FIRSTPOST.

Now a portable device to detect tuberculosis, other infections

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#cancer diagnostic device #Health #HealthMatters #Tuberculosis

Washington: A handheld cancer diagnostic device can rapidly detect tuberculosis (TB) and other important infectious bacteria, scientists have found.

The device developed by Massachusetts General Hospital (MGH) combines microfluidic technology with nuclear magnetic resonance (NMR) to diagnose these infections and determine the presence of antibiotic-resistant bacterial strains.

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"Rapidly identifying the pathogen responsible for an infection and testing for the presence of resistance are critical not only for diagnosis but also for deciding which antibiotics to give a patient," said Ralph Weissleder, director of the MGH Center for Systems Biology (CSB) and co-senior author of both papers.

"These described methods allow us to do this in two to three hours, a vast improvement over standard culturing
practice, which can take as much as two weeks to provide a diagnosis," Weissleder said.

Investigators at the MGH CSB previously developed portable devices capable of detecting cancer biomarkers in the blood or in very small tissue samples. Target cells or molecules are first labelled with

magnetic nanoparticles, and the sample is then passed through a micro NMR system capable of detecting and quantifying levels of the target.

But initial efforts to adapt the system to bacterial diagnosis had trouble finding antibodies - the detection method used in the earlier studies - that would accurately detect the specific bacteria. Instead the team switched to
targeting specific nucleic acid sequences.

The system described in the journal Nature Communications, detects DNA from the tuberculosis bacteria in small sputum samples. After DNA is extracted from the sample, any of the target sequence that is present is amplified using a standard procedure, then captured by polymer beads containing complementary nucleic acid sequences and labelled with magnetic nanoparticles with sequences that bind to other portions of the target DNA.

The miniature NMR coil incorporated into the device -which is about the size of a standard laboratory slide - detects any TB bacterial DNA present in the sample. Tests of the device on samples from patients known to have TB and from healthy controls identified all positive samples with no false positives in less than three hours.

Existing diagnostic procedures can take weeks to provide results and can miss up to 40 per cent of infected patients.
Results were even stronger for patients infected with both TB and HIV - probably because infection with both pathogens
leads to high levels of the TB bacteria - and specialised nucleic acid probes developed by the research team were able
to distinguish treatment-resistant bacterial strains.

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