Assessment of a Saline Injection Test for Location of a Right Atrial Catheter

PETER S. COLLEY, M.D.,* EDWARD G. PAVLIN, M.D.,* JAY GROEPPEL, M.D.†

In 1966, Michenfelder et al.1 introduced the use of a right atrial catheter for the removal of venous air emboli. Subsequently, Maroon et al.2 introduced the use of the precordial Doppler probe to facilitate the diagnosis of air emboli. It is essential that the precordial Doppler probe be properly placed over the right heart and that the catheter be located in or just above the right atrium. Recently, Tinker et al.3 suggested that one method of ensuring proper placement of the catheter tip and the precordial Doppler probe was forcefully to inject 5 ml of saline solution through the catheter. The resulting turbulence produced alteration in Doppler sounds that was regarded as signifying both that the probe was properly positioned over the right heart and that the catheter tip was located in or near the right atrium.

We have recently encountered a situation in which a right atrial catheter had accidentally and unknowingly been partially withdrawn from the right atrium and the cannular sheath would facilitate a higher success rate on the first attempt with this technique.

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REFERENCES

* Assistant Professor, Department of Anesthesiology.
† Resident, Department of Anesthesiology.

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Address reprint requests to Dr. Colley: Department of Anesthesiology RN-10, University of Washington School of Medicine, Seattle, Washington 98195.

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and chest to obtain an approximate location of the catheter tip during withdrawal. Injection of saline solution was also done in a fourth patient after a right subclavian catheter had inadvertently been directed into her right internal jugular vein.

RESULTS

In the three patients with right atrial catheters, each injection of saline solution produced marked alterations in Doppler sounds even when 30 cm of catheter had been removed. The postoperative recording of Doppler sound for one of the patients is shown in figure 1. Injections as the catheter was removed further failed to alter the Doppler sounds. In these patients, placement of the catheter on the body indicated that Doppler sounds were altered by injection of saline solution even when the catheter tip was in the axilla or proximal part of the upper arm (fig. 2). As the catheter tip was withdrawn further from the right atrium, a noticeably greater time lag between injection of saline solution and disruption of Doppler sounds became apparent. In the patient with the catheter in the right internal jugular vein, injection of saline solution also produced a marked alteration in Doppler sounds, despite the catheter tip’s being directed away from the heart.

DISCUSSION

In the report by Tinker et al.,3 the catheter was initially placed using the catheter tip as an exploring EKG electrode and using the appearance of a diphasic P wave to indicate that the tip was in the right atrium. At this institution, we routinely place the catheter the night preoperatively, and at that time check its posi-

Fig. 1. Continuous recording of Doppler sound amplitude during catheter withdrawal and injection of saline solution. Amplitude increased during catheter withdrawal and injection of saline solution, as indicated by greater upward deflection. Note that the injection increased Doppler sound amplitude at each 5-cm increment until 35 cm of catheter were withdrawn.

Fig. 2. Diagram showing estimated positions of catheter tip during its withdrawal in 5-cm increments. Signs indicate presence (+) or absence (−) of altered Doppler sounds produced by injection of saline solution.

tion roentgenographically. We have used the saline flush at the beginning of the operation the next day both to guide placement of the precordial Doppler probe and check that the catheter tip has not migrated.

We have found that the alteration of precordial Doppler sounds produced by injection of 5 ml of saline solution through a right atrial catheter does not necessarily indicate that the catheter tip is positioned so as to be effective in the diagnosis or treatment of right-heart venous air embolism. It appears that the turbulence produced by the injection travels for a considerable distance in the vascular system. The time lag between injection and a detectable change in Doppler sounds was very brief, even when the catheter was withdrawn a considerable distance, and would appear to be of limited value in detection of catheter tip malposition. Although injection of saline solution does not verify the position of the catheter, we have continued to use this test to facilitate positioning of the precordial Doppler probe. In addition, the site of insertion of right atrial catheters used for diagnosis and treatment of air emboli is carefully inspected preoperatively to ensure that the catheter has not been dislodged.

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Mishap with an Epidural Catheter

Tiong Oen Tio, M.D.,* Stanley D. Macmurdo, M.D.,† Ray McKenzie, M.D., F.F.A.R.C.S. (Eng.)‡

In 1949, Curbello introduced continuous epidural anesthesia.1 For a decade in our hospital we have practiced this technique by inserting a radiopaque Teflon catheter through a Tuohy needle. Although 202 broken central venous and cardiac catheters have been documented,2 we can find only two reports in the medical literature of broken epidural catheters.3,4

REPORT OF A CASE

An 18-year-old white woman, 57.1 kg, gravida 1, para 0, was scheduled for delivery with the use of continuous epidural anesthesia. The patient was in Stage I labor with the cervix 6 cm dilated when epidural anesthesia was started. By use of the Tuohy needle, the epidural space was identified at L2–3 and 2 ml 0.5 per cent bupivacaine were given as a test dose. Next, a 20-gauge radiopaque Teflon catheter, 91.4 cm long, was inserted through the Tuohy needle in the following manner. First, the stylet was withdrawn about 7.5 cm from the catheter end. The catheter was advanced through the needle until slight resistance was met. The needle was then gently angulated cephalad and the catheter pushed inwards without difficulty as the needle was removed. An additional 6 ml 0.5 per cent bupivacaine were added through the catheter. The patient had analgesia to pinprick to T8 bilaterally, and she was comfortable for an hour and 50 minutes.

For vaginal delivery we injected 18 ml 2 per cent chlorprocaaine through the epidural catheter to achieve perineal analgesia. The patient did not obtain relief of pain. Subsequently, delivery proceeded with use of nitrous oxide, oxygen, and local infiltration of the perineum. The epidural catheter was removed with ease at the end of delivery, but was incomplete. The end was tugged and the removed catheter segment measured 83.4 cm, leaving 8 cm in the patient.

DISCUSSION

Why this particular catheter broke is not clear. Although it was inserted with minimal difficulty, the

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* Clinical Instructor of Anesthesiology.
† Resident in Anesthesiology.
‡ Professor of Clinical Anesthesiology.

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Address reprint requests to Dr. Tio.