COMPARISON OF EFFICACY OF THREE COMMERCIALLY AVAILABLE ANTIBIOTIC DISCS

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Abstract

A study was undertaken to evaluate the efficacy of commercially available antimicrobial discs manufactured by Oxoid, UK, HiMedia Laboratories, Mumbai and Span Diagnostics, Surat. The discs were evaluated for their performance on the basis of percentage of coefficient of variation (%CV) which is a measure of reproducibility, mean zone diameters which is a measure of accuracy and range of zone diameter using both standard ATCC strains and clinical isolates. The data showed variation for all three manufacturers and therefore routine and regular quality control of discs as well as meticulous following of good laboratory practices is strongly advocated in clinical laboratories.

Key words: Antibiotic discs, CLSI (NCCLS) guidelines, efficacy testing

The discovery of antibiotics revolutionised the management of infectious diseases. However, the overuse and misuse of antibiotics is leading to the emergence of resistance to these life-saving drugs. Resistance to a variety of antimicrobial agents is emerging in bacterial pathogens throughout the world.[1] Consequently, it is now imperative for clinical microbiologists to provide clinicians with accurate information required for selecting antibiotics for patient therapy and care.

The method of choice for the clinical microbiologists for the in vitro antimicrobial susceptibility testing is still the disc diffusion method. Acceptance of the in vitro disk-susceptibility method has been aided by its simplicity and rapidity. The Kirby-Bauer technique[2] for disk susceptibility testing has been recommended by the CLSI, which is approved by the US FDA and is also recommended by the WHO. Standardisation of the technique controls variation in results and interpretation is based on comparison of inhibition zones with published criteria (M100-S15)[3] for zone diameters. A wide range of mono-disks are commercially available that are either manufactured indigenously or imported. Regardless of their origin, discs require scrupulous storage and handling techniques. This study was undertaken to compare the efficacy of three commercially available antibiotic discs viz., Oxoid, UK, HiMedia Laboratories, Mumbai and Span Diagnostics, Surat.

Materials and Methods

A total of three standard strains and four clinical isolates each of Escherichia coli ATCC 25922, Pseudomonas aeruginosa ATCC 27853 and Staphylococcus aureus ATCC 25923 were tested for their sensitivity to 16 different antibiotics as per CLSI guidelines.[3] The medium used for growing the isolates and testing sensitivity was Mueller-Hinton broth and Mueller-Hinton agar (Konda, Spain).

Antibiotics discs of identical potency, from Oxoid, UK, Hi Media Laboratories, Mumbai and Span Diagnostics, Surat were tested against each isolates and zone diameters recorded.

The reproducibility of each antimicrobial disk from each manufacturer was checked by repeating antibiotic sensitivity testing 20 times using the standard strains and per cent coefficient of variation (%CV) was calculated.[3]

The mean zone diameter was calculated with each disc followed by standard deviation. Reproducibility was considered unsatisfactory if per cent CV for a disc was more than 5%.[1] They were further evaluated for mean zone diameter being within the acceptable range as recommended by the CLSI guidelines. Discordant results were taken to be those results where the interpretation i.e., sensitive/resistant, of one disc differed from the other two.

Results

Reproducibility

Sensitivity discs used in the microbiology laboratory should ideally have least disc-to-disc variation viz., CV less than 5%.[1] The percentage of discs with unsatisfactory CVs has been tabulated in the table. Hi media discs showed the best reproducibility with standard strains while Oxoid discs showed it with clinical isolates.
The zone of inhibition is critical in labeling an isolate as sensitive or resistant. The interpretation is done as per CLSI guidelines. Wide variations in results were seen amongst the three types of discs (Figure). In this parameter Span’s discs performed best, followed by Oxoid and then Hi Media. The discs from different sources that gave different results in our hands may possibly have conformed to the FDA standard of antibiotic content of discs. However, the FDA permits a two-fold difference in content. With the more diffusible antibiotics this may increase zone diameters by as much as 7 mm. There are three main international standards for potency of antibiotics in the discs i.e., FDA, WHO and DIN specifications. Oxoid discs are made according to DIN specifications.

Interpretative discrepancies were seen in 2.4 and 2.7% of Hi Media and Span’s discs respectively. It may be that some discs are impregnated with more than 100% of the stated amount to compensate for loss of activity in handling.

Table: Comparative percentage of unsatisfactory coefficient of variation (CV) of the discs

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Span</th>
<th>Oxoid</th>
<th>HiMedia</th>
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<tbody>
<tr>
<td>Standard strains (n = 16)</td>
<td>3</td>
<td>18.7</td>
<td>2</td>
</tr>
<tr>
<td>Clinical isolates (n = 41)</td>
<td>7</td>
<td>17.1</td>
<td>4</td>
</tr>
<tr>
<td>Total (n = 57)</td>
<td>10</td>
<td>17.5</td>
<td>6</td>
</tr>
</tbody>
</table>

CV more than 5% considered unsatisfactory

Discussion

The laboratory testing of antibiotic susceptibility contributes directly to patient care and data generated from an antibiotic susceptibility test serves as a guideline for deciding therapy. Thus, the antibiotic sensitivity test report can have a powerful influence on antibiotic usage and hence on the factors that facilitate the emergence of antimicrobial drug resistance. Therefore, it follows that the test has to be a highly standardised one, performed using standard reagents, discs and with appropriate strains as quality controls. The antibiotic discs themselves serve as one of the key parameters of this test. To obtain accurate and reproducible results, a key point is the quality of the discs.

Coefficient of variation is an indicator of disc to disc variation within a batch and would be an indicator of the reproducibility of the test results. In case of discs from Span Diagnostics, 17.5% discs showed per cent CV more than 5%, whereas 10.0% of Oxoid discs and 8.8% of the HiMedia discs gave unsatisfactory per cent CV. One of the reasons for the variation could be slight differences in antibiotic concentrations of the discs in different batches. However, Brown D. F. and Kothari D in their study comparing commercial discs showed that different batches of single discs from the same source did not vary significantly in antibiotic content as indicated by variation in zone size.

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Interpretative discrepancies were seen in 2.4 and 2.7% of Hi Media and Span’s discs respectively. It may be that some discs are impregnated with more than 100% of the stated amount to compensate for loss of activity in handling.
This study emphasizes the need for stringent quality control testing of discs each time a new lot of discs is introduced in the clinical laboratory and also on a weekly basis as recommended by the CLSI. In the current study stringent measures were taken to ensure appropriate storage of discs. This could otherwise be an important factor affecting sensitivity. Discs should be returned to the refrigerator as quickly as possible after use. The most common cause of moisture reaching the discs and causing destruction of labile antimicrobials is condensation of warm laboratory air on cold discs removed from the refrigerator. Also, it is important to allow the cartridge blister pack to reach room temperature before exposing the discs. Manufacturers should pay special attention to maintenance of cold chain from their warehouses to that of distributors to the end users further curtailing the introduction of errors into performance. Frequent power cuts and delay in transport of discs from the manufacturer to the end user could play a role in the variations recorded in the present study. Many laboratories use discs produced by different manufacturers. Some even produce their own discs[7] therefore, there is a need of setting up a National quality control laboratory to provide the performance standards, reference quality control strains and quality antibiotic discs to ensure reproducible and reliable results. This would contribute to reliable data being available to the clinician and thus could help in framing scientifically based antibiotic therapy and prevent indiscriminate use of antibiotics.

References

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