Bacterial infection

Bacterial infections are classified by the causative agent, as well as the symptoms and medical signs produced.

Symptomatic infections are apparent, whereas an infection that is active but does not produce noticeable symptoms may be called inapparent, silent, or subclinical. An infection that is inactive or dormant is called a latent infection.

A short-term infection is an acute infection. A long-term infection is a chronic infection.

Diagnosis

The gold standard for confirming bacterial infections is culture-positive, which has a long sample-to-result turnaround time and poor sensitivity for unculturable and fastidious pathogens; therefore, it is hard to guide early, targeted antimicrobial therapy and reduce overuse of broad-spectrum antibiotics. Targeted Nanopore sequencing (NTS) is reported to be advantageous in detection speed and range over culture in prior published reports. However, investigation of the clinical performance of NTS is deficient at present. Thus, Fu et al. assessed the feasibility of NTS for the first time with cohort and systematic comparisons with traditional culture assays and PCR followed by Sanger sequencing. This retrospective study was performed on 472 samples, including 6 specimen types from 436 patients, to evaluate the clinical performance of NTS designed for identifying the microbial composition of various infections. Of these samples, 86.7% were found to be NTS positive, which was significantly higher than culture-positive (26.7%). A total of 425 significant human opportunistic bacteria and fungi detected by NTS were selected to go through validation with PCR followed by Sanger sequencing. The average accuracy rate was 85.2% (maximum 100% created by Cryptococcus neoformans, the last one 66.7% provided by both Staphylococcus haemolyticus and Moraxella osloensis, minimum 0% produced by Burkholderia cepacia). The accuracy rate also varied with sample type; the highest accuracy rate was found in pleural and ascites fluid (95.8%) followed by bronchoalveolar lavage fluid (88.7%), urine (86.8%), and wound secretions (85.0%), while the lowest was present in cerebrospinal fluid (58.8%). NTS had a diagnostic sensitivity of 94.5% and specificity of 31.8%. The positive and negative predictive values of NTS were 79.9% and 66.7%, respectively. For diagnosis of infectious diseases, the sensitivity was greatly increased by 56.7% in NTS compared with culture (94.5% vs 37.8%). Therefore, NTS can accurately detect the causative pathogens in infectious samples, particularly in pleural and ascites fluid, bronchoalveolar lavage fluid, urine, and wound secretions, with a short turnaround time of 8-14 h, and might innovatively contribute to personalizing antibiotic treatments for individuals with standardized protocols in clinical practices. IMPORTANCE Nanopore targeted sequencing (NTS) is reported to be advantageous in detection speed and range over culture in prior published reports. Investigation of the clinical performance of NTS is deficient at present. In our study, cohort and systematic comparisons among three assays (culture, NTS, and Sanger sequencing) were analyzed retrospectively for the first time. Fu et al. that NTS undoubtedly has incomparable advantages in accurately detecting the causative pathogens in infectious samples, particularly in pleural and ascites fluid, bronchoalveolar lavage fluid, urine, and wound secretions, with a short turnaround time of 8-14 h. For sterile specimens like blood and cerebrospinal fluid (CSF), the NTS outcomes should be validated using other nucleic acid-based detection technology. Overall, NTS might innovatively contribute to guiding early, targeted antimicrobial therapy with lower cost and reducing the overuse of broad-spectrum antibiotics [1].

1)
Fu Y, Chen Q, Xiong M, Zhao J, Shen S, Chen L, Pan Y, Li Z, Li Y. Clinical Performance of Nanopore Targeted Sequencing for Diagnosing Infectious Diseases. Microbiol Spectr. 2022 Mar 30:e0027022. doi: 10.1128/spectrum.00270-22. Epub ahead of print. PMID: 35352939.