



Integrating Ayurveda for Better Tolerance to Chemotherapy

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ABSTRACT: Cancer is a major social, public health, and economic problem in the 21st century. Chemotherapy is the second most widely accepted treatment protocol for cancer after surgery. But it comes with an increased risk of infections and side effects. Failure to manage the adverse effects of chemotherapy in a timely manner could have life-threatening consequences. Ayurveda Treatment has been found to be significantly handle the negative effects of chemotherapy. It allows patients to tolerate adversities of chemotherapy.

This review mainly deals with brief idea about chemotherapy, Side effects of Chemotherapy and how the adversities managed in western medicine as well as in ayurveda. Although Ayurvedic treatments may improve the quality of life for cancer patients and serve as a crucial immunity booster after chemotherapy. But there is a lack of evidence-based research to demonstrate its efficacy and potential. Research gaps and opportunities will be identified to guide development of research programs to validate safety and efficacy of these therapies. Importantly, the use of Ayurvedic modalities is not intended to substitute for allopathic treatments for cancer but as an integrative component for prevention and restoration of strength and immunity post treatment.

KEY WORDS: Ayurveda, Chemotherapy, Adverse effects

INTRODUCTION

Cancer is one of the leading causes of death in the world. IARC's 2022 report shows 20 million new cancer cases and 9.7 million deaths globally. Globally, one in five men or women develop cancer in lifetime, whereas around one in nine men and one in 12 women die from it. With demographics-based predictions indicating that the number of new cases of cancer will reach 35 million by 2050.¹ The scenario is similar in India. Cancer is a complex and multifaceted disease characterized by the uncontrolled growth and spread of abnormal cells. There are different types of cancer, each with its own unique characteristics and potential treatments.

Various treatments are available to combat cancer and the choice of treatment depends on the type of cancer, its stage, location, and the patient's overall health. The ongoing cancer treatments are surgery, chemotherapy, radiotherapy, immunotherapy, targeted therapy etc. Chemotherapy is the second most widely accepted treatment protocol for cancer after surgery. In the last three decades, chemotherapeutic agents and their usage have evolved significantly. but it comes with an increased risk of infections and side effects. Failure to manage the adverse effects of chemotherapy in a timely manner could have life-threatening consequences. Due to the failure of most of the radioprotectors and chemo protectors in controlling side

effects of conventional cancer therapy, the complementary and alternative medicines have attracted the view of researchers and medical practitioners more recently.

Surgery is often the first line of treatment, aiming to remove the tumour and cancerous cells. Radiation therapy uses high energy rays to destroy cancer cells, while Chemotherapy is the second most widely accepted treatment protocol for cancer after surgery. Over the past three decades, the development and use of chemotherapeutic agents have advanced considerably. Chemotherapy involves the use of drugs to destroy cancer cells that have spread throughout the body; however, it also damages healthy cells, leading to weakened immunity in patients. Integrating Ayurvedic medicine alongside chemotherapy may help reduce these adverse effects and enhance the overall strength and resilience of patients.

1.1 Drugs used in Chemotherapy ²

There are different types of chemo drugs that work in different ways, chemotherapy drugs are grouped based on their composition and how they destroy cancer cells. Some types of chemotherapeutic drugs work most effectively during specific phases of the cell cycle. While others kill cancer cells at all phases. They usually use one type of chemotherapeutic drug or a combination of drugs. This is called combination chemotherapy. mainly the chemotherapeutic drugs grouped under these 5 categories.

- Alkylating agents
- Antimetabolites
- Topoisomerase inhibitors
- Mitotic inhibitors
- Antitumor antibiotics

Alkylating agents

It is the oldest and most useful of antineoplastic drugs. It prevents cells from dividing and replicating by damaging the DNA. Its clinical use has evolved from the observation of bone marrow suppression and lymph node shrinkage in soldiers exposed to sulfur mustard gas warfare during world war I. Cisplatin is coming under this group.

Antimetabolites

This group exerts their major effects during the S phase or DNA Synthesis phase of cell cycle. It prevents cancer cells from making the genetic material, which helps to create new cancer cells. It also interferes with the growth of rapidly proliferating cells throughout the body. Commonly used antimetabolites are 6-mercaptopurine.

Topoisomerase inhibitors

It prevents an enzyme called topoisomerase from unwinding DNA strands during replication or transcription which leads to the accumulation of DNA damage and cell death. Common example is etoposide.

Mitotic inhibitors

Mitotic inhibitors are also called plant alkaloids, because they are made up of some plant material. These drugs work by interfering with a cancer cell's ability to divide and make new cells. The most promising widely used microtubule-stabilizing drug taxol (paclitaxel) that arrests cells in mitosis.

Antitumor antibiotics

The way of Antitumor antibiotics work is twofold. They disrupt protein synthesis in target cells. They bind to DNA causing its fragmentation, and prevent the DNA inside cancer cells from copying itself. Ultimately this stops the rapidly dividing cancer cells from replicating and eventually causes their death.

Among these the most commonly prescribed chemotherapy medications are alkylating agents.

1.2 Side effects of Chemotherapy^{3,4}

But this chemotherapy comes with an increased risk of infections and side effects. Failure to manage the adverse effects of chemotherapy in a timely manner could have life-threatening consequences. The side effects can be physical, emotional, and psychological, impacting a patient's quality of life.

Physical side effects include:

- Hair loss
- Fatigue and weakness
- Nausea and vomiting
- Diarrhea or constipation
- Mouth sores and dry mouth
- Loss of appetite
- Weight loss
- Anemia and low blood count.

Emotional and psychological side effects include

- Anxiety and depression
- Mood swings
- Memory loss and cognitive impairment
- Insomnia and sleep disturbances
- Fear and anxiety

Long term side effects

- Infertility
- Organ damage
- Nerve damage

Causes of side effects of chemotherapy

Chemotherapy-induced adversities primarily arise from the non-selective cytotoxic nature of anticancer drugs, which target rapidly dividing cells without distinguishing between malignant and healthy tissues. As a result, normal cells of the bone marrow, gastrointestinal tract, hair follicles, and reproductive system are also damaged, leading to side effects such as myelosuppression, mucositis, alopecia, and infertility.⁵ Furthermore, several chemotherapeutic agents generate reactive oxygen species (ROS), causing oxidative stress and damage to cellular DNA, lipids, and mitochondria, which contributes to organ toxicities like cardiotoxicity, hepatotoxicity, and nephrotoxicity.^{6,7} These effects are compounded by immunosuppression due to bone marrow suppression, resulting in neutropenia and increased infection risk.⁸

Additionally, chemotherapy triggers systemic inflammation and cytokine imbalance, leading to fatigue, fever, and cachexia.⁹ Drugs such as cisplatin, vincristine,⁹ and paclitaxel cause neurotoxicity through axonal injury and interference with microtubule function.¹⁰ Damage to the mucosal lining of the gastrointestinal tract results in nausea, vomiting, and diarrhoea.¹¹ The hepatic and renal systems bear a significant metabolic burden during drug detoxification, predisposing to hepatotoxicity and nephrotoxicity.¹² Moreover, individual genetic and metabolic variations influence the extent of drug-induced toxicity.¹³ Altogether, chemotherapy adversities stem from a complex interplay of cytotoxic, oxidative, inflammatory, and metabolic mechanisms affecting multiple organ systems.

1.3 Management of Side Effects

Most times the side effects from chemotherapy can be managed with medication or adjustment to the chemo dosage. Nausea, vomiting and fatigue can be managed with medication. To manage neuropathy,

physicians will often reduce a patient's dosage and prescribe medications to help restimulate the growth of nerves.

It is essential for patients to discuss potential side effects with their healthcare team to manage and minimize them. Medications, lifestyle changes and supportive care can help alleviate many of these side effects, improving the patient's overall wellbeing during and after chemotherapy. Due to the failure of most of the radioprotectors and chemo protectors in controlling side effects of conventional cancer therapy, the complementary and alternative medicines have attracted the view of researchers and medical practitioners more recently.

Ayurveda offers a holistic approach to managing the adverse effects of chemotherapy by focusing on restoring dosha balance, enhancing ojas (vital energy), and supporting the body's natural healing mechanisms. From an Ayurvedic perspective, the toxic and degenerative effects of chemotherapy resemble aggravation of Pitta dosha and vitiation of Rakta dhatu, leading to conditions akin to *Raktapitta* and *Raktadushti* (bleeding and inflammatory disorders). Ayurvedic management primarily involves the use of Rasayana therapy, which strengthens the body's resistance, improves tissue regeneration, and mitigates oxidative stress. Herbs like Ashwagandha (*Withania somnifera*), Guduchi (*Tinospora cordifolia*), Amalaki (*Embllica officinalis*), and Shatavari (*Asparagus racemosus*) have shown immunomodulatory, adaptogenic, and antioxidant activities that help reduce chemotherapy-induced fatigue, myelosuppression, and mucositis.^{14,15,16}

Furthermore, Ayurvedic interventions such as Panchakarma (detoxification therapies) and dietary regulation (Pathya-Apathya) play crucial roles in detoxifying residual drug metabolites and improving digestive and hepatic function. Medhya Rasayanas like Brahmi (*Bacopa monnieri*) and Mandukaparni (*Centella asiatica*) help manage cognitive disturbances and stress ("chemo brain"), while Triphala and Yashtimadhu (*Glycyrrhiza glabra*) alleviate mucositis and gastrointestinal irritation through their anti-inflammatory and mucoprotective properties. Ayurvedic formulations such as Chyavanprasha, Amritarishta, and Suvarna Bhasma are traditionally used as rejuvenators to enhance overall immunity and vitality in patients undergoing chemotherapy. Integrating these Ayurvedic measures alongside conventional treatment can improve treatment tolerance, reduce toxicity, and enhance quality of life, as supported by emerging clinical evidence.^{17,18,19}

1.4 Role of herbal drugs in Chemotherapy adversities

In recent years, there has been a growing interest in exploring the potential of herbal drugs in mitigating chemotherapy adversities. These natural agents have shown promise in reducing the severity of chemotherapy induced side effects, such as nausea, vomiting, fatigue and neuropathy.



Figure 1. Sahadevi (*Vernonia cinerea* (L.) Less)

Available from; https://gachwala.in/wp-content/uploads/2022/11/1280px-Cyanthillium_cinereum_-_flower.jpg

A study conducted by arul amuthan et al in 2021 that *Vernonia cinerea* regenerates tubular epithelial cells in cisplatin induced nephrotoxicity in cancer bearing mice without affecting antitumour activity. Study concluded

that CAE i.e. crude aqueous extract of sahadevi reverses the cisplatin induced kidney damage as well as regenerates proximal tubular epithelial cells, without compromising the anticancer effect of cisplatin.²⁰ Another study conducted in Dravya Guna department by shruti roy in 2019 that anti cancerous, antiangiogenic and molecular docking evaluation of the drug sahadevi in breast cancer, an *in vitro*, *in vivo* and *in silico* study. This study strongly suggests this drug possess anti-cancerous and anti-angiogenic potential against breast cancer and help to prevent its recurrence.



Figure 2. Ginger (*Zingiber officinale* Roscoe)

Available from; https://th.bing.com/th/id/OIP.sjTx_Blg364EQKMLAy-7AQHaE-?o=7&rm=3&rs=1&pid=ImgDetMain&o=7&rm=3

Efficacy and safety of Ginger on the side effects of chemotherapy in breast cancer patient: systematic review and meta-analysis.²¹ This study concluded that when compared to antiemetic treatment, ginger significantly reduced the severity of delayed nausea in breast cancer patients. The major pharmacological activity of ginger, is its active ingredients, including gingerols and shagaols. These compounds have anti-vomiting, anti-inflammatory, anti-stress, anti-cancer properties. They reduce gastric contractions but increase gastrointestinal activity. They also have anti-serotonin effects and exert destructive effects on free radicals that cause vomiting.



Figure 3. Mint (*Mentha × piperita* L)

Available from; <https://tse4.mm.bing.net/th/id/OIP.EgxvSdDVNLoBG-1uQ8ritAHaE8?rs=1&pid=ImgDetMain&o=7&rm=3>

Mint is commonly used as a flavoring in food, tea, toothpaste, washing solutions and medications. Menthol in peppermint acts as a gastric relaxant which reduces nausea and vomiting by relaxing the stomach muscles and gastric wall. Peppermint also has a calming effect. Aromatherapy with mint also has a psychological effect and reduces nausea and vomiting.²²



Figure 4. Nimba (*Azadirachta indica* A.Juss)

Available from; <https://www.toothmountainnursery.com/wp-content/uploads/2020/03/Neem.jpg>

A study conducted by marius alexander moga in 2018 that an overview on the anticancer activity of neem in gynecological cancers and concluded that Neem is considered to be a promising agent for protection against cisplatin-induced nephrotoxicity. This study investigating the effects of methanolic neem leaf extract on cisplatin induced toxicity of kidneys and increased the level of oxidative stress in rats. After five days of cisplatin injection, the authors observed injuries of the renal tissue and increased levels of nitric oxide. After oral administration of methanolic neem leaf extract for five days, the histological observations evidenced the rescue of the tissue from cisplatin damage and the normalization of nitric oxide products.²³

Another side effect of cisplatin is hepatotoxicity, and Neem's protective activity was evidenced by the decrease of elevated total bilirubin, urea, uric acid, and creatinine. These findings suggest that neem leaf supplements, administered before, after, or during classical anticancer therapy with cisplatin, is able to prevent hepatic injuries.



Figure 5. Jackfruit (*Artocarpus heterophyllus* Lam.)

Available from; [https://www.nparks.gov.sg/-/media/ffw/protected/flora/2/7/2733/artocarpus-heterophylla---jessica-teo-\(4\)_lowres.jpg](https://www.nparks.gov.sg/-/media/ffw/protected/flora/2/7/2733/artocarpus-heterophylla---jessica-teo-(4)_lowres.jpg)

Chemotherapy-Induced Leukopenia (CIL) is associated with increased mortality and economic burden on patients. This study was conducted to evaluate whether inclusion of green jackfruit flour in regular diet of those patients' receiving chemotherapy, could prevent CIL. This was a retrospective study conducted among a group of patients undergoing chemotherapy for solid tumors and who were supplemented with green jackfruit flour in their regular diet for diabetes.²⁴

This study concludes that addition of green jackfruit flour as a dietary intervention prevents Chemotherapy Induced Leukopenia (CIL).

Complete avoidance of leukopenia, greatly enhances the quality of life. Studies have shown that jackfruit contains many classes of phytochemicals which have beneficial effects on several chronic degenerative diseases and cancers. Phytonutrients such as lignans, isoflavones, and saponins in jackfruit contribute to its anticancer property.

In addition to these anticancer effects, researchers have reported that dietary pectin, present in green jackfruit flour, increases survival of bone marrow cells and intestinal crypt stem cells during chemotherapy

Table No 1: Showing herbs with chemical constituents & Pharmacological action

Drug	Chemical constituents	Pharmacological action
<i>Ardraka</i>	Gingerols and Shogaols	Anti-emetic (5-HT3 receptor antagonist)
<i>Sallaki</i>	Boswellic acids	Anti-inflammatory (inhibit COX-2 and 5-LOX)
<i>Haridra</i> ²⁵	Curcumin	Anti-inflammatory (inhibit COX-2 and TNF-alpha)
<i>Ashwagandha</i> ²⁵	Withaferin A	Anti-oxidant (Induces apoptosis in variety of cancer cells through the rapid generation of ROS)
<i>Guduchi</i> ²⁵	20 β hydroxyecdysterone, Cordioside, Columbin	Cytotoxic against HeLa cells

2. MATERIALS AND METHODS

The review of chemodrugs and their sideeffects were sourced from various text books. The review on management of adversities of chemotherapy and several herbal drugs involvement in this therapy were drew from reputable journals and websites.

3. DISCUSSION

From an Ayurvedic perspective, the major side effects of chemo-radiotherapy can be viewed as manifestations of aggravated *Pitta dosha*, particularly resembling conditions described as *Raktapitta* (bleeding disorders) or *Raktadushti* (vitiation or inflammation of the blood).

Ayurvedic treatment has been found effective in managing the adverse effects of chemotherapy, helping patients better tolerate its impact. Chemotherapy drugs primarily affect the gastrointestinal tract, whereas Ayurveda focuses on improving appetite and promoting healthy digestion. Moreover, Ayurvedic medicines help counteract the excessive heat generated by chemotherapy due to their strong anti-inflammatory properties.

Also, ayurvedic medications can enhance blood count. And, they eliminate blood toxins, and are very helpful in maintaining hemoglobin, Leucocytes (WBC count), and blood platelets. Therefore, a majority of patients finish their chemotherapy course in a predicted time. Because ayurvedic medicines can keep their blood counts stable.

Ayurveda medicines used in chemotherapy may play an important role in reversing the pathology and healing as well as reducing the side effects and cancer-associated complications. These medicines may be capable of enhancing therapeutic efficacy and reducing the toxicity of anticancer drugs used in chemotherapy.

Patients who have integrated Ayurvedic practices with their conventional cancer treatment have reported better management of side effects and an improved overall sense of well-being.

A 31-year-old female diagnosed with right infiltrative ductal carcinoma of the breast was advised chemo-radiation therapy following surgery. After her first chemotherapy cycle, she developed severe side effects, including palpitations, nausea, vomiting, hot flushes, and restlessness. She approached an Ayurvedic clinic, where she was administered specific *Panchagavya* and *Mridu Shodhana* therapies. With continued Ayurvedic management, her symptoms significantly subsided, allowing her to complete all six chemo- and radiotherapy sessions smoothly. This case highlights the effectiveness of Panchakarma and Panchagavya therapies in reducing chemo-radiotherapy-induced side effects and improving patient tolerance to conventional cancer treatments.²⁶

A 74-year-old woman diagnosed with follicular lymphoma had completed three chemotherapy cycles with no improvement and severe side effects, leading her to discontinue further treatment. Her family opted for Ayurvedic care, where a personalized *Rasayana* therapy was initiated to enhance quality of life, boost immunity, and support longevity. After eight months of treatment, PET-CT scans showed partial tumor regression, along with marked improvements in quality of life and physical performance. The patient survived 3.5 years following the initiation of *Ayurveda Rasayana Therapy (ART)*, which was well tolerated. This case highlights the potential of ART as a supportive therapeutic option for elderly cancer patients unable to undergo conventional cytotoxic treatments.²⁷

Integrating Ayurveda with conventional chemotherapy offers a holistic approach that not only mitigates treatment-related toxicities but also enhances patients' overall well-being and tolerance to therapy. Ayurvedic interventions through *Rasayana*, *Panchakarma*, and herb-based formulations help maintain hematological stability, reduce inflammation, and restore physiological balance by pacifying aggravated *Pitta* and detoxifying the blood. Clinical evidence and case reports demonstrate that such integrative care can improve quality of life, enable completion of chemotherapy cycles, and, in some cases, contribute to better therapeutic outcomes, making Ayurveda a valuable adjunct in cancer management.

4. CONCLUSION

The integration of Ayurveda with modern chemotherapy offers a promising complementary approach to cancer management. From an Ayurvedic standpoint, the adverse effects of chemo-radiotherapy are manifestations of aggravated *Pitta dosha* and *Raktadushti*, leading to disturbances in blood and tissue homeostasis. Ayurvedic interventions aim to restore this balance through detoxification (*Shodhana*), rejuvenation (*Rasayana*), and strengthening of the body's innate defense mechanisms (*Ojas*).

By employing formulations with *Pitta-pacifying* and anti-inflammatory properties, Ayurveda helps in neutralizing the excessive heat and oxidative stress produced by chemotherapeutic drugs. Additionally, these medicines contribute to the maintenance of healthy digestion (*Agni*), improvement of appetite, and purification of the blood, thereby enhancing hemoglobin, leukocyte, and platelet counts. This not only reduces the risk of treatment interruptions but also helps patients complete their chemotherapy cycles on schedule with fewer complications.

Therapies such as *Panchakarma* and *Panchagavya* have shown notable benefits in alleviating fatigue, nausea, mucositis, and other side effects commonly associated with chemotherapy and radiotherapy. Moreover, Ayurvedic supportive regimens improve the patient's overall quality of life, emotional well-being, and physiological resilience. Clinical observations and case studies further suggest that Ayurvedic treatment may enhance the therapeutic efficacy of anticancer drugs while minimizing their toxicity.

Therefore, Ayurveda holds great potential as an integrative and supportive care system in oncology. When combined judiciously with conventional treatments, it can contribute not only to symptom relief and side effect management but also to long-term restoration of health and vitality, embodying a truly holistic approach to cancer care.

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