Retrieval of a Ventriculooatrial Shunt Catheter from the Heart by a Venous Catheterization Technique

Technical Note

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ALTHOUGH disruption of the ventriculooatrial shunt has been frequently recognized, migration of the disrupted catheter into the heart is a rather rare complication. Holden and Crow reported such a case in 1963, where the venous catheter became disconnected in the neck and the distal end was found in the right ventricle; the catheter was recovered from the heart by thoracotomy. Since then, Long, et al., Comforti, et al., Dooley, et al., Faivre and Guilhou, and Becker and Nulsen have reported similar cases. The migrated intracardiac catheters in all of these cases were removed from the heart by either arteriotomy or pulmonary arteriotomy after a thoracotomy.

When we encountered a similar complication in a 4-month-old infant, a special percutaneous catheterization technique was used to retrieve an intravascular broken catheter. The detached intracardiac catheter was recovered from the heart through the right internal jugular vein, and a ventriculooatrial shunt was reestablished at the same time. We are not aware of any previous report of the use of this retrieval technique.

Case Report

This 4-month-old baby girl had had a myelomeningocele repaired immediately after birth. There was an increasingly tense anterior fontanel and spinal fluid leakage, and a ventriculogram revealed generalized ventricular dilatation. A ventriculooatrial shunt, using a low-pressure Holter valve, was performed 2 weeks after birth. The spinal fluid leakage from the repaired wound in her back immediately ceased, and her postoperative course was uneventful.

Examination. At a routine follow-up examination when the child was 4 months 3 weeks old, the anterior fontanel was noted to be tense. A chest radiograph revealed that the distal portion of the cardiac catheter was disconnected in the neck and apparently had migrated down into the right atrium (Fig. 1).

Operation. The detached catheter was retrieved by a catheterization technique, and the ventriculooatrial shunt was reestablished (Fig. 2). The technique of retrieval was as follows.

A 018 in. guide wire was folded over itself in its central portion and inserted into a 5F Teflon catheter. This was sterilized with the guide wire in place. With the patient under general anesthesia, the right internal jugular vein was exposed by blunt and sharp dissection. The proximal connecting

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Fig. 1. Chest radiograph obtained on admission showing proximal (arrow) and distal (arrow) portions of the detached Holter valve catheter which lies within the right atrium and superior vena cava.
Fro. 2. Reestablishment of the ventriculoatrial shunt by a new catheter following retrieval of the detached intracardiac catheter.

end of the Holter valve catheter, with a connector at the distal end, was then exteriorized. The jugular vein was thrombotic, but by careful exploration, a central lumen could be identified. The tapered Teflon catheter was inserted into the opening and gently forced toward the heart under image amplifier guidance. This dilated the fibrotic jugular vein; the catheter tip was then observed to enter the right atrium. The guide wire was advanced a distance of about 2.0 cm, and a loop was formed by advancing one limb of the protruding guide wires (Fig. 3 left); this also produced a distal curve, which could be adjusted into various positions. The looped wire was then maneuvered around and under the distal end of the Holter catheter. By retracting the limb of the wire that had been advanced, and then retracting both limbs together, the distal end of the Holter catheter was caught between the wire loop and Teflon catheter (Fig. 3 center). The entire assembly was then retracted into the superior vena cava. This procedure folded the Holter catheter over on itself (Fig. 3 right), and the assembly could then be drawn into the internal jugular vein where further gentle retraction allowed withdrawal through the internal jugular vein and out to the surface. A new catheter was passed by image intensifier guidance into the right atrium through the same vein. This catheter was then connected to the proximal catheter by a connector, which was secured to the vein by a circumferential ligature.

Postoperative Course. The patient had an uneventful recovery and was discharged 6 days after operation.

Discussion

Disruption of the shunting device and mi-
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...gation of the distal catheter into the heart has been reported with both the Holter valve and Pudenz-Heyer device. When the Holter valve is used, separation may occur at the site of entry of the cardiac catheter into the jugular vein where the catheter is frequently divided and connected by a piece of connector within the jugular vein. As pointed out by Conforti, et al., an inadequate ligature around the connector is probably the main cause of disruption at this site.

Long, et al., emphasized the possible role of a defect in the catheter or mechanical trauma to it during the insertion and strain upon the catheter by head movement. Faivre and Guillon thought that a silicone coating of the plastic tube, negative intrathoracic pressure, and mobility and trauma susceptibility of the neck, were the three unavoidable factors influencing this complication.

In our case, a synthetic ligature material polychlorofluoroethylene resin (Tevdek), was used to connect the catheters. Synthetic ligature materials, especially nylon, are known to absorb water and thereby lengthen. Although polychlorofluoroethylene resin does not absorb water, it has a low coefficient of friction, and this might have led to loosening of the knot in our case. To avoid this complication, Becker and Nulsen suggested application of a ligature around the undivided catheter, at the point of the indwelling connector, thus securing the catheter to the vein.

The radiopaque character of the silicone rubber catheter of the Holter device makes detection of complications much easier than in the Pudenz-Heyer device, where only the catheter tip is radiopaque; an angiogram may be necessary to visualize cardiac migration in the latter. Thus, the value of radiopaque material is obvious.

There are two objects in the management of this complication: the catheter in the heart must be recovered and the shunt reestablished. The thrombo-embolic and septicemic complications caused by the presence of a catheter within the heart have been well documented. Cardiac arrhythmia, erosion and penetration of the cardiac wall, and cardiac tamponade have also been reported. Removal of the intracardiac catheter is therefore necessary. Usually this has been done by thoracic surgery.

Curry proposed a catheterization technique for recovery of a detached intravascular catheter, after his distressing experience during an aortic catheterization. In our case, this technique proved equally useful for removal of a detached intracardiac catheter. In instances where the jugular vein is completely thrombosed, some other large intact vein such as the femoral or contralateral internal jugular vein may be used for retrieval. Should this fail, a direct intrathoracic approach would be necessary.

Summary

We have reported the successful removal of a detached Holter catheter lying in an intracardiac position by a catheter guidewire loop assembly. Thoracotomy and cardotomy were avoided by this simple procedure. Reestablishment of the ventriculoatrial shunt was accomplished as part of the procedure.

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