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PREPARATION AND IMPLEMENTATION OF ANTIBIOGRAM

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ABSTRACT

The hospital antibiogram is a periodic summary of antimicrobial susceptibilities of local bacterial isolates submitted to the hospital's clinical microbiology laboratory. Antibiograms are often used by clinicians to assess local susceptibility rates, as an aid in selecting empiric antibiotic therapy, and in monitoring resistance trends over time within an institution.

Hospitals use antibiograms to guide optimal empiric antibiotic therapy, reduce inappropriate antibiotic usage, and identify areas requiring intervention by antimicrobial stewardship programs. Creating a hospital antibiogram is a time-consuming manual process that is typically performed annually.

Clinicians refer to antibiograms to guide optimal empiric antibiotic therapy and reduce inappropriate antibiotic usage.

To serve these purposes, antibiograms must be constructed using standardized methods that allow inter and intra-hospital comparisons.

INTRODUCTION

The hospital antibiogram is a periodic summary of antimicrobial susceptibilities of local bacterial isolates submitted to the hospital's clinical microbiology laboratory. Antibiograms are often used by clinicians to assess local susceptibility rates, as an aid in selecting empiric antibiotic therapy, and in monitoring resistance trends over time within an institution.

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Clinicians refer to antibiograms to guide optimal empiric antibiotic therapy and reduce inappropriate antibiotic usage.

To serve these purposes, antibiograms must be constructed using standardized methods that allow inter and intra-hospital comparisons.

The Clinical and Laboratory Standards Institute (CLSI) developed consensus guidelines in 2007

(revised in 2014) for the collection, storage, analysis, and presentation of antimicrobial susceptibility data.

Appropriate empirical antibiotic treatment improves patient outcomes, while the selection of unnecessary broad-spectrum antibiotics can increase harm to patients, antimicrobial resistance, and hospital costs.

Antibiograms help to make data-driven decisions, but certainly other factors such as the severity of the patient's illness or immune status also play a role. Antibiograms can only relay data on isolates submitted to the microbiology laboratory.

Antibiograms are excellent tools to help decision making once the organism is known.

It is crucial to monitor emerging trends in resistance at the local level to support clinical decision making, infection-control interventions, and antimicrobial-resistance containment strategies.

The most frequent use of a cumulative antibiogram report is in guiding initial empirical antimicrobial therapy decisions for the management of infections in patients for whose microbiological test data to target treatment do not yet exist, and this is the focus of CLSI.

Antibiograms can also used to compare susceptibility rates across institutions and track resistance trends.

Consensus guidelines have been developed by the Clinical and Laboratory Standards Institute (CLSI) to standardise methods used in constructing antibiograms.

Only the first isolate from the patient is to be included in the analysis. The analysis should be done on the basis of patient location and specimen type. The percentage susceptibility of the most frequently isolated bacteria should be presented in the antibiogram, preferably in a tabular form. The antibiogram must be printed or put up in the intranet for easy access to all clinicians.

In 2002, the National Committee for Clinical Laboratory Standards (now known as the Clinical and Laboratory Standards Institute [CLSI]) published standards for constructing antibiograms.

Lack of ABGM preparation may be due to the fact that these small institutions have limited resources available or that their cultures are sent to outside laboratories, given that there is low demand for this service.

The Need

The hospital antibiogram is a periodic summary of antimicrobial susceptibilities of local bacterial isolates submitted to the hospital's clinical microbiology laboratory. Antibiograms are often used by clinicians to assess local susceptibility rates, as an aid in selecting empiric antibiotic therapy, and in monitoring resistance trends over time within an institution. Antibiograms can also used to compare susceptibility rates across institutions and track resistance trends. Susceptibility testing methods used in the microbiology laboratory provides quantitative and qualitative data.

Common methods of susceptibility tests

S. No.	Method	Measures
1.	Disk diffusion	Qualitative
2.	Broth dilution	Quantitative
3.	Agar screen	Qualitative
4.	Etest	Quantitative
5.	Beta-lactamase	Qualitative

To ensure that dependable data are presented to the community, institution of a standardized, consistent, and straightforward mechanism to generate, collect, and organize data at the local level is required. The M39 standard for collection, collation, and analysis of data should be followed.

The Role of the Microbiologist

The clinical microbiologist plays an important role in making of the antibiogram. The first task is the accurate daily reporting of bacterial cultures with the susceptibility results based on the latest Clinical and Laboratory Standards Institute (CLSI) guidelines.

The microbiologist plays a role in the formulation of the hospital empiric antibiotic policy, translating the cumulative antibiogram into practical applications.

Clinical microbiologists have an opportunity to play a key role in their hospitals, surveillance programs and in their communities.

They must provide accurate, clear, concise, and timely reports for use in guiding therapy and infection control decisions within the hospital. Although the responsibility for preparation and distribution of annual antibiograms may rest with clinical pharmacists, infectious disease specialists, or perhaps infection control practitioners, microbiologists.

The microbiologist is also encouraged to take a leadership role in the multidisciplinary approach of compiling local surveillance data and annual antibiogram development. This includes developing and maintaining a monitoring program, enhancing cooperation and communication among health care providers within the community, providing a means of

benchmarking and reconciling techniques used among the community laboratories, assessing local patterns of susceptibility, identifying emerging resistance, and conveying these data to the appropriate individuals in order to affect policies in treatment and develop strategies for preventing resistance in their hospitals and communities.

Consensus guidelines have been developed by the CLSI to standardise methods used in constructing antibiograms, with the goal of promoting the reporting of reliable and consistent antibiogram data.

The salient points of this document include the following.

- The data should be analysed annually. However, if there are a large number of isolates, this may be done six monthly or more frequently.
- At least 30 isolates should be present for inclusion in the analysis.
- The isolates that are obtained from diagnostic testing should only be included and those from surveillance cultures, e.g., MRSA screening should not be included. Colonisers should not be included.
- Include results for the antibiotics that are routinely tested.
- Only the first isolate from a patient irrespective of the specimen site should be included.
- The cumulative antibiogram should present only the percentage susceptible and not those which are intermediate susceptible.
- It is useful to stratify the antibiogram into outpatient, inpatient and ICU data [3].

The analysis is done on the basis of patient location: whether outpatient, ICU or inpatient (non-ICU). The next parameter to be analysed is the specimen type. At least five most frequently isolated organisms from each site should be used for the final antibiogram.

The percentage susceptibility to the antibiotics should be depicted separately for Gram positive and Gram negative isolates.

A master antibiogram for a region would allow a tertiary care institution to consider resistance patterns in hospitals referring patients and to select appropriate "presumptive" antimicrobial therapy or change drugs in non-responding patients. We hope that the concept of "empiric antimicrobial therapy" would be changed to that of "presumptive antimicrobial therapy" based on host factors, common pathogens.

Antimicrobial resistance data generated by this approach will have better day-to-day application than will data generated by large national databases. The data will also be useful in monitoring resistance trends in a region over time and assessing the effects of interventions to reduce antimicrobial resistance.

Antibiogram surveillance is quite different. Clinical laboratories assess the antimicrobial susceptibilities of bacterial isolates and summarize all susceptibility results for a specified period on an antibiogram report. Antibiograms conform to the susceptibility testing practices of individual laboratories, include information on both sterile and non-sterile isolates, may include duplicate isolates from a single patient, and lack an epidemiologic characterization of the patient or isolate.

Antibiogram which should reflect patient care needs along with the institution's formulary.

When properly prepared and interpreted, ABGMs are an important resource for healthcare providers. While patient-specific cultures and susceptibility reports are pending, the ABGM may guide empirical therapy decisions based on likely pathogens and their probable susceptibilities to anti-infectives available at the institution.

The Presentation

The antibiogram must be presented in a tabular form. The percentage susceptibilities should be mentioned separately for the Gram positive and the Gram negative bacteria.

Sensitivity pattern of gram positive isolates

S. No.	Antimicrobials	Organisms and no. of isolates	
		Staphylococcus aureus (12)	CoNS (10)
1.	Tetracycline	75%	60%
2.	Augmentin	62%	20%
3.	Cefotaxim	12.5%	40%
4.	Ceftriaxone	12.5%	80%
5.	Amikacin	5%	20%
6.	Vancomycin	62.5%	100%
7.	Azithromycin	50%	20%

Sensitivity pattern of gram negative isolates

S. No.	Antimicrobials	Organisms and no. of isolates			
		Klebsiella pneumonia (20)	E. coli (2)	Pseudomonas aeruginosa (2)	Proteus (2)
1.	Amikacin	90%	0	100%	100%
2.	Ceftriaxone	20%	100%	100%	100%
3.	Piptaz	30%	100%	100%	100%
4.	Meropenem	20%	100%	100%	100%
5.	Ciprofloxacin	10%	100%	100%	100%
6.	Augmentin	60%	100%	100%	100%
7.	Cefotaxim	0	100%	100%	100%

Printed antibiograms should be made easily available to the clinicians and at the nursing stations. It may also be put up on the hospital intranet for easy access.

These findings suggest that antibiograms should be reviewed thoroughly by infectious disease specialists (physicians and pharmacists), clinical microbiologists, and infection control personnel for identification of abnormal findings prior to distribution.

Uses:

The antibiogram can serve as a valuable tool in guiding antimicrobial therapy, but other patient factors, such as previous infection history and antibiotic use, also need to be considered.

Antibiograms may also be used to guide formulary decisions, although practically they are more useful in monitoring recent additions or deletions. Antibiograms that incorporate formulary, drug of choice, dosage, cost, and hospital-specific restrictions will facilitate patient-specific decisions.

Aggregating antibiogram data is a feasible and timely method of monitoring regional susceptibility patterns and may also prove beneficial in measuring the effects of interventions to decrease antimicrobial resistance.

Combining hospital antibiogram data appears to be an effective method of tracking antimicrobial susceptibility.

Regional surveillance can identify areas most in need of interventions aimed at decreasing resistance and can monitor the progress of these interventions. Aggregating antibiogram data appears to be an easy, inexpensive, effective way of accomplishing these goals.

In an era of antimicrobial misuse, increasing anti-infective resistance, and reduced emphasis on antibiotic development by pharmaceutical manufacturers, the need for reliable, accurate ABGM data to guide appropriate antibiotic selection is critical.

The NCCLS recommends that ABGMs be prepared on an annual basis to allow for proper trend interpretation without confounders of seasonal variations.

DISCUSSION

In an era of antimicrobial misuse, increasing anti-infective resistance, and reduced emphasis on antibiotic development by pharmaceutical manufacturers, the need for reliable, accurate ABGM data to guide appropriate antibiotic selection is critical.

The increased prevalence of antibiotic resistant strains is associated with greater morbidity, mortality, and healthcare cost. Thus, it is advantageous to have a sense of resistance patterns in a region in order to decide on the best antibiotic for use, lessening the drain on time and resources from increased lengths of stay, multiple trials of antibiotics, and/or non-judicious use of broad-spectrum antibiotics.

Antimicrobial resistance data generated by this approach will have better day-to-day application than will data generated by large national databases. The data will also be useful in monitoring resistance trends in a region over time and assessing the effects of interventions to reduce antimicrobial resistance.

CONCLUSION

A master antibiogram for a region would allow a tertiary care institution to consider resistance patterns in hospitals referring patients and to select appropriate "presumptive" antimicrobial therapy or change drugs in non-responding patients. We hope that the concept of "empiric antimicrobial therapy" would be changed to that of "presumptive antimicrobial therapy" based on host factors, common pathogens, and known susceptibility patterns in any given region.

Such tools would facilitate standardized data processing steps and eliminate manual antibiogram data compilation, which may be susceptible to error and subsequent misrepresentation of resistance patterns at a given institution.

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