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Original Research Article

A Clinicoepidemiological Study on Various Mucocutaneous Adverse Reactions of Anti-Cancer Drugs in Cancer Patients

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Conflict of interest: Nil

Abstract

Background: Cutaneous adverse reactions are the most commonly associated adverse effects with chemotherapy next to hematological toxicity. Chemotherapy is evolving with a tendency towards increasing the use of newer targeted agents. This has resulted in changing patterns of cutaneous adverse effects.

Aims: We aim to study clinicoepidemiological aspect of various mucocutaneous adverse reactions due to anti-cancer drugs in cancer patients.

Objectives: 1. Estimate occurrence of mucocutaneous adverse reactions among cancer pts on anticancer drugs. 2. To see the pattern, duration & latency of mucocutaneous reactions due to anticancer agents. 3. Study the association of cutaneous adverse reactions with various chemotherapy drugs or combination regimens. 4. Assess severity of various mucocutaneous adverse reactions using standardised criteria.

Methods: This was a cross sectional observational study carried out in dermatology department, SCB Medical college & AHPGIC, Cuttack during June 2020 to November 2021.

Inclusion Criteria: We included cancer patients who developed at least one mucocutaneous reactions after starting chemotherapy during our study period & gave consent to participate in our study.

Exclusion Criteria: Cancer cases who were on prior or concurrent radiotherapy, those who developed mucocutaneous reactions prior to starting chemotherapy & those who did not consent to participate were excluded. The obtained information was analysed retrospectively using SPSS software & results were represented using tables & statistical diagrams.

Results: Out of 200 cases, 131 were female & 69 were male. Overall, Breast cancer(37.5%) was the most common indication for chemotherapy followed by rectal cancer & cervical cancer. However, among males Ca Rectum was most common indication for chemotherapy followed by stomach & lungs cancers. Combination regimens were most frequently used. The dermatological

manifestations observed include hair changes (alopecia) in 73% cases, followed by skin changes (acral pigmentation, infusion site reactions, hand foot syndrome, Flagellate dermatitis, Supravenous Pigmentation, skin rash, acneiform eruptions, Xerosis etc) in 72% cases, nail changes (nail Pigmentation, Onycholysis, etc) in 56% & mucosal changes (Mucosal pigmentation, painful mucositis) in 14% cases respectively.

Limitations: Since most of chemotherapy consisted of combination regimens, it was difficult to imply specific drug in causal association. Due to the cross-sectional nature of our study with limited study period, cases could not be followed up properly.

Conclusion: Mucocutaneous adverse reactions of cancer chemotherapy can be mostly diagnosed by detailed history taking & physical examination. Many of the observed side effects are reversible changes, yet their inappropriate management might sometimes affect quality of treatment such as dose reduction or stoppage of drugs. A multidisciplinary approach including oncologist & dermatologist to prevent its occurrence or else limit its progression with appropriate timely management & proper counselling thereby improving the quality of patient care.

Keywords: Mucocutaneous Adverse Reactions, Supravenous Pigmentation, Hematological Toxicity.

Introduction

Cancer is a leading cause of death and a significant obstacle to improving life expectancy worldwide. According to WHO estimates, cancer is the first or second leading cause of death before the age of 70 in 112 of 183 countries in 2019, and third or fourth in another 23 nations.

Its management includes various modalities such as surgery, chemotherapy & radiation. Chemotherapy uses anticancer drugs to destroy cancer cells. Due to its action on rapidly dividing cells

normal dividing cells of body are also affected. Cutaneous toxicities are commonly associated manifestation of chemotherapy next only to hematological toxicity. Mucocutaneous manifestations develop consequent to adverse reactions. Although, rarely life threatening but these side effects can cause significant morbidity, psychological stress among patients. In our study we aim to assess the various mucocutaneous manifestations associated with current chemotherapeutic agents or regimens.

Aim was to assess the mucocutaneous side effects due to anticancer drugs in cancer patients. Objectives was to estimate occurrence, pattern, duration & latency of the mucocutaneous side effects & study their association with various chemotherapeutic agents.

Materials & Methods

1. A cross sectional observational study was conducted between June 2020 to December 2021 in a tertiary care hospital. After obtaining ethical clearance from institutional ethical committee, we included 200 cancer patients treated with chemotherapy who developed at least single mucocutaneous adverse reactions after starting Chemotherapy & gave valid consent to participate in this study. Those cancer patients who had developed mucocutaneous reactions before onset of chemotherapy, cases treated with prior or concurrent radiotherapy were excluded.
2. Data about Patient demographic profile, type of malignancy, anticancer chemotherapeutic agents used, duration of chemotherapy was collected in a

preformed proforma. A thorough dermatological examination was done and diagnosis was made on the basis of typical clinical findings & Investigations were carried out wherever necessary. Detailed descriptions, evolution and using CTCAE criteria severity of mucocutaneous lesions was assessed, photographed with consent.

3. The obtained data were represented using tables and statistical diagrams and analysed using SPSS 25.0 Software retrospectively. Chi-Square (Fischer's Exact if required) were used to test statistical significance of association. P value (<0.005) was considered significant.

Results

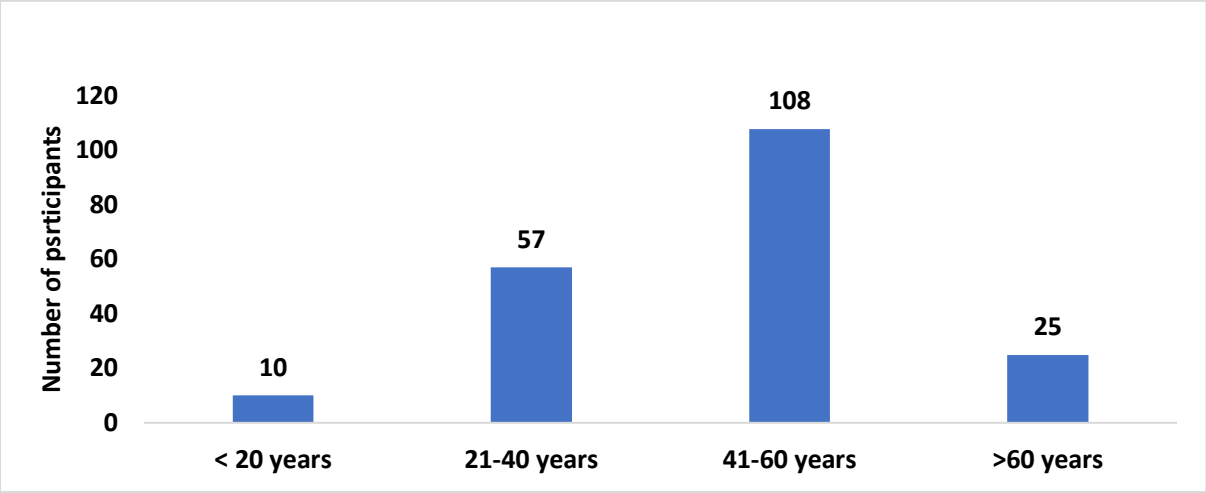

Figure 1: Shows frequency of cancer cases in various age groups

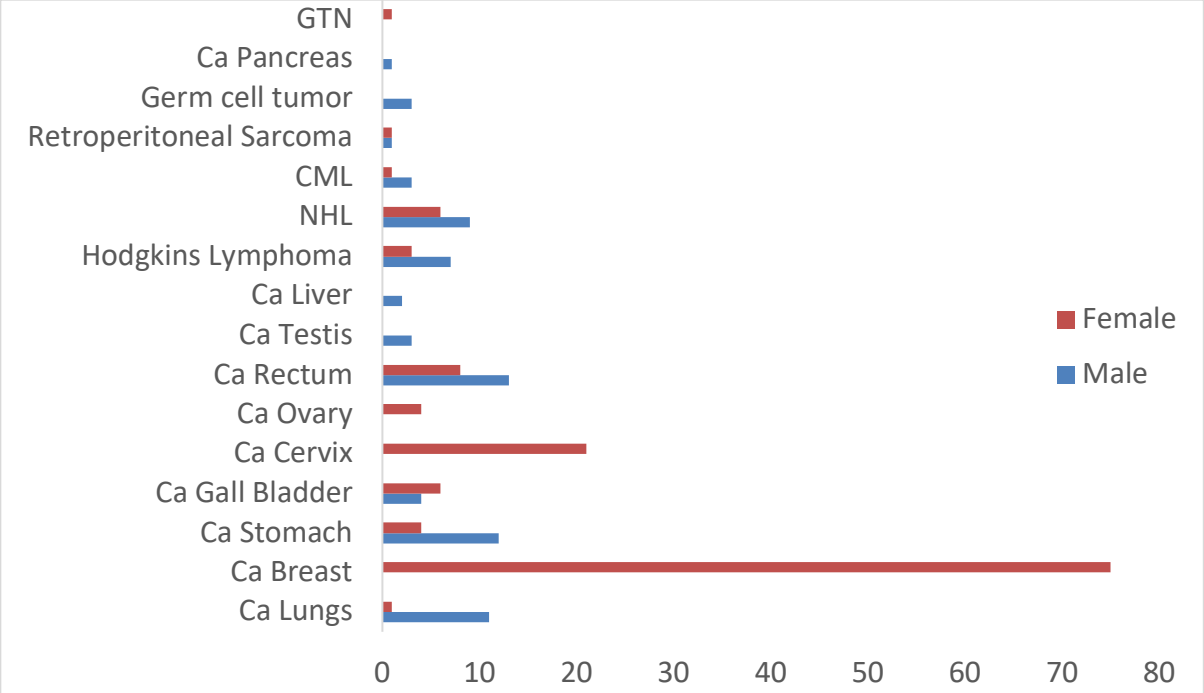

Figure 2: Shows frequency and gender-wise distribution of different cancers

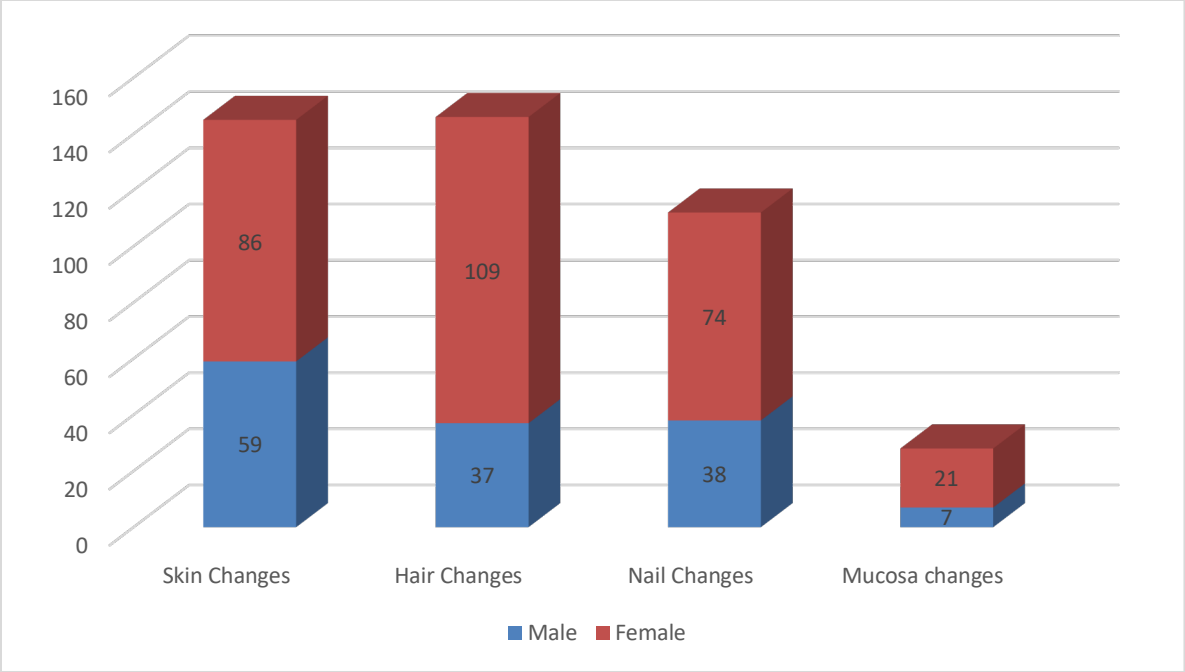

Figure 3: Shows genderwise distribution of dermatological adverse reactions

Table 1: Dermatological adverse reactions Of Cancer Chemotherapy

Dermatological adverse reactions	**Current study**	**A Menon *et al***	**S Naveed *et al***	**SGBiswal etal**	**Pavey *et al***
Acral Pigmentation	39.5%	22%	22%	-	22.2%
Infusion site skin changes	12%	6%	-	3.5%	0.9%
Hand Foot Skin Reactions	10%	-	28.76%	2.6%	1.9%
Supravenous Pigmentation	8%	-	4.42%	-	1.9%
Maculopapular rash	8%	-	3.1%	-	-
Xerosis	6%	26%	20.35%	4.4%	22.2%
Flagellate Pigmentation	4%	-	6.64%	1.3%	-
Acneiform eruptions	2%	9%	7.52%	-	-
Extravasation reactions	2.5%	-	-	1.8%	0.9%
Papulopustular rash	0.5%	-	3.54%	-	10%
Alopecia	73%	68%	63%	78.6%	38%
Nail Pigmentation	56%	15%	66%	2.9%	50%
Muehrcke's lines	6%	-	-		7.5%
Mee's lines	2%	4%	-	-	3.7%
Beau's lines	2.5%	8%	16.37%	-	2%
Onycholysis	4.5%	-	17%	-	-
Mucosal pigmentation	11.5%	-	-	-	2%
Mucositis	2.5%	12%	14.16%	-	2%

Table 2: Grading of various Cutaneous toxicities

Cutaneous Changes	Grade I	Grade II	Grade III
Acral pigmentation	63	16	-
Infusion site skin changes	13	13	-
Hand Foot Skin Reactions	10	8	2
Extravasation reactions	-	5	-
Maculopapular rash			
Xerosis	6	5	1
Alopecia	76	72	-
Melanonychia	112	-	-
Muehrcke's lines	12	-	-
Bee's lines	5	-	-
Oral mucositis	23	5	-

Table 3: Time at diagnosis of various dermatological adverse reactions

Cutaneous changes	Current Study	A Menon *et al*	Pavey *et al*
Acral Hyperpigmentation	4.84 (± 1.70)wks	2-4 wks	2nd cycle
Hand Foot Skin reactions	4.40 (± 2.32)wks	-	1st cycle
Supravenous Pigmentation	2.77 (± 2.01)wks	-	2nd cycle
Extravasation reactions	0.11 (± 0.02)wks	-	1st cycle
Flagellate Dermatitis	4.50 (± 2.07)wks	-	-
Acneiform Eruptions	5.40 (± 1.34)wks	6-8 wks	-
Maculopapular rash	1.62 (± 2.17)wks		
Xerosis	7.00 (± 3.71)wks	4-6 wks	3rd-4th cycle
Infusion site skin changes	1.02 (± 0.79)wks	-	-
Papulopustular rash	4.50 (± 4.94)wks	-	2-3 wks
Anagen Effluvium	2.89± (1.03)wks	3-6 wks	4 wks
NailPigmentation	5.75 (± 1.53)wks	3-6 wks	2nd cycle
Muehrcke's lines	5.91 (± 1.83)wks		4th cycle
Beau's lines	5.50 (± 1.00)wks		4th cycle
Mucositis	2.60 (± 2.60)wks	2-5 wks	1st cycle

Table 4: Dermatological adverse reactions of Chemotherapeutic agents

Sl No.	Dermatological adverse reactions	Chemotherapeutic agents
1.	Acral Pigmentation	5FU, Cyclophosphamide, capecitabine taxanes & platinum compounds
2.	Infusion site skin changes	taxanes, vinca alkaloids, 5FU & doxorubicin
3.	Supravenous Pigmentation	5FU, Daunorubicin , bleomycin
4.	Extravasation reactions	R-CHOP, FOLFOX, Methotrexate
5.	Xerosis	Premetrexed, EGFRI, Taxanes, 5FU & Platinum compounds
6.	Maculopapular rash	Paclitaxel & Carboplatin,
7.	Acneiform eruptions	R CHOP
8.	Hand Foot Skin reactions	Capecitabine, Taxanes, Sorafenib & platinum compounds
9.	Flagellate dermatitis	ABVD, BEP

10.	Papulopustular rash	R CHOP
11.	Facial pigmentation	Imatinib
12.	Alopecia	Taxanes, Cyclophosphamide, epirubicin, vincristine, doxorubicin, & platinum compounds
13.	Melanonychia	Cyclophosphamide, Paclitaxel, ABVD, CAPEOX, R CHOP regimens
14.	Mucosal pigmentation	Cyclophosphamide,dacarbazine, 5FU ,doxorubicin, epirubicin & platinum compounds
15.	Mucositis	Methotrexate

Table 5: Showing association of Chemotherapy Regimen containing drugs Paclitaxel and Carboplatin and Maculopapular Rash among patients having Breast Cancer (n=75)

	Maculopapular Rash present	Maculopapular Rash Absent	Total	p-value
Paclitaxel & Carboplatin given	5 (50%)	5 (50%)	10	<0.01*
Paclitaxel & Carboplatin not given	4 (6.1%)	61 (93.9%)	65	
Total	9	66	75	

*Fisher's Exact Test

Table 6: Showing association of Chemotherapy Regimen containing drugs Epirubicin and Cyclophosphamide and Nail Pigmentation among patients having Breast Cancer (n=75)

	Nail Pigmentation present	Nail Pigmentation Absent	Total	p-value
Epirubicin & Cyclophosphamide given	19 (82.6%)	4 (17.4%)	23	0.03
Epirubicin & Cyclophosphamide Not given	28 (53.8%)	24 (46.2%)	52	
Total	47	28	75	

Table 7: Showing association of Chemotherapy Regimens and Alopecia among all patients (n=200)

	Alopecia present	Alopecia Absent	Total	p-value
Single drug Regimen given	2 (20.0%)	8 (80.0%)	10	<0.01
Combination drug Regimen given	144 (75.8%)	46 (24.2%)	190	
Total	146	54	200	

Table 8: Showing association of Chemotherapy Regimens and Mucosal Pigmentation among all patients (n=200)

	Mucosal pigmentation present	Mucosal pigmentation Absent	Total	p-value
Single drug Regimen given	0 (66.7%)	10 (100%)	10	0.02*
Combination drug Regimen given	23 (22.1%)	167 (87.9%)	190	
Total	23	177	200	

*Fisher's Exact Test

Table 9: Showing association of Chemotherapy Regimen containing drugs Methotrexate and Mucositis among patients having Non-Hodgkin's Lymphoma (n=15)

	Mucositis present	Mucositis Absent	Total	p-value
Methotrexate given	2 (66.7%)	1 (33.3%)	3	0.02*
Methotrexate Not given	0	12 (100.0%)	12	
Total	5	13	15	

Legends to figures:

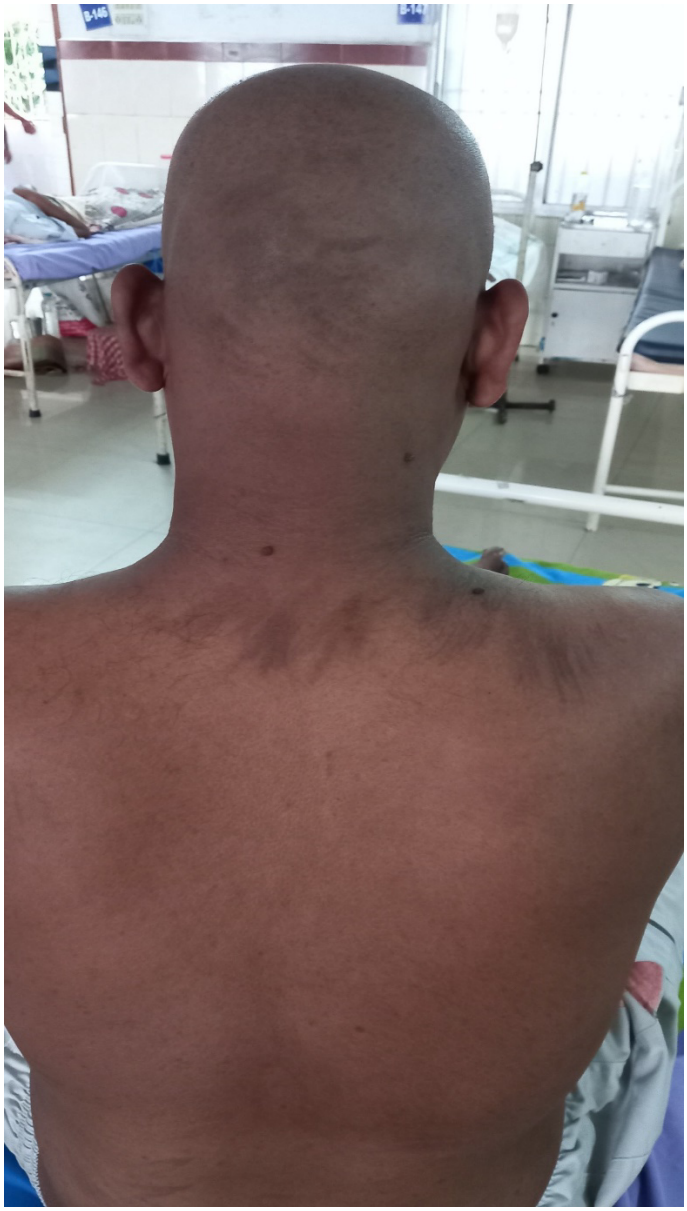

Figure 1: A 23 yrs male with Germ cell tumor on BEP regimen developed flagellate dermatitis.

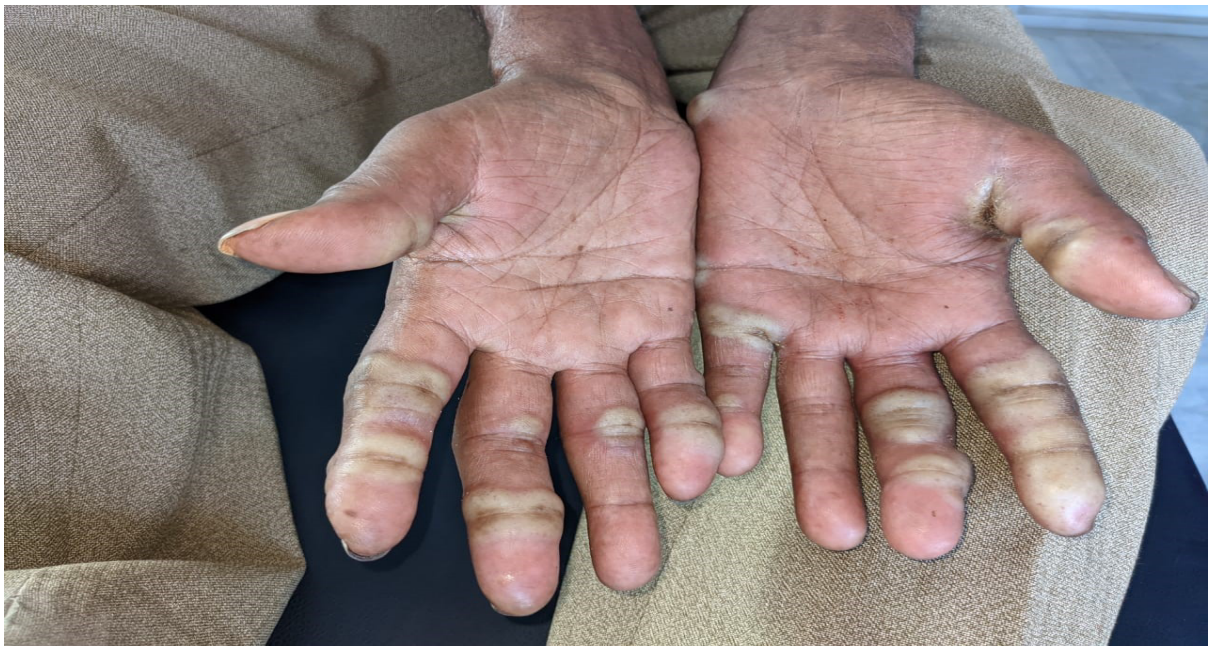

Figure 2: A 78 yrs male with Hepatocellular cancer taking Sorafenib sine last 6 wks, having bullous hand foot skin reactions for last 1 week

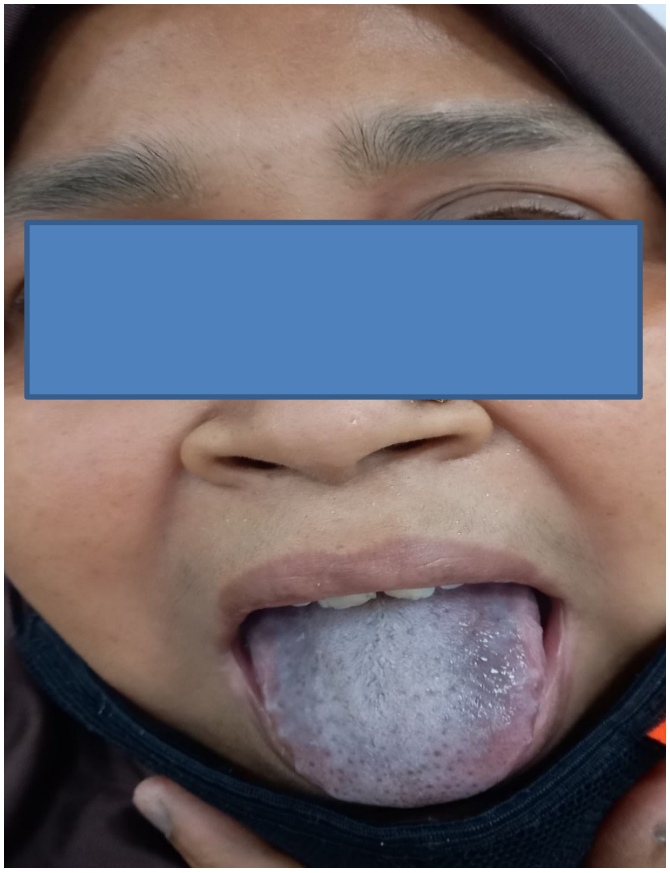

Figure 3: A 43 yrs female breast cancer patient on Epirubicin & cyclophosphamide regimen for 4 months

Figure 4: A 45yo female of cancer cervix received 5 cycles of paclitaxel & Carboplatin developed Muehrcke's nails

Out of 200 cases, 69 were males & 131 were females with the M:F ratio 1: 1.89. Mean age of study participants was 45.82 ± 13.68 years (Median 47.50 (IQR 38.25-55) years & range of age was 7yrs to 78 yrs. Mean duration of chemotherapy treatment in our study was 11.62 ± 8.02 weeks. (Median 10 (IQR- 8.00-12.75) weeks. We found cases received chemotherapy for 16 different types of malignancies of which breast cancer was most commonly seen among 37% cases. Others included Cancers of lungs (6%), stomach (8%), rectum (10.5%), cervix (10.5%), ovary (2%), testis (1.5%), Liver (1%), Gall Bladder (5%), Pancreas(1.5%), germ cell tumors (1.5%), & haematological malignancies such as CML(2%), Hodgkin's(5%) & Non-Hodgkin's lymphoma(7.5%), retroperitoneal sarcoma(1%), GTN(0.5%). Majority (190 out of 200) were treated with combination regimens, only 10 cases were treated with single-agent chemotherapy. The dermatological adverse reactions were hair changes (alopecia) in 73% cases, followed by skin changes (acral pigmentation, infusion site reactions, hand foot syndrome, Flagellate dermatitis, Supravenous Pigmentation, skin rash, acneiform eruptions, Xerosis etc) in 72% cases, nail changes (nail Pigmentation, Onycholysis, etc) in 56% & mucosal changes (Mucosal pigmentation, painful mucositis) in 14% cases respectively. There were 102 cases with at least one skin manifestation, 38 cases with two and 5 cases with three types of manifestations. Table 2 shows severity grade of various Cutaneous toxicities. Most skin lesions i.e, 67.3% were of Grade I

severity. While Grade II & III skin lesions comprise 27.9% & 4.6% respectively. Acral pigmentation was most common skin change. Anagen effluvium was most common hair change. Nail manifestations are observed in 56.5% cases included nail pigmentation, onycholysis & Beau's lines. Most i.e.,84 cases had diffuse pigmentation while Muehrcke's lines, Mee's lines, longitudinal melanonychia were present in 12, 4 & 2 cases respectively. The various dermatological side effects associated with chemotherapeutic agents depicted in Table 4

Discussion

In our study females outnumbered males which was similar to S G Biswal *et al* study where M:F ratio was 1:2.3. In contrast A menon *et al* observed more male cases (63%). Majority of cases in our study i.e, 108(54%) belong to 41-60yrs age group. (Figure 1) Similarly G sharma *et al* and A Menon *et al* studies majority cases in 41-60 yrs age. Overall, Breast cancer (37.5%) was most common indication for chemotherapy followed by rectal cancer & cervical cancer, however among males Ca Rectum was most common followed by Ca stomach & lungs.(Figure2) S Naveed *et al* (2019) study also reported breast cancer (28.3%) as most common malignancy followed by leukemia (18.58%), GIT malignancy (12.39%) & cervix (10.18%) etc. In G Fabbrocini *et al* (2012) study Breast cancer was seen in majority i.e, 45% of subjects followed by lungs cancer, prostate cancer, hodgkins lymphoma, stomach cancer, thyroid cancer etc. Similar to our study R Pavel *et al* (2015) found 53 out of 34 cases received combination regimen and N Saraswat *et al* (2019) also reported 168 cases received combination chemotherapy out of total 179 cases. In contrast A Menon *et al* (2018), reported use of single drug chemotherapy in 54% cases.

Mucocutaneous adverse reactions : Similar to our study, G Sharma *et al* study (2018) reported hair changes as most common presentation observed in 156 (78%) patients followed by Skin changes in 130 (65%) cases, nail changes in 102 (51%) cases and mucosal changes in 46 (23%) patients.(4)

A Menon *et al* who reported Grade I , ii & iii skin lesions in 42% , 32% & 1% respectively similar to our study

Skin Changes

In comparision to our study S Naveed *et al* and G Sharma *et al* observed skin manifestations in 84.51% and 65% cases respectively. whereas In Hae jin suh *et al* 56.1% had one CAE, while 32.5% and 11.4% reported two and three CAEs respectively. Table 1 depicts various dermatological adverse reactions in our study of which acral pigmentation was most common skin change. Whereas S Naveed *et al* & A menon *et al* reported Hand foot skin reactions & Xerosis as most common skin finding respectively. Acral pigmentation was seen with 5FU, Cyclophosphamide, capecitabine, taxanes & platinum compounds after a mean duration of 4.84($\pm$ 1.70) wks which was similar to A Menon *et al* study. Infusion site skin changes were observed with mean latency duration of 1.02 ($\pm$ 0.79) wks. A Menon *et al* (2018) reported injection site skin reaction among 6 cases of which 5 cases were of Grade I severity. In comparison, we found 13 cases of Grade I severity & 11 cases of grade II severity [1,2]. Hand Foot Skin reaction was observed with regimens containing Capecitabine, Taxanes, Sorafenib & platinum compounds. S G Biswal *et al* (2018) reported HFSR in 2.1% of subjects which is lower than our study & observed HFSR with regimens containing Docetaxel, Sunitinib, Cytarabine & cisplatin+paclitaxel+5 FU. Martin *et al* (2014) reported a higher incidence of 19.6 % & with regimens containing 5FU, Capecitabine &

Doxorubicin. We observed HFSR after a mean latency duration of 4.40 (± 2.32)wks. Martin *et al* who reported in 31 patients (19.6%) and its first presentation occurred at a median of 72 days (range 19-209 days). Grade 3 HFS developed in 6.3, 5.2, 3.7 and 2.4%, of patients receiving ECX, DCX, EOX or CX chemotherapy regimen, respectively. In comparison in our study, we identified Grade I, Grade II, and Grade III severity in 50 percent, 40 percent, and 10% of the 20 HFSR patients, respectively.[3-6] Supravenous Pigmentation was observed in 9% cases which was higher than incidence reported in S Naveed *et al* & A Menon *et al* studies. It was observed with combination regimens containing 5FU, Daunorubicin, bleomycin, Taxanes & Platinum compounds . Similar drugs are implicated in Sulochana *et al* study. We found a statistically significant association between Paclitaxel & carboplatin combination regimen & maculopapular rash among breast cancer patients (P Value < 0.01). (Table 5) Hazan *et al* reported diffuse maculopapular rash with Paclitaxel+ Carboplatin combination. Facial pigmentation (Melasma like) was seen in cases suffering from CML & were on long term Imatinib therapy. S Naveed *et al* & Ghunawat *et al* also reported similar findings. We found vitiligo lesion on upper chest in the female case since 3 months duration while the same patient had melasma like facial pigmentation since last 6 months, she was continuing on imatininb therapy since last 2years. S Hasan *et al* (2003) reported imatinib induced hypopigmentation [7,8]. Infusion site extravasation was observed with 3 NHL cases on R- CHOP & methotrexate, 2 cases of Ca Rectum on FOLFOX regimen. SG Biswal *et al* reported a slightly higher incidence of 3.5% with regimen containing 5FU & Platinum compounds. Pavey *et al* reported extravasation reaction in one case of breast cancer on paclitaxel & carboplatin. Acneiform eruptions was observed mostly among NHL cases on R CHOP regimen. Chiewchanvit *et al* (2004) and A Menon *et al* (2018) reported al reported a higher incidence of 4.5% & 9% respectively. One case of NHL on R-CHOP regimen developed papulopustular rash on face & trunk which subsided with oral steroids treatment. We observed Xerosis with regimens containing Premetrexed, EGFRI, Taxanes, 5FU & Platinum compounds with a mean latency duration 7.00 (± 3.71)weeks. R Pavey *et al* & A Menon *et al* reported xerosis in 22% & 26% respectively with onset around 4 – 6 wks of therapy. SG Biswal *et al* reported slightly lower incidence of 4.4% with combination regimen such as (Cisplatin+5FU), (5FU + Adriamycin + cyclophosphamide) & Temozolomide. Flagellate dermatitis was observed with ABVD & BEP regimens with a mean latency duration of 3-6 wks which was higher compared to SG Biswal *et al* study(1.3%) [9,10].

Hair Changes

Anagen effluvium was the most common cause of alopecia. Similarly S G Biswal *et al* study (2018) & G Sharma *et al* (2018) reported anagen effluvium in 78.6% & 78% cases respectively. There was significant association of alopecia with combination regimen compared to single agent chemotherapy. (Table 7) N Saraswat *et al* (2019) reported use of combination regimen in 94% alopecia cases. Alopecia mostly started within 1 month of starting chemotherapy. Trueb *et al* (2010) also reported onset of hair loss after 1 to 3 weeks of starting chemotherapy. We Observed Grade I alopecia in 71 cases & grade II alopecia in 75 cases. In comparison in A Menon *et al* Study 70% alopecia cases were of grade ii severity. Severity of alopecia was related to dosage & duration of chemotherapy. Being reversible in nature most cases were given reassurance [11-13].

Nail Changes

Similar to our study Rachel A Pavey *et al* (2015) found nail changes in 62.2% of total cases, which included diffuse nail pigmentation (78.7%), Muehrcke lines (12.1%), Mee's lines(9%) & Beaue's lines. We found nail pigmentation developed after a mean period of 5.75 (± 1.53) wks. This correlates with latency period of 3 to 6 wks in A Menon study. We found significant association between nail pigmentation & cyclophosphamide + Epirubicin regimen in breast cancer cases of our study(P value = 0.03).(Table 6) Other drug combination associated with nail pigmentation were Doxorubicin+ cyclophosphamide, Paclitaxel + carboplatin, CAPEOX, ABVD & R- CHOP regimens.

Mucosal Changes

In comparision to our study S Naveed *et al* and A menon *et al* reported mucosal changes in 14% and 12% of cases, while G Sharma *et al* reported in 23% cases. We Observed mucositis were of grade II severity whereas, A Menon *et al* found 50% cases each of grade I & II severity respectively. Mean duration of latency for mucositis & for mucosal pigmentation was 2.60(±2.60) wks and 5.21(±2.93) wks which is similar to A Menon *et al* study.

Chemotherapeutic regimen containing cyclophosphamide, epirubicin, doxorubicin, dacarbazine, 5FU & platinum compounds were associated with mucosal pigmentation. We found higher association of mucosal pigmentation with combination regimens as compared to single drug chemotherapy (P Value = 0.02).(Table 8) We found significant association between methotrexate & oral mucositis among NHL cases (P Value = 0.02).(Table 9)

Limitations

As this study was cross-sectional in nature with limited study period, cases could not be followed up properly. Therefore causal association of the drug, its dosage, and its side effect cannot be conclusively drawn.

Since most of chemotherapy consisted of combination regimens, it was difficult to imply specific drug in causal association. Lastly the ongoing covid pandemic situation restricted the sample size of our study .

Conclusion

We conclude that cutaneous side effects of Chemotherapy are related not only to specific types of drugs but also to the dosage & duration of chemotherapy. Most manifestations can be easily identified by detailed history & physical examination. Physicians knowledge of the possible dermatological toxicity, particularly when choosing chemotherapeutic drugs help in preventing treatment disruption such as dose reduction or stoppage of drugs. An accurate diagnosis and early identification of probable reactions can lessen considerable morbidity, cosmetic distortion, and psychological stress amongst cancer patients.

References

1. Menon A, Handattu S, Shetty J, Girisha B. Study of cutaneous adverse effects of cancer chemotherapy YR - 2018/1/1. Clin Dermatology Rev. (1 UL-https://www.cdriadvlkn.org/article.asp?issn=2542551X;year=2018;volume=2;issue=1;spage=19;epage=24;aulast=Menon;t=5):19 OP-24 VO – 2.
2. Naveed S, Thappa DM, Dubashi B, Pandjatcharam J, Munisamy M, Singh N. Mucocutaneous Adverse Reactions of Cancer Chemotherapy and Chemoradiation. Indian J Dermatol. 2019;64(2):122–8.
3. Fabbrocini G, Cameli N, Romano MC, Mariano M, Panariello L, Bianca D, *et al*. Chemotherapy and skin reactions. J Exp Clin Cancer Res. 2012 May;31(1):50.
4. Sharma G, Nigam P. Mucocutaneous

adverse effects in patients undergoing cancer chemotherapy. J Evol Med Dent Sci. 2018;7:5335–8.
5. Biswal SG, Mehta RD. Cutaneous Adverse Reactions of Chemotherapy in Cancer Patients: A Clinicoepidemiological Study. Indian J Dermatol. 2018;63(1):41–6.
6. Gómez-Martin C, Sánchez A, Irigoyen A, Llorente B, Pérez B, Serrano R, *et al*. Incidence of hand-foot syndrome with capecitabine in combination with chemotherapy as first-line treatment in patients with advanced and/or metastatic gastric cancer suitable for treatment with a fluoropyrimidine-based regimen. Clin Transl Oncol Off Publ Fed Spanish Oncol Soc Natl Cancer Inst Mex. 2012 Sep;14(9):689–97.
7. Hazan E, Santa E, Sahu J. Diffuse Rash After the Administration of Carboplatin and Paclitaxel. Am J Dermatopathol. 2016 May;38(5):365.
8. Ghunawat S, Sarkar R, Garg VK. Imatinib induced melasma-like pigmentation: Report of five cases and review of literature. Vol. 82, Indian journal of dermatology, venereology and leprology. United States; 2016. p. 409–12.
9. Hasan S, Dinh K, Lombardo F, Dawkins F, Kark J. Hypopigmentation in an African patient treated with imatinib mesylate: a case report. J Natl Med Assoc. 2003 Aug;95(8):722–4.
10. Pavey RA, Kambil SM, Bhat RM. Dermatological adverse reactions to cancer chemotherapy. Indian J Dermatol Venereol Leprol. 2015;81(4):434.
11. Chiewchanvit S, Noppakun K, Kanchanarattanakorn K. Mucocutaneous complications of chemotherapy in 74 patients from Maharaj Nakorn Chiang Mai Hospital. J Med Assoc Thai. 2004 May;87(5):508–14.
12. Trueb RM. Chemotherapy-induced hair loss. Ski Ther Lett. 2010;15(7):5–7.
13. Saraswat N, Chopra A, Sood A, Kamboj P, Kumar S. A Descriptive Study to Analyze Chemotherapy-Induced Hair Loss and its Psychosocial Impact in Adults: Our Experience from a Tertiary Care Hospital. Indian Dermatol Online J. 2019;10(4):426–30.