IN BRIEF A Summary of the Evidence

MALDI-TOF Mass Spectrometry for Pathogen Identification: A Review

Key Messages

- Matrix-assisted laser desorption ionization time-of-flight (MALDI-TOF) mass spectrometry is highly accurate in identifying most pathogens causing infection.
- In most cases, MALDI-TOF appears to reduce the time required for identifying a pathogen by at least 24 hours, but there are limitations to the evidence.
- MALDI-TOF might improve clinical outcomes including 30-day mortality, length of hospital stay, length of stay in intensive care, and recurrence and readmission, but there are limitations to the evidence.
- Effective communication between laboratories, infectious disease specialists, and treating physicians is required to take advantage of the faster pathogen identification times with MALDI-TOF and, while the use of these multidisciplinary services results in additional costs, the ability to start appropriate treatment earlier could potentially avoid the costs that would result from delaying treatment.

Technology

In MALDI-TOF MS, the prepared sample is mixed with a compound, dried, and exposed to multiple pulses of an ultraviolet laser, which ionizes the sample. The mixture of charged ions is accelerated in an electrical field toward a detector and the time of flight of each ion is recorded. The resulting spectrum is then analyzed against a database of results for known, specific pathogens. Two MALDI-TOF systems are registered in Canada: the Bruker Daltonics Flex and Microflex series, supported by the Biotyper software and database, and the bioMérieux VITEK MS, supported by the VITEK MS.

Issue

A review of the accuracy and reproducibility of MALDI-TOF MS in identifying organisms from solid media cultures or blood cultures, as well as a review of its clinical and cost-effectiveness, will help to determine the role of MALDI-TOF MS in pathogen identification.

Methods

A limited literature search was conducted of key resources, and titles and abstracts of the retrieved publications were reviewed. Full-text publications were evaluated for final article selection according to predetermined selection criteria (population, intervention, comparator, outcomes, and study designs).

Results

The literature search identified 2,620 citations, 77 of which were deemed potentially relevant. Two additional articles were retrieved from the grey literature. Of these 79 potentially relevant articles, 36 met the criteria for inclusion in this review including systematic reviews, health technology assessments, non-randomized studies, diagnostic accuracy studies, and cost comparison studies.

Context

To effectively treat an infection, it is important to know the pathogen — a virus, bacteria, or other micro-organism — causing the infection. Traditionally, pathogens have been identified by their appearance and characteristics using a variety of automated and manual procedures involving microscopy, biochemical assays, and molecular methods. Direct gene sequencing is considered definitive identification, but it is usually performed in specialist laboratories. An alternative method for identifying pathogens is called matrix-assisted laser desorption ionization time-of-flight (MALDI-TOF) mass spectrometry (MS). It is a highly specific and automated method that may require only minimal preparation of biological samples for testing.
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ABOUT CADTH
CADTH is an independent, not-for-profit organization responsible for providing Canada’s health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs and medical devices in our health care system.

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