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ROLE OF AYURVEDAIN MANAGEMENT OF LEUKEMIA (RAKTARBUDA)

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ABSTRACT: The abnormal growth of White Blood Cell in the bloods and bone marrow is called as Leukaemia. Leukaemia is the 11th most common cancer worldwide. Leukaemia is not a new disease for Ayurveda, which is mentioned under the heading of Raktarbud respectively. The mutations of any carcinogens are the first causative factor of abnormal growth of cancerous cell including Leukaemia. Accordingly to Ayurveda mithya aahar-vihar is a cause of Rakta Arbud. There are so many carcinogenic agent like Benzene and Pesticide are found in diet, which cause Leukaemia. Anaemia and bleeding tendency along with its complication, Splenomegaly, Hepatomegaly these are some clinical features of Rakta Arbud mentioned in Ayurveda, which is similar to Leukaemia. Trividhparikshan mentioned in Ayurveda a unique method which will help to diagnose the patients of any disease including Leukaemia. Though there is, no basic line of treatment of Leukaemia has found in Ayurveda. Some Raktarbudnashak herbs like *Lochnera rosea*, *Semecarpusana cardium*, *Urginea indica*, *podophyllum hexeandrum* and *Commiphora mukul* has mentioned. Certain poly herbal and herbomineral compound like *Roudraras*, *Vradhadaru Churn*, *Vradhadaru Yoga*, *Nityanandras*, *Kachnar Gugulu*, and *Hargauriras* has also found in the text, which has been indicated for Arbud. There are some clinical researches certain Ayurveda herbs and minerals like those that herbomineral Navjeevan Ras, Kamdudha Ras, Keharuba Pisti has found significant in the treatment of Leukaemia. *Somal* is an important mineral, which is found significant in vitro study and clinical study also. Thus, Ayurvedic drugs will be proved very effective to cure Leukaemia in future.

INTRODUCTION: Leukaemia is cancer of the blood or bone marrow (which produces blood cells). A person who has leukaemia suffers from an abnormal production of blood cells, generally leukocytes (white blood cells). Leukaemia are classified on the basis of cell types predominately involved, into Myeloid and Lymphoid, and on the basis of natural history of the disease, into acute and chronic [1].

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Thus the main types are AML (Acute Myeloid Leukaemia) ALL (Acute Lymphoblast/ Lymphocytic Leukaemia) CML (Chronic Myeloid Leukaemia), CLL (Chronic Lymphoblast/ Lymphocytic Leukaemia). Hairy cell Leukaemia (HCL) is an unusual variant of lymphoid neoplasia 14.1 million Adults in the world were diagnosed with cancer in 2012. There were 8.2 million deaths from cancer in the world in 2012.

According to the World Health Organization, death from cancer is expected to increase 104% worldwide by the year 2020. However, estimated 600,000-700,000 deaths in India were caused by cancer. Leukaemia is the 11th most common cancer worldwide, with around 352,000 new cases

diagnosed in 2012[2% of the total] .In 2014, it is estimated that there will be 52,380 new cases of Leukaemia and an estimated 24,090 people will die of this disease.[2]

Ayurveda has also mentioned the etiological factors, pathogenesis of Arbuda including rakta arbuda [3]. The management and prevention including pathya –apathya of arbuda also found in Ayurveda. Though the basic principle of rakta arbuda has not found due to its incurable condition, however the various herbal, polyherbal, minerals and herbo minerals drugs has suggested for rakta arbuda in Ayurveda. There are some *in-vitro*, clinical trials and case report of Ayurvedic drugs for Leukaemia, which has published in index medical journal but all these matters about aetiology, pathogenesis and management of raktaarbuda, has scattered. This research article will highlight, evaluate, elaborate and discuss about leukaemia with special reference to raktaarbuda.

2. Aims and Objective:

1. To evaluate, elaborate and discuss the Leukaemia with special reference to Rakta Arbuda.

2. To evaluate, elaborate and discuss the etiology, pathogenesis and Ayurvedic method of Rakta Arbuda.

3. To evaluate, elaborate and discuss the management and prevention of Rakta Arbuda with special reference to Leukaemia.

3. MATERIAL AND METHOD:

Material related to rakta arbuda and leukaemia is collected from Ayurvedic text including Bahatriye, Laghutrye. Bhavprakash nighntu, Rasratnasamuchaya, sidhabhashajyamani mala and text book of modern medicine respectively. The available commentary's of Ayurvedic sahitas has also referred to collect relevant matter. The index, non index medical journals has also referred to collect information of relevant topic.

4. Conceptual Study:

4.1Definitionof Leukaemia:

The Leukaemia is a group of disorder characterized by malignant transformation of blood forming cells. The proliferation of Leukemic cells takes place primarily in the bone marrow, and in certain forms, in the lymphoid tissue. Ultimately, the abnormal cells appear in the peripheral blood raising the total white cell count to high level In addition, feature of bone marrow failure (e.g. anaemia, thrombocytopenia, neutropenia) occurs.[4]

4.2 Types of Leukaemia:

Leukaemia is divided into two main groups, one is ALL, second is CLL. ALL progress rapidly which results in the accumulation of immature, useless cells in the marrow and blood and CLL progresses more slowly and allows more mature, useful cells to be made. In other words, ALL crowds out the good cells more quickly than CLL. Leukaemias are also subdivided into the type of affected blood cell. If the cancerous transformation occurs in the type of marrow that makes lymphocytes, the disease is called lymphocytic leukaemia.

A lymphocyte is a kind of white blood cell inside your vertebrae immune system. If the cancerous change occurs in the type of marrow cells that go on to produce red blood cells, other types of white cells, and platelets, the disease is called myelogenous Leukaemia.

Acute lymphocytic Leukaemia (ALL) is also known as Acute Lymphoblastic Leukaemia - This is the most common type of leukaemia among young children, although adults can get it as well, especially those over the age of 65. Survival rates of at least five years range from 85% among children and 50% among adults. The following are all subtypes of this leukaemia: precursor B Acute Lymphoblastic Leukaemia, precursor T acute lymphoblastic leukaemia, Burkett's leukaemia, and acute biphenotypic leukaemia. [5]

4.3 Leukaemia classification:

Acute Leukaemia is characterized by predominance of undifferentiated precursor or leukaemia blasts. Acute leukaemia may be derived from the myeloid stem cells called acute myeloblastic leukaemia (AML), or from the lymphoid stem cells termed acute lymphoblastic leukaemia (ALL). [6]

TABLE 1: FAB CLASSIFICATION OF ACUTE MYELOBLASTICLEUKAEMIA'S-(FRENCH, AMERICAN, BRITISH CLASSIFICATION)

Acute Myeloblastic Leukemia (AML)	Morphology
M0:Minimal differentiated AML	Blasts lack definite cytologic and cytochemical features but have myeloid lineage antigens.
M1: AML without maturation	Myeloblast predominant; few if any granules or Auer rods.
M2: AML with maturation	Myeloblasts with promyelocytes predominate; Auer rods may be present.
M3: Acute promyelocytic leukaemia	Hyper granular promyelocytes; often with multiple Auer rods per cell.
M4: Acute myelomonocytic leukaemia (Naegeli type)	Mature cells of both myeloid and monocytic series in peripheral blood; myeloid cells resemble M2
M5: Acute monocytic leukaemia	Two subtypes: M5a shows poorly –differentiated monoblasts M5b shows differentiated promonocytes and monocytes.
M6:Acute erythroleukaemia(Di Guglielmo's syndrome)	Erythroblast predominant (50%); Myeloblasts and Promyelocytes also increased.
M7:Acute megakaryocytic leukaemia	Pleomorphic undifferentiated blasts predominant; react with antiplatelet antibodies.

TABLE 2: FAB CLASSIFICATION OF ACUTE LYMPHOBLASTIC LEUKAEMIA'S-(FRENCH, AMERICAN, BRITISH CLASSIFICATION)

Acute Lymphoblastic Leukaemia (ALL)	Morphology
L1: Childhood –ALL (B-ALL and T-ALL)	Homogenous small lymphoblast; scanty cytoplasm, regular round nuclei, inconspicuous nucleoli.
L2:Adult ALL (mostly T-ALL)	Heterogeneous small lymphoblasts; variable amount of cytoplasm, irregular or cleft nuclei, large nucleoli.
L3: Burkitt type –ALL (B-ALL)	Large homogenous lymphoblast has; round nuclei, prominent nucleoli, and cytoplasmic vacuolation.

4.4Aetiology of Leukaemia:

The aetiology of Leukaemia is not known in most patients. However, a number of factors have been implicated.[7]

1. **Genetic factor:**
   There is high concordance rate among identical twins if acute leukaemia develops in the first year of life. Families with excessive incidence of leukaemia have been identified. Acute leukaemia occur with increased frequency with a variety of congenital disorder such as Down's, Bloom's, Klinefelter's and Wiskott-Aldrich's syndrome, Fanconi's anaemia and ataxia telangiectsia.

2. **Environmental factors:**
   Certain environmental factors are known to play a role in the aetiology of leukaemia. These include the following;

   Ionising radiation-e.g.-in individuals exposed to occupational radiation exposure, patients receiving radiation therapy, and Japanese survivors of the atomic bomb explosions. Radiation exposure is related to the development of CML, AML and all but not to CLL or HCL.

Chemical carcinogens-e.g. Benzene and other aromatic hydrocarbons are associated with the development of AML.

3. **Infection-** Induction of Leukaemia's in experimental animals by RNA viruses (retro viruses) has been studied for quite some time but more recently viral aetiology of adult T-cells Leukaemia –Lymphoma (ATLL) by a human retro virus called human T cells leukaemia –lymphoma virus I (HTLV-I) and (HTLV-II) for T cells variant of hairy cells leukaemia has been established

4. Cigarette, cigar, and pipe smoking have been associated with cancers of the lung, mouth, bladder, colon, kidney, throat, nasal

cavity, voice box, oesophagus, lip, stomach, cervix, liver, and pancreas, and with leukemia [8].

4.4-Pathogenesis (Leukaemogenesis) of Leukaemia as per Modern Medicine:

The leukaemia arises following malignant transformation of a single clone of cells belonging to myeloid or lymphoid series, followed by proliferation of the transformed clone. The evolution of leukaemia is muti-step process, and in many cases, acute leukaemia may develop after a pre-existing myelodysplastic or myeloproliferative disorder.

In acute leukaemia, the single most prominent characteristic of the leukaemia cells is a defect in maturation beyond the Myeloblast or Promyelocytes level in AML, and the lymphoblast level in ALL. However, it may be emphasised here that it is the maturation defect in leukemic blasts rather than rapid proliferation of leukemic cells responsible for causing acute leukaemia. The leukemic cells proliferate primarily in the bone marrow, circulate in the blood and *infiltrate into other tissues* such as lymph nodes, liver, spleen, skin, viscera and the central nervous system but the basic defect lies in the DNA, conferring a heritable malignant characteristic to the transformed cells and its malignant characteristic to the transformed cells and its progeny. RNA viruses (e.g.HTLV-1) and causes insertion mutagenesis for which oncogenes may play a role may induce a neoplastic phenotype.

A number of clonal cytogenetic abnormalities have been reported in association with the various forms of acute and chronic Leukaemias. The most consistent chromosomal abnormality among these is Philadelphia (Ph) chromosome seen in 70-90% cases with CML involving reciprocal translocation of parts of long arm of chromosomes 22 to the long arm of chromosome As the leukemic cells accumulate in the bone marrow they suppress normal haematopoietic stem cells, partly by physical replacing the normal marrow precursors. [9]

Pathogenesis (Samprapti) Raktarbuda as per Ayurveda: According to vagbhat, Vitiated Dosha will constricted and compress the blood within the Venous (siras). This will be mature it before time hence obstruction of bleeded blood produce lump of mamsa covered with muscular sprouts and grow very fast along with bleedings. This vitiated Shonit (blood) along with circulating blood within vessels produced Blood cancer. This make the patients suffer from pandu (Anaemia) and complication of blood.[10]

4.5 Clinical Manifestation of Leukaemia (Modern Medicine):

Acute Leukaemia:

Patients with **AML** most often present with nonspecific symptoms that begin gradually or abruptly and are the consequence of anaemia, leukocytosis, leucopoenia or leukocyte dysfunction, or thrombocytopenia. Half mention fatigue as the first symptom, but most complain of along with fatigue, weakness anorexia and weight loss are common. Fever with or without an identifiable infection is the initial symptom in 10% of patients. Signs of abnormal haemostasis (bleeding, easy bruising) are noted first in 5% of patients. On occasion, bone pain, lymphadenopathy, nonspecific cough, headache, or diaphoresisis the presenting symptom. Fever, Splenomegaly, Hepatomegaly, Lymphadenopathy, Sternal tenderness, and evidence of infection and haemorrhage are often found at diagnosis.[11]

Chronic Myeloid Leukaemia (CML):

Clinical feature-The onset of CML is generally insidious. Some of the common presenting manifestation is: Anaemia such as weakness, Pallor, dyspnoea and tachycardia, Weight loss, Lassitude, Anorexia, Night sweats, Splenomegaly, and Bleeding tendncy.[12]

Chronic Lymphoid Leukaemia (CLL):

Clinical feature: The onset of disease is characteristically insidious. Common presenting manifestations are Feature of Anaemia such as gradually increasing weakness, fatigue and dyspnoea, Enlargement of superficial lymph nodes is a very common finding, Splenomegaly and hepatomegaly are usual, Haemorrhagic manifestations are found in case of CLL with thrombocytopenia, Infection, particularly of respiratory tract, is common in CLL.[13]

Clinical Manifestation of *Raktarbuda* as per Ayurveda:

The patients suffer from anaemia (Pandu) and complication of blood loss.[14]

4.6 Laboratory Finding of Leukaemia: [15]

TABLE 3: HAEMATOLOGICAL FINDING IN LEUKAEMIA

Sr	Features	Acute Lymphoblastic Leukaemia(ALL)	Acute Myeloblastic Leukaemia(AML)	Chronic Lymphoblastic Leukaemia(CLL)	Chronic Myeloblastic Leukaemia(CML)
1.	Anemia	Normochromic type	Normochromic type	Normocytic normochromic type	Normocytic normochromic type
2.	White blood cell	Lymphoblast	Myeloblast Pancytopenia Neutropenia	Leukocytosis	Leukocytosis
3.	Platelets count	Thrombocytopenia Moderate to severely decreased (below-50,000/µl)	Thrombocytopenia Moderate to severely decreased (below-50,000/µl)	Normal or moderately reduced.	Normal but raised in about half the cases.

TABLE 4: BONE MARROW EXAMINATION IN LEUKAEMIA

1.	**Cellularity**	**Hyper cellular**	**Hyper cellular**	**-**	**Hyper cellular**
2.	Erythropoiesis	Erythropoietic cells are reduced	Erythropoietic cells are reduced	Reduced Erythroid precursors	Erythropoietic cells are reduced
3.	Megakaryo-Cytes	Reduced or absent	Reduced or absent	-	Megakaryocytes are conspicuous but are usually smaller in size than normal.
4.	Cytogenetics	Karyotypic abnormalities in 75% cases	Karyotypic abnormalities in 75% cases.	Philadelphia chromosomes are present.	Philadelphia chromosomes are present.
5.	Leukaemic cells	The bone marrow generally tightly packed with leukaemic blast cells.	The bone marrow generally tightly packed with leukaemic blast cells.	Increased Lymphocyte count	–

TABLE 5: CYTOCHEMESTRY IN LEUKAEMIA

1.	Myeloperoxidase	Positive	Positive in immature myeloid cells but negative in MO myeloblasts,	-	-
2.	Sudan black	Positive	Positive in immature cell.	-	-
3.	Periodic acid Schiff (PAS)	-	Positive in immature cells and M6 (Erythroleukaemia)	-	-
4.	Nonspecific esterase (NSE)	Positive-M4 and M5	Positive in monocytic series (M4 and M5)	-	-
5.	Acid phosphatase	Positive in –M4 and M5	Focal positivity in leukaemic blasts in ALL	-	-
6.	Neutrophill alkaline phosphatise (NAP)	- -	- -	- -	Reduced score

Identication of Impured (Vikrit) Blood as per Ayurveda:

Ayurveda suggested unique methods to determination the impurity of bloods from patients. The blood from patients mixed with food should be given to the animals and birds like dogs and crows. If it is not eaten then it should be supposed that impured bile blood. Another method also has described by Acharya Charka that A white cloth Soaked in that blood and dried, Should be washed with warm water, if the cloth retains the coloration, it is bile blood. However, if the cloth becomes clean and whites it is to be regarded as live blood.[16]

Trivadha Parikshan of Leukaemia:

Ayurveda has suggested trividhapariksha having darsan, sparsan, parsan. Which is unique and it will play major roll to diagnosis and disease.[17]

Darshan (Inspection):

The darsanpariksha is included in the inspection which is done by darshanindrya (eyes) of physician. It is nothing but visible signs of patients in Leukaemia-anaemia (Pandu), bleeding tendency (raktstraya) are major signs which is found in leukaemia. Which will be evaluated by inspection.

Sparshan (Palpitation)-It have major role,in the examination of patients which include palpitation. Splenomegaly (Plihavredhe), Hepatomegaly, fever, sternal tenderness these are some sign of leukaemia, which will be evaluated by Palpation.

Parshan (Questioning)-it is done by questionings about symptoms which is found in patient in leukaemia. Fatiguness, weight loss, bone pain, night sweats will be evaluated by questioning.

4.6 Management of Leukaemia (Raktarbuda) as per Ayurveda:

Though there is no basic line of treatment of Leukaemia has found in Ayurveda,as it is Asadhya (incurable), but some Ayurvedic herbs has been mentioned as a Rakta Arbudanashak (anti Leukaemic) in the Ayurvedic text books. Sandpuspa (*Lochnera rosea*), Bhallatak (*Semecarpus anacardium*), Vanpalandu *(Urginea indica*), Vantrapush *(podophyllum hexeandrum*), Gugulu *(Commiphora mukul*) has mentioned as Rakta Arbudanashak herbs in Ayurveda.

- Sandpushpa juice (10-20ml) and past (10gm) of whole plant, leaf and root will be useful to cured Leukaemia.[18]
- The Bhallatak will be cutted and boil in 200 ml milk after then it will be keeping for cool automatically and then ingested orally after application of Dharat in to mouth.[19]
- Vanpalandu tuber churn(120-200mg), syrup(30-60drop) and tincture (5-30) drop will be useful in curing Leukaemia.[20]
- Vantrapush root churn (250-500mg) and root abstract (15-60mg) will be useful in curing Leukaemia.[21]
- Gugulunirayas(2-4gm) will be useful to cure Leukaemia.[22]

Certain poly-herbal and herbo mineral compound has found in the text of Ayurveda, which has been indicated for Arbuda along with other disease:

- **Rodra Ras** having content Suta(mercury), Gandhak (sulphur), Nagavalli (*Piper betal*), Meghanada (*Amaranthus spinosus*), Punarnava *(Boerhaavia diffusa*) Pippali *(Piper longum*) and Gomutra (cow's urine).Which is given in 125mg thrice a day with honey orally.[23]
- **Vradhdaru churn** having content Vradhadaru *(Argyreia speciosa)*, Haritki *(Terminalia Chebula)*, Amalaki *(Emblica officinalis)*, Shunthi (*Zinziber officenalis)*, Marich (*Piper nigrum)*, Pipali (*Piper longum)*, Daruhaldi (*Berberisaristata)*, Chavya (*Piper retrofractum)*, Varun (*Crataevanurvala)*, Gokshur (*Tribulus* terrestris*)*, Chopchini (*Smilex china)*, Sudha, Mundi (*Sphaeranthus indicus)*, Gomutrakshara. This is given in 6-12gm along with kanji or gomutra.[24]

- **Vradhadaru yoga** having content Vradhadaru *(Argyreia speciosa),* Haridra (*Curcuma longa),* Shunthi (*Zinziber officenalis),* Marich (*Piper nigrum),* Pipali (*Piper longum),* Haritki *(Terminalia Chebula),* Amalaki *(Emblica officinalis),* Vibhitaki (*Terminalia bellerica),* Shigru (*Moringaoleifera),* Kampillak (*Mallotus philippinensis)* Ajnayan (*Trachysprmu mammi),* puranaguda and Gomutra (cow's urine). This is given in 1masa (3 gm) as orally. [25]

- **Nityan and Ras** having content Suta (mercury), Gandhak (sulphur), Tamra Bhasma, Kansya Bhasma, Vang Bhasma, Tuth, Sankh Bhasma, Varatica Bhasma, Shunthi (*Zinziber officenalis),* Marich (*Piper nigrum),* Pipali (*Piper longum),* Haritki$_2$ *(Terminalia Chebula),* Amalaki *(Emblica officinalis),* Vibhitaki (*Terminalia bellerica),* Loha Bhasma, Vidang (*Embeliaribes),* Sandhav lavana, Samudhra lavana, Sauvarchal lavana, Vidlavana, Audhbhidha lavana, Chavya (*Piper retrofractum),* Karchura (*Curcuma zedoria),* Padha (*Cissampelo spareira),* Devdaru (*Cedrusdeodara),* Ela (*Elettaria cardamomum),* Vradhadaru (*Argyreia speciosa),* Nishoth (*Operculinaturpethum),* Chitrka (*Plumbago zeylanica),* Danti (*Baliospermum montanum).* This is given in 375mg along with water as orally. [26]

- **Kachnargugulu** having content Kachnar (*Bauhinia variegate),* Shunthi (*Zinziber officenalis),* Marich (*Piper nigrum),* Pipali (*Piper longum),* Haritki *(Terminalia Chebula),* Amalaki *(Emblica officinalis),* Vibhitaki (*Terminalia bellerica),* Varun (*Crataevanur valaa),* Tezpatra *(Cinnamom nmtamala),* Dalchini (*Cinnamomnm zeylanicum),* Guggalu (*commiphera mukul),* Ela (*Elettaria cardamomum).*

  This is given in 1gm along with Kachnarkwatth (*Bauhinia varigata),* Mundi kwath (*Sphaeranthus indicus)* and Khadirsar (*Acasia catechu*) as orally. [27]

- **Hargauriras** having content Raskar poor ($Hgcl_2$), Hartal (AS_2S_3), Somal (AS_2O_3), Bhojpatra (*Betulautillis),* Phitkari. This is given 125 mg along with Dhrat. [28]

There are also clinical researches of certain Ayurvedic herbs and a mineral on Leukaemia has published recently:

- **Herbo mineral Navjeevan Ras** having content-Rajat Bhasma (Silver Bhasma), Jahar Mohara (Serpentine Stone), Nirvisha (*Delphinum denudatum*), Taruni, Gulab (*Rosea centifolia*), Chandan (*Santalum album*), Gojihva (*Onosma bracteatum*), Latakasturi (*Hibiscus abelmoschus*). Navjeevan Ras 250mg tablet thrice daily for first three month and 125mg tablet three times daily for next nine month was given.[29]

- **Kamdudha Ras having content** Maukticpishti (*Mytilusmar gartiferus,)* Pravalapishti *(Corallium rubrum),* Muktasuktipishti (*Mytilusmar gartiferus),* Kapardikabhasma (Calcinated and purified *Cypraeamoneta shells),* Sankha bhasma (Calcinated and purified *Turbinellarapa shells),* Amratasatva *(Tinospora cordifolia).* [30]

- **Keharubapisti having content** Trinakantamanichurn, Gulab ark (for mardan) [31].

Kamdudhar as 250mg + Kaharubapisti 125mg first three month four times daily mixed with honey next nine month only Kamdudharas (250mg) three times daily was given. Navjeevanras, Kamdudharas and Kaharubhapisti has achieved complete disease remission with the alternative treatment without any adverse side effect. Heerakabhasma/ Incinerated diamond (1gm), Suvarna bhasma /Incinerated Auram (2gm), Abhrakasahastraputi bhasma/Incineratrd Mica(3gm), Lauhabhasma /Incinerated iron (4gm), Tamrabhasma/Incinerated copper (5gm).[32]

Pathya in Arbudha:

Advice drumsticks (*Moringaoliefera*), old rice (*Oryzasativa)* green gram (*Phasleousaureus),* patol

(*Tricosanthesdioica),* bitter-gourd (*Momordica muricata),* pungent and non greasy foods.

Apathya:
Avoid taking milk, all types of meat preparation sugarcane and its products, sour, sweets, and hard to digest food and abisyanda causing foods.[33]

5. DISCUSSION: Leukaemia is cancer of blood or bone marrow in which abnormal growth of the WBC occurs due to persistent exposure of carcinogens. It having primarily two types Myeloid and Lymphoid further sub divided into Acute and Chronic. Morphologically Acute Myeloblastic Leukaemia has classified from M0 to M7, while Acute Lymphoblastic Leukaemia has classified from Lo to L3.Though the aetiology of Leukaemia is not known in most of patients, however some genetic factors, radiation and chemical carcinogens some infection RNA virus and the addiction of tobbbaco. These are responsible factor for Leukaemia.

Sushrata has mentioned the mithyaaahar-viharas a hetu (causative factor) of Rakta Arbuda (Leukaemia) [34]. Day by day the utilization of packed food having preservatives, flavouring agent has been increased which croses the upper limit. Most of the preservatives like Nitrates, formaldehyde, Benzene casuses leukaemia due to continuous persistent ingestion of such types of foods having carcinogenic agent [35]. After green revolution, the utilization of pesticides has been included increased in India.[36] Most of the organophosphorus and organophosphorus and organochlorine compound has found in human bloods due to continuous persistent and prolonged exposure of pesticides directly or indirectly out of which some having carcinogenic effects and causes leukaemia. The utilization of radioactive frequency of has been increased all over world including India due to up gradation of technology, which this radioactive compound emitted from mobile towers produces leukaemia to the few peoples living in and around that circumstance. The heavy metals and waste radioactive materials from atomic centres have also affected to the patients and may produce leukaemia. DDT and endosulfan was found as maximum in cow milk and water samples. High concentrations of DDT and endosulfan were observed in the all samples collected from different blocks of Patna district. Chlorpyriphos and Malathion pesticides residue were found below the WHO permissible limit in comparison to the other pesticides in tested cow milk and water samples. This study determined that the presence of carcinogenic pesticides in cow milk and water might increase cancer risk to the people of Patna [37].

In another study investigated the magnitude of contamination of DDT pesticides in vegetables, pulses and cereals, which were brought for sales to the consumer in the local markets of Sahibabad and Ghaziabad, most of the collected samples, were found to be contaminated with residues of DDT. In some of detected samples, DDT exceeded the limit of tolerance prescribed by WHO and FAO [38].

High concentrations of both BHC & DDE were observed in the serum samples of the people who had direct exposure to the pesticides, namely agriculturalists and public health workers with few exceptions [39]. The findings suggest that chronic low dose exposure to pesticides either directly or indirectly can be a major contributor for presence of pesticide residual levels in human blood [40].

Study shows that 16 studies included in the review, 14 show associations between pesticide exposure and leukemia [41].Thus dietary direct contamination or other sources of exposure of pesticide contribute the Leukaemia.

One potent carcinogen is the solvent benzene, which increases the risk for leukaemia from small amounts in the air. Others, like DDT and chloroform, require higher exposures to increase the cancer risk by the same amount Of the nearly 900 active ingredients in registered pesticides in the United States, about 20 have been found to be carcinogenic in animals, although not all have been tested. In the United States, a number of pesticides have been banned or their use has been restricted. These include ethylene oxide, amitrole, some chlorophenoxy *herbicides*, DDT, dimethyl hydrazine, hexachloro benzene, hexamethyl phosphoramide, chlordecone, lead acetate, lindane, mirex, nitrofen, and toxaphene**.** Studies of people with high exposures to pesticides, such as farmers,

pesticide applicators, crop duster pilots, and manufacturers, have found high rates of blood [42].

According to modern science in acute leukaemia, the single most prominent characteristic of the leukaemia cells is a defect in maturation beyond the myeloblast or promyelocyte level in AML, and the lymphoblast level in ALL.

Ayurveda has mentioned vitiation of *Doshas* with in blood sources. Which compress the blood cells and resulted the Rakta Arbuda. The clinical features of Anaemia, Splenomegaly, Hepatomegaly and Bleeding tendency these are the common manifestation of Leukaemia as per Ayurveda and this is similar to very similar of clinical manifestation by modern medicine.

Aneamia either lymphoblasts or myeloblasts in WBC and Thrombocytopenia these are the main blood pictures of the Leukaemia. While hyper cellurility reduced erythropoietic and blasts these are the major laboratory findings in Leukaemia. Ayurveda has also mentioned about the identification of impure bloods, which is not documented, whether it is useful to diagnosed Leukaemia or not.

Trividha Parikhsha is the unique methods of diagnosed of any disease mentioned in ayurved. Which will useful to diagnose the leukaemia somewhat. In Ayurveda there are so many herbal, polyherbal, mineral and herbomineral drugs are found for leukaemia or cancer which may play from major role in the treatment of Leukaemia.

Acharya Priyvat Sharma has mentioned to utilized Sandpuspha whole plant juice and paste to cured Rakta Arbuda (Leukaemia).

In vitro study of vincristine has demonstrated that certain compound capable of reversing the growth-inhibitory activity of Vincristine against human monocytic leukaemic cells [43].

The fractions from *Vinca rosea* were discovered to give interesting and, in some cases, profound activity againstthe P-1584 leukemia, an acute lymphocytic leukemia transplanted in DBA/~ mice [44].

Leurosine is the alkaloid of *Vincarosea* study within shown and demonstrable retardation of the P-1534 leukemia [45].

Herbo mineral Roudra Ras, Poly herbal Vradhdaruchurna and yoga, Nityanand Ras, Kachanar guggluvati these are the Ayurvedic drugs which mentioned for treatment of cancer. However, documentation according to current research criteria has not found.

A case study of combined herrbo mineral Navjeevan Ras, Kamdudha Ras and Kaharuba Pisti has showed a significant result in the treatment of Leukaemia. Ayurvedic formulation having heavy metals has also showed a significant result to cure a Leukaemia. Ayurveda has also suggested the Pathya-Apathya for Cancer, which is unique.

Semicarpusana cardium has resulted in significant clearance of the leukemic cells from the bone marrow and internal organs in Leukaemia animals with compare standreddrug imatinib mesylate. [46] 3-(8(Z), 11_(Z)-pentadecadienyl) catechol (SA-3C) isolated from kernel of *Semecarpus anacardium*has significant result as a anti cancer agent in various cancer including Leukaemia in cell line method. [47]

Semi synthetic anti cancerous drug of *Podophyllum hexandrrum* and lead compound namely etoposide, teniposide, etopophes, which are used for the treatment of cancer including Leukaemia.[48, 49]

Gugulipid mediated suppression of cancer cell proliferation reported significant in Leukaemia cell.[50, 51]

Though arsenic tri oxide (AS_2O_3)has not mention as a anti cancerous agent in Ayurveda but there are so many in vitro and clinical researches has proved, it has a anti leukaemia agent as per modern medical science .

In vitro study the percentage of these cells can be significantly increased after AS_2O_3 treatment.[52] In one *in vitro* study the result shows these As2O3 induces APL cell differentiation through direct or indirect activation of retinoic acid receptor-related signalling pathway.[53]

Arsenic tri oxide (AS_2O_3) and Retionic acid has proved superior to Retionic acid plus chemotherapy in the treatment of patients with low-to-intermediate-risk APL.[54]

Hot water and ethnol extract of Drum stick (*Moringa Olifera)* extract could kill majority of the abnormal cell among the primary cells harvested from 10 patients with acute lymphoblastic leukemia (ALL) and 15 with acutemyeloid leukemia (AML) as well as a culture of hepatocarcinoma cells.[55]

Ayurveda has already suggested about utilization of Drum stick plant (*Moringaolifera)* phalli in regular diet for patient of cancer.

CONCLUSION: Clinical manifestation of Raktarbuda are somewhat similar to Leukaemia and there are no of herbal, polyherbal, mineral and herbomineral drugs are found in text book of ayurveda. *In-vitro* and clinical research of these drugs on leukaemia also shows significant result, hence ayurvedic medicine may be play major role on leukaemia in future.

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