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A Descriptive Study on Adverse Reactions of Chemotherapy and Assessment of Knowledge Score in Cancer Patients

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ABSTRACT

Even with the evolution of chemotherapeutic procedures and agents, chemotherapy may cause certain side effects that impair the patient's quality of life. The aim of this research was to isolate and describe the side effects arising only from chemotherapy. This paper comprises an extensive research of the main side effects affecting the health status of patients undergoing chemotherapy procedures. In addition, Cancer patients experience a variety of symptoms that can be physical or psychological. These symptoms may vary in terms of occurrence, severity and distress and can be the result of the illness or the treatment

Key words:
Complications, Cancer, Knowledge Score, Chemotherapy, Preventive Strategies.

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INTRODUCTION

The term cancer refers to a heterogeneous group of diseases caused by an impairment of the normal functioning of genes, which leads to genetic damage[1]. The general concept of molecular mechanisms of cancer is explained in fig.1. It can affect almost any part of the body. The growths often invade surrounding tissue and can metastasize to distant sites. Cancer is a leading cause of disease worldwide.

In 2015, about 90.5 million people had cancer about 14.1 million new cases occur a year in the world, where 7.4 million (53%) in males and 6.7 million (47%) in females, giving a male: female ratio of 10:9, it causes about 8.8 million deaths [2]. Surgery, radiotherapy and drug therapy are the three main treatment options considered when a treatment plan is formulated for patients undergoing active management of their cancer[3].

The treatment aims are:

Eradicate the disease: cure the patient, If eradication is not possible then control the disease: induce a remission and prolong survival, If neither cure nor remission is possible then control symptoms. The drug therapies used to treat cancer can be classified as:

- Chemotherapy,
- Hormone therapy,
- Biological therapy.

The drugs used to treat cancer are cytotoxic agents, i.e. drugs that kill dividing cells commonly referred to as chemotherapy[4].

Objectives of chemotherapy

For cancers like leukemias and lymphomas, several phases of chemotherapy are necessary. A cure may be sought with aggressive therapy for a prolonged period to eradicate all disease. For leukemias, this curative approach may consist of

the following components: Remission induction: therapy given with the intent of maximizing cell kills. Consolidation (also

known as intensification or post-remission therapy): therapy to eradicate any clinically undetectable disease and to lower

the tumor cell burden at which level host immunological defenses may keep the cells in control. Maintenance: therapy given in lower doses with the aim of maintaining or prolonging a remission. For solid tumors, one or more approaches to chemotherapy may be used when seeking a cure based on the known utility of chemotherapy in line with other modalities,

such as surgery or radiation. Adjuvant chemotherapy was given after more definitive therapy, such as surgery, to eliminate any remaining disease or undetected micro-metastasis. Neoadjuvant chemotherapy was given to decrease the tumor burden before definitive therapy, such as surgery or radiation. Palliative therapy was usually given when complete eradication of the tumor is considered unlikely or the patient refuses aggressive therapy.

Palliative chemotherapy may be given to decrease the tumor size, control growth, and reduce symptoms. Salvage chemotherapy was given as an attempt to get a patient into remission, after previous therapies have failed [1]. The Aim of our study was to find the chemotherapy induced complications and assessment of knowledge score in cancer patients.

The **Aim** of our study was to find the chemotherapy induced complications and assessment of knowledge score in cancer patients.

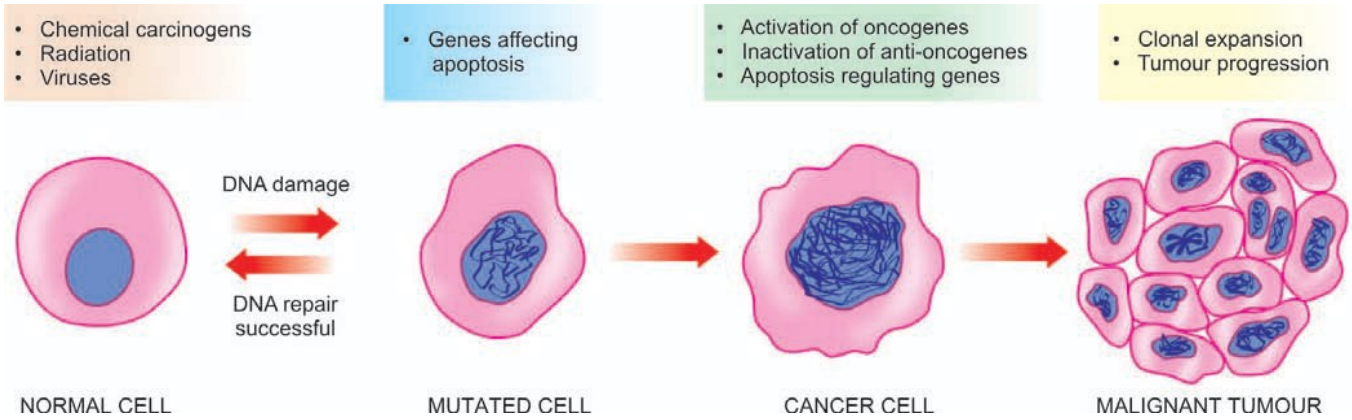


Fig.1: The general concept of molecular mechanisms of cancer[3].

MATERIALS AND METHODS

A descriptive - prospective study was conducted at our centre, after obtaining ethical committee clearance, during a **6 months** study period all the cancer patients starting from **September 2019 to February 2020** were screened. After excluding patients on concurrent radiotherapy, Pregnancy and lactating women, Pediatric patients, Patients who are receiving targeted therapy and immunotherapy and Patients who are not willing to participate in study, **176** consecutive cancer patients, who received chemotherapy in the oncology department, were included in the study. In all patients epidemiological data, malignancy, physical and psychological complications, physical and systemic examinations and chemotherapy treatment details were recorded.

RESULTS

Out of **176** cancer patients studied, 65 (36.93%) were male and 111 (63.06%) were female. They have 43 different types of cancers, out of which the majority is breast cancer of 43 participants with 24.43%, the majority of age range was 46-55 years with 58 participants of 32.95% and the **anorexia** was the more frequent complication observed, there were **25** types of rare complications observed in our research. At the end of the study out of 176 patients 176 were alive and no more mortality and morbidities were observed.

Table 1 shows distribution of data based on gender, the males with 36.93% and females with 63.06%, the females are found to be more in number than males because of majority of patients are in breast cancer. It is depicted in **Fig 2.** Percentage distribution of cancer patients based on gender.

Table 2 shows distribution of data based on age range of interval 9 years i.e., 16-25, 26-35, 36-45, 46-55 and 56-65 with percentage of frequency was 2.27%, 11.93%, 21.59%, 32.95% and 31.25% respectively. It is depicted in **Fig 3.** Percentage distribution of age group in cancer patients.

Table 3 shows distribution based on chemotherapy, in this study the Adjuvant, Neoadjuvant, Palliative and salvage are found to be 30.11%, 5.11%, 63.06% and 1.70%, the palliative chemotherapy is on top in our research. It is depicted in **Fig 4.** Percentage distribution of gender based on type of chemotherapy.

Table 4A and **4B** shows distribution of cancers based on gender, the breast cancer is the most observed cancer type in our research with 24.43%, the remaining were cervical, ovarian and lung cancers with 9.09%, 9.09% and 5.68% respectively. It is depicted in **Fig 5.** Percentage distribution of caner types.

Table 5 Shows distribution of assessment of knowledge score in cancer patients, in this shows that majority of the respondent 160 (90.90%) knew measure to manage nausea and vomiting and measure to manage fever, 156 (88.63%) knew meaning of chemotherapy, 123 (69.88%) of respondents managed diarrhea at home, while least of respondents i.e., only 22 (12.5%) had knowledge on measure to manage burning micturation. It indicated that most of the patients had no knowledge about management of chemotherapy related side effects. It is depicted in **Fig 6.** Percentage distribution of assessment of knowledge score study in cancer patients.

Table 6 Shows Grading of knowledge score in cancer patients, in this we graded then score into three Grades i.e., poor (0- 5 right responses), average (6-10 right responses) and good (11-16 right responses), out of 176 patients 110 (62.5%) had average knowledge, 44 (25%) had poor knowledge and where 22 (12.5%) had good knowledge on chemotherapy and its complications. It is depicted in **Fig 7.** Percentage grading of knowledge score in cancer patients.

Table 7 Shows Descriptive analysis of rare complications based on category; in this we differentiate the chemotherapy induced complications into eight categories. They were:

1. Pulmonological complications
2. Ophthamological complications
3. Dermatological complications
4. Neurological complications
5. Psychological complications
6. Urological complications
7. Gastro intestinal complications
8. Miscellaneous

The more number of complications were seen in the dermatological category, where as the more percentage of complications were in gastro intestinal i.e., anorexia with 71 (40.34%) participants, while the least one observed was hallucination in psychiatric complications with 4 (2.27%) participants. It is depicted in **Fig 8.** Percentage Descriptive analysis of rare complications**.** The aim of the study was to imply a specific chemotherapy as a causation of the complications, since the chemotherapy is mostly consisted of combination regimens. Therefore, we have tried to associate the drug combination itself.

Table 1. DISTRIBUTION OF DATA BASED ON GENDER (n= 176):

S.No	GENDER	FREQUENCY	FREQUENCY%
1.	Male	65	36.93%
2.	Female	111	63.06%

Table 2. DISTRIBUTION OF DATA BASED ON AGE (n= 176):

S.No	AGE GROUP (years)	FREQUENCY	FREQUENCY%
1.	16-25	4	2.27%
2.	26-35	21	11.93%
3.	36-45	38	21.59%
4.	46-55	58	32.95%
5.	56-65	55	31.25%

Table 3. DISTRIBUTION BASED ON CHEMOTHERAPY (n= 176):

Types of chemotherapy	No. of patients				
	Male	Male %	Female	Female %	Total %
Adjuvant	13	20%	40	36.03%	30.11%
Neo – adjuvant	4	6.15%	5	4.50%	5.11%
Palliative	47	72.30%	64	57.65%	63.06%
salvage	1	1.53%	2	1.80%	1.70%

Fig 4. Percentage distribution of gender based on type of chemotherapy.

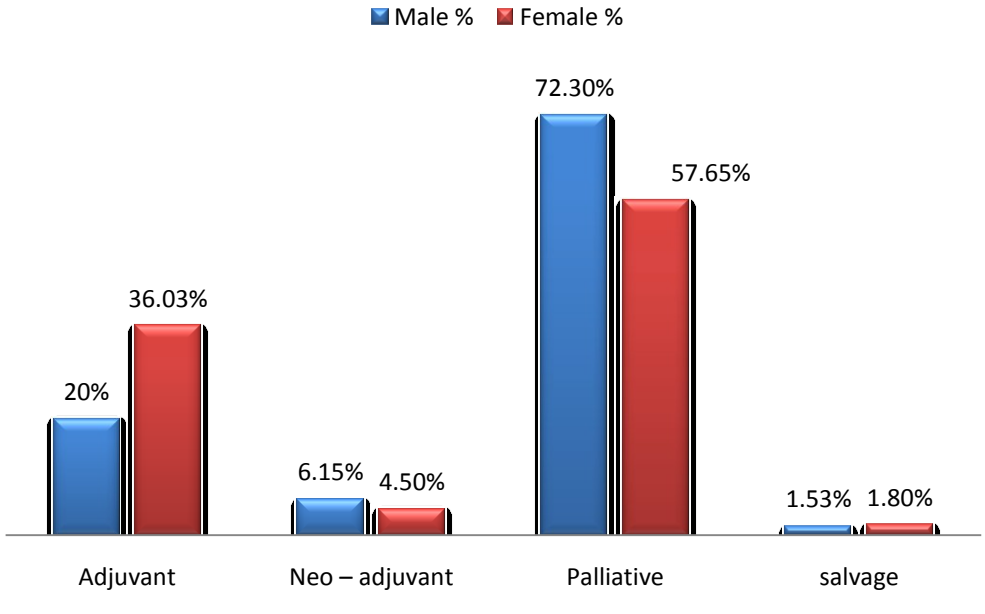


Table 4A. Distribution of cancers based on gender (n= 176):

S. No	cancer	Gender					
		Males	Male%	Females	Female%	Total	Total%
1.	Ca. Breast	0	0%	43	100%	43	24.43%
2.	Ca. Buccal mucosa	3	60%	2	40%	5	2.84%
3.	Ca. Cervix	0	0%	16	100%	16	9.09%
4.	CLL	4	80%	1	20%	5	2.85%

5.	Ca. Stomach	5	71.42%	2	28.57%	7	3.97%
6.	Ca. Partoid	1	100%	0	0%	1	0.56%
7.	Ca. Pancreas	3	100%	0	0%	3	1.70%
8.	Multiple Myeloma	2	50%	2	50%	4	2.27%
9.	Ca. Ovary	0	0%	16	100%	16	9.09%
10.	Iliac Sarcoma	2	100%	0	0%	2	1.13%
11.	Hepatic Carcinoma	1	33.33	2	66.66%	3	1.70%
12.	Non – Hodgkin Lymphoma	4	100%	0	0%	4	2.27%
13.	Ca. Tongue	2	50%	2	50%	4	2.27%
14.	Cholangio Carcoma	1	100%	0	0%	1	0.56%
15.	Hodgkins Lymphoma	4	100%	0	0%	4	2.27%
16.	Ca. Lung	7	70%	3	30%	10	5.68%
17.	Ca. Puryform Fossa	0	0%	1	100%	1	0.56%
18.	Ca. Colon	2	100%	0	0%	2	1.13%
19.	Ca. Rectum	3	100%	0	0%	3	1.70%
20.	Ca. Galbladder	0	0%	1	100%	1	0.56%
21.	Ca. Oesophagus	1	33.33%	2	66.66%	3	1.70%
22.	Ca. Prostate	1	100%	0	0%	1	0.56%
23.	DLBCL	0	0%	1	100%	1	0.56%
24.	Ewings Sarcoma	1	100%	0	0%	1	0.56%
25.	Pleuomorphic Sarcoma	0	0%	3	100%	3	1.70%

Table 4B. Distribution of cancers based on gender (n= 176):

S. No	cancer	Gender					
		Males	Male%	Females	Female%	Total	Total%
26.	Molar Pregnancy	0	0%	2	100%	2	1.13%
27.	Osteosarcoma	1	50%	1	50%	2	1.13%
28.	Non – Small cell carcinoma of Lung (NSCCL)	6	85.71	1	14.28	7	3.97%
29.	Ca. Vault	0	0%	5	100%	5	2.84%
30.	Alveolar Carinoma	0	0%	1	100%	1	0.56%
31.	Ca. Chest Wall	1	100%	0	0%	1	0.56%
32.	Dysgeminoma Cancer	0	0%	1	100%	1	0.56%
33.	Germ cell Tumour Seminoma	1	100%	0	0%	1	0.56%
34.	Oropharyngeal Carcinoma	1	100%	0	0%	1	0.56%
35.	Penis Cancer	1	100%	0	0%	1	0.56%
36.	Testicular Carcinoma	2	100%	0	0%	2	1.13%

37.	T – Cell Lymphoma	1	100%	0	0%	1	0.56%
38.	Ca. Periampulary	0	0%	1	100%	1	0.56%
39.	Synovial Carcinoma	1	100%	0	0%	1	0.56%
40.	Medulla Blstoma Sarcoma	0	0%	1	100%	1	0.56%
41.	Cholangio Sarcoma	1	100%	0	0%	1	0.56%
42.	Illiac Chondro Sarcoma	1	100%	0	0%	1	0.56%
43.	Ca. Caecum	1	50%	1	50%	2	1.13%
Total		65		111		176	

Table 5. Assessment of knowledge score in cancer patients (n= 176):

S.No	Knowledge score Questionnaires	Right Response	Right response Frequency %	Wrong Response	Wrong response Frequency %
1.	Meaning of chemotherapy	156	**88.63%**	20	**11.36%**
2.	Meaning of pre medication for chemotherapy	101	**57.38%**	75	**42.61%**
3.	Meaning of low count measures	96	**54.54%**	80	**45.45%**
4.	Measure to manage when you feel fatigue	85	**48.29%**	91	**51.70%**
5.	Measure to manage hair loss	112	**63.63%**	64	**36.36%**
6.	Measure to manage nausea and vomiting	160	**90.90%**	16	**9.09%**
7.	Measure to manage diarrhea	123	**69.88%**	53	**30.11%**
8.	Measure to manage constipation	99	**56.25%**	77	**43.75%**
9.	Measure to manage burning micturation.	22	**12.5%**	154	**87.5%**
10.	Measure to manage Myalgia	57	**32.38%**	119	**67.61%**
11.	Measure to manage Insomnia	86	**48.86%**	90	**51.13%**
12.	Measure to manage Vertigo	75	**42.61%**	101	**57.38%**
13.	Measure to manage loss of appetites	49	**27.84%**	127	**72.15%**
14.	Measure to manage skin rashes	36	**20.45%**	140	**79.54%**
15.	Measure to manage fever	160	**90.90%**	16	**9.09%**
16.	Chemotherapy side effects at home you usually manage	96	**54.54%**	80	**45.45%**

Table 5. Assessment of knowledge score in cancer patients (n= 176):

Fig 5. Percentage distribution of cancer types.

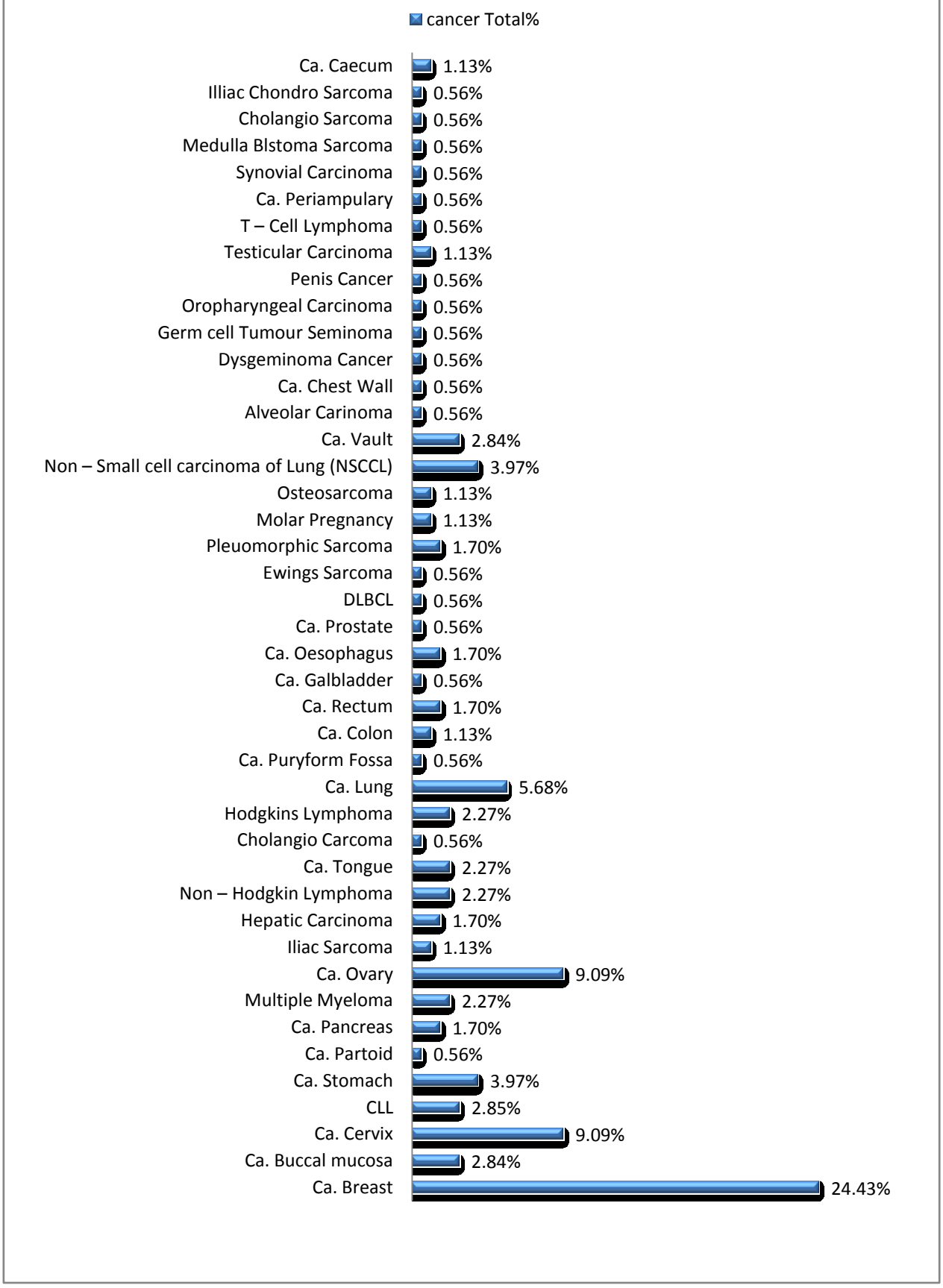


Fig 6. Percentage distribution of assessment of knowledge score study in cancer patients.

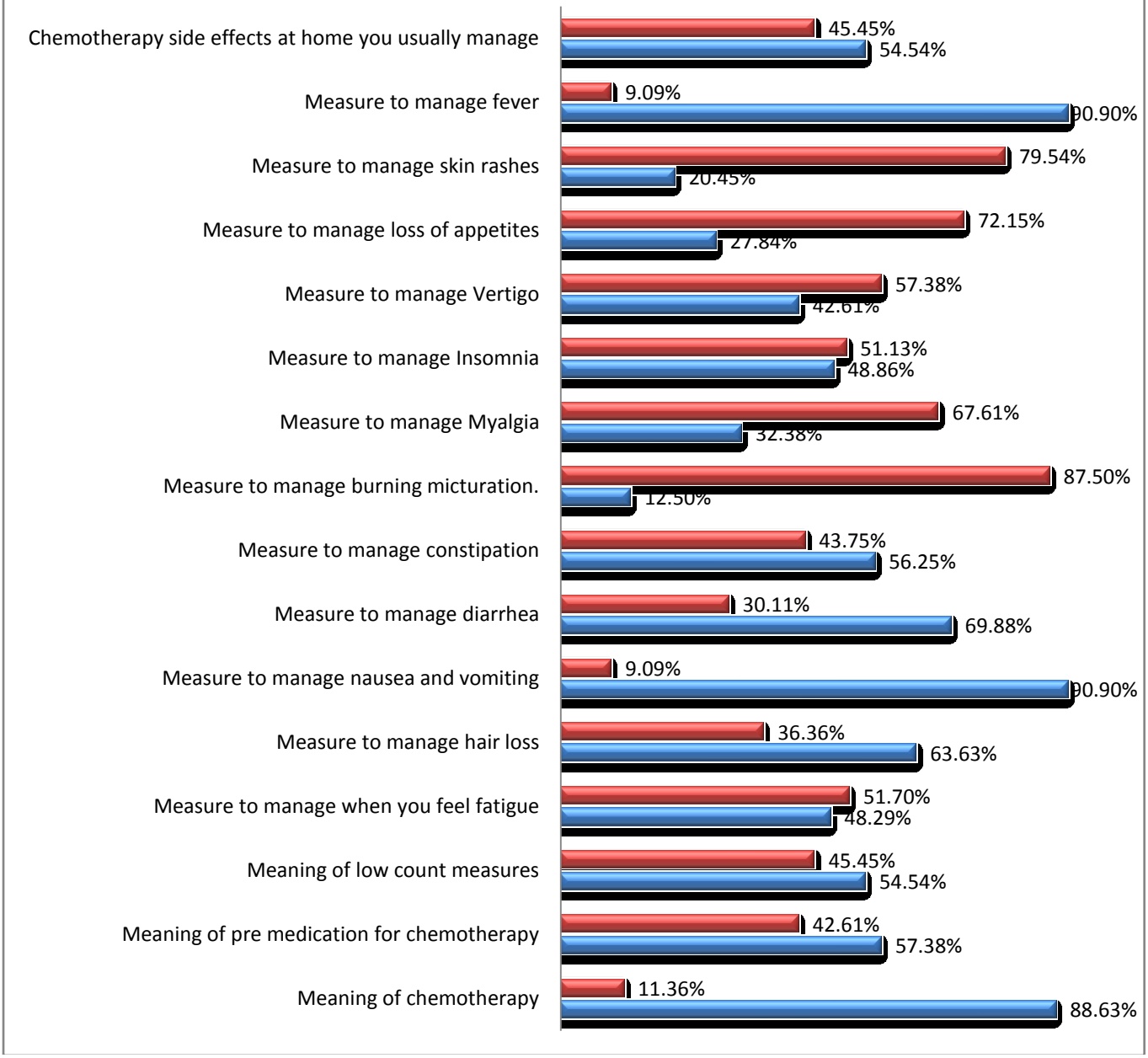


Table 6. Grading of knowledge score in cancer patients (n=176):

Knowledge	Poor (0- 5 Right Responses)	Poor Frequency %	Average (6-10 Right Responses)	Average Frequency %	Good (11-15 Right Responses)	Good Frequency %
Score	44	**25%**	110	**62.5%**	22	**12.5%**

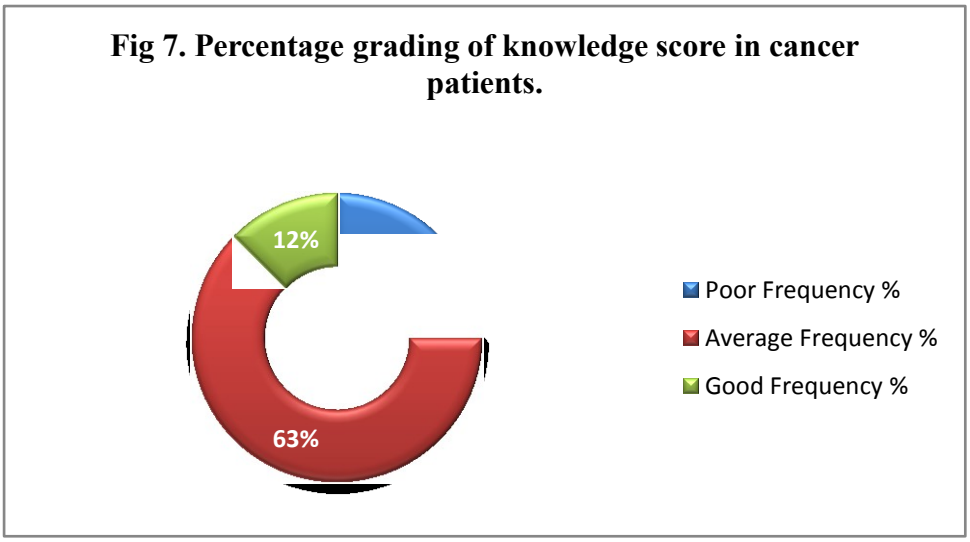
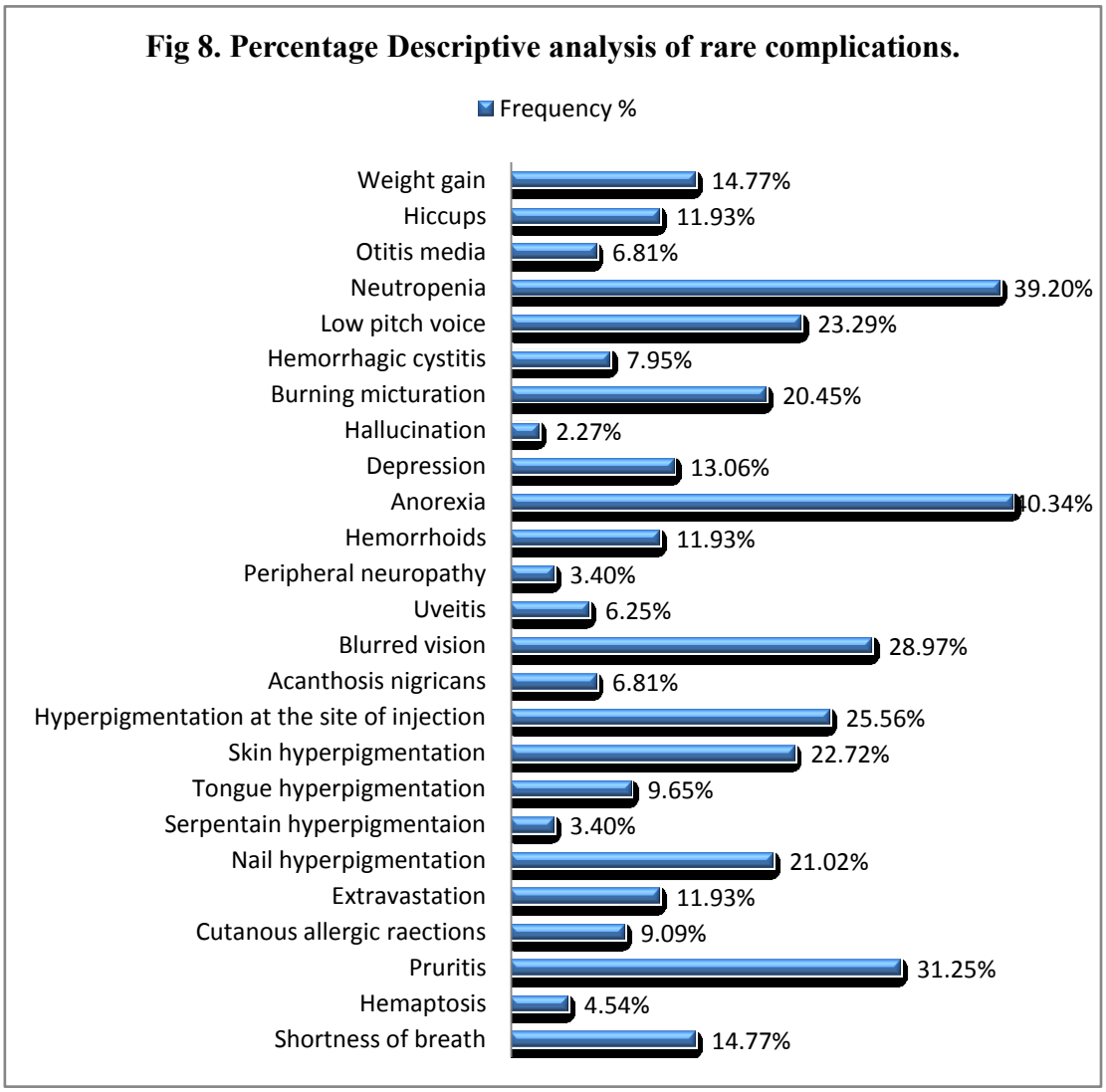


Table 7. DESCRIPTIVE ANALYSIS OF RARE COMPLICATIONS BASED ON CATEGORY (N=176):

S.No	Category	Complications	Frequency	Frequency %
1.	Pulmonological	Shortness of breath	26	14.77%
		Hemaptosis	8	4.54%
2.	Dermatological	Pruritis	55	31.25%
		Cutanous allergic raections	16	9.09%
		Extravastation	21	11.93%
		Nail hyperpigmentation	37	21.02%
		Serpentain hyperpigmentaion	6	3.40%
		Tongue hyperpigmentation	17	9.65%
		Skin hyperpigmentation	40	22.72%
		Hyperpigmentation at the site of injection	45	25.56%
		Acanthosis nigricans	12	6.81%
3.	Ophthalmological	Blurred vision	51	28.97%
		Uveitis	11	6.25%
4.	Neurological	Peripheral neuropathy	6	3.40%
5.	Gastro intestinal	Hemorrhoids	21	11.93%
		Anorexia	71	40.34%
6.	Psychological	Depression	23	13.06%
		Hallucination	4	2.27%
7.	Urological	Burning micturation	36	20.45%
		Hemorrhagic cystitis	14	7.95%
8.	Miscellaneous	Low pitch voice	41	23.29%
		Neutropenia	69	39.20%
		Otitis media	12	6.81%
		Hiccups	21	11.93%
		Weight gain	26	14.77%



DISCUSSION

To our knowledge, this was the first study that descriptively described the chemotherapy-induced complications experiences of local cancer patients. This was also the first study in **Guntur** that assessed the knowledge score on chemotherapy and its complications. Therapeutic strategies for cancer continue to evolve, and chemotherapy regimens continue to play important roles in cancer treatment[8]. Recently, a new class of antiemetic agents has been developed. Through ongoing observations, we found that they were generally from low socioeconomic backgrounds with relatively low income. Hair loss was always rated highly when ranking the severity of chemotherapy side effects [12].

As shown in **fig 9,** we observed alopecia in most of the patients. Alopecia was reported with adriamycin, paclitaxel, and gemcitabine + carboplatin. As shown in **fig 10,** serpentain supravenous hyperpigmentation in 6 (3.40%) patients, it was partially irreversible, it is seen in patients receiving therapy with adriamycin, cyclophosphamide and docetaxel and also in combinational regimens. As shown in **fig 11,** nail pigmentation in 37 (21.02%) patients, it is completely reversible, it is seen in patients receiving therapy with 5-FU, Adriamycin, cyclophosphamide, etoposide, oxaliplatine and docetaxel and also in combinational regimens. As sown in **fig 12.** We observed most of the patients with systemic and limbic edematous condition.

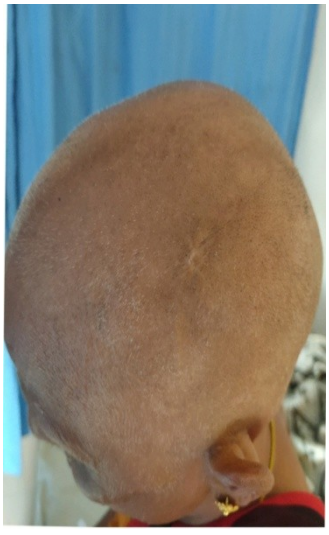


Fig 9. Alopecia

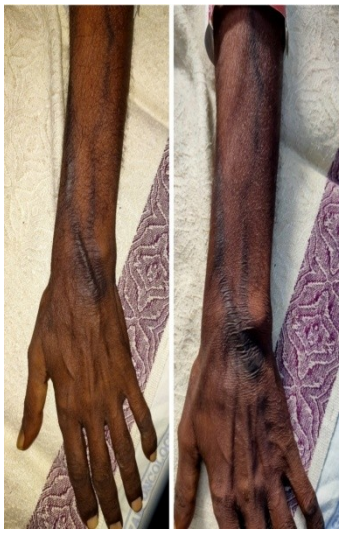
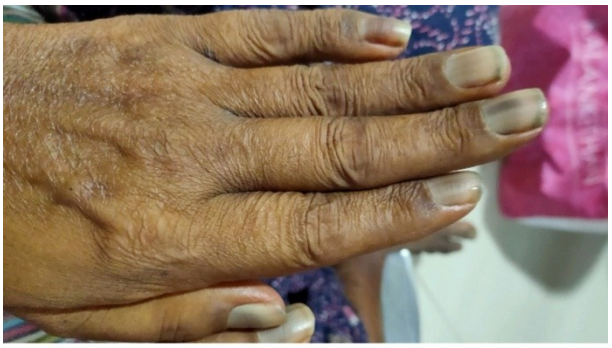


Fig10. Serpentain hyperpigmentation



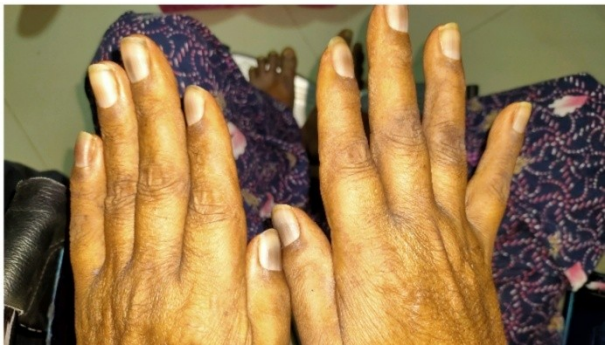


Fig 11. Nail Pigmentation

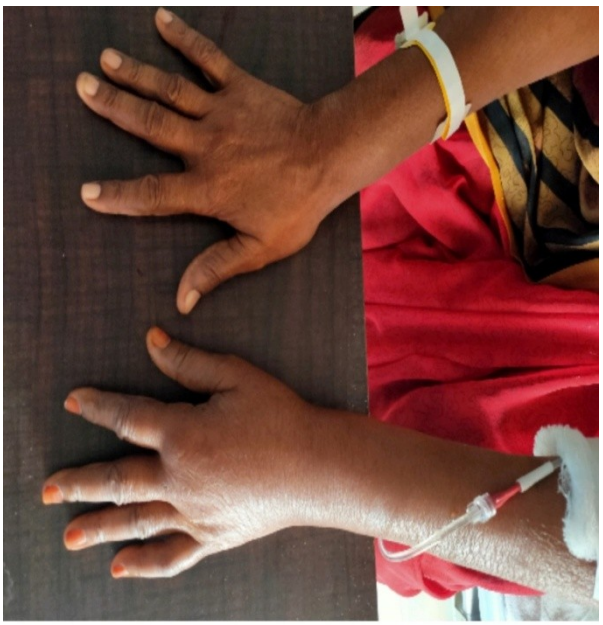


Fig 12. Edema

The NK-1 receptor antagonist aprepitant, when combined with 5-HT3 receptor antagonist and dexamethasone, are linked to a significant reduction in acute and delayed emesis in patients administered platinum-based regimens[5].

TOXICITY OF CHEMOTHERAPY

The extent of toxicity upon normal tissues seems to be correlated to the dose of the anti-neoplastic drug used, and it is also related to the frequency of the agent's administration. Many drugs target rapidly proliferating cells; however, they have the same action upon rapidly proliferating normal tissues such as bone marrow, intestinal mucosa, oral mucosa, hair follicles, and gonads[6].

- The GIT side effects of cancer chemotherapy are also common and can be both distressing and potentially fatal for patient.
- Oral and GIT Mucositis may cause local ulceration and pain, which it may leads to anorexia, malabsorption, weight loss, anemia, fatigue and increased risk of sepsis.
- Central and peripheral neurotoxicity caused anti-cancer drugs can dramatically reduced functional capacity and quality of life in cancer survivors [7].
- **Impact of side effects of chemotherapy:** the most traumatic side effect is hair loss, the 2nd most traumatic side effect is fatigue and other were nail changes and nausea/ vomiting
- **Regrowth of scalp hair:** 98% of patients respond to the regrowth of hair.
  99.9% of patients explained hair loss in breast cancer patients. Hair loss due to chemotherapy was been thought to, generally, be completely reversible.
- **Eye brows and eye lashes:** 90% of hair fells out among the cancer patients.
- **Nails:** severe/ moderate finger nails changes in 78% of patients, toenails changes in 64% of patients.

General side effects of chemotherapy

There are more than 100 different chemotherapy drugs which cause different general side effects such as

1. Bone marrow suppression, (leucopenia appears the 10th day of the chemotherapeutic course while thrombocytopenia after 10-14 days),
2. Anemia (not a common adverse effect of chemotherapy),
3. Alopecia (common manifestation of chemotherapy).

Cardio toxicity (commonly observed after chemotherapy) (associated with both older and newer therapies which may lead to:

1. Left ventricular impairment or congestive heart failure (CHF),
2. Hypertension.
3. Thrombo-embolism,
4. Pericardial thickening or cardiac arrhythmias.

Neurologic complications: neurotoxicity after chemotherapy includes

1. seizures,
2. peripheral and cranial neuropathy,
3. Myelopathy,
4. Aseptic meningitis,
5. Cerebellar syndrome,
6. Stroke and
7. Encephalitis.
8. Chemotherapy-induced peripheral neuropathy (CIPN).

Neurotoxicity can appear in up to 97% of patients treated with oxaliplatin, which is manifested in an acute or chronic form. There are several types of drugs that cause neurotoxicity. These drugs are:

- DNA alkylating agents (platinum derivatives such as cisplatin, carboplatin, and oxaliplatin),
- Microtubule-targeting (taxanes such as docetaxel and paclitaxel, epothilones such as ixabepilone),
- Vinca alkaloids such as vincristine and podophyllin analogs) and
- Other drugs such as proteasome inhibitors.

Other side effects are:

1. Defects in spermatogenesis (frequently observed in chemotherapy),
2. Nausea and vomiting (two of the most frequent side effects of chemotherapy),
3. Fatigue (common symptom present during chemotherapy),
4. Diarrhea,
5. Reactivation of hepatitis-B,[6]

Miscellaneous Drug-Specific Toxicities [15]:

1. **Hemorrhagic Cystitis Induced by Cyclophosphamide or Ifosfamide**: Patients receiving cyclophosphamide must maintain **a high fluid intake** prior to and following the administration of the drug and be counseled to empty their bladders frequently. Early symptoms suggesting bladder toxicity include dysuria and increased frequency of urination. Should microscopic hematuria develop, it is advisable to stop the drug temporarily or switch to a different alkylating agent, to increase fluid intake, and to administer a urinary analgesic such as **phenazopyridine.** The neutralizing agent, **mesna**, can be used for patients in whom cystitis develops. With severe cystitis, large segments of bladder mucosa may be shed, resulting in prolonged gross hematuria. Such patients should be observed for signs of urinary obstruction and may require cystoscopy for removal of obstructing blood clots. The cyclophosphamide analog ifosfamide can cause severe hemorrhagic cystitis when used alone. However, when its use is followed by a series of doses of the neutralizing agent mesna, bladder toxicity can be prevented.
2. **Peripheral Neuropathy Due to Vinca Alkaloids** and Other Chemotherapy Drugs: Neuropathy is caused by a number of different chemotherapy drugs, the most common being vincristine. The peripheral neuropathy can be sensory, motor, autonomic, or a combination of these types. In its mildest form, it consists of paresthesias of the fingers and toes. Occasionally, acute jaw or throat pain can develop as a form of trigeminal or glossopharyngeal neuralgia. With continued vincristine therapy, the paresthesias extend to the proximal interphalangeal joints, hyporeflexia appears in the lower extremities, and significant weakness can develop. Other drugs in the vinca alkaloid class as well as the taxane drugs (docetaxel and paclitaxel) and agents to treat myeloma (bortezomib and thalidomide) cause similar toxicity. The presence of neurologic symptoms was not in itself a reason to stop therapy; the severity of the symptoms must be balanced against the goals of therapy. Usually, though, the development of moderate to severe paresthesias or motor impairment results in the decision to discontinue the drug. Constipation is the most common symptom of autonomic neuropathy associated with the vinca alkaloids. Patients receiving these drugs should be started on mild cathartics and other agents; otherwise, severe impaction may result from an atonic bowel. More serious autonomic involvement can lead to acute intestinal obstruction with signs indistinguishable from those of an acute abdomen. Bladder neuropathies are uncommon but may be severe. These two complications are absolute contraindications to continued vincristine therapy.
   Therapies targeting oncogenesis pathways include
   - HER2 inhibitors (lapatinib, pertuzumab, trastuzumab);
   - VEGF signaling pathway inhibitors (afilbercept, axitinib, bevacizumab, carozantinib, lenvatinib, pazopanib, ramucirumab, regorafenib, sorafenib, sunitinib, vandertanib);
   - multitargeted tyrosine kinase inhibitors (dasatinib, nilotinib, ponatinib);
   - proteasome inhibitors (bortezomib, carfilzomib); and
   - immune checkpoint inhibitors (ipilimumab, nivolumab, pembrolizumab).

   Many of the pathways targeted by these drugs share a common biologic pathway in cardiac tissue. Untoward cardiac events are being increasingly reported with these agents, including arrhythmias, cardiac ischemia, myocarditis, thrombosis, and heart failure. It was important to carefully monitor patients on these drugs and aggressively manage any modifiable cardiac risk factors (smoking, hyperlipidemia, diabetes mellitus and sedentary lifestyle).
3. **Cisplatin nephrotoxicity** and Neurotoxicity: Cisplatin is effective in treating testicular, bladder, head and neck, lung, and ovarian cancers. With cisplatin, the serious side effects of nephrotoxicity and neurotoxicity must be anticipated and aggressively managed. Patients must be vigorously hydrated prior to, during, and after cisplatin administration. Both kidney function and electrolytes must be monitored. Low serum magnesium, potassium, and sodium levels can develop. The neurotoxicity is usually manifested as a peripheral neuropathy of mixed sensorimotor type and may be associated with painful paresthesias. Development of neuropathy typically occurs after cumulative doses of 300 mg/m2. Ototoxicity was a potentially serious manifestation of neurotoxicity and can progress to deafness. **Amifostine**, given intravenously at a dose of 910 mg/m2 over 15 minutes prior to cisplatin, is used to protect against nephrotoxicity and neuropathy. Use of amifostine does not appear to compromise its antineoplastic effect. The second-generation platinum analog, carboplatin, was non-nephrotoxic, although it was myelosuppressive. In the setting of preexisting kidney disease or neuropathy, carboplatin was occasionally substituted for cisplatin.

Preventive Strategies

Cardio toxicity could be life threatening, and thus several attempts have been made to attenuate and minimize such toxicity induced by chemotherapy, Clinical practice suggests close monitoring and evaluation of patient risks for developing complications after treatment. Early detection and immediate proper medication could reverse the condition in time that minimizes cardio toxicity with some changes in molecular structures, including:

- Epirubicin, Idarubicin, and Mitoxantrone, have been developed and became another appealing alternative as studies in cancer patients showed comparable drug efficacy with lower **cardiotoxicity** to **conventional.**
- Liposomal DOX is another strategy to reduce the drug toxicity as encapsulating DOX was restricted to the site with tight capillary junction like in the heart's wall, while readily penetrating through the more fragile tumor vasculature.
- Dexrazoxane was the only FDA-approved cardioprotective agent against cardiotoxicity induced by anthracyclines. Due to the potential risk of developing secondary tumors and interfering effect of dexrazoxane towards anticancer activity,
- Dexrazoxane clinical use is limited only to some certain groups of patients, namely, adult patients with breast cancer who have received cumulative dose of at least 300mg/m2 doxorubicin or 540mg/m2 epirubicin[11].
- Some of the side effects of chemotherapy have a specific pharmacological basis. Haemorrhagic cystitis with cyclophosphamide is a consequence of urinary excretion of the irritant metabolites, e.g. acrolein.
- Maintaining a high-fluid output can prevent this or by giving the drug MESNA (mercaptoethone sulphonate) that conjugates these metabolites to promote safe excretion[14].
- Therapy with G-CSF was associated with faster bone marrow recovery, with a significant negative correlation between G-CSF and duration of neutropenia. Likewise, reported a significant shortening of CIN and FN, as well as of the mean duration of hospitalization. These advantages have been documented by other researchers. A recent study on urological cancer patients reported a good outcome when G-CSF was administered[8].
- For alopecia, it was suggested in the study 24, the cooling technique of use of the scalp. It was effective in 52% of cases, contributed to the improvement of well-being and quality of life[9].
- Use of zolpidem, a hypnotic agent, improves sleep and quality of life of breast cancer survivors with hot flashes associated with sleep disorder, but treatments for sleep may be important to improve strategies to improve well-being[9].
- To alleviate hot flashes, studies encouraging use of a variety of drugs including clonidine, gabapentin, inhibitors of serotonin and norepinephrine selective. SGB (Stellate ganglion block) has emerged as a new technique to reduce this toxicity. Other alternatives include hormone replacement therapy. The authors emphasize the option to use hormones only for patients in post menopause with breast cancer with hormone receptor positive[9].
- This has led to the development of a new class of antiemetic agents, such as aprepitant, an antagonist of the neurokinin-1 (NK-1) receptor.
- The addition of aprepitant to 5-HT3 receptor antagonist and dexamethasone in cisplatin-based chemotherapy markedly reduces acute and delayed emesis. This three-drug combination has also been investigated, with favorable results, in patients receiving a combination of an anthracycline and cyclophosphamide based regimen, and these studies were funded by pharmaceutical companies[13].

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CONCLUSION:

In this study had revealed some of the chemotherapy-induced complications experienced by local cancer patients. Though these symptoms have been well characterized, their high prevalence and impact on patients' QOL and psychosocial aspects were of concern. Clinical Pharmacists were well-accepted as patient educators in this aspect. In fact, findings of patients' perceptions and informational needs may serve as a valuable guide for clinical pharmacists to help in side effect management. In this study out of 176 respondents on knowledge on management of chemotherapy related side effects more than half of the respondents had average knowledge on management of side effects of chemotherapy. As we know **prevention is better than cure,** so prophylactic therapy has to be implemented to achieve better therapeutic out comes.

CONFLICTS OF INTEREST: None declared.

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