

Analysis of price variation of some commonly used antibacterial agents

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ABSTRACT

Background: Antimicrobial resistance is a serious problem. Resistance may develop due to irrational use including poor patient compliance due to prescription of expensive drugs. In present study, the variation in the price of commonly used antibacterial was analysed.

Methods: The price of commonly used antibacterial agents listed in recent issues of CIMS and MIMS was analysed in respect of number of brands available, price range (10 tablets or capsules) and 1 ampoule or vial (parenteral preparation) i.e. minimum, maximum and average price and price ratio (maximum/minimum). FDCs and formulation with only 1-2 brands were excluded.

Results: The number of brands of oral antibacterial agents varied from 3 (faropenem 200 mg) to 90 (azithromycin 500 mg). The maximum price variation amongst different brands was 21.64 for levofloxacin 500 mg followed by 14.28 and 11.26 for linezolid 600 mg and moxifloxacin 400 mg respectively. For parenteral preparations, the number of brands varied from 2 (gentamicin 80 mg) to 57 (ceftriaxone 1 g). The maximum price variation was 5.05 for meropenem 1 g followed by 3.69 and 2.63 for meropenem 500 mg and ceftriaxone 1 g respectively.

Conclusions: A very wide price variation was observed amongst different brands of both oral and parenteral formulations of antibacterial agents. Prescribing expensive brands may lead to resistance due to poor patient compliance.

Keywords: Antimicrobial agents, Cost analysis, Outcomes research, Pharmacoeconomics, Price variation

INTRODUCTION

Antimicrobial agents (AMAs) are very important with regard to cure of disease. In spite of great advancement in medical sciences still very few diseases are curable with drugs due to availability of effective antimicrobial agents. It has been found that most of the infectious disease are curable if treated with rationality. AMAs are costlier preparation and studies have shown that doctors are often not aware or do not pay much attention to, the cost of antibiotics which they are prescribing and do not realize the unnecessary impact on patient finances.¹⁻³ Moreover, little attention has been paid to cost variation amongst different brands from reputed pharmaceuticals. Different brand of a generic drug is expected to provide same quality

of treatment, but indiscriminate use of AMAs may cause various problems that include antimicrobial resistance and adverse drug reactions. The emergence of antimicrobial resistance is a serious problem. To prevent the resistance, guidelines to use antibiotics and antibiotic policy were introduced from time to time by the concerned regulatory authorities.

Resistance may develop due to irrational use; this includes poor patient compliance (adherence to treatment) because patient may not complete the course of treatment, if expensive drugs are prescribed. The price of various drugs can be compared including comparison amongst different brands to provide the best treatment with minimum cost i.e. cost minimization analysis as a part of outcomes

research i.e. pharmacoeconomics.^{4,5} Few studies are available with regard to analysis of price variation amongst AMAs.

In present study, the variation in the price of commonly used antibacterial was analyzed in current scenario to ascertain the rational drug therapy with regard to prescription of economical drugs.

METHODS

The price of commonly used antibacterial agents listed in recent issues of CIMS (January to March 2017) and MIMS (March 2017) was analyzed.

Inclusion criteria

The antibacterial included in the analysis were oral preparations of 4-fluoroquinolones (4-FQs), β-lactam antibiotics, tetracyclines, macrolides and miscellaneous antibiotics, injectable β-lactam antibiotics and aminoglycosides and other commonly used injectable antibacterial agents. Only single agent formulations were included.

Exclusion criteria

Fixed dose combinations of antibacterial were excluded in the study. The formulations having only one to two brands and rarely used and newer antibacterial were also excluded.

The formulations were analyzed in respect of number of brands available, price range (10 tablets or capsules) and 1 ampoule or vial (parenteral preparation) i.e. minimum, maximum and average price and price ratio (maximum/minimum). The average price was calculated by adding the price of all the available brands of an antibacterial agent and divided by number of brands. Price variation was determined to know the difference between costlier and cheaper drug.

RESULTS

The number of brands of oral 4-FQs varied from 7 (norfloxacin 400 mg) to 58 (levofloxacin 500 mg) (Table 1). The number of brands of oral β-lactam range from 3 (faropenem 200 mg) to 59 (cefixime 200 mg) (Table 2).

Table 1: Variation in the price of some commonly used 4-fluoroquinolones (oral preparation).

Antibacterial agent	No. of brands	*Price range (INR)		Average price	Price ratio maximum/minimum
		Minimum	Maximum		
Norfloxacin 400mg	7	12.37	68	27.32	5.49
Ciprofloxacin 250mg	33	21.95	59.80	29.2	2.72
Ciprofloxacin 500mg	41	41	70	54.5	1.70
Ofloxacin 200mg	48	28	310	52.3	11.0
Ofloxacin 400mg	32	53.26	530	74.4	9.95
Sparfloxacin 200mg	19	57.2	291.6	95.6	5.09
Moxifloxacin 400mg	12	71	800	465.7	11.26
Levofloxacin 250mg	39	30	74.5	42.4	2.48
Levofloxacin 500mg	58	45	974	82.5	21.64
Gemifloxacin 320mg	16	99	580	252.8	5.85

*For a unit of 10 tablets or capsules; INR-Indian rupee

Table 2: Variation in the price of some commonly used oral β-lactam antibiotics.

Antibacterial agent	No. of brands	*Price range (INR)		Average price	Price ratio maximum/minimum
		Minimum	Maximum		
Ampicillin 250 mg	5	17.42	69.50	30.9	3.98
Ampicillin 500 mg	5	32.40	89.50	58.0	2.76
Amoxicillin 250 mg	19	30.00	69.00	41.3	2.3
Amoxicillin 500 mg	34	56.30	113.00	72.5	2.00
Cephalexin 250 mg	10	47.60	89.00	61.5	1.86
Cephalexin 500 mg	12	88.70	169.95	98.2	1.90
Cefadroxil 500 mg	09	33.10	70.6	43.8	2.13
Cefuroxime axetil 50 mg	51	99	399	218.4	4.03
Cefuroxime axetil 500 mg	57	98	862.50	348.2	8.80
Cefixime 200mg	59	54	198	95.4	3.66
Cefpodoxime 200 mg	57	70.67	269	125.6	3.80
Faropenem 200mg	03	317	361	345	1.13

*For a unit of 10 tablets or capsules; INR-Indian rupee

Table 3: Variation in the cost of some commonly used tetracyclines, macrolides and miscellaneous antibiotics (oral preparation).

Antibacterial agent	No. of brands	*Price range (INR)		Average price	Price ratio maximum/minimum
		Minimum	Maximum		
Doxycycline 100 mg	8	6.15	44	18.9	7.15
Minocycline 100 mg	5	249	460	282.8	1.85
Clarithromycin 250 mg	16	70	433.25	286.7	6.18
Clarithromycin 500 mg	12	250	930	548.4	3.72
Roxithromycin 150 mg	20	52	145	72.4	2.78
Azithromycin 250 mg	88	65	147	82.6	2.26
Azithromycin 500 mg	90	160	358.30	278.4	2.24
Clindamycin 150 mg	6	130	294.50	178	2.26
Clindamycin 300mg	10	151.50	394	252.5	2.60
Linezolid 600 mg	24	70	1000	527.3	14.28

*For a unit of 10 tablets or capsules; INR-Indian rupee

Table 4. Variation in the cost of commonly used injectable β -lactam antibiotics.

Antibacterial agent	No. of brands	*Price range (INR)		Average price	Price ratio maximum/minimum
		Minimum	Maximum		
Cefotaxime 250 mg	11	12.92	28.50	16.5	2.20
Cefotaxime 500 mg	9	17.31	44.66	26.2	2.58
Ceftriaxone 250 mg	45	28.38	35.50	32.6	1.25
Ceftriaxone 500 mg	37	35.00	65.00	48.2	1.85
Ceftriaxone 1 gm	57	46.95	123.75	76.4	2.63
Cefoperazone 1 gm	3	156	295	228.6	1.89
Ceftazidime 250 mg	6	67.41	132.10	85.65	1.95
Ceftazidime 1 gm	12	229.20	457	362.4	1.99
Meropenem 500 mg	10	349	1290	879	3.69
Meropenem 1 gm	26	592	2990	1802.6	5.05
Aztreonem 1 gm	5	450	940	628.5	2.08
Ertapenem 1 gm	3	2400	2450	2425	1.02
Doripenem 500 mg	4	3200	4449	3646.6	1.39

*For one ampoule or vial; INR-Indian rupee

Table 5: Variation in the price of aminoglycosides and other commonly used injectable antibacterial.

Antibacterial agent	No. of brands	*Price range (INR)		Average price	Price ratio maximum/minimum
		Minimum	Maximum		
Amikacin 250 mg	23	24.90	39.00	28.6	1.56
Amikacin 500 mg	26	38.55	83.00	62.4	2.15
Gentamicin 40 mg	3	7.21	7.81	7.48	1.08
Gentamicin 80 mg	2	7.26	8.02	7.64	1.10
Tobramycin 80 mg	4	48.00	80.00	61.1	1.66
Netilmicin 25 mg	5	46.60	59.50	52.1	1.27
Netilmicin 50 mg	5	86.75	110.00	99.65	1.26
Vancomycin 500 mg	7	250	389	336.4	1.55
Teicoplanin 400 mg	6	1267	1676.70	1429.2	1.32
Clinadamyacin 300 mg	7	82.50	131	102.3	1.58
Clinadamyacin 600 mg	7	155	282	208	1.81

*For one ampoule or vial; INR-Indian rupee

Considering the oral preparation of tetracyclines, macrolides and miscellaneous antibiotics, the number of brands varied from 5 (minocycline 100 mg) to 90 (azithromycin 500 mg) (Table 3). Overall, the number of brands of oral antibacterial agents varied from 3 (faropenem 200 mg) (Table 2) to 90 (azithromycin 500 mg) (Table 3). For parenteral preparations of β -lactam the number of brands varied from 3 (cefoperazone 1 g and ertapenem 1 g) to 57 (ceftriaxone 1 g) (Table 4); and parenteral preparation of aminoglycosides the number of brands varied from 2 (gentamicin 80 mg) to 26 (amikacin 500 mg) (Table 5).

Regarding the price variation, the maximum price variation amongst different brands of oral formulation was 21.64 for levofloxacin 500 mg (Table 1) followed by 14.28 and 11.26 for linezolid 600 mg (Table 3) and moxifloxacin 400 mg (Table 1) respectively. For parenteral preparations, the maximum price variation was 5.05 for meropenem 1 g (Table 4) followed by 3.69 and 2.63 for meropenem 500 mg and ceftriaxone 1 g (Table 4) respectively.

DISCUSSION

In the present study, the main objective was to analyse the cost variation amongst various brand of generic antimicrobials manufactured by pharmaceuticals and widely prescribed by clinicians. The study has revealed a very wide variation/range in the minimum and maximum price amongst different brands of AMAs available in India.

One of the important causes of poor patient compliance is high cost of treatment leading to relapse and antimicrobial resistance. The number of brands/formulation of AMAs available in India⁶ is high with very wide variation in their cost. Incomplete information to prescribers, government regulations including drug pricing policies and economic interest of pharmaceuticals (profit making, certain targets) also contribute to prescription of costlier drugs.⁷⁻⁹

The problem can be overcome if AMAs are prescribed by (a) generic names and/or (b) prescribing cheapest available brand.¹⁰ Prescription of cheapest brand is only possible when proper training is given to doctors during their formative years as doctors particularly interns are not aware about cost of drug.^{1,2} Thus, teaching of pharmacoeconomics must be included in undergraduate medical curriculum¹¹ and training should be given to interns and residents.

The training should also lay emphasis on evaluation of new AMAs from formularies and drug promotional literature.^{12,13} Awareness and training to clinicians will reduce the cost of treatment of infectious disease as shown by certain studies.¹⁴ One study has shown that maximum price was twice than minimum for oral AMAs. Sharref et al¹⁵ Showed price variation of 3.7 times for single parenteral antibiotic.¹⁶

Another study revealed that costliest brand were sold more than the cheapest brands; and there was tendency to prescribe costlier AMAs.³ Appropriate measures should be taken by doctors, pharmacists and drug regulators should assess the maximum variation in price of a drug and fix the price accordingly with rationality.¹⁷

CONCLUSION

A very wide price variation was observed amongst different brands of both oral and parenteral formulations of antibacterial. Thus, it is recommended to prescribe generic drugs or drugs with lowest price/with average price, in case of doubt in bioavailability. Moreover, there is need to create awareness amongst the clinicians and residents regarding prescribing of cheaper brands of AMAs.

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