Accurate placement of the atrial catheter in ventriculoatrial shunts

Technical note


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A combined radiological and surgical technique that permits identification of appropriate recipient vessels and accurate placement of the atrial catheter in ventriculoatrial shunts is described. The procedure uses readily available radiological skills and reduces operation time and morbidity related to malpositioning of the distal catheter.

KEY WORDS • hydrocephalus • ventriculoatrial shunt • venography • atrial catheter

A L THOUGH the peritoneum is currently the preferred site for cerebrospinal fluid drainage in hydrocephalus, ventriculoatrial shunts continue to have a role in situations in which the peritoneal site is precluded by virtue of intraabdominal adhesions, local sepsis, and scarring from previous surgery. Accurate placement of the distal catheter of the ventriculoatrial shunt is both technically more difficult and fraught with greater risk of complications than is the case with the ventriculoperitoneal shunt. Several circumstances account for this difficulty. First, identification of the venous anatomy may pose a problem, particularly in patients with multiple revisions in whom tissue scarring and vessel thrombosis make the intraoperative search for an appropriate site of catheter placement both time consuming and hazardous. Second, the lack of control of the catheter tip when threading the shunt tubing along the vessel not uncommonly leads to kinking or malpositioning of the distal catheter in the jugular, subclavian, or innominate veins with enhanced propensity for thrombosis and shunt blockage.

In the technique described here, both of these difficulties are addressed. The venous anatomy is delineated preoperatively, which allows selection of an appropriate recipient vessel; a guide wire is then inserted under radiographic control to serve both as a landmark during the neck dissection and as a means of ensuring correct positioning within the right atrium.

T e c h n i q u e

In patients who have undergone previous surgery or in whom anomalies of venous drainage are suspected, venography is performed immediately prior to surgery. This procedure allows identification of a suitable recipient vein, usually the internal jugular vein. In children, a No. 5 French vascular catheter is inserted via the femoral vein, and venography provides clarification of the venous anatomy and selection of the recipient vein. A 0.035-in. guide wire is then advanced along the venous catheter via the right atrium into the superior vena cava, and its tip is positioned in the selected vein. The vascular catheter is removed, leaving the guide wire in situ, and the femoral entry site is covered with a clear adhesive film, thus temporarily securing the free end of the guide wire while the patient is transferred to the operating room.

At surgery, the proximal shunt insertion procedure is performed in the usual manner. A standard transverse neck incision at the anterior border of the sternomastoid muscle is made and the cannulated vein is dissected out; the guide wire is usually readily palpable within its lumen. The vein is secured between vascular slings while a purse-string suture of 6-0 monofilament thread is inserted and a small venotomy is made, through which the guide wire can be retrieved. When the required length of atrial catheter (from the neck incision to the midatrial point)
has been ascertained, the open-ended distal catheter is threaded over the guide wire (Fig. 1) and advanced into the right atrium. The correct position of the catheter is verified radiologically, after which the guide wire can be withdrawn from the femoral vein. To date, we have achieved a correct catheter placement in all instances in which the technique has been employed.

Discussion

The importance of precise positioning of the distal catheter in ventriculoatrial shunts was recognized from the inception of this means of cerebrospinal fluid diversion. The difficulties encountered in achieving accurate placement and the consequences of malpositioning atrial catheters have been well described, however, and prompted the development of ingenious methods to aid correct placement during the late 1960s and 1970s. These techniques relied on the changes in either electrocardiographic waveform or pressure characteristics encountered on passage of the catheter tip from the jugular vein into the right ventricle. Such methods, however, do not overcome the difficulty of negotiating the catheter tip into the correct position.

The ventriculoatrial shunt continues to have a place in modern pediatric neurosurgical practice, particularly in cases that may be complicated by the effects of previous surgery or venous thrombosis. The technique described here is advocated in such complex situations and is not proposed for routine insertion of the ventriculoatrial shunt. This procedure incorporates both preoperative evaluation of the venous anatomy for a suitable recipient vein and a means of simple and confident placement of the atrial catheter. Morbidity related to prolonged operating time and the need for re-exploration are both likely to be reduced as a consequence of using this technique.

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References
