ANALYSIS OF COST VARIATION OF ANTI-CANCER DRUGS

Prasan R. Bhandari

Department of Pharmacology, SDM College of Medical Sciences & Hospital, Dharwad, Karnataka

ABSTRACT:

Introduction: Indian pharmaceutical industry being one of the largest pharmaceutical markets in the world has a large number of branded formulations and generic brands of the same drug with a large difference in their selling price. The study was planned to find out variation in cost of anti-cancer drugs

Methods: Information was sourced from NETMED MOBILE APP. The drug formulation being manufactured by only one company or being manufactured by different companies; however, in different strengths would be excluded. Difference in the maximum and minimum price of the same drug formulation manufactured by different pharmaceutical companies and percentage variation in price would be calculated.

Results: The maximum cost variation in the alkylating agents group was seen with Oxaliplatin 50mg/10ml (71.43%). In the antimetabolite group the maximum cost variation was seen in Gemicitabine 1000mg (357.67%). 68.7% cost variation was observed with Paclitaxel 30mg/5ml in the antimitotic natural products group. Doxorubicin 10mg/5ml showed the maximum cost variation in the cytotoxic antibiotic group as well amongst all the anticancer drugs. Within the targeted group imatinib 400mg showed the maximum cost variation i.e 505.20%.

Conclusion: Thus, this study highlights that there is a significant price difference among the anti-cancer drugs manufactured by different companies. Hence stringent measures should be brought into implementation by the government and concerned agencies for uniformity in drug pricing.

Keywords: Cost-Analysis, Anti-cancer; Analysis

INTRODUCTION

Cancer is a major health problem responsible for 9% of deaths worldwide. In developed countries like USA, 25% of deaths are related to some form of cancer [1], whereas in India there are 2-2.5 million cases of cancer at any point of time and 0.7 to 0.9 million new cases are being detected every year and approximately half of these cases die [2]. Like in any other country, cancer consumes a major portion of health budget in India also.

Generally, anti-cancer drugs are costlier than any other category of drugs and they substantially contribute to the growing drug expenditure by the patients [3]. There are many causes for the high cost of anti-cancer drugs like high cost of drug development [4],

virtual monopoly [5], lack of reduction of cost even after generic versions are available [6], lack of threshold for clinical benefits [7], incentive for more chemotherapy [8] and also the sheer seriousness of the disease as many cancers except the early stage cancers, testicular cancer, and certain blood cancers, are incurable and patients willing to pay any amount of money to get the latest drugs [9].

In developed countries, where a system of medical insurance is in place, it may not be a concern but in developing countries like India, where the medical insurance is only in an emerging stage, affordability to anti-cancer drugs becomes a major concern [10]. The compliance of the patient also significantly depends on the cost of the prescribed medicines [11] and higher cost means a decreased compliance.

Pharmaceutical market in India has over 20,000 medicine formulations [12] and majority of them are sold under brand names [13]. Indian markets are flooded with a huge number of anti-cancer drugs and the same drugs are sold under different brands [14] which puts the prescribing physicians in a difficult state to choose the best drug for a given patient.

Information generated from cost analysis studies will be helpful both for the doctors in choosing the correct medicine for their patients and also for policy makers in successfully utilizing the meager resources that are available [15]. A comprehensive search in various databases and internet would be done for the study to analyze the variation of prices among anti-cancer drugs in the Indian market.

MATERIALS AND METHODS

1. Initially it was decided that the price in INR of anti-cancer drugs manufactured by different pharmaceutical companies in India, in the same strength would be obtained from "Current Index of Medical Specialties".

2. However, after scanning some similar literature it was observed that one of the major limitations of such studies was that, sources of information were limited to CIMS. But there are few other brands which are marketed in India but not published in the above-mentioned source.

3. Hence going by the explosion of online pharmacies it was decided to obtain the information from these sources. They would provide the current prices.

4. After scouting numerous online pharmacies and drug price webpages of India such as medguideindia, netpharmacy, 1mg.com, medicineindia, drug, drugtodayonlineindia.com, CIMS (online version); it was personally observed that the ease of obtaining the data was best with netmeds app. One could filter the prices of medicines as desired from low to high or vice versa. One could even remove the out of stock medicines.

5. Hence the information was sourced from NETMED MOBILE APP.

6. The drug formulation being manufactured by only one company or being manufactured by different companies; however, in different strengths would be excluded.

7. Cost of the anti-cancer drug formulation would be calculated for an average of 1 UNIT (tablets / CAPSULES).

8. Difference in the maximum and minimum price of the same drug formulation manufactured by different pharmaceutical companies and percentage variation in price would be calculated.

9. Percentage cost variation would be calculated as follows:

% Cost variation = $\underline{\text{Maximum cost - Minimum cost} \times 100}$

Minimum cost

10. The cost ratio i.e. the ratio between the maximum and minimum cost of the same generic anti-cancer drug would be calculated as follows:

Cost ratio =   Maximum cost / Minimum cost

STATISTICAL ANALYSIS

The findings of our observational study would be expressed as absolute numbers and percentages.

RESULTS

As seen in Table 1, Figure 1-3, the maximum cost variation in the alkylating agents group was seen with Oxaliplatin 50mg/10ml (71.43%).

In the antimetabolite group the maximum cost variation was seen in Gemicitabine 1000mg (357.67%) table 1, Figure 4-5.

68.7% cost variation was observed with Paclitaxel 30mg/5ml in the antimitotic natural products group Table1 , Figure 6,7.

Doxorubicin 10mg/5ml showed the maximum cost variation in the cytotoxic antibiotic group as well amongst all the anticancer drugs. Table 1, Figure 8,9.

Within the targeted group imatinib 400mg showed the maximum cost variation i.e 505.20%.Table 1, Figure 10,11.

TABLE 1: MAXIMUM PRICE, MINIMUM PRICE, COST RATIO's AND COST VARIATION IN ANTICANCER DRUGS

DRUG	MAXIMUM PRICE INR	MINIMUM PRICE INR	COST RATIO = MAXIMUM PRICE/MINIMUM PRICE	COST VARIATION = MAXIMUM PRICE - MINIMUM PRICE/MINIMUM PRICE * 100
ALKYLATING AGENTS				
Cyclosporine 500mg	76	75	1.01	1.33
Ifosphamide 2gm + Mesna 100mg	1217	1017	1.20	19.67
Cisplatin 50 mg	350	316	1.11	10.76
Cisplatin 10 mg	89	63	1.41	41.27
Oxaliplatin 50mg/10ml	3312	1932	1.71	71.43
Oxaliplatin 100mg/20ml	6726	4800	1.40	40.13
Oxaliplatin 100mg/50ml	4300	3500	1.23	22.86
Carboplatin 450mg/45ml	2802	2222	1.26	26.10
ANTIMETABOLITES				
Methotrexate 5mg	82	33	2.48	148.48
Methotrexate 7.5mg	114	44	2.59	159.09
Cytarabine 15mg/10ml	1241	1107	1.12	12.10
Gemicitabine 200mg	1512	777	1.95	94.59
Gemicitabine 1000mg	6920	1512	4.58	357.67
ANTIMITOTIC NATURAL PRODUCTS				
Vincristine 1mg/ml	57	51	1.12	11.76
Vinorelbine 10mg/ml	3299	2700	1.22	22.19
Vinolelbine 50mg/5ml	16900	11700	1.44	44.44

Paclitaxel 30mg/5 ml	1746	1035	1.69	68.70
CYTOTOXIC ANTIBIOTICS				
Doxorubicin 10 mg/5 ml	4425	206	21.48	2048.06
Doxorubicin 20mg/10 ml	49275	20490	2.40	140.48
Mitomycin 40mg/unit	2620	2168	1.21	20.85
TARGETED AGENTS				
Imatinib 100 mg	1015	413	2.46	145.76
Imatinib 400 mg	3026	500	6.05	505.20
Geftinib 250 mg	4402	1158	3.80	280.14
Sorafenib 20mg	8880	1881	4.72	372.09
Rituximab 100 mg/10 ml	8500	5300	1.60	60.38
Rituximab 500 mg/50 ml	101110	30285	3.34	233.86
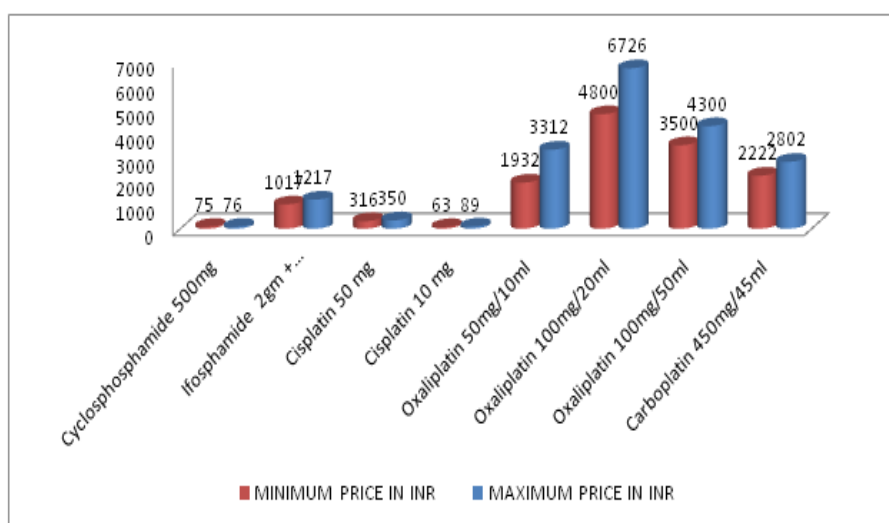
FIGURE 1: DIFFERENCE IN MAXIMUM AND MINIMUM PRICE OF ALKYLATING AGENTS
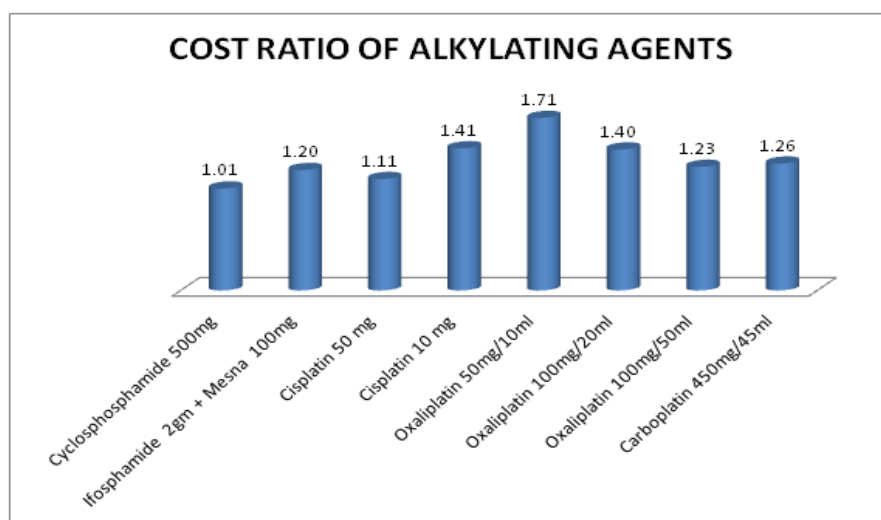

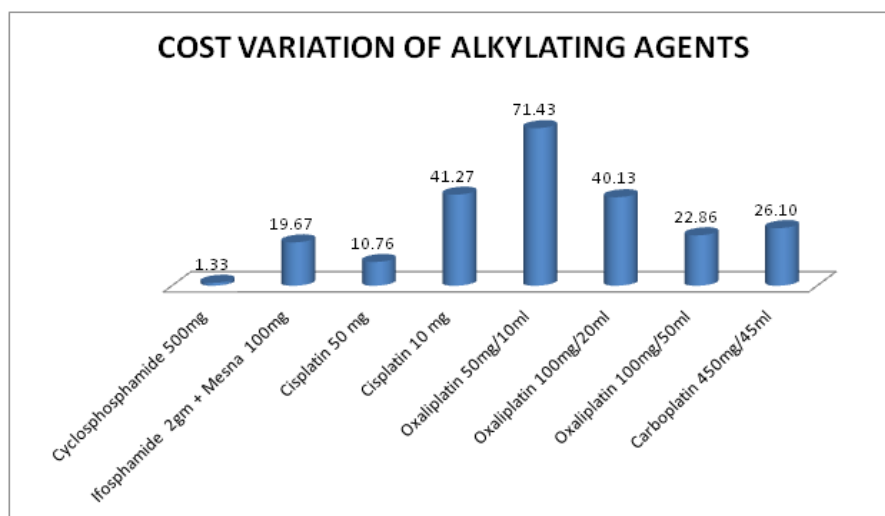**FIGURE 2: COST RATIO OF ALKYLATING AGENTS**
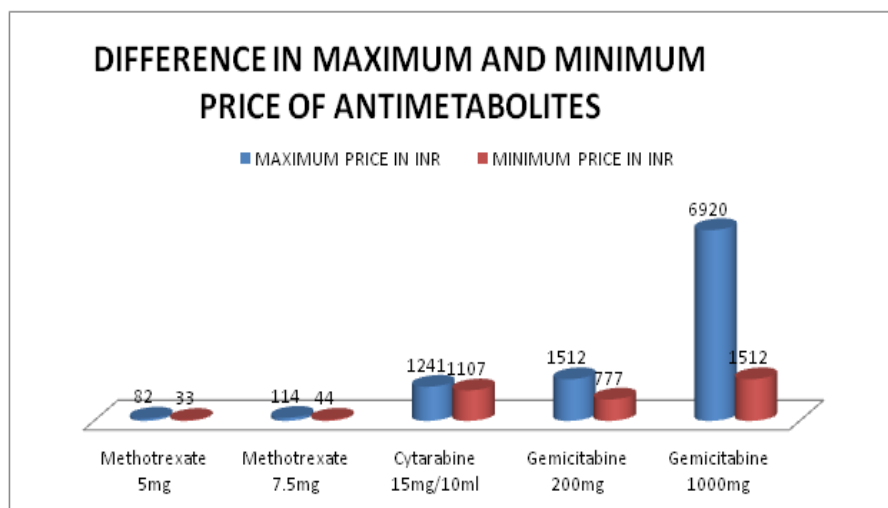
COST VARIATION OF ALKYLATING AGENTS

FIGURE 3: COST VARIATION OF ALKYLATING AGENTS

DIFFERENCE IN MAXIMUM AND MINIMUM PRICE OF ANTIMETABOLITES

FIGURE 4: DIFFERENCE IN MAXIMUM AND MINIMUM PRICE OF ANTIMETABOLITES

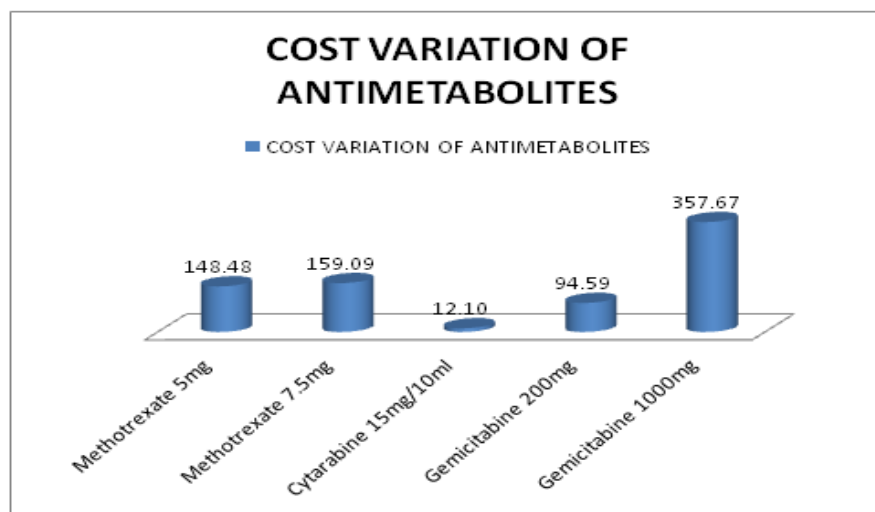## COST VARIATION OF ANTIMETABOLITES

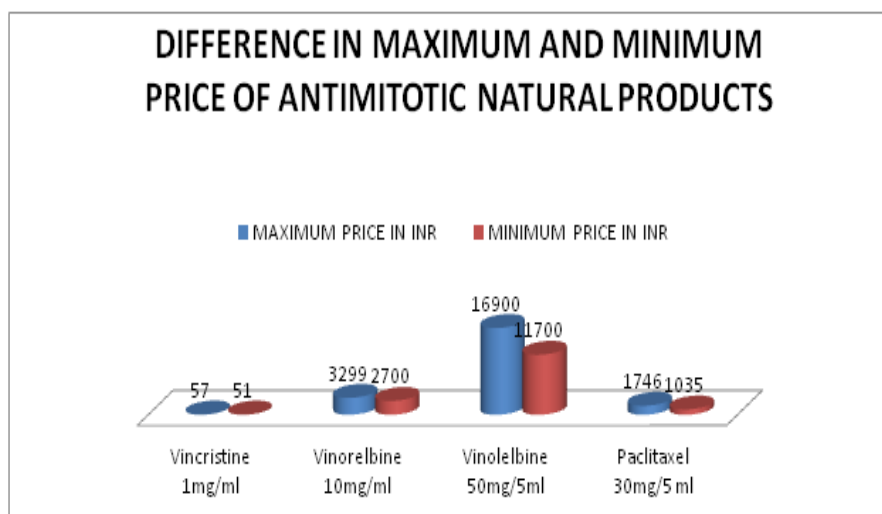**FIGURE 5: COST VARIATION OF ANTIMETABOLITES**

FIGURE 6: DIFFERENCE IN MAXIMUM AND MINIMUM PRICE OF ANTIMITOTIC NATURAL PRODUCTS
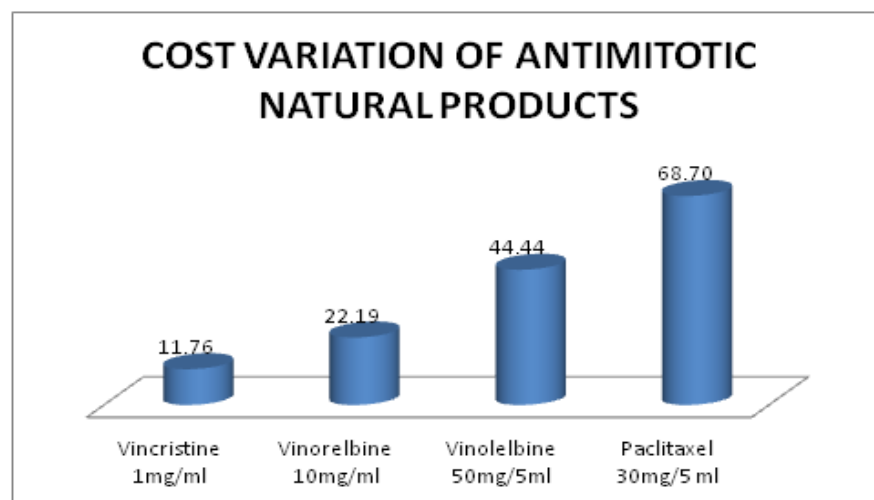

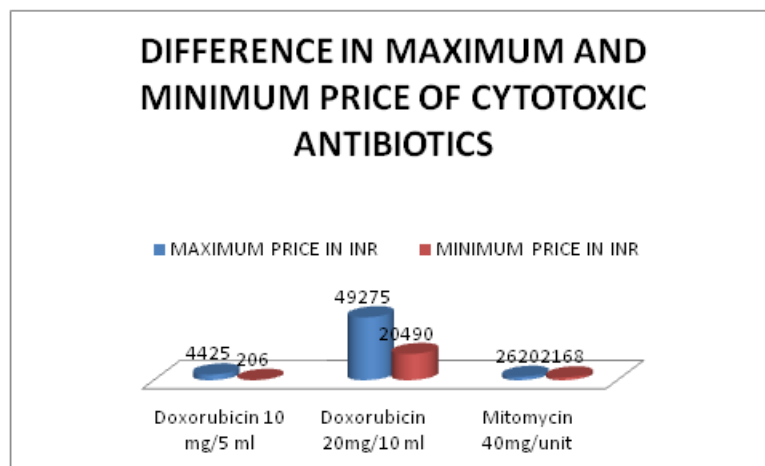**FIGURE 7: COST VARIATION OF ANTIMITOTIC NATURAL PRODUCTS**

FIGURE 8: DIFFERENCE IN MAXIMUM AND MINIMUM PRICE OF CYTOTOXIC ANTIBIOTICS
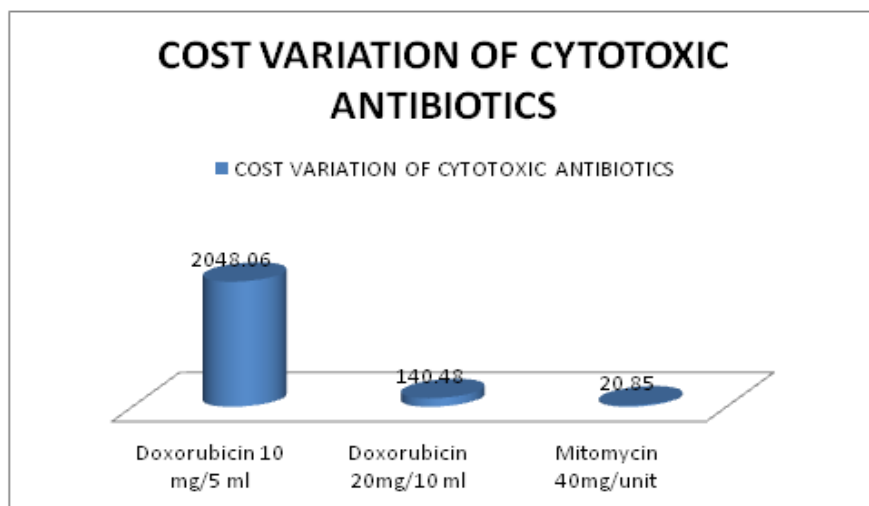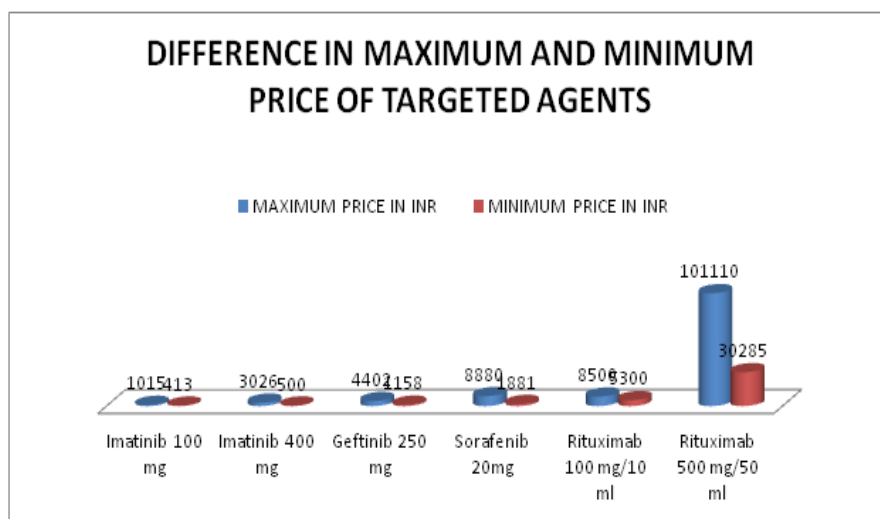
FIGURE 9: COST VARIATION IN CYTOTOXIC ANTIBIOTICS

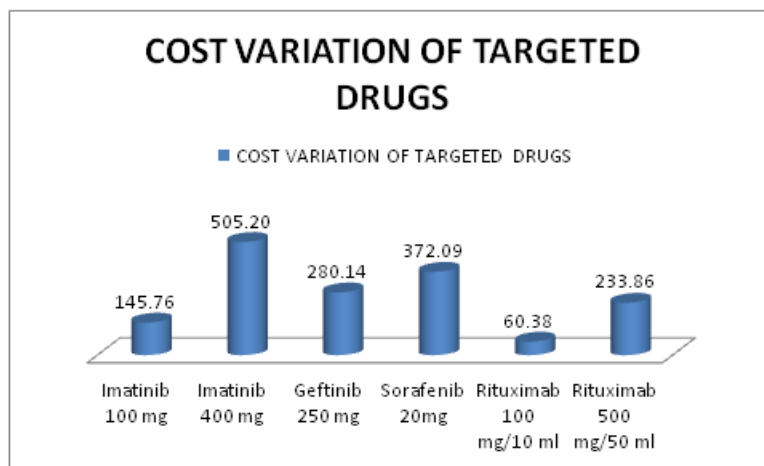**FIGURE 10: DIFFERENCE IN MAXIMUM AND MINIMUM PRICE OF TARGETED AGENTS**

FIGURE 11: COST VARIATION OF TARGETED DRUGS

DISCUSSION

The present study showed a very high variation in the maximum and minimum price of anti-cancer agents. The percentage variation in the cost was above 100% with most of the drugs and there is substantial variation in the cost of different brands of same anticancer agents in Indian market which is consistent with the results from previous studies.

Medication compliance is more important in such disorders and the cost of the prescribed drugs is one of the factors which decide drug compliance.[16,17]

Higher medication costs is one of the major reason for medication non-adherence which has been associated with adverse health outcomes such as treatment failure. This results in progression of the disorder thus enhances the medical care costs considerably. Prescribing physicians should pay attention to the drug prices in a country like India wherea huge percentage of patients are paying themselves for their medical bills and are not covered by insurance schemes.

Health insurance in India principally covers hospitalization and not out-patient or domiciliary care. Out-patient healthcare spending in India has augmented by almost fifty percent in the last 10 years. Hence there is an pressing need to create awareness to the health care providers about cost variation and its associated consequences.

It has been observed that doctors have suboptimal awareness of drug cost. In such situation if costly brands are prescribed patients has to pay unnecessarily more money and that creates an economic burden and can affect the compliance on the patient counterpart. The situation can be improved if drug cost is given greater emphasis during medical training program of doctors.

Presently, a limited number of drugs are under drug prices control order. Government should get higher number of drugs under price control. Drug Price Control Order (DPCO) and the National Pharmaceutical Pricing Authority (NPPA) are effective tools for regulation of drug prices. [18,19]

Even in economically strong counties like US, the issue of drug cost variation and high costs of anti-cancer drugs is extremely predominant. It was demonstrated that generic docetaxel had the lowest costs and cost/outcome however other drugs like abiraterone, enzalutamide and cabazitaxel were overpriced for their values. Siddique M et al., suggested that high cost of generic cancer drugs also are the problems present in developed countries too. Mailankody S et al., evaluated that price of cancer drugs is independent of novelty and current pricing models are not rational. Vogler S et al., too mentions that the price of new cancer drugs varies widely from 28% to 388% between high-income countries. Interventions or changes in policies can help in lowering the cost of anti-cancer drug. These include breaking the monopoly in anti-cancer drug manufacturers, altering the regulatory guidelines by government agencies in favour of manufacturers with economical anti-cancer drugs and making the new anti-cancer drug approvals faster, increasing the cost effectiveness ratio of anti-cancer drugs. Additionally, achieving a balance between physician autonomy in prescribing anti-cancer drugs and costs incurred by patients too would benefit. Encourage non-profit generic companies by giving them tax incentives and other measures, value based reimbursement by medical insurance companies and bringing more anti-cancer drugs under DPCO. [20].

CONCLUSION

Thus, this study highlights that there is a significant price difference among the anticancer drugs manufactured by different companies. Hence stringent measures should be brought into implementation by the government and concerned agencies for uniformity in drug pricing.

Self expenditure unfavorably disturbs the drug compliance in the long run. There must be a wide-ranging action from policymakers, regulatory authorities, government agencies, doctors, pharmacists, and the general public to solve this issue of cost variation of drug.

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