ANTIBIOGRAM 2016

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MESSAGE

The growing menace of antimicrobial resistance is a challenge to contemporary medicine that needs to be addressed through the prudent use of antibiotics.

In this regard, institutional antibiograms constitute invaluable resources that can be used by clinicians to judiciously tailor empirical antibiotic regimens in accordance to local antibiotic susceptibility trends. Such rational approach to antibiotic usage improves the treatment outcome of individual patients and stalls the emergence of resistant bacterial flora in the hospital environment.

It, therefore, gives me immense pleasure to release the document titled "Antibiogram 2016", which compiles the antibiotic susceptibility profile of clinically significant pathogens recovered at AIIMS Bhopal Hospital during the year 2016. I am sure that this endeavour will be useful in fostering Antimicrobial Stewardship at AIIMS Bhopal.

I congratulate Dr Debasish Biswas and his team from the Department of Microbiology for this novel initiative and wish that they continue to bring out this annual report in the coming years, as well.

Prof. (Dr.) Nitin M. Nagarkar
This is a summary of the antibiotic sensitivity profile of clinical isolates recovered at AIIMS Bhopal Hospital during the year 2016. However, for organisms in which < 30 isolates were recovered in 2016; isolates collected over a longer period (i.e. 2015 and 2016) have been considered. This is in accordance with CLSI guidelines.

The antibiogram has been organized according to the site of infection (bloodstream, respiratory, skin & soft tissue and urinary tract), type of organism (Gram positive and Gram negative bacteria) and location of the patient (OPD, IPD & ICU). These factors are common variables that influence the choice of empirical antibiotics in the clinical setting. Consideration of the institutional antibiogram, with respect to these factors, is likely to make the choice of antibiotics locally relevant and facilitate improved patient outcome.

Antibiotic prescription, if guided by local antibiogram, would also impede the emergence of resistant bacterial flora in the hospital environment and thus lower the incidence of untreatable or difficult-to-treat infections.

The data in this report is presented in the form of bar diagrams depicting the percentage of susceptible isolates recovered from a particular site of infection, followed by certain salient observations reflected in the figure.

We acknowledge certain inherent limitations in this data: (a) It lacks several key susceptibility profiles specific for certain patient populations. Mention of key clinical inputs like post-operative infection, diabetes, presence of indwelling devices, antenatal care, etc in the requisition forms would have helped in creating antibiograms specific to these patient groups. (b) Secondly, we did not have enough isolates from some serious infections like meningitis, community acquired pneumonia, genital tract infections, acute gastroenteritis, etc to enable the construction of valid antibiograms for these infections. (c) Thirdly, the entire range of antibiotics was not consistently available throughout the surveillance period, owing to irregular supply chain and delayed procurement processes. As a result, all the isolates included in this antibiogram could not be uniformly tested against an identical panel of antibiotics.

We invite queries from clinicians interested in antibiograms of specific patient groups or performance of specific antibiotics that are not mentioned in this report. We would try to answer such queries from the database compiled by us for the years 2015 and 2016, if possible.
KEY FINDINGS:

- Salmonella sp. isolated from bloodstream were uniformly susceptible to 3rd gen Cephalosporins, Azithromycin, Piperacillin-Tazobactam, Carbapenems & Levofloxacin.
- Among the bloodstream isolates recovered from in-patients, Colistin was found to be the most effective antibiotic. Susceptibility of other commonly used antibiotics used in septicaemia, like Imipenem, Piperacillin-Tazobactam and Aminoglycosides, ranged between 60% - 70%.
- There was alarming decline in susceptibility to all antibiotics among ICU respiratory isolates.
- Aminoglycosides performed better than Carbapenems & Piperacillin-Tazobactam for almost all Gram negative infections (respiratory, skin & soft tissue and urinary)  
- MRSA prevalence in Staphylococcal skin & soft tissue infections was 26% and 32% in OPD and IPD patients respectively.
- The common antimicrobials used for Gram-positive coverage in skin and soft tissue infections, like Clarithromycin; Clindamycin; Azithromycin and Levofloxacin, were effective against 74% - 82% of the OPD isolates.
- Nitrofurantoin was the most efficacious oral urinary antibiotic. The oral antibiotics commonly used in UTI like fluoroquinolones, co-trimoxazole and oral cephalosporins had susceptibility coverage of only 41% - 58% among OPD patients.
Bloodstream isolates of Salmonella sp. were found to have similar susceptibility towards 3rd generation Cephalosporins, Piperacillin- Tazobactam, Carbapenems, Levofloxacin and Azithromycin.

Significant number of Salmonella isolates was not tested for susceptibility to Ciprofloxacin. However, 89.5% of the isolates tested were non-susceptible for Ciprofloxacin.

The Gram negative bacteria recovered from in-patients included Salmonella sp. (16.7%), other members of Enterobacteriaceae family (66.6%) and non-fermenting Gram-negative bacilli (16.7%).

Colistin was the most effective antibiotic against these isolates. Susceptibility of other commonly used antibiotics like Imipenem, Piperacillin-Tazobactam and Aminoglycosides ranged between 60% - 70%.
Significant number (≥ 30) of respiratory isolates was recovered from ICU patients for Gram-negative bacteria only.

Alarming level of resistance was observed among these isolates to all antibiotics commonly used in this setting: 3rd and 4th generation Cephalosporins, Carbapenems, β lactam/β lactamase inhibitor combination, Aminoglycosides, Fluoroquinolones.

The susceptibility of the ICU respiratory isolates ranged from 22% - 29% for Aminoglycosides; 11% - 21% for Carbapenems and 4% - 21% for β lactam/β lactamase inhibitor combination.

49% of these isolates belonged to Enterobacteriaceae family, 30% were Acinetobacter sp. and 21% were Pseudomonas sp.

Significant number of respiratory isolates was not recovered from OPD or IPD patients or among Gram-positive organisms.

Comparison of the susceptibility profile of ICU respiratory isolates in 2015 & 2016

Almost all antibiotics, for which data was available for both 2015 & 2016, demonstrated a dramatic decline in the susceptibility profile of respiratory ICU isolates in the year 2016.
SKIN & SOFT TISSUE INFECTIONS

Antibiogram of Gram Negative isolates recovered from patients with skin & soft tissue infections

- Gram negative organisms recovered from Skin & Soft tissue infections among IPD patients were more susceptible to Aminoglycosides (Amikacin, Tobramycin, Gentamicin) than to 3rd generation Cephalosporins (Ceftazidime, Ceftriaxone, Cefotaxime); 4th Generation Cephalosporins (Cefepime), Carbapenems (Imipenem, Doripenem, Meropenem); β-lactam/β-lactamase inhibitor combinations (Ampicillin-Sulbactam, Piperacillin-Tazobactam) and Fluoroquinolones (Levofloxacin).
- Similarly among the OPD isolates of Gram negative bacteria recovered from skin and soft tissue infections, Amikacin was almost as effective as Piperacillin-Tazobactam and superior to the other antibiotics listed above.

Antibiogram of Gram Positive isolates recovered from patients with skin & soft tissue infections
Irrespective of in vitro data, Rifampicin and aminoglycosides are not indicated for mono-therapy in Gram-positive infections

Oxacillin susceptibility, which is taken as a surrogate marker for Methicillin sensitivity, was observed in only 66% of the OPD isolates of Gram-positive bacteria.

The prevalence of MRSA, among the Staphylococcal isolates recovered from SSTI at AIIMS Bhopal during the period of surveillance, was **26% among OPD patients and 32% among IPD patients**. MRSA are considered resistant to other β- lactam antimicrobial agents (Penicillins, β lactam/β lactamase inhibitor combinations, carbanems and cephalosporins with the exception of the newer cephalosporins with anti-MRSA activity i.e. Ceftaroline & Ceftobiprole).

An overwhelming majority of Gram-positive bacteria (84% among OPD and 74% among IPD isolates) were Penicillin resistant. Penicillin-resistant staphylococci (95% among OPD and 84% among IPD isolates) produce β lactamase and are considered resistant to all penicillinase-labile penicillins (Ampicillin, Amoxicillin, Carbenicillin, Ticarcillin, Azlocillin, Mezlocillin, Piperacillin).

The common antimicrobials used for Gram-positive coverage in skin and soft tissue infections, like Clarithromycin; Clindamycin; Azithromycin and Levofloxacin, were found to be effective against 74% - 82% of the OPD isolates. Only 30% of the isolates, however, were susceptible to Ciprofloxacin.

We did not have sufficient number of isolates to make valid conclusions regarding the antibiogram of post-operative wound infections. However, among the antibiotics commonly used for surgical prophylaxis we observed the following susceptibility rates:

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Overall Susceptibility</th>
<th>Susceptibility for Gram +ve bacteria</th>
<th>Susceptibility for Gram –ve bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>14%</td>
<td>Data not available. But</td>
<td>14%</td>
</tr>
<tr>
<td>Amoxycillin-Clavulanic Acid</td>
<td>13%</td>
<td>63% of these bacteria were Methicillin-resistant, in which Cefazolin and Amoxycillin-Clavulanic Acid are ineffective</td>
<td>13%</td>
</tr>
<tr>
<td>3rd Generation Cephalosporins</td>
<td>27% - 44%</td>
<td>27% - 44%</td>
<td></td>
</tr>
<tr>
<td>Amikacin</td>
<td>79%</td>
<td>86%</td>
<td>77%</td>
</tr>
</tbody>
</table>
Among the orally available antibiotics, Nitrofurantoin was found to have the maximum susceptibility rates for Gram negative urinary isolates recovered from OPD, IPD & ICU patients. The other oral antibiotics commonly prescribed in UTI like fluoroquinolones, co-trimoxazole and oral cephalosporins were found to have alarmingly low susceptibility profiles among urinary isolates recovered from OPD (41% - 58%), IPD (18% - 48%) and ICU (14% - 32%) patients. Among the injectable antibiotics, Aminoglycosides performed better than carbapenems for all urinary isolates (84% - 93% vs. 58% - 79% for OPD patients; 71% - 76% vs. 50% - 65% for IPD patients and 44% - 49% vs. 30% - 45% for ICU patients); with Piperacillin - Tazobactam occupying an intermediate position (susceptibility of 86%, 64% and 41% among OPD, IPD and ICU patients respectively).

In a bid to develop patient-specific antibiogram for antenatal mothers, we analysed the susceptibility profiles of Gram-negative urinary isolates from Obstetrics & Gynaecology OPD.

Antibiogram of Gram Negative isolates recovered from patients with Urinary Tract Infections

Antibiogram of Urinary Gram negative isolates from Ob & Gy OPD

In a bid to develop patient-specific antibiogram for antenatal mothers, we analysed the susceptibility profiles of Gram-negative urinary isolates from Obstetrics & Gynaecology OPD.
Similar trend for Nitrofurantoin, oral and injectible antibiotics was observed in this patient population, as was observed in the general pool of OPD patients. Nitrofurantoin was the most effective oral antibiotic and aminoglycosides performed better than carbapenems among the injectable antibiotics.

**Antibiogram of Urinary Gram negative isolates from Paediatrics OPD**

- The antibiotic susceptibility profile of Gram negative pathogens recovered from pediatric out-patients (<18 years) also mirrored the trend observed among the general pool of patients.
- **Nitrofurantoin** was the most effective oral antibiotic.
- Among the injectable preparations, **Aminoglycosides** had a susceptibility range between 85%-94%; while the corresponding figure for Carbapenems was 62%-80%. **Piperacillin-Tazobactam** had an intermediate position with susceptibility of 88%.
- The oral antibiotics like Co-trimoxazole, Oral Cephalosporins and Amoxicillin-CLavulanic Acid had susceptibility of 52%, 39% and 22% respectively.

**Antibiogram of urinary isolates from >65 year old male patients from OPD**

- Since elderly males constitute another common patient population with susceptibility for UTI, we also analysed the susceptibility profile of urinary isolates recovered from them.
- Though Nitrofurantoin continued to be the most effective antibiotic in this group also, there was overlap in the susceptibility profile of Aminoglycosides and Carbapenems.
- Compared to fluoroquinolones with susceptibility rates ranging between 14% and 37%, Co-trimoxazole was found to have higher susceptibility (48%) in this group.
Antibiogram of Gram Positive isolates recovered from OPD patients with UTI

- Significant number of Gram positive urinary isolates was recovered only from OPD patients and not from IPD and ICU patients.
- Nitrofurantoin susceptibility was observed in 91% of the Gram-positive isolates.
- Susceptibility to Aminopenicillins (Ampicillin) and high-level Gentamicin was better than the commonly used fluoroquinolones.
- In contrast to skin and soft tissue infection, significantly higher Penicillin susceptibility was observed among the urinary Gram-positive isolates.