Dr Marcus Panning chooses to elect Fast-track diagnostics kits, for efficient diagnosis of vulnerable patient groups



Dr. Marcus Panning

Introduction

The importance of detecting common diseases including respiratory infections in vulnerable patients, encompassing the immunosuppressed and children is of increasing importance, and should not be overlooked. Despite recent progresses in infectious disease pathophysiology, and the discovery of effective treatments, infectious disease diagnostics is still a challenging issue, facing everyday healthcare delivery worldwide.

Although the progress made in new treatment development is remarkable, and is still evolving, many patients still receive inaccurate or delayed diagnosis, resulting in suboptimal treatment. Whether diagnosing a single patient or responding to a worldwide pandemic, the early and accurate diagnosis of infectious pathogens is essential in making a significant difference to treatment plans, and patient prognosis.

Dr Marcus Panning is a physician and medical virologist at The University Medical Centre Freiburg, who sees large numbers of paediatric and immunosuppressed patients. His team relies on prompt and efficient disease diagnosis, to provide effective care and make a significant difference to patient outcome. This article includes the views of Dr Panning on infectious disease diagnosis, and the laboratory's adoption of Fast-track diagnostics (FTD) kits currently utilised for successful infectious disease detection.

Traditional methods of infectious disease diagnosis

Traditional methods of detecting agents of disease in clinical samples previously involved the isolation and magnification of the bacteria, fungi, parasite, or virus in culture by growing microorganisms in a laboratory under precise conditions. Although cell culture has traditionally been the benchmark for organism identification, the drawbacks include; cost, requirement of skilled personnel and time. In a clinical setting, time is of the essence for efficient treatment, waiting for results for days or weeks, is simply not a viable option. Added to this, not all pathogens can be efficiently cultured, and low sensitivity is also an issue. The need for alternative methods, allowing time-sensitive and accurate diagnosis is imperative to successful treatment, and as a result there have been major developments over the years.

Advances in infectious disease diagnosis – from PCR to a multiplex approach

Molecular diagnosis has evolved considerably in recent years, and has revolutionised the way in which laboratories diagnose human pathogens. Real-time polymerase chain reaction (PCR) techniques have led the way, by allowing rapid detection of microorganisms that were previously difficult or impossible to detect by traditional methods. Real-time PCR is a variation of the standard PCR technique, used to quantify deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) within a sample.

Real-time PCR begins with reverse transcription of RNA into complementary DNA (cDNA), using a reverse transcriptase enzyme, followed immediately by polymerase chain reaction. The detection of viral and bacterial sequences is carried out via several fluorescence detection technologies. The presence of specific viral and bacterial sequences in the reaction is distinguished by an increase in fluorescence observed from the relevant dual-labelled probe, and is reported as a cycle threshold (c_t) by the real-time thermos-cycler.

Real-time PCR allows clinical laboratories to detect the pathogens directly from clinical samples, eradicating the time spent waiting for a culture to grow. Although real-time PCR has transformed infectious disease diagnosis, multiplex real-time PCR further saves time, effort and money, through the detection of numerous pathogens simultaneously. Multiple sets of genespecific primers are used to amplify separate genes from the template DNA or RNA within a single tube, in a single set of reaction conditions. Once complete, the method allows the analysis of each individual amplification product from the mixture.

Adopting a multiplex PCR approach can be extremely beneficial in any laboratory, where repeated analyses with similar types of targets are carried out. However in a clinical setting when diagnosing infectious diseases performing multiplex PCR, clinicians are able to perform complete screening for pathogens responsible for specific clinical syndromes in a short space of time. This diagnostic approach is extremely important in infectious disease diagnosis, where time and accuracy are important factors in allowing patients to receive the correct diagnosis. Over the past decade the technique has been utilised to screen for individual or symptom associated viruses, and also examine the associations of viral infection with disease.

Dr Marcus Panning, the University Medical Centre Freiburg

Amongst other research endeavours, Dr Marcus Panning's team are interested in testing for Acute Lower Respiratory Tract Infections (LRTIs) in both in-patients and out-patients. LRTIs are caused by a wide variety of viral and bacterial pathogens, and constitute a significant cause of antibiotic use, morbidity and mortality worldwide. Current guidelines for paediatric and adult patients recommend antibiotic treatment in patients hospitalised with acute LRTI or pneumonia. However up to 45% of LRTI cases in adults and 87% in children are of viral origin and antibiotic treatment is regularly not the answer. Dr Panning sees a large number of patients from both haematology and oncology departments, where large proportions are immunosuppressed, or paediatric. In these particularly vulnerable patient groups, it is vital that diagnoses are quick and efficient, to enable prompt and accurate treatment plans. The number of tests run within Dr Panning's laboratory varies depending upon the time of year, but on average they test between 1500 and 2500 samples annually. Of the samples tested, approximately 50-70% are positive. This highlights the need for efficient multiplex infectious disease detection kits to provide efficient and accurate disease detection, and ensure rapid and correct treatment options are employed.

The laboratory at The University Medical Centre Freiburg is not new to multiplex testing having used this approach since 2007-2008, prior to Dr Panning joining the team. For Dr Panning the main benefit of using multiplex PCR is time-efficiency, and when choosing an infectious disease diagnostic kit, his main priorities are excellent overall performance, cost efficiency, the ability to obtain real-time readouts, and ease of use when processing with the apparatus. In contrast to existing methods such as cell culture, multiplex PCR allows diagnosis within hours of drawing a sample, which is effective in all patient populations, but especially in vulnerable patient groups.

After running comparison studies, Dr Panning's laboratory found that the overall performance of the Fast-track diagnostics kits proved advantageous over those used previously. The compat-





ibility, reliability, flexibility and ease of use were appealing factors, in addition to the kits being less labour intensive than those already being used. In a laboratory where thousands of samples are tested, improved efficiency is a key benefit. Dr Panning and his team currently make use of two kits from Fast-track diagnostics; FTD Respiratory pathogens 21 kit, and the FTD Viral Gastroenteritis kit. The Fast-track diagnostics Respiratory pathogens 21 kit is an *in vitro* test for the qualitative detection of nucleic acid in respiratory samples, as an aid to the evaluation of infections with multiple pathogens.

As Dr Panning's laboratory runs tests on a large volume of samples, having the ability to run tests quickly and reliably is of the upmost importance to provide timely results and diagnoses, for clinicians and vulnerable patients. The Fast-track diagnostics kits allow results to be produced in a timely fashion, but they also allow Dr Panning to test for atypical pathogens, which otherwise would not be tested for unless another sample was drawn. Having the ability to simultaneously test for atypical pathogens reduces the number of samples which need to be tested, in order to reach a diagnosis, resulting in time and cost savings. Fast-track diagnostics kits are also advantageous, as bacterial and viral pathogens can be tested for in the same run, allowing for a broader range of pathogen detection, without having to run multiple tests.

Conclusion

Considerable progress has been made in the diagnosis of infectious diseases. Newer more efficient techniques have had a tremendous impact on the treatment of patients with infectious diseases. In comparison to spending days or weeks in the laboratory growing and testing a culture, multiplex PCR offers the opportunity for multiple pathogens to be tested within a few hours. Rapid and efficient diagnosis now allows clinicians to successfully diagnose patients and commence correct treatment plans all within the same day, which has been confirmed by Dr Panning and his team. From cell cultures to multiplex PCR, we have seen rapid advances in infectious disease diagnostics. Although progress has been made, there is still room for improvement, and development is continually ongoing to further improve systems and methods. Lyophilisation, for example, is set to bring new levels of efficiency and simplicity to diagnostic testing within laboratories, which will take diagnostic testing to new levels.

Do you have more general questions for Fast-track diagnostics? If so, simply email your questions to <u>support@fast-trackdiagnostics</u>. <u>com</u>, and one of our Application Specialists will get back to you.

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