Bacterial Organisms and Antimicrobial Resistance Patterns

George K Varghese¹, Chiranjay Mukhopadhyya², Indira Bairy², KE Vandana², Muralidhar Varma¹

Abstract

- Gram negative bacilli are the commonest cause of infections at all sites in the Indian setting
- There is a considerable degree of resistance to both first line and second line gram negative agents
- Resistance to gram positive cocci is less of a problem than that of gram negative bacilli. MRSA prevalence though is not insignificant.

Introduction

The pattern of infections and antimicrobial resistance patterns we see in India are quite different from what is reported in the West. Surprisingly there is little formal data on the subject from India¹. We have collated the information of samples from Kasturba Hospital Manipal collected over a one year period (2007 - 2008) and are sharing the information as requested by the Editor.

Results

Blood Cultures

The overall yield of positive cultures from a Bac-T Alert Biomerieux aerobic culture system of about 6,000 samples processed was 12%.

68.3% of isolates were Gram negative bacilli. The commonest being E. coli followed by Klebsiella and Salmonella.

Of the Gram positive isolates, the commonest was Coagulase Negative Staphylococci. A good chunk of these were clearly contaminants from the skin during collection. This was borne out by an earlier study where we had correlated the clinical status of patients with positive blood culture reports. The most important gram positive isolates were Staphylococcus aureus followed by Enterococci.

Urine Cultures

Data from almost 11,000 samples with a positive yield in almost a third clearly confirm as is well known that Gram negative bacilli are the commonest cause of UTI’s (90%). E.coli accounted for two-thirds of the gram negative isolates followed by Klebsiella in 18% and Pseudomonas in 8.4%.

8% of isolates were Gram positive cocci and 1% Candida sp. The commonest coecal organism was Enterococcus.

Pus, Wound and Body fluids

6,000 samples with growth in over a third of them. 76% were gram negative bacilli with 24% being gram positive cocci. The commonest gram negative isolate was Pseudomonas (38%) followed by E. coli and Klebsiella.

Staphylococcus aureus accounted for 72% of the coccal isolates.

Respiratory Samples (Sputum and Throat swabs)

61% of the isolates were gram negative bacilli and 39% gram positive cocci. The commonest gram negative was Pseudomonas (42%) followed by Klebsiella, Acinetobacter and E. coli. Some of these isolates undoubtedly reflect colonization.

The commonest gram positive organism was β hemolytic Streptococci (37%) followed by Staphylococcus aureus and Streptococcus pneumoniae.

Resistance Patterns of Common Bacteria

Well over 50% of E. coli and Klebsiella strains are resistant to commonly used gram negative drugs making therapy of even common problems like UTI’s unpredictable.

Resistance to 2nd line drugs in these strains resistant to first line agents is no less worrying, with resistance rates of 40% to Piperocillin/Tazobactam, 38% for Cefpiperazon/Sulbactam, 54% to Cefpirome (4th Gen. Cephalosporin), 54% to Aztreonam and 4% to Meropenem and Imipenem. Fortunately in situations like lower UTI’s, there is clinical response even with some of the resistant agents as levels considerably higher than the MIC’s are attained in urine when renal function is normal.

Resistance to Quinolones in Pseudomonas and Acinetobacter is...
in the order of 70%. Resistance to 2nd line antipseudomonal drugs like Piperocillin/Tazobactam, Cefaperazone/Sulbactam and Cefpirome in these strains were 42%, 40% and 54% respectively. Resistance to Carbepenems ran to 8% in the strains showing first line resistance.

Salmonella typhi and paratyphi are currently considerably more sensitive than a few years ago when MDR Salmonella typhi was widely prevalent throughout India. Resistance to Ampicillin was 21%, Chloramphenicol 0%, TMP/SMX 11%, Ciprofloxacin 12% and to 3rd gen. Cephalosporins 0% (Cefotaxime/Ceftriaxone).

Resistance to Staph. aureus is less of a problem compared to Gram negative bacilli. However, Oxacillin (Methicillin) resistance (MRSA) rates are 35% which is significant.

Enterococcal resistance to Ampicillin was 42% and to Gentamicin 20%. The combination of the two is synergistic as long as MIC's are not very high. Vancomycin resistance was not identified during the period.

Streptococcus pneumoniae was Pencillin sensitive and no Vancomycin resistance was identified.

Discussion

The main problem across most sites of infections as shown above is Gram Negative bacillary infections. This is the scenario in most centers in India. This is quite different from the Western setting where the major share of hospital associated infections since the 1980's are Gram positive coccal organisms like Staph. aureus and Enterococci. Resistance issues also are more related to these organisms and problems like VRE (Vancomycin Resistant Enterococci), VISA (Vancomycin Intermediate Staph. aureus) are growing concerns. Consequently, new agents to tackle these organisms like Quinupristin-Dalfopristin, Daptomycin, Dalbavancin and Ceftobiprole have been developed. In the

Gram negative bacilli scenario on the other hand, there are very few 'new' molecules in the pipeline. The only drugs which have come on the scene is an ‘old’ potentially toxic agent Colistin (Polymyxin E) which has been revived, Tigecycline (a glycyclycline related to the tetracycline group) and newer Carbepenems like Doripenem which have no major advantage over older related agents. We have one of the highest rates of gram negative bacillary resistance in the world. Therefore, the scenario of panresistant Gram negative bacillary sepsis in an individual who has been hospitalized for a few weeks is a very ‘real’ problem in the Indian setting. The main problem at least in E.coli and Klebsiella in India is ‘ESBL’ (Extended Spectrum ß lactamase) producing strains of these organisms which are resistant to almost all the penicillin and cephalosporin group drugs plus unrelated agents like aminoglycosides and quinolones. Resistance factors are usually carried on plasmids which are transmitted easily as they are quite ‘promiscous’.

The problems are compounded by the following realities: generous antimicrobial use, poor community sanitation facilities, poor infection control practices in most hospitals related to large patient numbers and inadequate personnel, financial constraints of both patients and hospitals and also to a considerable extent lack of awareness of these issues amongst healthcare personnel. ICU’s have sick patients who are usually heavily antibiotic experienced, have invasive lines and catheters and are the ‘hotbeds’ of drug resistant organisms particularly gram negative bacilli. This ‘reality’ is reasonably well known. What is less known is the fact that multidrug resistant community acquired gram negative bacillary infections are now pretty common in all parts of India. It is high time that the medical community, government, patients and everybody who has a stake in the nation’s health attempts to address this problem with a multi-pronged approach to try and curb the vicious cycle involved. Else, there is the real risk of landing up in a scenario practically akin to what existed in the pre-antibiotic era.

References