



TOXICITY DUE TO CHEMOTHERAPY & RADIOTHERAPY & ITS AYURVEDIC APPROACHES

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ABSTRACT

Chemotherapy and radiotherapy are the treatment modalities for cancer that are extensively used in current times due to their effectiveness against many cancers. These therapies can cause severe toxicities, including loss of appetite, diarrhea, anorexia, constipation, vomiting, burning sensations, weakness, alopecia, and fever. Reduction in hemoglobin, white blood cells, and platelets is among other adverse effects of chemotherapy. In this context, Ayurveda can be an evidence-based proven approach to prevent and resist complications of cancer therapies. Several Ayurvedic drugs such as Brahmi, Brihamarasayan, Guduchi, Yasthimadhu, and Ashwagandha can help alleviate the side effects caused by chemotherapy and radiotherapy. These drugs also offer therapeutic benefits against cancer. Ayurvedic medicines reduce the burning sensation induced by chemotherapy, improve digestion, restore blood counts, remove toxins, and induce mental calmness. In this way, Ayurveda plays a significant role in preventing and managing complications of chemotherapy and radiotherapy. There is a need to explore such approaches that counteract the side effects of chemotherapy and radiotherapy. Considering this fact, the present article explores the role of Ayurvedic modalities in preventing and managing chemotherapy and radiotherapy complications.

Keywords: *Ayurveda, Cancer, Chemotherapy, Toxicity, Radiotherapy, Agad Tantra*

INTRODUCTION

The significant approaches to cancer treatment include radiation, chemotherapy, and biologic therapy. These modalities are used in combination or individually according to the severity of the disease. These approaches work differently and offer a synergistic response when used in combination. However, these therapies have some severe adverse effects; especially radiation and chemotherapy reveal the most toxic side effects that need addressing for better therapeutic outcomes [1-3].

Chemotherapy and radiotherapy are considered highly toxic among the various cancer therapies. The acute toxicity of these therapies occurs for a few weeks, while chronic toxicity occurs for months or years after the treatment. The significant side effects of chemotherapy are nausea, vomiting, mucositis, diarrhoea, alopecia, etc. Radiation therapy may produce side effects such as anorexia, fatigue, sleep disturbances, headaches, nausea, vomiting, anaemia, etc. Long-term complications of these therapies include esophagitis, pharyngitis, laryngitis, dysphagia, hepatotoxicity, fatigue, cognitive deficits, infertility, etc [2-4].

The conventional management of these side effects involves using protectors, which are given to prevent tissue damage and used before symptoms of toxicity appear. Another treatment is given when toxicity develops after the therapy to mitigate symptoms of toxicity. However, radio-protectors and chemo-protectors are not so practical; therefore, they are unable to provide complete solutions against the side effects of cancer therapies. Thus, complementary and alternative approaches have been utilised recently to resolve this issue. This article highlights approaches of Ayurveda for the comprehensive management of chemo-radiotherapy side effects [3-5].

Chemo-Radiotherapy:

Chemotherapy involves anti-cancer drugs to treat cancer; these drugs can halt the growth of a tumour, help to kill cancer cells, prevent the spread to other parts, etc. These therapies reduce the risk of recurrence, alleviate symptoms and restrict further pathogenesis of the disease. Radiotherapy uses high doses of radiation, which destroys cancer cells, suppresses the severity of symptoms and limits the spread of disease. Radiation therapy can be external or internal; however, external radiation is employed commonly [2, 3].

Toxicity of Chemo-Radiotherapy

Chemo-radiotherapy targets all rapidly dividing cells, thus affecting not only tumour cells but also gastrointestinal cells, skin cells, blood cells, reproductive cells hair, etc. Reproductive organs and oral mucosa also suffered significantly. Therefore chemo-radiotherapy imparts various side effects such as mucositis, alopecia, constipation, fatigue, anorexia, altered taste, sleep disturbances, anaemia, pharyngitis, laryngitis, hepatotoxicity and infertility, etc [1-4]. The various types of side effects of chemo-radiotherapy and their descriptions are presented in **Table 1**.

Short-Term Side Effects

- ✓ My mouth and throat are sore.
- ✓ Loss of appetite
- ✓ Diarrhea
- ✓ Constipation
- ✓ Anemia
- ✓ Fatigue
- ✓ Cognitive dysfunction

Long-Term Side Effects:

- ✓ **Osteoporosis**
- ✓ **Damage to vital organs**
- ✓ **Vision Impairment**
- ✓ **Hearing Loss**
- ✓ **Nerve damage**

Table 1: Side effects of chemo-radiotherapy and their descriptions

Category of Chemo-Radiotherapy Side Effect	Description
Haematological Toxicity	<ul style="list-style-type: none"> ✓ Bone marrow suppression results in neutropenia and anemia. ✓ Thrombocytopenia ✓ Risk of infections and bleeding.
Gastrointestinal Side Effects	<ul style="list-style-type: none"> ✓ Nausea and vomiting ✓ Diarrhoea and constipation
Dermatological Toxicity	<ul style="list-style-type: none"> ✓ Phlebitis, urticaria, erythema and vein discoloration ✓ Alopecia, dermatitis and hyperpigmentation
Gonadal Dysfunction	<ul style="list-style-type: none"> ✓ Oligospermia ✓ Ovarian failure and premature menopause
Nervous System Changes	<ul style="list-style-type: none"> ✓ Numbness in limbs, tired muscles and trembling ✓ Confusion and cognitive deficits

Ayurveda approaches for combating chemo-radiotherapy side effects:

Ayurveda recommends *Snehana* with medicated *ghee*, *Shamana* therapy with soothing medications such as *Chandana* and *Yashtimadhu*, etc. *Rasyana* drugs improved symptoms associated with chemotherapy and radiotherapy side effects. Natural remedies like *Haritaki*, *Vibhitaki*, *Amalaki* and *Guduchi* impart chemo and radio-protective effects. These drugs ameliorate radiation-induced injury, pacify *Pit-*

ta Dosha and restore normal body function after the therapy. Drugs which pacify *Pitta Dosha* mainly recommended here since *Pitta* is *Dosha* which aggravated predominantly during the side effects of chemo-radiotherapy [5, 6].

Pacification of *Dosha*: The chemo-radiotherapy affects all *Dosha*, but the main side effects are associated with the aggravation of *Pitta Dosha* therefore, various approaches are suggested for the pacification of *Pitta Dosha* to suppress the side effects of chemo-radiotherapy as mentioned in **Table 2**.

Table 2: Chemo-radiotherapy induced manifestations of *Pitta Dosha* and their Ayurveda management:

Manifestations of Aggravated <i>Pitta Dosha</i>	Ayurvedic Management
<i>Dav</i>	Cooling and soothing remedy (<i>Ghee</i> and <i>Yashtimadhu</i>)
<i>Mukhapaka</i>	Gargle and administration of <i>Khadiradi vati</i>
<i>Osha</i>	<i>Chandana</i> and <i>Ushir</i>
<i>Galpaka</i>	Gargle with <i>Khadiradi vati</i> and oils of aromatic plant
<i>Payupaka</i>	Soothing drug like <i>Yashtimadhu</i>
<i>Davatu</i>	Cooling agent like sugarcane juice

As mentioned above Ayurveda suggested specific therapeutic approaches for the management of aggravated *Dosha* associated with chemo-radiotherapy side effects [6-8]. The particular symptom of these conditions can be alleviated by different Ayurvedic approaches as mentioned in **Table 3**. These natural therapies appreciably improve various symptoms such as anemia, mucositis, diarrhea, pharyngitis, hepatotoxicity, constipation, fatigue and skin problems, etc.

Table 3: Chemo-radiotherapy side effects and Ayurveda remedies for each condition:

Side Effects	Ayurvedic Remedies	References
Anorexia	<ul style="list-style-type: none"> ✓ <i>Shunthi</i>, <i>Maricha</i> and <i>Pippali</i>, etc. for gargling purpose ✓ <i>Lavangadi Churna</i> for chronic condition 	[9, 10]

	✓ <i>Khadiradi Vati</i> for oral ulcers	
Mucositis	✓ <i>Kalaka Churna</i> for mouth gargles ✓ Application of <i>Yastimadhu</i> with honey	[11]
Nausea and Vomiting	✓ <i>Haritaki</i> with honey ✓ <i>Jivaneeya Ghrita</i> and <i>Khandkushmandavaleha</i>	[12, 13]
Anemia	✓ <i>Triphala</i> decoction, <i>Dhatriavaleha</i> and <i>Loha Bhasma</i>	[14]
Diarrhea	✓ <i>Pepper</i> with honey and <i>Chitraka</i> ✓ <i>Jatiphala</i> and <i>Dadimastaka Churna</i>	[15]
Sleep Disturbances	✓ <i>Kshirbala</i> oil and <i>Mahamasha</i> oil ✓ <i>Shweta Musli</i>	[16, 17]
Constipation	✓ <i>Erand Tail</i> with <i>Triphala</i> ✓ <i>Isabgol</i> husk	[18]
Cognitive Deficits	✓ <i>Shankhapushpa</i> and <i>Brahmi</i> ✓ <i>Chavanprash</i> and <i>Ashwagandha</i>	[19]
Pharyngitis	✓ <i>Eucalyptus</i> and <i>Mentha</i> oil.	[20]
Skin Toxicity	✓ <i>Abhyanga</i> with <i>Bala Taila</i> ✓ <i>Swedana Karma</i> and <i>Basti</i>	[9]
Infertility	✓ <i>Kapikachhu</i> and <i>Tribulus terrestris</i>	[21, 22]
Hepatotoxicity	✓ <i>Punarnavastaka Kwath</i> and <i>Ashwagandha</i>	[23]

These drugs or specific therapy acts by different ways to manage chemo-radiotherapy side effects as mentioned below in **Table 4**.

Table 4: Mode of action of Ayurvedic approaches in managing chemo-radiotherapy side effects:

Mechanism	Impact of Chemoradiotherapy	Ayurvedic Intervention	Mode of Action	References
Antioxidant Activity	Generates free radicals causing oxidative stress and damage to healthy tissues.	Curcumin	Scavenges free radicals and upregulates antioxidant enzymes.	[24, 25]
		<i>Ashwagandha</i>	Increases levels of endogenous antioxidants like superoxide dismutase and glutathione peroxidase.	
Anti-inflammatory Effects	Induces inflammation in various tissues, leading to side effects such as mucositis and dermatitis.	<i>Boswellia serrata</i>	Inhibits pro-inflammatory enzymes and reduces inflammation.	[26, 27]
		Turmeric	Inhibits nuclear factor-kappa B (NF-κB), a protein complex that controls transcription of DNA and cytokine production.	
Immunomodulation	Weakens the immune system, making patients more susceptible to infections.	<i>Guduchi</i>	Enhances the activity of macrophages and increases the production of antibodies.	[28, 29]
		<i>Ashwagandha</i>	Modulates immune responses by increasing white blood cell count.	

Adaptogenic and Stress-Reducing Effects	Leads to physical and emotional stress.	<i>Ashwagandha</i>	Reduces cortisol levels, thereby lowering stress and fatigue.	[30, 31]
		<i>Tulsi</i>	Acts as an adaptogen, helping to maintain homeostasis and reduce stress.	
<i>Panchakarma</i> Therapies and Dietary Recommendations	Causes accumulation of toxins (<i>Ama</i>) in the body.	<i>Panchakarma</i>	Includes therapies like <i>Virechana</i> and <i>Basti</i> that help to cleanse the body and remove toxins.	[32, 33]
		Dietary Recommendations	Emphasize foods and herbs that support liver detoxification and improve digestion.	
Tissue Regeneration and Healing	Damages tissues.	Aloe Vera	Promotes wound healing and skin regeneration.	[34, 35]
		<i>Shatavari</i>	Supports tissue repair mechanism.	

DISCUSSION

Chemo-radio therapy induces high toxicity and causes potential damage to adjacent healthy cells, leading to side effects such as diarrhea, fatigue, pharyngitis, laryngitis and esophagitis, etc. The major side effects of chemo-radiotherapy include *Raktapitta* and *Raktadushti* which manifested due to the aggravation of *Pitta dosha*. Ayurveda advocates the use of soothing and cooling remedies for the reversal of chemo-radio therapy induced manifestations of aggravated *Pitta dosha*.

Ayurveda offers specific remedies for the prevention and management of these side effects. Chemotherapy affects gastrointestinal tract, Ayurvedic treatments improve appetite, thus prevent therapy induced digestive problems and promote digestion, alleviate symptoms of nausea, vomiting and diarrhea, etc. *Haritaki* powder is suggested for nausea, *Pippali* for diarrhea and *Triphala* is advised for constipation.

The other drugs also mentioned for combating chemo-radiotherapy side effects. In this context specific drugs are recommended for particular side effects. *Khadiradi vati* and *Yastimadhu* provides relief in therapy induced mucositis, aromatic oil spray is suggested for pharyngitis. *Dhatriavaleha* for anemia, *Panchakola ghrita* and *Punarnavashtaka kwath* for

hepato-toxicity, *Gokshuradi modaka* for male infertility, *Brahatashatavari ghrita* and *Ashokarista* for female infertility, *Ashwagandha* for fatigue and *Bala taila* for skin problem. Insomnia and mental stress are common issues during chemotherapy, here *Shiropichu* considered beneficial for this problem. Psychological counseling is also essential in managing side effects and assuring treatment adherence. According to Ayurveda diet can also help in minimizing chemotherapy side effects, rice, boiled vegetables, soup, cow's milk, ghee and easy to digest foods, etc. are recommended for such conditions.

CONCLUSION

The side effects of chemo-radiotherapy include mouth sores, hair loss, difficulty in bowel movements, extreme tiredness, loss of appetite, changes in taste, sleep disturbances, anemia, sore throat and liver damage, etc. Due to the limited success of conventional radio-protectors and chemo-protectors in managing these side effects, complementary and alternative medicines, particularly Ayurveda, have gained attention from researchers and medical practitioners. Ayurvedic solutions to these issues could serve as valuable adjuncts to conventional treatments, potentially improving the quality of life for cancer patients.

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