Introduction: The hematological disorders are frequently encountered in the general population. There is a wide range of hematological disorders in general public. The disorder may be minute, like iron deficiency anemia, or it may be severe like bone marrow infiltration. Bone marrow is an investigation that is necessary to reach to the final diagnosis in most of these disorders. In certain cases, it is not uncommon that the underlying hematological disorder presents with very vague symptoms. This poses a big problem for the clinician to reach the diagnosis. Bone marrow examination is a very useful investigation in such cases to make the definitive diagnosis.

The most frequently encountered hematological disorders in most clinical setup include Megaloblastic anemia, idiopathic thrombocytopenia purpura, aplastic anemia, and leukemias. All these cases can be diagnosed by review of the bone marrow aspiration and biopsy. The usual findings in megaloblastic anemia are low hemoglobin and high mean cell volume. It is caused because of deficiency of vitamin B-12 and folate due to deficiency in diet. Leukemia is a malignant disorder in children and bone
marrow examination is necessary for making its diagnosis.\(^6\)

The frequency of different hematological diseases varies from region to region. Therefore, the present study was done with a rationale to determine the frequency of various hematological disorders through bone marrow examination in our region.

**Material and Methods:**

It was a retrospective cross-sectional study. It was performed in the Pathology Department, Khyber Teaching Hospital, Peshawar. The study was done from January 2016 to December 2016. The sampling was done through non-probability purposive sampling. The reports of bone marrow aspirate and biopsy were studied. Data regarding age, gender, and final diagnosis made by bone marrow aspiration and biopsy were recorded in a proforma. Results were analyzed using SPSS version 18. Mean and standard deviation were calculated for quantitative variables e.g., age. Frequencies and percentages were calculated for qualitative variables like diagnosis and gender.

Inclusion Criteria: Cases of all ages and both sexes, having complete record of their age gender and bone marrow diagnosis.

Exclusion Criteria: Cases with incomplete records, or where there was a dry tap, or marrow was diluted, or sample was inadequate to make any diagnosis.

**Results:**

About 139 cases were included in the study. The mean age of the study population was 30.7±7 years, with a range of 1.5-60 years. About 63 (45%) cases were males, while 76 (55%) cases were females.

Frequency of different hematological disorder is given in Table 1.

**Discussion:**

The commonest hematological disorder in the present study was Leukemia, followed by megaloblastic anemia. In a study done by Khan MI in Peshawar, megaloblastic anemia was the commonest disease in study population, while leukemia was third in order seen in 22% cases.\(^1\) In one study leukemia, was present in 11.3% of the cases.\(^6\) Similar data is reported by Khan A and Shiddappa.\(^6,10\) Similar results are reported in another studies done in Peshawar.\(^5,13\) Megaloblastic anemia commonly presents as pancytopenia.\(^6\)

In the present study, hypersplenism was seen in 3.5% cases. Such patients do not show any blasts or other atypical cells in their bone marrow smears. When there is splenomegaly, the hematopoietic cells tend to accumulate in the splenic sinusoids.\(^11\) This leads to peripheral cytopenias.\(^11\) In a local study done by Khan MI, excessive peripheral destruction was reported in about 9.4% cases.\(^1\) In another study done in Saudi Arabia, a figure of 4.4% is reported for excessive peripheral destruction.\(^12\)

In the present study, aplastic anemia was seen in about 6.5% cases. In aplastic anemia, the bone marrow aspirate was hypocellular while the trephine showed increased fat spaces. The aplastic anemia may be due to congenital causes or acquired in origin.\(^1,14\) Aplastic anemia is associated with failure of the bone marrow. This results in a decreased production of hematopoietic cells.\(^14\) This results in fever, anemia, pallor and bruises all over the body.\(^5\)

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Table-1: Comparison of demographic factors of the studied cases

<table>
<thead>
<tr>
<th>Bone Marrow Findings</th>
<th>Frequency (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukaemias</td>
<td>30</td>
<td>21.7</td>
</tr>
<tr>
<td>Megaloblastic anemia</td>
<td>26</td>
<td>18.8</td>
</tr>
<tr>
<td>Immune thrombocytopenic purpura</td>
<td>26</td>
<td>18.8</td>
</tr>
<tr>
<td>Hemolytic anemia/erythroid hyperplasia</td>
<td>17</td>
<td>12.3</td>
</tr>
<tr>
<td>Aplastic anemia</td>
<td>9</td>
<td>6.5</td>
</tr>
<tr>
<td>IDA</td>
<td>9</td>
<td>6.5</td>
</tr>
<tr>
<td>ACD</td>
<td>8</td>
<td>5.7</td>
</tr>
<tr>
<td>Hypersplenism / Excessive peripheral destruction</td>
<td>5</td>
<td>3.6</td>
</tr>
<tr>
<td>Metastatic infiltration</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Visceral leishmaniasis</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Paroxysmal Nocturnal Hemoglobinuria</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Malaria</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Primary Myelofibrosis</td>
<td>1</td>
<td>0.7</td>
</tr>
</tbody>
</table>

\(IDA: iron deficiency anemia, ACD: anemia of chronic disorder\)
monest causes of bone marrow aplasia include drugs and viral infections like viral hepatitis.\textsuperscript{15-17}

In our study, immune thrombocytopenic purpura (ITP) was observed in 18.8% cases. In ITP, the platelet count in peripheral blood is low but the megakaryocytes in the bone marrow aspirate are increased.\textsuperscript{18} In a study done in Peshawar by Khan MI showed that ITP was sen in 3.6% of cases.\textsuperscript{1} Similar data is reported by other local an international studies done so far.\textsuperscript{1,6,19} The usual presentation of cases with ITP is with bruises all over the body and mucosal bleeds.\textsuperscript{20}

In the present study, iron deficiency anemia was seen in 6.5% cases. In such cases, the iron stores in the bone marrow are absent.\textsuperscript{21,22} In a study done in Peshawar, about 3.3% cases had iron deficiency anemia.\textsuperscript{1} In another study conducted by Khan A et al, it was proposed that about 7.6% patients had iron deficiency Anemia.\textsuperscript{6} Ikram N et al from Islamabad represented the same data.\textsuperscript{23}

In our study, it was shown that myelofibrosis and visceral leshmeniasis were among the rare disorders. Similar pattern was reported by Khan MI et al and Niazi M et al in their studies from Peshawar where it was reported that myelofibrosis and visceral leshmaniasis lie in the rarer spectrum of hematological diseases.\textsuperscript{1,24} Similar finding is reported from Ghana.\textsuperscript{2} In primary myelofibrosis, there is excessive production of platelet derived growth factor by the bone marrow megakaryocytes.\textsuperscript{25} This in turn activates fibrocytes to lay down collagen, and thus cause fibrosis of the bone marrow tissue.\textsuperscript{1} In visceral leshmaniasis, there are amastigote forms of leshmania donovani in the bone marrow aspirate. Such patients present to the OPDs with complaints of fever, and on examination, there is hepatosplenomegaly.\textsuperscript{25}

**Conclusion:**
Leukemia is the commonest hematological disorder in our region, followed by megaloblastic anemia. Myelofibrosis is the rarest disorder. Bone marrow aspiraton and biopsy can successfully make the final diagnosis of hematological diseases. Therefore, it is an important diagnostic tool in hematological workup.

**Recommendations:** Due to high incidence of leukemia and megaloblastic anemia in our region, it is recommended that public should be made aware about causes, prevention and treatment of these diseases. It will improve the health of the community.

Further studies should be done including large number of participants to generate bigger data which can be more representative of the actual population

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**Role and contribution of authors:**
Dr Asif Hussain Munir, collected the data, references and did the initial write up

Dr Muhammad Ihtesham Khan, critically review the article and made the final changes

Dr Safi a Rahman, helped in collecting the data and references and discussion write up.

**References:**