(SD2021-055) Mass Spectrometry-Based Detection of Beta Lactam Hydrolysis Enables Rapid Detection of Beta Lactamase Mediated Antibiotic Resistance

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OTHER INFORMATION

KEYWORDS

Antibiotic resistance, Beta-lactamase, ESBL, Extended Spectrum Beta Lactamase, MALDI-TOF MS, Antibiotic resistance testing, beta lactam hydrolysis, ass-spectrometry, urinary tract infection, beta lactam, Beta Lactamase Mediated Antibiotic resistance

CATEGORIZED AS

- **Medical**
  - Diagnostics
  - Disease: Kidneys and Genito-Urinary System
  - Screening

RELATED CASES

2021-Z08-1

BACKGROUND

Beta-lactam antibiotics account for the majority of antibiotics used worldwide. Resistance by beta-lactamase expression is a serious and growing threat.

The typical workflow in a clinical microbiology laboratory leading to identification of antibiotic resistant organisms consists of 1) sample plating and mixed growth, 2) pathogen isolation and growth, 3) identification of the organism by biochemical tests or Matrix Assisted Laser Desorption Ionization Time of Flight (MALDI-TOF), and finally 4) observed growth in antibiotic containing media to determine antibiotic susceptibility/resistance patterns. This workflow requires 36 to 72 hours, involves multiple manual steps, and may not detect inducible resistance.

The evolution and spread of antibiotic resistance among human pathogens represents a serious public health threat. Faster identification of the presence of antibiotic resistant organisms is a key component in the effort to reduce the spread of antibiotic resistance, as evidenced by the inclusion of diagnostic development in the CDC's national strategy to combat antibiotic resistance.

Given the clinical challenges that beta-lactamase expressing pathogens present, there is a clear need for faster identification to both enable effective treatment and to enact isolation precautions preventing further spread of resistant organisms

TECHNOLOGY DESCRIPTION

Researchers from UC San Diego developed a method to determine if beta-lactamase activity is detectable in urine specimens (without isolation and culture steps) within hours, enabling faster identification of resistance.

This approach uses mass spectrometry to demonstrate beta-lactamase activity directly in biological specimens by measuring the hydrolysis of target antibiotics through the disappearance of protonated molecular ions in the presence of resistant organisms. This invention demonstrates, for the first time, that the activity of ESBL enzyme present in a centrifuged urine specimen are sufficient for robust detection, using LC-MS, before the required culture and isolation of pathogenic organisms.

APPLICATIONS

This invention provides a method to detect clinically significant beta-lactamase activity directly from urine samples without the need for culture, 24-48 hours sooner than traditional culture-based methods.
Furthermore, this detection method leverages mass spectrometers commonly found in clinical laboratories.

ADVANTAGES

Beta-lactamase activity is detectable in urine specimens (without isolation and culture steps) within hours, enabling faster identification of resistance.

INTELLECTUAL PROPERTY INFO

This patent-pending technology is available for commercialization. Please contact UC San Diego to explore licensing options.

RELATED MATERIALS

- Suhandynata RT, Lund K, Caraballo-Rodríguez AM, Reed SL, Dorrestein PC, Fitzgerald RL, Bevins NJ. Mass Spectrometry-Based Detection of Beta Lactam Hydrolysis Enables Rapid Detection of Beta Lactamase Mediated Antibiotic Resistance. Lab Med. 2021 Aug 17:lmab068. doi: 10.1093/labmed/lmab068. Epub ahead of print. PMID: 34403464. - 08/17/2021

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