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Repeat Injection after a "Failed Spinal": At Times, a Potentially Unsafe Practice

To the Editor:—A significant and particularly frustrating limitation of spinal anesthesia is the occasional failure to achieve an adequate sensory block. Basic textbooks of clinical anesthesia specify that, when such failures occur, it is permissible to repeat the lumbar puncture and administer the same or a lesser amount of local anesthetic.[1,2] We believe this practice to be, at times, potentially harmful.

Failure to achieve spinal anesthesia has been attributed to a variety of causes, but most often to technical error[3,4]: Cullen asserted that 99% of failed spinal anesthetics can be ascribed to "failure to introduce all or part of the analgesic solution into the subarachnoid space."[4] We suggest, instead, that maldistribution of local anesthetic within the subarachnoid space is a more common cause for a failed spinal anesthetic.

While maldistribution tends to be readily appreciated as a potential cause of relative failures (*i.e.*, incomplete spinal blocks), it is largely unrecognized as an etiology for "complete failures." For example, in a prospective study examining the etiology of spinal failures, 12 of 1891 anesthetics were classified as "complete failures" and attributed to failure of anesthetic to reach the cerebrospinal fluid (CSF).[5] However, to explain that CSF flow was present both before and after injection of the local anesthetic solution, the authors postulate that movement of the needle during injection or inadvertent placement of part of the needle bevel between the dura and arachnoid could have occurred. We suggest that such total failures more often represent cases of extreme maldistribution. That is, hyperbaric local anesthetic has accumulated in a very restricted sacral distribution, and because few clinicians routinely test for a block by a careful examination of the sacral dermatomes, restricted distribution is misinterpreted as a "complete spinal failure." (It is interesting to note that in both this study and a previous prospective study,[6] inability to aspirate CSF following injection did not significantly increase the incidence of anesthetic failure.) Similarly, a restricted sacral distribution can explain the apparent lack of anesthesia in two continuous spinal anesthetics reported as "complete failures"[7] (in both cases a catheter could not be threaded cephalad and had been advanced in a caudad direction).

The apparent absence of anesthesia or the presence of a restricted sacral distribution following an initial intrathecal injection of local anesthetic has important implications to the further management of such cases. We recently reported four cases of cauda equina syndrome that occurred following continuous spinal anesthesia.[8] In all four, there was evidence of a restricted sacral block and, in order to achieve adequate anesthesia, additional doses of local anesthetic were administered incrementally; the total dose administered was greater than that usually administered with a single-injection technique. We contend that, because of the restricted distribution, local anesthetic was not diluted by CSF, and regional concentrations were neurotoxic. In related spinal model studies, we have been able to demonstrate that administration of three consecutive 50-mg doses of hyperbaric 5% lidocaine through a sacrally directed catheter can result in regional concentrations greater than that associated with neurotoxic damage in animal models.[9]

If a single-injection spinal has failed because of maldistribution of local anesthetic, there is the potential (albeit less than with a fixed indwelling catheter) for repeated injections to distribute in the same restricted pattern and possibly reach neurotoxic concentrations. With this suspicion in mind, we queried the closed-claims database to determine if it contained cases of cauda equina that had occurred following a repeated single-injection spinal. The case descriptions within this database are very limited; however, of 308 claims for nerve damage (in the total database of 2,046 claims), there are five claims for cauda equina syndrome*; three of these cases involved a subarachnoid block. In two, a "failed spinal" had occurred, followed by a repeat injection. Tetracaine was used in one and lidocaine in the other. Unfortunately, there is no information about the concentration and/or total doses of local anesthetic. Additionally, the documentation in the closed-claims database for the third case was inadequate to determine whether a repeat injection had been performed. Clearly, the information from these closed claims is insufficient to substantiate our concerns about the risk of neurologic injury from a repeated single-injection spinal anesthetic. Nonetheless, we suggest that the following be considered:

1. Aspiration of CSF should be attempted immediately before and following injection of local anesthetic.
2. Sacral dermatomes should always be included in an evaluation of the presence of a spinal block. (If maldistribution is present, it is likely that the greater the disparity between the expected level of anesthesia and that actually achieved, the higher the risk for neurotoxicity with a repeated injection.)
3. If CSF is aspirated following anesthetic injection, it should be assumed that the local anesthetic has been delivered into the subarachnoid space; total anesthetic dosage should be limited to the maximum dose a clinician would consider reasonable to administer in a single injection.
4. If an injection is repeated, the technique should be modified to avoid reinforcing the same restricted distribution (*e.g.*, alter the patient's position, use an anesthetic with a different baricity, or straighten the lumbosacral curvature).
5. If CSF cannot be aspirated after injection, repeat injection of a "full" dose of local anesthetic should not be considered unless careful sensory examination (conducted after sufficient time for development of sensory anesthesia) reveals no evidence of blockade.

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Another Potential Complication of a Pulmonary Artery Catheter Insertion

To the Editor:—We would like to report a case of a washer of a Tuohy-Borst valve (Baxter Healthcare Corp., Santa Ana, CA) dislodged into the sheath inserted in the right internal jugular vein. When the pulmonary artery (PA) catheter was inserted, persistent resistance to its further advance was encountered. Neither loosening the Tuohy-Borst cap nor reinsertion of the dilator was helpful. The wire was reinserted; the sheath was removed; and a new sheath was inserted without difficulty, followed by reinsertion of the PA catheter with ease. When the defective sheath was examined, the Tuohy-Borst valve was noticed to contain four pieces, as shown in figure 1. The distal rubber washer (fig. 1, arrow) had migrated to within 5 cm from the tip of the sheath, impeding insertion of the dilator. While examining the defective sheath outside the patient, further insertions of the dilator through the valve displaced this distal washer from the sheath *via* the tip. The washer is made of soft rubber, which explains how it was able to traverse the sheath. X-ray of the pieces in the figure revealed that only the third large washer is radiopaque.

When difficulty is encountered during insertion of a PA catheter is not alleviated by loosening the Tuohy-Borst cap, we recommend immediate replacement of the sheath in order to avoid embolization of a potentially dislodged component of a Tuohy-Borst valve.

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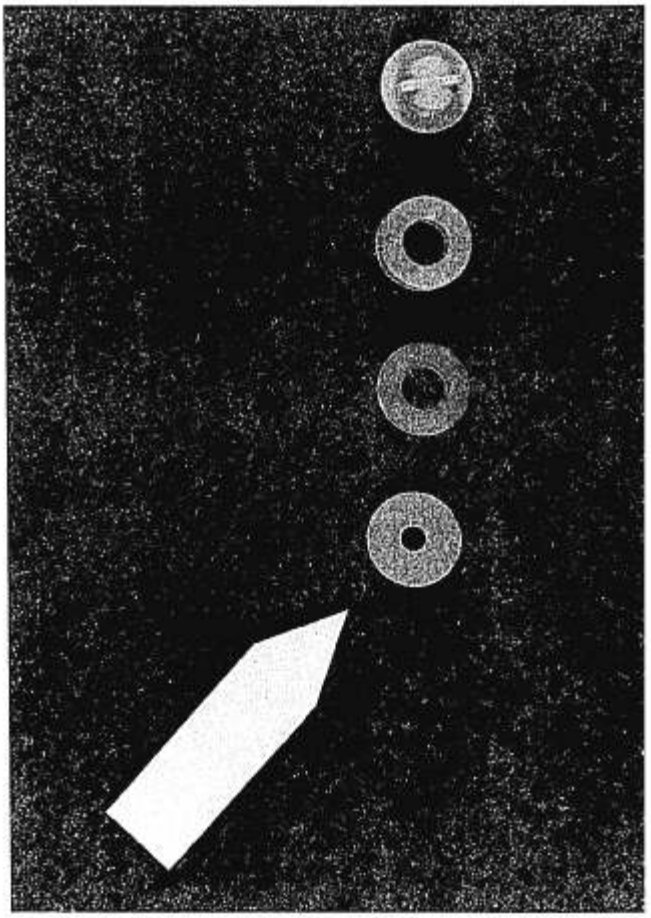

FIG. 1. The Tuohy-Borst valve assembly. The arrow indicates the distal rubber washer.

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In Reply:—The returned product was evaluated by our Quality Assurance Laboratory, and it was confirmed that the catheter seal had been pushed out of the Tuohy-Borst adaptor.

This specific problem has resulted in several corrective actions in the manufacturing process (*i.e.*, siliconization). In addition, the Tuohy-Borst duckbill valve and seals are being redesigned to prevent them from being pushed through the introducer.

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