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Antimicrobial Stewardship: A Shared Responsibility among Primary Prescribers, Pharmacists, Infectious Disease Physicians and Microbiologists

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Abstract

Introduction: Antimicrobial stewardship is a key component of a multidisciplinary approach to prevent emergence of antimicrobial resistance. It is an imperative to have antimicrobial stewardship program in place in each hospital and health facility.

Method: Antimicrobial stewardship (AMS) program in our hospital was initiated in 2017 and interventions introduced were formulary restriction, preauthorization, education of health care workers, prospective data collection and feedback to prescribers, IV to oral switch for eligible cases.

Results: Discontinuation and de-escalation rate of restricted antimicrobials was cumulatively around 60% whereas only 35%-40% of restricted antimicrobials were continued. Appropriateness of initiation of antimicrobial was improving over time by regular/continuous education and increasing awareness to prescribers. We noticed a positive impact on antimicrobial prescribing patterns as primary prescribers/pharmacists were actively reassessing the cases and de-escalating antimicrobials when indicated. There was a 50% decline in hospital associated *Clostridium difficile* cases and slight downwards trend in MDROs.

Conclusion: AMS program in our facility has demonstrated a downward trend in consumption of broad-spectrum antimicrobials, increased IV to oral conversion rates for antimicrobials and decrease in hospital-acquired *Clostridium difficile* infections. Antimicrobial stewardship is a shared responsibility among primary prescribers, pharmacists, infectious disease physicians as well as microbiologists to ensure safe antimicrobial prescribing and improving patient outcome.

Keywords: Antibiotics; Stewardship; Resistance; Antimicrobials; *Clostridium difficile*

Introduction

Antimicrobial stewardship is a key component of a multidisciplinary approach to prevent emergence of antimicrobial resistance and to decrease *Clostridium difficile* infections [1-4]. According to CDC report 2.8 million antibiotic-resistant infections occur in the United States each year with more than 35,000 deaths [5].

Previous studies have shown inappropriate use of antimicrobials in hospital setting up to 50% of the cases [3]. It is of utmost necessity to have an antimicrobial stewardship program in place in each hospital and healthcare facility. Strategies to implement antimicrobial stewardship program include formulary restriction, preauthorization of restricted antimicrobials, physician education, computer assisted programs (for example for monitoring of antibiotic prescriptions, IV to oral conversion, order sets for common infections like pneumonia and integration of microbiology results in antimicrobial prescriptions) [1,2,6-8].

Methods

Population settings

Al-Wakra Hospital, a 320 bedded teaching hospital in state of Qatar, caters multi-national population and offers a number of specialist services including medical and surgical subspecialties, burn, critical care and bariatric surgery.

Study design and patients

It is a single Center observational prospective study where antibiotic consumption was monitored in adult inpatients admitted between Jan 2017 till December 2019. Antibiotic consumption was measured by daily defined dose (DDD). De-escalation and discontinuation rate of restricted antimicrobials was recorded by clinical pharmacists in excel sheet updated daily by inpatient pharmacy in AMS shared folder and data was analyzed on monthly basis. Furthermore, AMS interventions done by clinical pharmacists were recorded in patient's records in Cerner and retrieved monthly. Data was presented and discussed with hospital AMS committee on quarterly basis.

AMS team

AMS team was multidisciplinary comprised of infectious disease (ID) physician, clinical pharmacists, infection control practitioners and clinically microbiologist.

AMS Interventions

Interventions chosen for implementation were formulary restrictions, hard stop of restricted antimicrobials after 48 hours by pharmacy, prospective data collection, analysis of clinical interventions and feedback to prescribers, IV to oral conversion of antimicrobials. Restricted antimicrobials included broad-spectrum antibiotics, antiviral agents and antifungal agents according to local hospital policy (total 23 antimicrobials in number). Under formulary restriction, these antibiotics required ID physician approval to continue beyond 48 hours of initiation. Primary prescribers were educated about the pathway to prescribe restricted antimicrobials and to involve ID physician as early as possible to ensure continuity of care. ID physician reviewed the cases and decide about management of antibiotics (de-escalation, discontinuation, continuation or escalation). In case of continuation of restricted antimicrobial therapy, duration and dose was adjusted according to indication, therapeutic drug monitoring and renal/hepatic adjustment.

Appropriateness of antimicrobial therapy was also monitored for compliance with local guidelines and clinical judgment. Multiple education sessions were delivered to health care workers about AMS interventions and choosing right antibiotic according to local guidelines and local antibiograms. They were also emphasized to follow infection control practices and hand hygiene.

Various multidisciplinary meetings were arranged with different departments to give them feedback about their prescribing patterns, discussing local antibiogram and addressing their concerns for smooth utilization of antimicrobials and not to disturb continuity to of care. Hot line from IV pharmacy on call to ID physician on call was maintained for troubleshooting. Nurses were also involved and educated to ensure smooth flow of antibiotics dispensing pathway.

Medical microbiologist ensured that results are communicated promptly with restriction of antimicrobial sensitivity reporting, in addition to providing the necessary advice to clinicians.

Physicians were encouraged for IV to oral conversion of antimicrobials if patient is eligible and fit for administration of oral antibiotics according to local hospital guidelines. Ceftriaxone being highly consumed antimicrobial across hospital was selected to be monitored for oral conversion in eligible patients.

Results

A total of 2500 ASP interventions documented from January 2018 to December 2019 (Figure 1). Top 10 antimicrobials for the clinical interventions were: ceftriaxone, vancomycin, cefuroxime, amoxicillin clavulanate, piperacillin tazobacatam, meropenem, amikacin, clindamycin, gentamicin, and metronidazole Average acceptance rate by the prescribers was 96.2 %.

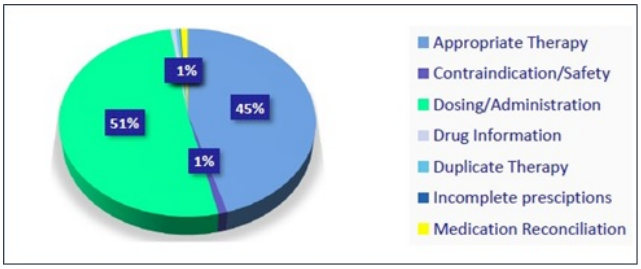

Figure 1: AMS interventions by clinical pharmacists from Jan 2018-Dec 2019.

Upon analysis ceftriaxone was one of the highly consumed antimicrobials across the hospital. As there is well known association with overuse of cephalosporins and emergence of extended spectrum Beta-lactamase organisms, actions were taken to decrease the use of ceftriaxone (i-e physician education, increasing IV to PO switch and alternating use of ceftriaxone by penicillins. These actions lead to decrease in the use of ceftriaxone gradually.

IV to oral switch of ceftriaxone was monitored in medical and surgical wards over 8 months. Initially rate of switch was low but with continuous education and review of the cases by clinical pharmacists there was 40% improvement (Figure 2). Early IV to oral switch is associated with decreased hospital stay and decreased IV infusion related adverse effects that needs to be measured in future as outcome of this project.

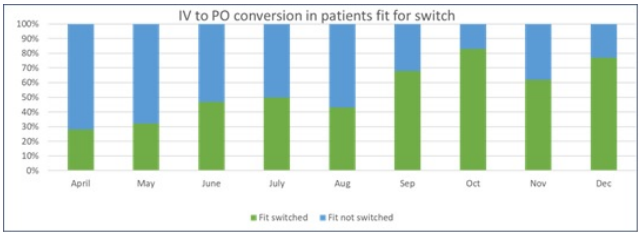

Figure 2: IV to oral switch of ceftriaxone in medical and surgical units from April- Dec 2019.

Discontinuation and de-escalation rate of restricted antimicrobials, monitored on monthly basis, was cumulatively 55 percent, 40% of restricted antimicrobials were continued, 5 percent were escalated, after ID physician review. It was found that appropriateness of the treatment was improving as time evolved by regular monitoring/auditing, continuous education and increasing awareness of prescribers [9].

As a result of continuous education and interventions by stewardship team, we observed a positive impact on antimicrobial prescribing patterns. Primary prescribers/pharmacists were actively reassessing the cases to de-escalate the antimicrobials if indicated. Erturk et al. in his study demonstrated favorable impact of similar interventions i-e ID physician approval of restricted antimicrobial and prospective audit and feedback on decreasing inappropriate use of antimicrobials.

Overall, the outcome was down-trend in the use of ceftriaxone (Figure 3), justified use of broad-spectrum antimicrobials, increased appropriateness of therapy according to local guidelines, increased IV to oral switch of ceftriaxone and decrease in hospital acquired *Clostridium difficile* infections.

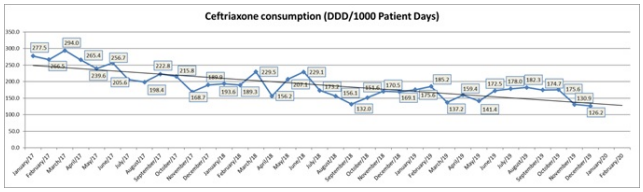

Figure 3: DDD of ceftriaxone in Al-Wakra hospital over 3 years (Jan2017-Dec 2019).

Discussion

Antimicrobial stewardship program is a set of coordinated interventions to improve the use of antimicrobials [10]. AMS interventions to ensure justified use of antibiotics is of utmost importance for combating the problems of antimicrobial resistance and *Clostridium difficile* [4,8,9]. Various models for antimicrobial stewardship initiatives have been implemented and studied such as infectious disease physician led interventions [11-16], clinical pharmacist led interventions, computer-assisted techniques, premade order sets for common infections, hard stop of restricted antimicrobials after 48-72 hours, cycling of antibiotics [1,2,4,8]. Core elements of a stewardship program, as described by Center of disease prevention and control (CDC) are single physician/pharmacist leader accountability, hospital leadership commitment, pharmacy expertise, implementation of interventions like preauthorization of antimicrobials and prospective audit and feedback monitoring and tracking of the data and education [5]. Common interventions include preauthorization for antimicrobials by ID physician, de-escalation of broad-spectrum antibiotics, IV to by mouth conversion of antimicrobials, limiting the use of third and fourth generation cephalosporins, education of primary prescribers, appropriateness of the dose and duration of antimicrobials according to indication and therapeutic drug monitoring [3,4,6,7,13,14]. Local antibiograms at institutional level are helpful for AMS programs for the development of guidelines for empiric therapy [14].

Antibiotics consumption was measured in daily defined dose (DDD) as per WHO recommendation [17,18]. The WHO-assigned "DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults" [18]. Monitoring antimicrobial use by DDDs per 1000 patient-days is a major advancement that can aid standardized comparisons among different facilities [19,20]. Data revealed significant reduction in DDD of ceftriaxone and fluroquinolones (Figure 2) whereas Piperacillin tazobacatm and meropenem were almost the same.

It is mandatory to have stewardship program in all healthcare facilities to provide optimum care for the patients and to decrease the incidence of multidrug-resistant organisms. Interventions need to be chosen according to patient population, facility resources, resistance patterns of microorganisms and antimicrobial prescribing patterns [2-4,7,8,15]. Interventions should be recorded and pre-and post-intervention data needs to be assessed to monitor the success of the program.

Educational/awareness sessions conducted on regular basis reinforce compliance with AMS measures. It is crucial to involve primary prescribers, attending physicians, pharmacists and nurses in antimicrobial stewardship program to comply with chosen stewardship interventions and infection control practices. Feedback to the primary prescribers should be given on periodic basis [9].

Conclusion

Antimicrobial stewardship is every one's responsibility. In the era of rising resistance patterns and paucity of new antimicrobials in the pipeline, we need to save our antimicrobials for serious infections. We conclude that antimicrobial stewardship is a shared responsibility among primary prescribers, pharmacists, ID physicians and microbiologists to ensure safe antimicrobial prescribing and improving patient outcome as well as to decrease the rate of hospital-acquired *Clostridium difficile* and multi drug-resistant organisms. Focused education and awareness among healthcare workers and primary prescribers are Key components to combat antimicrobial resistance.

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Conflict of interest

Authors declare to have no conflict of interest.

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