

Forensic Microbiology Holds the Key to Containing Hospital Disease Outbreaks and Superbug Epidemics

Polymerase Chain Reaction (PCR) technology – rapidly replicating DNA in a test tube – can swiftly and accurately identify a bacterial outbreak and trace the source. This technology could help curtail hospital outbreaks, especially those which result in the deaths of newborn babies from the *Klebsiella* bacteria or the *Enterobacter* outbreak (from infected drips). Various outbreaks of this type have killed over 17 infants in South African hospitals over the last 12 months.

Dr Gerhard Weldhagen, a member of the National Pathology Group (NPG) and molecular biologist, said that PCR enabled clinicians to test outbreaks on a molecular level. It provided results much more rapidly than a traditional bacterial culture. "Using PCR techniques can reduce the waiting period for a result from weeks to days. In addition, traditional bacterial culture can only identify the organism, not its genetic source, whereas a PCR test can be absolute about the genetic background of the infection. This tells you whether the disease is being spread by one person, or one infected batch of equipment, or whether it is multi-sourced," Dr Weldhagen said.

In essence, PCR is a rapid, relatively inexpensive and simple means of producing large numbers of copies of DNA molecules from minute quantities of source material, such as a single hair follicle or even

a single cell. This replication is possible even when cells and bacteria are dead.

Hospitals are breeding ground for bacteria, many of which are harmless to healthy individuals but deadly to the sick. Babies, the elderly and adults with weakened immune systems are all vulnerable to infections, which can be spread by poor hygiene practices. Other sources of infection include 'moonlighting' personnel who work shifts at a variety of institutions.

The rise of superbugs – bacteria immune to antibiotics – has made treatment that much more difficult. According to Dr Weldhagen, this phenomenon makes it all the more important to identify the culprit bacteria as early as possible, to contain the spread of the infection and implement early treatment options for the sick. "In certain cases, PCR also enables us to test the drug sensitivity of the organism at a molecular level, to determine the most effective course of treatment," he said.

PCR kits are still primarily imported from the European Union or from America although some pathology groups are developing assays in-house to deal with South African specific diseases. Due to intervention by the NPG, the price of imported PCR kits has almost halved, making the technology more accessible than ever. The quality and sensitivity of PCR tests continue to improve. Automation within the laboratory has also decreased the risk of contamination, another factor that is contributing to the growing use of PCR markers.

PCR put to the test

Other examples of the use of PCR testing include:

- Blood tests – PCR is now a mainstream tool for testing donated blood for HIV contamination.
- HIV – a PCR test shortens the 'window period' when HIV is not detectable. Results are now conclusive for 50% of patients within 16 days and 100% of patients within 6 weeks.
- HIV – PCR can also be used to determine which drugs a patient is resistant to. At the moment this testing is only employed when the 3rd or 4th drug regimen fails although ideally it should be introduced at the first sign of resistance as this would enable doctors to determine which medication in the HIV cocktail the patient was resistant to and allow them to keep prescribing drugs that still worked, prolonging the effectiveness of all medicines.
- Genetic screening – PCR can be used to detect diseases such as cystic fibrosis, haemochromatosis and porphyria.
- Cancer – certain tumours respond better to certain types of treatment, for example, what kind of ovarian cancer a patient has determines which treatment she should receive. The accuracy of PCR testing helps pinpoint the exact treatment required.
- Paternity tests – fast, easy, reliable.