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Clinical evaluation of antibiotic utilization pattern in surgical department in Vardhman institute of medical sciences

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Abstract
Antibiotics are powerful and effective drugs in the fight against infectious diseases caused by bacteria, and have saved millions of lives since their first appearance about 50 years ago. Rational use of antibiotics is extremely important as injudicious use can adversely affect the patient, cause emergence of antibiotic resistance and increase the cost. As per the World Health Organization, rational use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, and at the lowest cost to them and their community (WHO,1987). The use of antibiotic prophylaxis has been shown to prevent post-surgical wound infection. When employed rationally, significant reduction in the mortality and morbidity and saving in resources can be achieved. Hence based on above findings the present study was planned for Clinical Evaluation of Antibiotic Utilization Pattern in Surgical Department in Vardhman Institute of Medical Sciences.

The present study was planned in Department of Surgery, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar. Total 50 patients undergone the surgical procedure in the hospital were included in our study. All medically relevant information was noted in a predefined data collection form. Alternatively, these case charts were reviewed for prescription of antibiotics. The demographic data and the detailed history of patient regarding past, present, family, personal and drug history was taken. The other details like the present diagnosis, reason for the present admission, any investigations done to confirm the diagnosis were also noted.

The data generated from the present study concludes that Third generation cephalosporin was the preferred or most prescribed choice of drug for prophylaxis followed by penicillins. The average number of antimicrobials prescribed in surgery department was 3 per patients. Amoxicillin and clavulanate were the fixed drug combination that was prescribed maximally.

Keywords: antibiotics, surgery, prescription pattern, etc

Introduction

An antibiotic is a type of antimicrobial substance active against bacteria and is the most important type of antibacterial agent for fighting bacterial infections. Antibiotic medications are widely used in the treatment and prevention of such infections. They may either kill or inhibit the growth of bacteria. A limited number of antibiotics also possess antiprotozoal activity. Antibiotics are not effective against viruses such as the common cold or influenza; drugs which inhibit viruses are termed antiviral drugs or antivirals rather than antibiotics [1].

Sometimes, the term antibiotic which means "opposing life", is broadly used to refer to any substance used against microbes, but in the usual medical usage, antibiotics (such as penicillin) are those produced naturally (by one microorganism fighting another), whereas nonantibiotic antibacterials (such as sulfonamides and antiseptics) are fully synthetic. However, both classes have the same goal of killing or preventing the growth of microorganisms, and both are included in antimicrobial chemotherapy. "Antibacterials" include antiseptic drugs, antibacterial soaps, and chemical disinfectants, whereas antibiotics are an important class of antibacterials used more specifically in medicine and sometimes in livestock feed [2].

Antibiotics have been used since ancient times. Many civilizations used topical application of mouldy bread, with many references to its beneficial effects arising from ancient Egypt, China, Serbia, Greece and Rome. The first person to directly document the use of moulds to treat infections was John Parkinson (1567–1650). Antibiotics revolutionized medicine in the 20th century. Alexander Fleming (1881–1955) discovered modern day penicillin in 1928. After realizing the great potential there was in penicillin, Fleming pursued the challenge of how to market it and translate it to commercial use. With help from other biochemists, penicillin was finally available for widespread use. This was significantly beneficial during wartime. Unfortunately, it didn't take long for resistance to begin. Effectiveness and easy access have also led to their overuse [citation needed] and some bacteria have developed resistance. This has led to widespread problems, and the World Health Organization has classified antimicrobial resistance as a "serious threat [that] is no longer a prediction for the future, it is happening right now in every region of the world and has the potential to affect anyone, of any age, in any country" [3].

Antibiotics are used to treat or prevent bacterial infections, and sometimes protozoan infections. (Metronidazole is effective against a number of parasitic diseases). When an infection is suspected of being responsible for an illness but the responsible pathogen has not been identified, an empiric

therapy is adopted. This involves the administration of a broad-spectrum antibiotic based on the signs and symptoms presented and is initiated pending laboratory results that can take several days [4].

When the responsible pathogenic microorganism is already known or has been identified, definitive therapy can be started. This will usually involve the use of a narrow-spectrum antibiotic. The choice of antibiotic given will also be based on its cost. Identification is critically important as it can reduce the cost and toxicity of the antibiotic therapy and also reduce the possibility of the emergence of antimicrobial resistance. To avoid surgery, antibiotics may be given for non-complicated acute appendicitis.

Antibiotics may be given as a preventive measure and this is usually limited to at-risk populations such as those with a weakened immune system (particularly in HIV cases to prevent pneumonia), those taking immunosuppressive drugs, cancer patients, and those having surgery. Their use in surgical procedures is to help prevent infection of incisions. They have an important role in dental antibiotic prophylaxis where their use may prevent bacteremia and consequent infective endocarditis. Antibiotics are also used to prevent infection in cases of neutropenia particularly cancer-related [5].

There are many different routes of administration for antibiotic treatment. Antibiotics are usually taken by mouth. In more severe cases, particularly deep-seated systemic infections, antibiotics can be given intravenously or by injection. Where the site of infection is easily accessed, antibiotics may be given topically in the form of eye drops onto the conjunctiva for conjunctivitis or ear drops for ear infections and acute cases of swimmer's ear. Topical use is also one of the treatment options for some skin conditions including acne and cellulitis. Advantages of topical application include achieving high and sustained concentration of antibiotic at the site of infection; reducing the potential for systemic absorption and toxicity, and total volumes of antibiotic required are reduced, thereby also reducing the risk of antibiotic misuse. Topical antibiotics applied over certain types of surgical wounds have been reported to reduce the risk of surgical site infections. However, there are certain general causes for concern with topical administration of antibiotics. Some systemic absorption of the antibiotic may occur; the quantity of antibiotic applied is difficult to accurately dose, and there is also the possibility of local hypersensitivity reactions or contact dermatitis occurring. It is recommended to administer antibiotics as soon as possible, especially in life-threatening infections. Many emergency departments stock antibiotics for this purpose [6].

Antibiotics are screened for any negative effects before their approval for clinical use, and are usually considered safe and well tolerated. However, some antibiotics have been associated with a wide extent of adverse side effects ranging from mild to very severe depending on the type of antibiotic used, the microbes targeted, and the individual patient. Side effects may reflect the pharmacological or toxicological properties of the antibiotic or may involve hypersensitivity or allergic reactions. Adverse effects range from fever and nausea to major allergic reactions, including photodermatitis and anaphylaxis. Safety profiles of newer drugs are often not as well established as for those that have a long history of use [7].

Common side-effects include diarrhea, resulting from disruption of the species composition in the intestinal flora, resulting, for example, in overgrowth of pathogenic bacteria, such as Clostridium difficile. Antibacterials can also affect the vaginal flora, and may lead to overgrowth of yeast species of the genus Candida in the vulvo-vaginal area. Additional side effects can result from interaction with other drugs, such as the possibility of tendon damage from the administration of a quinolone antibiotic with a systemic corticosteroid.

Exposure to antibiotics early in life is associated with increased body mass in humans and mouse models. Early life is a critical period for the establishment of the intestinal microbiota and for metabolic development. Mice exposed to subtherapeutic antibiotic treatment – with either penicillin, vancomycin, or chlortetracycline had altered composition of the gut microbiota as well as its metabolic capabilities. One study has reported that mice given low-dose penicillin (1 μg/g body weight) around birth and throughout the weaning process had an increased body mass and fat mass, accelerated growth, and increased hepatic expression of genes involved in adipogenesis, compared to control mice. In addition, penicillin in combination with a high-fat diet increased fasting insulin levels in mice. However, it is unclear whether or not antibiotics cause obesity in humans. Studies have found a correlation between early exposure of antibiotics (<6 months) and increased body mass (at 10 and 20 months). Another study found that the type of antibiotic exposure was also significant with the highest risk of being overweight in those given macrolides compared to penicillin and cephalosporin [8]. Therefore, there is correlation between antibiotic exposure in early life and obesity in humans, but whether or not there is a causal relationship remains unclear. Although there is a correlation between antibiotic use in early life and obesity, the effect of antibiotics on obesity in humans needs to be weighed against the beneficial effects of clinically indicated treatment with antibiotics in infancy.

The emergence of resistance of bacteria to antibiotics is a common phenomenon. Emergence of resistance often reflects evolutionary processes that take place during antibiotic therapy. The antibiotic treatment may select for bacterial strains with physiologically or genetically enhanced capacity to survive high doses of antibiotics. Under certain conditions, it may result in preferential growth of resistant bacteria, while growth of susceptible bacteria is inhibited by the drug. For example, antibacterial selection for strains having previously acquired antibacterial-resistance genes was demonstrated in 1943 by the Luria–Delbrück experiment. Antibiotics such as penicillin and erythromycin, which used to have a high efficacy against many bacterial species and strains, have become less effective, due to the increased resistance of many bacterial strains [9].

Resistance may take the form of biodegredation of pharmaceuticals, such as sulfamethazine-degrading soil bacteria introduced to sulfamethazine through medicated pig feces. The survival of bacteria often results from an inheritable resistance, but the growth of resistance to antibacterials also occurs through horizontal gene transfer. Horizontal transfer is more likely to happen in locations of frequent antibiotic use.

Antibacterial resistance may impose a biological cost, thereby reducing fitness of resistant strains, which can limit the spread of antibacterial-resistant bacteria, for example, in

the absence of antibacterial compounds. Additional mutations, however, may compensate for this fitness cost and can aid the survival of these bacteria. Paleontological data show that both antibiotics and antibiotic resistance are ancient compounds and mechanisms. Useful antibiotic targets are those for which mutations negatively impact bacterial reproduction or viability [10].

Several molecular mechanisms of antibacterial resistance exist. Intrinsic antibacterial resistance may be part of the genetic makeup of bacterial strains. For example, an antibiotic target may be absent from the bacterial genome. Acquired resistance results from a mutation in the bacterial chromosome or the acquisition of extra-chromosomal DNA. Antibacterial-producing bacteria have evolved resistance mechanisms that have been shown to be similar to, and may have been transferred to, antibacterial-resistant strains. The spread of antibacterial resistance often occurs through vertical transmission of mutations during growth and by genetic recombination of DNA by horizontal genetic exchange. For instance, antibacterial resistance genes can be exchanged between different bacterial strains or species via plasmids that carry these resistance genes. Plasmids that carry several different resistance genes can confer resistance to multiple antibacterials. Cross-resistance to several antibacterials may also occur when a resistance mechanism encoded by a single gene conveys resistance to more than one antibacterial compound [11].

Antibacterial-resistant strains and species, sometimes referred to as "superbugs", now contribute to the emergence of diseases that were for a while well controlled. For example, emergent bacterial strains causing tuberculosis that are resistant to previously effective antibacterial treatments pose many therapeutic challenges. Every year, nearly half a million new cases of multidrug-resistant tuberculosis (MDR-TB) are estimated to occur worldwide. For example, NDM-1 is a newly identified enzyme conveying bacterial resistance to a broad range of beta-lactam antibacterials. The United Kingdom's Health Protection Agency has stated that "most isolates with NDM-1 enzyme are resistant to all standard intravenous antibiotics for treatment of severe infections." On 26 May 2016 an E coli bacteria "superbug" was identified in the United States resistant to colistin, "the last line of defence" antibiotic [12].

Antibiotics are powerful and effective drugs in the fight against infectious diseases caused by bacteria, and have saved millions of lives since their first appearance about 50 years ago. Rational use of antibiotics is extremely important as injudicious use can adversely affect the patient, cause emergence of antibiotic resistance and increase the cost [13, 14]. As per the World Health Organization, rational use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, and at the lowest cost to them and their community (WHO, 1987). The use of antibiotic prophylaxis has been shown to prevent post-surgical wound infection. When employed rationally, significant reduction in the mortality and morbidity and saving in resources can be achieved. Hence based on above findings the present study was planned for Clinical Evaluation of Antibiotic Utilization Pattern in Surgical Department in Vardhman Institute of Medical Sciences.

Methodology

The present study was planned in Department of Surgery, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar. Total 50 patients undergone the surgical procedure in the hospital were included in our study. All medically relevant information was noted in a predefined data collection form. Alternatively, these case charts were reviewed for prescription of antibiotics. The demographic data and the detailed history of patient regarding past, present, family, personal and drug history was taken. The other details like the present diagnosis, reason for the present admission, any investigations done to confirm the diagnosis were also noted.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria: Patients underwent the surgical procedure in the hospital.

Exclusion Criteria: Patients underwent multiple complications and not willing to study.

Results & Discussion

Infections are the major reason for the poor prognosis of a condition. So proper control of infections can avoid or prevent certain situations which lead to morbidity or mortality. Control of infections can be achieved by usage of antibiotics. Just like a coin have two sides; antibiotics also have two-sided effects. One is in control of infection; the other is the resistance of an organism. For a decade, the problem of resistance is rising. This led to the usage of fixed dose combinations, usage of multiple antibiotics in order to have a good control on infection. Various studies are already done on the drug utilization of antibiotics, but most are conducted in developed countries and adding to that very little data is available in regard of south India. Random prescription of antibiotics by physicians for multiple organ infections does not give a clear picture on the percentage of a particular class of antibiotic in the prescription which reflects irrationality. This study helps in addressing a few of these aspects. Certain guidelines are laid out for the rational use of antibiotics. Irrespective of the guidelines, many physicians prescribe antibiotics irrationally. In the present trends, antibiotics account for the majority of prescriptions. Studies conducted by many professionals shown that almost every prescription contains an antibiotic [15].

Antibiotics are the sub stanceswhich selectively suppress the growth of or kill other microorganisms at very low concentration. This definition excludes other natural substances which also inhibit microorganism but are produced by microbes but are needed in higher concentration. Especially in intensive care and surgical department antibiotics is the most frequently prescribed drugs. To increase quality of care, infection control and cost containment certain programs designed to encourage appropriate antibiotic prescriptions in health institutions. Antibiotics are one of the pillars of modern medical care and play a major role both in the prophylaxis and treatment of infectious diseases. The issues of their availability, selection, and proper use are of critical importance to the global community. As the use of antibiotics to prevent infections at the surgical site is known as the surgical antibiotic prophylaxis. It is an effective management

strategy for reducing postoperative infections, provided that appropriate antibiotics are given at the correct time for appropriate durations and for appropriate surgical procedures [15].

Table 1: Demographic Details

Parameters	No. of Cases
Age	
Below 20 years	1
20 – 30 years	8
31 – 40 years	12
41 – 50 years	11
51 – 60 years	10
61 & above years	8
Sex	
Males	34
Females	16
Total	50

Table 2: Demographic Details

Diagnosis	No. of Cases
Hernia	12
Cellulitis	9
Diabetic foot ulcer	8
Abscess	8
Appendicitis	5
Cholelithiasis	5
Others	3

Table 3: Antibiotics Prescribed

Antibiotics	No. of Cases
Cephalosporin	14
Penicillin	11
Nitroimidazoles	9
Aminoglycosides	5
Fluoroquinolones	4
Oxazolidine	3
Carbapenems	1
Lincosamides	1
Macrolides	1
Others	1

Table 4: Disease Wise

Disease	Antibiotics	No. of Cases
Cellulitis	Amox+clavulanic acid	9
Diabetic foot and ulcer	Ceftriaxone	6
Abscess	Metronidazole	7
Cholelithiasis	Ampi+cloxacillin	4
Appendicitis	Metronidazole	4
Hernia	Ceftriaxone	9
Others	Metronidazole	2

A research study conducted by Meher B. R and others showna majority of male patients, which was in correlation to our study [16]. Our present study has shown that antibiotic prescription was found to be major in the age group of 21-40 y. A similar study conducted by Pandiamunian J & Somasundaram G of Mahatma Gandhi Medical College & Research Institute, Puducherry has shown the prescription of antibiotics was maximum in the age group of 51-60 y [17]. Beta-lactams and quinolones were the commonly prescribed antimicrobial classes. Among beta-lactams, cephalosporins specifically III generations were on the top. This is quiet in correlation to the study conducted by Lisha Jenny John et. al in which cephalosporins and aminoglycosides are seen [18]. A study conducted by Mujtaba Hussain Naqvi Syed and others shown that more than half of the patients taken into the study were with a single antibiotic followed by two antibiotic usages. This was found contradictory with our study where two antibiotic usages were seen in major followed by three drug usage [19].

Irrational use of antibiotics is a significant contributor for development of antibiotic resistance. As antibiotic resistance has posed a significant threat to management of infectious diseases and incidence of antibiotic resistance is increasing day by day, urgent steps are needed to promote rational use of antibiotics [20]. Antibiotics utilization study can help in fostering the habits of rational use of antibiotics which means at right dose, for right duration and at right cost.

The finding of Ramesh etal in which they have reported average number of drugs and antibiotic per prescription 4.1 and 1.5 respectively. Antibiotics were mostly prescribed by their brand names and only 16% antibiotics were prescribed by their generic names which corroborates with finding of Ramesh *et al*. [21].

The study was carried out to understand the current prescribing behavior, to enhance the quality of antibiotics prescribing and raise awareness about antibiotic resistance among general medical practitioners. As the prevalence of antibiotic resistance is higher, pharmacist should play an important role in improving the quality of life of patients by providing patient counseling and health screening services. It is important to improve the antibiotic prescribing based on culture sensitivity test which helps in choosing appropriate antibiotics for patients and leading less resistance [22]. To avoid interactions alternative choice of antibiotics are advised to be prescribed by the physicians. Antibiotics policies and guidelines are to be prepared and frequently revised to update the information regarding various infectious diseases, their sensitivity and resistance patterns. There is a need to develop proper guidelines for the prophylactic use of antibiotics in surgery and various infections.

National guidelines for the management of common infections are needed to minimize the overuse and misuse of antimicrobial agents in tertiary care hospitals. Rational prescribing of antibiotics avoids poly-pharmacy and prevents antibiotic resistances. A large surveillance study on antimicrobial prescribing appropriateness in different hospital settings is warranted and aimed at adverse drug reaction, emergence of bacterial resistance, minimizing unnecessary cost.

This indicates that the absence of an policy pertaining to prescribing antibiotics or the failure of the prescribers to follow the policies in place. National List of Essential Medicines (NLEM 2011) guideline states that all higher generation antibiotics must be prescribed only if there is evidence of resistance as indicated by culture sensitivity test and only specialists are authorized to prescribe the higher generation antibiotics.

Clinical training for this group of doctors often focuses more on diagnostic rather than therapeutic skills. Pharmacological knowledge along with practical prescribing skills is required to prescribe antibiotics rationally. Physician are needed to prescribe the medications in accordance with the patients' condition.

Conclusion

The data generated from the present study concludes that Third generation cephalosporin was the preferred or most prescribed choice of drug for prophylaxis followed by penicillins. The average number of antimicrobials prescribed in surgery department was 3 per patients. Amoxicillin and clavulanate were the fixed drug combination that was prescribed maximally.

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