Risk reduction in epidural procedures

January 29 2014

L-R: Neil Vaughan, Professor Michael Wee and Dr Venky Dubey.

Thousands of epidurals are performed by doctors every year. The procedure is commonly used for pain-relief during childbirth, the treatment of chronic back pain or as a means to provide anaesthesia during operations.

Inserting an epidural needle into the spine requires great skill and extensive training, and can be challenging even for experienced anaesthetists. Obesity poses further difficulties, due to technical

problems locating the epidural space.

Currently around one in every 100 epidural procedures lead to a post-dural puncture headache, one in 6,700 cause a neurological injury and approximately one in every 80,000 will result in permanent harm.

Professor Michael Wee from Poole Hospital explains: "One of the most common problems after an epidural for labour is what is called a dural tap, where the epidural needle punctures the covering of the spinal cord and causes leakage of spinal fluid. This may cause a debilitating headache for the mother and prevent her from caring for and enjoying her newborn. There is a need to provide precise training in a delicate clinical procedure which has potentially devastating effects when things go wrong."

Medical devices being developed by Bournemouth University and Poole Hospital will help doctors to carry out the procedure – and reduce the risk for patients.

"I decided to team up with BU's School of Design, Engineering & Computing as it has the necessary expertise and skills in developing the epidural simulator," says Professor Wee. The project is being led by BU's Dr Venky Dubey, alongside PhD student Neil Vaughan, Professor Wee and Dr Richard Isaacs, also from Poole Hospital.

Dr Dubey believes they can dramatically reduce the risks associated with the procedure by providing training on a state of the art epidural simulator, thereby reducing the learning curve.

He says: "You don't know with each patient how far the epidural needle has to go. It varies from person to person and it is very difficult to tell.

"It is all based on training and experience – when doctors are inserting

the needle into the spine, they know they have reached the epidural space as there is a loss of resistance. But even for an experienced anaesthetist it is quite difficult, because different people have different body shapes and sizes. Our proposed epidural simulator will allow us to simulate all types of body conditions to allow doctors to practise the technique."

The team has developed software which uses information such as a patient's height, weight and body shape and integrates it with ultrasound and MRI scans to predict where their epidural space will be.

Dr Dubey adds: "The ultimate aim is to have a novel epidural simulator which accurately replicates individual characteristics and gives doctors experience of the procedure without them having to practise on a patient."

The devices have been tested on porcine cadavers and clinical trials on patients have looked at the relationship between Body Mass Index (BMI) and the epidural ligaments pressure.

The trials found that as patient BMI increases, the epidural ligamental pressure decreases; the patients with the lowest BMI had the highest mean pressure. This is a new and important finding.

The project has already received international attention, and recently won the Institution of Engineering and Technology (IET) Innovation Award in the Information Technology category. It has also been shortlisted for a number of prestigious awards – including in the Technology and IT to Improve Patient Safety category at the National Patient Safety Awards 2013, the American iShow, and the International Student Design Showcase 2013 – which it won.

It was also the only UK-based project at the American Society of

Mechanical Engineers (ASME) Innovation Showcase, competing against Ivy League universities.

"Nobody has done anything like this before – there's quite a buzz about it," says Dr Dubey. The team eventually hopes to commercialise the simulator and industry partners are interested in the work.

Provided by Bournemouth University