https://doi.org/ 10.33472/AFJBS.6.10.2024.5369-5378

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

DRUG UTILIZATION PATTERN AND COST ANALYSIS OF PRESCRIPTIONS OF CANCER PATIENTS

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Article History
Volume 6,Issue 10, 2024
Received:29 Apr 2024
Accepted : 29 May 2024
doi: 10.33472/AFJBS.6.10.2024.5369-5378

ABSTRACT

Background: Cancer remains a significant global health challenge, with India adding approximately one million new cases annually. The rising prevalence necessitates effective management strategies, including the appropriate utilization of chemotherapeutic agents.

Aim: This study aims to evaluate the drug utilization patterns and perform a cost analysis of prescriptions in cancer patients at a tertiary care teaching hospital in Jaipur, India.

Methodology: A cross-sectional study was conducted over 18 months, involving 237 cancer patients admitted to the medical oncology department. The study assessed demographic details, clinical characteristics, drug utilization patterns, and cost analysis of prescriptions. WHO drug prescribing indicators were used to evaluate the rationality of prescriptions. Data were analyzed using descriptive statistics.

Results: The study included 237 patients with a mean age of 53.62 years. The majority were male (62%), and the most common age group was 51-60 years. Gastrointestinal cancers were the most prevalent, followed by respiratory and female reproductive cancers. Platinum coordination complexes were the most frequently prescribed drugs (29.7%), followed by Taxanes (15.4%) and Anti-metabolites (12.8%). The average number of drugs per prescription was 7.89, with 82% prescribed by generic names. Injections were used in 98% of cases, and 62% of prescriptions included drugs from the National Essential Medicine List. The mean cost of chemotherapy per prescription was Rs 36,255, with targeted therapies being the most expensive.

Conclusion: The study highlights importance of monitoring the drug utilisation studies regularly which will help in updating the treatment protocols with new therapies coming, provide rational and, cost effective management of the cancer patients. This will further reduce irrational use of anti-cancer drugs.

Keywords: Cancer, Drug Utilization, Chemotherapy, Cost Analysis, platinum coordination complexes

INTRODUCTION

Cancer is an incurable disease that has a major impact on human life globally. In India every year a million fresh cases are added to the cancer prevalence. With such high rates of incidence, it has become one of the leading non-communicable diseases. As per Global Cancer Observatory data, there were an estimated 20.0 million new cancer cases worldwide and 9.7 million deaths due to cancer in the year 2022.[1] Cancer has the characteristic potential to invade or spread to any part of the body and is characterized by abnormal cell growth.[2]

Management of cancer can be done by various approaches, majority of them include, surgery, radiotherapy, chemotherapy, immunotherapy, and hormonal therapy. Chemotherapy is an important part of cancer management. The main aim of chemotherapy is to 'cure' the disease, prolong the survival of cancer patients and provide them with the highest possible quality of life.[3] Anti-cancer drugs are mostly given in combination and are administered with other drugs to prevent side effects occurring due to chemotherapy regimens.

Chemotherapeutic agents are almost always observed for having adverse effects and toxicities, and their irrational use can precipitate the same factors, including an increase in morbidity and mortality of cancer patients. Therefore, timely, and correct diagnosis for cancer management is much needed to cure the disease at an early stage. All these aspects make drug utilization studies play a vital role in anti-cancer therapy.

In today's world where drugs are a major part of management of patients in hospitals, genuine and appropriate use of drugs by health care professionals is very necessary. This accounts for importance of drug utilization studies all over the world. Drug utilization studies started in 1960s but it caught attention during a symposium on drug toxicology organized by WHO (World Health Organization) in Moscow in 1964.[4] WHO defined drug utilization studies as 'marketing, distribution, prescription and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences.' (WHO, 2003) [5]

Interventions are required at many levels to increase drug utilization studies in cancer patients, due to advancement in the pathophysiology of cancer and the introduction newer drugs.[6] Monitoring the drug utilization studies regularly will update the treatment protocols with new therapies which would provide rational and, cost effective management option to cancer patients. This will help to reduce irrational use of anti-cancer drugs and improve the therapeutic efficacy of drugs.

It must be borne in mind that the process of initiating chemotherapy is a complex task since it involves huge costs and imposes severe economic burden on the patient. In an environment where medical management costs are hitting the roof and still escalating day by day, pharmacoeconomic studies are required which would help healthcare workers in providing cost-effective regimens. Pharmacoeconomic studies identify, measure, and compare the cost and consequences of pharmaceutical products and services.[7] The cancer chemotherapy practice can be improvised by introducing cost-controlling SOPs and new systemic interventions which may be helpful to increase the quality of patient care. Cancer has become a major economic burden for the country. Therefore, cost analysis studies are a prerequisite for anti-cancer agents used in cancer patients.

As the prescribing pattern of anti-cancer agents is developing every day and new therapies are coming for improving cancer management, drug utilization studies are now promoted in almost all countries, including India. In this regard, training, awareness programs, or campaigns regarding drug utilization studies should be extensively carried out, to promote rational and evidence-based use of medicine. Regardless of so many encouraging advances, many cancers are incurable till date. Increased prevalence of cancer results in high healthcare expenditure and chemotherapy drugs are a considerable share of total cancer related expenditure. [8] Drug utilization studies and cost distribution analysis are important for healthcare professionals for prescribing anti-cancer agents, as it gives a spotlight on major areas of assessing optimal drug use with cost effectiveness.[9]

Taking into consideration, the importance of drug utilization studies and pharmacoeconomic studies in cancer patients, the present study was conducted to assess drug utilization pattern of anti-cancer drug at a tertiary care teaching hospital.

MATERIALS AND METHODS

STUDY DESIGN:

A cross-sectional study was conducted for 18 months at a tertiary care hospital in Jaipur to evaluate drug utilization pattern and cost analysis of prescriptions of cancer patients. The study was commenced after obtaining approval from the Institutional Ethics Committee.

SAMPLE SIZE:

Considering the prevalence of cancer in Rajasthan to be 5.67% [10] and absolute error of 3%, the sample size comes out to be 237, thus 237 cancer patients admitted in medical oncology department during the study period and, meeting the following inclusion and exclusion criteria were included in the study.

INCLUSION CRITERIA:

- Patients aged >18years of either sex
- All cancer patients admitted in the oncology department during the study period.
- Patients on at least one anti-cancer drug.

EXCLUSION CRITERIA:

- Patients not willing to give informed written consent.
- Pregnant and lactating females.
- Patients whose prescriptions were not reliable and have insufficient data.
- Patients who underwent surgical and radiotherapy treatment only

METHODOLOGY:

The study was started after taking approval from institutional ethics committee. The participants were explained about the entire study procedure and an informed written consent was obtained. All the required prescribing details from eligible patients, were recorded in a specially designed Performa. The information included demographic details, clinical details, and details of drug therapy of cancer patients. Rationality of prescriptions was analyzed using WHO drug prescribing indicators.[11] Cost analysis of prescriptions was done based on pharmacy bills.

STATISTICAL ANALYSIS:

The collected data like demographic details, clinical variables and drug details were analyzed using descriptive statistics in terms of frequency and percentage. WHO drug prescribing indicators were compiled at the end of the study to analyze number of prescriptions for polypharmacy, percent of prescriptions with injectables, percent of prescriptions with antibiotics, percent of drugs prescribed with generic name and percent of drugs prescribed from National essential medicine list.[12] Costs of the prescriptions on cancer patients were expressed as mean±SD.

RESULTS

A total of 237 prescriptions were studied from the department of medical oncology. Study population was selected according to the inclusion and exclusion criteria defined for the study. The collected prescriptions were studied for demographic details, clinical details, details of drug therapy and WHO core drug prescribing indicators.

Age & gender wise distribution of cancer

In this study, the mean age of cancer patients was 53.62 ±14.96 years, with the highest being 87 years and lowest 18 years with 147 (62%) males and 90 (38%) females as study participants. Maximum 73 (30.8%) cases of cancer were found in 51- 60 years age group, followed by 61-70 years age 60 (25.32%) as shown in figure 1.

FIGURE 1: Bar diagram showing age and gender-wise distribution of cancer

Drug utilization pattern of anticancer drugs prescribed

In this study, Platinum coordination complex [146 (29.7%)] were main modality of treatment among cancer patients followed by Taxanes [76 (15.4%)] and Anti-metabolites drugs [63 (12.8%)]. Cytotoxic drugs [58 (11.8%), Topoisomerase inhibitors [46 (9.3%)] and Alkylating agents [45 (9.1%)] were also used for treating cancers. A detailed classification of anticancer drugs used for treating study participants is depicted in Figure 2.

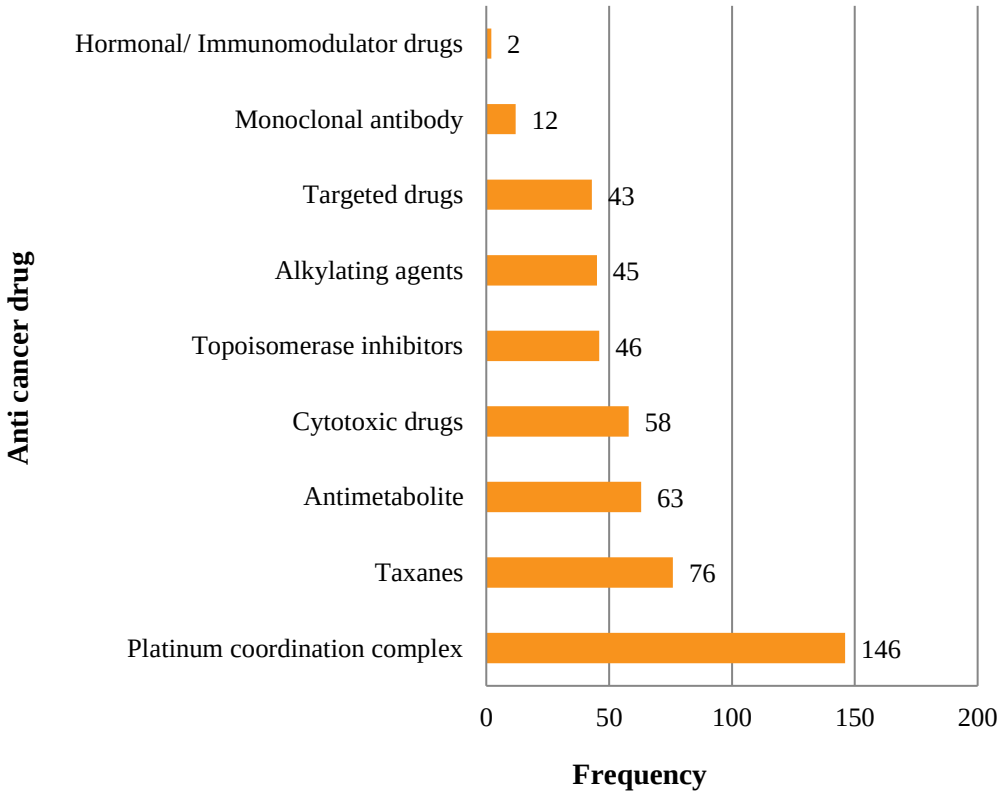

FIGURE 2: Drug utilization pattern of anti-cancer drugs

Pattern of Utilization of anti-cancer drug regimens, in commonly occurring cancers

A variety of anticancer drugs were used to treat different types of cancer as depicted in Table 1.

TABLE 1: Anti-cancer drug regimens used in different types of cancers

Type of cancer	Treatment	No of patients (n=237)	Percentage
Lung cancer	Etoposide + Carboplatin	21	8.86
	Paclitaxel + Carboplatin	12	5.06
NHL	Rituximab + Bendamustine	12	5.06
	Vincristine + Cyclophosphamide + Rituximab	9	3.80
Ovary cancer	Paclitaxel + Carboplatin	10	4.22
	Bleomycin + Etoposide + Cisplatin	7	2.95
Stomach	Docetaxel + Oxaliplatin + 5FU	11	4.64
Breast cancer	Gemcitabine + Carboplatin	10	4.22
	Adriamycin + Cyclophosphamide	5	2.11
Buccal cancer	Docetaxel + Cisplatin + 5FU	10	4.22
	Paclitaxel + Cisplatin	1	0.42
Renal	Nivolumab + Iplimumab	4	1.69

Adjuvant drug therapies prescribed with anti-cancer drugs

Figure 3 shows that crystalloid fluid [228 (16.5%)], dexamethasone [227 (16.4%)], antihistaminic drugs [226 (16.3%)] were main adjuvant drugs used along with anticancer drugs among cancer patients.

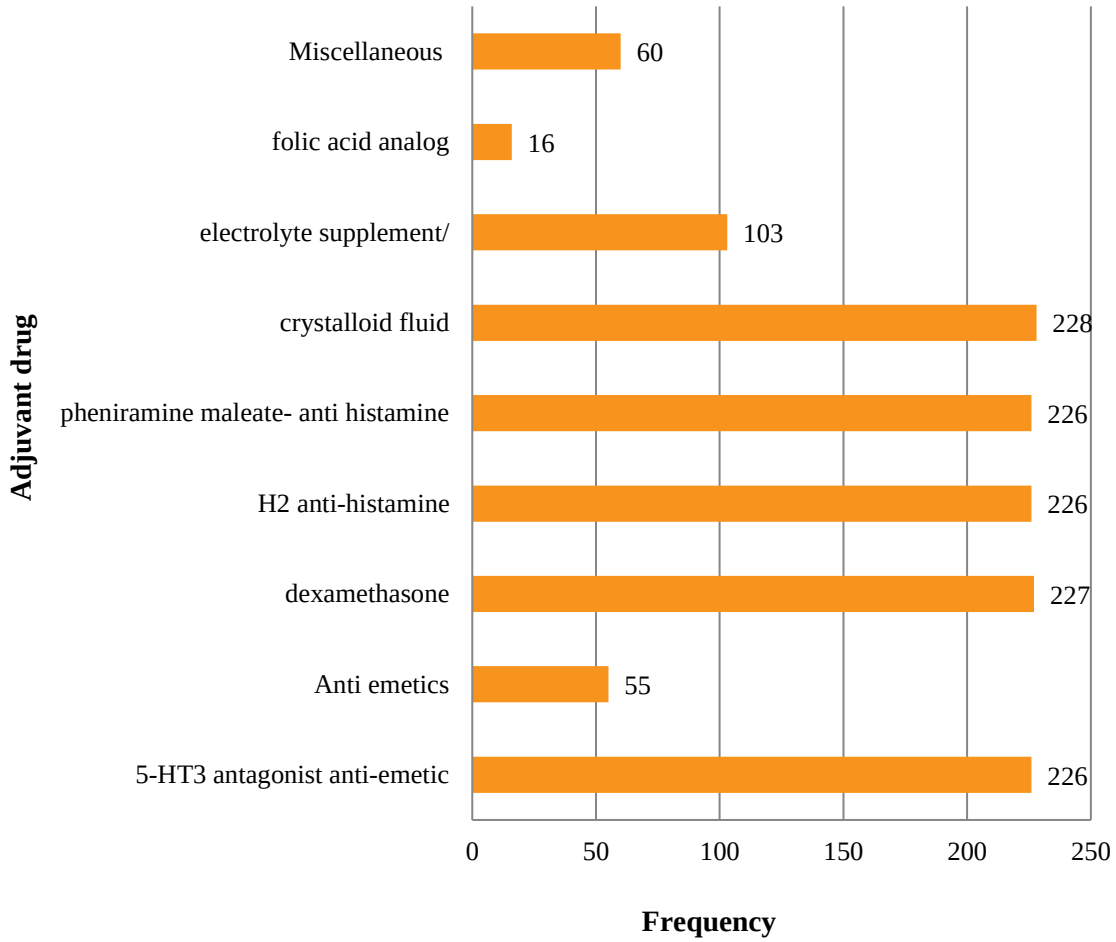

FIGURE 3: Adjuvant drug utilization pattern among cancer patients

WHO Drug prescribing indicators

Table 2 portrays the analysis done based on WHO drug prescribing indicators. The average number of drugs per prescription were 7.89 while 82% of prescriptions were having drugs prescribed by their generic names. 98% of patients encountered injectable therapy while 62% of prescription were having drugs prescribed from National essential medicine list 2018.

TABLE 2: WHO Core drug prescribing indicators

Indicator	Frequency	Percentage
Average number of drugs per encounter	Mean – 7.89	
Percentage of drug prescribed by generic name	194	82 %
Percentage of encounters with an antibiotic	0	0 %
Percentage of encounters with an injection	232	98 %
Percentage of drug from essential medicine list	147	62 %

Cost of treatment according to per prescription

The Mean cost of chemotherapy was Rs 36,255 ±74,330 with maximum Rs 4,76,201 & minimum Rs 1,877. Targeted therapy in form of Monoclonal antibodies were the most expensive

(Rs 2,22,933) and cytotoxic drugs being the lowest in cost analysis. Table 3 shows cost of chemotherapy regimens prescribed, based on per day therapy. This table reveals that targeted therapy drugs prescribed in renal cancer are of highest cost in the present study, resulting in high cost of the regimen for renal cancer patients. Next highest cost is of the regimen prescribed to NHL patients, Rituximab + Bendamustine. Bleomycin + Etoposide + Cisplatin, regimen is of the lowest cost, prescribed to the patients of ovary cancer.

Table 3: According to types of cancer,
Cost of Chemotherapy Regimens prescribed (per day)

Type of cancer	Treatment	Cost of Drugs (Rs)	Cost of Regimen (per day) (Rs)
Lung cancer	Etoposide + Carboplatin	150+2333	2,483
	Paclitaxel + Carboplatin	7408+2333	9,741
NHL	Rituximab + Bendamustine	68246+39902	1,08,148
	Vincristine + Cyclophosphamide + Rituximab	80+156+68246	68,482
Ovary cancer	Paclitaxel + Carboplatin	7408+4666	12,074
	Bleomycin + Etoposide + Cisplatin	1308+150+316	1,774
Stomach	Docetaxel + Oxaliplatin + 5FU	2500+2510+428	5,438
Breast cancer	Gemcitabine + Carboplatin	10320+2333	12,653
	Adriamycin + Cyclophosphamide	2622+99	2,721
Buccal cancer	Docetaxel + Cisplatin + 5FU	2756+316+428	3,500
	Paclitaxel + Cisplatin	10334+948	11,282
Renal	Nivolumab + Iplimumab	238800+125000	3,63,800

DISCUSSION

Drug utilization studies are encouraged to a greater degree in all health care sectors, to update the knowledge of clinicians for new advances in chemotherapy regimens, to treat the cancer patients effectively. The availability and utilization of anti-cancer drugs are mainly influenced by their cost, especially in developing countries like India. However, due to lack of information on comparative drug prices and quality, situation for physician becomes difficult to prescribe the most economical treatment. The present study was aimed to analyze the drug utilization review and cost analysis of anticancer drugs used in a tertiary care teaching hospital.

237 cancer prescriptions were analyzed in the oncology department. In our study, it was observed that there were a greater number of males (147, 62%). The incidence of cancer rate (both males and females) was more in the age group of 51-60 years (73, 30.8%). Some studies showed female predominance and, others had male predominance like our study. [13,14,9] A study conducted in Hyderabad had 36.8% of cancer patients from 56-60 years of age group. [13]

Out of 39 types of cancer detected in present study, involving 11 body systems, GI cancer (26 %) was more prevalent, followed by respiratory cancer (14 %) and female reproductive cancer (13 %). In males, lung cancer (26, 17.6%) was most prevalent followed by NHL (11, 7.4%), buccal mucosa (11, 7.4%), and stomach cancer (10, 6.8%), whereas in females ovary cancer was most prevalent (16, 17.7%) followed by breast cancer (14, 15.5%) and NHL (10, 11.1%). Our results are in line with a study where Gastrointestinal tract cancers (25%) were most observed, followed by breast cancer (18.5 %) and genitourinary cancers (16.5%).[9] Another study found head and neck cancer (46.7%) to be more common followed by gastrointestinal cancer (24.1%) and reproductive system (14.51%) cancer.[13] In the state of Rajasthan, cancers of lip, oral cavity and pharynx, respiratory and intrathoracic organs, digestive organs, lymphoid, hematopoietic, and related tissues and genital organs are common cancers in male and breasts, genital organs, digestive organs, and benign neoplasm are leading cancers in female.[15]

Our observation concludes that the maximum patient i.e. 208 (88%) received multiple-drug chemotherapy, while the remaining 29 (12%) including, cancer patients of endometrium cancer (6), pancreatic cancer (4) and prostate cancer (4) patients had received single drug chemotherapy. Another study done in Mangalore showed that 87 out of 200 subjects received single drug chemotherapy, while in one more study had 65.2% patients' receiving multiple-drug chemotherapy. [9,13]

Platinum coordination complex for example cisplatin (146, 29.7%) was the main modality of treatment among cancer patients followed by Taxanes (76, 15.4%) and anti-metabolic drugs (63, 12.8%). This observation is in line with a study published in India by Dave et al which concludes that cisplatin (18.5 %) is commonly used chemotherapy in cancer patients.[16] Similar study found platinum compounds (64.58%) were the main class of cytotoxic drug prescribed in their patients followed by carboplatin and oxaliplatin drugs (20.65% and 5.43% respectively).[13] Another study found cytotoxic drugs (90 %) as the most prescribed drugs for their cancer patients while hormonal (1.4 %) and other drugs (1.4 %) were the least commonly prescribed. In the present study also, the least prescribed drugs were hormonal agents and immune modulator agents.[9] Etoposide + Carboplatin (21) was the regimen used for lung cancer in the present study, while in other the study Carboplatin + Paclitaxel is prescribed for the management of lung cancer.[13]

In the present study, antihistaminic drugs (226, 16.3%), 5 HT3 antagonist anti-emetics (226, 16.3%), dexamethasone (227, 16.4%), and, crystalloid fluid (228, 16.5%) were main adjuvant drugs used along with anticancer treatment. While 682 adjuvant drugs were given to 144 study samples in a study done in Karnataka, in which the antiemetics were the most prescribed drugs accounting for 21.54% of total adjuvant drugs followed by drugs to reduce acidity (20.8%). [13]

In our study on the grounds of indicators, the average number of drugs per prescription was 7.89, a lower number of drugs per prescription was found in other study and it was 6.01 drugs per prescription, one more study manifested a higher number of drugs prescribed per prescription in comparison to our study, which was 9.63. [13,17] Prescribing anti-cancer agents in combination for better management of the disease and administering adjuvant drugs for preventing adverse effects of anti-cancer drugs, gives the picture of polypharmacy but can be easily justified.

82% of prescriptions were having drugs prescribed by their generic names. In a study done with 144 sample size, percentage of drugs ordered by the generic name was 76.7%.[13] One more study show a higher number of drugs prescribed by generic name (93%) as compared to our study. [17]

According to WHO core drug prescribing indicators, 98% of prescriptions had encounters with an injection or parenteral route of drug administration, which was 75.5% in another study.[17] Antibiotics are only prescribed when needed according to the clinical condition of the patients, so they are very less in percentage in our study, proving no unnecessary usage of antibiotics.

In our study, 62% of prescriptions were having drugs prescribed from the essential medicine list which was slightly lower than the percentage of drugs prescribed by some other studies who had scores of 88.4% and 82.2%.[17,13]

In the current study, the mean cost of chemotherapy was Rs 36,255, which goes from a maximum of Rs 4,76,201 to a minimum of Rs 1,877. According to another similar study, the unit cost of inpatient chemotherapy on an average was calculated to be Rs 5725.12 per patient per bed day.[18] The study revealed that regimens used for renal cancer nivolumab+iplimumab, to be of highest cost. Further few studies revealed that trastuzumab contributed to the major cost in drug therapy (Rs. 4,50,000), followed by paclitaxel (Rs. 4,07,898).[9]

CONCLUSION

In conclusion, cancer prevalence was found more in males with maximum number of patients from age group 51-60 years. Most of the cancers were diagnosed to be from gastrointestinal system. Platinum coordination complex were main modality of treatment among cancer patients followed by Taxanes and Anti metabolic drugs. The most commonly used adjuvant drugs in our study were antihistaminic drugs, 5-HT3 antagonists, dexamethasone and crystalloid fluids. The study concluded that prescribing habits were appropriate and in accordance with WHO guidelines.

There was need to adhere more to national essential medicine drug list. WHO promotes that more drug utilization studies are needed in every health care setting to assess and assure the rational drug use. The study revealed that the average cost of anticancer therapy is very high, and showing maximum in our study to be Rs 4,76,201. Therefore, cost analysis for anticancer drugs is essential among healthcare professionals in order to highlight the importance of assessing optimal drug use with cost effectiveness.

ACKNOWLEDGMENTS

We would like to express our sincere gratitude to all those who have contributed to the successful completion of this research. We are particularly grateful to our academic mentors and colleagues for their invaluable guidance and insightful feedback. Our appreciation also extends to department of oncology for providing the primary details required for the study.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

FUNDING SOURCE

The study received no grants.

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