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Comparative Evaluation of Quality of Life in Patients of Head and Neck Carcinoma with Radiation Induced Skin-injury in Oncology Department at Tertiary Care Hospital

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Abstract

Radiation mitigators are the compounds which can minimize post irradiation-toxicity provided they are administered before the onset of toxic symptoms. In present study we compared pre and post-treatment quality of life in head and neck cancer patients receiving radiotherapy.Sixty patients of Head and neck carcinoma more than 18 years of age of either sex and willing to give informed consent were included in the study. In Group-1, 30 patients received the Beclomethasone cream that was topically applied from the day-1 of radiotherapy till 4-weeks after completion of radiotherapy, whereas In Group-2, 30 patients received the local application of the herbal paste from the day-1 of radiotherapy till 4-weeks after completion of radiotherapy. These 60 patients were evaluated at 6 month post-therapy using the European organisation for research and treatment of cancer quality of life questionnaire C30 .For measuring radiation-induced reactions, chi-square test was applied and number of patients in different grades was calculated as per Radiotherapy oncology group criteria. Similarly for measuring radiation-induced mucosal reactions, non-parametric test i.e chi-square test was applied and number of patients in different grades was calculated as per radiotherapy oncology group criteria. As per quality of life questionnaire, evaluation on symptom scale revealed that fatigue, pain, dyspnoea, appetite loss and insomnia got worsened in Gp-1 patients, except for diarrhoea, constipation and nausea or vomiting while in Gp-2 patients, all symptoms showed improvement after 6 month of completion of treatment. Comparing pre and post-treatment , the global health status showed statistically significant improvement in group-2 patients receiving polyherbal paste .The

present study revealed a beneficial effects of polyherbal paste containing Azadirachta indica, aloe vera, Ocimum sanctum and Curcuma longa on radiation induced skin injury in patients with Head and neck carcinoma as compared to topical Beclomethasone cream. Also there was improvement in quality of life in cancer patients receiving herbal paste measured at 6 month post-treatment.

Key-words: Beclomethasone dipropionate cream, ionizing radiation, Quality of life

Introduction

Globally cancer is the leading cause of death worldwide. Head and neck cancer (HNC) ranks 6th among the cancer list and include malignancies of larynx, hypopharynx, nasal cavity, paranasal sinuses, oral cavity, nasopharynx,oropharynx and salivary glands.In majority HNC are squamous cell cancer. Risk factors include consumption of tobacco and alcohol. In developing country like india, carcinoma of oral cavity is the most commonly diagnosed HNC , with male population preponderance.[1,2]

Quality of life[2] (QoL) is also termed as the Patients perception of his or her general well being. It is a multi-dimensional indicator that that includes psychological, social, occupational, functional and physical well being. The term health-related QoL is preferred over QoL.[3] Due to complex nature of head and neck region, Patients of HNC faces multiple problems pre and post-treatment, for e.g difficulty in swallowing, oral pain, dry mouth due to destruction of salivary glands, facial disfigurement, absent sweating and burnt-like skin due to radiation injury. Therefore assessment of QoL by European organisation for research and treatment of cancer quality of life questionnaire C30 (EORTC QLC-C30) in HNC patient receiving radiotherapy becomes of paramount importance.There is huge task infront of us to improve the QoL in HNC patients post-treatment,so that the patients returns to his or her original state.[4,5]

There is always an impending need for a good radioprotective agents. Many chemical compounds have been screened for their radio protective potential. These synthetic compounds shows toxicity at their optimum protective doses. To reduce the toxic effects of synthetic compounds, there is a need to explore the new compounds. The use of natural compounds for improving one's health has increased in present time. Therefore, it is quite desirable that the choice of alternative radioprotective agents could be from plants origin. But, their use as radioprotective agents needs scientific evaluation and validation. Natural radioprotective agents could be more successful and cheaper than synthetic compounds.[6] An ideal radioprotective agents should have the following properties like possessing free radical scavenging activity by upregulating m-RNAs of antioxidant enzymes such as catalase, glutathione transferase, glutathione peroxidase, superoxide dismutase[6,7],

preventing radio oxidative damage, facilitating DNA and cellular repair, immuno modulatory action, facilitating revival of damaged and affected organs, promoting the recovery of hematopoietic and immune functions,[8] compaction of DNA,[9]triggering the DNA repair enzymes, detoxifying the radiation induced reactive species,[10] delay of cellular division and inducing hypoxia in the tissues,[11] reduction in lipid peroxidation and elevation in non-protein sulphydryl group.

Topical corticosteroids have been shown to have an anti-inflammatory effect in radiation dermatitis and, therefore, are commonly prescribed to treat this condition. It has been found that radiation exerts acute and chronic effects due to excessive production of eicosanoids namely prostaglandins, prostacyclin, thromboxanes and leukotrienes. These mediators may be responsible for vasodilatation, increased vascular permeability, thrombosis and chemotaxis seen after radiation exposure. Glucocorticoids are known to inhibit eicosanoid synthesis by interfering with phospholipase A2. Several studies have shown that administration of glucocorticoid inhibit the effects of radiation in humans.[12,13]

In our study, Aloe vera, Azadirachta indica, Curcumin longa and Ocimum sanctum were studied to test their radioactive potential..

***Aloe vera*:**

Aloe barbadensis (Mill.) belongs to family Lilliaceae and commonly known as Aloe vera. Aloe leaf contains two basic components, pulp (gel) and latex. Aloe gel(AG) is a clear mucilaginous substance produced by parenchymal cells located in central region of the leaf. AG is composed mainly of water (99%) and mono and polysaccharides (25% of dry weight of the gel). The most common monosaccharide in AG is mannose -6-phosphate and most common polysaccharides are called gluco-mannans.[14] The prominent gluco-mannon is named as acemannan. AG significantly stimulates collagen synthesis in dermal wound in rats.[15] Mannose-6 phosphate was found to be responsible in wound healing in man.[16] Thereafter, various biological properties of Aloe have been reported by several workers. Topically applied Aloe gel can help in healing of radiation burns.[17] Latex contains anthraquinone, glcosides that are potent stimulant laxatives. Aloe gel is rich in vitamins [A (ß-carotene), C and E],[18] glutathione peroxidase, several isoenzymes of superoxide dismutase and minerals like zinc and selenium.[14,18,19]

Ocimum sanctum :

It is a medicinal herb widely used in the ayurveda system of medicine in india. It is used for treating various infections , many skin diseases, common cold and cough, malarial fever and hepatic disorders. It also possesses anti-bacterial[19], anti-inflammatory[20], antiviral[21], anti-carcinogenic[22] , antioxidant and immunostimulatory activities.[23] Uma Devi et al[24] reported its radioprotective property

for the first time. Aqueous and alcoholic extract of leaves have radioprotective properties, but its aqueous extract was more effective in increasing survival.[24] Its extract was compared with WR-2721, a standard radioprotector.[25]Its intraperitoneal injection in mice before delivering 2 Gy total body Gamma-radiation produced a significantly higher bone marrow stem cell survival. Ocimum sanctum contain two active components namely, orientin and vicenin. These components protected human lymphocyte chromosomes against radiation.[26,27]

Azadirachta indica:

Neem *(Azadirachta indica)*, a member of the Meliaceae family, is a fast growing tropical evergreen tree with a highly branched and stout, solid stem. There is interesting and compelling evidence to suggest that neem may be used as a tumor suppressor. Neem extracts and its purified products have been examined for induction of apoptosis among the cancer cells. Treatment with neem extract[28] suppressed the level of expression of bcl-2 protein, which is a strong pro-survival factor in cancer cells and at thesame time enhanced the level of expression of pro-apoptotic Bax protein.[29] There are many evidences to suggest that neem products e.g., Azadirachtin A, nimbolide and nimbidin possess convincing anticancer properties.[30,31]

***Curcuma longa* (*Haldi*):**

Curcumin (diferuloylmethane), the yellow pigment in Indian saffron (*C. longa*; also called turmeric, *haldi*, or *haridara* in the East and curry powder in the West), has been consumed by people for centuries as a dietary component and for a variety of proinflammatory ailments.[32] with wound healing properties in rodents.[33,34] Widespread research within the last decade in cell culture and in rodents has shown that curcumin can sensitize tumours to different chemotherapeutic agents. Likewise evidence too demonstrates that this agent can sensitize a variety of tumours to Gamma-radiation including glioma, neuroblastoma, cervical carcinoma, epidermal carcinoma, prostate cancer, and colon cancer. The mechanism behind its chemosensitiser and radiosensitiser activity demonstrates that it down regulates several growth regulatory pathways and precise genetic targets including genes for nuclear factor kappa-light-chain enhancer of activated B cells, Signal transducer and activator of transcription 3, Cyclooxygenase-2, Akt (Protein Kinase B), antiapoptotic proteins, growth factor receptors, and multidrug-resistance proteins. While it acts as a chemosensitiser and radiosensitiser for tumours in some cases, curcumin has also been revealed to safeguard normal organs from chemotherapy and radiotherapy-induced toxicity. The protective effects of curcumin seem to be facilitated by its ability to induce the activation of nuclear factor (erythroid-derived 2) and expression of antioxidant enzymes, directly neutralize free radicals, and inhibit p300 histone acetyl

transferase (HAT) activity. These preclinical studies are expected to lead to clinical trials to prove the potential of this age-old golden spice for treating cancer patients.[35,36]

Material and Methods

Preparation of herbal paste:

A viscous gel-like material was collected from the incised leaf of Aloe vera plant. Fresh Ocimum sanctum leaves, Azadirachta indica leaves (50 grams each) and Curcuma longa roots (5 gram). This was further grounded into a paste with the help of mixer/grinder. This paste was properly mixed with 100 gram of Aloe vera juice.

Study protocol:

The study was approved by the institutional ethic committee. Written and verbal informed consent was obtained from all the participants. Inclusion criteria included 60 patients of Head and neck carcinoma more than 18 years of age of either sex were included in the study. In Group-1, 30 patients received the Beclomethasone cream that was topically applied from the day-1 of radiotherapy till 4-weeks after completion of radiotherapy.while In Group-2, 30 patients received the local application of the herbal paste over skin that beginned from the day-1 of radiotherapy till 4-weeks after completion of radiotherapy. Exclusion criteria included patients known to be allergic to ingredients of Herbal paste or with H/o allergy to steroids, mentally incapacitated patients, distant metastasis, skin cancer, congenital anomaly of head and neck or H/o chronic illness.

Efficacy was judged by comparing Group I versus Group II patients as per RTOG-grading criteria.

Evaluation of skin toxicity and mucosal reaction was done as per RTOG-criteria:

Grade	Description
0	No change over baseline
1	Follicular, faint or Dull erythema/ epilation/ dry squamation/ decreased sweating
2	Tender or bright edema, patchy moist desquamation/ moderate edema
3	Confluent, moist desquamation, pitting edema
4	Ulceration, Haemorrhage, necrosis

QoL Evaluation:

European organisation for research and treatment of cancer quality of life questionnaire C30 (EORTC QLC-C30) was used for QoL assessment. It consisted of 45 items with following domains namely, physical well-being, social well being, spiritual well-being and symptoms specific to head and neck cancer. Total QoL score ranged from 45 to 180 and interpreted as higher the scores better the QoL. Total QoL scores of ≤115 represents poor Qol, Scores between 116 to 128 represents average QoL and scores >129 represents high QoL.

Data was entered and analysed using the statistical package for the social sciences (SPSS version 23). For categorical variables, frequencies and percentages were reported while for continuous variables, mean and standard deviation were reported. Comparison of continuous variables was done using t-test.

RESULTS:

For measuring radiation-induced reactions, Non-parametric test like chi-square test was applied and number of patients in different grades was calculated as per RTOG-criteria.

For evaluating mucosal reactions [as per RTOG criteria][see Table-1]:

TABLE-1: MUCOSAL REACTIONS [as per RTOG criteria]:

4^{TH} WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	02	19	09	0
HERBAL GROUP	02	22	06	0

$P < 0.01$

5^{TH} WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	0	12	18	0
HERBAL GROUP	0	16	14	0

$P = 0.72$

6^{TH} WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	0	3	21	6
HERBAL GROUP	0	8	22	0

$P < 0.01$

7^{TH} WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	0	0	25	5
HERBAL GROUP	0	6	24	0

$P < 0.01$

6^{TH} MONTH- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	4	22	04	0
HERBAL GROUP	08	21	01	0

$P < 0.01$

For measuring radiation-induced mucosal reactions, Non-parametric test i.e chi-square test was applied and number of patients in different grades was calculated as per RTOG-criteria.

1] At 4^{th} week, comparing two groups as a whole, treatment with herbal paste prevented radiation induced mucosal ulceration in group II-patients and was considered to be statistically significant[$P<0.01$].

2] At 6th and 7th week, comparing two groups as a whole, in Group-II patients, herbal treatment was again statistically significant in healing mucosal ulcers and prevented patients going to Grade-III.

3] Even at 6th-month, difference between two groups was statistically significant.[P<0.01]

For evaluating skin-reactions[as per RTOG criteria][see Table-2]

TABLE: 2 SKIN REACTIONS [as per RTOG-criteria]:

4TH WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	0	24	06	0
HERBAL GROUP	02	28	02	0

P < 0.01

5TH WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	0	18	12	0
HERBAL GROUP	0	22	08	0

P < 0.052 [borderline significant]

6TH WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	0	08	12	10
HERBAL GROUP	0	09	21	0

P< 0.057

7TH WEEK- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	0	01 [3.3%]	21	08
HERBAL GROUP	0	10 [33.3%]	20	0

P < 0.01

6TH MONTH- No of patients	GRADE 0	GRADE 1	GRADE 2	GRADE 3
STEROID GROUP	03	16	10	01
HERBAL GROUP	10	18	02	0

P < 0.01

For measuring radiation induced skin-injury, again chi-square test was applied, since data was qualitative and number of patients entering into different grades was assessed by RTOG-criteria.

1] At 4th -week, comparing two groups, difference between two groups was statistically significant in preventing skin -reactions.[P<0.01]

2] At 5th week, difference between two groups in preventing skin reactions was borderline significant.[P<0.052].

3] At 7th –week, difference between two groups was statistically significant and herbal paste treatment prevented patients going into Grade-III of skin reactions.

4] At 6th month, again difference between two groups was statistically significant.

QoL assessment: [see Table-3]

Pre-treatment assessment was done at day-1 of treatment while post-treatment assessment was done 6 months after completion of steroid or herbal treatment.

Table-3 QoL assessment as per EORTC QLC-C30) Questionaire:

GLOBAL QoL:

Scales & Items	Groups	Pre-treatment	Post-treatment	p-value
Global QOL	Gp-1[steroid]	59 ± 18	60 ± 16	0.25 NS
	Gp-2[herbal]	71 ± 20	79 ± 22	0.006 S

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

FUNCTIONAL SCALE:

	Groups	Pre-treatment	Post-treatment	p-value
Physical	Gp-1[steroid]	83 ± 15	84 ± 14	0.3 NS
	Gp-2[herbal]	70 ± 23	76 ± 24	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

	Groups	Pre-treatment	Post-treatment	p-value
Emotional	Gp-1[steroid]	67 ± 20	68 ± 20	0.4 NS
	Gp-2[herbal]	71 ± 22	81 ± 21	<0.001HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Cognitive	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	91 ± 16	90 ± 16	0.6 NS
	Gp-2[herbal]	76 ± 22	82 ± 21	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; *S = Significant*

Social	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	81 ± 20	77 ± 19	0.007 S
	Gp-2[herbal]	77 ± 24	89 ± 19	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Role	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	74 ± 20	73 ± 21	0.7 NS
	Gp-2[herbal]	72 ± 29	76 ± 27	0.009 S

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

SYMPTOM SCALE:

Fatigue	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	27 ± 15	30 ± 14	0.1 NS
	Gp-2[herbal]	32 ± 23	22 ± 22	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; *S = Significant*

Pain	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	29 ± 19	24 ± 16	0.9 NS
	Gp-2[herbal]	18 ± 20	14 ± 22	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Dyspnoea	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	9 ± 17	10 ± 18	0.4 NS
	Gp-2[herbal]	16 ± 60	11 ± 21	0.6 NS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Loss of appetite	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	26 ± 13	29 ± 14	0.09 NS
	Gp-2[herbal]	15 ± 25	13 ± 29	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Diarrhoea	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	1.6 ± 6	7 ± 10	<0.001 HS
	Gp-2[herbal]	7 ± 24	4 ± 14	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Constipation	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	1 ± 4	6 ± 7	<0.001 HS
	Gp-2[herbal]	11 ± 21	6 ± 17	0.002 S

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Nausea/vomiting	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	8 ± 6	12 ± 7	<0.001 HS
	Gp-2[herbal]	7 ± 17	4 ± 13	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Financial difficulty	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	44 ± 20	58 ± 23	<0.001 HS
	Gp-2[herbal]	25 ± 29	18 ± 23	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; S = Significant

Insomnia	Groups	Pre-treatment	Post-treatment	p-value
	Gp-1[steroid]	38 ± 20	30 ± 17	0.9 NS
	Gp-2[herbal]	22 ± 28	15 ± 25	<0.001 HS

NS= Non-significant; BS = Borderline significant; HS = Highly significant; *S = Significant*

On Global QoL scale:

In the group-1, pre-treatment scores value was 59 ±18 versus post-treatment score value of 60± 16 and p-value was calculated to be insignificant[p value of 0.25] while in Group II, pre-treatment values was 71 ± 20 vs post-treatment value of
79 ± 22 and p value was significant [p<0.01].

On Functional scale:

For physical functioning in Gp-1 , pre-treatment vs post treatment values were 83±15 vs 84± 14 with p-value of 0.3 [NS] while in Group –II, pre-treatment versus post treatment values were 70 ± 23 vs 76 ± 24and p-value was found to be highly significant.[p < 0.001].

For emotional functioning, in Gp-1 , pre-treatment vs post treatment values were 67 ± 20 vs 68 ± 20 with p-value of 0.4[NS] while in Group –II pre-treatment versus post treatment values were 71 ± 22 vs 81 ± 21 and p-value was found to be highly significant.[p < 0.001]

For cognitive functioning, in Gp-1 , pre-treatment vs post treatment values were 91 ± 16 vs 90 ± 16 with p-value of 0.6 [NS] while in Group –II pre-treatment versus post treatment values were 76 ± 22 vs 82 ± 21 and p-value was found to be highly significant[HS].[p < 0.001]

For social functioning, in Gp-1 , pre-treatment vs post treatment values were 81 ± 20 vs 77 ± 19 with p-value of 0.01 [Significant] while in Group –II pre-treatment versus post treatment values were 77 ± 24 vs 89 ±19 and p-value was found to be significant[S][p < 0.001]

For role functioning,in Gp-1 , pre-treatment vs post treatment values were 74 ± 20 vs 73 ± 21 with p-value of 0.7[NS] while in Group –II pre-treatment versus post treatment values were 72 ± 29 vs 75 ±27 and p-value was found to be significant.[p < 0.01]

On Symptom scale:

For fatigue, in Gp-1 , pre-treatment vs post treatment values were 27 ±15 vs 30 ±14 with p-value of 0.1[NS] while in Group –II pre-treatment versus post treatment values were 32 ± 23 vs 22 ± 22 and p-value was found to be significant.[p < 0.001]

For pain, in Gp-1 , pre-treatment vs post treatment values were 29 ±19 vs 24 ±16 with p-value of 0.9 [NS] while in Group –II pre-treatment versus post treatment values were 18 ± 20 vs 14 ± 22 and p-value was found to be significant.

[p < 0.001]

For dyspnoea, in Gp-1,pre-treatment vs post treatment values were 9 ±17 vs 10 ± 18 with p-value of 0.4 [NS] while in Group –II pre-treatment versus post treatment values were 16 ± 60 vs 11± 21 and p-value was found to be not-significant.[p value of 0.6]

For loss of appetite , in Gp-1 pre-treatment vs post treatment values were 26 ± 13 vs 29 ±14 with p-value of 0.09 [NS] while in Group –II pre-treatment versus post treatment values were15± 25 vs 13 ± 29 and p-value was found to be highly significant.[p < 0.001]

For diarrhoea , in Gp-1 pre-treatment vs post treatment values were 1.6± 6 vs 7 ± 10 with p-value of [NS] while in Group –II pre-treatment versus post treatment values were 7 ± 24 vs 4±14 and p-value was found to be highly significant.[p < 0.001]

For constipation , in Gp-1 pre-treatment vs post treatment values were 1 ± 4 vs 6± 7 with p-value of <0.001[HS] while in Group –II pre-treatment versus post treatment values were 11 ± 21 vs 6 ±17 and p-value was found to be significant.[p < 0.01]

For nausea / vomiting , in Gp-1 pre-treatment vs post treatment values were 8 ± 6 vs 12± 7 with p-value of <0.001 [HS] while in Group –II pre-treatment versus post treatment values were 7 ±17 vs 4 ±13 and p-value was found to be less than 0.001[HS]

For financial difficulty , in Gp-1 pre-treatment vs post treatment values were 44 ± 20 vs 58 ± 23 with p-value of <0.001[HS] while in Group –II pre-treatment versus post treatment values were 25 ± 29 vs 18± 23 and p-value was found to be highly significant.[p < 0.001]

For insomnia , in Gp-1 pre-treatment vs post treatment values were 38± 20 vs 30 ±17 with p-value of 0.9[NS] while in Group –II pre-treatment versus post treatment values were 22 ± 28 vs 15 ± 25 and p-value was found to be highly significant.[p < 0.001].

Discussion

Present study revealed a marked beneficial effects of herbal gel containing Azadirachta indica, aloe vera, Ocimum sanctum and Curcuma longa on radiation induced skin injury and improving quality of life at 6 month after end of treatment in patients with Head and neck carcinoma as compared to topical Beclomethasone cream. Beneficial effect of herbal preparation may be due to their antioxidant, free radical scavenging and immunostimulant properties of ingredients present in these 4 herbal extracts. It is now well established that exposure to ionizing radiation causes production of reactive oxygen species[ROS], reactive nitrogen species[RNS] and also the generation of other free radicals. Free radicals are highly reactive and are capable of altering all biological molecules including lipids, DNA and proteins.

Since plants contain different phytochemicals their radioprotective activity may be mediated through several mechanisms. Scavenging of radiation-induced free radicals and elevation of cellular antioxidants might be foremost mechanism for radioprotection due to the presence of polyphenols. These polyphenols could up-regulate messenger RNA of antioxidant enzymes such as catalase, GSH transferase, GSHPx, superoxide dismutase (SOD) and hence counteract the oxidative stress-induced by ionizing radiations. Protection against radiation-induced damage is also conferred by the up-regulation of DNA repair genes, which bring about an error free repair of DNA damage. Certain extent of radioprotective activity is provided by the reduction in LPO and elevation in non-protein sulfhydryl groups. The plants and herb may also inhibit activation of protein kinase C, mitogen activated protein kinase, cytochrome P-450, nitric oxide and several other genes that may be responsible for inducing damage after irradiation.Phytochemicals produce their radioprotective effects through various mechanisms, with their activity being measured predominately as either antioxidants, free radical scavengers, DNA repair modulators or preventers of DNA damage and lastly based on anti-inflammatory action. In the past 20 years, there has been a major shift towards evaluating phytochemicals as radioprotectors, primarily due to their potential bioequivalence, efficacy and in most cases low toxicity, relative to many of the established synthetic compounds available. Plants ability is in part due to the numerous antioxidant phytochemicals that they possess as part of normal metabolic processes. Polyphenols like flavonoids and their naturally occurring derivatives are structurally adapted in order to be activated by electron donating substituents which inhibit energy transfer mechanisms, ultimately suppressing oxidative stress and stabilising redox processing.[37]

On evaluating European organisation for research and treatment of cancer quality of life questionnaire C30 (EORTC QLC-C30), on Functional scale, physical, emotional, cognitive and role functioning deteriorated in group-1 patients except social functioning, while in Gp-2 patients all these modalities showed improvement at 6 month post-treatment. Evaluation on Symptom scale revealed that fatigue, pain, dyspnoea, appetite loss and insomnia got worsened in Gp-1 patients, except for diarrhoea, constipation and nausea or vomiting.while in Gp-2 patients, all 9 symptoms showed improvement after 6 month of completion of treatment.

Conclusion

To conclude, radiation toxicity is a major problem for patients receiving therapy for malignancies. To date, there are only a limited number of radioprotectant agents used clinically to minimise the severity and duration of toxicities associated with radiation therapy. There are a number of promising agents emerging, however, further studies assessing their effects is required. Herbal

extract paste in our study prevented post-radiation induced mucosal and skin-reactions and showed better effect than beclomethasone cream in patients of head and neck carcinoma receiving radiotherapy . The protective effects persisted for 6 month. Thus herbal paste made in our study exhibited radiation mitigator and radioprotector potential and there was a significant improvement in Global QoL

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