

Case Report

Biomedical Science and Clinical Research

Dexamethasone-Induced Avascular Necrosis in a Pre-B Acute Lymphoblastic Leukemia Patient: A Case Report

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Abstract

Avascular necrosis (AVN) poses a significant risk to acute lymphoblastic leukemia (ALL) patients, with the hip joint being the most commonly affected. Systemic corticosteroids, like dexamethasone, contribute to nearly one-third of AVN cases. In our specific case, a 5-year-old male ALL patient, undergoing dexamethasone-based chemotherapy, presented with acute bilateral leg pain. MRI findings confirmed grade 3 avascular necrosis in the right femoral capital femoral region. As a result, dexamethasone was discontinued from the treatment plan, and the patient was discharged with oral pain medication, scheduled for orthopedic follow-ups. This case underscores the importance of close monitoring during systemic corticosteroid use in leukemia treatment. While AVN typically develops over prolonged steroid exposure, our case demonstrates its potential occurrence even after a short course. Early detection improves the prospects for conservative treatment, emphasizing the necessity for awareness and cautious steroid use in ALL therapy.

**Keywords:** Dexamethasone, Avascular Necrosis, Leukemia, Children, Case Report

1. Introduction

The use of systemic corticosteroid therapy for the treatment for pediatric hematological malignancy has led to a drastic improvement in the rate of survival of children with acute lymphoblastic leukemia but at the cost of increased toxicities and long-term complications [1]. One of the serious complication out of these is avascular necrosis (AVN), which results from a temporary or permanent loss of blood supply to the bone [2]. The incident rate of AVN is between 0.43% and 17.6% [3]. AVN usually causes significant chronic pain and reduced mobility, with some patients requiring joint replacements. The most common location is the hip, other includes the knee, talus, and humeral head. Several risk factors have been identified for the development of avascular necrosis in children with hematologic cancers; such as, direct cellular toxicity (chemotherapy, radiation therapy), underlying rheumatologic conditions such as systemic lupus erythematosus, age of 11 years or greater at the time of therapy, increased dose of corticosteroids, and female sex [4,5]. If AVN is caught early then there is a better chance for successful conservative treatment. The usual operative treatment that may provide pain relief and delay or avoid the requirement for joint replacement at early stages is core decompression [3]. Almost one-third of all cases of AVN are associated with the use of systemic corticosteroids [6].

2. Case Report

In our case report, we present a 5-year-old male diagnosed with pre-B acute lymphoblastic leukemia, receiving treatment according to the UK ALL 2013 guidelines, which includes dexamethasone. During maintenance therapy involving monthly Vincristine, Dexamethasone 6mg/m<sup>2</sup> pulses, and oral chemotherapy, the patient presented to the emergency department with a two-day history of bilateral leg pain.

Plain X-ray followed by MRI scan was done. The radiograph performed showed a small irregular stippled right femoral capital epiphysis with loss of normal contour and internal sclerosis. A small internal cystic change was also seen. MRI features are suggestive of an established grade 3 right femoral capital avascular necrosis, contour irregularity and structural collapse and a small area of developing avascular necrosis in the left femoral capital epiphysis.

While the patient's pain improved with medication, orthopedic evaluation deemed him fit and pain-free, allowing for regular follow-ups. Notably, dexamethasone was discontinued from his treatment regimen after a thorough literature review on dexamethasone-induced avascular necrosis.

### 3. Discussion

Corticosteroids, including dexamethasone, are integral in cancer treatment, managing nausea, and vomiting during chemotherapy. A rare yet severe side effect is steroid-induced avascular necrosis, primarily afflicting hip, shoulder, and knee joints. Patients typically present with escalating pain during movement, necessitating early detection and intervention. The patient presented with the complaint of increasing pain during movement [7].

The usual occurrence of AVN happens after a long duration of steroid use. However, it can happen even after a short duration of steroid use. In most cases, it takes about 6 to 8 months for the manifestation of steroid-induced avascular necrosis [7]. There is no precise knowledge of the important factors associated with the use of steroids such as dose, duration of therapy, peak dose, route of administration, cumulative dose, or idiosyncratic susceptibility. It has been reported the development of steroid-induced AVN just after a 7-day course of dexamethasone in which the patient received 112 mg of the total dose [8]. There also have been reports of steroid-induced AVN following the administration of 172, 191, and 216 mg of dexamethasone over 37, 22, and 18 days, respectively [9]. Therefore, it can be interpreted that no safe dose of steroids has been established [7]. Our patient has been on dexamethasone as a part of the chemotherapy protocol since 18th, Jan 2019 and after 5 months of being on dexamethasone, the patient reported to the emergency department with the complaint of bilateral leg pain.

The exact cause of steroid-induced AVN is not clear, but several theories suggest it may be linked to factors like microfractures from steroid-induced osteoporosis, increased blood clotting, inflammation, and interference with fat metabolism. Steroids may hinder the breakdown of fatty substances, leading to narrowed blood vessels and reduced blood flow, ultimately resulting in bone necrosis [10].

If AVN is caught early, then there is a better chance for successful conservative treatment. The diagnosis can be made before any changes appear on the x-ray films. MRI can be used to diagnose AVN because it can detect AVN in the earliest stages when symptoms are not yet present. Joint destruction or significant disability can be avoided with conservative measures such as rest, walking with the help of crutches, or reduction in all activities that can lead to the exacerbation of the affected joint [11]. A total joint replacement can be done once the joint is fully destroyed. In our patient; after the initial x-rays, MRI was done and confirmed the presence of steroid-induced avascular necrosis. The patient was discharged on conservative measures

and oral pain medication.

The use of steroids should not be taken lightly. Patients who are on steroids should be informed about the possibility of developing avascular necrosis and should be on a follow-up with their physicians or orthopedics so that it can be caught early and treated to limit joint destruction and disability.

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