

## Correlation of Hair Loss with Chemotherapy Protocols- A Hospital Based Cross-Sectional Study

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### ABSTRACT:

Chemotherapy has always played a pivotal role in cancer treatment armamentarium. Whereas chemotherapeutic drugs are a blessing for cancer patient, they sometimes become a curse as they come with myriad of adverse effects. Among all adverse effects, cutaneous adverse effects are of prime importance as far as psycho-social milieu of a patient is concerned and are known to worsen the quality of life in these patients. Cutaneous involvement can be in the form of skin involvement, nail abnormalities and hair abnormalities. Hair abnormalities are a common side effect of cancer chemotherapeutic agents. There are myriad hair changes which can be caused by the cancer chemotherapeutic drugs such as hair loss, textural changes, colour changes, hair shaft changes involving various sites like scalp, eye brows, eye lashes, body etc.

**KEYWORDS:** cancer, chemotherapy, alkylating agents, alopecia, antibiotics

### I. INTRODUCTION

The term "Cancer" is derived from the Greek word "Karkinos" (for crab) which denotes a non-communicable disease (NCD) characterized by uncontrolled abnormal growth of cells (tumor/lump) in any part of the human body. Chemotherapy is employed as a crucial component of multimodal approach within the management of varied malignancies. The appearance of cancer chemotherapy has profoundly influenced the treatment and survival of cancer patients.

The cancer chemotherapeutic drugs have the ability to cause hair abnormalities. The drugs that lead to hair changes such as alopecia are alkylating agents, vinca alkaloids, antimetabolites, anthracyclines and antibiotics, as well as the new classes of drugs, the toxoids. Various hair disorders include persistent chemotherapy induced alopecia, persistent radiotherapy-induced alopecia, endocrine therapy-induced alopecia and hirsutism,

dyspigmentation of hairs, textural changes and changes in follicle cycle, localised hypertrichosis and targeted therapy-induced alopecia.

The most common cutaneous adverse effect of treatment with cytostatics is alopecia (Dunagin1982). The development of new cases anticancer drug therapy associated alopecia is approximately 65% and tends to vary by the specific drugs and different regimens. 15% calculated incidence of all-grade alopecia has been reported 6 with targeted therapies. Conditioning cytotoxic chemotherapies (ie, busulfan, melphalan, and fludarabine) lead to complete alopecia in nearly 100% of patients who have undergone hematopoietic stem cell transplantation. As with most of the drugs related toxicity, the severity of the side-effect is also route, dose and schedule dependent. Also, there may be marked differences in the potential for alopecia between drugs belonging to the same generic class and whether or not they are given in combination (Lederle, 1990).

**SOURCE OF DATA:** A Cross Sectional study on hair loss in 120 patients undergoing chemotherapy was conducted in departments of Dermatology and Radiation-therapy/Oncology, Govt. Medical College Jammu. Informed consent was taken from all the subjects for participation in the study as well as for relevant pictures.

**DURATION:** October 2019 to October 2020  
**STUDY TYPE:** Hospital based cross sectional study.

**INCLUSION CRITERIA:** All diagnosed cancer patients who are on cancer chemotherapy.

**EXCLUSION CRITERIA:** All patients receiving or planned for concomitant radiation therapy.

- Patients developing dermatological manifestations as a result of internal malignancy.
- All patients with history of or concomitant endocrinopathy such as Hypo/Hyperthyroidism, Diabetes mellitus. PCOD, Cushing's syndrome, Hyperandrogenemia.

- Patients having hair abnormalities prior to the starting of chemotherapy.
- All patients of less than two weeks duration of chemotherapy.
- All patients who deliberately had shaven scalp hairs.
- All patients who had undergone any surgical procedure over scalp or any major surgical procedure.
- All patients on other medications that may lead to alopecia, such as, Antiarrhythmics, Antipsychotic drugs, Antiretrovirals, Statins.
- All patients with history of or concurrent infections such as, Syphilis, tinea capitis, hepatitis, HIV.
- All patients with history of other diseases such as, Discoid Lupus Erythematosus, Dermatomyositis, Amyloidosis, systemic lupus erythematosus, Anaemia. Patients on oral contraceptives.

**METHODOLOGY:**

- All clinically diagnosed cases of cancers and receiving chemotherapeutic drugs, presenting to Dept. of Oncology and Dept. of Dermatology from Oct 2019 to Oct 2020, full-filling inclusion and exclusion criteria, were enrolled and clinically examined for hair loss.
- Institutional Ethics Committee permission was taken and demographic details were recorded.
- Types of malignancy, drug protocol, interval between the onset of hair loss, and initiation of chemotherapy were assessed.
- Details regarding disease (cancer) such as organ involvement, type of cancer, grading of cancer, duration of cancer, associated symptoms, were recorded.
- Treatment details such as class of chemotherapeutic agents, regimen followed, single drug or combination of drugs, dosage, route, frequency of administration, total

number of cycles at the time of assessment, were recorded.

- History pertaining to hair loss was taken with specific focus on site, onset and their correlation with initiation of treatment.
- The National Cancer Institute Common Terminology Criteria for Adverse Events (CTCAE 5.0) was used to grade hair loss.

**STATISTICAL METHODS:** The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean± SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and pie diagrams. Chi-square test or Fisher’s exact test, whichever appropriate, was employed for assessing correlation of hair changes with various parameters. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

**Age distribution:** The age of patients enrolled in our study ranged from 20-85 with mean age 54.3±12.41. Majority of the patients were in the age group 50-59 (30.5%) followed by 60-69 (28.3%), 40-49 (18.3%), 70 years (10.8%).

**Gender distribution:** In our study, out of 120 patients, there were 62 (51.7%) females as compared to 58 (48.3) males.

**Category of chemotherapy drugs employed in the study patients:** Most common category of chemotherapeutic drugs administered to the study patients was alkylating agents (88.3%) followed by anti microtubule agents (50%), antimetabolites (25.8%). Alkylating agent+ Anti microtubule inhibitors was the most common category combination administered to the patients (37.5%). This was followed by Alkylating agent+ Antimetabolites (19.2%).

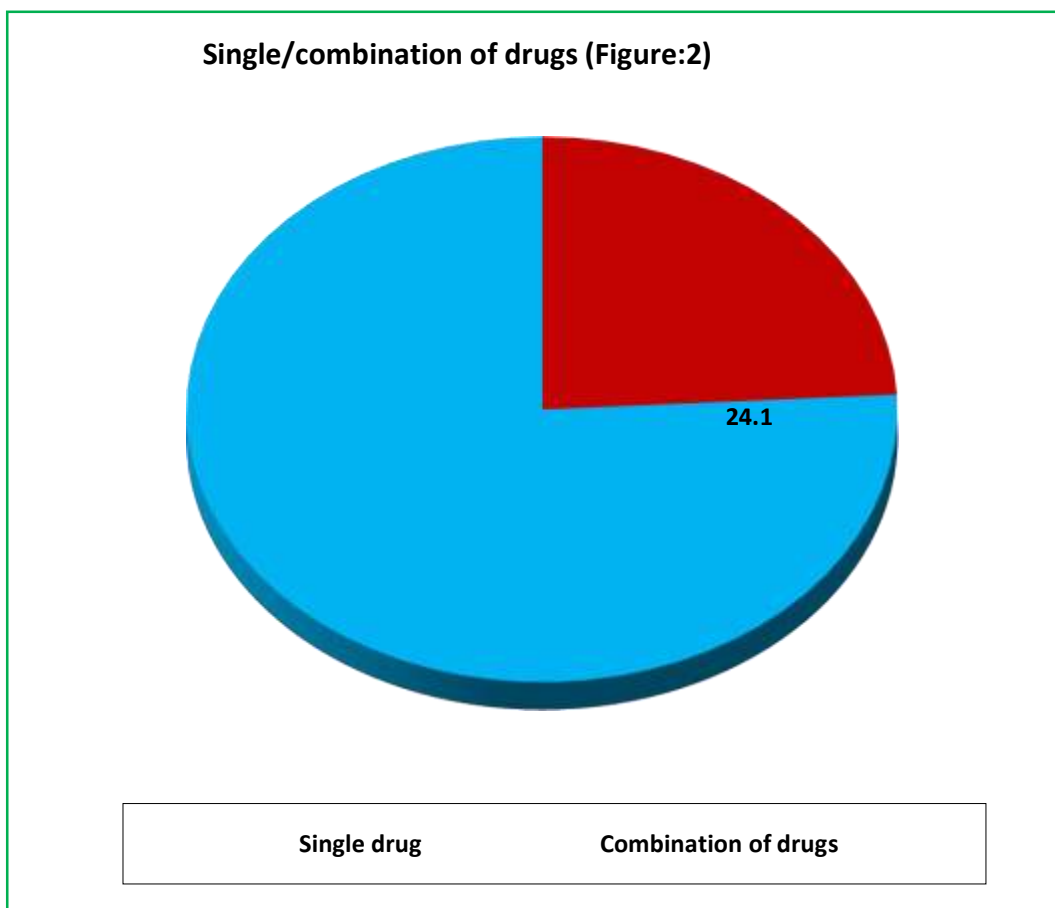
<b>Drug category</b>	<b>Number</b>	<b>Percentage</b>
Alkylating agent	106	88.3
Topoisomerase inhibitors	24	20
Anti microtubule inhibitors	60	50
Antimetabolites	31	25.8

Targeted therapy	5	4.2
Immunotherapy	1	0.8
Alkylating agent+ Topoisomerase inhibitors	21	17.5
Alkylating agent+ Anti microtubule inhibitors	45	37.5
Alkylating agent+ Antimetabolites	23	19.2
Anti microtubule inhibitors+ Antimetabolites	1	0.8
Anti microtubule inhibitors+ Immunotherapy	1	0.8
Alkylating agent+ Topoisomerase inhibitors+ Antimicrotubule inhibitors	3	2.5
Alkylating agent+ Antimicrotubule inhibitors+Antimetabolites	5	4.2
Total	120	100

**Chemotherapy drug protocol: combination/single agent:** Combination of chemotherapeutic drugs was present in 75.8% of study patients (n=91) against single chemotherapeutic agent in 24.2% (n=29).

**Table 2 : Single/combination of drugs**

Drug	Number	Percentage
Single drug	29	24.2
Combination of drugs	91	75.8
Total	120	100



**Distribution of treatment regimen among study patients:** Paclitaxel 100 mg + carboplatin 150 mg (33.3 %) was the most common treatment regimen administered to our study patients .This was followed by combination of doxorubicin 50 mg + cyclophosphamide 500 mg (17.5%), gemcitabine 1500 mg + oxaliplatin 100 mg. (9.2%).

**Hair changes in the study patients:** In our study, the most common hair change observed was hair loss (88.2%). This was followed by texture change (21.8%), colour change (17.6%), change in appearance (16.8%) and shaft changes (14.3%).

**Characteristics of hair loss: onset:** Majority of the patients in our study had onset of hair loss during 4th week post initiation of chemotherapy (71.7%). This was followed by onset in 3rd week (14.2%), 2nd week (11.3%), 6th week (1.9%) and

8th week (0.9%).

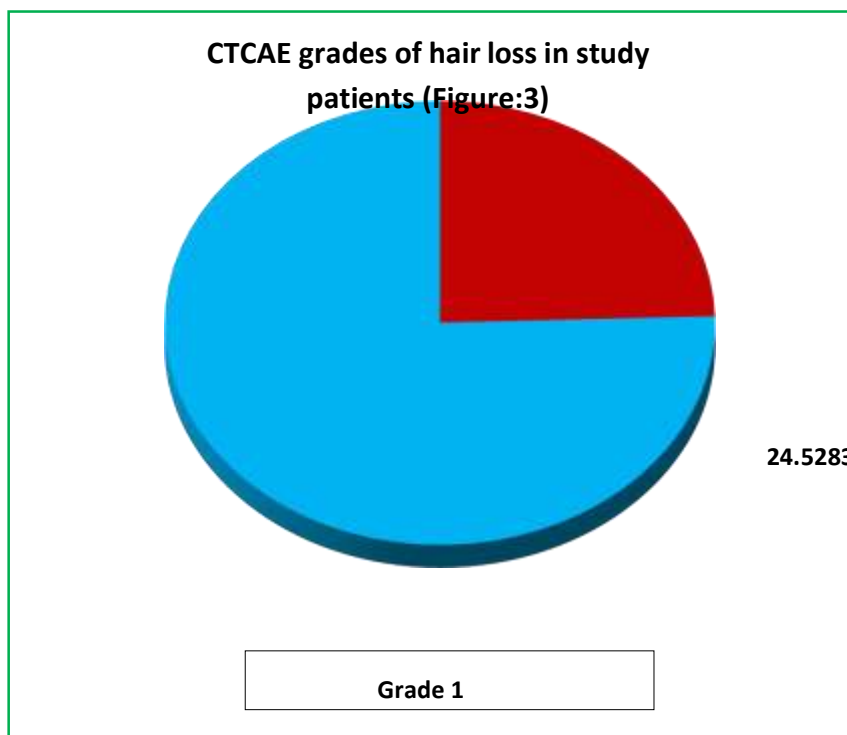
**Characteristics of hair loss: site:** Scalp was the most common site of hair loss observed in our study (41.5%). This was followed by collective involvement of scalp + eyebrow (33.0%), Scalp + beard (5.7%), Scalp+ eyebrow+ eyelash+ body (5.7%).

**Characteristics of hair loss: extent:** In our study the extent of hair loss was 80% in maximum number of patients (50%). This was followed by 50% (34.9%), 20% (14.2%), 100%.

**Characteristics of hair loss: grading:** Grade 2 hair loss was observed majority of the patients in our study (75.5%). This was followed by grade 1 hair loss in 24.5% of the study patients. Table 1 and Figure 1

**Table 3: CTCAE grades of hair loss in study patients**

CTCAE Grades	Number	Percentage
Grade 1	26	24.5
Grade 2	80	75.5
Total	106	100



**Characteristics of hair loss: type:** Anagen effluvium was the most common type of hair loss observed in 100% of the subjects effected with hair loss in our study.

**Correlation of hair loss with treatment in study patients:**

**Table 4: Correlation of hair loss with treatment in study patients**

H hair loss	Treatment																	P-value
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	
Present	4	39	18	3	2	3	4	10	9	1	5	1	2	1	1	1	1	0.019*
Absent	1	0	3	1	0	1	5	1	0	1	0	0	1	0	0	0	0	

A=Paclitaxel 100 mg, B=Paclitaxel 100 mg+ carboplatin 150 mg, C=Doxorubicin 50 mg+ Cyclophosphamide 500 mg, D= Paclitaxel 250 mg+ Carboplatin 450 mg, E= Cyclophosphamide 1200 mg+ doxorubicin 80 mg+ vinblastine 10 mg, F= Docetaxel 40 mg+ Oxaliplatin 100 mg+ Capecitabine 500 mg, G= Cisplatin 50 mg, H= Gemcitabine 1500 mg+ Oxaliplatin 100 mg, I= Oxaliplatin 100 mg+ Capecitabine 500 mg, J= Gemcitabine 750 mg, K= Bortezomib 2 mg, L= Vincristine 2 mg+ Doxorubicin 70 mg+ Cyclophosphamide 750 mg, M= Gemcitabine 750 mg+ Cisplatin 30 mg, N= Paclitaxel 100 mg+

Cytarabine 750 mg, O= Paclitaxel 100 mg+ cisplatin 40 mg, P= Paclitaxel 270 mg+ cisplatin 100 mg+ 5 Fluorouracil 900 mg, Q= Transtuzumab 130 mg+ Paclitaxel 100mg

**\*Statistically Significant (P-value<0.05)**

**Correlation of hair loss with chemotherapy protocol combination /single agent:**

Hair loss was observed in 91.2% of the patients on combination therapy and 68.75% of the patients on single agent. The correlation was statistically significant (P=value 0.009).

Hairs were observed to be rough in 22.33% of the

patients who were on combination of chemotherapy and 18% on single agent.

Parameter		Single/combination		P-value
		Single	Combination	
Hair loss	Present	11	94	0.009*
	Absent	5	9	

## II. DISCUSSION:

Hair abnormalities are a common side effect of cancer chemotherapeutic agents. There are myriad hair changes which can be caused by the cancer chemotherapeutic drugs such as hair loss, textural changes, colour changes, hair shaft changes involving various sites like scalp, eye brows, eye lashes, body etc. Although most of these changes are reversible, their mere occurrence leads to anxiety and emotional distress, even causing patients to reject chemotherapy. Thus an in-depth understanding of the hair changes secondary to chemotherapy is essential for the development of efficient preventive and treatment methods. Therefore we conducted a cross sectional study in Departments of Dermatology and Oncology of Government Medical College Jammu from November 2019 to October 2020 in which a total of 120 patients who fulfilled inclusion and exclusion criteria were enrolled for evaluation of hair changes.

A total of 120 patients were enrolled in our study satisfying inclusion and exclusion criteria.

- The age of the patients enrolled in our study ranged from 20-85 with mean age 54.3 years.
- Females outnumbered males. There were 62 (51.7%) females as compared to 58 (48.3%) males. Maximum hair changes were observed in females.
- Carcinoma Lung (34.5%) the most common cancer among males patients whereas carcinoma breast (32.8%) was the most common cancer among female patients.
- Alkylating agents (88.3%) was the most common category of chemotherapeutic drugs administered to the study patients.
- Maximum patients were administered

combination of chemotherapeutic drugs (75.8 %) as compared to single chemotherapeutic agent (24.2 %).

- Paclitaxel 100 mg + carboplatin 150 mg (33.3 %) was the most common treatment regimen administered to our study patients.
- Hair loss (88.2%) was the most common observation in our study. This was followed by texture change (21.8%), colour change (17.6%), change in appearance (16.8%) and hair shaft changes (14.3%).
- Hair loss was observed in 106 (88.2%) patients in our study. Majority had onset during 4th week post initiation of chemotherapy (71.7%) with scalp being the most common site whether isolated (41.5%) or in combination with other sites (100%).
- The extent of hair loss was 80% in maximum number of our patients (50%). Involvement of eyebrows in combination with scalp was second most common site of hair loss observed in 33% of our subjects. Majority of the patients in our study (75.5%) had grade 2 hair loss. Anagen effluvium was the most common type of hair loss observed in 100% of the subjects.

## III. CONCLUSION

According to the observations of our study, chemotherapy of cancer cause a variety of hair changes. Hair loss is the most common observation followed by texture change, colour change and hair shaft change. These changes have a statistically significant correlation with chemotherapy regimen, drug protocol, chemotherapy administration frequency, number of cycles of chemotherapy and duration of treatment.

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