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Tiny Prenatal Surgery Robot to Fight Spina Bifida

A tiny robot with a £10m price tag could assist doctors in performing surgery on unborn children with congenital conditions such as spina bifida. Researchers at University College London (UCL) and Belgium's KU Leuven are working to devise a tiny robotic instrument, which could generate 3D imagery of a foetus in the womb. An automated hand on the device would have the ability to deliver stem cells to damaged organs or to engage in delicate surgical procedures.

Earlier Intervention for Spina Bifida

A priority for the research is the transformation of treatment for children who develop spina bifida while in the womb. The condition causes severe neurological problems due to the leakage of amniotic fluid into gaps in a malformed spinal cord. The baby's brain development is then inhibited, when germs in the fluid reach the organ. The most serious form of the disease, myelomeningocele spina bifida, affects about one in 1,000 children.

The objective of the project is to allow doctors to patch any gaps in the spinal cord once they appear. Timing is crucial, since early intervention will be the most effective in preventing the progression of any spinal malformations and consequent brain damage. Presently, surgery is not possible on unborn babies younger than 26 weeks old, when damage might already be extensive. The procedure is also very risky for the mother, since it involves opening her abdomen and uterus, which could trigger premature birth.

Design Based on Optic and Robotic Advances

Project engineers imagine a thin, flexible probe with a head for a tiny 3D camera and at least two arms for carrying a plaster-like patch to repair gaps in the spine of a developing child with spina bifida. The photo-acoustic images generated by the camera would guide surgeons to the site of the spinal gap. Not only would it offer the unborn child a better chance for healthy development, but the mother's health would be less jeopardised by the minimally invasive procedure. The device could also be fitted with instruments for the delivery of stem cells to damaged organs in other foetal conditions.

According to the project's leader, Professor Sebastien Ourselin of UCL's Centre for Medical Imaging Computing, "The aim is to create less invasive surgical technologies to treat a wide range of diseases in the womb, with considerably less risk to both mother and baby." The creation of instruments, which capitalise on the latest developments in optics and robotics will offer doctors the best possible tools for performing delicate prenatal surgeries. Funding for the project comes from the Wellcome Trust and the Engineering and Physical Science Research Council.

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