Original Article

Emerging antimicrobial resistance in hospital a threat to public health

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Abstract

Background: Antimicrobial resistance(AMR) threatens the health of many throughout the world, since both old and new infectious diseases remain a formidable public health threat. When pathogenic microorganisms can multiply beyond some critical mass in the face of invading antimicrobials, treatment outcome is compromised. This phenomenon is referred as antimicrobial resistance (AMR).

Objective:

This retrospective study was conducted to assess the overall antimicrobial resistance in bacterial isolates from tertiary care hospitals as majority of patients here receive empirical antibiotics therapy.

Method: This retrospective study was carried out in teaching hospital, Greater Noida to determine prevalence of multidrug resistance in patients in relation to empirical antibiotic therapy in hospital. Various samples (pus,urine,blood) were collected for bacterial culture and antibiotic sensitivity.

Results:

Total 500 bacterial strains isolated from ICU, surgery, obstetrics & gynaecology and orthopaedics and their sensitivity pattern was compared in this study. The highest number of resistant bacterias were of pseudomonas sp. i.e. 21(33.87%) followed by 16(25.80%) of staphylococcus aureus, 12(19.35%) of Escherichia coli, Klebseilla sp & Proteus vulgaris were 05(8.06%) each & Citrobacter sp. 03(4.83%). Total 62(12.4%) bacterial isolates were found to be resistant to multiple drugs. The 31 (50%) of these resistant bacteria were prevalent in ICU, 12(19.35%) in Surgery, 11(17.74%) in Gynaecology, 08(12.90%) in Orthopaedics.. All the bacterial strains were resistant to common antibiotics like Penicillin, Amoxicillin, Doxycycline & Cotrimoxazole and some were even resistant to Imipenem.

Conclusion:

Therefore we have outlined the nature of the antimicrobial resistance problem as an important health issue for national and international community. It is advised to avoid use of empirical antibiotics therapy.

Key words: Antimicrobial resistance, empirical antibiotic therapy

Introduction:

Antimicrobial resistance (AMR) threatens the health of many throughout the world, since both old and new infectious diseases remain a formidable public health threat. There is extensive usage of antimicrobials in a hospital with or little infection control interventions which was typical of most Indian hospitals at the time of the study. AMR is an issue of great significance for public health at the global level, considered as wonder drugs, antibiotics are after prescribed empirically, inappropriately and inadequately and have thus become one of the highly abused agents[1]. The emergence of community-associated versions of nosocomial pathogen- methicillin-resistant Staphylococcus aureus. The introduction of ceftazidime and aztreonam shortly after cefotaxime has accelerated the evolution of Extended spectrum of beta lactamase(ESBL) in hospitals worldwide roughly at the same time and is now a major problem[2]. ESBLs are more prevalent in Klebsiella pnemoniae than in any other enterobacterial species, and outbreaks of infections caused by ESBL producing strains have been reported widely. ESBL producing strains are probably more prevalent than currently recognized because they are often undetected by routine susceptibility testing methods. Occurrence of ESBL producing Klebsiella spp. has been also reported from South India[3] and Central India[4].

Antimicrobial resistance is an under-appreciated threat to public health in nations around the globe. With globalization booming, it is important to understand international patterns of resistance. The effectiveness of many antibiotics is decreasing due to its extensive

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use over a decade or two. This has led to increase in the number of bacterial strains acquiring resistance to these antibiotics. This resistance is mainly due to spread of plasmids that code for drug inactivating enzymes[5]. Antimicrobial resistance of U.S.A was compared with China in one study, the U.S.A. exhibits more moderate differences in resistance prevalence among different patients. The average prevalence of resistance for ICU, other inpatients, and outpatients in the U.S. are 20%, 17% and 13%, respectively; in China, average resistance for hospital-acquired infections is 41% and that for community-acquired infections is 28%[6]. Multidrug resistant bacteria require thorough investigation to know the extent to which it is prevalent in a particular hospital, the micro organisms involved in such cases along with their antibiotic resistance pattern and at the end, the necessary measures to be taken for the prevention of any hospital acquired infections.

Methodology:

This was a retrospective study. The antibiotic resistance pattern data of total 500 bacterial strains studied were isolated from patients admitted in ICU, Gynecology & Obstetric, Surgery, Orthopaedics wards from Jan-2010 till Dec-2010 in Sharda Hospital, Greater Noida. In these wards pool of resistant bacterial strains are present because of long stay of patients due to medical emergencies,post surgical hospital infections, road accidents and maximum use of empirical antibiotics in therapeutics or for prevention of infection. The samples like pus, urine and blood were taken for study and were transported immediately to the Microbiology Laboratory for culture of the sample on blood agar and Macconkey's agar culture media and incubated at 37°C for overnight. If any micro organism had grown on culture, it was identified and antibiotic sensitivity testing was done aerobically on Muller Hinton agar as per conventional guidelines. [7]

Results:

This study was carried out on 500 strains, 62 (12.4%) strains were resistant to most of the antibiotics. The 31 (50%) of resistant bacteria were prevalent in ICU, 12(19.35%) in Surgery, 11(17.74%) in Gynaecology, 08(12.90%) in Orthopaedics (Table 1).The highest number of resistant bacteria were Gram negative bacteria, the resistance in pseudomonas sp. was 21(33.87%) followed by 12(19.35%) of Escherichia coli, Klebseilla sp & Proteus vulgaris were 05(8.06%) each and Citrobacter sp. cases were 03(4.83%) and cases of Gram positive cocci includes 16(25.80%) cases of staphylococcus aureus (Table 2). All the bacterial strains were resistant to Penicillin, Amoxicillin, Doxycycline & Cotrimoxazole and some gram negative bacilli (19.04% pseudomonas sp.,16.6% of E.coli, 20% of Klebsiella sp. and 20% of Proteus vulgaris) were even resistant to Imipenem (Table 3). It was supposed to occur due to empirical and indiscriminate use of recent antibiotics as well as less stringent sterilization procedures[8].

Table -1: Multidrug resistant isolates recovered from different wards.

	Multidrug resistant isolates (n=62)	%
Gynaecology	11	17.75%
ICU	31	50 %
Surgery	12	19.35%
Orthopaedics	08	12.90%

Table- 2: Prevalence of Multidrug resistant organism in this study (n=62)

	Gynaecology (n=11)	ICU (n=31)	Surgery (n=12)	Orthopaedics (n=08)	Total (%)
Pseudomonas sp.	02	15	03	01	21 (33.87)
Staphylococcus aureus	04	04	05	03	16 (25.80)
Escherichia coli	02	08	01	01	12 (19.35)
Klebsiella sp.	01	02	01	01	05 (8.06)
Proteus Vulgaris	02	02	01	Nil	05 (8.06)
Citrobacter sp.	Nil	Nil	01	02	03 (4.83)

Table-3: Percentage of Organisms Resistant to a Particular Antibiotic.

	Psuedomonas (%)	E.Coli (%)	Klebseilla sp.(%)	Proteus vulgaris (%)	Citrobacter sp. (%)	Staphylococcus aureus (%)
Penicillin	100	100	100	100	100	100
Amoxycillin	100	100	100	100	100	100
Amoxycillinclavulenic acid	57.1	66.6	60	100	80	100
Imipenem	19.04	16.6	20	20	0	0
Norfloxacin	100	83.3	100	100	100	100
Ciprofloxacin	85.7	75	100	100	100	75
Gatifloxacin	71.4	50	60	100	100	100
Gentamycin	100	66.6	100	100	100	100
Amikacin	85.7	0	0	60	33.3	0
Ceftriaxone	90.4	66.6	60	100	100	100
Cefotaxime	100	100	100	100	100	100
Chloromphenicol	76.2	25	60	100	100	–
Doxycycline	100	100	100	100	100	100
Nitrofurantion	100	0	100	100	100	–
Cotrimoxazole	100	100	100	100	100	100

Discussion:

Total 500 bacterial strains were taken in this study, isolated from ICU,surgery,obstetrics & gynaecology and orthopaedics and these bacterial strains were resistant to common antibiotics like Penicillin, Amoxicillin, Doxycycline & Cotrimoxazole and some were even resistant to Imipenem. In this study 62 (12.4%) bacterial isolates were found to be resistant to multiple drugs and 50% of these resistant bacterial strain isolates were from ICU followed by 19.35%,17.74%and 12.90% resistant bacterial strains isolated from surgery,gyaenaecology & orthopaedic wards respectively. The highest number of resistant bacterias were of pseudomonas species.

Previous studies from India have reported prevalence of ESBL producers to be 6.6 to 68%[9-16]. ESBL production (68%) was reported among gram negative bacteria from a tertiary care hospital[12]. The 48.3% of urinary isolates tested were ESBL producers[13]. In South India, it was reported 6.6% ESBL prevalence among *Klebsiella pneumonia* from children, whereas it was shown 40% and 41% ESBL positivity among *K. pneumonia* and *E. coli* respectively in their study cohort. Another study reported an incidence of 58.06% for ESBL producing *E. coli* and 57.14% for ESBL producing *Enterobacter* spp[16].

These are the patients who were given high spectrum of antibiotics empirically for treatment which is believed to be responsible to make bacteria resistant to higher generation of antibiotics. There are enough gaps in the existing body of scientific evidence to make it a risky response to increasing public concern to deny that there is a problem with respect to resistance in the environment. At present the situation is different. It is the responsibilities of health care workers to conserve antibiotic resources and discourage empirical usage of antibiotics therapy to prevent antimicrobial resistance. These duties are discharged through the antibiotic policy and hospital infection control committees. These corporate activities require collective action. The operation of responsibility requires dedication, innovation, persistence and an ability to operate as a member of a team. Improving antimicrobial use involves ensuring optimal selection, adequate dosage for right duration.

Generally, pathogens in hospitals are resistant to multiple antibiotics due to increased selection pressure of antibiotics. With â-lactams being the most frequently prescribed antimicrobials, the emergence of ESBL - producing organisms in clinical infections can result in treatment failure which constitutes a serious threat to the use of current â-lactam therapies. The prevalence of ESBLs among clinical isolates varies from country to country and from hospital to hospital because of different approaches to prevention and control procedures .These β–lactamases have been found

worldwide in many different genera of Enterobacteriaceae and Psedomonas aeruginosa. The prevalence of ESBLs among clinical isolates varies from country to country and from hospital to hospital because of different approaches for prevention and control procedures. This therefore necessitates the need for research on ESBL -producing organisms to supplement the existing data with a view to addressing the problems associated with the use of β-lactam antibiotics in the treatment of infections.

Conclusion:

In this study 62 (12.4%) bacterial isolates were found to be resistant to multiple drugs. The highest number of resistant bacterias were of pseudomonas sp. All the bacterial strains were resistant to common antibiotics like Penicillin, Amoxicillin, Doxycycline & Cotrimoxazole and some were even resistant to Imipenem. These are the patients who were given high spectrum of antibiotics empirically for treatment is believed to be responsible to make bacteria resistant to higher generation of antibiotics. It is ethical on part of medical staff to avoid use of empirical antibiotics therapy. We have outlined the antimicrobial resistance problem as an important health issue for national and international community. Surprisingly, this issue virtually never receives prominent attention at the national or international level, despite its scope and potentially devastating impact on global public health in the coming decades.

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