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**Hematology**

# Hematological Abnormalities in Visceral Leishmaniasis: About 2 Cases and Literature Review

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**Abstract** **Case Report**

Visceral leishmaniasis is a vector-borne disease primarily linked to infection with Leishmania infantum in the Mediterranean region. The clinical and biological manifestations of visceral leishmaniasis are often misleading, particularly with pseudo-hematologic symptoms. Our study aims to report on the main morphological abnormalities of the bone marrow in two hospitalized children with infantile visceral leishmaniasis at the Mohamed VI University Hospital Center in Marrakech. General deterioration and splenomegaly were the dominant clinical findings. On a biological level, pancytopenia was consistent in both patients. The diagnosis was confirmed by demonstrating the parasite in the bone marrow. On myelogram, there were quantitative and qualitative abnormalities across cellular lineages, sometimes accompanied by hemophagocytosis. Knowledge of these abnormalities associated with visceral leishmaniasis can help to suspect this parasitic disease and encourage the biologist to search for Leishmania bodies on bone marrow smears.

**Keywords:** hemophagocytosis, pancytopenia, dyserythropoiesis, bone marrow aspiration, visceral leishmaniasis (VL).



## INTRODUCTION

Leishmaniasis is a parasitic disease caused by flagellated protozoa of the Leishmania genus. This parasite is transmitted from mammal to mammal by biting a vector arthropod: a female sandfly of the genus Phlebotomus. Leishmaniasis is widespread, occurring as foci of varying importance on all continents except Oceania [1,2].

Leishmaniasis is considered a public health problem in Morocco and is one of the diseases for which mandatory reporting is required [3,4]. The existing forms are the localized cutaneous form and the visceral form that affects children by excellence (VL) or Kala Azar, the latter caused by Leishmania infantum. Dogs are the parasite's primary reservoir [4-5].

In 2020, the WHO reported 12,838 new cases of VL. 34% of cases were notified in the African continent and 29% in the Eastern Mediterranean Region. The Americas and Southeast Asia regions reported 16% and 18% of cases, respectively, while only 2% of cases have been detected in Europe and the Western Pacific region [6].

In Morocco, according to the Ministry of Health, 6,8149 cases of leishmaniasis of all forms were reported between 2008 and 2020. Mucocutaneous leishmaniasis, Cutaneous leishmaniasis (CL), and Visceral leishmaniasis (VL) represent 57%, 41%, and 2% of all recorded cases, respectively [7]. With a significant decrease in new cases of VL recorded, from 163 cases in 2008 to 69 cases in 2020 [7].

We report here two cases of VL with hematological abnormalities in bone marrow examination.

## CASE PRESENTATION

### Case 1

A one-year-old female with no significant past medical history was referred to the pediatric emergency department for evaluation of febrile splenomegaly evolving over one week.

On admission, the patient appeared dehydrated and pale, with conjunctival pallor, a temperature of 38.7°C, and polypnea. No cutaneous lesions or peripheral lymphadenopathy were noted. Abdominal examination revealed hepatosplenomegaly, which was subsequently confirmed by ultrasound imaging.

Initial laboratory investigations demonstrated severe anemia (hemoglobin: 6.1 g/dL), thrombocytopenia (46,000/µL), and neutropenia (430/mm³), consistent with pancytopenia. Red blood cell indices showed mild microcytosis (mean corpuscular volume: 78 fL). The anemia was non-regenerative, with a reticulocyte count of 102,000/mm³. A direct antiglobulin (Coombs) test was positive.

Renal function tests were within normal limits. Liver function tests revealed significant cytolysis, with aspartate aminotransferase elevated to 15 times the upper limit of normal and alanine aminotransferase to 2.5 times the upper limit. Total bilirubin was elevated at 22.4 mg/L, predominantly unconjugated. Additional abnormalities included hypoalbuminemia (14.2 g/L), elevated lactate dehydrogenase (three times the upper limit of normal), and decreased prothrombin time (22.1%). C-reactive protein was elevated at 78 mg/L, consistent with an inflammatory syndrome.

**Case 2**

A three-year-old male with no prior medical history was admitted for progressive deterioration of general condition over a 15-day period.

Clinical examination revealed a pale, dehydrated child with mild conjunctival pallor and a temperature of 38°C. Splenomegaly associated with superficial lymphadenopathy was present, without hepatomegaly.

Laboratory findings showed hypochromic, non-regenerative anemia (hemoglobin: 7 g/dL), thrombocytopenia (60,000/µL), and neutropenia (550/mm³), again indicating pancytopenia. Red blood cell indices demonstrated microcytosis (mean corpuscular volume: 70 fL). Renal and hepatic function tests were within normal limits, except for mild hypoalbuminemia (20 g/L). C-reactive protein was elevated at 50 mg/L.

Abdominal ultrasound confirmed isolated splenomegaly. Peripheral blood smear revealed anisopoikilocytosis, predominantly microcytosis and hypochromia, with occasional annulocytes.

Bone Marrow Findings

Bone marrow aspiration was performed in both patients to investigate pancytopenia.

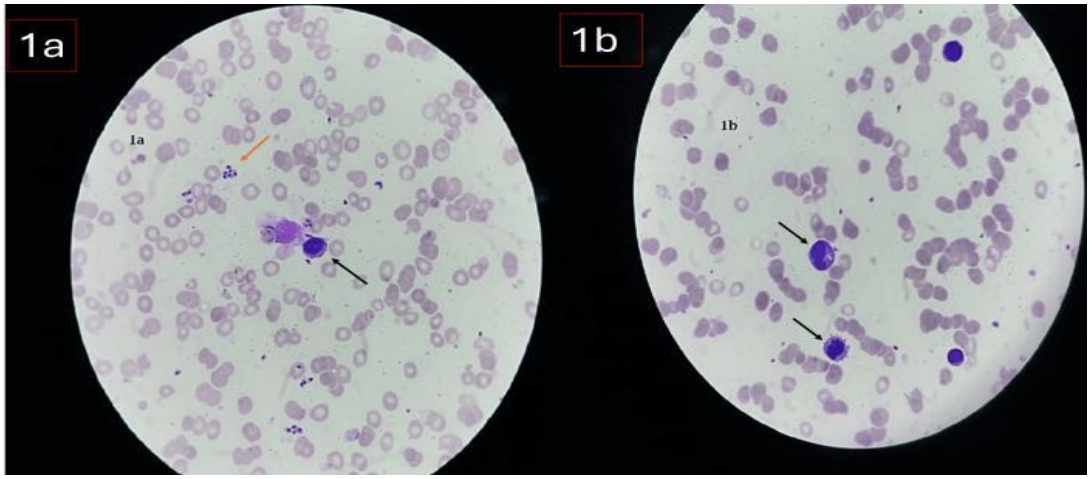


**Figure 1: Dyserythropoietic features in erythroblasts in a patient with visceral leishmaniasis**

*(1a) Amastigotes of Leishmania (Orange arrow) Nucleocytoplasmic asynchrony (black arrow)*
*(2b) Ragged erythroblastic membrane, irregular nucleus and slight nuclear segmentation (black arrow)*

In both cases, the marrow was hypercellular with increased megakaryocytes. Erythroid hyperplasia was observed (39% in Case 1 and 40% in Case 2), with dyserythropoietic changes, including mild nucleo-cytoplasmic asynchrony, nuclear irregularities, laminated cytoplasm, and irregular cytoplasmic borders (Figure 1).

The granulocytic lineage was relatively decreased (36% in Case 1 and 31% in Case 2), with evidence of dysgranulopoiesis, including hypogranulation, cytoplasmic vacuolization, and numerous pseudo–Pelger-Huët anomalies. Lymphocytosis (25% and 24%, respectively) with associated plasmacytosis (5%) was also noted. Hemophagocytosis was identified in Case 2 (Figure 2).

Numerous intracellular and extracellular Leishmania amastigotes were observed in both bone marrow samples, confirming medullary involvement.

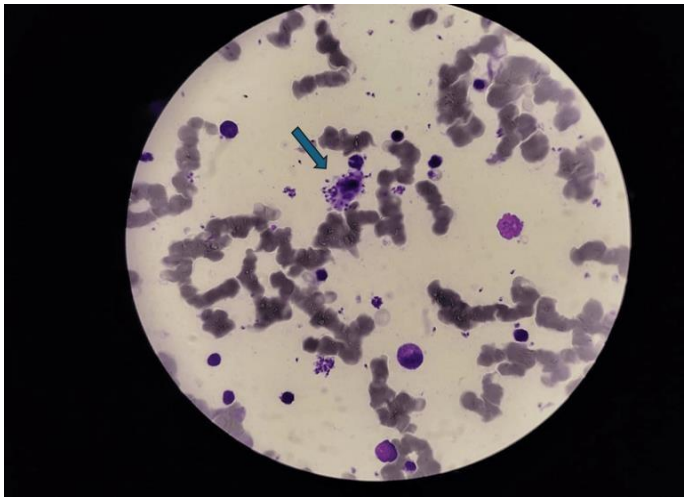

**Figure 2: Histiocytes containing numerous Leishmania amastigotes (blue arrow)**

## DISCUSSION

In 2020, of the 200 countries and territories reporting data to the World Health Organization (WHO), 98 (49%) were considered endemic for leishmaniasis, including 79 (40%) endemics for visceral leishmaniasis (VL) [6]. In Morocco, VL remains a notifiable disease; however, the number of new cases did not exceed 69 in 2020, including six cases reported in the Marrakech–Safi region [7]. Although VL is relatively uncommon, it remains an important differential diagnosis in endemic areas because delayed recognition may lead to significant morbidity.

In the classic Mediterranean form of VL in young children, the clinical triad of fever, pallor, and splenomegaly is typically observed [2]. In our series, both patients presented with this triad, while hepatomegaly was present in only one case, which is consistent with previously published data [8,9]. Biological features suggestive of VL include variable pancytopenia and an inflammatory syndrome [2]. In the present cases, both patients had pancytopenia associated with elevated C-reactive protein (CRP) levels.

Anemia is a major feature of VL and was severe at admission in our patients, with a mean hemoglobin level of 6.5 g/dL. Similar findings have been reported in other series [4,10]. This anemia is thought to result from two main mechanisms. First, a central mechanism may occur through bone marrow irritation by parasitic antigens, leading to dyserythropoiesis [9,11]. Second, and more commonly, a peripheral mechanism is involved, related to hypersplenism and autoimmune phenomena, with complement activation following antigen–antibody complex formation. Prolonged parasitism may further contribute to progressive worsening of anemia [4,9,12]. Thrombocytopenia and leukopenia may also result from hypersplenism and hemophagocytosis [13,14]. These cytopenias can mimic hematologic malignancies and may therefore lead to bone marrow aspiration [8,9].

Detection of Leishmania bodies on peripheral blood smear is uncommon in children, although it has been reported [15,16]; this was not observed in our patients. Traditionally, definitive diagnosis relies on examination of bone marrow aspirate stained with May–Grünwald–Giemsa (MGG) [2]. On microscopy, the parasite is seen in its amastigote form, usually within macrophages, but more often extracellularly. It measures 2–5 µm and is characterized by a round or oval purple nucleus and a darker punctiform or bacilliform kinetoplast [8,9]. According to the literature, the diagnostic yield of bone marrow examination ranges from 54% to 92% [3,4,17,18].

Bone marrow analysis in our patients showed several abnormalities that help explain the cytopenias associated with VL. These findings mainly included erythroid hyperplasia and features of dyserythropoiesis, both of which are frequently reported in this disease [9,19]. Dyserythropoiesis may be cytoplasmic or nuclear. Cytoplasmic dyserythropoiesis is usually associated with iron deficiency and is characterized by reduced hemoglobinization and an abnormal or fragile erythroblastic membrane [19]. Nuclear dyserythropoiesis results from megaloblastic changes or defects in nuclear segmentation. Common findings include delayed nuclear maturation, nucleocytoplasmic asynchrony, open chromatin, Howell–Jolly bodies, multinuclearity, multipolar mitoses, karyorrhexis, and nuclear fragmentation [19]. Our findings are in line with these descriptions, as erythroid hyperplasia with multiple dyserythropoietic changes was present.

Hemophagocytosis was observed in only one case, which is consistent with its rarity in VL [20]. Medullary plasmacytosis is reported in approximately 50% of cases and was also noted in the same patient [20]. The association between VL and macrophage activation syndrome remains uncommon but clinically important [9]. Other bone marrow abnormalities described in VL include lymphoid hyperplasia, which was observed in our patients, as well as dysgranulopoiesis such as

vacuolated cytoplasm, hypogranulation, and pseudo–Pelger-Huët cells [9,20]. Although granulocytic abnormalities were less frequent in our series, their presence should prompt a careful search for Leishmania bodies.

Aggregates of Leishmania bodies have also been described and may appear flower-like, clover-shaped, ball-like, or irregularly star-shaped. Awareness of these patterns is important to avoid confusion with platelet aggregates [20]. In our series, the extracellular localization of the parasite was a frequent finding, as previously reported in the literature.

VL is a chronic disease with a slow course, and in the absence of treatment, it progresses toward worsening clinical and biological impairment. Severe cachexia may develop, along with deterioration in general condition and increased susceptibility to infections [4]. When a diagnosis is made early and appropriate management is initiated promptly, the prognosis is generally favorable. Treatment response, however, is strongly influenced by disease duration, and advanced stages may respond poorly or incompletely to therapy [4]

## CONCLUSIONS

Visceral leishmaniasis remains a notifiable disease in Morocco despite its gradual decline. This condition is associated with numerous hematological and particularly cytological abnormalities, which should prompt biologists to consider this parasitosis during bone marrow aspiration examination, thereby enabling rapid diagnosis without resorting to more costly tests and avoiding delays in treatment.

**Additional Information**

**Disclosures**

**Human subjects:** Consent was obtained or waived by all participants in this study.

**Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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