AVN of All Four Heads in a Case of T Cell Acute Lymphocytic Leukemia: A Rare Case Report

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Abstract

Introduction: Avascular necrosis (AVN) of bone is a significant long-term complication of treatment of hematological malignancies that can result in significant morbidity and alteration of quality of life. There are a few reports of AVN in patients with lymphoma or leukemia describing the incidence, risk factors, and diagnostic studies. Incidence rate vary widely depending on the time the study was conducted and the methods used for diagnosis. In patients with ALL multiple factors can contribute to the pathogenesis of AVN, such as the malignancy itself, procoagulant states and cytotoxic drugs. However, corticosteroids are considered to be the most important etiological factor. We hereby present a unique case where all the four heads, both femoral and humeral are simultaneously involved in a case of ALL at the time of presentation.

Case Report: A 28 year old female, diagnosed as a case of T cell ALL under treatment presented to our OPD with complaints of pain in both shoulders and hip joints. High dose of prednisone and methotrexate was administered. She finally underwent allogenic stem cell transplantation 1 year after the diagnosis was made. On clinico-radiological examination both humeral and femoral head AVN was diagnosed. AVN of femoral head was managed operatively by core decompression and non weight bearing for 3 months. AVN of humeral head was managed non operatively by physiotherapy. Zolendronic Acid was given yearly 6 months post op and supplemental calcium, vitamin D for 2 years. At the end of 1 year patient was revaluated clinico-radiologically which showed marked improvement in hip ROM with Harris Hip Score improved from 54 to 72 on the right side and from 51 to 69 on the left side. For shoulder there was improvement too with Constant- Murley score improved from 50.3 to 92.0 on the right side and from 60.9 to 96.0 on the left side.

Discussion: Bone pain is a complaint in as many as 50% of patients with acute leukemia, especially those with ALL. Joint pain occurs much more commonly than other bone pain in patients with leukemia and may be due to hyperuricemia, leukemic joint infiltration and, rarely, AVN. Management of AVN of femoral head involves non operative and operative management. With the current evidence, bisphosphonates are the mainstay in non operative management of AVN and can be used for 3 years in Stage-I, II and III (Stienberg Classification). Core decompression is the most routinely performed surgical procedure for treatment of early AVN. This is a novel case reported in which there is a simultaneous involvement of bilateral shoulder joints along with the hip joints.

Conclusion: This is a novel case reported in which there is a simultaneous involvement of bilateral shoulder joints along with the hip joints. A high level of suspicion is required while treating AVN especially in cases of known long term steroid intake. Institution of early treatment is the key in the management of AVN for a favourable outcome.

Keywords: Avn; Core Decompression; Bisphosphonates; T Cell All; Humeral Head; Femoral Head.
Introduction
Avascular necrosis (AVN) of bone is a significant long-term complication of treatment of hematological malignancies that can result in significant morbidity and alteration of quality of life. There are a few reports of AVN in patients with lymphoma or leukemia describing the incidence, risk factors, and diagnostic studies [1]. Incidence rates vary widely depending on the time, the study was conducted and the methods used, for diagnosis. A 3-year cumulative incidence of 9% in children treated for acute lymphoblastic leukemia (ALL) was reported by Larsan et al [2]. Ojala et al used MRI screening and reported AVN in 9 of 24 patients (38%) with ALL, 6 of whom were asymptomatic [3]. As AVN can be detected in completely asymptomatic patients, the true incidence remains unknown.

In patients with ALL multiple factors can contribute to the pathogenesis of AVN, such as the malignancy itself, procoagulant states and cytotoxic drugs [4]. However, corticosteroids are considered to be the most important etiological factor. Glucocorticoid therapy in animal models have shown to produce adipocyte hypertrophy in the bone marrow which results in elevated intraosseous pressure there by reducing intramedullary blood flow, leading to marrow ischaemia and ultimately necrosis [5]. Reduction of blood flow to the femoral head has also been demonstrated in animals treated with short-term high-dose methylprednisolone [6]. Glucocorticoids can also cause direct toxicity to osteocyte cells [7].

The most commonly involved site is the weight bearing area of hip, that is the femoral head either unilateral or bilateral [8]. The incidence of traumatic as well as atraumatic forms of osteonecrosis of the shoulder, particularly the atraumatic form, is difficult to determine. Atraumatic necrosis of humeral head has multiple associated risk factors. Steroid [9] and alcohol abuse predominate, but dysbarism, hemoglobinopathies, coagulopathies, Gaucher disease, connective tissue disorders, and idiopathic disorders have also been identified as risk factor [10]. However, it definitely appears to occur less often than in the hip. Simultaneous occurrence of AVN in the femoral as well as humeral head is never seen at presentation. We hereby present a unique case where all the four heads, both femoral and humeral are simultaneously involved in a case of ALL at the time of
Case Report

A 28 year old female, diagnosed as a case of T cell ALL under treatment presented to our OPD with complaints of pain in both shoulders and hip joints. Going through her treatment records revealed that she presented to our hospital 2 years back, with complaints of low grade fever, weakness, dyspnoea at rest along with history of recurrent episodes of bleeding from nose. Her investigations at first presentation were Haemoglobin of 6gm%, TLC was 5800/mm3, and platelet count was 84000/mm3 without any blast in peripheral blood. Bone marrow biopsy was done which showed 72% blasts and were positive for CD4, CD5, CD7 and negative for MPO, CD3, and CD8. The patient was planned for treatment under BFM 90 protocol. High dose of prednisone and methotrexate was administered. She finally underwent allogenic stem cell transplantation 1 year after the diagnosis was made. On examination she had tenderness at the Scarpa’s triangle in both the hips (Right>Left) and equally over both the shoulder joint line. Range of motion (ROM) in hips was painfully restricted by 10 to 40 degree in all the planes (Right>Left) with no fixed deformities or limb length discrepancies. Harris Hip score on the right side was 50.3 and left side was 60.9. ROM in both shoulders was painfully restricted by 10 to 30 degree in all planes with abduction and internal rotation maximally affected. Constant-Murley score was 54 and 51 on right and left shoulder respectively. Radiographs of both the shoulders AP view (Fig.1a & 1b) and pelvis with both hips AP (Fig.2) and Frog leg lateral (Fig.3) revealed features suggestive of AVN of both femoral and humeral heads. On MRI evaluation of both hips (Fig.4a & 4b) revealed AVN grade III and grade II on right and left side respectively. MRI of both shoulders (Fig.5a & 5b) confirmed the diagnosis of AVN. As per ARCO (Association research circulation osseous) hips were classified as Grade IIb and IIa in right and left respectively.

AVN of both the hips was treated by Core decompression in the same setting. Post operative period was uneventful and she was kept non weight bearing for 3 months following which she was allowed assisted weight bearing with the help of crutches. At the end of 4 months she was walking full weight bearing unaided with minimal discomfort. She was also given IV Zolindronic acid post op 6 months. AVN of shoulders were managed by physiotherapy and bisphosphonates alone. At the end of 1 year patient was reevaluated clinically which showed marked improvement in hip ROM with Harris Hip Score improved from 54 to 72 on the right side and from 51 to 69 on the left side. For shoulder there was improvement too with Constant-Murley score improved from 50.3 to 92.0 on the right side and from 60.9 to 96.0 on the left side. Radiologically serial post op X-rays of both hips at
1 (Fig.6), 3 (Fig.7), 6 (Fig.8) and 12 months (Fig.9) showed progressive improvement with decrease in avascular lytic areas and increase in marrow density and maintained head congruity.

On the contrary X-ray evaluation of the shoulders at 12 months (Fig.10) showed increase in lytic areas, although the head contour was maintained.

With yearly doses of IV Zolindronic acid and vitamin D and calcium supplementation the patient has been nearly pain free for the past 2 years. She is on regular follow up and is now able to carry on her routine activities normally.

**Discussion**

Malignancies of the lymphoid cells range from the most indolent to the most aggressive ones. These cancers originate from the cells of immune system that is the B cells, T cells or the Natural Killer cells at different stages of differentiation. While Chronic Lymphoid Leukemia (CLL) is the disease of elderly, the Acute Lymphoid Leukemias (ALL) are predominantly cancers of children and young adults. Of these T-cell Acute Lymphoblastic Leukemia (T-ALL) accounts for about 25% of ALL in adults [11]. Patients usually present with fever, malaise, breathlessness, bleeding tendencies. They have anemia, high white blood cell counts and may present with organomegaly, particularly mediastinal enlargement and CNS involvement.

Bone pain is a complaint in as many as 50% of patients with acute leukemia, especially those with ALL [12]. Joint pain occurs much more commonly than other bone pain in patients with leukemia and may be due to hyperuricemia, leukemic joint infiltration and, rarely, AVN [13]. AVN of
the bone is a rare but serious complication of ALL or its treatment, usually related to corticosteroid use [4]. Its development, in many cases, results in significant pain and loss of function sometimes necessitating joint replacement [14]. AVN of bone has been reported in adolescents with ALL but not in older patients. It has been suggested that adolescents are prone to the development of bone AVN, secondary to a physiologic increase in steroids or to increased mechanical stress due to greater physical activity [4].

Management of AVN of femoral head involves non-operative and operative management. With the current evidence, bisphosphonates are the mainstay in non-operative management of AVN and can be used for 3 years in Stage-I, II and III (Stienberg Classification) [15,16]. Core decompression is the most routinely performed surgical procedure for treatment of early AVN. It decreases the intraosseous pressure in the femoral head and increases blood flow to the necrotic area, thus augmenting new bone formation. It has been considered as the only cost-effective surgical procedure for AVN [17,18], but the success of the treatment is largely dependent on the etiology and radiographic parameters such as lesion size, location or collapse of the lesion [16,18].

This is a novel case reported in which there is a simultaneous involvement of bilateral shoulder joints along with the hip joints. Our patient although had an involvement of both shoulder and hip joints, did not require a replacement surgery and improved clinico-radiologically as it was diagnosed early and preventive measures like non-weight bearing, core decompression, bisphosphonates and physiotherapy were employed early in the management.

**Conclusion**

AVN of humeral head is less common compared to that of femoral head but can lead to significant morbidity and disability. Although it’s a rare presentation but its occurrence could be more than what we know as we seldom evaluate the shoulder pain in a case of AVN induced by steroids or chemotherapy. A high level of suspicion is required while treating AVN especially in cases of known long term steroid intake. Institution of early treatment is the key in the management of AVN for a favourable outcome.

**References**


