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Original Research Article

Clinicopathological Profile of Patients with Chronic Leukaemia

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ABSTRACT

Leukaemias are the malignancies arising from unregulated clonal proliferation of haematopoietic stem cells. The present work is an attempt to study the frequency of chronic leukaemia, to analyse and classify and to correlate the clinicopathological findings in patients with chronic leukaemia.
The present study included 50 cases over a period of two and half years. Taking into consideration detailed clinical history and physical examination; we performed peripheral smear examination after staining with Leishman stain. We found 37 cases of CML and 13 cases of CLL.

Keywords: Chronic Myeloid Leukaemia, Chronic Lymphocytic Leukaemia, Peripheral blood smear.

INTRODUCTION

Leukaemia is characterised by diffuse replacement of bone marrow and/or peripheral blood by neoplastic cells. [1] Leukaemia occurs in a number of forms which differ in their clinical, pathological and haematological features. The two main criteria used in the classification are the clinical course of the disease, and the type and degree of differentiation of the predominant leukaemic cell population as revealed by the morphological examination of the blood and the bone marrow. Leukaemias are therefore classified as acute and chronic according to the clinical course, and as myeloid and lymphoid, according to the cell line predominantly involved in the leukaemic process. Modern classification systems for acute and chronic leukaemias are based on cytomorphology, cytochemistry, immunophenotyping, immunogenetics and molecular cytogenetics. [2]

A group of French, American and British (FAB) haematologists has described a classification system for acute leukaemias and is based on the blood and bone marrow morphological features defined by Romanowsky and cytochemical staining. Leukaemia is classified in this system as acute when more than 30% of the bone marrow consists of blasts. Chronic leukaemias are also divided basically into lymphoid and myeloid categories, and tend to be more indolent in behavior. Disorders that do not fulfill the criteria for either acute or chronic leukaemia are common and are seen in middle aged and elderly patients. They are called as indolent acute or smouldering leukaemias. [3]

CHRONIC MYELOID LEUKAEMIA:

It is characterized by presence of Philadelphia chromosome formed by

reciprocal translocation of BCR-ABL gene at chromosome 22 and 9 respectively.

STAGES OF CML: There are three stages:-

a}Chronic Phase: Lasts several years and is characterized by accumulation of myeloid precursors and mature cells in bone marrow, peripheral blood, and extramedullary sites. The most important findings are leucocytosis and basophilia. Neutrophil alkaline phosphatase activity is low or absent in more than 90% patients with CML.

b}Accelerated Phase: Is characterized by an increase in disease burden and in frequency of progenitor/precursor cells rather than terminally differentiated cells. The peripheral blood and bone marrow reveal the following features

- Increased blasts (10-19%) in peripheral blood and/ or bone marrow.
- Persistent or increasing WBC count and /or persistent or increasing splenomegaly unresponsive to therapy.
- Peripheral blood basophilia>20%.
- Persistent thrombocytosis (10,00,000/cmm) uncontrolled by therapy.
- Persistence of thrombocytopenia (<1,00,000/cmm) unrelated to therapy.
- Cytogenetic evidence of clonal evolution.

c}Blast Crisis: Is characterized by the rapid expansion of a population of differentiated arrested myeloid or lymphoid blast cells. The peripheral blood and bone marrow reveal the following features:-

Peripheral blood or bone marrow blasts> 20%.

Extramedullary blast proliferation. Most common sites are skin, lymph nodes, spleen, bone, CNS. [4-6]

ATYPICAL CHRONIC MYELOID LEUKAEMIA (aCML) BCR-ABL1 negative:

Definition: Atypical chronic myeloid leukaemia BCR-ABL1 negative (aCML) is a leukaemic disorder with myelodysplastic as well as myeloproliferative features. It is characterized by principal involvement of the neutrophil lineage with leucocytosis resulting from an increase in dysplastic neutrophils and their precursors. However multilineage dysplasia is common and reflects the stem cell origin of a CML. The neoplastic cells do not have a BCR-ABL1 fusion gene. [7]

CHRONIC MYELOMONOCYTIC LEUKAEMIA (CMML)

DIAGNOSTIC CRITERIA:

1. Peripheral blood monocytes >1.0X109/L.
2. Blast + promonocytes <20% in blood and marrow.
3. Absence of Ph chromosome or BCR/ABL fusion gene.
4. No rearrangement of PDGFRA or PDGFRB.
5. Dysplasia in one or more myeloid lineages. [6]

CHRONIC EOSINOPHILIC LEUKAEMIA (CEL):

DIAGNOSTIC CRITERIA:

1. Eosinophilia (eosinophilic count ≥1500/cmm)
2. There is no Ph chromosome or BCR-ABL 1 fusion gene or other myeloproliferative neoplasm or MDS/MPN.
3. There is no t(5;12)(q31-35;p13) or other rearrangement of PDGFRB.
4. There is no FIP1L1-PDGFRA fusion gene or other rearrangement of PDGFRA.
5. There is no rearrangement of FGFR1.
6. The blast cell count in peripheral blood and bone marrow is less than 20% and there is no inv (16)(p13.1q22)or t(16;16)(p13.1;q22) or other features diagnostic of AML.
7. There is a clonal cytogenetic or molecular genetic abnormality, or blast cells are more than 2% in the peripheral blood or more than 5% in the bone marrow. [8]

CHRONIC MONOCYTIC LEUKAEMIA (CMoL):

Anemia is mild. Anisocytosis and poikilocytosis are usually present. The leucocyte count is usually normal or low but may be elevated. The percentage of monocytes is increased but the absolute monocyte count is often normal. The platelet count may be normal or elevated. [9]

JUVENILE MYELOMONOCYTIC LEUKAEMIA (JMML)

JMML makes up about 2% of leukaemic cases in childhood. Approximately one third of patients with JMML have cytogenetic abnormalities, predominantly monosomy 7. [10]

Current Diagnostic Criteria for Juvenile Myelomonocytic Leukaemia (JMML):

All of the following:

1. Absence of t(9;22) BCR/ABL fusion gene
2. Absolute monocyte count > 1000/mm3
3. <20% blasts in bone marrow

At least two of the following:

1. Circulating myeloid precursors
2. White blood cell count > 10000/mm3
3. Increase in fetal haemoglobin for age
4. GM-CSF hypersensitivity [11]

CHRONIC LYMPHOCYTIC LEUKAEMIA (CLL):

Chronic lymphocytic leukaemia (CLL) is a leukaemia of small, mature B cells, mostly affecting adults over 65 years of age. It is the most common form of lymphoid malignancies in adults, accounting for approximately 11% of all haematologic neoplasms and 24% of all leukaemias. [12]

The disease typically occurs in elderly, with the highest incidence being in those aged 50 to 55 years, affecting men twice as often as women. However 70-80% of the patients are diagnosed incidentally. Alternatively lymphadenopathy, splenomegaly or both may be detected when patients are symptomatic; the most frequent symptom is fatigue or a vague sense of being unwell. Less frequently, enlarged nodes or development of infection is the initial complaint. Anemia and thrombocytopenia are uncommon. [13]

BLOOD PICTURE:

In the absence of extramedullary tissue involvement, more than $5X10^9$/L monoclonal lymphocytes must be present in the peripheral blood for diagnosis of CLL. According to the 2008 guidelines from the World Health Organization and the International Workshop on Chronic Lymphocytic Leukemia (IWCLL), the clonal lymphocytosis must last at least for 3 months. [12]

In majority of the cases, the neoplastic cells are small, mature looking lymphocytes with high N: C ratio, scanty cytoplasm and dense, clumped chromatin. Nucleoli are inconspicuous. 'Smudge' or 'basket' cells are a characteristic feature of CLL. They are also called as shadow cells of Gumprecht. They appear to be the result of decreased vimentin content. A recent study suggests that patients with 30% or more smudge cells are more likely to have mutated IgV_H gene and have a better prognosis than those with <30% smudge cells. [14]

Atypical CLL- The term atypical CLL has been applied to the cases that resemble CLL morphologically except for the presence of a subset (usually 10% to 15%) of neoplastic cells that are larger, and exibit greater nuclear irregularity, have a prominent nucleolus of prolymphocyte or have plasmacytoid features. Recently this term is not used in WHO classification. [15]

BONE MARROW PICTURE:

Bone marrow (BM) infiltration by CLL is divided into four common patterns: interstitial, nodular, mixed interstitial and nodular, and diffuse. BM histopathology (diffuse vs non-diffuse) is a highly significant prognostic parameter. [16]

CRITERIA FOR DIAGNOSIS:

The International Workshop on CLL (IWCLL) proposed the following criteria:

(1) A sustained peripheral blood lymphocyte count greater than $10x10^9$/ L with most of the cells being mature appearing lymphocytes.

(2) A bone marrow aspirate, showing greater than 30% lymphocytes.

(3) Peripheral blood lymphocytes identified as monoclonal B cells.

The diagnosis is confirmed if criteria 1 plus 2 or 3 are present. If the peripheral blood lymphocyte count is less than $10x10^9$/L, then both criteria 2 and 3 must be present. [17]

CHRONIC LYMPHOCYTIC LEUKAEMIA / PROLYMHOCYTIC LEUKAEMIA (CLL/PLL):

This terminology has been used in the original FAB classification but now it is omitted from the WHO classification (2008). In nearly 15% of B-cell CLL patients, the population of leukaemic cells consists of mixture of small lymphocytes and prolymphocytes, the latter cell type accounting for 11-55% of lymphoid cells. [18] These patients present with lymphadenopathy and age distribution is similar to patients with CLL but has more pronounced splenomegaly. [19]

B-CELL PROLYMPHOCYTIC LEUKAEMIA (PLL):

It is a subacute lymphoid leukaemia with an approximate incidence of 10% of CLL. The diagnosis of PLL requires presence of 55% of the circulating leukaemic lymphocytes with a prolymphocytic morphology. [18] The majority (approximately 75%) of PLL cases are of B-cell origin. [20]

LABORATORY FEATURES:

More than three fourth of the patients have blood lymphocyte count greater than 1,00,000/cmm. The infiltrate in the bone marrow is present in a nodular as well as a diffuse pattern with almost total replacement of the normal marrow elements. At presentation, patients commonly have a normochromic and normocytic anemia, with blood haemoglobin less than 11g/dL and/or blood platelet count less than 1,00,000/cmm. [21] As in CLL, patients commonly have hypoglobulinemia. [22]

T-CELL PROLYMPHOCYTIC LEUKAEMIA (T-PLL): Patients present with hepatosplenomegaly, lymphadenopathy, skin lesions and marked leucocytosis. Cytopenias such as anemia and thrombocytopenia are common. [23]

MORPHOLOGY: The morphologic spectrum of T-PLL is variable. The leukaemic cells are small to intermediate in size with slight to marked nuclear irregularities. The chromatin is condensed and nucleoli are present but usually not prominent as those seen in PLL. Nuclear contour is round to irregular and irregularities can be quite marked. The cytoplasm is usually lightly basophilic and agranular. Bone marrow involvement is often extensive and present in an interstitial and diffuse pattern. Cutaneous involvement can be present. [23]

HAIRY CELL LEUKAEMIA

Hairy cell leukaemia (HCL) is an indolent, chronic B-cell lymphoproliferative disorder involving the bone marrow and spleen. HCL tends to affect middle-aged Caucasian males. Male predominance is seen with a male to female ratio of 4:1 showing higher incidence in males of Ashkenazi Jewish heritage. [24]

The classic diagnostic triad for HCL includes varying degrees and combinations of cytopenias usually splenomegaly and the recognition of circulating hairy cells (HC) with bone marrow reticulin fibrosis due to involvement by HC. [25]

Morphologic analysis reveals that hairy cells are mononuclear cells with an eccentric or central nucleus, which may be round, ovoid, reniform, or convoluted. The nucleus has a reticular chromatin pattern, and the cells have a variable amount of blue-gray cytoplasm, which exhibits thin cytoplasmic projections so called “fried egg” appearance. [24]

MATERIALS AND METHODS

The present study was undertaken at the Pathology Department of our hospital. The study included 50 cases over a period of two and half years from February 2011 to July 2013.

All the clinical information required for the study was obtained from history and previous case records of the patients.

Selection of patients: A total of 50 patients of chronic leukaemia attending the OPD or admitted in the hospital wards were included in this study. The patients were clinically examined and followed up till their discharge.

During the first examination, a detailed history was taken, viz. fever, weakness, fatigue, loss of appetite, weight loss, bleeding tendencies, bone and joint pain, abdominal fullness, pain in abdomen, weight loss, vomiting and other symptoms, if any. A detailed clinical examination was done at the time of diagnosis. This included:

a) General examination with recording of signs such as pallor, pyrexia, lymphadenopathy, bone tenderness, especially sternal tenderness, petechiae or ecchymosis.

b) Detailed systemic examination was done to assess hepatomegaly and splenomegaly.

Radiological examination: Abdominal ultrasonography was performed in those patients complaining of abdominal fullness or pain.

All the patients underwent the following investigations-

Haemoglobin (Hb) estimation, total leucocyte count (TLC), differential leucocyte count (DLC), platelet count and peripheral blood smear examination (PBS). Both the EDTA and finger prick samples were collected by taking all aseptic precautions. Peripheral blood smears were prepared from both the samples. Hb estimation was done by cyanometh method. TLC, DLC and platelet count were done manually.

Peripheral blood smear examination: - PBS stained with Leishman's stain (routine) were prepared for all the cases and examined under light microscopy. Leishman's stain is a Romanowsky type of stain and contains methylene blue and eosin. It is a mixed dye, i.e. both acidic and basic components of the dye are coloured. A differential count was performed. The peripheral smear was reported considering the normal cell constituents, cell abnormalities and parasites. A provisional diagnosis was made.

RESULTS

This study included 50 cases of chronic leukaemia, 37 cases of CML and 13 cases of CLL in a span of 2 and ½ years period from February 2011 to July 2013.

The chronic leukaemias were classified according to the WHO classification of tumours (2008).

CML was the most common chronic leukaemia comprising 74% of chronic leukaemias followed by CLL (26%).

CHRONIC MYELOID LEUKAEMIA:

Age: Most of the cases of CML were seen in the 4th to 6th decade (77.56%) with the mean and median age of 42.3 years and 48 years respectively. The mean and median ages of males were higher than that of females

(36.3 years and 35 years respectively).

Sex: The frequency of CML was higher in males with M: F ratio of 3.1:1.

Presenting symptoms: Weakness/fatigue (70.27%), pain/fullness in abdomen (54.05%) and fever (45.94%) were the commonest presenting symptoms in CML, while vomiting (05.40%) and loss of weight (02.70%) was seen in a minority of the cases. Five of the CML (13.51%) cases were diagnosed incidentally.

Presenting signs: Splenomegaly (81.08%), pallor (51.35%) and bone tenderness (29.73%) were the most common signs observed in CML.

Phase of CML: Most of the cases of CML (72.97%) were in chronic phase at the time of diagnosis, while the frequency of CML cases in accelerated phase and blast crisis was 21.62% and 05.41% respectively.

Table no. 1: Haematological parameters (mean and median values) of chronic myeloid leukaemia

Haematological Parameters	Mean	Median
Haemoglobin g/dL	9.5 (4-12)	10 (4-12)
TLC/mm^3	1,61,190 (16,000- 4,80,000)	1,28,000 (16,000- 4,80,000)
Platelet count/mm^3	3,14,000 (40,000-6,00,000)	3,00,000 (40,000-6,00,000)

Haemoglobin: 62.16% CML cases had haemoglobin values ≥ 9.5 g/dL and 37.84% cases had haemoglobin value < 9.5 g/dL with mean and median haemoglobin values of 9.5 g/dL and 10 g/dL respectively.

TLC: Leucocytosis was seen in all the cases of CML with most cases (37.84%) having TLC between 20,000- 99,000/mm^3, followed by those having (29.73%) TLC between 1,00,000- 2,49,000/mm^3. The mean and median TLC values were 1,61,190/mm^3 and 1,28,000/mm^3 respectively.

Platelet count: Thrombocytosis was more frequently seen. The frequency of thrombocytopenia and thrombocytosis in CML cases were 13.51% and 24.33% respectively.

Median basophil count: Median basophil count was 14% in accelerated phase while it was 3% in chronic phase.

CHRONIC LYMPHOCYTIC LEUKAEMIA:

Out of 13 cases of CLL, nine cases had typical CLL and four had CLL with increased prolymphocytes.

Age: Most cases of CLL were seen in 7th decade (46.15%) with mean and median ages of 60.7 years and 62 years respectively. However there was not much difference between mean and median ages of males (59.6 years and 60 years respectively) and females (61.8 years and 62 years respectively).

Sex: Frequency was almost equal in CLL with M: F ratio of 0.85:1.

Presenting symptoms: Weakness/fatigue (76.29%), fever (45.94%), breathlessness (38.46%) and pain/fullness in abdomen (23.07%) were the commonest presenting symptoms in CLL.

Presenting signs: Splenomegaly (61.53%), pallor (61.53%), lymphadenopathy (46.15%) and bone tenderness (30.76%) were the commonest signs observed in CLL.

Table no. 2: Haematological parameters (mean and median values) of chronic lymphocytic leukaemia

Haematological Parameters	Mean	Median
Haemoglobin g/dL	8.9 (5.0-12.5)	10 (5.0-12.5)
TLC/mm^3	1,00,923 (20,000- 2,50,000)	96,000 (20,000- 2,50,000)
Platelet count/mm^3	1,54,000 (20,000-2,40,000)	1,60,000 (20,000-2,40,000)

Haemoglobin: 69.22% of CLL cases had haemoglobin values ≥ 9.5 g/dL and 30.78% cases had haemoglobin values < 9.5 g/dL with the mean and median values of 8.9 g/dL and 10 g/dL respectively.

TLC: Leucocytosis was seen in all the cases of CLL with most cases (53.84%) having TLC between 20,000- 99,000/mm^3 followed by those (38.46%) having TLC between 1,00,000- 2,49,000/mm^3. The mean and median TLC values were 1,00,923/mm^3 and 96,000/mm^3 respectively.

Platelet count: The frequency of thrombocytopenia in CLL cases was 30.76%. None of the CLL cases had thrombocytosis.

Median absolute lymphocyte count: The median absolute lymphocyte count in CLL was 57,600/ mm^3.

Smudge cell %: Mean and median values of smudge cell % in CLL were 21.92% and 20% respectively.

DISCUSSION

Chronic leukaemias are not uncommon in our country. Different studies have been conducted on various aspects of individual haematological malignancies in the past.

In the present study, the frequency of CML (74%) was much higher than CLL (26%), which was comparable with the frequencies reported by Prasad et al. [1] Laishram et al [26] also reported higher frequency of CML (86.66%) than CLL (13.34%).

CHRONIC MYELOID LEUKAEMIA:

In the present study, the median age of CML was 48 years, which was comparable with the study reported by Hehlmann et al. [27] In the present study, male: female ratio of CML was 3.1:1. As with all the other studies reported, present study also showed a male preponderance.

Table no. 3: Comparison of frequency of presenting symptoms in CML

Symptoms	Prabhu et al (1986)	Kumar et al (2003)	Idris et al (2004)	Jameel et al (2006)	Present study (2013)
Fever	31%	54.5%	87%	64.4%	45.94%
Weakness/ Fatigue	60%	61.7%	45%	37.3%	70.27%
Pain/fullness in abdomen	54%	53.7%	-	62.7%	54.05%
Weight loss	24.2%	27%	38%	-	02.70%
Loss of Appetite	-	-	-	-	18.91%
Breathlessness	-	-	-	-	13.51%
Asymptomatic	3.9%	5.3%	-	-	13.51%

In the present study, the most common presenting symptoms were weakness/fatigue, pain/fullness in abdomen and fever which were comparable with the studies reported by Prabhu et al [28] and Kumar et al. [29]

In the present study, the frequency of splenomegaly in CML was 81.08%, which was comparable with the studies reported by Jonte et al, [30] Savage et al [31] and Hehlmann et al. [27] In the present study, the frequency of pallor in CML was 51.35%, which was comparable with the study reported by Jameel et al. [32] In the present study we reported bone tenderness (29.73%) as one of the presenting sign, which was not reported by the other studies.

Table no. 4: Comparison of cases according to phases of CML at presentation

Author	Boma et al (2006)	Ahmed et al (2007)	Present study (2013)
Chronic phase	78.6%	77.8%	72.97%
Accelerated phase	16.7%	15.5%	21.62%
Blast crisis	4.7%	6.7%	5.41%

In the present study, the percentage of cases in chronic phase, accelerated phase and blast crisis of CML were comparable with the values reported by Boma et al [33] and Ahmed et al. [34]

In the present study, most of the cases of CML had haemoglobin ≥9.5 g/dL, which was comparable with the values reported by Savage et al. [31]

In the present study, most of the cases of CML had TLC between 20,000-3,50,000/mm^3, which was comparable with the TLC values reported by Savage et al. [31]

In the present study, 5.40% of cases had TLC below 20,000/mm^3, which was comparable with value reported by Savage et al. [31]

In the present study, 10.81% of cases had TLC > 3, 50,000/mm^3, while Savage et al [31] reported 19.0% cases having TLC > 3, 50,000/mm^3.

In the present study, the frequency of thrombocytopenia in CML cases was 13.51%, which was comparable with the study reported by Jonte et al. [30] In the present study, the frequency of thrombocytosis in CML cases was 24.33%, while that reported by Jonte et al [30] and Savage et al [31] was much higher accounting for 48% and 49.6% cases respectively.

In the present study, the overall median basophil count and that seen in chronic phase were comparable with the values reported by Agis et al. [35] In the present study, the median basophil count in accelerated phase was 14%, while that reported by Agis et al [35] was 18% which was slightly higher than that of the present study.

CHRONIC LYMPHOCYTIC LEUKAEMIA:

In the present study, 69.23% of cases had typical CLL, while those reported by Melo et al [36] and Teke et al [37] were 58% and 94% respectively.

In the present study, 30.77% of cases had CLL with increased prolymphocytes, which was comparable with the study reported by Melo et al, [36] while Teke et al [37] reported lower frequency (06%) of CLL with increased prolymphocytes.

In the present study, the mean age of CLL was 60.7 years, which was comparable

with the studies reported by Gauld et al [38] and Sriphatphiriyakun et al. [39]

In the present study, CLL showed a slight female preponderance with a M:F ratio of 0.85:1. Omoti et al [40] reported higher frequency of CLL in females with male to female ratio 1:3.

Table no. 5: Comparison of frequency of presenting symptoms in CLL

Symptoms	Idris et al (2004)	Sriphatphiri-yakun et al (2005)	Agrawal et al (2007)	Present study (2013)
Fever	80%	21%	25%	46.15%
Weakness/ Fatigue	87%	38.6%	60%	76.29%
Pain/fullness in abdomen	-	-	-	23.07%
Breathlessness	-	-	-	30.76%
Weight loss	55%	32.6%	-	-
Loss of appetite	-	8.15%	-	-
Bleeding manifestation	-	-	7.36%	-
Asymptomatic	-	8.15%	7.36%	-

In the present study, weakness/fatigue (76.29%) was the most common symptom followed by fever (46.15%). Similarly, in the studies conducted by Idris et al, [41] Sriphatphiriyakun et al [39] and Agrawal et al [42] weakness/fatigue (87%, 38.6% and 60% respectively) was the most common symptom followed by fever (80%, 21% and 25% respectively).

In the present study, splenomegaly (61.53%) was the most frequent sign, which was comparable with the frequencies reported by Mukibii et al, [43] Sriphatphiriyakun et al [39] and Agrawal et al. [42] In the present study, the frequency of lymphadenopathy was 46.15%, which was comparable with the studies reported by Mukibii et al [43] (33.3%) and Agrawal et al [42] (55%). In the present study, the frequency of pallor was 61.53%, which was comparable with the study reported by Idris et al [41] (62%).

In the present study, the mean haemoglobin and mean platelet count were 8.9 g/dL and 1,54,000/mm^3 respectively, which were comparable with the mean values reported by Idris et al. [41] In the present study, the median TLC of CLL cases was 96,000/mm^3, which was comparable with the value reported by Agrawal et al. [42] Other studies by Maljaei et al [44] and Gogia et al [45] reported lower median TLC values as compared to that of the present study. In the present study, the median ALC in CLL cases was 57,600/mm^3, which was comprable with the values reported by Maljaei et al [44] and Agrawal et al. [42] In the present study, minimum, maximum, mean and median values of peripheral blood lymphocyte % were comparable with the study reported by Zaher et al. [46]

Table no. 6: Comparison of median smudge cell count in CLL

Study	Median smudge cell count
Nowakowski et al [14] (2009)	28%
Zaher et al (2011)	27%
Present study (2013)	20%

In the present study, the mean smudge cell count was 21.92% while the mean smudge cell count reported by Zaher et al [46] was 30.1% which was somewhat higher than that of the present study.

CONCLUSION

In the present study, the frequency of chronic leukaemias was higher than that of acute leukaemias. CML was the most common chronic leukaemia followed by CLL. Most of the cases of CML were seen in the 4th to 6th decade with the mean and median age of 42.3 years and 48 years respectively, males being more commonly affected.

Weakness/fatigue, pain/fullness in abdomen and fever were the commonest

presenting symptoms in CML, splenomegaly and pallor being most common presenting signs. Other haematological parameters of CML were almost comparable with the other reported studies.

Despite all the recent advances in the diagnostic modalities, peripheral blood smear still remains indispensible in making the diagnosis of haematological malignancies and providing a framework for further patient health care.

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