Is it possible to improve antimicrobial susceptibility tests by improving the precision in concentration determination of bacteria?

Company: Q-linea
Place: Uppsala
Start: Autumn 2020
Application: Deadline June 1st, 2020

Background

Antimicrobial resistance is when bacteria develop the ability to survive the treatment and leads to that the bacteria can continue to grow. Infections caused by antimicrobial resistant bacteria are difficult - sometimes impossible - to treat.

There are *in vitro* tests for characterization of bacterial susceptibility to different antimicrobials, so called Antimicrobial Susceptibility Test (AST), which are used at the microbiology lab. Such test results can be used by the clinician to reach effective treatment by providing information about at what concentration the bacteria are killed (or inhibited from growth) *in vitro*., the so called Minimal Inhibitory Concentration (MIC). Performance of an AST methods is measured and evaluated with two main parameters, Essential Agreement (EA) and Categorical Agreement (CA). EA is if the test results is essentially the same as the results obtained using the gold standard reference method, i.e. broth microdilution whereas CA is if the classification is correct. Bacteria tested with AST is classified, based on the MIC result, into Resistant (R), Intermediate increased exposure (I) or Susceptible, standard exposure (S). Due to the inherent variability of today's standard method EA is deemed as the same or one doubling concentration up or down for the MIC value. This makes it difficult to obtain correct classification at the breakpoints between S, I and R.

To give reliable *in vitro* AST results it is important to know the concentration of bacteria used. Q-linea have developed one such test and implemented it into our automatic diagnostic systems, ASTar®. The current method performs within todays specifications for AST, i.e. +/- 60% of the intended concentration of actual amount of live and viable bacteria in the sample.

This project is to evaluate if further improvements of the concentration determination method can be obtained by incorporating bacterial identify in the algorithms for concentration determination and if so – will this in turn lead to a further improvement of the *in vitro* AST results? This has special importance for bacteria that have decreased susceptibility to antibiotics but are treatable if higher doses are used. This category of bacteria has received recent attention in AST guidelines, being an approach to widen the utility of existing antibiotics.

Project

The aim of the project is to investigate how the ASTar systems method for concentration determination can be improved if the identity of the bacteria is included in the algorithm for concentration determination. Each bacterial specie has its own characteristics that contribute to the variability observed when making concentration measurements. Our hypothesis is that this can be improved on - but it is unknown if this also may lead to improved results in the AST. Some data indicate that it could be the case, but it has not been shown in any dedicated study. We will focus on Streptococci for this project, an important respiratory pathogen, with first work on the concentration determination step and evaluation on how much more precise the ASTar concentration determination method will be by making a dedicated standard curve for Streptococci. Second step, if the first step succeeds, is to evaluate if the final AST result shows an improvement with respect to reproducibility for AST testing for carbapenems and Streptococci when the bacteria has a MIC-value close to the clinical breakpoints.

About Q-linea

Q-linea is an innovative research, development and manufacturing company that primarily develops instruments and disposables for rapid and reliable infection diagnostics. Q-linea's vision is to help save lives by ensuring antibiotics continue to be an effective treatment for future generations. Q-linea develops and delivers preferred solutions for healthcare providers, enabling them to accurately diagnose and treat infectious disease in the shortest possible time.

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