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Case Report

# Case report: Treatment of bone marrow edema of femoral head with hyperbaric oxygen therapy

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ABSTRACT

Bone marrow edema syndrome is a rare condition of unclear etiology that is characterized by hip pain, limited osteopenia on plain radiography, and characteristic MRI findings. Although the etiology and pathogenesis of bone marrow edema syndrome are not currently known, different mechanisms have been proposed, including microvascular injury, venous obstruction, secondary localized hyperemia, abnormal mechanical stress, metabolic causes, neurogenic compression, etc.

Hyperbaric oxygen therapy (HBO) appears to be effective in treating bone marrow edema syndrome, resulting in an accelerated recovery of hip function compared to pharmacological therapy alone.

The primary effects of HBO in bone marrow edema are threefold. Firstly, by improving oxygen tension in tissue fluids at the site of bone necrosis, which prevents further loss of ischemic bone. Secondly, HBO-induced vasoconstriction decreases edema allowing better perfusion to the injury site, and thirdly, by enhancing reparative process by providing an improved oxygen environment for osteoclastic function, neovascularization and osteogenesis.

Here, we report a case of bone marrow edema syndrome of hip in a 32-year-old male patient, which was conservatively managed.



## 1. Introduction

The term 'bone marrow edema' was first introduced in 1988 characterized by ill-defined areas of decreased signal intensity on T1-weighted MRI and increased signal intensity on T2-weighted images (Table 1).[1–3] Bone marrow edema syndrome (BMES) of the hip is discussed as a possible early reversible stage of avascular necrosis, but the incidence of progression from BMES to avascular necrosis is still unclear.[4]

BMES of the hip is a recently identified clinical entity that has been described as transient osteoporosis or algodystrophy hip affecting middle-aged men.[5] The most common site affected is the hip joint, with the left hip more frequently involved than the right. Bilateral involvement occurs in only 25–30% of cases. Up to 40% of patients have involvement of

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**Table 1 – MR features of BMES of the femoral head on SE T1-weighted images.**

| | |
|---|---|
| Location | At least one portion of femoral head |
| Outline | Blurred contour |
| Homogeneity | Homogeneous, no low/high signal intensity within the lesion on T1 WI |
| Signal intensity | Moderate |

other joints, such as lower-extremity joints, upper-extremity joints, and the spine, with migration to multiple sites or recurrence seen in 25–50% of this population.[4–6]

Diagnosis is made by excluding other possible causes of hip pain. The clinical course is benign, and spontaneous recovery usually occurs over 2–12 months. All current treatment options are considered as symptomatic therapy since a causative influence on the pathogenetic vascular disturbance has not yet been reported.[6,7]

Because of the reversibility of the disease, treatment usually consists of avoiding load on the hips as well as the use of nonsteroidal anti-inflammatory drugs (NSAIDs), bisphosphonates, and prostacyclin and hyperbaric oxygen therapy (HBO), which can improve local hemodynamic characteristics.[8,9]

## 2. HBO helps in management of bone marrow edema by

1. Improving oxygen tension in tissue fluids at site of bone necrosis. This prevents further loss of ischemic bone cells.
2. Enhancing reparative process by providing improved oxygen environment for osteoclastic function, neovascularization, and osteogenesis (improving microcirculation).
3. Decreasing tissue edema.
4. Stimulating angiogenesis.
5. Decreasing intraosseous pressure within femoral head.

## 3. Case report

An Arabic national is a 32-year-old male, nonsmoking doctor, who presented to our hyperbaric medicine unit with primary complaints of pain around the left hip joint and difficulty in walking.

He had experienced a sudden onset of diffuse pain around the left hip joint for the past 4 months with no history of trauma or any other systemic illness. Pain was not accompanied by fever, skin rash, urethritis, etc. Pain was aggravated by walking and prolonged standing.

The pain caused the patient to alter his gait, but was able to walk with assistance. The visual analog scale (VAS) pain score at that time was 7–8 on a 10-point scale with 1 indicating the least pain and 10 indicating the worst pain. On physical examination, range of motion of the left hip was limited and painful in all ranges. Laboratory data and NCV/EMG findings were normal.

Blood work ruled out gout and X-ray hip revealed sclerosis with osteophytes seen in the right hip joint suggestive of degenerative changes but left hip appeared normal (Fig. 1). MRI

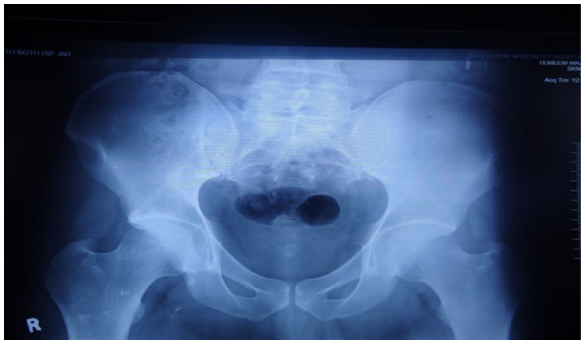

**Fig. 1 – X-ray of pelvis.**

reported underlying bone disorder 'early osteomyelitis with inflammatory changes' in left hip (Fig. 2).

He was advised to take analgesics, NSAIDs, and supplements to alleviate pain and reduce inflammation.

He was asked to repeat MRI after 8 weeks of this pharmacological regime. Following 4 weeks of therapy, his condition improved with mild to moderate pain on prolonged walking with a stick reducing to 5–6 on VAS. Orthopedic advised to continue the treatment and to repeat MRI after 4 weeks. MRI showed extension of inflammatory changes to involve >50% of head and >50% of neck of hip joint. MRI pelvis revealed marked 'bone marrow edema' at the femoral head.

He was advised for further investigations including bone and DEXA scan, which revealed avascular necrosis of femur head (Fig. 3) and mild osteopenia with slightly increased fracture risk, respectively.

He was then advised for HBO along with other conservative treatment. 50 sessions of HBO were given at 2.4 ATA for 90 min with 60 min of oxygen breathing. He showed good improvement with no pain on rest (VAS = 0); on walking, pain reduced to 2 on VAS and mild pain with VAS of 4–5 on heavy exertion. He walked without support and had improved general well-being.

After 2 months of treatment, MRI reported reduction in intensity of osteoblastic activity in head, neck, and trochanteric region of left femur suggesting good response to treatment (Fig. 4).

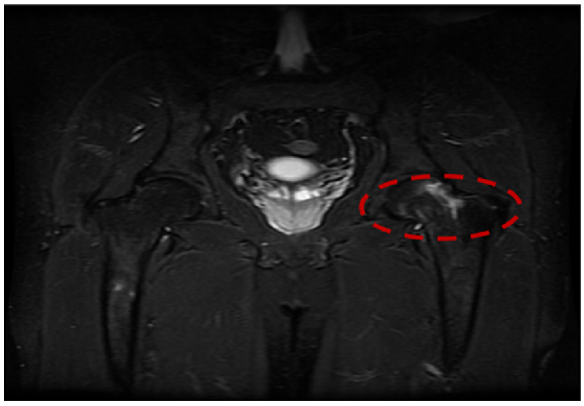

**Fig. 2 – MRI of pelvis.**

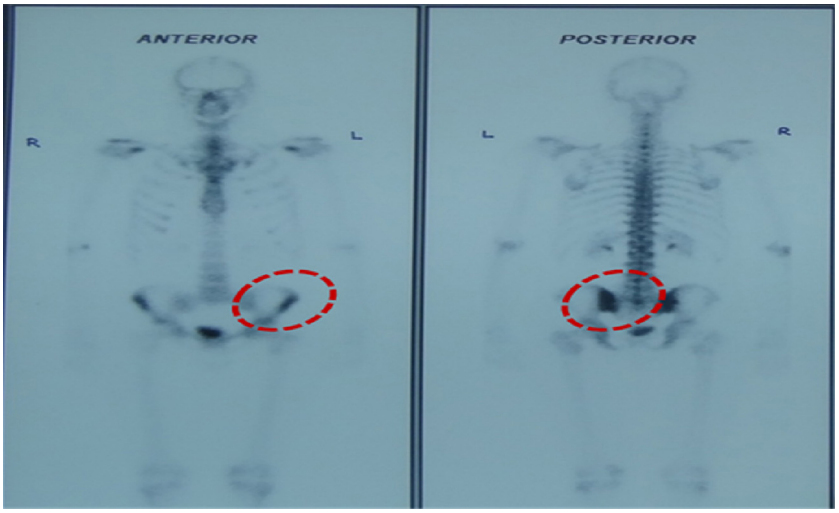


**Fig. 3 – Bone scan of pelvis.**

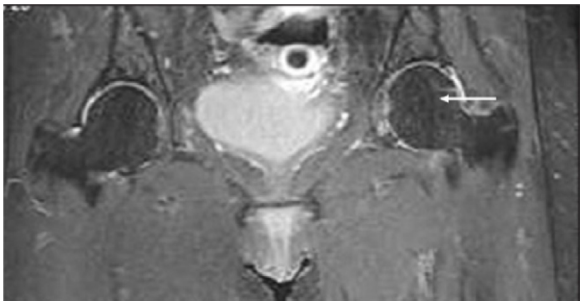

**Fig. 4 – MRI of pelvis.**

## 4. Discussion

BMES is a rare, but underdiagnosed source of pain, which mainly occurs around joints of the lower extremity.[1–5] It is also called transient osteoporosis and may be a reversible early stage of avascular necrosis suggested by FICAT classification (Table 2), a distinct self-limiting transient condition or a form of reflex sympathetic dystrophy predominantly affecting healthy young or middle-aged patients.[6–8]

The pathophysiology of bone marrow edema is unclear, but this terminology is used in association with an entire spectrum of pathological conditions related to trauma or reactive changes related to osteonecrosis, idiopathic transient osteoporosis, arthritis, metabolic bone disorders, and neoplasms.[10,12]

Correct diagnosis is often delayed and the existing therapeutic options are limited, with most of them being only symptomatic.[13,14] Localized bone marrow edema is evident, and, with the advent of magnetic resonance imaging (MRI), it has become the most specific evidence of the condition. On the MRI scan, the marrow edema is revealed by decreased and increased signal intensity on T1- and T2-weighted images, respectively.[11] The options for treatment, however, are limited, consisting primarily of nonspecific, symptomatic therapy with NSAIDs, other analgesics, corticosteroids and reduction of weight bearing until clinical and radiological resolution. In rare cases of bone marrow edema, core decompression has been the option for surgery.[15–17]

HBO enhances oxygenation of the hypoxic tissues, thus reducing edema of the cancellous bone through a high concentration of free oxygen in the extracellular portion and may therefore give good results if associated with other conservative or surgical treatments.[8,9] HBO is inhaling 100% oxygen at a pressure higher than the atmosphere in a chamber that enhances collagen synthesis, fibroblast proliferation, and angiogenesis. It decreases tissue edema by causing vasoconstriction, hence reducing intraosseous pressure that restores the venous drainage and accelerates the microcirculation.[18–20]

**Table 2 – FICAT classification.**

| Stage | X-ray | MRI | Bone scan | Symptoms |
|---|---|---|---|---|
| 0 | Normal | Normal | Normal | Nil |
| 1 | Normal or minor osteopenia | Edema | Increased uptake | Pain typically in the groin |
| 2 | Mixed osteopenia and/or sclerosis and/or subchondral cysts, without any subchondral lucency | Geographic defect | Increased uptake | Pain and stiffness |
| 3 | Crescent sign and eventual cortical collapse | Same as plain film | – | Pain and stiffness ± radiation to knee and limp |
| 4 | End stage with evidence of secondary degenerative change | Same as plain film | – | Pain and limp |

## 5. Conclusion

The findings indicate that HBO along with other conservative treatment is a reliable noninvasive tool with low complication rate for treating BMES of the hip. Further studies would be worthwhile because this treatment has the potential to resolve patient suffering quickly.

## Conflicts of interest

The authors have none to declare.

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