A Lengthening Procedure for Ventriculo-Atrial Shunts

Technical Note

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In most pediatric hospitals, revisions of ventriculo-atrial shunts present a recurring and an increasing problem. Obstructions of the ventricular catheter are easily overcome, but when the continued growth of the child alters the position of the lower end of the shunt, difficulties occur. Much time can be spent in operations designed to keep the lower end of the tube close to the junction of the superior vena cava and the right atrium. These revisions are associated with a morbidity and mortality directly proportional to the amount of manipulation necessary during this and previous revisions.

A warning that the lower end of the shunt is moving to an unsatisfactory position can usually be obtained from radiographs of the chest. These are repeated at intervals that will depend upon the rate of skeletal growth. Most surgeons prefer to lengthen the shunt before growth of the child brings the lower end into a position that predisposes obstruction. It is generally conceded that revision becomes necessary when radiographs centered on the 6th thoracic vertebra show that the tip of the cardiac catheter has reached the level of the 4th thoracic vertebra.

The lengthening operations have often been time-consuming, and not infrequently a new route for the catheter must be devised. During the past year, we have investigated the degree of obstruction and adhesion to which the tube is subject within the venous channels, and have devised methods to overcome the difficulties identified. A procedure has now been perfected which achieves a great reduction in time and manipulation.

Fig. 1A. Left: Venogram showing the internal jugular vein to be patent as high as the common facial vein. Right: Venogram showing that the lower end of the internal jugular vein is patent. The cardiac catheter lies at the junction of the right and left innominate veins.
During the initial period, venography of the superior vena cava was carried out on all children needing shunt lengthening. In some infants, the venous channels were patent as high up as the point of entry of the cardiac catheter into the internal jugular vein. In others, varying degrees of occlusion had taken place which in some extended down to the superior vena cava (Fig. 1). It was also possible to demonstrate varying degrees of adhesion between the tube and the walls of the veins.

These findings suggested that the difficulties encountered were due to contraction of the walls of the veins around the tube and adhesions between the tube and the vein walls. Although the catheter could be pulled up and away from these adhesions, it did not possess enough rigidity to be pushed down to a lower level. This difficulty was overcome by introducing a stiffening device into the cardiac tube.

The method employs a radio-opaque guide wire which is introduced down the cardiac end of the shunt. The guide wire not only strengthens the tube during subsequent manipulations but allows easy recognition of the lower end in radiographs or with an image intensifier. The procedure can be carried out more easily with the Pudenz-Heyer

Fig. 1B. Left: The right innominate vein is occluded. Right: The right internal jugular vein is occluded, and a considerable collateral circulation is demonstrated.

Fig. 2. Drawing showing the pump placed as high as possible in the parietal region.