

Supervision of Antibiotics Switch from Intravenous to Per Oral and its Added Benefits for Better Patient Compliance

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S M Biradar^{1*}, Chaitanya kulkarni¹, Kanagala Srikanth¹, Sachin L Kanakappanavar¹, B S Khaja Jainuddin¹, S. S. Devarmani², Sharan Badiger²

Authors Affiliations

¹Department of Clinical Pharmacy Practice, SSM College of Pharmacy and Research Centre, Vijaypur-586103, India.

²Department of Medicine, Shri B. M. Patil Medical College Hospital and Research Centre, Vijaypur-586103, India.

Corresponding Author

S M Biradar

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Abstract: **Introduction:** Antibiotics Intra Venus (IV) to per oral (PO) conversion is one of the key strategies in the Antimicrobial stewardship program (ASP). Early switch over from IV to oral therapy has major advantages, such as reduced risk of catheter related infections, Less expensive, reduction in the hidden costs and early discharge from a hospital. **Methods and materials:** a prospective and observational study was conducted over a period of six month among respiratory tract infection patients who admitted to general medicine and pulmonary department. The necessary data were collected in specially designed format from respective case sheets. **Results:** 84 patients were enrolled in the present study and 71 patients were subjected to antibiotic conversion whereas 13 patients were not subjected to antibiotic conversion. The patients who were subjected to antibiotic conversion were divided into 2 groups, Group E and Group L. Group E had subjects who were converted early from IV to oral antibiotic within 1-4 days and Group L had subjects who were converted from IV to oral antibiotics within 5-10 days. Out of 71 patients, 39 patients were subjected to early antibiotic switch whereas 32 patients were subjected to late antibiotic switch. The frequently prescribed IV antibiotic was levofloxacin (39.02%) and same is switched to oral (39.1%). The most common type of antibiotic conversion method was step down therapy (68%) and the most frequently converted class of antibiotics was fluoroquinolones. **Conclusion:** conversion of antibiotics from IV to per oral, especially early conversion reduce the length of hospital stay and reduce the financial burden of a patients and, minimizes the possible IV complications which influence the faster recovery of a patients and improves the better patient compliance

Keywords: Antibiotics, Switch Therapy, Intravenous to Per Oral, Minimize Financial Burden.

INTRODUCTION

Antimicrobial stewardship program (ASP) is a rational systematic approach to use of antimicrobial agents in order to achieve optimal outcomes. Intravenous (IV) to per oral (PO) conversion is one of the key strategies in the ASP and considered to prevent the emergence of antimicrobial resistance and prevent healthcare associated infections. IV to Oral conversion practice can effect through three methods of which, the first one is termed as ‘Sequential therapy’ and refers to the act of replacing a parenteral version of a medication with its oral counterpart of the same compound. The second one is called ‘Switch therapy’ involves the conversion of an IV medication to an oral equivalent within

the same class and with same level of potency, but of a different compound. The third modality is ‘Step down therapy’ in which an injectable medication is substituted with an oral agent in another class or a different medication within the same class where the frequency, dose, and the spectrum of activity may not exactly be similar (Chandrasekhar, D., & PokkaVayalil, V. 2019; & Cyriac, J. M., & James, E. 2014). World Health Organization (WHO) reports that the irrational use of medicines is a major problem. Hence IV to Oral switch over within an appropriate time is one of the major aspects to improve the rational use of antimicrobials (Shrayteh, Z. M. *et al.*, 2014). Patients who continue to receive parenteral route therapy are at an increased risk for infusion related adverse events. The presence of an IV catheter provides a portal for bacterial and fungal growth(Shrayteh, Z. M. *et al.*, 2014) Early switch over from IV to oral therapy has major advantages, such as reduced risk of catheter related infections, Less expensive, reduction in the hidden costs and early discharge from a hospital (Cyriac, J. M., & James, E. 2014).

Respiratory tract infections can be caused by bacteria, viruses and others. Broad-spectrum antibiotics are most often prescribed to provide a rapid resolution of the infections. Intravenous administration is relatively common in the hospital setting, where it is often reserved for difficult cases, such as patients with severe infection or underlying chronic disease. Intravenous administration is expensive, however, as parenteral formulations have a greater acquisition cost than the corresponding oral form. Furthermore, administration via this route is more labor-intensive, incurring extra costs associated with hospitalization, staffing, delivery and consumables. Therefore, many patients are switched to oral administration after a short duration of IV treatment. As antibiotics can account for up to 30% of the hospital’s drugs budget, considerable cost savings can be made by keeping IV administration to a minimum.

The risk of complications such as post infusion phlebitis, which occurs in up to 70% of infusions, is reduced if the duration of IV administration is reduced (Kurtzhals, K. E. et al., 2016). Hence the current study was undertaken to study the effect of early conversion of IV to oral antibiotics in respiratory tract infections.

MATERIALS AND METHODS

Ethical clearance

The study was approved by the Institutional Ethical Committee Ref: IEC/BLDE COP/2019/02.

Data source and research strategies

A Prospective observational study involves collection of observed data from the patient case files on daily basis and does not include any direct interventions with the patients. This study enrolled the patients above 18 years of age admitted in General medicine and Pulmonology department among inpatients meeting the inclusion criteria of the study. The relevant data such as patient demographics, data regarding diagnosis, prescribed antibiotic drugs, indication and type of conversions were extracted and documented on a specific patient data collection form. Duration of antibiotic switch from IV to Oral route was evaluated to determine the length of hospital stay. The obtained data was subjected to Mann Whitney U test and Chi square test to obtain the level of significance and to compare the data in between.

Inclusion Criteria:

The patients enrolled into study who met the following inclusion criteria:

- Adult patients (above 18yrs) prescribed with antibiotics admitted in the General Medicine Ward and Pulmonary ward during the study period.
- Patient who are willing to participate and ready to give consent.
- Patients who are newly diagnosed with respiratory tract infections.

Exclusion Criteria:

- ICU patients.
- Pregnant women.
- Out patients.
- Those with a second site of infection.

Criteria used to determine patient’s eligibility for intravenous to oral antimicrobial switch therapy (Tejaswini, Y. S. et al., 2018)

- 1) Temperature <38°C or >36°C for 24–48 h; normalizing body temperature; afebrile for at least 8–24 hr.
- 2) No unexplained tachycardia, hemodynamic instability.
- 3) Clinical improvement, no clinical indication for intravenous therapy.
- 4) Oral fluids/food tolerated, no reason to believe oral absorption of antimicrobials may be poor; may be by nasogastric/gastric feeding tube.
- 5) Improving white blood cell count.
- 6) Suitable oral antimicrobial therapy.
- 7) No surgery scheduled within next 24–36 hr (Tejaswini, Y. S. et al., 2018).

RESULTS

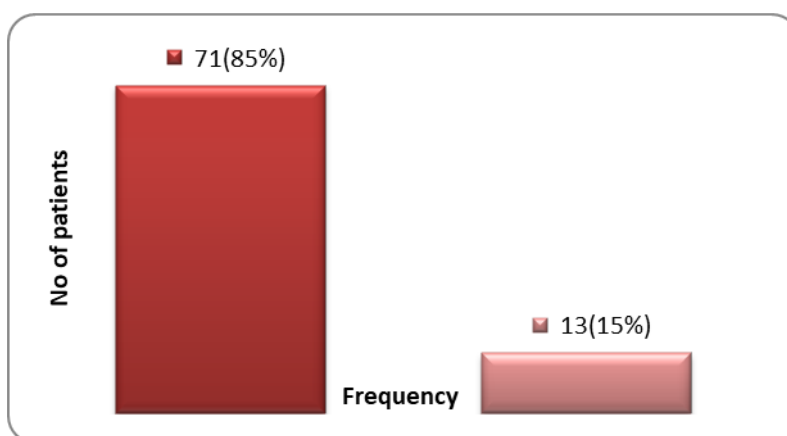


Figure 1: Details of the patients who were subjected to antibiotic conversion and patients who were not subjected to antibiotic conversion.

Table 1: Patients subjected to early and late conversion

Gender	Group E	Group L	Chi square test
Male	21(49%)	22(51%)	
Female	18(64%)	10(36%)	X ² =1.635 P=0.2011*
Total	39	32	

*:No significant difference

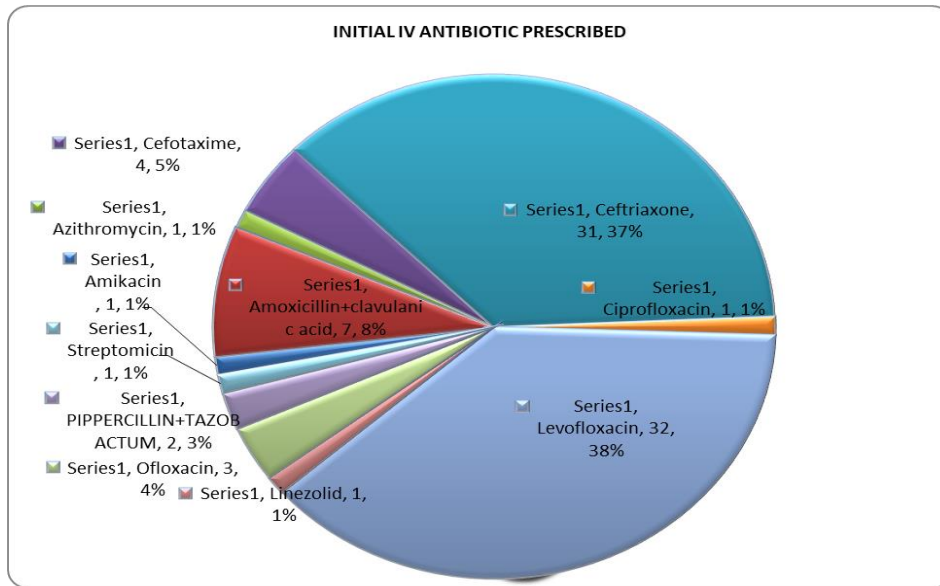


Figure 2: Frequency of initial antibiotics prescribed among different antibiotics.

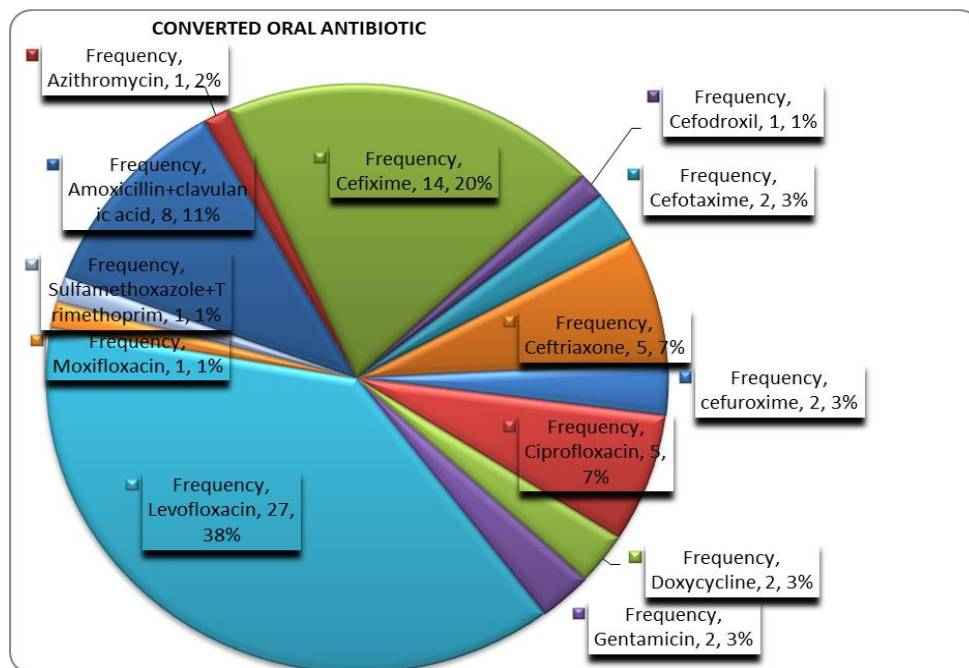


Figure 3: Frequency of converted antibiotics among different antibiotics.

Table 2: Type of antibiotic conversion

Types of Conversion	Frequency (%)	Chi square test
Step down therapy	48(68%)	$X^2=56.577$ P<0.0001*
Sequential therapy	13(18%)	
Switch therapy	10(14%)	

*: Highly significant

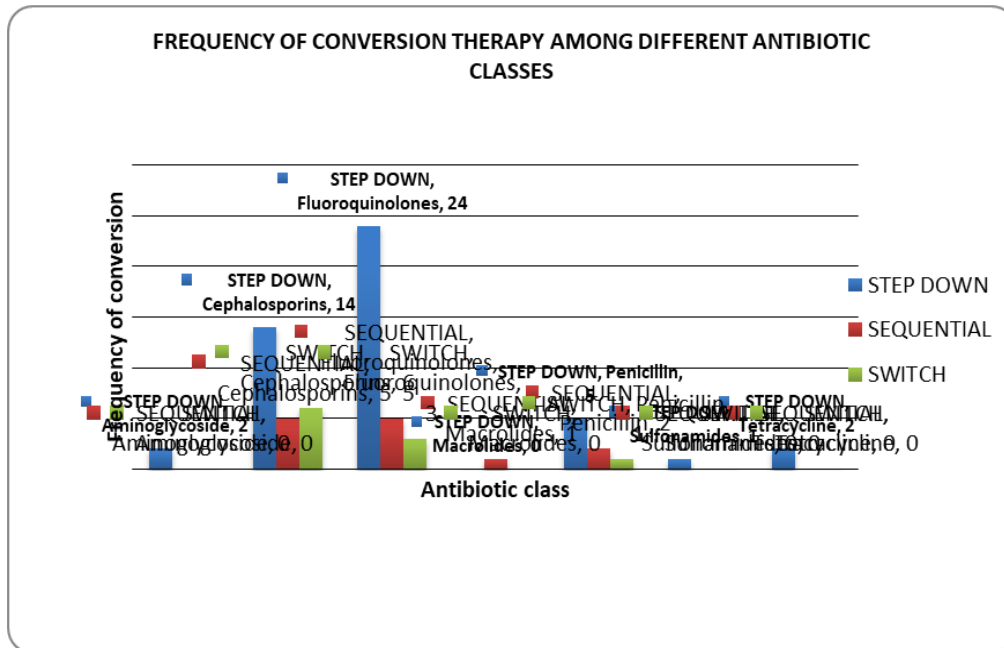


Figure 4: Frequency of conversion based on different type of conversion therapy among antibiotic classes

Table 3: Length of hospital stay for early and late conversion

Type of conversion	Length of hospital stay (mean ± sd)	Mann Whitney U test
Early conversion (n=39)	4.9±1.28	U=82.00
Late conversion (n=32)	7.9±1.72	P<0.0001*

*:Highly significant

Table 4: Systemic Inflammatory Response Syndrome from Each Ward.

Assessment of systemic inflammatory response syndrome (SIRS) in each ward		
Criteria	Medical ward n=74(%)	Pulmonology ward n=10(%)
Temperature (%)		
<36°C or >38°C	14(18.9)	2(20)
Normal	60(81.1)	8(80)
Not recorded	-	-
Heart Rate (%)		
>90 beats per min	5(6.76)	0
Normal	69(93.24)	10(100)
Not recorded	-	-
Respiration rate (%)		
>20breaths per min	-	-
Normal	8(10.81)	1(10)
Not recorded	66(89.19)	9(90)
Pa Co2(%)		
<4.3kpa	2(2.7)	-
Normal	72(97.3)	-
Not recorded	-	-
White Blood Cell count (%)		
<4000/mm ³	-	-
>12000/mm ³	30(40.54)	1(10)
Normal	44(59.46)	9(90)
Not recorded	-	-

Note: A minimum of 3 parameters to be met for SIRS in order to switch from IV to oral.

Eighty four patients were enrolled in the present study. Ten patients were taken from Pulmonology ward of both males and females and seventy four patients were from medical department. Among 84 patients 52(62%) were male and 32(38%) were female. The numbers of patients with habit of smoking were

27(32%) and alcohol consumption were 15(18%), not shown in the tables. The patients were divided into two groups, Group E (Early conversion) and Group L (Late conversion). Group E had subjects who were converted early to oral antibiotic within 1-4 days and Group L had subjects who were converted to oral antibiotics within

5-10 days. A systemic inflammatory reflex syndrome (SIRS) criterion was applied for all the patients (Tejaswini, Y. S. *et al.*, 2018). Patients who met a minimum of 3 parameters in this criterion were subjected to IV to Oral antibiotic conversion.

DISCUSSION

The present study was a prospective observational study of supervision of switch from intravenous to oral antibiotics in respiratory tract infections which was similar to study conducted by Cooke *et al.*, (2002) The number of males enrolled in the study based on the inclusion criteria were 62% while females were 38%, which is contradictory to the study conducted by Maqsood Ahmed Khan *et al.*, (2018) where, included 241 patients out of which 140(58.09%) were females and 101(41.91%) were males.

Out of 84 patients, 74 patients were taken from medicine department and 10 patients were taken from pulmonology department for the study. Among 84 patients, 71 patients were subjected to antibiotic switch whereas 13 patients were not subjected to antibiotic switch, as they did not meet the SIRS criteria. This was contradictory to the study conducted by Yannamani Satya Tejaswini *et al.*, (2018) in which out of 117 patients, 41 patients were subjected to antibiotic conversion whereas 76 patients were not subjected to antibiotic conversion.

Among 71 patients subjected to antibiotic switch, 39 patients were subjected to early antibiotic switch and 32 patients were subjected to late antibiotic switch. From 39 early switched patients, 21 patients were male and 18 patients were female whereas out of 32 late switched patients, 22 patients were male and 10 patients were female with no significant difference (Chi square test: $X^2=1.635$). This study was compared to the one conducted by Zeina M Shrayteh *et al.*, (2014) in which among 356 patients included in the study, 118 patients were switched to oral route within 3 days of hospitalization whereas remaining two third of patients were subjected to switch beyond 3 days. Our study was in correspondence to the study conducted by Dominik Mertz *et al.*, (2009) in which 38% (246/646) of episodes of continued iv antibiotic therapy, patients *m et al.*, 1 criteria for switching to oral antibiotics on the third day, and 151/246 (61.4%) were switched.

In the present study, while comparing early and late conversion it is found that 54% of males were converted early and 46% of females were converted early, which does not make any statistical differences.

39% of the patients in the study were initially prescribed with levofloxacin which was the most common initially prescribed antibiotic administered intravenously and it was the most preferred option when switching to oral route. These findings were different from the study proposed by Priyanka Erabelly *et al.*,

(2015) which showed penicillins+betalactams (38.31%) were widely prescribed antibiotic, followed by cephalosporins.

The average length of hospital stay for patients with an early conversion was found to be 4.9 ± 1.28 days and in late conversion was 7.9 ± 1.72 days. This clearly highlights the increased duration of hospitalization for patients undergoing for a late conversion. Similar findings were seen with study conducted by Jan Jerlik Ooseterhert *et al.*, (2006) where as Total length of hospital stay was 9.6 (5.0) and 11.5 (4.9) days for patients in the intervention group and control group (1.9 days, 0.6 to 3.2). The comparison of length of stay in early and late conversion was obtained from Mann Whitney 'U' test. The P value is found to be <0.0001 which is considered to be highly significant between early and late converted patients.

The most prevalent respiratory tract infection in the present study was acute exacerbation of COPD (33%) while URTI (5%) was the most common co-existing illness, which is understandable due to the similarity in the risk factors of both which was in resemblance to the study conducted by Zeina M Shrayteh *et al.*, (2014) and Maqsood Ahmed Khan *et al.*, (2018).

The most frequently used type of conversion was Step down therapy (68%) which has highly significant difference with a P value <0.0001 (Chi square test: $X^2=56.577$) as when compared with sequential and switch therapy. This was contradictory to that of Zeina M Shrayteh *et al.*, (2014) in which the most commonly used type of antibiotic switch, was sequential therapy (52.5%).

In the present study SIRS criterion was also taken into account in resemblance to the study of J.Cooke *et al.*, (2002). The strength of present study was that it included patients with a wide variety of respiratory tract infections while majority of the other related studies focus on mainly one type of infection. The analysis of all classes of antibiotics used in conversion was an added advantage in having a better understanding about the effects and benefits of conversion therapy.

Future research could be done on the field of pharmacoeconomics to better understand and find out the most cost effective combination of antibiotics that could be converted from IV to oral. Studies can also be done on the safety of these conversions as a wide range of information on this strategy will encourage physicians to adopt it.

CONCLUSION

The present study highlights that there are large array of medications are available for IV to PO conversion therapy and various types of IV to PO conversions are possible. From the different parameters compared and outlined in the present study, following

conclusions could be drawn that among three types of conversion therapy, step down therapy is the most commonly used conversion method and the analysis shows that early conversion from IV to PO antibiotics will reduce the duration of hospitalization. Therefore early conversion from IV to oral antibiotics not only reduces the financial burden of a patients, it minimizes the possible IV complications too and Boosts the faster recovery of a patients.

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Nil

Conflicts of interest

There are no conflicts of interest between the patients

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