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Magnetic guided neuronavigation: tracking of the tip of the catheter without rigid pin fixation of the patient`s head

Magnetisch geführte Neuronavigation: Tracking der Katheterspitze ohne Fixierung des Patientenkopfes in einer Mayfieldhalterung

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Objective

Free-hand accurate placement of ventricular catheters can be difficult in cases of small ventricels, abnormal ventricular anatomy or occipital placement. Misplacement of the catheter and multiple insertion efforts can lead to intracerebral bleedings, obstruction of the catheter, longer operation time and higher infection rates. Misplacement of the catheter due to deviation at rigid ventricular ependyma cannot be controlled by conventional neuronavigation systems during insertion. Aim of this study was to evaluate the accuracy of a magnetic tracking system compared to conventional optical guided neuronavigation systems in patients with hydrocephalus or skull base tumors.

Methods

The sensor (4 mm magnetic coil, diameter 0.95 mm) of the flexible stylet, placed at the tip of the instrument, was tracked by a 3D magnetic system (AURORA Tracking System, Northern Digital Inc controller®), based on a Kolibri® (Brainlab AG, Munich) Image Guidance System. The accuracy of the magnetic tracking system was compared to optical tracking by geometrical means, cadaver studies and in 30 patients with hydrocephalus or tumors of the skull base. Possible intraoperative magnetic fields and metallic instruments were tested for their influence on the navigation system.

Results

In cadaver tests, the accuracy of the system was similar to optical tracking systems (which only track the proximal end of the probe). But tracking the sensor at the tip of the instrument also enabled the system to control correct placement of the catheter even when the stylet bend during insertion. The influence of magnetic fields and metallic instruments in the operating theatre was low and could be easily avoided. In 30 patients with tumors of the skull base or hydrocephalus the accuracy of the neuronavigation was estimated below 5mm. Even patients, whose head wasn`t fixed in a rigid mayfield pin fixation, accuracy of the system was maintained.

Conclusion

In order to control exact catheter placement with regard to optimal position and trajectory, magnetic tracking of the tip of the insertion stylet is a reliable method. The magnetic guided Neuronavigation is a valuable addition to the armamentarium of navigational systems existing so far.