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Hong Kong develops endoscope-assisted micro-robot to eradicate biofilms in ear tubes

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Bacterial biofilms contribute to recurring infections, but eradication is difficult in the tortuous and obstructed auditory canals



Biofilm builds up in the ear tube over time and contributes to otorrhea, or drainage of fluid from the ear, and debris deposition, which in turn can cause blockages and recurring infections. For severely blocked ear tubes, surgeons have to use specialised mechanical tools to clear the occlusion or replace the ear tube during endoscopy. This manoeuvre requires delicate expert skills to avoid injuries to the ossicular chain and tympanic membrane.

Hence, a research team with members from the Department of Mechanical and Automation Engineering at Faculty of Engineering, and the Department of Otorhinolaryngology, Head and Neck Surgery at CU Medicine, Chinese University of Hong Kong (CUHK) joined hands to develop a magnetic helical micro-robot with endoscope-assisted delivery for biofilm eradication in ear tube. The treatment system consists of helical micro-robot, endoscope, magnetic actuation unit with robotic arm, and catheter. Surgeons first use an endoscope to deliver the helical micro-robot with a catheter into the ear tube. Then they can remotely actuate the micro-robot by the programmed magnetic field in the ear tube to perform biofilm eradication.

Professor Joseph Sung, Dean of Lee Kong Chian School of Medicine and CUHK's Emeritus Professor, said, "Although biofilm has been known for quite sometime, the clearance of biofilm has been an unsolved problem for decades. So far, no medication has proven to be useful in clearing the microbes once they are established on the surface as a layer. This study represents a major breakthrough using both mechanical and chemical methods in the same modalities. Its application is not limited to ear tubes for otitis media: potentially it can be used in other medical devices or implants placed in the human body where biofilm infections can occur."