



Vancomycin Prescription Pattern in a Teaching Hospital: The Promising Role of Antimicrobial Control Programs

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ABSTRACT

Background: Irrational use of antibiotics is a healthcare problem which can lead to antibiotic resistance. Vancomycin resistance is developing worldwide and is a huge financial burden to healthcare systems. Antimicrobial control programs are an essential component of educational programs in ensuring the optimal use of antibiotics. This study aimed to evaluate the effects of an educational program implemented at an Educational Medical Center on vancomycin prescription patterns.

Methods: This was a cross-sectional, pre-post interventional study carried out at Imam Hussein Hospital affiliated with Shahid Beheshti University of Medical Sciences (SBMU), Tehran, Iran, between 2014 to 2016. Vancomycin protocol was prepared, then all physicians and assistants were trained through workshops and instructed to order vancomycin based on the approved protocol. The primary objective of this study was to determine the change in vancomycin usage – calculated based on the Defined Daily Dose (DDD) per 100 patient-days in each ward – collected in three phases: at baseline, during the educational program and post-intervention phase.

Results: The data revealed that total vancomycin consumption significantly decreased at the baseline and post-intervention phases in comparison with during the educational program ($p=0.007$, $p=0.105$, respectively).

Conclusion: The educational programs in this study were effective at optimizing antibiotics usage and the study results showed that antimicrobial training programs can be successfully implemented for the management of vancomycin usage at our university-affiliated hospital.

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Introduction

Overuse and misuse of antibiotics are one of the most important global problems in hospital settings, which can lead to antibiotic resistance. It also increases the likelihood of adverse drug reactions (ADRs) and the cost of health services (1). Many strategies have been employed for optimal use of antibiotics, for example, rational initiation of

empirical antimicrobial therapy, using appropriate dosing regimens, appropriate de-escalation of antimicrobial therapy, intravenous to oral switch therapy, awareness of local resistance and antimicrobial control programs (2). Of the aforementioned strategies, antimicrobial control programs are an essential approach. Preparing guidelines, prior authorization policies, performance evaluation, primary focus

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on limiting antibiotic usage and educational programs are the main activities in antimicrobial stewardship programs (3). Educational activities are an important part of antimicrobial control programs. The goal of these programs is to increase the physician’s knowledge regarding the rational usage of antimicrobial agents and microbial resistance (4).

Vancomycin is the first choice for the treatment of Methicillin-Resistant Staphylococcus Aureus (MRSA) and Enterococcus. Increasing rates of resistance to vancomycin, with organisms like Vancomycin-Resistant Staphylococcus Aureus (VRSA) and Vancomycin-Resistant Enterococci (VRE) has been documented, which is a significant financial burden for the healthcare system (5). We designed this study to evaluate the effects of antimicrobial control programs, especially educational programs, on vancomycin prescription patterns.

Methods

This was a cross-sectional, pre-post interventional study including three phases, each for three months, carried out at Imam Hussein Hospital affiliated with Shahid Beheshti University of Medical Sciences (SBMU), Tehran, Iran, between 2014 to 2016. Seven wards, including surgery, radiotherapy, internal medicine, intensive care, psychiatry, pediatrics and emergency medicine were included in this study.

In the first step, a vancomycin usage protocol was prepared based on guidelines from the Infectious Diseases Society of America (IDSA) (6) through collaboration with this antibiotic subcommittee, consisting of infectious diseases and clinical pharmacy specialists. Subsequently, the protocol was approved by the Drug and Therapeutics Committee (D & T) committee and all physicians and assistants were trained by an antibiotic subcommittee. This educational program was intended to focus on the importance of vancomycin antimicrobial resistance, indications, appropriate dosing, appropriate administration, and related adverse effects. This program was delivered through workshops held in four sessions, with each session being approximately 60 minutes in duration. Following enrollment in these trainings, all physicians and assistants were required to place vancomycin orders based on the approved protocol.

The amount (dosing) of administered vancomycin was collected in three phases, each consisting of 3 months; phase 1 (baseline or pre-intervention): December 22, 2014 to March 19, 2015; phase 2: during the educational program: September 21 to December 21, 2015; and phase 3 (post-intervention): December 22, 2015 to March 19, 2016. All data were extracted from the Hospital Information System (HIS). The consumption of vancomycin was calculated based on the Defined Daily Dose (DDD) per 100 patient-days for each ward. The primary objective of this study was to determine the change in vancomycin usage based on DDD per 100 patient-days in predetermined wards of the hospital. The results were analyzed by SAS software (Version 9.1) and Poisson regression model was used to compare the vancomycin consumption.

Results

Vancomycin consumption based on DDD per 100 patients’ day in three phases is presented by the seven groups admitted in Tables 1 and 2.

Table 1. Consumption of vancomycin based on the DDD/100 patients/day. Comparison of pre-intervention consumption to post-intervention.

Wards	Pre- / Post- Intervention	DDD/100 patients/day	Relative percent reduction	P-value
Surgery	Before ^a	8.07	23	0.095
	After ^b	6.23		
Radiotherapy	Before	3.99	55	0.009
	After	1.79		
Internal Medicine	Before	14.12	45	0.001
	After	7.74		
Intensive care	Before	15.11	29	0.105
	After	10.71		
Emergency	Before	12.96	27	0.041
	After	9.41		
Psychiatry	Before	0	-	-
	After	0		
Pediatric	Before	6.05	27	0.057
	After	4.39		
Total	Before	11.12	34	0.007
	After	7.28		

^a Pre-Intervention or baseline: 22-December 2014 to 19-March 2015 (phase 1)

^b Post-Intervention: 22-December 2015 to 19-March 2016 (phase 3)

Data related to the comparisons between phase 3 and phase 1 of the study are summarized in Table 1. The results revealed that total vancomycin consumption decreased by 34% (23 to 55) from phase 1 to phase 3, which was significant (P = 0.007). Of the 7 wards that were included in this study, the decrease was not significant in the pediatrics, intensive care and surgery units (with P = 0.057, P = 0.105, and P = 0.095 respectively).

Table 2 shows a comparison of data between phase 3 and phase 2 of the study. We detected a significant decrease in total vancomycin use (22.84%, P = 0.015). This decrease was significant in the internal medicine and emergency

medicine wards ($P = 0.002$ and $P = 0.029$, respectively).

Table 2. Consumption of vancomycin based on the DDD/100 patients/day. Comparison of vancomycin use before intervention to after the intervention.

Wards	Pre- / Post- Intervention	DDD/100 patients/day	Relative percent reduction	P-value
Surgery	Before ^a	7.08	12	0.327
	After ^b	6.23		
Radiotherapy	Before	3.16	43	0.173
	After	1.79		
Internal medicine	Before	11.69	34	0.002
	After	7.74		
Intensive care	Before	10.49	2	0.856
	After	10.71		
Emergency	Before	13.73	31	0.029
	After	9.41		
Psychiatry	Before	0.16	-	-
	After	0		
Pediatric	Before	5.18	15	0.530
	After	4.39		
Total	Before	8.25	23	0.015
	After	7.28		

^a During the educational program: 21-September to 22-December 2015 (phase 2)

^b After the intervention: 22-December 2015 to 19-March 2016 (phase 3)

Discussion

Despite the efforts to reduce the misuse of antibiotics, the irrational consumption of antibiotics remains a major concern. In 2015, Hamishehkar et al. assessed the appropriateness of vancomycin usage in a teaching hospital in Tabriz (Iran) (7). The results of this study indicated that 69.3% of patients received vancomycin inappropriately. Furthermore, the administered dose of vancomycin was inappropriate in most cases. In Tehran (Iran) Ayazkhoo, et al., evaluated the indication for vancomycin use and its administered dose, which showed that more than half of patients receiving vancomycin were at the risk of receiving low drug levels based on the guidelines (8).

The purpose of this study was to investigate the influence of antimicrobial control programs, especially educational programs on the pattern of vancomycin prescription which

demonstrated that antimicrobial educational programs are effective for promoting its rational use. The results of similar studies have indicated educational and training sessions to be effective when offered according to the appropriate guidelines (9-11).

In their systemic review, Roque et al. had found improvement in adherence to guidelines and decrease in the total amount of antibiotics prescribed after educational interventions, in 46% and 41% of all the reviewed studies, respectively (12). Therefore, the utilization of antimicrobial control programs with an emphasis on education will improve the pattern of antibiotic usage.

In another study by Mohammadi et al. an antibiotic stewardship program implemented in the pediatric intensive care unit (PICU) of a hospital in Mashhad (Iran) that had also targeted vancomycin use demonstrated that training reduces inappropriate vancomycin usage without increasing mortality (13). Finally, the results of the study by Goossens et al. in Belgium showed that creating awareness regarding antimicrobial resistance and providing a knowledge base for physicians was important in reducing antibiotic resistance (14).

In conclusion, based on this findings of this research, we concluded that antimicrobial control programs communicated through educational activities and training sessions can be effective in changing antibiotic prescription patterns among hospital physicians, which in turn ensure more appropriate and rational use.

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