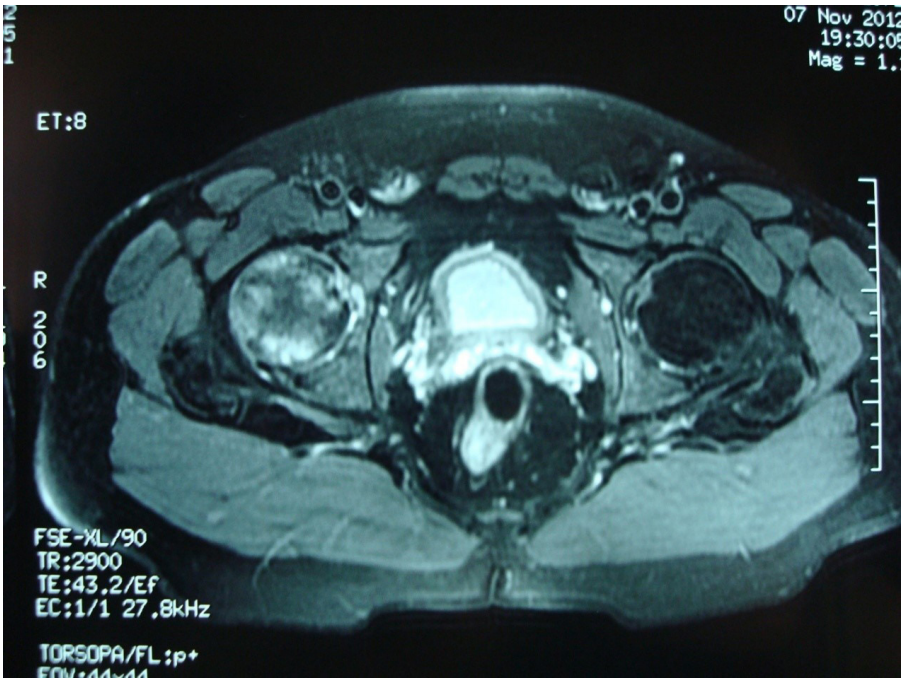

Figure 1. *Transverse T2 image of both femoral heads with a highly heterogeneous signal on the right side*

Rosen proposed that an obstructed venous drainage could lead to local hyperemia and the femoral head's demineralization, a common finding in these patients [9]. Hofmann et al. in 1993 assumed that Transient Osteoporosis is nothing more than a reversible ischemic attack, followed by rebound hyperemia in the surrounding bone [10]. Histologic examination of bone and bone marrow specimens showed no signs of necrosis [11].

Proximal Nerve Roots theory suggests that a microvascular injury affecting the small vessels near the proximal nerve roots would lead to transient denervation, also contributing to TOH symptoms [12]. The time course in which the TOH subsides symptoms indicates the time that this kind of nerve injury requires to heal. In a similar direction, some find a resemblance to Reflex Sympathetic Dystrophy and Complex Regional Pain Syndrome. Undoubtedly, bone marrow edema is the main event that is related to TOH. A possible mechanism would be a local hypervascularity, leading to increased capillary permeability. This theory gains ground since it is also supported by angiographic and scintigraphic studies [13].

Finally, Regional Accelerated Phenomenon activation due to noxious stimuli would cause a turnover process ten times that of a normal bone. Transient osteoporosis of the hip has also been described in patients following bariatric surgery [14].

Symptoms and diagnosis

Typically include a sudden onset of increasing unilateral hip pain, usually alleviated when the patient lies down. There might be a moderate decrease in hip motion range, mainly in abduction and rotation [15], and the patient may walk with a noticeable limp [16]. In rare cases, there might be bilateral involvement of the hip joints [17].

Some particular imaging studies are used to set the diagnosis of TOH. After receiving a full medical history, that is emphasized on the duration and the various characteristics of the pain related to the condition as mentioned above and examining the patient clinically. Inflammation indicators such as ESR may be elevated, though they are in no way a specific study that we can rely on when establishing a diagnosis.

The hip's conventional radiography would be the initial evaluation in most diagnostic endeavors, as shown on AP and lateral views. The common find-

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ings are subchondral bone loss, joint effusion with a preserved articular space, while osteopenia is rarely evident in the first 1-2 months, as well as any possible microfractures [18]. In later stages of untreated TOH, few patients' X-rays present the so-called "phantom appearance" of the femoral head, namely a complete absence of its bony features [12]

An alternative evaluation of classic X-ray investigation seems to be bone scintigraphy. It detects lesions in the bone during the first stage of TOH – the main disadvantage of conventional radiography. Furthermore, the increased radionuclide uptake in the femoral head is quite useful in distinguishing TOH from avascular necrosis in the early stages. Although used and described in the literature, computer tomography and ultrasound of the hip are not sensitive enough.

MRI is the gold standard when dealing with TOH (fig. 1). It is a study both sensitive and specific enough to set the diagnosis along with the clinical findings and medical history. And that is mainly since MRI is the sole adequate test to assess bone marrow edema. Classical results include a low-intensity signal in the T1 sequence, with a loss of the local tissue's expected fatty appearance and a high-intensity signal on T2.

Differential diagnosis

TOH is characterized by acute disabling pain without a prior history of trauma. There is a focal loss of bone in the histologic examination. First radiologic findings are evident 3-6 weeks after the initial symptoms. Bone loss could be extensive, but the vast majority of cases present spontaneous improvement. As far as imaging is concerned, osteopenia is found on later stages' X-rays and bone scintigraphy reveals increased radionuclide uptake. Bone marrow edema on MRI is evident 48 hours after the onset of pain [19].

Migration occurs in 5-40% of patients with TOH. Unlike TOH, inflammatory changes of the skin may be present. Usually, migration happens towards a neighboring joint. Sometimes TOH is described under the common term "Transient Regional Osteoporosis." A paramount aspect of diagnosing TOH is distinguishing it from avascular necrosis of the femoral head [19]. The latter usually affects the bone's superior anterior surface and is typically found in the hip or knee. There are no early signs of bone marrow edema on the MRI scan. "Double line" sign on T2 is considered to be pathognomonic. On the T1 sequence, low signal intensity lesion is pathognomonic. The femoral head's vascular necrosis is commonly associated with alcohol abuse and corticosteroid treatment and presents a high incidence in Japan [20]. An MRI scan with intravenous contrast administration would help differentiate TOH from neoplastic conditions such as multiple myeloma, lymphoma, leukemia, and metastatic bone disease. Inflammatory arthritis would present with elevated lab tests such as ESR, CRP, and WBC. It would also include periarticular imaging signs like soft tissue involvement and joint effusion, apart from the hip's transient osteoporosis.

Treatment

The overwhelming majority of TOH cases are treated non-operatively. In some patients with intense hip pain, drilling of the femoral head may help, though there seems to be no clinical advantage over pharmacotherapy [1]. The typical instructions include avoiding weight-bearing and paracetamol.

Intravenous bisphosphonate therapy has been proposed to restore average bone density in the region, together with nutritional measures, namely calcium and vitamin D [13, 21]. Iloprost, a prostacyclin analog, dilates vessels and reduces bone marrow edema [20]. Trevisan and Ortolani suggest periodic evaluation of densitometry throughout TOH treatment to adjust weight-bearing instructions [22].

hysical therapy and aqua exercise help patients so that hip movement is secured without further loading of the affected joint. In other cases, there is always the risk of a stress fracture. The pulsed electromagnetic field seems to be a promising new treatment [23] and hyperbaric oxygen therapy [24], although there is not enough literature to support them. A time course of approximately 6-8 months is required until adequate resolution of the symptoms. Treating the patient with a salmon calcitonin injection daily has been shown to reduce the pain and shorten the disease [25].

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TABLE 1.

Differential diagnosis		
1	Osteonecrosis	Past medical history, Radiologic signs
2	Inflammation	Elevated WBC, ESR, CRP
3	Neoplasia	Exclusion by MRI findings

TABLE 2.

Treatment options		
1	Drilling of the femoral head	May cause some pain relief
2	Calcitonin, Bisphosphonates, Teriparatide	Shortens course of the disease
3	Pulsed electromagnetic field, hyperbaric oxygen	No adequate data

Discussion

Diagnosing TOH is quite tricky in most cases as the usual presenting symptom is the acute onset of pain. The treating physician should keep in mind that TOH can migrate to other joints, primarily those bearing weight (e.g., the knee). The widely accepted pathophysiologic hypothesis is that a primary insult causing vascular disturbance and microfractures may result in bone marrow edema diminishing the bone trabeculae, resulting in temporary bone loss [26]. The additional vulnerability determined by pregnancy is also inadequately described. However, the loss of calcium imposed by the required transfer to the fetus, particularly towards the end of pregnancy, may play a role. Overload set by the weight increase during the third trimester also contributes to the pathology, as mentioned above. It may play a role in the higher incidence of fracture observed during this period [1]. Finally, an osteoporotic or osteopenic background probably acts as an additional variable, as indicated by the anti-resorptive treatment's satisfactory clinical outcomes [27].

MRI is the gold standard diagnostic tool suggested by the past literature [1]. Its role is critical in differentiating TOH from AVN and ruling out traumatic injury, fracture, degenerative processes, inflammatory diseases, ischemic injury, infection, and neoplasia [3]. Early detection and correct diagnosis can prevent unnecessary surgical intervention, usually employed in cases such as BME. Based on reported cases in the literature, medical therapies (including teriparatide, zoledronic acid, or a combination of alendronate and calcitonin) could reduce the duration of symptoms [1]. Core decompression shows no better results than medical therapy [1]. Adjustment to a lifestyle with limited weight-bearing and physical therapy also seems to be beneficial for the patient.

In recent years further clinical details have been unveiled regarding TOH, though the exact pathologic mechanism remains unclear. If left untreated, it may progress into avascular necrosis or even fracture [1]. Every treating physician's primary target should be alleviating the symptoms while establishing an early diagnosis and excluding similar clinical entities.

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