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RESEARCH ARTICLE

Cost variation analysis of various brands of anticoagulants, fibrinolytics, and antiplatelet drugs currently available in Indian pharmaceutical market

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ABSTRACT

Background: Cardiovascular disease is both highly prevalent and expensive to treat. Many novel anticoagulants, fibrinolytics, and antiplatelet agents have been found to be effective in decreasing the morbidity and mortality associated with cardiovascular disease. In the Indian market, there is large variation in the prices of anticoagulants, fibrinolytics, and antiplatelet drugs marketed in India. **Aims and Objectives:** Thus, a study was conducted to find out the variation in cost in the anticoagulants, fibrinolytics, and antiplatelet drugs available in India and to evaluate the difference in cost of various brands of the same anticoagulants, fibrinolytics, and antiplatelet drugs by calculating percentage variation in cost. **Materials and Methods:** Cost of a particular drug in the same strength and dosage forms being manufactured by different companies was obtained from "current index of medical specialties" January to April 2017 edition. Minimum and maximum price of anticoagulants, fibrinolytics, and antiplatelet drugs manufactured by different pharmaceutical companies, and percentage cost variation was calculated. **Results:** The cost of anticoagulants, fibrinolytics, and antiplatelet drugs by different companies was different. The highest percentage of cost variation was for tablet clopidogrel (75 mg) 394.61%, followed by tablet acenocoumarol (3 mg) 171.70%, injection enoxaparin sodium (60 mg/0.6 ml) 143.68%, tablet aspirin (75 mg) 51.55%, and lowest percentage cost variation was observed for injection streptokinase (1.5 MIU) 1.31%. **Conclusion:** There is lot of variation in the prices of different brands of the same anticoagulants, fibrinolytics, and antiplatelet drugs currently available in Indian market. Despite the implementation of price control, brand price variations still exist widely for commonly used drugs. Reassessment of pricing policy and implementation of quality norms is required.

KEY WORDS: Anticoagulants; Fibrinolytics; Antiplatelet Drugs; Cost Analysis; Cost Variation

INTRODUCTION

Hemostasis is the arrest of bleeding from damaged blood vessels and is very important for life. A wound causes constriction of the vessels along with adhesion and activation of platelets and formation of fibrin. Platelet activation results in the formation of hemostatic plug which halts bleeding and further reinforced by fibrin. Thrombosis is the pathological formation of hemostatic plug within the vasculature in the absence of bleeding (hemostasis in the wrong place).[1] Hemostasis and thrombosis play an important role in understanding both of arteries (e.g., thrombotic stroke and MI) and veins (e.g., deep vein thrombosis and pulmonary embolism). Anticoagulants, fibrinolytics, and antiplatelets are important drugs in treating thrombotic disorders. Platelets have a key and critical role in the coagulation and thromboembolic phenomenon. Prostacyclin present in the endothelium prevents sticking of platelets

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to the healthy endothelium, but when there is damage to endothelium platelet aggregation occur to form the hemostatic plug. Inappropriate hemostasis accelerates atherosclerosis, leading to pathological thrombosis. Pathological thrombosis leads to myocardial infarction, stroke, and peripheral vascular thrombosis. The function of platelet is regulated by various endogenous substances which are either released within the platelets or from outside the platelet such as from the blood vessel wall. At present, available antiplatelet drugs interfere with one or more steps in the process of platelet activation and produce a measurable reduction in the risk of thrombosis. There are two situations in which antiplatelet therapy should be considered – such as secondary prophylaxis, in a patient that has had a thromboembolic event, and primary prophylaxis, in the patient considered at risk.

In conditions associated with arterial thrombosis (atherosclerosis and cardiac disease), antiplatelet agents are the first line of drugs. In all others, antiplatelet drugs should be considered as adjunctive agents with anticoagulants.

Approximately 50% of mortality around the world is due to cardiovascular diseases. Within the next 15 years, it has been predicted that these diseases will increase rapidly in India and this country will be host to more than half the cases of heart disease in the world.[2] Since 2000, they were expected to be the fastest growing long-term disease expanding at 9.2% every year.[3] Antiplatelet drugs reduce the incidence of cardiovascular events by 20–25% in people with established coronary artery disease (CAD) or at high risk of CAD.[4] Coronary heart disease and stroke have increased in both urban and rural areas.

In the WHO guide to good prescribing "P" stands for personal, signifying that the prescribing physician has a personal formulary of drugs prescribed rationally taking into account the efficacy, safety, suitability, and cost of available drugs for a specific disease condition. While prescribing, the physician considers minor modification needed in the standard dose, frequency, or route of drug administration and whether the drug prescribed is cost-effective or not.

Pharmacoeconomics play a key role in practice of medicine in developing countries. Compliance with the treatment of disease by the patient is largely influenced by the cost of the drugs. Pharmaceutical industry manufactures many branded formulation of the same drug with large difference in selling price. In India, most of the drugs are available in brands and these are also prescribed by clinician mostly in brand name. This may affect the patient's finance adversely if costly brand is prescribed, especially in cardiovascular diseases which need treatment for prolonged duration.[5]

Limited studies are available in Indian scenario, which compare the cost of drugs of different brands. Hence, we decided to carry out the study which compares the cost of different brands of drugs used for the treatment of cardiovascular diseases. The study here focuses on cost variation analysis on different available brands of anticoagulants, fibrinolytics, and antiplatelet drugs in India.

MATERIALS AND METHODS

This was an analytical study, cost of anticoagulants, fibrinolytics, and antiplatelet drugs was calculated for 10 tablets.

Anticoagulants, fibrinolytics, and antiplatelet drug formulations with same strength, dose, and number were included for the study. The drug manufactured by single company and fixed-dose combinations was excluded from the study.

"Current index of medical specialties (CIMS)" January–April 2017 edition was referred to know the maximum and minimum price in INR (per 10 tablets) of anticoagulants, fibrinolytics, and antiplatelet drugs in all the available strength and dosage forms being manufactured by different companies in India were obtained.[6]

Percentage cost variation of the costliest to the cheapest brands of the same generic anticoagulants, fibrinolytics, and antiplatelets was calculated.

From this, we can know how many times the costliest brand costs more than the cheapest brands in each generic group.

Cost ratio = Maximum cost/Minimum cost

Percentage cost variation[7] was calculated by

$$\text{Cost variation BMI}(\%) = \frac{\text{Maximum cost} - \text{Minimum cost}}{\text{Minimum cost}} \times 100$$

Statistical Analysis

Data were analyzed using percentages and proportions.

RESULTS

The prices of anticoagulants, fibrinolytics, and antiplatelets produced by several pharmaceutical companies were analyzed. Tables 1-3 show percentage cost variation of anticoagulants, antiplatelets, and fibrinolytics. Wide variation in the prices of several brands of same anticoagulants, fibrinolytics, and antiplatelets was found in Indian pharmaceutical market. The highest percentage cost variation was found for clopidogrel 75 mg tablet (394.61%), followed by acenocoumarol 3 mg

Table 1: Percentage cost variation of antiplatelet drugs

S. No	Drug	Dosage form	Dose	For	Minimum price	Maximum price	Cost ratio	% cost variation
1	Aspirin	Tablet	75 mg	10	1.94	2.94	1.515	51.56
2	Cilostazol	Tablet	50 mg	10	63	83	1.317	31.74
			100 mg	10	109	162.5	1.490	49.082
3	Clopidogrel	Tablet	75 mg	10	28.18	139.38	4.946	394.60
			150 mg	10	57.4	88	1.533	53.310
		FC tablet	75 mg	10	11.94	50	4.187	318.76
			150 mg	10	67	142	2.119	111.94
4	Eptifibatide	Injection	20 mg/10 ml	10 ml	2198	2500	1.137	13.73
			75 mg/100 ml	100 ml	7693	8510	1.106	10.62
5	Ticlopidine	Tablet	250 mg	10	75.5	99.73	1320	32.09
6	Tirofiban	Injection	5 mg/100 ml	100 ml	3495	4200	1.201	20.17
7	Prasugrel	Tablet	5 mg	10	54	70	1.296	29.62
			10 mg	10	99	124	1.252	25.25
	FC tablet		5 mg	10	90	120.5	1.338	33.88
			10 mg	10	120.5	153.3	1.272	27.21

Table 2: Percentage cost variation of anticoagulants

S. No	Drug	Dosage form	Dose	For	Minimum price	Maximum price	Cost ratio	% cost variation
8	Enoxaparin sodium	Injection	20 mg/0.2 ml	0.2 ml	204.9	332	1.62	62.03
			40 mg/0.4 ml	0.4 ml	385	902	2.34	134.28
			60 mg/0.6 ml	0.6 ml	475	1157.5	2.43	143.68
			80 mg/0.8 ml	0.8 ml	637.42	813	1.27	27.54
9	Heparin	Injection	5000 IU/ml	1 ml	59.4	90	1.51	51.51
10	Bivalirudin	Injection	250 mg	1	6300	8599.5	1.36	36.5
11	Acenocoumarol	Tablet	1 mg	10	34.62	45	1.29	29.98
			2 mg	10	60.24	75	1.24	24.50
			3 mg	10	85	230.95	2.71	171.70
			4 mg	10	81.16	91	1.12	12.12

Table 3: Percentage cost variation of fibrinolytics drugs

S. No	Drug	Dosage form	Dose	For	Minimum price	Maximum price	Cost ratio	% cost variation
12	Streptokinase	Injection	1.5 MIU	1	3350	3393.92	1.01	1.31

tablet (171.70%), enoxaparin sodium (60 mg/0.6 ml) injection (143.68%), aspirin 75 mg tablet (51.55%), heparin 5000 IU/ml injection (51.51%), cilostazol 100 mg tablet (49.08%), bivalirudin 250 mg injection (36.5%), prasugrel 5 mg FC tablet (33.89%), Ticlopidine 250 mg tablet (32.09%), Tirofiban 5 mg/100 ml injection (20.17%), eptifibatide 20 mg/10 ml injection (13.74%), and lowest percentage cost variation is for streptokinase 1.5 MIU injection (1.31%).

DISCUSSION

Approximately 2 billion people in the developing countries around the world do not have access to drugs. They are not having access to drugs due to low purchasing power of patients and the high cost of the drugs. Indian pharmaceutical market is predominantly a branded generic market, i.e., more than one company sells a particular drug under different brand names apart from the innovator company. Therefore, the number of pharmaceutical drugs available in the market also is very high. This condition has led to greater price variation among drugs marketed.[8] Ultimately, it can lead to poor patient compliance, especially in case of drugs such as anticoagulants and antiplatelets which needs prolonged therapy. Poor patient compliance is a worldwide problem and can result in patients receiving inadequate doses of medication [Figure 1].[9]

The drug prices available in CIMS are compared as it is a readily available source of drug information and is updated regularly. Anticoagulants, fibrinolytics, and antiplatelet drugs are selected as they affect the morbidity and mortality

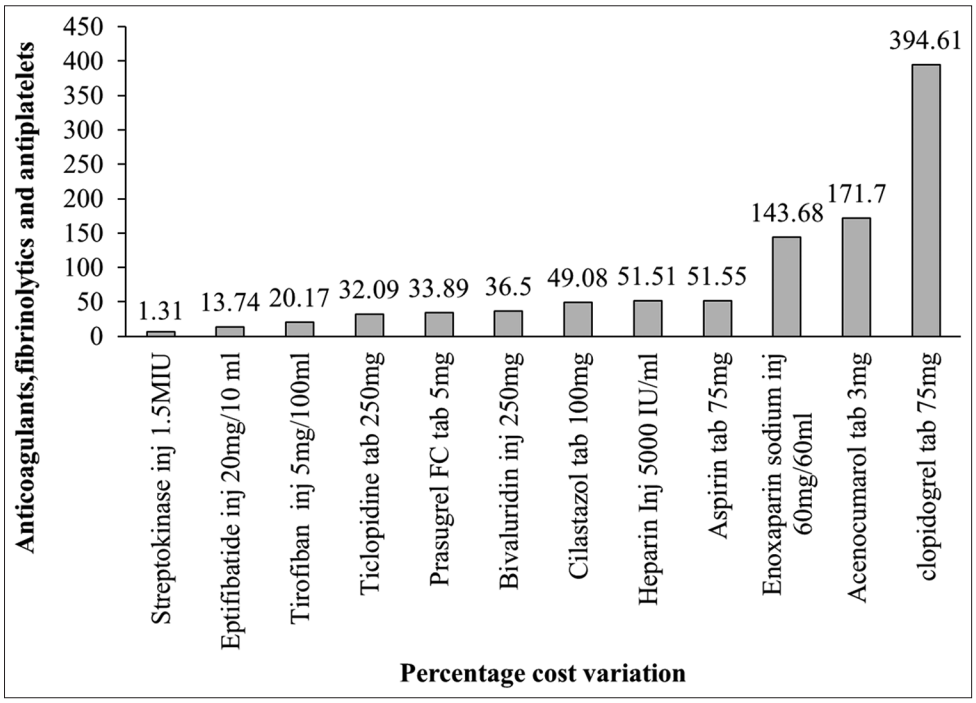

Figure 1: Percentage cost variation of anticoagulants, antiplatelets, and fibrinolytics

in patients with cardiovascular diseases and the treatment requires continuous prescription drug use. Anticoagulants, fibrinolytics, and antiplatelet drugs are a cornerstone therapy for patients with atherosclerotic vascular disease, including those with CAD, cerebrovascular disease, and peripheral arterial disease.

In India, studies are lacking which compare the cost of same drug sold under different brand names by different pharmaceutical companies. Therefore, this study was undertaken to compare the cost of different brands of the same anticoagulants, fibrinolytics, and antiplatelets. Moreover, antiplatelets are given for prolonged period may be lifetime, which have an influence on mortality and morbidity in patients with cardiovascular disease.

As far as antiplatelet drugs are concerned, our study results are similar to the study done by Rashmi *et al*.[10] and Jean-Michel *et al*. Aspirin is actually more cost-effective for secondary prevention of coronary disease compared to clopidogrel. In the current pricing, clopidogrel does not have cost-effectiveness as attractive as aspirin. Hence, aspirin would be a better choice for those patients who can tolerate aspirin in place of clopidogrel. Reduction in the price of clopidogrel can overcome this issue.[11]

In the developing countries like India, where patients have become victims of the expensive medical bills for which they have to spend from their own pockets, unlike developed countries where insurance schemes cover the medical bill expenses. It is felt that practitioners could provide better services and minimize costs of drugs if they have knowledge about various prices of the drugs of different companies.

Drug Price Control Order (DPCO) and the National Pharmaceutical Pricing Authority (NPPA) are effective tools for regulation of drug prices. DPCO is an order issued by the government to fix prices of drug. Drugs which come under DPCO cannot be sold at a price higher than that fixed by the government. In India, in 1979, 80–85% of the drugs in the market were under price control. The number has slowly decreased, and by 2002, only 15–20% of drugs were under price control.[12] Ceiling price of drugs is fixed by NPPA, Government of India in accordance with DPCO. The price of drugs is revised every year according to wholesale price index. The manufacturers may increase the maximum retail price of scheduled formulations once in a year, in the month of April on the basis of the wholesale price index with reference to the previous calendar year, and no prior approval from the government is required.[13]

This study is taken up with the objectives of knowing the costs and percentage price variation among anticoagulants, fibrinolytics, and antiplatelets which are being manufactured by different companies in India. Even the cost ratio was also noticed to be high.[14] The highest percentage cost variation was observed for tablet clopidogrel 75 mg (394.6%) and lowest percentage cost variation was for injection streptokinase 1.5 MIU (1.31%). Among different dosage formulations of anticoagulants, fibrinolytics, and antiplatelets, tablet clopidogrel 75 mg, tablet acenocoumarol 3 mg, and injection enoxaparin sodium 60 mg/0.6 ml had price variation >100%, and the rest had price variation <100%.[15]

Higher medication costs have been found to be a reason for medication non-adherence and have been found to be related to adverse health outcomes. Medication non-compliance

can be the single most common reason for treatment failure. Non-compliance of the drug therapy results in progression of the disease which increases the overall medical care costs dramatically. Treatment with generic drugs has been found to have fewer adverse clinical outcomes and improved treatment adherence than treatment with brand name versions. The costly brand of same generic drug is scientifically proved to be in no way superior to its economically cheaper counterpart.[16]

The limitation of the study is 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. Drug combinations are not included which are another drawback of this study.

CONCLUSION

The average percentage price variation of different brands of the same anticoagulants, fibrinolytics, and antiplatelets drugs manufactured in India is very wide. Increased adherence to the treatment can be achieved by decreasing expensive treatment strategy and switching to cost-effective therapy.

To overcome the disadvantage of cost variation of the drugs, generic prescribing should be encouraged. Cheaper generic medications should be prescribed by the practitioners.

REFERENCES

1. Rang HP, Ritter JM, Flower RJ, Henderson G, editors. Haemostasis and Thrombosis. In: Rang and Dale's Pharmacology. 8th ed. London: Elsevier Churchill Livingstone; 2018. p. 293.
2. Gupta R, Joshi P, Mohan V, Reddy KS, Yusuf S. Epidemiology and causation of coronary heart disease and stroke in India. BMJ J 2008;94:16-26.
3. Akila L, Rani RJ. Cost analysis of different brands of antianginal drugs available in India. Int J Basic Clin Pharmacol 2015;4:860-3.
4. Wong CK. The role of antiplatelet agents. Best Pract J 2009;19:32-7.
5. Das SC, Mandal M, Mandal SC. A critical study on availability and price variation between different brands: Impact on access to medicines. Ind J Pharm Sci 2007;69:160-3.
6. Current Index Of Medical Specialities. United Kingdom: Haymarket Media Group; 2017.p. 150-5.
7. Shankar PR, Subish P, Mishra P, Lalit M. Ambiguous pricing of Nepalese medicines. J Inst Med 2006;28:35-8.
8. Thomas M. Rational drug use and essential drug concept. In: Parthasarthi G, Nyfort-Hasen K, editors. A Textbook of Clinical Pharmacy Practice. 1st ed. Himayatnagar, Hyderabad: Orient Longman; 2004. p. 72-3.
9. Kardas P, Bishai WR. Compliance in infective medicine. Adv Stud Med 2006;6:652-8.
10. Rashmi A, Nerlekar S, Rajeev K. Study of variation in prices of oral antiplatelet drugs available in Indian market. Int J Basic Clin Pharmacol 2016;5:810-3.
11. Jean-Michel G, Pamela GC, Paula AG, Lawrence WW, Karen MK, Hunink MG, *et al*. Cost effectiveness of aspirin, clopidogrel, or both for secondary prevention of coronary heart disease. N Engl J Med 2002;346:1800-6.
12. World Health Organization. Essential Drugs and Medicines: Drug finance. Available from: http://www.whoindia.org/EN/. Section2/Section/Section160_959.htm. [Last accessed on 2019 Feb 04].
13. Patel BS, Chavda FM, Mundhava SG. Cost variation analysis of single non-steroidal anti-inflammatory agents available in Indian market: An economic perspective. Int J Pharm Sci 2016;7:2174-80.
14. Frazier LM, Brown JT, Divine GW, Fleming GR, Philips NM, Siegal WC, *et al*. Can physician education lower the cost of prescription drugs? A prospective, controlled trial. Ann Intern Med 1991;115:116-21.
15. Jana S, Mondal P. Pharmacoeconomics: The need to sensitize undergraduate medical students. Ind Pharmacol 2005;37:277-8.
16. Allisabanavar SA, Reddy NS. Cost variation analysis of various brands of antiepileptic drugs currently available in Indian pharmaceutical market. Int J Basic Clin Pharmacol 2017;6:1666-9.

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