Retrograde cannulation of the jugular vein: erroneous positioning of the catheter in the subarachnoid space

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Summary
This report describes one complication related to retrograde positioning of a catheter in the jugular vein in a patient in a coma resulting from subarachnoid haemorrhage. The catheter was found in the cervical subarachnoid space, as confirmed by radiography with contrast medium. Attention is focused on the fact that this technique, usually performed easily and safely, may occasionally present potentially severe complications. (Br. J. Anaesth. 1995; 74: 345–346)

Key words
Veins, jugular, cannulation. Complications, subarachnoid cannulation.

Retrograde catheterization of the internal jugular venous bulb is a useful technique which is becoming more widespread as it enables monitoring of cerebral blood flow (CBF) and cerebral metabolism (CMRO\textsubscript{2}). Cerebral oxygen extraction (\text{CEO}_2) may also be obtained from the difference in oxyhaemoglobin saturation between arterial blood (\text{SaO}_2) and venous blood in the jugular venous bulb (\text{SjO}_2) [1]. In the technique used, a percutaneous puncture is made in the internal jugular vein immediately adjacent to the carotid artery and medial to the sternocleidomastoid muscle at the level of the lower edge of the thyroid cartilage, and a catheter is inserted, the tip of which is passed to the level of the jugular bulb. This type of catheterization, widely used by many authors [1–3], is not considered to present severe risks. The present report describes one complication which occurred during positioning of a catheter in a patient with subarachnoid haemorrhage.

Case report
A 49-yr-old male patient, 1.70 m in height, with the appearance of marked senilism, was admitted to the neuro intensive care unit with suspected subarachnoid haemorrhage (onset of sudden violent headache with loss of consciousness and rigor nucal is). Eleven years previously in another neurosurgical unit the patient had undergone surgery for an aneurysm of the left middle cerebral artery, after which he enjoyed good health. Neurological symptoms on admission included coma, isocoric pupils and photomotor reflex present, left response in extension (fifth stage of the Hunt and Hess scale [4]). His cardiovascular state was stable but spontaneous ventilation was inadequate and therefore the trachea was intubated via the nasal route and the lungs were ventilated artificially. Computerized tomography (CT) scan on admission revealed the presence of subarachnoid blood spreading into the cisterns of the base and also into the sylvian fissure associated with left temporal intracerebral haematoma and left acute subdural parieto–occipital haematoma. Cerebral angiography revealed a giant aneurysm of the left middle cerebral artery with dislocation of the clip positioned in the previous operation.

It was decided to submit the patient to emergency surgery and clip the aneurysm; the patient was prepared to surgery as follows: propofol sedation 2 mg kg\textsuperscript{-1} bolus followed by an infusion of 2 mg kg\textsuperscript{-1} h\textsuperscript{-1}, neuromuscular block with pancuronium 0.08 mg kg\textsuperscript{-1}, invasive monitoring of systemic arterial pressure and central venous pressure, urinary catheterization and continuous i.v. infusion of nimodipine 1 mg h\textsuperscript{-1} for the first 2 h and then 2 mg h\textsuperscript{-1} thereafter.

Emergency transcranial Doppler monitoring was carried out on both middle cerebral arteries using a TC264C (EME) apparatus: this revealed an oscillating flow characterized by a narrow systolic peak with normal blood flow direction, followed during the diastolic phase by inversion in the direction of the blood flow. This tracing, indicating severe intracranial hypertension, is considered typical of brain death following head trauma, but in patients with subarachnoid haemorrhage may not necessarily indicate a poor prognosis [5].

A catheter was then positioned in the right internal jugular vein by the retrograde route in order to monitor \text{SjO}_2 and the arteriojugular difference in blood lactate concentration. The manoeuvre, carried out according to the technique described by Cruz and colleagues [1], did not present any apparent difficulty: a 19-gauge needle, 70 mm in length, and a 17-gauge catheter, 15 cm in length, and Seldinger...
wire, 40 cm in length (Leader-Cath, Medival, Italy) were used. The vessel was located at the first attempt and the wire guide and the catheter were passed centrally without any apparent obstacle.

On extraction, however, the wire appeared to be slightly bent; attempts at aspiration from the catheter produced serosanguinous fluid. An anteroposterior x-ray was carried out to check the positioning of the catheter tip in the jugular vein bulb, which is situated at the level of the mastoid base [6]. This showed that the catheter, a few millimetres from the entrance point, had turned medially and reached the midline of the neck. A lateral x-ray with injection of contrast medium was performed and this demonstrated clearly spread of medium into the subarachnoid cerebral space. The catheter was removed promptly and the patient was transferred immediately to the operating theatre for surgery.

Discussion

Monitoring of $S_{10}$ has been used widely in our department since 1991 for patients with severe head trauma or subarachnoid haemorrhage, using retrograde catheterization of the internal jugular vein, based on the reports of others [1–3].

In our patient the internal jugular vein was cannulated at the first attempt by an operator with extensive experience in anterograde cannulation but less so in retrograde cannulation. Jugular vein cannulation is generally considered not to present severe risks: the complications have been summarized previously [7].

In our patient it is tempting to hypothesize that the point of the needle, which was initially within the vessel (as demonstrated by reflux of venous blood in the aspirate), then penetrated the posterior wall of the jugular vein during insertion of the metal guide; this probably then followed retrogradely the path of a cervical spinal nerve, thereby reaching the subarachnoid space.

It was not possible on aspiration to immediately recognize incorrect positioning of the catheter because the cerebrospinal fluid was heavily contaminated by massive subarachnoid haemorrhage.

The case described here, regardless of the mechanism of subarachnoid catheterization, demonstrated that even a simple and routine manoeuvre such as retrograde cannulation of the internal jugular vein may expose the patient to serious risks: withdrawal of several millilitres of spinal fluid (instead of jugular venous blood) would have led, on account of the increased intracranial pressure (confirmed by transcranial Doppler) to the danger of a sudden decrease in CSF pressure with cerebral herniation.

We suggest that in all cases (in particular subarachnoid haemorrhage) where this type of catheterization is performed, radiographic monitoring should be carried out, preferably with contrast medium using both lateral and anteroposterior views.

References