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Cancer Therapy in Ayurveda - A Systemic Review

By Shanti Bhushan ... - 08/18/2009

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Abstract:

Thousands of herbal and traditional compounds are being screened worldwide to validate their use as anti-cancerous drugs. An integrated approach is needed to manage cancer using the growing body of knowledge gained through scientific developments. Hence, an attempt is made in this review to discuss about the pathology and therapeutic management of various cancers described in Ayurveda. Review of literature on anticancer drugs of plant origin revealed identification of newer ayurvedic drugs that are not mentioned in the ancient texts. These new findings add up to ayurvedic science that has been developed through ages. In addition, details of experimental and clinical studies conducted on single and compound ayurvedic preparations for their anticancer efficacy strongly emphasize ayurvedic therapy as a scientifically motivated one and not simply unconventional.

Keywords: Cancer; Medicine, Treatment, Herbal, Ayurveda

Introduction:



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Cancer is one of the most dreaded diseases of the 20th century and spreading further with continuance and increasing incidence in 21st century. In the United States, as the leading cause of death, it accounts for 25% of all the deaths in humans presently. It is considered as an adversary of modernization and advanced pattern of socio-cultural life dominated by Western medicine. Multidisciplinary scientific investigations are making best efforts to combat this disease, but the sure-shot, perfect cure is yet to be brought into world medicine. Recently, a greater emphasis has been given towards the researches on complementary and alternative medicine that deals with cancer management. Several studies have been conducted on herbs under a multitude of ethno botanical grounds. For example, Hartwell [1–9] has collected data on about 3000 plants, those of which possess anticancer properties and subsequently been used as potent anticancer drugs [10]. “Ayurveda” as it means in Sanskrit (the ancient language of India) – ‘ayus’ (life) and ‘ved’ (knowledge) is often translated as science of life and is a 5000 years old system of Indian medicine. It emphasizes prevention of disease, rejuvenation of body systems and extension of lifespan. It has been successful from very early times in using these natural drugs and preventing or suppressing various tumours using various lines of treatment.

This article reviews the available literature regarding researches on anti-cancerous ayurvedic herbs and also includes a summary of treatment strategies for various cancers. It is written with an intention to raise awareness and encourage implementation of ayurvedic therapies for fighting cancer and suggesting an integrated approach in tumour management and treatment.

Ayurvedic Concept Of Cancer

Charaka [11] and Sushruta [12] samhitas, two well-known Ayurvedic classics, describe cancer as inflammatory or non-inflammatory swelling and mention them as either Granthi (minor neoplasm) or Arbuda (major neoplasm). Ayurvedic literature defines three body-control systems, viz., the nervous system (Vata or air), the venous system (Pitta or fire), and the arterial system (Kapha or water) which mutually coordinate to perform the normal function of the body. In benign neoplasm (Vataja, Pittaja or Kaphaja) one or two of the three bodily systems are out of control and is not too harmful because the body is still trying to coordinate among these systems. Malignant tumours (Tridosaja) are very harmful because all the three major bodily systems lose mutual coordination and thus cannot prevent tissue damage, resulting in a deadly morbid condition [12].

Fundamental Classification

Ayurvedic classification of neoplasm depends on various clinical symptoms in relation to Tridoshas. Group I: Diseases that can be named as clear malignancy, which includes arbuda and granthi, e.g. mamsarbuda (melanoma) and raktarbuda (leukaemia), mukharbuda (oral cancer), etc. Group II: Diseases that can be considered as cancer, such as incurable ulcers with e.g. tridosaj gulmas (abdominal tumours like carcinomas of the stomach and liver or lymphomas). Group III: Diseases with the possibility of malignancy, e.g. Visarpa (erysipelas), asadhya kamala (incurable jaundice) and nadi vrana (sinusitis) [13,14].

Etiology

According to Sushruta, the fundamental cause of major neoplasm is the

pathogens that affect all parts of the body. He called the sixth layer of the skin as 'Rohini,' (epithelium) and pathogenic injuries to this layer in muscular tissues and blood vessels caused by lifestyle errors, unhealthy foods, poor hygiene and bad habits results in the derangement of doshas, which leads to the manifestation of tumours [12,15]. Excess of water or fat in the corpus of the tumour and the stability and rigid confinement of the doshas in a particular place were described as reasons for the non-infectious and non-suppurative nature of these abnormal growths [12,16]. Cancer in each person differs according to the person's exposure to pathogens and genetic constitutions which make each of them to react differently to the same diet. The factors responsible for the vitiation of doshas are discussed here [17].

- a. Vata aggravating factors: excessive intake of bitter, pungent, astringent, dry foods and stressful conditions.
- b. Pitta aggravating factors: excessive intake of sour, salty, fried foods and excessive anger.
- c. Kapha aggravating factors: excessive intake of sweet, oily food and sedentary nature.
- d. Rakta aggravating factors: excessive intake of acid or alkali containing foods. Fried and roasted foods, alcoholic beverages, sour fruits are some examples. Excessive anger or severe emotional upset, sunbathing or working under scorching sun or near fire and hot conditions, etc. are some other causes [11].
- e. Mamsa aggravating factors: excessive use of exudative foods like meat, fish, yoghurt, milk and cream. Behaviours leading to exudation like sleeping during the day and overeating are some of the causes for pathogens invading the fatty tissues [11].
- f. Medo aggravating factors: excessive intake of oily foods, sweets, alcohol and lazy attitude [11,12].

Pathogenesis Of Tumours

According to Ayurvedic principles, the disease cannot be named on its own because it differs between persons in terms of illness, clinical presentation and also the treatment required [14]. Thus, pathogenesis in Ayurveda is explained on the basis of Tridoshas. Agni or Pitta, which is present in each and every cell, is responsible for digestion and metabolism in human body. The decrease in agni is inversely proportional to the related tissue and therefore in arbuda, the decreased state of dhatwagni (deranged metabolism) will result in excessive tissue growth. Vata can be correlated with the anabolic phase of growth whereas kapha to the catabolic phase. Cancer originates due to a metabolic crisis, i.e. aggravation of vata forces and suppression of kapha forces, both interacting with one another resulting in proliferation. However, the abnormal cancerous growth at a specific organ (Ekadesavridhi) is managed by compensation from other parts of the body (Anyasthaniyakshaya), e.g. body weight loss (cachexia) [17]. Sushruta has proposed six stages in the pathogenesis of all diseases but his concept suits more to the pathology of the tumour than pathogenesis itself.

1. Sanchaya: early stages of localized neoplastic changes.
2. Prakopa: transformation of primary growths into metastatic tumours.
3. Prasara: metastasis.
4. Sthana samsraya: complete metastasis and secondary growth.
5. Vyakti: clinical signs and symptoms are expressed.

6. Bheda: the stage where differentiation of growth occurs on the basis of histopathology[17].

Cancer Therapy—A Practical Dilemma

Any practical solution in combating this dreadful disease is of paramount importance. An alternative solution to western medicine embodied with severe side effects is the use of medicinal plant preparations to arrest the insidious nature of the disease. Many herbs have been evaluated in clinical studies and are currently being investigated phytochemically to understand their tumouricidal actions against various cancers. Thus, cancer patients who already got crippled with this disease, further burdened by drug-induced toxic side effects have now turned to seek help from the complementary and alternative medicine hoping for a better cure. Ayurvedic therapy was found to be able to cure these chronic diseases better, which were previously not amenable to treatment by western medical practices. This traditional Indian medicine with its evolution through centuries has always fascinated practitioners and researchers for its applications in cancer treatment on a scientifically proven research background.

Principles Of Ayurvedic Treatment

Abuse of nature's law upsets the human system and ends up in disease like cancer. It is again the nature, the foremost physician who brings the cure. The Ayurvedic system of medicine was well founded on the basic principles of nature and its elements after a careful and thorough study of human physiology. This is the first system to emphasize health as the perfect state of physical, psychological, social and spiritual component of a human being. The therapeutic approach of Ayurveda has been divided into four categories as Prakritisthapani chikitsa (health maintenance), Roganashani chikitsa (disease cure), Rasayana chikitsa (restoration of normal function) and Naishtiki chikitsa (spiritual approach) [18]. Finding the cause of an illness is the basic goal of ayurvedic therapy. It classifies disease development into six stages that include aggravation, accumulation, overflow, relocation, build-up in a new location, and manifestation into a recognizable disease. Ayurvedic physicians can diagnose an illness at even initial stages of body imbalance and their therapeutic approach maintains a balance by supplying deficient substances as well as reducing the excessive ones. Surgery is considered only for advanced cases.

Ayurvedic Texts About Cancer Treatment

During the 7th century BC, Atreya and Dhanwantari used herbal medicines for treating the early stages of cancer and surgery in advanced cases. In the 8th century AD, Vagbhata, a Buddhist physician composed two texts: Astanga Hridaya [19] and Astanga sangraha [20] where new methods for cancer treatment were introduced. Other Ayurvedic texts of internal medicine, viz., Chakradatta [21] composed by Chakrapani (10th century AD), the Sarangadhara Samhita [22] by Sarangadhara (14th century AD), the Bhavaprakasha Samhita [23] by Bhavamisra (15th century AD), the Satmya Darpan Samhita by Viswanath (16th century AD), the Vaisajya Ratnabali by Binoda Lala Sen Gupta (18th Century AD), the Rasatarangini by Sadananda Sharma (19th century AD), etc. explain numerous remedies to treat internal and external neoplasms.

Treatment Modalities

Sodhana chikitsa (purification process), which eliminates vitiated doshas, have been primarily used for medical management of cancer. When both internal and external medications were given then it is called as panchakarma chikitsa. The other type of curative therapy is called somana chikitsa, which pacifies dosha and gradually relieves the disease. However, this treatment is prescribed only to weaker patients for whom sodana chikitsa is contraindicated. In Rasayana prayoga (immunotherapy), certain poisonous plants, mercury like metals and animal products were rendered non-toxic and harmless by the use of alchemy and are used as rejuvenating drugs. Other methods of treatment include, dhatwagni chikitsa (correction of metabolic defects), vyadhipratyanika chikitsa (specific anti-cancerous drugs) and lakshanika chikitsa (symptomatic treatment) [24]. When medical treatment practices fail, then the case was left to surgeons. Surgical cancer management in Ayurveda include the principles of fomentation by means of external application, cleansing by internal medication, treatment to liquefy the contents of the swelling, opening the tumour surgically for evacuation of its contents, cauterisation to avoid recurrence and post-operative care for healing the wound [15]. Cauterisation with alkalis and acids and other surgical procedures were performed with herbal and mineral medicines. Arbuda is excised completely from its deep root seat and cauterisation done to destroy any of the remaining cell particles [24].

Classical Drugs Claimed In Ayurvedic Texts

Traditional line of treatment: Traditional methods employed in treatment of various cancers were given in Table 1. In addition to these traditional methods, various herbal combinations mentioned in Ayurvedic texts are listed in Table 2. The main objective of these tables is to support the physicians and researchers to utilize these traditional methods as well as herbal drugs for an effective cancer treatment.

Scientific Principles Of Ayurvedic Anticancer Drugs

Herbal decoctions consisting of multiple herbs each possessing tremendous potential for a cancer cure are commonly used in Ayurveda. These formulations are reported to work on multiple biochemical pathways and are capable of influencing several organ systems simultaneously. The benefit of an herbal decoction is that it can nourish the body as a whole by supporting various organ systems [25]. Many of the herbs mentioned below have scientifically-proven anti-cancerous properties and are used for the treatment of various cancers.

Andrographis paniculata

The extract and isolated diterpenes (andrographiside and neoandrographolide) from this plant are proved to be beneficial against tumourigenesis by their anti-lipoperoxidative action and by enhanced carcinogen detoxification action [26–29].

Annona atemoya/muricata

Bullatacin, an acetogenin isolated from the fruit of *Annona atemoya*, induces apoptosis, preceded by chromatin margination and tumour cells condensation [30]. Several other annonaceous acetogenins, e.g. muricins A–G, muricatetrocin A and B, longifolicin, corossolin, and corossolone are also showed to be significantly selective in bringing in vitro cytotoxicities to tumour cells [31].

Phyllanthus niruri/amarus

An aqueous extract of *P. amarus* increases the life span of the tumour bearing rats and normalizes glutamyl transpeptidase activity [32]. It plays a major role in disruption of HBsAg mRNA transcription and post-transcription which could be beneficial against viral carcinogenesis [33].

Piper longum

Piperine, an active alkaloid extracted from this plant has been used as an ingredient of ayurvedic anticancer formulations because of its anti-oxidative potency in both in vitro and in vivo conditions [34].

Podophyllum hexandrum Linn. (Podophyllin)

It is a powerful anticancer drug against various cancers for e.g. sarcomas, adenocarcinoma and melanoma. Podophyllin and its active principle, podophyllotoxin are known for their cytotoxic effect by virtue of their properties of mitotic inhibition, nuclear fragmentation, impaired spindle formation and they are also found to be karyoplastic. The mechanism of action has been suggested as necrosis and is a direct consequence of its cytotoxic effect on tumour tissues. These derivatives have been analysed in cancer chemotherapeutic studies and the methods of preparation of these compounds are patented [10]. In recent days, chemically modified podophyllotoxins are widely used in cancer therapeutics. VP-16 (etoposide), a podophyllotoxin derivative has been tested against in vitro and in vivo cancer cells and been used against hepatic cancers for more than a decade [35]. It has proved its efficacy in combination with epirubicin in phase II studies [36,37]. By this combination therapy at least 3% of the patients had complete cure and 36% had partial response. P-glycoprotein, a drug efflux pump, seems to be less effective in reducing VP-16 concentration in cancer cell lines and hence this drug proves to be more efficient in these cells [38]. It is also safe even above therapeutic dosage without much toxic effects.[39].

Tinospora cordifolia

The active principles from *T. cordifolia* enhance host immune system by increasing immunoglobulin and blood leukocyte levels and by the stimulation of stem cell proliferation. It has the ability to reduce solid tumour volume by 58.8%, which is comparable to cyclophosphamide, a known chemotherapeutic agent [40–42]. These immuno stimulating properties can be used in the prevention of tumour mediated immuno suppression and hence could be a drug choice for various cancers.

Semecarpus anacardium

In Ayurveda classics, numerous references are available on the anticancer properties of *Semecarpus anacardium* nuts [43]. An extensive review describes the phytochemical and pharmacological properties of *S. anacardium* [44]. The chloroform extract of *S. anacardium* nut possess antitumour action with increased life span against leukaemia, melanoma and glioma [45,46]. The milk extract of *S. anacardium* produces regression of hepatocarcinoma by stimulating host immune system [47] and normalizing tumour markers including alpha-fetoprotein levels [48,49]. This preparation stabilizes the lysosomes, and normalizes glycoprotein and mineral content in the body during cancer progression [50,51]. It also corrects hypoglycaemia [52] and controls abnormal lipid peroxidation [53] by the maintenance of antioxidant defense status [54]. In the microsomes, it acts

as a bifunctional inducer of both phase I and II biotransformation enzymes and prevents tumour initiation by preventing carcinogen activation [55,56]. Histologically, on treatment with the *S. anacardium* extract to hepatocarcinoma animals,

the liver sections showed almost a normal architecture. The nodules become completely regressed and further cell necrosis was prevented [57]. Anacartin forte, another preparation from *S. anacardium* has been used for several decades as an anticancer drug since it is giving health improvement with alleviation or disappearance of troublesome symptoms. It provides clinical benefit with an extension of survival time in various cancers including oesophageal, chronic myeloid leukaemia, urinary bladder and liver cancer [58]. Another Ayurvedic drug containing *S. anacardium*, *Amura rohitaka*, *Glycyrrhiza glabra* and copper powder were reported to inhibit breast tumour development in mice by significantly extending the survival period. This drug was also found to be efficient in clinical trials [13].

Ayurvedic herbs, which are widely used and scientifically proven of their anticancer properties, are presented in Table 3. Smit et al. [59] have also elaborately listed ayurvedic herbal drugs with anticancer activity. Some of these herbs are shown to enhance the therapeutic efficacy and/or reduce the toxicity of anticancer drugs used in chemotherapy. Also few of them possess radiosensitising effect too (see Table 4). Pharmacological details of ayurvedic herbs like therapeutic dosage, side effects, and comments about safety and herb-drug interactions were given in Table 5.

Benefits Of Ayurveda In Cancer Cachexia

Cancer cachexia is a common clinical problem that substantially impacts upon the quality of life and survival of cancer patients. The pathophysiology of this syndrome implicates tumour induced metabolic changes and immune responses. Clinical manifestations include anorexia, chronic nausea and change in body image. Among several potential benefits of ayurvedic medicine, relief from cancer cachexia is especially valuable. Ayurvedic herbs used in cancer therapy results not only in total healing, but also reduces the side effects and cancer associated complications. It also avoids the need for supplemental therapy to manage cancer cachexia. Each herbal product contains multiple active principles that may operate synergistically, producing therapeutic benefits and lowering the risks on adverse effects. The anorexia or weight loss could be effectively managed by *Withania somnifera*, *Sida cordifolia*, *Asparagus racemosa*, *Vitis vinifera*, *Plumbago zeylenica*, *Tinospora cordifolia*, *Zingiber officinale*, *Coptidis rhizoma*, etc. These herbs have been shown to improve appetite, food intake, malnutrition, fatigue and sensation of well-being which could elicit bodyweight gain. These herbs might stimulate the flow of digestive juices, thereby improving digestion and increasing the appetite. *Aegle marmelos*, *Holarrhena antidysenterica*, *Punica granatum*, *Cyperus rotundus*, *Emblica officinalis*, and *Plumbago zeylanica* can be used as anti-diarrhoeals when diarrhoea becomes one of the complications of cancer cachexia. *Terminalia chebula* could be useful against chronic constipation and digestive disorders which are common in cancer patients resulting in loss of appetite. *Eclipta prostrata*, *Emblica officinalis*, *Withania somnifera*, *Piper longum* can be directed to correct nausea and vomiting [60]. Among the above-mentioned herbs, *Withania somnifera* [61] and *Tinospora cordifolia* [42] are also proven to be powerful immunostimulants, which could increase body resistance power during cancer associated immunosuppression. Ayurvedic anticancer therapy includes recommendations for lifestyle and use of specific foods and herbs

which are very helpful not only in preventing the progression of the disease but also makes the patients feel better and comfortable overcoming the symptoms. *Allium sativum* (garlic) could be helpful to manage pain and ache. *Bacopa monniera* strengthens mental faculties and helps to manage insomnia or sleeplessness due to stress [62]. An herbal combination of *Withania somnifera*, *Asparagus racemosa*, *Hydrocotyle asiatica*, *Nardostachys jatamansi*, *Elettaria cardamomum*, *Tribulus terrestris*, *Zingiber officinalis* and *Eclipta alba* could also be useful in the treatment of anxiety, tension and insomnia. *Ocimum sanctum* is beneficial against stress and depression during cancer. *Curcuma longa*, *Zingiber officinale*, *Glycyrrhiza glabra*, *Terminalia chebula*, *Ocimum sanctum* and *Adhatoda vasica* are used to control cough and shortness of breathe especially for lung cancer patients [60]. Thus, ayurvedic therapeutic regimen rejuvenates the body tissues, tones up the systems and act as a tonic to the body against cancer cachexia. This kind of orientation toward total healing and health promotion makes ayurvedic treatment approach to cancer therapy promising.

Cancer Therapy In Ayurveda—Future Prospects

Because large population use ayurvedic medicine worldwide, there is an urgent need for additional, carefully conducted, high-quality intensive research to evaluate its efficacy and to develop this discipline to meet ever-new challenges of modern medicine in the field of oncology. The most rigid evaluation should take place with gold standards for clinical research—the randomized controlled clinical trial (RCT). Priority for research funding should be given to clinical investigations in Ayurveda involving well-designed studies with encouraging results especially for diseases like cancer to which conventional medicine has been shown to be less effective. Attention should be given not only to the evaluation of safety and examination of effectiveness in treatment strategy, but also to the consideration of community practice settings, patient expectations, compliance and cost effectiveness. Standardization and quality production of herbal products may allow us to develop low cost therapies with reduced risk over pharmaceuticals. In any case, studies on anticancer ayurvedic drugs will be popular from the economy point of view because cancer is becoming the major cause of death.

Conclusion

Future research on this topic would help to identify safe and effective anticancer drugs and will further the exploration of their mechanism of action. Ayurvedic practitioners and researchers in medical sciences can help to improve this medicine by increasing their involvement and contribution. Case study is the research design, which can form basis for future research directions and can provide valuable contributions to the medical field with minimal cost budgets. Case studies have also been suggested by the NCCAM (National Center for Complementary and Alternative Medicine, Bethesda, USA) as a means to determine whether a complementary anticancer therapy demonstrates potential efficacy against particular cancer and whether clinical development of the therapy should continue [63,64]. It is no longer an option to ignore ayurvedic drugs or treat them as something unconventional from regular medical practices.

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Table 1: Classical treatment protocols for various tumours in Ayurveda

Type of tumour	Tumour subtypes	Classical treatment procedures
Granthi	Vatika granthi	Helloborus niger, Tinospora cordifolia, Clerodendron

		serratum, Aegle marmelos, Hoya viridiflora, Elephantopus scaber, Soyimida febrifuga and Gynandropis pentaphyllawere applied locally [16]
	Paittika granthi	Terminalia chebula powder with either grape or sugarcane juice were used orally. The paste of Glycyrrhiza glabra, Eugenia jambolana, Terminalia arjuna or Calamus rotang were used of external application [16]
	Kapaja granthi	Paste of Capparis spinosa, Capparis sepiaria, Agati grandiflora, Lagenaria vulgaris, Premna herbacea, Pongamia glabra, Musa sapientum and Randia dumetorum used in local application [16]
Arbuda	Classical procedures	Classical procedures Fomentations, cauterisation, scraping, blood letting, medicated enemata and other surgical procedures [17]
	Traditional treatment	Habitual intake of Basella rubra or application of alkali preparation of Musa paradisiaca, Conch shell ash, Elaeocarpus tuberculatus, Sulphur, Potassium carbonate, Embelia ribes and ginger were used to cure arbuda [16]
	Vataja arbuda	Paste of Benincasa cerifera, Cucumis memordica, Cocos nucifera, and Eranda beeja, Ricinus communis along with butter or milk were applied [65]
	Pittaja arbuda	Tumours were treated with leaves of Ficus glomerata, Tectona grandis, and Elephantopus scaber repeatedly and then with a honey mixed fine paste of Aglaja roxburghiana, Caesalpinia sappa, Symplocos racemosa, Terminalia arjuna, Xanthium strumarium was applied [16]
	Kaphaja arbuda	After surgical removal of tumour, a drug that remove doshas from both the ends (vomiting and purgation) were employed. Then for purification, a decoction of Clitoria ternatea, Jasminum grandiflorum and Nerium odorum leaves was used. For the postoperative care, oil cooked with Premna herbacea, Embelia ribes, Cissampelos pareira was applied
	Medoja arbuda	Curcuma domestica, Triticum sativum, Symplocos racemosa, etc. were made into a powder and applied externally by mixing them with honey. Oil from Pongamia glabra were used of internal administration [65]

Table 2: List of herbs commonly used in ayurvedic anticancer

treatment

S. No	Name of the herb	Method and use
1	<i>Vitis vinifera</i>	The mixture of <i>Terminalia chebula</i> , grape juice and <i>sugar cane juice</i> has been used [3]. Resveratrol, a natural product derivative from grape juice has been proved to possess cancer chemopreventive activity [66]
2	<i>Baliospermum montanum</i>	The paste comprising of <i>Baliospermum montanum</i> , <i>Plumbago zeylanica</i> , <i>Euphorbia neriifolia</i> , <i>Calotropis procera</i> , jaggery, <i>Semecarpus anacardium</i> applied over the tumours [12]
3	<i>Madhuca indica</i>	This paste is prepared from the barks of <i>Madhuca indica</i> , <i>Syzygium cumini</i> , <i>arjuna Terminalia arjuna</i> and <i>Salix caprea</i> and prescribed for local application [12]
4	<i>Pandanus odoratissimum</i>	A paste of <i>Pandanus odoratissimum</i> with sugar was applied externally [12]
5	<i>Pterospermum acerifolium</i>	The flowers of <i>Pterospermum acerifolium</i> mixed with sugar to be applied locally
6	<i>Raphanus sativus</i>	Local application of <i>Raphanus sativus</i> powder paste with the radish ash was considered effective against <i>kaphaja arbuda</i>
7	<i>Barleria prionitis</i>	The <i>Barleria prionitis</i> oil prepared with whole plant is indicated for external application during acute stages of cyst in blood vessels [20]
8	<i>Prosopis cineraria</i>	This paste made up of <i>Prosopis cineraria</i> seeds, <i>Raphanus sativa</i> , <i>Moringa oleifera</i> , barley and mustard with sour buttermilk was applied locally for disintegrating cysts [20]
9	<i>Amorphopallus campanulatus</i>	The mature tuber is first burnt and then mixed with butter and jaggery and applied for tumour destruction [12]
10	<i>Oxoxylum indicum</i>	The drug <i>Oxoxylum indicum</i> prescribed in treatment of <i>granthi</i> [12]
11	<i>Basella rubra</i>	The plant and leaves are ground with sour buttermilk with salt for preparing a poultice and indicated for <i>arbuda</i> [12]
12	<i>Flacourtia romantchi</i>	The paste of <i>Flacourtia romantchi</i> , <i>Cassia fistula</i> , <i>Capparis sepriaria</i> , is recommended for <i>kaphaja</i> tumours [12]
13	<i>Moringa oleifera</i>	The paste of <i>Moringa oleifera</i> seeds, <i>Solanum xanthocarpum</i> , <i>Sinapis dichotoma</i> , <i>Holarrhena antidysenterica</i> and <i>Nerium odorum</i> roots prepared with buttermilk is used for <i>arbuda</i> tumours [23]
14	<i>Ficus bengalensis</i>	Application of mixture of <i>Ficus bengalensis</i> and <i>Saussurea lappa</i> pacify tumour growth on bone [23]

15	<i>Curcuma domestica</i>	The <i>Curcuma domestica</i> powder in combination with <i>Symplocos racemosa</i> , <i>Soymida febrifuga</i> , is mixed with honey and this is used as an external remedy [23]
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Table 3: Scientific evidence on herbs used in Ayurveda proven to have anticancer property

Name of the herb	Indications	References
<i>Abrus precatorius</i>	Yoshida sarcoma (rats) Fibrosarcoma (mice) Ascites tumour cells	Subbareddy and Sirsi [67]
<i>Albizzia lebbbeck</i>	Sarcoma 180 (mice)	Dhar et al. [68]
<i>Allium sativum</i>	Sarcoma (rat)	Hu et al. [69]
<i>Aloe vera</i>	Yoshida AH-130 ascite hepatoma (pleural tumour) human neuroectodermal tumours	Corsi et al. [70], Pecere et al. [71]
<i>Alstonia scholaries</i>	HSI human sarcoma benzo(a)pyrene induced forestomach carcinoma	Dhar et al. [68], Jagetia et al. [72]
<i>Amura rohitaka</i>	Leukaemia	Prasad and Deshpande [73], Rabi and Gupta [74]
<i>Anacardium occidentale</i>	Hepatoma 129	Dhar et al. [68]
<i>Asparagus racemosus</i>	Human epidermoid carcinoma	Dhar et al. [68]
<i>Bacopa monniera</i>	Walker carcinosarcoma 256	Bhakuni et al. [75]
<i>Berberis aristata</i>	Human epidermal carcinoma of the nasopharynx, <i>N</i> -nitrosodiethylamine induced carcinogenesis	Bhakuni et al. [75], Anis et al. [76]
<i>Boswellia serrata</i>	Human epidermal carcinoma of the nasopharynx, Leukaemia and brain tumours	Dhar et al. [68] Hostanska et al. [77]
<i>Calotropis gigantea</i>	Human epidermal carcinoma of the nasopharynx	Bhakuni et al. [75], Dhar et al. [68]
<i>Curcuma longa</i>	Fibro sarcoma, Preclinical and clinical trials review	Sriganth and Premalatha [78], Aggarwal et al. [79]
<i>Datura metel</i>	Human epidermal carcinoma of the nasopharynx	Dhar et al. [68]

<i>Erythrina suberosa</i>	Sarcoma 180	Dhar et al. [68]
<i>Euphorbia hirta</i>	Freund virus leukaemia	Dhar et al. [68]
<i>Gynandropis pentaphylla</i>	Hepatoma 129	Dhar et al. [68]
<i>Heliotropium indicum</i>	P-388 lymphocytic leukaemia	Pal et al. [80]
<i>Hygrophila spinosa</i>	Dalton's lymphoma, Ehrlich ascites carcinoma and Sarcoma-180	Maiti [81] , Mazumdar et al. [82]
<i>Ixora undulata</i>	P-388 lymphocytic leukaemia	Dhawan et al. [83]
<i>Juniperus indica</i>	Human epidermoid carcinoma of the nasopharynx	Dhawan et al. [83]
<i>Luffa cylindrica</i>	Schwartz leukaemia	Bhakuni et al. [84]
<i>Melia azedarach</i>	Walker carcinosarcoma 256	Bhakuni et al. [75]
<i>Moringa oleifera</i>	Human epidermoid lymphocytic leukaemia Skin papillomagenesis	Dhawan et al. [83] Bharali et al. [85]
<i>Nerium indicum</i>	Erlisch ascites carcinoma	Pal et al. [80]
<i>sNigella sativa</i>	Lewis lung carcinoma, Colon cancer	Dhar et al. [68] Salim and Fukushima [86]
<i>Ocimum sanctum</i>	Skin and liver tumours	Dubey et al. [87]
<i>Paederia foetida</i>	Human epidermoid carcinoma of the nasopharynx	Dhar et al. [68]
<i>Picrorrhiza kurroa</i>	Hepatic cancers	Dhar et al. [68]
<i>Plumbago zeylanica</i>	Hepatoma	Parimala and Sachdanandam [88]
<i>Rubia cordifolia</i>	P-388, L-1210, B-16 melanoma, colon 388, Lewis lung carcinoma, mammary carcinoma	Itokawa et al. [89]
<i>Taxus</i>	Cytotoxic against various tumours	Melado et al. [90]

<i>buccata</i>		
<i>Vinca rosea</i>	P-1534, carcinoma of the breast, cervix, kidney, lung and ovary	Rastogi and Mehrotra [91]
<i>Withania somnifera</i>	Various tumours	Dhar et al. [68]

Table 4: Therapeutic enhancement potential of ayurvedic herbs on cancer chemotherapy/radiation

Name of the herb	Chemotherapy/ayurvedic herb intervention studies
<i>Allium sativum</i>	Water-soluble derivative of garlic, S-allylmercaptocysteine (SAMC), inhibited proliferation and cell cycle progression in two human colon cancer cell lines, SW-480 and HT-29, similar to the effects of sulindac sulfide (SS), a well-known colon cancer chemopreventive agent. Co-administration of SS with SAMC enhanced the growth inhibitory and apoptotic effects of SS, suggesting the usefulness of SAMC alone or in combination with SS or other chemopreventive agents [92]
<i>Aloe vera</i>	In a randomised double-blinded clinical trial, comparing mild soap and aloe vera gel against incidence of radiation therapy induced skin reactions, the median time of five weeks was taken to show any skin changes in the aloe/soap treatment versus three weeks in the soap only treatment. The protective effect of adding aloe to the soap regimen increases during long time radiation exposure [93]. In another clinical trial involving patients with advanced solid tumours, for whom no other standard effective therapy was available, combination of pineal indole melatonin (MLT) plus Aloe vera extracts produced some therapeutic benefits, at least in terms of stabilization of disease and survival when compared to MLT alone treatment [94]
<i>Alstonia scholaris</i>	The <i>Alstonia scholaris</i> extract pre-treatment increased the effect of radiation as by enhancement of cell killing in HeLa and KB cells, followed by HL60, MCF7, and HePG2 cells. In in vivo studies, with Ehrlich ascites carcinoma bearing mice the pre-treatment of extract caused increased life span of animals when compared with untreated irradiated group [95]. The combination treatment of <i>Alstonia scholaris</i> extract with cyclophosphamide was also found to be most effective against Ehrlich ascites carcinoma as it caused the highest tumour regression and enhanced the mean and average survival time when compared with cyclophosphamide alone treated group [96]
<i>Curcuma longa</i>	When radiation and curcuma were applied together as

	synergical therapy, curcuma showed a radiation sensitising effect in HeLa, K-562 and IM-9 cell lines [97]. Curcumin, the active constituent from <i>Curcuma longa</i> also enhances the anticancer potential of Cisplatin and reduces its nephrotoxicity in fibrosarcoma bearing rats [78]
<i>Heliotropium indicum</i>	In a Phase I study consisting of Solid tumour patients who have undergone prior chemotherapy/ radiation therapy, Indicine N-oxide, an alkaloid from <i>Heliotropium indicum</i> have shown some improvement against skin melanoma and ovarian carcinoma [98]
<i>Moringa oleifera</i>	Pre-treatment with the leaf extract of <i>M. oleifera</i> exhibits significant radiation protection to the bone marrow chromosomes in mice and this could be useful to overcome side effects of radiation therapy [99]
<i>Nigella sativa</i>	In mice bearing Ehrlich ascites carcinoma, thymoquinone (TQ), the main constituent of the <i>Nigella sativa</i> oil, significantly enhanced the therapeutic efficacy of ifosfamide by improving its antitumour effect and reducing its nephrotoxicity. Furthermore, mice treated with ifosfamide in combination with TQ showed less body weight loss and mortality rate compared to IFO single therapy [100]
<i>Ocimum sanctum</i>	Orientin and Vicenin, two water-soluble flavonoids isolated from the leaves of <i>Ocimum sanctum</i> have shown significant protection to the human lymphocytes against the clastogenic effect of radiation, radiation lethality and chromosomal aberrations in vivo. This radioprotection associated with their antioxidant activity may have clinical potential in cancer therapy [101]
<i>Taxus baccata</i>	In a Phase II study, the triplet regimen based on taxol (active constituent of <i>Taxus baccata</i>), ifosfamide, and carboplatin has proved active, safe, and easy to deliver on an outpatient basis for patients with advanced stage IIIB-IV non-small-cell lung cancer [102]. Another combination of Herceptin with Taxol significantly improves the overall response rate, increases the time to progression and the overall survival in breast cancer patients. These effects are more pronounced in patients characterized with HER/2 +++ over expression [103]. Taxol also exerts a weak radiosensitising effect on breast and cervical carcinoma cells on the basis of an optimal Taxol/radiation scheduling [104]
<i>Withania somnifera</i>	<i>W. somnifera</i> when administered for 4 days before paclitaxel treatment and continued for 12 days caused significant reversal of neutropenia of paclitaxel in mice. It can be used as an adjuvant during cancer chemotherapy for the prevention of bone marrow depression associated with anticancer drugs [105]. The active component,

withaferin A isolated from the extract showed significant antitumour and radiosensitising effects in experimental tumours in vivo, without any noticeable systemic toxicity [106]. In Ehrlich ascites carcinoma mice, the extract showed dose dependent inhibition on tumour growth and increased the survival rate. Combination of radiation therapy with extract increased tumour cure and tumour-free survival [107]. It also reduces cyclophosphamide induced myelosuppression and leucopenia can be useful in combination chemotherapy [108,109]

Table 5: Pharmacological details of Ayurvedic anticancer herbs [110–114]

Name of the herb	Therapeutic dose	Side effects /contraindications	Interactions with other herbs/drugs
<i>Abrus precatorius</i>	Leaf decoction: 56–112 ml, root powder: 0.5–1 g	Nausea, stomach cramping, coma, circulatory collapse	None known
<i>Allium sativum</i>	2–5 g per day, solid extract: 0.3–1 g, oil: 0.03–0.12 ml t.i.d.	Excess can cause stomach upset. May increase the risk of hemorrhagic complications	May interact with aspirin
<i>Aloe vera</i>	Extract: 10–20 ml, powder: 0.05–0.2 g	Long term intake may aggravate ulcers, haemorrhoids	Possibly interact with cardiac glycosides and diuretics
<i>Alstonia scholaris</i>	Liquid extract: 4–8 ml	Lethargy, Nasal congestion, allergy	Interact with St. John's wort, general anaesthetics
<i>Amorphopallus campanulatus</i>	0.3–0.6 g	None reported	None known
<i>Anacardium occidentale</i>	No typical dosage	None reported	None known
<i>Andrographis paniculata</i>	Powder: 1.5–6 g, juice of leaves and stem: 1–4 ml t.i.d., andrographolide:	Nausea, anorexia, emesis, Urticaria	Interact with anticoagulant and antihypertensive drugs/herbs

	4–6 mg		
<i>Asparagus racemosus</i>	Powder: 20–30 g	No adverse effects	None known
<i>Bacopa monniera</i>	5–10 g (0.4–0.5 g 8×) per day	Rarely cause dermatitis	None known
<i>Berberis aristata</i>	Powder: 1–3 g May be toxic at higher dosage	May cause lethargy, nose bleeds, nausea, vomiting, diarrhoea	May interfere with Vitamin B assimilation
<i>Boswellia serrata</i>	0.4 g/2–3 times a day, gum resin: 2–3 g, oil: 1–1.5 ml, bark decoction: 56–112 ml	No adverse effects reported	None known
<i>Calotropis cylindric</i>	0.5–1 g	Vomiting, diarrhoea, bradycardia	May interact with cardioactive herbs and horsetail
<i>Curcuma longa</i>	1.5–3.0 g	Non-toxic Contraindicated in gastric ulcers	No interactions reported
<i>Datura stramonium</i>	0.05–0.1 g	Vomiting, hypertension, loss of consciousness. May lead to coma	May interact with anti-cholinergic drugs
<i>Erythrina suberosa</i>	28–32g	Insufficient information available	Insufficient information available
<i>Euphorbia hirta</i>	Powder: 0.12–0.3 g, liquid extract: 0.1–0.3 ml	Nausea, vomiting, dermatitis with skin contact	No interactions known to occur
<i>Ficus religiosa</i>	Powdered bark: 1–3 g, liquid extract: 60–120 ml	Large amounts can cause catharsis/allergies	None reported

<i>Gynandropis pentaphylla</i>	2 g	Insufficient information available	Insufficient information available
<i>Hygrophila spinosa</i>	Seed powder: 2–8 g, liquid extract: 40–50 ml	Insufficient information available	Insufficient information Available
<i>Ixora crocinea</i>	2–2.5 g	Insufficient information available	Insufficient information available
<i>Juniperus communis</i>	2–10 g per day	Long term may cause kidney damage	Possibly interact with anti-diuretic drugs
<i>Luffa cylindrica</i>	1.3 –1.9 g	None reported	No interactions known to occur
<i>Nerium indicum</i>	0.25–0.4 g	Nausea, vomiting, diarrhoea	None known
<i>Ocimum sanctum</i>	1–3 g, leaf infusion: 4–12 ml	May cause constipation at higher dosage for long term	None known
<i>Phyllanthus niruri</i>	Powder: 3–6 g	None reported	None reported
<i>Picrorrhiza kurroa</i>	0.5–1 g	Nausea, diarrhoea, skin rash at high doses, contraindications in pregnancy	None known
<i>Piper longum</i>	0.5–1 g	May have contraceptive activity, avoid use during pregnancy and lactation	Piperine may interact with enzymatic drug biotransformation
<i>Rubia cordifolia</i>	Powder: 1–3 g, liquid extract: 56–112 ml	No adverse effects reported	None known
<i>Tinospora cordifolia</i>	Powder: 1–3 g, liquid extract: 56–112 ml	Nausea	Excessive dose might inhibit Vitamin B assimilation
<i>Vinca rosea</i>	Dosage depends on	GI upset, hepatotoxicity,	No interactions known to occur

	depends on severity of the disease	nausea, vomiting, may also cause hypoglycemia	known to occur
<i>Withania somnifera</i>	2-6 g	Nausea, dermatitis, abdominal pain, diarrhoea	May potentiate the action of barbiturates and benzodiazepines

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informative

Submitted by Dr.S.Gunasakaran on Wed, 09/23/2009 - 17:19.



Dear Bhushan,

Your article is very informative

Dr.S.Gunasakaran, MBBS, MD

Login or register to post comments

nice article

Submitted by rajesh kumar javvadi on Wed, 12/09/2009 - 06:40.

Ayurvedic herbs are standardized are not can i use Ayurvedic herbs in project..

j.rajesh kumar



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The best article..!!

Submitted by Rahul Ghaste on Sat, 11/14/2009 - 18:00.

The best article..!!

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hi

Submitted by Sumeet Dwivedi on Mon, 09/21/2009 - 06:22.



Dear Sir,

Really a great efforts in consideration to the indigeneous knowledge.....

Good keep it up

with regards

Sumeet Dwivedi

sumeetdwivedi

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good compilation

Submitted by Amol S. Malpani on Sun, 08/23/2009 - 12:42.



Dear Shanti bhushan,

Really good to have such information. But if you see adverse effects of many herbs as nausea and vomiting. In such cases these become difficult to administered by oral route. Can you suggest some other suitable routes for these drug extracts/ herbs, which are generally given in the form of powder or oral liquids?

Amol

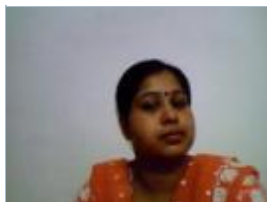
<http://www.pharmainfo.net/amolsmalpani/biography>



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Pharmaceutical Chemistry

Submitted by Deepa Chauhan on Fri, 08/21/2009 - 10:57.



Excellent article

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EXELLENT.....

Submitted by samarthsagar on Wed, 08/19/2009 - 12:40.



Really helpful review for furthr study
with ayurveda!!!!!!!!!!!!

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