Abstract

Haematological neoplasms comprise a collection of heterogeneous neoplastic conditions that arise from cells of the bone marrow and lymphoid system. This study describes the pattern and distribution of haematological neoplasms at a tertiary hospital in Northern Province, Sri Lanka.

A descriptive retrospective audit was conducted of all haematological neoplasms diagnosed by bone marrow and peripheral blood examination.

A total of 435 haematological neoplasms were diagnosed and reported during the 4-year period. Acute myeloid leukaemia was the commonest haematological neoplasm, followed by plasma cell neoplasm, myelodysplastic syndrome, acute lymphoblastic leukaemia, chronic myeloid leukaemia, and chronic lymphocytic leukaemia. Male predominance was seen in most haematological neoplasms, compatible with local, regional, and global data. Female predilection was noted in essential thrombocythaemia, matching global trends, and in myelodysplastic syndrome, in contrast to global data.

Acute myeloid leukaemia is the most common haematological neoplasm.

Keywords

Haematological neoplasms, acute myeloid leukaemia, Jaffna

Introduction

Haematological neoplasms comprise a collection of heterogeneous neoplastic conditions that arise from cells of the bone marrow and lymphoid system. These are clonal disorders derived from these cells which have undergone genetic alterations. Haematological neoplasms comprise around 8% of all malignancies globally. The most common forms are leukaemia, non-Hodgkin’s lymphoma, multiple myeloma, and Hodgkin’s lymphoma. With limited resources for diagnosis and treatment, haematological neoplasms constitute a significant burden to healthcare systems in resource-poor settings.

Diagnosis of a haematological neoplasm relies on the availability of a number of investigations such as blood picture, bone marrow aspiration and trephine biopsy, and immunophenotyping by flow cytometry. In addition, genetic studies like cytogenetics, polymerase chain reaction, and next generation sequencing play an important role in diagnosis. Even though facilities for morphological assessment are widely available, technical and financial challenges pose barriers to the use of other investigations by haematologists practicing in low-resource settings.

Teaching Hospital Jaffna is a tertiary care centre in the Northern Province of Sri Lanka which serves a population of around 1.2 million. The Haematology Unit of the Teaching Hospital Jaffna is well-equipped and has facilities to perform an array of haematological investigations, except cytogenetic and molecular studies, which are outsourced as per requirement.

The Haematology Unit carries out approximately 300 bone marrow examinations in a calendar year. The unit commenced performing immunophenotyping by flow cytometry in 2016. Apart from samples from the Teaching Hospital Jaffna, the Haematology Unit also receives samples from peripheral hospitals located in the Northern Province. Since 2016, the diagnosis of haematological neoplasms is confirmed by morphology and flow cytometry.
This study describes the pattern and distribution of haematological neoplasms at Teaching Hospital Jaffna in northern Sri Lanka, including the frequencies of haematological neoplasms, their demographic distribution, and trends in detection rates, over a 4-year period.

**Materials and Methods**

This was a retrospective descriptive study of all haematological neoplasms diagnosed by bone marrow and peripheral blood examination at the Haematology Unit, Teaching Hospital Jaffna, between July 2016 and June 2020. Data on haematological neoplasms (age, sex, and diagnosis) were retrieved from the database maintained at the Haematology Unit, and analysed with SPSS (v26). Haematological neoplasms were categorised according to the ICD 11 classification (ICD-O-3 code list). Data were summarised using frequencies and percentages.

**Results**

In total, 435 patients were diagnosed to have haematological neoplasms during the 4-year period. The median age at diagnosis was 62 years (range 1-93 years). Just over half of the sample were male (52%, n=226) showing a slight male preponderance (male: female 1:0.9). A large majority were Sri Lankan Tamils, contributing 97% to the sample. Additionally, 77.5% of all patients were residents from Jaffna district, while the remaining cases were reported from Kilinochchi, Mannar, Mullaitivu, and Vavuniya, with a few additional cases from outside the Northern Province (Table 1).

| Demographic characteristics | Frequency | Percentage |
|-----------------------------|-----------|------------|
| **Sex**                     |           |            |
| Male                        | 226       | 52         |
| Female                      | 209       | 48         |
| **Ethnicity**               |           |            |
| Sri Lankan Tamil            | 422       | 97         |
| Sri Lankan Muslim           | 12        | 2.7        |
| Sinhalese                   | 1         | 0.002      |
| **District**                |           |            |
| Jaffna                      | 337       | 77.5       |
| Kilinochchi                 | 36        | 8.2        |
| Mullaitivu                  | 27        | 6.2        |
| Vavuniya                    | 16        | 3.6        |
| Mannar                      | 14        | 3.2        |
| Other                       | 5         | 1.1        |

Table 1: Demographic profile of patients (n=435)

When considering the number of cases by year, a higher number were observed in the latter two-year period (2018/2019 and 2019/2020) (Table 2).

| Year       | Frequency | Percentage |
|------------|-----------|------------|
| 2016/2017  | 92        | 21.1       |
| 2017/2018  | 94        | 21.6       |
| 2018/2019  | 130       | 29.9       |
| 2019/2020  | 119       | 27.4       |

Table 2: Year-wise distribution of diagnosed haematological neoplasms

The most commonly reported haematological neoplasm was acute myeloid leukaemia (AML) which accounted for 21.4% (n=93), followed by plasma cell neoplasms (PCN) 19.1% (n=83) and myelodysplastic syndrome (MDS) 15.6% (n=68) (Table 3).

| Type of Haematological neoplasm | Frequency | Percentage |
|--------------------------------|-----------|------------|
| AML                            | 93        | 21.4       |
| PCN                            | 83        | 19.1       |
| MDS                            | 68        | 15.6       |
| ALL                            | 49        | 11.3       |
| CML                            | 37        | 8.5        |
| B-CLPD                         | 22        | 5.1        |
| CLL                            | 22        | 5.1        |
| ET                             | 14        | 3.2        |
| PRV                            | 11        | 2.5        |
| PMF                            | 11        | 2.5        |
| CMML                           | 11        | 2.5        |
| MPN-NOS                        | 4         | 0.9        |
| T-CLPD                         | 4         | 0.9        |
| Clonal Eosinophilia            | 2         | 0.5        |

Table 3: Distribution of haematological neoplasms (July 2016 to June 2020)

The AML category included 87 AML-NOS (not otherwise specified) cases along with two cases of AML with myelodysplasia related changes, two cases of mixed phenotypic acute leukaemia -B/myeloid, and one case of myeloid leukaemia associated with Down syndrome. In AML, the
The median age of diagnosis was 60 years (range 3-86) with a near-equal distribution among males and females (males: females = 47:46) (Table 4).

**Table 4: Age and Sex distribution of haematological neoplasms**

| Haematological neoplasm | Median Age | Minimum age | Maximum age | Sex ratio |
|-------------------------|------------|-------------|-------------|-----------|
| AML                     | 60.0       | 3           | 86          | 1.02      |
| ALL                     | 16.0       | 1           | 76          | 1.45      |
| CML                     | 52.0       | 27          | 85          | 1.64      |
| PRV                     | 70.0       | 55          | 90          | 10.0      |
| ET                      | 68.5       | 40          | 80          | 0.55      |
| PMF                     | 63.0       | 46          | 81          | 1.20      |
| MPN-NOS                 | 59.5       | 50          | 70          | 0.40      |
| MDS                     | 65.0       | 27          | 85          | 0.91      |
| CMML                    | 71.0       | 56          | 86          | 0.54      |
| Clonal Eosinophilia     | 62.0       | 44          | 80          | 1.00      |
| PCN                     | 66.0       | 33          | 90          | 1.30      |
| CLL                     | 71.0       | 50          | 93          | 1.30      |
| B-CPLD                  | 60.0       | 19          | 74          | 0.69      |
| T-CPLD                  | 38.5       | 3           | 61          | 1.00      |

PCN consisted of 80 plasma cell myeloma cases, two solitary plasmacytomas and one case of plasma cell leukaemia. This group of neoplasms malignancies showed a clear male predominance (male: female = 47:36) with a median age at diagnosis of 66 years (range 36-90 years) (Table 4).

The 68 cases of MDS included 51 cases of MDS with multi lineage dysplasia, 11 MDS cases with excess blasts, four cases of unclassifiable MDS, one case of MDS with 5q-anomaly and one case of therapy related MDS. The median age at diagnosis was 65 years (range 27-85 years) with a marked female predominance (male: female = 23:14) (Table 4).

Both precursor B-cell lymphoblastic leukaemia and T-lymphoblastic leukaemia/lymphoma were considered in the acute lymphoblastic leukaemia (ALL) category (11.3%, n=49). The median age at diagnosis was 16 years (range 1-76 years), with a male preponderance (male: female = 29:20).

The myeloproliferative neoplasms (MPN) category included chronic myeloid leukaemia (CML), polycythaemia rubravera (PRV), essential thrombocythaemia (ET), myelofibrosis (MF) and myeloproliferative neoplasm - not otherwise specified (MPN-NOS).

Among them, CML was the commonest type diagnosed during the 4-year period; 37 cases were reported with a median age of 53 years, showing male predominance (male: female = 23:14). The remaining MPNs showed similar numbers of cases; 14 cases of ET, 11 cases of PRV, and 11 cases of MF. The median age at presentation was 68.5, 70, and 63 years, for ET, PRV and MF, respectively.

Chronic lymphocytic leukaemia (CLL) contributed 6% of all haematological neoplasms with 26 reported cases. The median age at diagnosis was 71 years (range 50-93 years) with a slight male predominance (male: female = 15:11). Lastly, 22 (5.1%) cases of B cell chronic lymphoproliferative disorders were reported with a median age at diagnosis of 60 years with a male to female ratio of 0.69 and T cell chronic lymphoproliferative neoplasms contributed only to 0.92% of all neoplasms.

**Discussion**

To our knowledge, this is the first study of the pattern and distribution of haematological neoplasms undertaken in northern Sri Lanka.

In our study, the median age for all haematological neoplasms was 62 years, a relatively younger age compared to international data. For instance, the median age at diagnosis of haematological neoplasms in Europe and globally is in the 7th decade. [6, 7]

Male predominance was seen in most haematological neoplasms, also compatible with local, regional and global data.[4, 8, 9] A possible explanation for the male predilection may be greater exposure to occupational, environmental and other hazards during outdoor activities, compared to females.[10, 11, 12] But this result needs further evaluation locally.

Female predilection was noted in essential thrombocythemia (ET) which matches global incidences. [3] By contrast to international data, however, our study revealed a female predominance in myelodysplastic syndrome (MDS) and B cell chronic lymphoproliferative disorders (B-CLPD).[3, 4, 5] This observation also needs to be interpreted cautiously as the
unavailability of genetic studies for MDS and the
diagnosis of B-CLPD being mostly made from
tissue sections at the Histopathology Department,
may have affected the ultimate figures.

Year wise distribution showed a marginal increase
in number of haematological neoplasms over
the study period, which maybe due to the greater
availability of diagnostic facilities, improved
access, and increased awareness among primary
care physicians. While these possibilities need
further exploration, the decline in diagnosed cases
in the last year (July 2019 to June 2020) is probably
due to the overall reduction in hospital admissions
due to the covid pandemic.

The common haematological neoplasms detected
in the study period (in order of percentages) were
acute myeloid leukaemia (AML), plasma cell
neoplasms (PCN) and myelodysplastic syndromes
(MDS), corresponding to global incidence. [3, 4, 5]
The most frequent neoplasm was AML, contributing
21.4%, a one fifth of all haematological neoplasms
diagnosed at Teaching Hospital Jaffna. The category
included AML-not otherwise specified cases, AML
with myelodysplastic changes, myeloid leukaemia
associated with Down syndrome and therapy related
AML. Most of the cases in the present study were
labelled as AML-NOS due to the unavailability of
resources to perform genetic studies at the hospital.
According to global data, acute leukaemia is the
second most common haematological neoplasm
after non-Hodgkin’s lymphoma (NHL). [4,13,14]
but WHO figures show that acute leukaemia is the
commonest type in the Asian region including India
(14). The second commonest neoplasm detected in
our study was PCN. This category included mainly
plasma cell myeloma, with one case of plasma cell
leukaemia and two cases of solitary plasmacytoma.
PCN make up 10% to 15% of all haematological
neoplasms worldwide. [3] while in this study they
contributed 19.1%. Median age of presentation
was 66 years, in line with international data (70
years). Male predominance was observed in this
study (male to female ratio 1.3:1), compatible with
global incidence (1.1:1). [3]

MDS accounted for 15.6% of all haematological
neoplasms in the present study. The median age of
presentation was 65 years, while global data show
a median age of 70 years. [3]

Chronic myeloid leukaemia (CML) comprised
8.5% of haematological neoplasms with the median
age at presentation 52 years, a much younger age
in contrast to international data. [15,16,17] but
consistent with data from India. [13] CML showed
a slight male predilection, in line with global data.
Of the other myeloproliferative neoplasms,
primary myelofibrosis showed a similar median
age at presentation when compared with world
figures, while for polycythaemia rubrae (PRV)
and ET the median age is comparatively higher
in the present study. [3] Gender predilection for
ET and myelofibrosis (MF) were almost similar
with WHO data. PRV was reported in 10 males
while only one female was diagnosed, this finding
keeps up with global data where it shows a male
predominance although the ratio globally being
male to female 1-2:1.[3]

Acute lymphoblastic leukaemia (ALL) consisted
of B-ALL and T-ALL accounting for 11.3% of all
haematological neoplasms in the study. Median age
of presentation was 16 years although the age range
was 1 to 76 years, consistent with international
figures. [3, 4, 5] Median age of presentation for
chronic lymphocytic leukaemia (CLL) was 71
years with a male predominance; both compatible
with global data. [3]

NHL (B-CLPD and T-CLPD collectively) only
contributed to 6% of all haematological neoplasms
in this study, in stark contrast to global data and
all other studies reviewed. [8, 12, 18, 19] NHL
is usually diagnosed by histopathologists with
a tissue diagnosis; bone marrow examination or
immunophenotyping by flowcytometry are not
required. This may explain the fewer number of
cases reported by the Haematology Unit of
Teaching Hospital Jaffna.

Collaborative studies with the Histopathology
Unit are needed to describe the pattern of NHL
and Hodgkin’s lymphoma, which rely on tissue
biopsy for diagnosis. Further studies are needed
to compare the spectrum of haematological neoplasms in various parts of the country. A study done outside the Northern Province would be beneficial to identify geographical and ethnic variations.

The present study demonstrates that epidemiological studies can be conducted within resource limited settings, yielding valuable estimates of cancer burden.

**Conclusion:**

This study represents the first of its kind from a tertiary care hospital with diagnostic haematology facilities in the northern province of Sri Lanka. The study noted different patterns of occurrence of haematological neoplasms in comparison to noted incidences regionally and globally. Questions related to the pattern of haematological neoplasms, including their distribution and risk factors in other areas of the country, remain unresolved and offer interesting challenges to future researchers.

There are no conflicts of interest.

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