

# “Dry tap” of Bone Marrow and its Clinical Importance.

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## ABSTRACT

**Objective:** Dry tap is usually defined as a “failure to obtain bone marrow on attempted marrow aspiration”. The diagnosis and management of many haematological diseases depends on examination of the bone marrow, which involves two separate specimens i.e. a cytologic and a histologic preparation. The purpose of this study was to document the causes of dry tap and importance of bone marrow biopsy.

**Design:** Descriptive study.

**Place and duration of study:** All reports of simultaneous marrow aspirations and biopsies, performed at the Haematology Department of the Armed Forces Institute of Pathology Rawalpindi between January 1, 2007 and July 1, 2007, were reviewed to determine the frequency of dry taps and the diagnosis and pathologic findings in these cases.

**Method:** A total number of 500 patients were studied. The standard technique was employed in obtaining the samples from posterior superior iliac crest. In the bone marrow examination, aspirate needle was used for bone marrow aspiration and Jamshidi needle (Regular/Adult, 11-gauge) was used for trephine biopsy. All of the procedures for bone examinations were performed unilaterally.

**Results:** Among the 500 studied cases of simultaneous bone marrow aspirations and biopsies, 51 were dry taps (10%). Of these 51 dry taps, only 10 (19.6%) showed normal marrow biopsies, whereas the majority showed significant marrow pathology, usually associated with fibrosis, or hypercellularity, or both. These conditions most likely account for the inability to aspirate marrow. The most frequent diagnoses were acute leukaemia 16 (31.4%), secondary myelofibrosis 3 (5.9%), lymphoproliferative disorder 4 (7.8%), idiopathic myelofibrosis 4 (7.8%), hairy cell leukaemia 2 (3.9%), plasmacytosis 2 (3.9%), secondaries 5 (9.8%), osteoporosis 2 (3.9%) and myeloproliferative disorder 3 (5.9%).

**Key words:** Dry tap, Bone marrow aspiration, Bone marrow biopsy.

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## INTRODUCTION

The Diagnosis and management of many haematologic diseases (leukoerythroblastic blood picture and unexplained cytopenias) depends on examination of the bone marrow which includes two separate specimens: a cytologic preparation and a histologic preparation. The cytologic preparation of bone marrow, obtained by aspiration, allows the visualization of cells and their precursors morphology (platelets, white blood cells and red blood cells) and the histologic preparation of bone marrow, usually obtained with a Jamshidi needle, allows optimal evaluation of bone marrow cellularity, fibrosis or infiltrative disease. As for as the haematologic malignancies, bone marrow examination has also been increasingly useful in documenting metastasis involvement of tumors<sup>1,2</sup>. Failure to obtain bone marrow on attempted marrow aspiration, “dry tap or a blood tap” has commonly been described to faulty technique<sup>3</sup>. Although this can happen when bone marrow histology is normal, a dry tap usually indicates significant diseases most often metastasis carcinoma, acute leukaemia, idiopathic myelofibrosis

or hairy cell leukaemia with associated fibrosis<sup>4,5</sup>. In dry tap, the aspirate may contain a mixture of tumour cells, osteoblasts and osteoclasts. Sometimes the aspirate is wholly or partly necrotic and this observation should lead to suspicion of malignant infiltration.

## MATERIAL AND METHOD

This study was conducted at the Armed Forces Institute of Pathology, Rawalpindi. It was a descriptive study and sampling was done by non-probability convenience technique without involving any gender/age discrimination. The study was conducted from January 1, 2007 and July 1, 2007 wherein a total number of 500 patients from the Armed Forces Institute of Pathology, Rawalpindi were studied. Patient characteristics were recorded in each case, including presenting symptoms, onset of symptoms, physical examination findings, peripheral blood counts, peripheral blood morphology, diagnostic evaluation and management. The standard technique was employed in obtaining the samples from posterior superior iliac crest. The skin

covering the biopsy site was cleaned with an antiseptic. The patient was positioned, and a local anesthetic such as lidocaine was administered first under the skin with a fine needle and then around the bone at the intended puncture site with a somewhat larger gauge needle. The aspirate needle was used for aspiration and a Jamshidi needle (Regular/Adult, 11-gauge) was used for trephine biopsy. The bone marrow aspirate was used to make several preparations on glass slide. Touch preparations were done if the aspiration resulted in a "dry tap" or if aspiration material was considered to be technically inadequate for evaluation, or if it was hemodilute. Bone marrow aspiration, touch preparations and peripheral blood smears which were obtained at the same time by biopsy were stained by May Grunwald-Giemsa or Hematoxylene-eosin. Trephine biopsies were fixed in 10% neutral buffered formaline for at least 24 hours, and then decalcified overnight in a decalcifying solution which is a mixture of 8% HCl and 10% formic acid at equal amounts of volume. Following the automated tissue processing, biopsies were embedded in parafin blocks, and 0.3 micrometer sections were cut.

## RESULTS

A descriptive study was carried out which revealed that out of the 500 studied patients, 51 were dry taps (10%). Of these 51 dry taps, only 10 (19.6%) showed normal marrow biopsies, whereas the majority showed significant marrow pathology, usually associated with fibrosis, or hypercellularity. The most frequent diagnosis were acute leukaemia 16(31.4%), secondary myelofibrosis 3(5.9%), lymphoproliferative disorder 4(7.8%), idiopathic myelofibrosis 4(7.8%), hairy cell leukaemia 2(3.9%), plasmacytosis 2(3.9%), secondaries 5(9.8%), osteoporosis 2(3.9%) and myeloproliferative disorder 3(5.9%).

The table below shows the study results of trephine biopsy in "dry tap" marrows:

Results of Trephine Biopsy	Frequency	%age
Normal marrow	10	19.6
Secondary Myelofibrosis	3	5.9
Lymphoproliferative Disorder	4	7.8
Idiopathic Myelofibrosis	4	7.8
Hairy cell leukaemia	2	3.9
Acute leukaemia	16	31.4
Plasmacytosis	2	3.9
Secondaries	5	9.8
Osteoporosis	2	3.9
Myeloproliferative disorder	3	5.9
<b>Total</b>	<b>51</b>	<b>100.0</b>

## DISCUSSION

The bone marrow examination is considered one of the most valuable diagnostic tools to evaluate haematologic disorders. Its indications have included the diagnosis of myeloproliferative disorders, multiple myeloma, fever of unknown origin (FUO), presence of microorganisms, such as tuberculosis, mycobacterium avium intracellulare (MAI) infections, histoplasmosis and leishmaniasis, storage diseases (e.g. Niemann-Pick disease and Gaucher disease), patients with idiopathic thrombocytopenia purpura (ITP), incidental elevated serum paraprotein levels, iron deficiency anemia, B12/folate deficiency, polycythaemia vera and infectious mononucleosis as well as the staging and therapeutic monitoring for lymphoproliferative disorders such as chronic lymphocytic leukemia (CLL), Hodgkin and Non-Hodgkin lymphoma and hairy cell leukemia<sup>6</sup>. The bone marrow examination in evaluating patients with suspected malignancy has a limited value unless supported by some other clinical finding, such as a leukoerythroblastic blood picture<sup>1,7,8</sup>. Instead of a single specific finding, there are a number of correlates that may be useful for marrow infiltration. In this study, most of the patients were presented with leucoerythroblastic blood picture and unexplained cytopenias<sup>9,10</sup> which are strong indicators of the necessity of bone marrow examination. The invasion of metastatic cancer cells may cause the early release of some cytokines, leading to the development of leucoerythroblastic reaction even before the marrow is completely replaced. "Dry tap" is a term used to describe failure to obtain bone marrow on attempted marrow aspirations. Extensive marrow fibrosis and hypercellularity have been proposed as mechanisms to account for the inability to withdraw marrow by aspiration<sup>11,12</sup>. The histology of this study showed that the most common changes associated with scanty yield aspirations were bone marrow hypercellularity (especially due to immature cells), bone marrow fibrosis (patchy or diffuse) either primary or secondary bone marrow fibrosis and secondaries. A very few 'dry tap' cases showed normal bone marrow by trephine biopsy. This study has shown that a 'dry tap' should not be dismissed as being due to faulty technique and should be followed by a bone marrow biopsy (length of the biopsy cores ranged between 1.2 cm and 2.2 cm) which have been found to have a definitive advantage over aspirates in cases of dry tap<sup>13,14,15</sup>.

## CONCLUSION

This study concluded that the bone marrow biopsy must be indicated from the patients in whom the repeated attempts of bone marrow aspiration resulted completely "dry tap" and patients presented with leucoerythroblastic blood picture and cytopenias.

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