



Antibiotic stewardship programme in pediatrics: A review

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Citation this Article: Ashita Ajith, Dr.Dhanya Dharman, “Antibiotic stewardship programme in pediatrics: A review”, IJMSIR- August - 2021, Vol – 6, Issue - 4, P. No. 105 – 108.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

Antibiotic stewardship programs (ASP) have been created in many hospitals in an effort to optimize the use of antibiotics. It is a coordinated program that promotes the appropriate use of antibiotics, improves patient outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms. Antibiotics are widely prescribed for children and the frequency of antibiotic use in pediatric patients has led to a significant increase in the prevalence of multidrug-resistant bacterial infections among children. The Pediatric Infectious Diseases Committee on Antimicrobial Stewardship has defined the development of ASPs in three different settings: inpatients setting, special population pediatric setting, and outpatients. The cornerstone for ASP is appropriate selection, dose and duration of antibiotics. The advantages of ASP include decrease in antimicrobial resistance and cost of care. The successful implementation of ASP can be assessed clinically and Pediatric-focused ASPs are necessary because of the differences in antimicrobial need and use among this patient population, unique considerations and dosing,

vulnerability for resistance due to a lifetime of antibiotic exposure, and the increased risk of adverse events.

Keywords: Antibiotic Stewardship Programme (ASP), Antibiotics, Pediatrics, Microbial resistance

Introduction

Antibiotics are widely prescribed for children and the prescription patterns differ between each hospitals and many of the prescription are unwanted. The frequency of antibiotic use in pediatric patients has led to a significant increase in the prevalence of multidrug-resistant bacterial infections among children.^[1-2] Antibiotic stewardship programs have been created in many hospitals in an effort to optimize the use of antibiotics. It is a coordinated program that promotes the appropriate use of antibiotics, improves patient outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms.^[3] The use of antibiotics in pediatric intensive care units (PICU) is very high. All hospitals should have ASPs that serve all patient types.⁴ This includes the adult academic and community hospitals that primarily care for children. The cornerstone for

ASP is appropriate selection, dose and duration of antibiotics. The advantages of ASP include decrease in antimicrobial resistance and cost of care.^[5-6] The ASP in pediatric ICUs can be implemented through physician, pharmacist, nurses. The four main components of this programme were: Selection of appropriate agent, based on the patient characteristics, previous antibiotics received in current illness, nature of disease/infection and microbiological details available if any before the admission, prescribing in appropriate dose and recommendation regarding interactions or monitoring of therapy. It has been demonstrated that between 20 to 50% of prescriptions for children are potentially unnecessary or inappropriate.^[7] There are many antibiotics especially broad spectrum of antibiotics prescribed for the children. This pattern of antibiotic usage increases the risk of serious side effects, raises healthcare costs, and contributes significantly to the global emergency of antimicrobial resistance.^[8] The Pediatric Infectious Diseases Committee on Antimicrobial Stewardship has defined the development of ASPs in three different settings: inpatients, special populations (e.g. oncology), and outpatients. Indeed, the characteristics of specific ASPs may vary to best fit the needs of different settings.^[9]

Need of asp in pediatric population

Consumption of antibiotics is very high in pediatric population and repeated antimicrobial use is most common in children admitted in ICUs. Neonates are especially vulnerable since they receive broad spectrum antimicrobials much more frequently than older children. Moreover, they are more prone to early upgradation of antimicrobials due to high risk of morbidity and mortality. Neonates also have maximum risk of antimicrobial associated severe adverse effects,

including necrotizing enterocolitis, invasive candidiasis, increased hospital stay, and bacterial resistance.^[10] With the recognition of the various challenges noted with antibiotic use in pediatric and neonatal population, Pediatric Infectious Disease Society (PIDS) in formed the Pediatric Committee of Antimicrobial Stewardship with the mission of advancing pediatric antimicrobial stewardship in various clinical settings, promoting research, and developing antimicrobial stewardship educational programs.^[11] Through this program the best clinical outcome for the treatment or prevention of infection with minimal toxicity and minima resistance and other adverse events can be achieved. The main goals include:

- Improve patient outcome: improve infection cure rate, reduce surgical infection rate, reduce mortality and morbidity,
- Improve patient safety: reduce antimicrobial consumption without increasing mortality or infection related readmissions; reduce colonization or infection by controlling the use of higher antimicrobial,
- Reduce resistance: restrict relevant agents; and
- Reduce health care costs.

Implementing of ASP

For the implementation there must be a policy to ensuring and monitoring the proper usage of antibiotics^[12] and other intervention can include:

Designing and executing policies on reassessing the need and choice of the antibiotics started empirically at the time of admission in pediatric department.

Adhering to the policies, which is also monitored, reviewed and through this decide the need of antibiotics before the therapy is initiated.

Prospective audit and feedback: This involves a review regarding antibiotics are prescribed to the children.

Regular changes from intravenous to oral treatment so that needs less access to intravenous medications.

Dose adjustments in patients with the cases of organ dysfunction and requiring dose optimization like those with therapeutic drug monitoring, higher doses for achieving CNS penetration, doses for highly resistant bacteria.

Automatic alerts to avoid unnecessary duplication of drugs which have overlapping spectra.

Time sensitive automatic stop orders for certain prescriptions whenever it is necessary.

The successful implementation of ASP can be assessed based on antimicrobial consumption in terms of daily dose, cost and days of treatment, antimicrobial adverse events, resistance patterns, intervention and monitoring. Clinical outcome measurements are assessed based on cure versus failure, (both clinically, and microbiologic), superinfection, and reinfection.

ASP on high-risk pediatric patients

Through many studies conducted, the ASP in pediatric population and making an integral part of hospital care, can identify the high risk patients and yield several important findings like, ASP recommendations can be frequently included to stop therapy in high-risk pediatric patients, which did not result in worsening clinical outcomes. Then in patients with a single ASP and reviewing them during their hospitalization, making ASP recommendation was associated with decreasing the length of hospital stay. And then, these ASP recommendations can result in shorter antibiotic durations when treating common high-risk infections without an increase in the treatment failure rate. Broad-spectrum antimicrobial use is high, and prompt initiation of appropriate antimicrobials is critical in

these vulnerable pediatric patients.^[13] Durations of antimicrobial therapy are often not clearly defined in high-risk children. Underlying immunocompromised conditions modify both the inflammatory response to infection and the response to treatment.^[14] However, the undesired consequences of broad-spectrum antimicrobial use is also more frequent, including infection with multidrug-resistant pathogens.^[15] Thus, stewardship efforts are extremely important in this population both to minimize the unnecessary use of antimicrobials and to optimize the antimicrobials being used.

Implementation, maintenance, and growth of successful ASPs require a willingness to understand and have a flexible mindset about certain cultural norms, including those specific to individual hospitals, medical specialties, and to the culture of medicine.^[16] In health care setting there must be a pediatric-specific ASPs, in the interest of decreasing the incidence of antibiotic-resistant bacteria and improving health care for children. Antimicrobial resistance is a major threat. It is essential to take some urgent steps to stop this rising resistance. Pediatric-focused ASPs are necessary because of the differences in antimicrobial need and use among this patient population, unique considerations and dosing, vulnerability for resistance due to a lifetime of antibiotic exposure, and the increased risk of adverse events.^[17] The ASP is one of the key strategies to prevent the emergence of antimicrobial resistance but the success of this program needs joint efforts at the level of community, patient, and the healthcare provider.

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