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Influence of Intravenous to Oral Antibiotic Conversion and its Practice in a Tertiary Care Hospital

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Abstract

Antibiotic therapy is crucial in the effective management of infectious diseases and its irrational use is a major risk factor for the development of drug-resistant organisms. An early switch from Intravenous to Oral antibiotic therapy could be one of the factors that influence the Length of Hospital Stay and increase the treatment cost. The aim of the study was to evaluate the practice of Intravenous to oral antibiotic conversion and its impact on patient care and clinical outcome at a tertiary care Hospital. A prospective observational study was conducted for 6 months. Patient demographic details, medical & medication history, diagnosis, drug administration, conversion day & time, microbiological reports, discharge summaries were collected from case sheets. Day of therapy, duration of Intravenous & oral antibiotic therapy, Length of Hospital Stay were calculated &compared. Results reveal that 68.25% were converted from IV to oral while 31.75% were not converted. Since we got a high number of converted cases, therefore, the days of therapy (68.68%), length of hospital stay (62.21%), duration of IV therapy (60.63%) were increased for converted groups than the not converted group. Calculated estimated cost (Rs.471.59) for the treatment shown increased for the not converted group. Early conversion of IV to oral in patients with at least 24 hours of IV therapy can shorten the duration of IV therapy and reduce treatment costs without altering the outcome of treatment.

Keywords: Intravenous to oral switch, Antibiotic, Sequential therapy, Step-down therapy.

INTRODUCTION

To manage serious infections in the hospital most clinicians use intravenous (IV) antibiotics initially to ensure an optimal concentration of antibiotics at the site of infection. Inappropriate antibiotic use is recognized as a key driver of antimicrobial resistance. Unnecessarily prolonged courses of IV antibiotics are also associated with increased length of hospital stay, increased costs of nursing, pharmacy, and medical time in the insertion of IV lines, preparation, dispensing, and administration of IV agents, and the increased morbidity and mortality associated with IV line infections [1]. To optimize antibiotic use, a switch from IV antibiotics to oral therapy in the appropriate patient has several advantages. These include a shorter length of hospital stay with the associated reduction in morbidity and mortality, a reduction in staff workload, and a reduction in antibiotic costs [2].

Hence, the present study aimed to evaluate the practice of IV to the oral conversion of antibiotics and its impact on the length of stay in a tertiary care hospital [3].

MATERIALS AND METHODS

A prospective observational study was carried out for six months at PK Das Institute of Medical Sciences, Kerala, India. The study was approved by the Institutional Ethics Committee. Both male and female patients hospitalized for more than 24 hours with antibiotic therapy were screened and included in the study. Patients with gastrointestinal absorption problems, sepsis, and pregnant and lactating women were excluded from the study. A total of 300 patients were screened, that 274 patients were enrolled in the study for evaluation. Data was collected by using a

structured questionnaire. Demographic characteristics of patients, allergies, primary diagnosis, co-morbidities, or presumed indication for antibiotic therapy, microbiological results (if available) were collected as the first part. In the second part, Antibiotic type, duration of therapy, route of administration, and length of hospital stay were recorded. Collected data were analyzed by using SPSS.26 software and the Chi-square test was used to identify the correlation between dependent variables at the confidence level of 95%. $P < 0.05$ was considered as a statistically significant difference.

RESULTS

In our current study, a total of 274 patient's medication charts were reviewed and assessed the usage of antibiotics. Out of 274 patients, we found that 145 (52.92%) were males and 129 (47.08%) were females. From that, we grouped the patients into age-wise like up to 18 years, 18-60 years, and above 60 years of age. In that we got 57(20.80%) of patients who are up to 18 years, 104 (37.96%) were 18-60 years of age and 113 (41.24%) were above 60 years of age. Types of therapy were classified in that the total number of converted cases was 187. Among the 187 cases, 155 (82.89%) were given treatment for documented infections, 20 (10.69%) were empirical therapy and 12 (6.42%) were prophylactic treatment (Table-1).

Table-1: Demographic Details and Type of Treatment (n=274)

S. No	Demographics	Total number	Percentage (%)
	Gender		
1.	Males	145	52.92
2.	Females	129	47.08
	Age wise (Yrs)		
3.	Below 18	57	20.80
4.	18-60	104	37.96
5.	Above 60	113	41.24
	Type of Treatment		
6.	Documented Infection	155	82.89
7.	Empirical	20	10.69
8.	Prophylaxis	12	6.42

In our study, we considered all departments where intravenous administration was given and converted into oral tablets. Departments taken were general medicine, pediatrics, general surgery, and special wards which include cardiology, neurology, pulmonology, etc. In this, 135 cases (49.27%) were from general medicine, 46 cases (16.79%) were from pediatrics, 69 cases (25.18%) from special wards, and 24 cases (8.76%) from general surgery. From this, we can see the cases given as converted and not converted as a separate category (Table-2).

Table-2: Studied subjects in Various Departments (n=274)

S. No	Departments	Number of cases	Percentage (%)	IV	IV+PO
1.	General Medicine	135	49.27	44 (50.57)	91(48.67)
2.	Paediatric	46	16.79	20(22.99)	26(13.90)
3.	Special ward	69	25.18	22(25.29)	47(25.13)
4.	General surgery	24	8.76	1 (1.15)	23(12.30)
5.	Total	274	100	87 (100)	187(100)

In the class wise distribution total of 461 antibiotics were prescribed in our study in which mostly prescribed antibiotics were combinations 181 (39.26%) which were followed by cephalosporin 177 (38.40%), fluoroquinolones 43 (9.33%), macrolides 27 (5.86%), aminoglycosides 12 (2.60%), penicillin 6 (1.30%), oxazolidone 5 (1.08%), furan derivative 5 (1.08%), tetracycline 3 (0.65%), nitro imidazole 1 (0.22%), lincosamide 1 (0.22%) (Table-3).

Table-3: Class of Antibiotics Used in the Treatment (n=274)

S. No	Class of Antibiotics	Total number	Percentage (%)
1.	Cephalosporins	177	38.40
2.	Penicillins	6	1.30
3.	Macrolides	27	5.86
4.	Fluoroquinolones	43	9.33
5.	Oxazolidinones	5	1.08
6.	Combinations	181	39.26
7.	Aminoglycosides	12	2.60
8.	Furan Derivatives	5	1.08
9.	Tetracyclines	3	0.65
10.	Others	2	0.22

Combinations are again specifically categorized and we found that the most used combination of antibiotics was penicillin with beta-lactamase 90 (49.72%) followed by cephalosporin beta-lactam combination 79 (43.65%), amoxicillin cloxacillin 9 (4.98%), and others 3 (1.65%). From this converted, not converted and the same drug in IV and PO were calculated. Cephalosporin beta-lactam combination 67 cases were not converted and 12 cases were converted and both IV and oral cases were 2. Penicillin beta-lactamase IV 59, oral was 31 and IV+PO were 21. Amoxicillin cloxacillin combination has IV, PO, and IV+PO as 5, 4, 4 cases respectively. Other combinations like tetracycline lactobacillus, fluoroquinolones + azole derivative, anti-tubercular drug combination was only belonged in converted by the same number 1 respectively (Table-4).

Table-4: Types of Combination (n=274)

S. No	Combination of antibiotics	Total Number	%	IV	PO	IV+PO
1.	Cephalosporin+Beta Lactamase Inhibitor	79	43.65	67	12	2
2.	Penicillin + Beta Lactamase Inhibitor	90	49.72	59	31	21
3.	Amoxicillin+ Cloxacillin	9	4.98	5	4	4
4.	Others	3	1.65	-	3	-

Among 274 cases, 187 (68.25%) were converted and 87 (31.75%) were not converted. Types of conversion were done and among 187 converted cases mostly step-down 79 (42.24%) conversion takes place which is followed by switch 60 (32.09%) and sequential 48 (25.67%) (Table-5).

Table-5: Number of Cases Converted From IV to Oral and Not Converted (n=274)

S. No	Type of Conversion	Total Number	Percentage (%)
1.	Converted from IV to Oral	187	68.25
	Sequential	48	25.67
	Switch	60	32.09
	Step down	79	42.24
2.	Not Converted	87	31.75

The length of hospital stay (LOHS) and day of therapy was calculated for IV to Oral converted non-converted cases. Mean LOHS for IV to Oral converted cases was 4.58 and the total day of therapy was found to be 2.04. For non-converted cases, the Mean LOHS was 5.86 and the Mean days of therapy were found 0.96. Significance found for both length of hospital stay and days of therapy ($P < 0.001$)

Duration of IV therapy and length of hospital stay were related, from that Mean Duration of IV therapy for converted from IV to Oral was found to be 3.827, and the Mean duration of IV therapy for non-converted cases was 5.281. The mean duration of antibiotic therapy for converted was 8.24 and the Mean duration of antibiotic treatment for non-converted was 5.39. Mean LOHS for IV to Oral converted was 4.58 and for non-converted was 5.86. Significance was found for the length of hospital stay and duration of IV therapy. ($P < 0.001$) (Table-6).

Table-6: Duration of Therapy and Hospital Stay (n=274)

S. No	Type of Conversion	Duration of IV Therapy (Mean ± SD)	Total Duration of Antibiotic Therapy (Mean±SD)	LOHS (Mean ±SD)	P Value
1.	Converted from IV to Oral	3.827±1.98	8.24±3.59	4.58±2.04	<0.001
2.	Not Converted	5.281±2.63	5.39±2.72	5.86±2.37	

DISCUSSION

Intravenous administration is associated with a higher risk of infusion reactions and medical management costs. Studying the association between antibiotic use and patient outcomes is of great importance and can imply whether the guideline-adherent prescribing practice is safe and secures equal or better patient outcomes [4].

In our study population males were more in number as compared to females which is similar to the study conducted by Zeina M. Shrayteh *et al*., [5] In the case of antibiotic therapy needs, the above 60 years of age group showed higher frequency followed by the 18-60 year of age group. Similar findings were observed in an earlier study conducted by Yannamani Satya Tejaswini *et al*., in which showed a high frequency of antibiotic therapy in the age group 61-70 years and then 51-60 years [3].

Mostly the treatment for the documented disease was the reason for the continuation of the antibiotic treatment than for empirical, & then for prophylactic therapy which is was almost the same as that of a study conducted by Zeina M. Shrayteh *et al*., & Asuman İnan *et al*., [5, 6].

The antibiotic prescription ratio was higher in medical wards than surgical wards. -Likewise, various studies including a study conducted by Asuman Inan, Ozgur Dagl *et al*., showed that a higher proportion of antibiotic use occurs in the medical wards [6].

The most commonly used antibiotics were cephalosporins and fluoroquinolones in converted cases. Similar findings were observed earlier study conducted by S M Biradar and Pathi Indu *et al*., [7].

In order of the frequency of prescription in our hospital, first-line antibiotics were penicillin-sulbactam, cephalosporins – beta-lactamase inhibitors. Following our data, Ozkurt *et al*., reported that the most commonly used antibiotics in a research hospital were ampicillin-sulbactam (15.0%), cephalosporins (14.7%), and nitroimidazoles (11.1%) [8].

Among all the converted cases the type of conversion which took more frequently was step-down followed by the switch and then sequential. When compared to a study conducted by Yannamani Satya Tejaswini *et al*., sequential therapy was observed more frequently than switch and step-down therapy [3].

In our study, we considered all departments where intravenous administration was given and converted into oral tablets. Types of conversion were done and among 187 converted cases mostly step down 79 conversion takes place which is followed by switch 60 and sequential 48. In our study, most of the cases got converted and a few were not converted.

The expectation of clinicians' to change their antibiotic prescribing behaviors needs to be supported by STOP guidelines and expert advice to reassure clinicians that guideline adherent antibiotic prescribing is safe and effective [4].

The possible barriers to a timely switch strategy perceived by the study results include unfamiliarity with guideline recommendations, misconceptions, or lack of outcome expectancy. [3] These barriers were also reflected in the study results of Schouten *et a*l., and Halm *et al*., [11, 12]. Also, Physicians were not aware of the existence of clear guidelines on the adequate timing of the switch [3].

The study conducted by Yannamani Satya Tejaswini *et al*., showed that LOHS had significantly decreased following IV to oral conversion [3]. Shrayteh ZM *et al*., reported that there is no alteration in the LOHS by using IV to oral conversion whereas the duration of antibiotics is significantly reduced [5]. A reduction in the length of hospital stay is one of the major areas of potential cost savings in using switch criteria and a study was conducted by Przybylski KG *et al*., [8].

In our study, the mean length of hospital stay for converted cases from IV to Oral was shorter than non-converted cases. Early switching reduced the duration of IV therapy and length of hospital stay and led to substantial cost savings. The median length of hospital stay was reduced from 6 to 5 days ($P<0.05$) and the median duration of IV therapy was significantly reduced from 5 to 3 days ($P<0.01$) were shown in a study conducted by Mouwen AMA *et al*., [10]. In our study, the duration of IV antibiotics was shorter in number in converted cases than non-converted cases. Similar findings showed in a study conducted by Zeina M Shrayteh *et al*., [5].

In our study, the mean days of therapy were 2.04 days for converted cases from IV to oral and shorter than non-converted cases. But contrary to the present findings, the average number of days of therapy for patients converted was 1.53 days shorter than that of patients who were not converted to oral therapy ($p<0.003$) showed in a study conducted by Przybylski KG *et al*., [9]

CONCLUSION

The practice of IV to oral conversion can shorten the duration of IV therapy and reduce treatment costs without any negative influence on the outcome of treatment. Rational use of antibiotics makes it better for a healthy society and that will influence the outcome of the patient in a fruitful way. In our study, we found that most of the conversion was not according to the guideline. So it's the responsibility of health care professionals to thoroughly review the medical records and identify patients who are eligible for the conversion. In our study, we have got the means of days of therapy, length of hospital stay, and duration of IV therapy were increased for non-converted groups than the converted group. With the increasing rate of IV to oral antibiotic therapy conversion, the expenditure for the treatment could be minimized.

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