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Research Article

Increased use of cephalosporin as first line agent instead of penicillin

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ABSTRACT

The objective of the present study was to analyze the increased use of cephalosporin as first line agent instead of penicillin. The study involve the collection of 100 in-patient prescription from 6 different wards including peads ward (peadriatric ICU), surgical ward, medical ICU, nephro ward, cadio ward, and emergency ward of a local government hospital. Data was analysed for the rational use of cephalosporin as first line agent, and need and reason of increased use of cephalosporin (broad spectrum) in in-patients instead of penicillin. The results we observed are that, 3rd generation cephalosporin (ceftriaxone) is most commonly used agent among cephalosporin, which has broad spectrum activity against gram +ve and gram -ve bacterias. Ceftriaxone is using alone, in combination with penicillin and/or with other classes of antibiotic mostly with fluroquinolones. Cephalosporin are frequently using among peads, children and adults, where as penicillin is frequently using among elder patients. Among peadriatic ICU and ward and surgical ward, cephalosporins are frequently used for surgical prophylaxis and seriously ill peads. We observed that antibiotics are prescribed in most cases without culture test, and in last we determine the rationality of use of cephalosporin in each case and found that out of 100 in-patients 19 have irrational use. The intense use and misuse of antibiotics are undoubtedly the major forces associated with the high numbers of resistant pathogenic and commensal bacteria worldwide. Antibiotic resistance is a tremendous and ever-growing problem in today's hospitals.

Keywords: cephalosporins, penicillin, first line agent

INTRODUCTION

The most important class of antibiotic affecting cell wall biosynthesis is beta lactam group (a four atom cyclic amide) is the pharmacophore of all beta lactam antibiotics Figure 1. Penicillin was discovered by Alexander Fleming in1920. It is very imp and widely used antibiotic and was first extracted from the Penicillium notatum. Penicillin is effective against gram-positive and negative cocci and some gram positive bacilli.it is bacteriostatic in action but in certain conc. it can act as a bactericidal agent. Penicillin inhibits the synthesis of bacterial cell wall. The cephalosporins are a class of β-lactam antibiotics originally derived from the fungus *Acremonium*, which was previously known as "Cephalosporium". Presently cephalosporins antibiotics are classified as first, second, third and fourth generation. In general, progression from first to fourth generation is associated with a broadening of the Gram-negative anti bacterium spectrum.

Rational use of antibiotic is that we use drug on the basis of infection if minor infection or minimum organism involve then we use peniciliin. If group of organism is enlarged and no coverage of penicillin then we use cephalosporin generation wise ist we use ist generation if not cure then second choice like this 3rd and 4th generation. But in initial stage when no severe infection and we directly use third generation then resistance developed and if we want to use next time ist generation then no effect will produced. It is very harmful because ist generation not help us to cure infection. Therefor it is necessary to use antibiotic by right choice. Organisms like methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE) are reaching record levels of prevalence. Well-targeted antibiotic therapy (which depends on an accurate diagnosis) reduces the need for sequential, hit-and-miss courses of antibiotics and the consequent risk of antibiotic resistance. Resistance to broad

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spectrum cephalosporin can also lead to other beta lactum antibiotic resistance [1-6].

METHODOLOGY

Resistance to antibiotics is a major public-health problem and antibiotic use is being increasingly recognized as the main selective pressure driving this resistance. Our aim was to assess increased use of cephalosporins instead of penicillins in inpatients in a government hospital in the year 2012 over the period of 1 month, conducted in Karachi, Pakistan. We collected 100 inpatients prescriptions using either cephalosporins or penicillins, or both in combination. Particular emphasis was placed on the use of cephalosporins as first line agents in comparision with penicillins in determining the rationality of the treatment therapy. For this we visited 6 different wards including peads ward (peadriatric ICU), surgical ward, medical ICU, nephro ward, cadio ward, and emergency ward, and collect 100 in-patients prescriptions.

RESULTS AND DISCUSSION

In recent years, there is increased in use of cephalosporin as first line agent instead of penicillin. The collected 100 in-patient data which is gathered from 6 different wards of hospital including different age group patients, different diseases and gender, who are prescribed either cephalosporin or penicillin or both or along with other antibiotic class of drug (mostly quinolones) as their first line treatment or prophylactic treatment shows the following results, which is also illustrated by the graphical representation as given in figure 2:

Out of 100 in-patients, 36 patients were prescribed cephalosporin alone as their first line treatment,15patients were prescribed penicillin alone as their first line treatment,7 patients were prescribed both cephalosporin + penicillin ,22 patients were prescribed cephalosporin in combination with any other class of antibiotic,15 patients were prescribed penicillin in combination with any other class of antibiotic,5 patients were prescribed penicillin and cephalosporin along with any other class of antibiotic.

A total of 70 in- patients were prescribed cephalosporin, whether cephalosporin was prescribed alone or with penicillin and/or with any other class of antibiotic, the most frequently use generation of cephalosporin was 3rd generation, which were prescribed to 66 in-patients out of 70 in-patients. The most frequently used agent of 3rd generation cephalosporin was ceftriaxone. Ceftriaxone were prescribed to 58 in- patients out of 66 in-patients. Ceftriaxone has broad-spectrum activity against Gram-positive and Gram-negative bacteria including many of the significant Enterobacteriaceae. They are also very active against streptococci. In most cases, it is considered to be equivalent to cefotaxime in terms of safety and efficacy. Ceftriaxone injection is used to treat certain infections caused by bacteria such as gonorrhea (a sexually transmitted disease), pelvic inflammatory disease (infection of the female reproductive organs that may cause infertility), meningitis (infection of the membranes that surround the brain and spinal cord), and infections of the lungs, ears, skin, urinary tract, blood, bones, joints, and abdomen. Ceftriaxone injection is also sometimes given before certain types of surgery to prevent infections that may develop after the operation. It works by killing bacteria. Antibiotics will not work for colds, flu, or other viral infections figure 3.2 patients were prescribed 1st generation cephalosporin.2 patients were prescribed 2nd generation cephalosporin.66 patients were prescribed 3rd generation cephalosporin. No patients were prescribed 4th generation cephalosporin.

To closely observe the pattern of use of cephalosporin and penicillin as first line agents we determine their use in males and females separately as: out of 100 in-patients, 55 were female and 45 were male patients. 72% use of cephalosporin in females and 46% use of cephalosporin in males figure 4. Out of 45 male patients, 21male in-patients were prescribed cephalosporin. Out of 45 male patients, 16 male in-patients were prescribed penicillin. Out of 45 male patients, 8 male in-patients were prescribed both cephalosporin and penicillin both. Out of 55 female patients, 40 female in-patients was prescribed cephalosporin. Out of 55 female patients, 13 female in-patients were prescribed penicillin. Out of 55 female patients, 2 female in-patients were prescribed cephalosporin and penicillin both.

To more closely observe the pattern of use of cephalosporin and penicillin as first line agents we determine their use in different age groups. For this we have divided patients into 3 age groups i.e; children (1 day to 15 years), adults (15- 45 years), and elders (above 45 years).

This shows that cephalosporin is widely used among children age group patients (including neonates) than other age group patients, only single case of penicillin as first line agent was seen and in very few cases penicillin is given in combination with cephalosporin in children age group. The cephalosporins are mainly eliminated by the

kidneys, and their elimination rates are reduced at birth. As a consequence, clearance is reduced and $t_{1/2}$ is more prolonged in the neonate than in more mature infants. Ceftriaxone has a broad spectrum of in vitro activity and is used in neonates for treating gonococcalophthalmia and as a second line drug for sepsis and meningitis. It can precipitate if used together with calcium leading to severe reactions including neonatal death. Other possible adverse events of significance in the neonate include biliary sludging, kernicterus and increased chances of invasive candidiasis. Third generation cephalosporin use can also lead to an increase in infections due to Extended spectrum beta lactamase (ESBL) producing organisms. Mechanisms of resistance to cephalosporins may confer resistance to other beta-lactam agents. Where as in adult age group, cephalosporin, penicillin or combination of both was observed but the rate of use of cephalosporin was quite high than penicillin as first line agent. In elder age group, above 45 years, the rate of use of penicillin is higher than cephalosporin as first line agent and in very few cases penicillin is given in combination with cephalosporin.

We evaluate the use of cephalosporin in 6 different wards that includes (peads ward including peadriatic ICU, surgical ward, medical ICU, Nephro ward, cardio ward and emergency ward) and found that the cephalosporin is mostly used in peads ward including peadriatic ICU, and surgical ward. In surgical ward, cephalosporin was basically prescribing for surgical prophylaxis as pre and postoperative medicnes.

Ceftriaxone injection is also sometimes given before certain types of surgery to prevent infections that may develop after the operation. Ceftriaxone is statistically superior to other antibiotics in preventing both local and remote postoperative infections. The preoperative administration of a single 1 gm dose of Rocephin (ceftriaxone) may reduce the incidence of postoperative infections in patients undergoing surgical procedures classified as contaminated or potentially contaminated (eg, vaginal or abdominal hysterectomy or cholecystectomy for chronic calculouscholecystitis in high-risk patients, such as those over 70 years of age, with acute cholecystitis not requiring therapeutic antimicrobials, obstructive jaundice or common duct bile stones) and in surgical patients for whom infection at the operative site would present serious risk (eg, during coronary artery bypass surgery).

The recommendations presented here are an attempt to aid in more rational selection of antibiotics based on the most likely pathogens for a given infection and the susceptibility profiles of these pathogens that are specific to this institution. Antibiotic therapy must still be individualized based on a patient's severity of illness, comorbidities, culture history, antibiotic history, and immune status. Subsequently, therapy should be modified based on the patients' clinical status and the microbiology data obtained. Cultures of presumed infected site(s) should always be obtained (preferably prior to any antibiotics).Initial empiric therapy should be chosen based on most likely pathogens, hospital susceptibility patterns, cost-effective therapy, and impact on development of resistance.

Patients' flora may be altered by previous antibiotic courses and recent therapy should be taken into account when choosing initial empiric therapy. Desire to preserve usefulness of antimicrobials of greatest importance in treatment of human disease is important. Mechanisms of resistance to cephalosporins may confer resistance to other beta-lactam agents so; there safe use for particular indication should be promoted to avoid spread of multidrug resistant organism infections. There are few infections where cephalosporins are the antibiotics of first choice and their use should be avoided when other narrower spectrum antibiotics remain effective. Ceftriaxone is an appropriate first line treatment for gonorrhoea, pelvic inflammatory disease and epididymo-orchitis. Ceftriaxone may also be used for suspected meningitis in patients allergic to penicillin (benzylpenicillin is first-line). Cefaclor may be considered as a second-line treatment for otitis media, sinusitis, cellulitis, diabetic foot infection and mastitis. Cephalexin is a third-line alternative for the treatment of urinary tract infection in pregnant women (after nitrofurantoin and trimethoprim).

Out of 100 in-patients, in which cephalosporin is given as first line agent, 47 cases are rational and 12 are irrational. Out of 100 in-patients, in which penicillin is given as first line agent, 25 cases are rational and 5 are irrational. Out of 100 in-patients, in which cephalosporin and penicillin both are given as first line agent, 9 cases are rational and 2 are irrational figure 7.

CONCLUSION

Cephalosporins are the most common class of antibiotics used to treat bacterial infection. These drugs have proven to be safe, clinically effective, and easy to use. The expanded-spectrum cephalosporins (e.g., cefotaxime, ceftriaxone, and ceftazidime), either alone or in combination with other antibiotics, are the most common antibiotics used as initial empiric therapy for treating serious

infections. In general, well-targeted antibiotic therapy (which depends on an accurate diagnosis) reduces the need for sequential, hit-and-miss courses of antibiotics and the consequent risk of antibiotic resistance. In some groups of patients, early and aggressive antibiotic therapy can dramatically improve survival. Combination therapy in which combining two or more antibiotics can increase the odds of defeating a bacterial infection, since a bacterium that becomes resistant to one antibiotic does not necessarily achieve resistance to a second or third one. Two antibiotics can also work synergistically to speed up healing and possibly short-circuit the development of resistance.

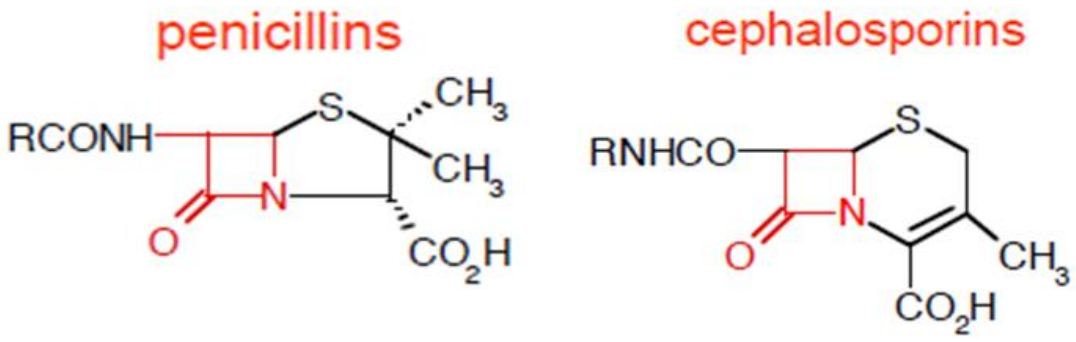

Figure 1: Beta lactam antibiotics

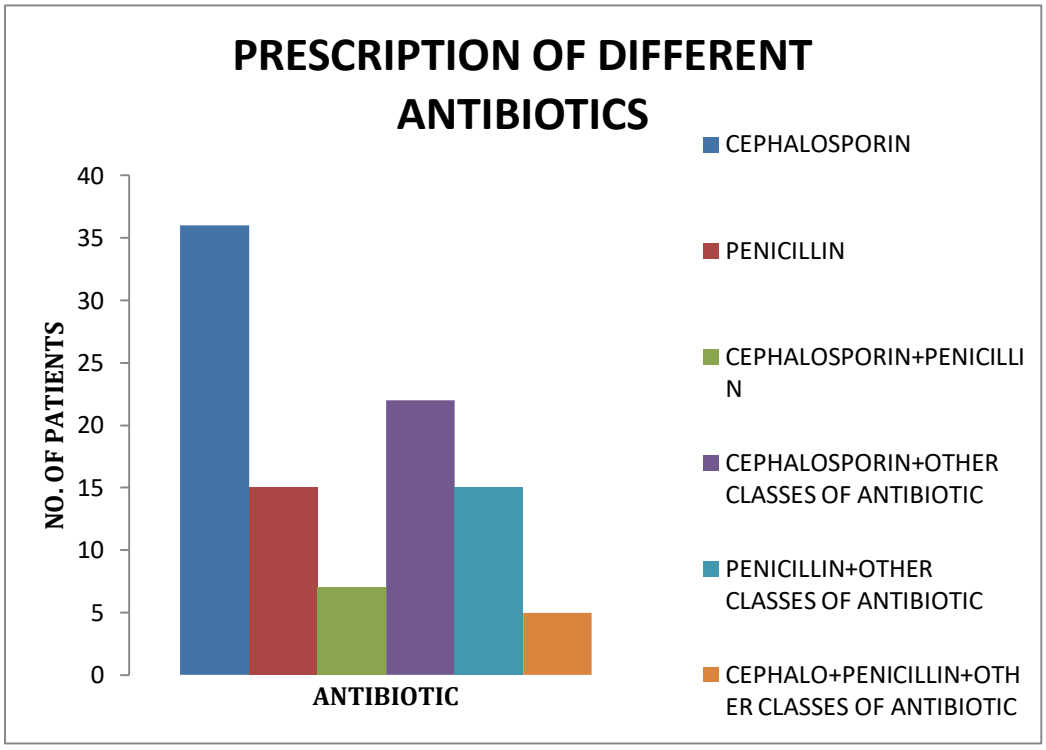

Figure 2: Prescription of antibiotics

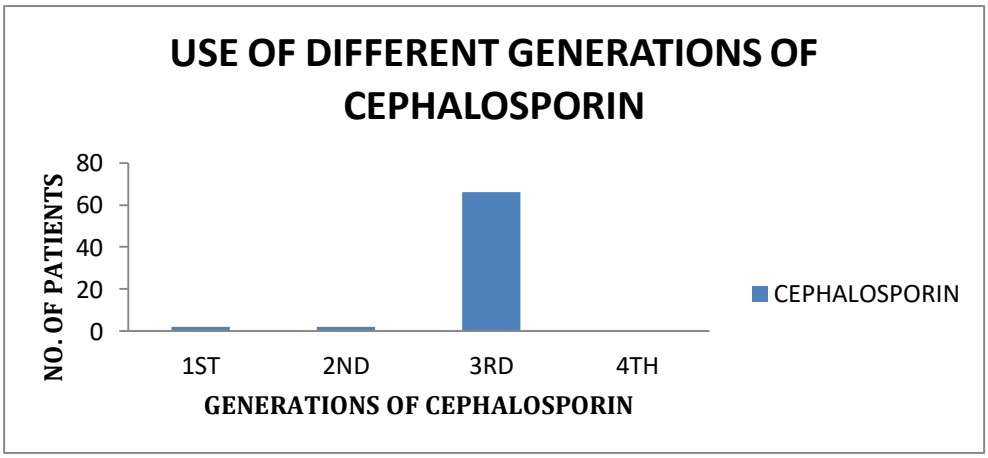

Figure 3: Prescription pattern of cephalosporin generation

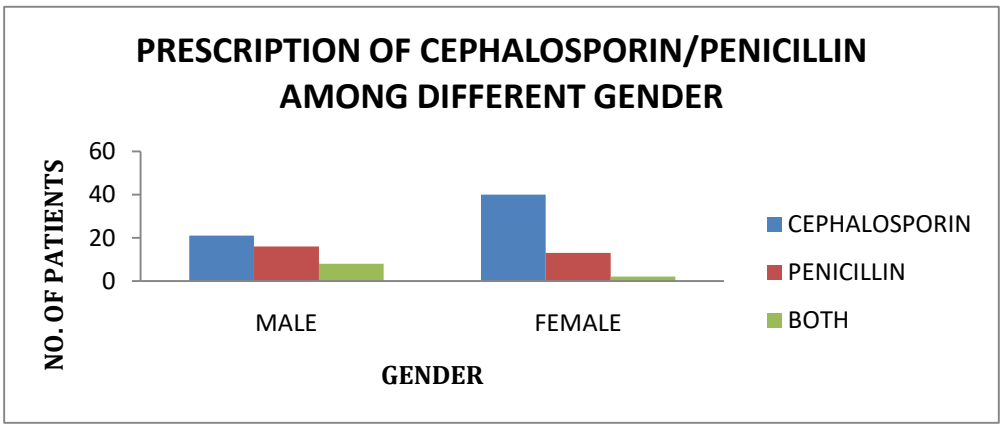

Figure 4: Prescription pattern of cephalosporin in different gender

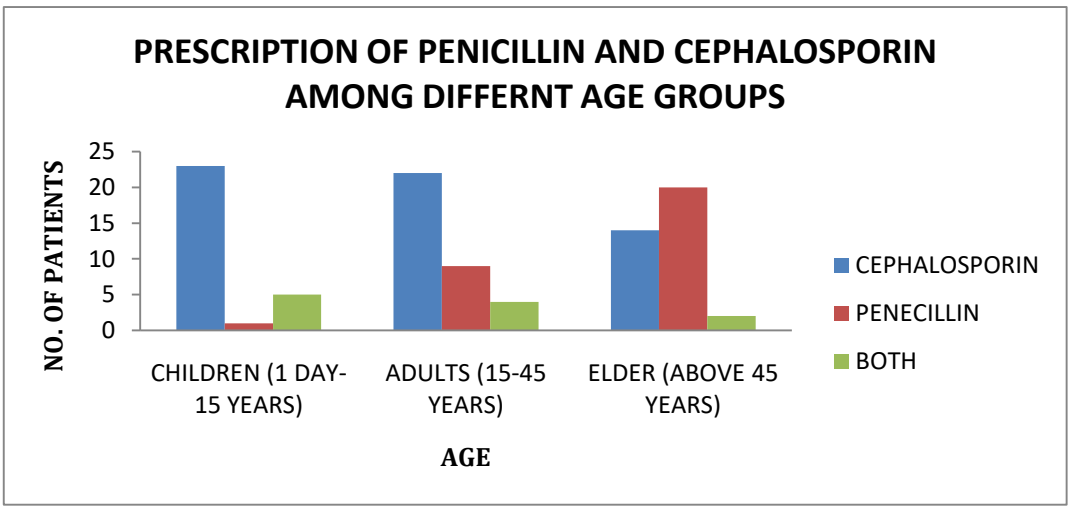

Figure 5: Prescription pattern of cephalosporin in different age group

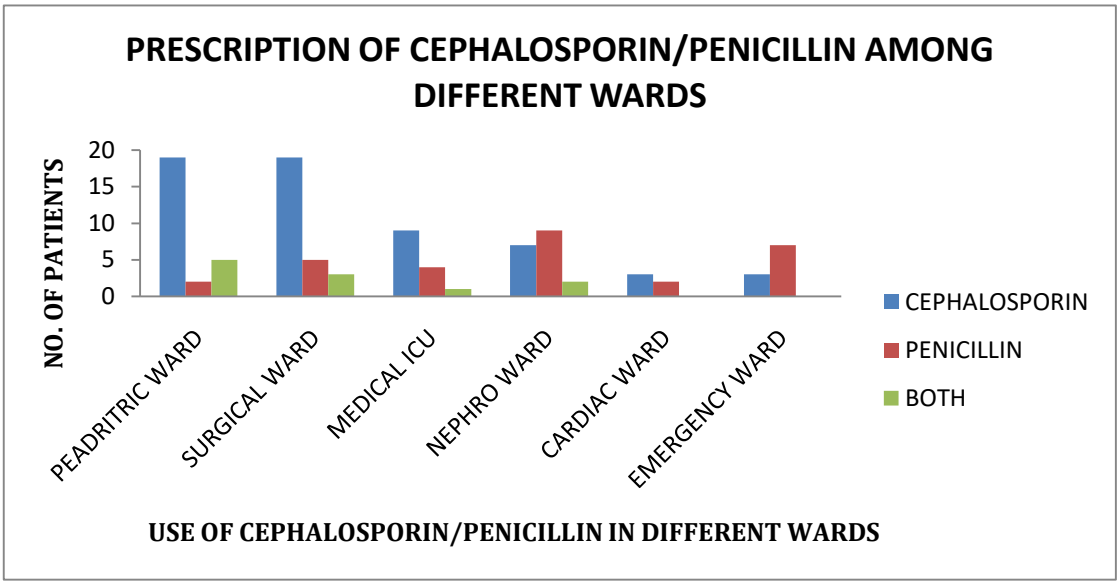

Figure 6: Prescription pattern of cephalosporin in different Wards

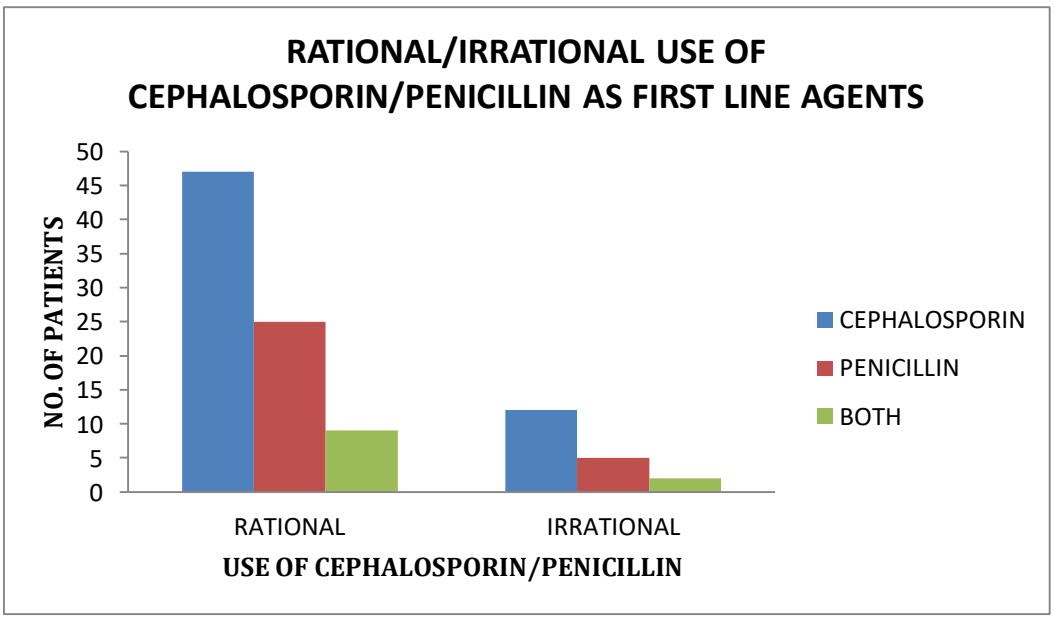

Figure 7: Rational and Irrational use of antibiotics

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