

Atypical Avascular Necrosis treated with Hyperbaric Oxygen Therapy

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Introduction

Non-traumatic osteonecrosis (ON), also known as avascular necrosis (AVN), is most common in the 40 year-old male with hypothyroidism and tobacco abuse (20 pack years) controlled on levothyroxine presented with right knee pain after lifting a heavy object. femoral head. Around 15,000 cases are reported each year, mostly in men between 38 – 50 years old. He described a "pop" with immediate difficulty ambulating. Previously had no difficulties with activities of daily living with a metabolic equivalent score of 4. The Although pathophysiology is not completely understood, it is hypothesized to be due to microvascular pain persisted for 6 years before evaluation. disease leading to ischemia and eventual infarction of the bone over months to years.

Less common sites of AVN include the humeral head, distal femur, talus, and scaphoid bones. These sites are more prone to ischemic processes given they are enclosed in cartilage with minimal collateral circulation.

Precipitating factors for development of AVN include trauma (femoral neck fractures or hip dislocations), glucocorticoids, bisphosphonates, alcohol or tobacco abuse, hemoglobinopathies, systemic lupus erythematosus, Gaucher disease, Legg-Calve-Perthes, and decompression disease.

Although AVN can be seen on X-ray in advanced stages, the gold standard for diagnosis is magnetic resonance imaging (MRI). MRI can characterize the extent and location of disease for surgical planning, both for joint sparing procedures (such as decompression, grafting, and osteotomy), as well as total joint replacement. AVN is primarily treated with surgery, and contributes to 10% of all total hip replacements in the United States.

Hyperbaric oxygen therapy (HBOT) has been used as an adjunct to both surgical and non-AVN with good surgical management of results when applied early the IN course, typically Ficat stage I or II which meet insurance approval in many disease HBOT is thought to work by reduction of local hypoxia, edema, and inflammation, states. as stimulate angiogenesis and increase micro-circulation. Early diagnosis of AVN can as well reduce the risk of disease progression and possibly prevent invasive surgical interventions. Once AVN has progressed to Ficat stage III or IV, HBOT appear less effective.

Pre-Radiographic Pre-Collapse Collapse



Arthritis

Initial evaluation suspected patellar dislocation. He completed physical therapy, but the pain progressed, requiring a cane for ambulation. X-rays showed no abnormalities, but eventually found to have severe peripheral artery insufficiency secondary to arteriovenous malformation. He received bilateral lower extremity arterial stents, which greatly improved his pain, no longer requiring a cane.

Despite improvement in symptoms, he continued to have pain both proximal and distal to his knee. MRI showed bone infarcts within the distal femur and proximal tibia that correlated to his areas of pain. When questioned further, patient never had glucocorticoids or bisphosphonates. He was referred for hyperbaric oxygen therapy (HBOT) for avascular osteonecrosis of the distal femur and proximal tibia.







Fig 2. Transverse MRI of right knee showing bony infarcts of distal femur (left) and proximal tibia *(right) pre HBOT (top) and post-HBOT (bottom)





Patient underwent weekday daily HBOT with 100% oxygen at 2.4 atmospheres for 90 minutes with two 5 minute air breaks for 59 treatments. Patient otherwise did not make changes to his lifestyle or medications. Patient reported resolution of all symptoms. Repeat MRI at 6 weeks post-HBOT showed no progression of disease. We hypothesize HBOT helped with microvascular changes that may not be present on MRI.

HBOT could be of benefit in the treatment of AVN in atypical sites other than the femoral head. 20-40 HBOT treatments is a standard course, but extension of therapy up to 60 treatments may be beneficial if symptomatic improvement has not yet plateaued. When used early in the disease course, HBOT may delay or even reduce the need for surgical interventions, but more investigation is needed.

Our Patient



Fig 3. Sagittal MRI of right knee showing bony infarcts of distal femur and proximal tibia pre-HBOT (left) and post-HBOT (right)

Treatment and Discussion

