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Prevention and Cure of Chemo-Radiotherapy Induced Toxicity through Ayurveda

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ABSTRACT

Chemotherapy and Radiotherapy are mainly used for the treatment of cancer but it also kills the normal body cells including W.B.C., R.B.C., Platelets and others along with cancer cells. These short term and long term hazards of chemotherapy or radiotherapy are called as acute or chronic toxicity, respectively. Febrile neutropenia, nausea, vomiting, diarrhoea, stomatitis, hair loss, fatigue, allergic reaction, peripheral neuropathy these are the clinical manifestation of acute toxicity of chemotherapy while anemia, nausea, vomiting, diarrhoea, non-infective cystitis, are the acute toxicity of radiotherapy. Osteoporosis, avascular necrosis, Cataract, Neuropsychiatric deficits, Neuropathy, Cardiomyopathy, Pulmonary dysfunction, Hepatorenal dysfunction and Infertility, are the chronic toxicities due to chemotherapy. Ayurveda has a potency to prevent and treat these toxicities by using basic principles of Ayurveda. *SarivadiHima*, *MouktikayuktaKamdudha*, *PadmakadiGhruta*, *ShatavariKalpahelp* helps to treat the toxic effect of chemo-radiotherapy while vomitab, *Bilvachuran*, *Dadimastakchuran*, *Haridradi tail*, *Yastimadhu* powder mouthwash, *Nalpalmadi* oil, *Drakshavahlay*, Urtiplex capsule and lotion, *Bhumayamalki* and *Atibalachuran* will help to relieve the toxicity symptomatically. *Asthisanharadichuran*, *Panchtiktsheervasti*, *Sukhavativarti*, *Kalyanakghrit*, *Amritaghyatailam*, *Soma churan*, *PunarnavadiKawath*, *Rohitakadivati*, *Kapikachuadichuran*, *Phalghritand Khjuraditailam* should be given to treat the chronic toxicity of chemotherapy. *AyurvedicRasayanalike Baladi*, *Nagabala*, *Vijyasaradi*, *Triphala*, *Shankhpushpighrita*, *Aindra*, *Medhya*, *Neelkanth*, *Chyawanprash*, *Gokshuraka*, *Punarnava*, *Guduchiyadi*, *Shishukalpdrumghrita* and *Lauhabhasmadi*, which may be helpful for preventions of the toxicity caused by chemotherapy. Thus, Ayurveda may play the major role to prevent and treat the acute and chronic toxicity of chronic-radiotherapy.

KEYWORDS Chemo-toxicity, Radio-toxicity, Vishakta, Ayurveda



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INTRODUCTION

Chemotherapy is the use of any drug to treat any disease but the word chemotherapy means especially the treatment of cancer by cytotoxic & other drugs. Cancer is one of the leading causes of morbidity and mortality worldwide. According to National Cancer Institute, in 2016, there were an estimated 15.5 million cancer survivors in the United States¹. In 2017, 1,688,780 new cancer survivors and 600,920 cancer deaths are projected to occur in the United States². In 2018, an estimated 1,735,350 new cases of cancer patients will be diagnosed in the United States and 609,640 people will die from the disease³. The number of cancer patients is expected to increase to 20.3 million by 2026⁴. New data show that India now has the third highest number of cancer survivors among women after China and the United States⁵. Though chemotherapy plays a major role in the treatment of cancer but it gives potentially dangerous hazards which may be acute or chronic to the patient of cancer. The studies have shown that **cancer survival rates after receiving chemotherapy can be as startlingly low as 2.1%**⁶. Chemotherapeutic agents are not specific for cancer cells, however, and the side effects of treatment are a result of their

antiproliferative actions in normal tissues such as the bone marrow, skin and gut. Most cytotoxic drugs can have significant adverse effects having a narrow therapeutic window or index. Considerable supportive therapy is often required to enable patients to tolerate therapy and achieve benefit. Myelosuppression is common to almost all cytotoxics. This not only limits the dose of drug, but also can cause life-threatening complications⁷.

AIMS AND OBJECTIVES

1. To elaborate, evaluate and discussions of toxicity of Chemotherapy and Radiotherapy as per Ayurveda and modern science.
2. To elaborate, evaluate and discussions the role of Ayurveda to prevent and cure of chemo-radio induced toxicity.

METHODOLOGY

A thorough literary survey has been done to collect the compatible matters of this fundamental research. The text of Ayurveda including *Brihatrayi*, *Laghutrayi*, its concerned commentaries and modern textbook of medicine were referred to collect, evaluate, elaborate and to prepare the *Ayurvedic* clinical protocol for prevention and management of Chemo-Radio induced toxicity.

CONCEPTUAL STUDY

A. The Assessment of Acute Toxicity of Chemotherapy⁸

Table 1 Assessment of Acute Toxicity of Chemotherapy (NCI 2012):

Grade	Mild – 01	Moderate- 02	Severe- 03	Life-threatening- 04
1. Neutrophils	<1.5 × 10 ⁹ /L	<1.5–1.0 × 10 ⁹ /L	<1.0–0.5 × 10 ⁹ /L	<0.5 × 10 ⁹ /L
2. Febrile neutropenia			ANC, 1,000/mm ³ with a single temperature of ≥38.3°C (101°F) or a sustained temperature of ≥38°C (100.4°F) for more than one hour	Life-threatening consequences, urgent intervention indicated
3. Nausea	Poor appetite without alteration in eating habits	diet decreased without significant weight loss dehydration or malnutrition	Inadequate oral calorific or fluid intake, IV fluids, tube feedings, or TPN indicated	Life-threatening consequences
4. Vomiting	One episode in 24 hours	2–5 episodes in 24 hours, IV fluids indicated	> 6 episodes in 24 hours, IV fluids indicated or TPN	Life-threatening consequences
5. Diarrhea	Less than 4 stools per day over baseline, mild increase in ostomy output compared with baseline	Increase of 4–6 stools per day over baseline IV fluids indicated, moderate increase in ostomy output compared with baseline not interfering with ADL	More than 7 stools per day over baseline, incontinence, IV fluids, hospitalization, severe increase in ostomy output compared with baseline, interfering with ADL	Life-threatening conditions including hemodynamic collapse
6. Mucositis	Inflammation of the mucous membrane	Patchy ulcerations of the mucous membrane	Contiguous ulcerations or pseudomembranes, bleeding with trauma	Tissue necrosis, significant spontaneous bleeding, life-threatening conditions
7. Hair loss	Thinning or patchy	Complete		
8. Fatigue	Fatigue relieved by rest	Fatigue not relieved by rest and limiting instrumental ADL	Fatigue not relieved by rest, limiting self-care ADL	
9. Allergic reaction	Drug-induced fever (upto 38°C), along with Transient flushing or rash, intervention not indicated	Intervention or infusion interruption indicated response promptly to symptomatic treatment, eg, antihistamines	Prolonged recurrence of symptoms following initial improvement, hospitalization required for clinical	Life-threatening consequences, urgent intervention required
10. Anaphylaxis			Bronchospasm with or without urticaria, allergy-related edema, angioedema, hypotension, parenteral intervention indicated,	Life-threatening conditions which need urgent intervention required
11. Peripheral motor neuropathy	Asymptomatic, clinical or diagnostic observations	Moderate symptoms limiting instrumental ADL	Severe symptoms limiting self-care ADL, the assistive device indicated	Life-threatening consequences, urgent intervention indicated

	only, intervention not indicated			
12. Peripheral sensory neuropathy	Asymptomatic, loss of deep tendon reflexes, or paresthesias	Moderate symptoms limiting instrumental ADL	Severe symptoms limiting self-care ADL	Life-threatening consequences, urgent intervention indicated
13. Extravasation		Erythema including associated symptoms like edema, pain, induration, phlebitis.	Necrosis or Ulceration, severe tissue damage, operative intervention indicated	Life-threatening conditions which need urgent intervention indicated
14. Injection site reaction	Tenderness with or without associated symptoms (eg, warmth, erythema, itching)	Pain, lipodystrophy, edema, phlebitis	Ulceration or necrosis, severe tissue damage, operative intervention indicated	Life-threatening consequences, urgent intervention indicated

ADL = Activities of Daily Living

B. The Assessment Toxicity of Radiotherapy⁹

Table 2 Assessment Toxicity of Radiotherapy

Grade	Mild – 01	Moderate- 02	Severe- 03	Life-threatening- 04
1. Anemia	Hemoglobin (Hgb) < 10 g/dl	Hgb < 10 – 08 g/dl	Hgb < 08 – 6.5 g/dl	Life-threatening consequences; urgent intervention indicated
2. Nausea	Poor appetite without alteration in eating habits	Diet decreased without significant weight loss dehydration or malnutrition	Inadequate oral calorific or fluid intake, IV fluids, tube feedings, or TPN indicated	Life-threatening conditions
3. Vomiting	One episode in 24 hours	2–5 episodes in 24 hours, IV fluids indicated	> 6 episodes in 24 hours, IV fluids indicated or TPN	Life-threatening consequences
4. Diarrhoea	Less than 4 stools per day	4 to 6 stools per day over, IV fluids indicated,	More than 7 stools per day, hospitalization and IV fluids indicated,	Life-threatening conditions with hemodynamic collapse
5. Cystitis non infective	Microscopic hematuria; minimal increase in frequency, urgency, dysuria, or nocturia; new onset of incontinence	Moderate hematuria; moderate increase in frequency, urgency, dysuria, nocturia or incontinence; continuous bladder irrigation by catheter indicated;	Gross hematuria; transfusion, IV medications or hospitalization indicated; elective endoscopic, radiologic or operative intervention indicated	Life-threatening consequences; urgent radiologic or operative intervention indicated

C. Ayurvedic Management of Chemotherapy-Induced Acute Toxicity

I. (Cold infusion): *Sarivadi Hima*¹⁰

Table 3 Ingredient of *SarivadiHima*

Sr	Herbs	Latine name	Part Used	Proportion
1	<i>Sariva</i>	Hemidesmusindicus	Root	01

2	<i>Madhuk</i>	Madhucaindica	Ripe fruit & Flower	1 + 1 = 02
3	<i>Chandan</i>	Santalum album	Stem bark	01
4	<i>RaktaChandan</i>	Pterocarpussantalinus	Stem bark	01
5	<i>Padmak</i>	Prunuscerasoides	Stem bark	01
6	<i>Gambhari</i>	Gmelinaarborea	Fruit	01
7	<i>Ushir</i>	Vetiveriazizanioides	Root	01

Hima is the cold infusion of fragrant or cold potency herbs which are intended to be used for *Pitta* problems. *Himakalpa* is mentioned by *AacharyaSushruta* in which all active ingredients are cold in potency. *SarivadiGana* is prepared by immersing 10 gm (1 part) of each drug in 3 parts of water for 4 – 6 hours and then filtered and administered.

Dose- 40 ml (Internal)

II. *MouktikayuktaKamdudha*¹¹

1 Praval (Coral)-Madhur(Sweet), *Amla* (sour), *Kashay*(Astringent) , *Sheeta* (Cold) *Madhur*(Sweet) *Pittashamak*, *KaphaghnaRasayan* , *Jwaraghna*, *Rakta-pittahar*, *Vishbadhahar*

2 Mouktika (Pearl)-Madhur(Sweet), *Kashay* (Astringent), *Sheeta*(Cold), *Madhur*(Sweet) *Tridoshshamak*, *Dahashamak* , *Balya*

3 Shankha (Conch shell)-Tikta (Bitter), *Ushana* (Hot), *Madhur*(Sweet), *Kaph-Pitta shamak*, *Chhradighna*

4 Shauktika (Peral Shell)-Katu(Pungent), *Sheeta*(Cold), *Madhur*(Sweet), *Vat-Pittaghna*, *Arochakahar*, *Chhardighna*

5 Kapardika (Cowrie shell)-Katu(Pungent), *Sheetoshna*, *Madhur*(Sweet), *Vat-Kaphaghna*

6 Guduchi(Tinosporacordifolia)-Tikta, *Kashay*, *Ushna*, *Madhura*, *Tridoshshamak*, *Deepan*, *Pachak*, *Pittasarak*, *Balya*, *Raktashodhak*, *Jwaraghna*, *Dahaprashama n*

7 Gairik (Red Lumber Stone)-Madhur, *Kashay*, *Sheet*, *Madhur*, *Pittashamak* , *Vishhara*

III. *Padmakadi Ghruta*¹²

1 Padmak (Kamal) Swaras(NelumboNucifera)-Madhur, *Kashaya*, *Sheet*, *Madhur*, *Pitta* – *Kaphanashak*, *Trushna*(Thirst), *Daha* (Burning all over body), *Visphot* (Boils), *Visha*(Toxicity), *Visarpa* (Herpes), *Raktapitaa* (Bleeding through openings of body) *Dahaprashaman*, *varnya*, *Chhardighna*, *Trushnanigrahan*, *Stambhan*, *Mutravirajaniya*, *Mutravirechaniya*, *Vishghana*, *Balya*

2 DurvaSwaras (CynodondactylonPers)-Madhur, *Tikta*, *Kashaya*, *Sheet*, *Madhur*, *Pitta nashak*, *Kaphanashak*, *Trushna* (Thirst), *Arochak* (Loss of taste), *Vanti* (Vomiting), *Visarpa*(Herpes), *Daha*(Burning sensation), *TwakRog* (Skin disease) *Prajashtapana*, *varnya*, *ropana*, *Dahprashman*, *Stambhan*.

3 *Anantmool* (*HemidesmosIndicus*)-

Madhur, Sheet, Madhur, Tridoshashamak, Agnimandya (Loss of appetite), *Aruchi* (Loss of taste), *Kasa* (Cough), *Visha* (Toxicity), *Jwar* (Fever), *Atisar* (Loose motion), *Raktapitta* (Bleeding through openings of body), *Pittashamak, Rakatprasadak, Sthanyashodhan, Vishghna, Dahaprashaman, Jwarhar, Purishsangrahaniya*

4 **Goghrut**-*Madhur, Sheet, Madhur, Vatshamak, Pittashamak, Vishanashak, Rasayan* (Rejuvenator), *Visarpa* (Herpes), *Daha* (Burning all over the body),

Agnimandya (Loss of appetite), *Balvardhan, Agnidipan*

IV. *ShatavariKalpa*¹³

1 ***Shatavari*** (*Asparagus racemosus*)-*Madhurtikta, Sheet, Madhur, Vat-pittashamak, Grahani* (Irritabile bowel), *Arsha* (Piles), *Kshay* (Tuberculosis), *Gulm, Atisar* (Diarrhoea) *Balya, Vayasthapan, Pittashamak, Rasayan. Netrya, Sthanyakar, Shothhar, Medhya, Rudhya, Vrushya, Agnivardhan*

2 **Sugar**-*Madhur Sheet, Madhur-Pitta shamak, Tarpan, Balya*

D. Symptomatic Ayurvedic Treatment of Chemotherapy Induced Acute Toxicity

Table 4 Symptomatic Ayurvedic Treatment of Chemotherapy Induced Toxicity

Sr.	Toxicity	Ayurvedic Medicine
1	Nausea Vomiting	Vomiteb Syrup ¹⁴ -Adults: 10ml three to four times a day. And Child: 5 ml three to four times a day
2	Diarrhea	<i>BilvaChurna</i> ¹⁵ - 3gm + <i>Dadimastaka churna</i> ¹⁶ -3gm
3	Stomatitis	<i>Haridradi Tail 'Gandoosh'</i> , every 4 hourly and application of <i>Yastimadhu</i> powder with honey or herbal mouthwash in the oral cavity, 8 g of <i>F. caryophylli</i> , 6 g of <i>F. schisandrae</i> , and 4 g each of <i>R. glycyrrhizae</i> , <i>M. officinalis</i> , and <i>H. menthae</i> were extracted twice with 80% ethanol. Extracts were concentrated, mixed with 200 mL water, and packaged in plastic bottles or freshly prepared curcumin mouthwash ¹⁷ .
4	Hair loss	<i>Nalpamaradi</i> oil for External Application ¹⁸
5	Fatigue	<i>Drakshavaleha</i> ¹⁹ 10 gm with Milk
6	Allergic reaction	URTIPLEX Capsule ²⁰ : Adults: 2 caps twice a day and Child: 1 cap twice a day along with Urtiplex Anti Itch Lotion locally. Urtiplex Lotion ²¹ - Apply on the affected area as per requirement gently twice a day.
7	Peripheral motor & sensory neuropathy	<i>BhumyamalakiChurna</i> : 3 g twice a day and a decoction prepared from 10 g of <i>Atibalamula</i> twice a day ²² .
8	Extravasation	Refer to Surgical Management
9	Injection site reaction	Refer to Surgical Management
10	Febrile neutropenia	Decoction of <i>Giloya</i> + <i>Musta</i> + <i>Amalaki</i> ²³ and <i>Brahma rasayana</i> 10 grams ²⁴

1. **Vomiteb Syrup**: It is a herbal syrup which is safe and effective herbal anti-nauseant, anti-emetic. *Hedychiumspicatum* and *Zingiberofficinale* in VOMITEB regulate the gastrointestinal motility

thereby preventing gastroesophageal reflux. *Elettariacardamomum* protects the gastric mucosa. 2. ***BilvaChurna*** reduces the frequency of bowel movements and calms intestinal spasms and pain.

3. **Dadimashtakachurnam** is used to correct indigestion and to treat malabsorption syndrome and diarrhoea. It is also ideal for people who have to take the trouble of passing stools many times in a day. Used to correct indigestion and to treat malabsorption syndrome, diarrhoea and IBS.

4. **Haridradi Tail 'Gandoosh'**, every 4 hourly and Oral application of *Yastimadhu* powder with honey

5. **Nalpamaradi oil**- It is effective on *Pittaja* skin disorders and Hair Loss due to Chemotherapy

6. **Drakshavaleha** is one of the widely used herbal products for Fatigue. It is an herbal jam.

7. **Urtiplex Cap**: Conch shell calx 60 mg, cowrie shell calx 30 mg, rubiacordifolia 300 mg, acacia catechu 300 mg, emblica officinalis 250 mg, picrorhizakurroa 300 mg, tinosporacordifolia 150 mg, adhatodavasica 300 mg, curcuma longa 150 mg, andropogonmuricatus 120 mg, berberisaristata 75 mg, hemidesmusindicus 60 mg, nardostachysjatamansi 60 mg, zingiberofficinale 30 mg. It is a herbo-

mineral capsule which is best for itching and rashes.

8. **Urtiplex Lotion**- *Kumarigel* (Aloe barbadensis) 10 %, Marigold oil (Tagetes erecta) 0.1 %, Sarson oil (Brassica campestris) 1 %, Peppermint (Menthol, Menthapiperata) 0.25 %, Powders of *Yashadabhasma* (Zinc oxide) 1 %, *Kokambutter* (Garcinia indica) 2 % .It is a natural antiallergic and anti-itch formulation. *Kumari gel* (Aloe Vera) is very potent herb known for its skin soothing, antiinflammatory as well as antibacterial activity. Marigold oil (Tagetes erecta) and Sarson oil (Brassica campestris) help in relieving itching and reducing the flare-ups as it possesses antiinflammatory and antioxidant activity. Due to cooling nature and antipruritic property, menthol is beneficial for urticaria. Zinc oxide and Kokum (*Garcinia indica*) butter help to soothe skin.

9. **The Decoction of Giloya + Musta + Amalaki** for Fever and *Brahma Rasayana* 10 grams in the morning with the half glass of warm milk or warm water, half an hour before breakfast proved beneficial to prevent Febrile neutropenia.

E. Ayurvedic Management of Radiotherapy Induced Toxicity

Table 5 Ayurvedic Treatment of Radiotherapy Induced Toxicity:

Sr.	Toxicity	Ayurvedic Medicine
1.	Anaemia	<i>Punarnava Mandoor</i> ²⁵
2.	Nausea and Vomiting	Vomiteb Syrup ²⁶ - Adults: 10ml three to four times a day and Child: 5 ml three to four times a day

3.	Diarrhea	<i>Bilva Churna</i> ²⁷ - 3gm + <i>Dadimastaka churna</i> ²⁸ -3gm
4.	Cystitis non infective	<i>Chandanavasav</i> ²⁹ and <i>Chandra-Prabhavati</i> ³⁰

F. Ayurvedic Method of Prevention and Management of Chronic Toxicity of Chemotherapy

Table 6 Chronic Toxicity of Chemotherapy Drug on Various Organs³¹ and its Effect on *Srotas*

DRUG	ORGAN	Chronic Toxicity	Clinical Features	<i>Srotas Vikriti</i> (Affected Systems)
Glucocorticoids	Bone	Osteoporosis,	Increased risk of bone fractures, acute and chronic pain	<i>Ashthi - VahaSrotas</i> (Skeletal system)
		Avascular necrosis	osteonecrosis, cellular death of bone components	
	Eyes	Cataracts	blurry vision, loss of vision	<i>Indriya- VahaSrotas</i> (Sensory- organ)
Methotrexate, cytarabine	Brain	Neuropsychiatric deficits, Cognitive decline	Deficits in overall <u>intelligence</u> , <u>mental illness</u> .	<i>Mano- VahaSrotas</i> (Psychological system)
Vincristine, platinum, taxanes	Peripheral nerves	Neuropathy, Hearing loss	<u>numbness</u> , <u>tremor</u> , impairment of balance, and <u>gait abnormality</u>	<i>Vata- VahaSrotas</i> (Nervous system)
Anthracyclines, Trastuzumab	Heart	Cardiomyopathy	fatigue, <u>shortness of breath</u> , <u>irregular heart beat</u> and <u>fainting</u>	<i>Prana- VahaSrotas</i> (Respiratory and cardiovascular system)
Bleomycin Methotrexate	Lung	Pulmonary fibrosis	Shortness of breath, particularly with exertion, Chronic dry, hacking	<i>Prana- VahaSrotas</i> (Respiratory and cardiovascular system)
		Pulmonary hypersensitivity	coughing, Fatigue and weakness, Chest discomfort including chest pain	
Platinum, others	Kidney	Decreased function, hypomagnesemia	Oligourea or anurea	<i>Mutra- VahaSrotas</i> (Excretory system)
Various	Liver	Altered function	Stomach pain, Nausea, Loss of appetite, Jaundice (yellow skin and eyes).	<i>Anna- VahaSrotas</i> (Digestive system)
Alkylating agents, others	Gonads	Infertility, premature menopause	Abnormal sperm production or function, impair female fertility.	<i>Sukra- VahaSrotas</i> (Reproductive system)
Various	Bone marrow	Aplasia,	Anemia , Pallor, Weakness, Lethargy	<i>Rasa- VahaSrotas</i> (Lymphatic system)
		myelodysplasia,	Anemia, paleness (pallor), unusual bruising or bleeding, petechiae	

Secondary Leukemia	Anemia, Easy bruising or bleeding, Paleness of the skin, Excessive fatigue, Bone pain
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The chemotherapy and chemotherapeutic agents have somewhat similar to *Ksharakarma* and *Kshara-dravya*(caustic alkalies) respectively. Because their properties, mechanisms of action and toxicities are similar. There are two types of *Ksharakarma*, first is *Bahyaparimarjana* (External application) and second is *Abhyantaraparimarjana* (Internal application)³².

These drugs (*Kshara-dravya*)possesses the predominance of *Katu* (pungent) *rasa*, *Lavana* (salt) *rasa*, *Tikshna* (penetrating) and *Ushna*(hot) in potency and causes *Dahana* (burning), *Pachana*(digesting), *Avadharana* (tearing), *Vilayana*(dissolving), and *Sodhana* (cleaning)³³.

It has also indicated for as excision, incision, extraction and scarifications in various conditions such as *Nashaarsha* (nasal polypi) and *Arbuda*(malignant tumors).

Ayurveda has also mentioned the contraindication of *Kshara-Karma* (chemotherapy) in phobic, weak, emaciated and *vata* and *Pitta* vitiated patients. It is also contraindicated in the patients of facial paralysis, hyperpyrexia, diarrhoea, anaemia, *Shiroroga* (disease of

the head) and heart disease, *Prameha*(diabetes), *Akshipaka* (inflammation of eyes), cataract and anorexia. It cannot be given also the patients who under gone emesis and purgation during menstruation, pregnancy and having inflamed ovary, vagina and alcoholic patients³⁴.

G. Ayurvedic Management of chronic toxicity of Chemotherapy:

1. Management of *Ashthi* – *VahaSrotasVikriti*–

6 gm *Asthisanharadichurna*³⁵ twice a day along with gheeshould be given.

Procedure³⁶-

*PanchatiktaKsheerBasti*containing *Ksheer*, *Ghritaa*and *Tiktatmaka Rasa dravya* (*Guduchi*, *Nimba*, *Vasa*, *Kantakari*and *Patol*)should be given in morning after breakfast for 30 days per rectally in the treatment of *Asthikshaya*.

Eat a calcium-rich diet, which includes milk, cheese, yoghurt, broccoli, spinach and soy like products. It has been revealed that Vitamin D stimulates the absorption of calcium into the body³⁷.

2. Management of *Indriya* – *VahaSrotasVikriti*–

External application of *Sukhavativarti*³⁸should be used on eye

twice a day with 10-20 ml oral medicaments including *Mahatriphala Ghrita*³⁹.

3. Management of *Mano-VahaSrotasVikriti*–

10-20ml *KalyanakaGhrita*⁴⁰ twice a day should be given in *Mano-VahaSrotasVikriti*.

4. Management of *Vata-VahaSrotasVikriti*–

10-20 *Amritaghyatailam*⁴¹ twice a day should be given in *Vata-VahaSrotasVikriti*.

5. Management of *Prana-VahaSrotasVikriti*–

3-6 gm *Soma Churna*⁴² twice a day should be given with warm water in *Prana-VahaSrotasVikriti*.

6. Management of *Mutra-VahasrotasVikriti*–

Niruhabasti of Punarnavadikvatha should be given per rectally for 30 days with 20-40 ml oral medicaments including *Punarnavadikvatha*^{43,44}.

7. Management of *Anna-VahaSrotasVikriti*–

500mg-1000mg *RohitakadiVati* should be given orally twice a day with *KarelaSwaras* (Bitter Gourd juice)⁴⁵.

8. Management of *Sukra-VahaSrotasVikriti* -

- **Male Infertility-** 3-6 gm *Kapikachhuadichurna*⁴⁶ should be given twice a day with cow's milk

- **Female Infertility-** 6-12 gm *Phala Ghrita*⁴⁷ should be given twice a day **with** warm milk or warm water

9. Management of *Rasa-VahaSrotasVikriti*–

5-10 gram *Kharjuradileha* should be given twice a day **with** *Madhu* and *Ghrita*⁴⁸.

Table 7 Preventive Measure in Chemotherapy

Sr.no	Rasayana	Indication
1.	<i>NagabalaRasayana</i> ⁴⁹	The chemotherapeutic agents like glucocorticoids causes <i>AsthivahaSrotasVikarti</i> which is one of the places of <i>Vata</i> , <i>Nagbalarasayan</i> or <i>Baladirasayan</i> should be used to prevent osteoporosis and avascular necrosis as this <i>Rasayan</i> have <i>Vatashakmak</i> property.
2.	<i>BaladiRasayana</i> ⁵⁰	
3.	<i>VijyasaradiRasayan</i> ⁵¹	<i>VijyasaradiRasayan</i> or <i>Trifalarasayan</i> should be used to prevent the cataract due to glucocorticoids as it is <i>Chakshukshya</i> property (wholesome for eyes).
4.	<i>TrifalaRasayana</i> ⁵²	
5.	<i>Shankhpushpi Ghrita</i> ⁵³	<i>ShankhpushpiGhrita</i> should be used to prevent hearing loss caused due to Vincristine, Platinum & Taxanes.
6.	<i>AindraRasayana</i> ⁵⁴	<i>AindraRasayana</i> or <i>Medhyarasayan</i> should be use to prevent the <i>Vikratin</i>
7.	<i>MedhyaRasayana</i> ⁵⁵	<i>Mano-VahaSrotas</i> caused due to chemotherapeutic agents Methotrexate, Cytarabine as it is indicated in mental illness.
8.	<i>NeelkanthRasayana</i> ⁵⁶	<i>Neelkanth rasa</i> is a <i>Rasayana</i> which is indicated for heart disease should be used in cardiomyopathy caused by chronic toxicity of Anthracyclines & Trastuzumab.
9.	<i>Chyawanprash</i> ⁵⁷	<i>Prana-VahaSrotasvikriti</i> like pulmonary fibrosis and pulmonary hypersensitivity has the chronic toxicity due to induction of Bleomycin and Methotrexate which will be prevented by giving <i>ChyawanprashRasayana</i> .

10.	<i>Punarnava Rasayana</i> ⁵⁸	<i>Punarnava Rasayana</i> or <i>Gokshuraka Rasayana</i> should be used in renal failure caused by chronic toxicity of Chemotherapeutic agents like Platinum.
11.	<i>Gokshuraka Rasayana</i> ⁵⁹	
12.	<i>Guduchiyadi Rasayana</i> ⁶⁰	Some chemotherapeutic agents cause chronic toxicity in the form of hepatic dysfunctions and jaundice which can be prevented by given <i>Guduchiyadi Rasayana</i> along with that chemotherapeutic agent.
13.	<i>Shishukalpdrum Ghrita</i> ⁶¹	The infertility will be found in male while premature menopause along with infertility will be found in females due to the chronic toxic effect of chemotherapeutic agent like Alkylating agents which can be prevented by using <i>Shishukalpdrum Ghrita Rasayan</i> .
14.	<i>Lauhabhasmadi Rasayana</i> ⁶²	<i>Rasa Vaha Srotas Vikraiti</i> in the form of anaemia due to bone marrow failure caused by induction of chemotherapeutic agents which can be prevented by giving <i>Lauhabhasmadi Rasayana</i> along with chemotherapy.

H. IPD Nursing Care for Chemo- Radio Therapy Patient⁶³

1. Surface Cleaning -The floors and counter surfaces, bedroom, drawing room, dining room kitchen and the bathroom should be kept clean and neat. A simple disinfectant such as Lysol or another household product that has a disinfection claim on the label should be used regularly. Vacuum the house regularly using a vacuum with a HEPA filter (High-Efficiency Particle Arrestor).

2. Hand Washing – Hand washing is the most important thing to be done by the patient and the family. The Antimicrobial scrub should be used instead of regular soap and water. Hands must be washed for 30 minimum seconds. Paper towels should be used to wipe the hands in the bathroom and in the kitchen.

3. Sick Friends or relatives - During times when the patient has low blood counts, friends or relatives that are sick, or

friends or relatives that have family members living with them that are sick should not come.

4. Masks - Masks should be worn by the parent only if the parent is sick or feels a cold coming on. Masks are not generally needed unless someone who has to be with the patients has a cold. Hand washing is also essential before applying the mask.

5. Dishwashing - It is necessary that all dishes and eating utensils washed in hot water with soap after eating. A dishwasher is preferred if possible. During the low blood counts, there is a high chance of infections so clean and neat dishes and silverware should be used. Paper plates, utensils, and napkins may be used alternatively.

6. Washing fruits and vegetables - Fresh fruits and vegetables should always be washed and scrubbed in running water. All dirt and other matter should be removed before eating. The fresh juices should be

pasteurized before use. Though peeled fruit is the safest; oranges and apples should be carefully peeled with antiseptic precautions. Berries, melons, and peaches are generally a higher risk for mold, and should be inspected very carefully or avoided; canned fruit may be an alternative for these.

7. Mold (Fungus) –The mold, sources of mold and other things which are using by the patients of chemotherapy may be very dangerous. So all mold and sources of mold should be cleaned and/or removed. Water stagnation, leaks or other potential mold hazards should be fixed and kept dry.

8. Air filter - An air filter is not normally necessary unless patient is in a high mold or dust area, or there is another known airborne hazard; however, if you do decide to use an air filter, a HEPA filter is necessary.

9. Raw Foods - Raw eggs and raw cookie dough are not recommended for eating, and raw eggs should not be added to smoothies that are made. All types of meat should be cooked properly so that no portions are raw. All milk should be pasteurized.

10. Clothes Washing - All clothes should be washed regularly with detergent, and preferably after every wearing, and with

warm or hot water. Commercial laundry facilities should not be used.

DISCUSSION

Cancer cases as well as mortality are increasing rapidly. Though the Chemotherapy and Radiotherapy are the treatment of cancer at present. But both therapies give potentially dangerous hazards which are intolerable in most of the cases. Sometimes patients are died due to Chemotherapy rather than cancer. Febrile neutropenia, Nausea, Vomiting, Diarrhoea, Stomatitis, Hair loss, Fatigueness and Allergic reaction etc are the clinical manifestation of acute toxicity of post Chemotherapy. This qualitative data can be measured by giving gradations like mild, moderate, severe and life-threatening for prognosis purpose. Anaemia, nausea, vomiting, diarrhoea and non-infective cystitis these are some clinical manifestation of acute toxicity of post radiotherapy. These can be also asses by giving gradations like mild, moderate, severe and life threatening to decide prognosis. *SarivadiHima* contains *Sariva*, *Madhuk*, *Chandan*, *RaktaChandan*, *Padmak*, *Gambhari*, *Ushir* which having *Raktpittahar*, *Pittajawarhar* and *Dahashamak* properties. Hence, it can play a major role to calm down the post

Chemotherapy and Radiotherapy toxicity. *MouktikayuktaKamdudha* contains *pisti* of *Praval* (Coral), *Mouktika* (Pearl), *Shankha*(Conch shell), *Shauktika* (Peral Shell), *Kapardika* (Cowrie shell), *Guduchi*(*Tinosporacordifolia*) and *Gairik*(Red Lumber Stone) which having *Pittashamak*property. Hence it can be used to counteract the toxicity. *PadmakadiGhruta* contains *Padmak*(*NelumboNucifera*), *DurvaSwaras* (*CynodondactylonPers*), *Anantaol* (*HemidesmosIndicus*), *Goghrut* which can be also used to calm down the toxicity of chemotherapy and Radiotherapy. *ShatavariKalpacan* be used to reduce chemotherapy and Radiotherapy induced debility as it having *Rasayan* property. Syrup *Vomitab*, *Bilvachurna*,*Dadimashtakachurna*, *DrakshAvaleha*, *BhumyamalakiChurna* and *AtibalaChurna* will be used to give symptomatic relief from chemotherapy induced nausea, vomiting, diarrhoea, fatigue, neuropathy and neropathy respectively. *Haridradi Tail* for '*Gandoosh*' and *Yastimadhupowder* with honey for oral application will be helpful to reduce chemotherapy induced stomatitis if it is used along with herbal mouthwash. *Nalpamaradi oil* can be used for hair loss while *urtiplex* lotion and

capsules can be used for allergic reaction due to chemotherapy.

The decoction of *Giloye*, *Musta* and *Amalakimay* be useful to reduce mild febrile neutropenia. Surgical management should be given in chemotherapy induced extravasation and injection reaction at the site. Osteoporosis, avascular necrosis, Cataracts, Neuropsychiatric deficits, Neuropathy, Cardiomyopathy, Pulmonary dysfunction, Hepatorenal dysfunction and Infertility are the common chronic toxicity due to chemotherapeutic agents like glucocorticoids, Vincristine, platinum, Taxanes Methotrexate, cytarabine, Anthracyclines, Trastuzumab, Bleomycin, Alkylating agents respectively. *AsthivahaSrotas* (Skeletal System), *IndriyavahaSrotas*(Sensory Organ), *ManovahaSrotas* (Psychological System), *VatavahaSrotas*(Nervous System), *PranavahaSrotas* (Respiratory and cardiovascular system), *MutravahaSrotas* (Excretory System), *AnnavahaSrotas* (Digestive System) and *SukravahaSrotas* (Reproductive System) will be affected due to chronic toxicity of chemotherapeutic agents. *Asthisanharadichuran* and *Panchtikaksheers* should be given to reduce the osteoporosis due to Chemotherapy along with calcium-rich diet. *Sukhavativarti*, *Kalayanakghrut*,

Amritaghyatailam and *Soma churan* should be given to manage cataract, psychosomatic disorder, neuropathy and pulmonary disorder. *Niruhavastiof PunarnavadiKawath* will be useful to improve the renal function while *Rohitakadivati* will be useful to improve hepatic function. *Kapikachuadichuran* and *Phalghrit* will be given to manage male and female infertility respectively. *Khajuradileha* will be beneficial to manage bone-marrow dysfunction. Some Ayurvedic Rasayana like *Vijyasaradi*, *Baladi*, *Nagabala*, *Triphala*, *Shankhpushpighrita*, *Aindra*, *Medhya*, *Neelkanth*, *Chyawanprash*, *Punarnava*, *Gokshuraka*, *Guduchiyadi*, *Shishukalpdrumghrita* and *Lauhabhasmadi*, these are the Rasayana described in the Ayurveda texts should be given along with chemotherapy to prevent the toxicity of chemotherapeutic agents. The special care should be taken to prevent external infections during the period of induction of chemotherapy and radiotherapy as the immunity of patient during this therapy goes to downward. Surface cleaning of the room of patients should be cleaned by vacuum cleaner to avoid airborne infection by respiratory tract. Hand washing of patient and the family member is necessary to control the infections inserted by hand. Sick friends

and relatives should be avoided during and after the chemotherapy & radiotherapy to avoid the cross infections. Use of clean & neat food dishes is essential to avoid transmissions of utensil infections. The food and vegetables should be used after running wash. All mold and sources of mold should be cleaned and removed properly as it is very dangerous to the chemotherapeutic patient. The air filter or mask should be used to avoid airborne infections. The raw foods should not be recommended. Thus, the patients of acute or chronic toxicity of chemotherapy and radiotherapy can be managed by using holistic approach and basic principles of Ayurveda.

CONCLUSION

The acute or chronic toxicity of Chemotherapy and Radiotherapy has been well known for its morbidity and mortality in cancer patients. *SarivadiHima*, *MouktikayuktaKamdudha*, *PadmakadiGhruta* and *ShatavariKalpa* can be helpful to counteract the toxicity of chemotherapy and radiotherapy along with symptomatic treatment. Ayurveda may play a major role to prevent the toxicity if it will be given during the therapy. Thus, Ayurveda has a potency to prevent and

cure the toxicity of chemotherapy and radiotherapy.

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