



Review Article

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A REVIEW ON AYURVEDIC PERSPECTIVE OF NEOPLASTIC DISORDERS WITH SPECIAL REFERENCE TO LEUKEMIA

Vishnu B ^{1*}, James Chacko ², Mahesh C. Kundagol ³, Devipriya Soman ⁴

¹Third Year PG Scholar, Kayachikitsa, Amrita School of Ayurveda, Vallikkavu, Kollam, Kerala, India

²Professor & HOD, Kayachikitsa, Amrita School of Ayurveda, Vallikkavu, Kollam, Kerala, India

³Associate Professor, Kayachikitsa, Amrita School of Ayurveda, Vallikkavu, Kollam, Kerala, India

⁴Assistant Professor, Kayachikitsa, Amrita School of Ayurveda, Vallikkavu, Kollam, Kerala, India

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*Corresponding author

E-mail: vishu2xll@gmail.com

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ABSTRACT

Neoplasm is defined as a mass of tissue that is formed by an abnormal, autonomous and excessive proliferation of cells. Neoplasms can be basically categorized into benign (Tumor) and malignant (Cancer) types. Leukemia is a type of malignant neoplasm, having malignant clonal expansion of immature myeloid or lymphoid blast cells characterized by increase in circulating WBCs. A review of Ayurveda samhitas (treatises) provides us with only some basic classification of arbuda, which is the nearest possible correlation for neoplasm available. An in-depth analysis of our classics shows that Raktaja arbuda described by acharyas is fundamentally different from the modern leukemia. An attempt to delve deep into the pathogenesis of leukemia, particularly various kinds of leukemia and possibly correlate the different stages to many multitudes of diseases described by Ayurveda acharyas is done. Leukemia is widely regarded as a manageable disease with good prognosis, if detected early. In spite of this, certain types of leukemia have a tendency to spread rapidly with unpredictable behavior. We have to assess the role Ayurveda can play in the management of Leukemia.

Keywords: Leukemia, Arbuda, Raktarbuda

INTRODUCTION

Leukemia is characterized by the malignant clonal expansion of myeloid or lymphoid cells with an increase in number of circulating WBCs. Several theories have been postulated regarding the cause for leukemia, with very little concrete evidence supporting any of them. All the scientists have agreed upon are the genetic involvement in triggering leukemia. Genetic mutation in the stages of transformation of immature blast cells into hematopoietic cells results in different forms of leukemia. The gross management of leukemia is still an enigma for Ayurveda, since the exact pathogenesis or progression of the disease cannot be dependently explained through ayurvedic treatises. The treatment principles are openly interpreted by physicians¹.

Neoplasm- Definition and Classification

Neoplasm is defined as tissue formed by abnormal, autonomous and excessive proliferation of cells². It can be generally classified into (i) Benign, (ii) Malignant, (iii) Carcinoma-in-situ and (iv) Neoplasms of uncertain or unknown behavior³.

- i. Benign Neoplasms: It is a mass of cells, that lacks the ability to invade neighboring tissue or metastasize.
- ii. Malignant Neoplasms: A group of cells, possessing the characters of invasion and metastasis.
- iii. Carcinoma-in-situ: A cancer that is developing or a group of clonal cells, which can potentially become cancerous.
- iv. Neoplasms of uncertain or unknown behavior: A group of clonal cells, whose behavior cannot be predicted.

Common Causes

Neoplasms can have a multitude of causes or it can arise from a single cause as such. Genetic mutations are one of the commonest causes which causes neoplasms. Alcohol consumption and Tobacco usage accounts for a huge section of lung carcinoma. The varying environmental changes and changing dietic pattern are also some of the reasons for the increasing incidence of cancer⁴.

Biology of Neoplasm

Neoplasms are clonal in origin, i.e., they arise from genetic mutations within a single homogenous population of precursor stem cell or cancer cell. When the stem cell undergoes further division, it develops heterogeneity and differentiates into various cells with a cancerous mutation. This leads to further abnormalities and metastasizing of the neoplasm⁵.

Genes most commonly affected are found to be those controlling, (i) Cell cycle check points, (ii) DNA repair, (iii) DNA damage recognition, (iv) Apoptosis, (v) Differentiation and growth staging⁶.

The proliferation of tumor cell depends on certain factors like, enzyme telomerase abnormality, loss of cell to cell adhesion and abnormal nutrient supply⁷.

Further it is aided by the fact that cancer cells are usually not recognized by the immune system because of failure to express HLA and co-stimulatory B7 molecules or secretion of immune

suppressive cytokines and cause generalized immune suppression⁸. As the tumor cells become larger and larger, they require more and more nutrition. When the nutrition requirements of the neoplastic cells are not met by the existing circulation, it facilitates the formation of new blood vessels. Angiogenesis of new blood vessels also aid in the spread of tumor to distant parts of the body⁹.

Hematopoiesis

Hematopoiesis is the process of normal production of myeloid and lymphoid cells. All the myeloid and lymphoid progenitor cells are derived from a single multipotent hematopoietic stem cell called Hemocytoblast. From this original Hemocytoblast a common myeloid progenitor and a common lymphoid progenitor cell arises. The common myeloid progenitor cell, further differentiates to form megakaryocytes, erythrocytes, mast cell and a myeloblast cell. Myeloblast cell differentiates further to form basophil, neutrophil, eosinophil and monocytic cells. The common lymphoid progenitor cell on the other hand, divides to form a large granular lymphocyte and small lymphocyte. The small lymphocyte further divides to form T-lymphocytes and B-lymphocytes¹⁰.

Leukemia is widely agreed to develop because of some genetic mutation, that happens in the stages of hematopoiesis, thus producing immature myeloblast and lymphoblast cells which begin to crowd the bone marrow. This immature blast cells amount to about 10-15% of the total production of hemopoietic cells. The immature blast cells, above a particular threshold starts to release into the blood stream, as a reaction to which the number

of leucocytes increases. This is the reason for the abnormal amount of leucocytes circulating in a patient with leukemia¹¹.

Risk Factors

Scientists have yet to conclusively pin down the causes for leukemia. All they have been able to do, propose some known risk factors.

Working with certain chemicals like Benzene, Formaldehyde etc., is a known risk factor in the causation of leukemia. Exposure to chemotherapy, Human T-Lymphotropic virus infection, Exposure to ionizing radiation, Tobacco smoking, certain genetic syndromes like Down's syndrome, Fanconi's anemia, Bloom's syndrome etc., are naturally predisposed to develop leukemia in later life¹².

General Symptoms

Leukemia presents itself with systemic symptoms like weight loss, fever, frequent infections, shortness of breath, muscular weakness, muscle pain, pain and tenderness of bones and joints; psychological features like fatigue, loss of appetite; lymph node swelling, hepatomegaly, splenomegaly, night sweats, easy bruisability, petechia etc¹³.

General Classification

Leukemia can be classified in two different ways, i.e., (i) Based on onset and progression of disease and (ii) Based on the nature of cells involved¹⁴.

Based on the onset and progression of disease, leukemia can be classified into Acute and Chronic Leukemia¹⁵.

Table 1: Classification of leukemia based on disease progression.

Acute	Chronic
Rapid increase in the number of immature blast cells.	Excessive, but slow buildup of relatively mature, but still abnormal cells.
Takes weeks or months to progress.	Takes months or years to progress.
Fulminant presentation of all cardinal symptoms.	Vague symptoms will be present.
Immediate treatment is required.	Sometimes monitored for a while, to treat them effectively.
Can be fatal within weeks to six months, if left untreated.	Median survival is one to two years if untreated.

Based on the nature of cell involved, Leukemia can be classified into Lymphoblastic or Lymphocytic Leukemia and Myeloblastic or Myelogenous Leukemia¹⁶.

Table 2: Classification of leukemia based on nature of cells affected.

Lymphoblastic	Myeloblastic
Called as lymphoblastic/lymphocytic leukemia.	Called as myeloblastic/myelogenous leukemia.
Involvement of bone marrow cells, which normally goes on to form lymphocytes.	Involvement of bone marrow cells which goes on to form red blood cells, some type of WBCs and platelets.

Combining both these classification, leukemia can be differentiated further into, (i) Acute Lymphoblastic/Lymphocytic Leukemia, (ii) Acute Myeloblastic/Myelogenous Leukemia, (iii) Chronic Lymphoblastic/Lymphocytic Leukemia, (iv) Chronic Myeloblastic/Myelogenous Leukemia.

Acute Leukemias

1. Acute Lymphoblastic/Lymphocytic Leukemia: Acute lymphoblastic Leukemia is the commonest cancer of childhood¹⁷. It is thought to develop due to a genetic mutation

in the lymphoid blast cell before undergoing further differentiation into B-lymphocytes and T-lymphocytes¹⁸.

2. Acute Myeloblastic/Myelogenous Leukemia: AML is the commonest acute leukemia in adults¹⁹. The neoplastic proliferation of blast cells is derived from marrow myeloid elements like, precursor myeloid stem cell or myeloid blast cell²⁰. It can be found generally in patients who have undergone rigorous chemotherapy sessions as a long-term complication²¹.

Classification (French American British System)

Table 3: Classification of Acute myeloblastic leukemia based on French American British system²².

M0: Minimally differentiated
M1: Myeloblastic leukemia without maturation
M2: Myeloblastic leukemia with maturation
M3: Hyper granular promyelocytic leukemia
M4: Myelomonocytic leukemia
M4Eo: Variant, increase in marrow eosinophils
M5: Monocytic leukemia
M6: Erythroleukemia
M7: Megakaryoblastic leukemia

Prognosis

ALL has good prognosis in children (70-90%), Females and Translocation between chromosomes 15 and 9. It has poor prognosis in Adults (40% cure rate), Males, Involvement of Philadelphia chromosome, Presentation with central nervous system signs, leucocyte count greater than $100 \times 10^9/L$ ²³.

AML has good or intermediate prognosis in case of translocation between chromosomes 8 and 21 and between 15 and 17, inverse of 16th chromosome and deletion of 7q chromosome. It has very poor prognosis in case of deletion of 5q chromosome or abnormal 3q chromosome²⁴.

Diagnosis

Diagnosis of acute leukemia can be done through, history of the patient, physical examination, lab investigations and neurogenic symptoms.

The patient will have a history of; (i) 1-4 months' fatigue, malaise, (ii) Easy bruisability, frank bleeding, (iii) Dyspnea, weight loss, (iv) Bone pain or abdominal pain²⁵.

His physical examination will reveal; (i) Anemia, pallor, (ii) Fever, pneumonia or (iii) Sepsis, infections²⁶.

Classification/Prognosis (RAI staging)

Table 5: Classification of Chronic Lymphocytic Leukemia based on RAI staging³⁴.

Stage	Features	Average Life expectancy
0	Lymphocytosis	>13 years
I	Lymphocytosis + Lymphadenopathy	8 years
II	Lymphocytosis + Splenomegaly/Hepatomegaly	5 years
III	Lymphocytosis + Anemia (Hb<110g/L)	2 years
IV	Lymphocytosis + Thrombocytopenia (<100x10 ⁹ /L)	1 year

Chronic Myelogenous Leukemia has three distinct phases, (i) Chronic phase, (ii) Accelerated phase and (iii) Blast crisis³⁵

In chronic phase, the patient will be asymptomatic or will have mild symptoms like, Fatigue, Joint pains, Abdominal fullness etc³⁶.

In Accelerated phase, the patient will have 10-15% Myeloblasts in the blood or bone marrow, Thrombocytopenia which is unrelated to therapy or Thrombocytosis which is unresponsive to therapy and Increasing splenomegaly or WBC count, unresponsive to therapy³⁷.

The final phase is known as Blast crisis. It acts similar to acute myeloblastic leukemia, with very fast progression and median lifespan measured in weeks. The cardinal feature is the fulminant presence of all leukemia general symptoms and the incidence of greater than 20% myeloblasts in blood or bone marrow³⁸.

Table 4: Classification of Acute lymphoblastic leukemia based on French American British system.

ALL-L1: small uniform cells
ALL-L2: large varied cells
ALL-L3: large varied cells with vacuoles

His lab investigations will show; (i) Peripheral Blood Smear shows greater than 20% blast cells, (ii) Myeloblasts greater than 1,00,000/UI, (iii) Prothrombin time/partial thromboplastin time will be elevated²⁷.

Neurogenic symptoms are comparatively rare; but if present, is a medical emergency. Some of the neurogenic symptoms the patient can present with are, (i) Headache, (ii) Vomiting, (iii) Papilledema, (iv) Convulsions²⁸.

Chronic Leukemias

1. Chronic Lymphoblastic/Lymphocytic Leukemia: It is the commonest form of leukemia found in general population²⁹. It exclusively affects B-lymphocytes³⁰. Genetic mutations, trisomy's and deletions of chromosomes influence risk. In certain conditions, pneumonia was found to be a triggering event³¹.
2. Chronic Myeloblastic/Myelogenous Leukemia: Characteristic features are uncontrolled clonal proliferation of myeloid cells. It can occur due to a mutation of preliminary multipotent stem cell or myeloid progenitor stem cell³². Almost 90% cases are positive for Philadelphia chromosome³³.

Diagnosis

Diagnosis in Chronic Lymphocytic Leukemia is done by identifying (i) Sustained peripheral blood lymphocyte count greater than $10 \times 10^9/L$ and (ii) Bone marrow aspirate showing greater than 30% lymphocytes³⁹.

Diagnosis in Chronic Myelogenous Leukemia can be done by the presence of leucocyte count greater than $50 \times 10^9/L$, peripheral blood smear showing full spectrum of myeloid cells and basophils greater than $10 \times 10^{10}/L$ ⁴⁰.

Ayurvedic Perspective of Neoplasm

We can compare neoplasm to the disease arbuda described in ayurvedic classics. Caraka⁴¹ (1000BC) and Susrutha⁴² (800BC) Samhita's, two well-known ayurvedic treatises, describe about

granthi (minor neoplasm) or arbuda (major neoplasm), which can be contextually correlated to cancer. According to Susruta acharya, dosa accumulates in the gatra pradesha (body) producing mamsadi dhatu vitiation, leading to the development of a rounded, fixed, large, deep-rooted, slow growing, non-inflammatory swelling associated with mild pain⁴³.

Types

Susrutha acharya⁴⁴ and Vagbhata acharya⁴⁵ has enumerated different types of arbuda as; (i) vataja, (ii) pittaja, (iii) kaphaja, (iv) raktaja, (v) mamsaja and (vi) medaja

Leukemia-Ayurvedic Perspective

No direct reference to Leukemia or its sub-classifications has been definitely identified in the Ayurvedic Literature. Acharya susruta's description of raktaja arbuda can be correlated with certain features of Lymphocytic and Myeloid Leukemias like enlarged lymph glands, Thrombocytopenia etc. However, the pathophysiology of origin of Leukemia which is not fully understood; cannot be fully explained by the raktaja arbuda samprapti (pathogenesis) of Susruta Acharya⁴⁶. We can derive a probable condition based on dosha, dhatu, samprapti (pathogenesis), srotas (channels) etc. To understand this better, we have to derive the process of hematopoiesis in ayurvedic terms.

According to acharya caraka, the ahara (food) we consume will undergo jatharagni paka (metabolism) to form anna rasa (metabolites). This anna rasa, will enter yakrit (liver) and Pliha (spleen), where to undergoes ranjana (coloration) by the action of ranjaka pitta to form the final rakta dhatu⁴⁷ (blood).

Hence, we can surmise that, a comparable condition to leukemia can occur because of; (i) production of rasa, (ii) production of ranjaka pitta, (iii) or because of structural abnormality of yakrit (liver) or Pliha (spleen).

Samprapti

From the above discussion, we can derive a probable samprapti (pathogenesis) for leukemia.

Because of nidana sevana (consumption of causative factors) like excessive consumption of pittala ahara vihara, amla (acidic), lavana (salty) rasas etc., aggravates tridoshas, which get localized in rasa and rakta dhatus, in turn vitiating them. This produces further debilitation of uttarothara (successive) dhatu, producing visible clinical signs and symptoms. This stage vitiates further to spread the dosa throughout the body.

Acharya Chakrapani, while explaining pandu roga samprapti has stated that by the consumption of excessive amla, lavana rasa, pittala aharas etc. causes the vitiation of pitta, which causes shoshana (emaciation) of rasa dhatu, resulting in improper formation of rakta, resulting in signs and symptoms of vaataja pandu⁴⁸.

Lakshanas

Table 6: Signs and Symptoms of Leukemia with comparable ayurvedic lakshanas.

Symptoms (Modern)	Lakshanas (Ayurvedic)
Weight loss	Karshyata
Fever	Jvara
Shortness of breath	Shwasa
Weakness	Balahani
Fatigue	Tandra
Loss of appetite	Aruchi
Splenomegaly	Pliha
Easy bleeding	Raktapitta
Reddish patches	Asramandalam
Lymph node swelling	Grandhi

Management

Leukemia, being a disease with rapid progression in acute cases and with dire consequences, if managed incorrectly even in chronic stages, need the back-up of modern medicines to meet any emergency situations. In such a scenario, Ayurveda can play a limited role in the primary management of leukemia. Most of the patients, who come in search of ayurvedic management can be classified as, (i) Those who chose to take up ayurvedic treatment, knowing all the risks., (ii) Those who wish to combine ongoing modern treatments with ayurvedic medications., (iii) Those who have already undergone the modern treatment and wish to treat the side-effects of chemotherapy and radiation with ayurvedic medicines., (iv) Those who have already completed the modern treatment, and wishes to undergo ayurvedic treatment during the remission phase., (v) Those who comes only for palliative management.

The general line of treatment can be modeled according to the stage of disease, (i) Primary stage treatment and (ii) Secondary stage treatment.

In the primary stage of leukemia, ayurvedic medications can be given to manage symptoms of bleeding tendency, fever, tastelessness etc. Classical shodhana (eliminative therapies), done after snehapaana cannot be administered in majority of cases. If at all shodhana (elimination) is required, only mrdu shodhana (mild eliminative procedures) should be done⁴⁹. In acute leukemia, raktapitta or vaataja pandu roga chikitsa can be adopted⁵⁰. Simultaneously, it is advisable to undergo modern medications to keep the disease progression in check. When the patient undergoes chemotherapy or radiation, several side-effects like constipation, nausea, vomiting, anorexia etc. will be present, which can be mitigated using ayurvedic medications⁵¹.

During the secondary stage of the disease, when the disease has advanced and the patient has already undergone established treatment regimen, ayurvedic medications can be given to alleviate the pain, fatigue, tastelessness, weight-loss, constipation. When the disease is in chronic or remission phase, mrdu shodhana (mild eliminative procedures) trailed by pandu roga chikitsa, Raktapitta chikitsa followed by suitable rasayana (rejuvenative medicine) regimen can be adopted⁵².

If we analyze the most common symptoms of leukemia and deducing the pathogenesis to be a defect in any one of the stages of hematopoiesis, most common symptoms of leukemia like; Karshyata, jvara, Balahani, toda, tandra, Aruchi, Pliha, Raktapitta etc. can be seen in Rasapradoshaja vikaras⁵³, Raktapradoshaja vikaras⁵⁴, Pandu roga⁵⁵ and Raktapitta⁵⁶.

CONCLUSION

Cancer is generally perceived by the general population as the end-all. They falsely believe, there is no coming back to a normal life after being afflicted by cancer.

We as the physicians have a moral responsibility to educate the patients about the realities of the disease as well as to remove the social stigma related to cancer. We must also be realistic about the scope of our treatment as well as be aware about its limitations.

By adopting various treatment regimens, which improves the patients' activities of daily life will in itself be a blessing for him and enable him to live his life with dignity.

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