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Subdural Catheterization—Probably Not. I.

To the Editor:—I read the recent report from Stevens and Stanton-Hicks[1] with great interest. However, I feel that two points need clarification. First, I fail to comprehend how a relatively stiff epidural catheter can be persuaded to enter what is classically described as a potential space between dura mater and arachnoid mater. This is made more unlikely when one of the boundaries of this space, the arachnoid, is such a delicate membrane with numerous connections to the overlying dura.[2] Second, a Portex® epidural catheter has three helical side holes and a closed end. These holes are situated 8, 12, and 16 mm from the tip of the catheter. This would imply that a not inconsiderable length of catheter was threaded into the subdural space without suspicion.

I believe an alternative explanation is more feasible. The epidural catheter was advanced into the subarachnoid space for only a short distance, such that the proximal hole lay opposite the subdural space. It would then be possible to aspirate cerebrospinal fluid from the distal holes, as was noted by the authors. However, if the subsequent injection of local anaesthetic was made slowly, the agent would preferentially emerge from the proximal hole, *i.e.*, the one opposite the subdural space. This can be demonstrated *in vitro* by use of a simple model. A Portex® epidural catheter can be introduced through the side of a polyethylene infusion bag such that the proximal hole remains outside. A slow injection of methylene blue will be seen to emerge only from the proximal hole, whereas if the injection is made more quickly, dye can be seen to enter the infusion fluid.[3] This is due to a difference in resistance to the injection afforded by the infusion fluid relative to atmospheric pressure. Although I cannot find any reference to the pressure within the subdural space, cerebrospinal fluid pressure in the lateral position is generally quoted as being 0.7–1.8 kPa.[4] Because the pressure in the epidural space is much lower, it seems reasonable to conclude that there is also a pressure difference between the subarachnoid and subdural spaces.

Unfortunately, the authors neither mentioned the length of epidural catheter inserted, nor the speed at which the injections were made. However, the subsequent radiologic demonstration of contrast medium appearing in both subarachnoid and subdural spaces is easily accounted for by this explanation.

Finally, the authors highlight the dangers of attempting to salvage an anesthetic technique that had obviously gone wrong. Replacing the epidural catheter would have been a more logical approach in this case.

K. J. WEST, M.B., B.S., F.F.A.R.C.S.
Institute for Anaesthesiology and
Intensive Care
University Hospital
Oostersingel 59, Postbus 30.001
9700 RB Groningen
The Netherlands

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Subdural Catheterization—Probably Not. II.

To the Editor:—The very interesting case, which was nicely studied,[1] showed the complication of what appears to be a subdural, yet extra arachnoid, placement of an epidural catheter. The authors report that a Portex® catheter had been inserted; however, it was not reported whether it was a single- or multiple-orifice catheter. Of note are the two areas of accumulation of contrast material on the subsequent radiographs. If the catheter had multiple orifices, it would be possible to have injected the local anesthetic and the contrast media both subarachnoid and extraarachnoid *via* the side ports and, one could conjecture, even epidurally. Because this has been reported previously, it suggests that single-orifice catheters may have an advantage.[1]

It was noted in the discussion that rotation of the Tuohy needle may be a practice of some. If you hold a Tuohy needle steadily and rotate the needle, you will note that the sharp edge of the needle describes a very nice arc, which could cut a circular pattern through the dura. For this reason, I advocate that when an epidural needle is placed by whatever technique and the epidural space is identified, the needle should not be rotated.

I would suggest that once the dura has been violated in an attempted epidural, the procedure at that level should be abandoned and another interspace sought. Invariably, if the needle is withdrawn to what theoretically may be the epidural space, the Touhy needle will direct the catheter to the hole in the dura that has just been made. The case presented documents the problem that many of us have seen but not followed up so elegantly.

LLOYD F. REDICK, M.D.
Professor of Anesthesiology
Department of Anesthesiology
Duke University Medical Center
Durham, North Carolina 27710

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In reply:—I find the mechanism of subdural injection proposed by Drs. West and Redick to be very interesting. However, the epidural catheter used in our report,[1] like all epidural catheters used at the University of Colorado, had only one hole at the tip of the catheter. Although it is perhaps possible that the catheter tip was located in the subarachnoid space and that local anesthetic (and later contrast material) retrogradely entered the subdural space, I believe it is much more likely that the catheter tip was located in the subdural space; otherwise, this complication would be much more common in continuous spinal anesthesia, for example. Thus far there have been no such reports to my knowledge.

By whatever mechanism it occurs, subdural injection of local anesthetic is a complication of epidural anesthesia.[2,3] Once the subdural space is distended by either cerebrospinal fluid or local anesthetic, it is possible to insert a catheter into this space, as other authors have also demonstrated radiographically.[4–6] Finally, in response to Drs. West and Redick, we clearly stated in our article that subdural injection of local anesthetic is more likely after perforation of the dura.

R. A. STEVENS, M.D.
Institut fuer Anaesthesiologie
Universitaet Duesseldorf
Moorenstrasse 5
D-4000 Duesseldorf
West Germany

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Monitoring Maternal Heart Rate during Epidural Injection of a Test Dose Containing Epinephrine

To the Editor:—The potential for local anesthetic toxicity following epidural injection has prompted Moore and Batra[1] to suggest that an increase in heart rate after the injection of a test dose containing 0.015 mg epinephrine is both sensitive and specific for the identification of intravascular injection.

Recently, Abraham *et al.*[2] reported the administration of an epidural test dose containing 0.015 mg epinephrine