Anti-microbial catheter to cut infection risk for dialysis patients

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Medical experts at The University of Nottingham have shown that an innovative anti-microbial catheter could vastly improve treatment and the quality of life for many community-based dialysis patients.

Results of a study published in the leading journal Biomaterials, have shown that the catheter has the potential to ward off attack from a wider variety of pathogens and protect Continuous Ambulatory Peritoneal Dialysis (CAPD) patients from infections for up to 100 days — around 20 times longer than current catheters.

CAPD offers patients with kidney failure an alternative to traditional haemodialysis, in which patients are hooked up to a dialyser to have excess waste minerals filtered from their blood. Treatment can take up to four hours and needs to be done around three times a week, having a huge impact on the patient's quality of life.

CAPD uses a catheter directly into the patient's peritoneal cavity to collect waste fluids and replace them with dialysis solution, which is left in the body for around five hours and does the work that would normally be done by the kidney. As it is a simple process that can be completed at home, patients can enjoy a relatively normal lifestyle.

However, the length of time the catheter needs to be left in the body and its direct insertion into the peritoneal cavity leaves the patient especially vulnerable to infection which often means the removal of the catheter and a return to traditional hospital-based haemodialysis.

The new catheter, which has been developed by experts in the School of Clinical Sciences at The University of Nottingham has been shown in the lab to kill on contact a wide range of the most common type of staphylococcal infections, including the hospital-acquired infection MRSA, and, for the first time, a number of gram negative pathogens including E coli. It has also proved to be continuously effective for 100 days.

Dr Roger Bayston, who led the study, said: "The reviewers for the journal described what we have done as a remarkable achievement. This study has not only demonstrated the potential of what this catheter can do but has established the need for rigorous and clinically-focussed laboratory evaluation of such new devices.

"The lab-based studies have already shown such robust results that the likelihood of the catheter demonstrating satisfactory clinical performance is extremely high."

The data will also be useful for companies investigating the potential investment opportunities for the knowledge transfer of the technology.

The technology behind the catheter is a patented process whereby anti-microbial agents are inserted into the device post-manufacture so they become a molecular part of the catheter. The silicone material of the catheter is a polymer, a network formed from molecules that have tiny spaces in between them. The device is soaked in a bath of chemicals, such as chloroform, and the anti-microbial agents which causes the silicone to swell to twice its normal size, making these gaps between molecules bigger. The chloroform is then removed and the device shrinks back to its normal size encasing the anti-microbial agents inside but allowing them to move through the silicone and kill any pathogens coming into contact with the surface of the catheter.

It follows on from work at Nottingham by Dr Bayston to develop a catheter for neurosurgery and to treat brain conditions such as hydrocephalus. This catheter is now being used by around 110,000 patients around the world and has reduced their risk of infection by between 70 and 90 per cent.

The researchers also now hope to adapt it for use in central venous catheters which are used to deliver cancer drugs and nutrition, and urinary catheters, which are commonly used in the healthcare of the elderly and to manage urinary tract problems in people with spinal injuries and spina bifida. This will involve some adaptation to cover specific pathogens such as, in the case of foley catheters, Proteus which produces a biofilm on the catheter and converts urea in urine into ammonia, causing minerals and phosphates to form a painful crystallised crust at the neck of the catheter. This in turn can lead to bladder infections and, if left untreated, the more serious condition of pyelonephritis which destroys the kidneys by turning them into scar tissue and causes renal failure.

The work on the CAPD catheters has been supported by the company Martech, based in Philadelphia, USA, which has been assisting in the acquisition of FDA and EU approval and the Nottingham research team is now planning a clinical trial with Dr Richard Fluck and Dr Chris McIntyre of the Renal Unit at Derby City General Hospital.

They are keen to hear from other potential industrial partners who would be interested in assisting in taking their research forward and collaborating on technology transfer.

Source: University of Nottingham (news : web)