Epinephrine-containing Test Doses—Don’t Throw the Baby Out With the Bath Water

To the Editor:—The clinical report by Cartwright et al.¹ dealing with maternal heart rate changes following a plain epidural test dose was of great interest to us, especially since it seemed to contradict our clinical impression of the usefulness of epinephrine-containing test doses.

Cartwright et al. documented wide changes in maternal heart rate following the epidural injection of 3 ml of plain 0.5% bupivacaine. The implicit assumption in their study is that such a test dose should be without hemodynamic consequences. The injection rate used (1 ml/s) requires exceptional force to achieve (even using a 3 ml syringe) when injecting a standard epidural catheter. The jet stream of local anesthetic exiting the catheter may cause nerve root irritation, resulting in discomfort and an elevated heart rate. It would be interesting to know if a similar distribution of heart rate changes would occur using a more realistic injection rate.

In our clinical use of epinephrine-containing test doses, we do not apply a rigid criterion such as that evaluated by Cartwright et al. based on the data of Moore and Batra.² Instead, we observe both maternal heart rate and blood pressure (using an ECG monitor and automated blood pressure device) during and between uterine contractions. The test dose (3 ml 0.25% bupivacaine containing 15 μg epinephrine) is given following a uterine contraction, and heart rate and blood pressure are monitored for a temporally related increase over baseline values. In the event of an equivocal response, the test dose is repeated. This practice usually resolves any ambiguity, and the catheter can then be used or replaced as appropriate.

Leighton et al. * recently reported the heart rate effects of 15 μg epinephrine injected intravenously in laboring women and compared a criterion derived from the observations of Moore and Batra to a retrospectively devised scheme which compares the maximum heart rate

changes in the 2 min following injection with the maximum heart rate observed in the 2-min period prior to injection. This latter method, which is quite similar to our clinical practice, was shown to be an effective method for evaluating an epinephrine test dose in laboring patients.

The study by Cartwright et al. may be technically flawed. It does not consider blood pressure changes in evaluating a test dose, and fails to consider the possibility of repeating the test dose to resolve an ambiguous response. Their conclusions are misleading, and discourage the use of a clinically valuable test for determining inadvertent intravascular catheterization. In the past 6 yr on our obstetrical service (approximately 7,000 epidurals), we have not had an instance of inadvertent intravascular injection following the use of an epinephrine-containing test dose.

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REFERENCES
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Epinephrine and the Obstetric Epidural Test Dose

To the Editor:—Cartwright et al.¹ have clearly demonstrated that, in obstetric practice, the inclusion of epinephrine in the epidural test dose will not completely prevent accidental intravascular injections of local anesthetic. Their data analysis does, however, overestimate the extent of the problem.

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TABLE 1. The Effect of Alterations in Test Dose Procedure on Success Rates in 10,000 Patients

<table>
<thead>
<tr>
<th></th>
<th>Oyston &amp; Prince</th>
<th>Cartwright et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate increase (bpm)</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Test repetition if first result positive</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>90%</td>
<td>50%</td>
</tr>
<tr>
<td>Specificity</td>
<td>94%</td>
<td>88%</td>
</tr>
<tr>
<td>Unnecessary removal of epidural catheter</td>
<td>576</td>
<td>1200</td>
</tr>
<tr>
<td>Successful warning of intravascular injection</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Intravenous injection despite negative test dose</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

Although the results are not perfect, there is a substantial improvement.

An epinephrine-containing test dose is not necessary before every obstetric epidural block; in certain instances, it may even be dangerous to the fetus, but when large volumes of concentrated bupivacaine are to be injected, it is still a useful safety measure.

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In Reply.—The raison d’être for our study on epidural test doses was an attempt to evaluate the clinical application for the proposed 15 μg epinephrine test dose; particularly, its seemingly unquestioned extension from use in sedated elective surgical cases to awake laboring obstetric patients. The value of the epinephrine test dose in such surgical patients has been shown, and, I feel sure, could be logically applied also as a test dose for epidural blocks performed in anesthetized patients, a common practice in Europe.

Although, in clinical practice, the insertion of the epidural catheter or the initial epidural injection occasionally can cause some patient discomfort, it is usually transient, and so the injection rate of 1 ml/s for the test dose was accepted as in previous protocols. If one is establishing a valuable clinical test, then an attempt to apply rigid criteria is necessary for the test to become widely accepted. If blood pressure changes are added to the test criteria, then the use of an automated noninvasive blood pressure monitor by a single-handed anesthesiologist to evaluate a very rare epinephrine response lasting 1–2 min is not scientifically acceptable. Any meaningful data for such a rapid event would require the use of invasive arterial monitoring.

Our study involved the acquisition of data during the administration of a plain epidural test dose, and, as such, no comment or conclusions can be made on the repeated use of the epinephrine test dose in equivocal cases, other than a possible awareness of the underlying variability of heart rate in obstetric patients. Whether our evaluation of the statistics is taken, or that of Oyston and Prince (above), it is irrelevant because of the unacceptably high false positive rates and unnecessary removal of epidural catheters, in relation to the low incidence of the complication in question. I would tentatively suggest that statistics derived from data on ten unpremedicated volunteers may need further confirmation.

That there has not been an instance of accidental intravenous injection in 7,000 epidural blocks, as mentioned above, is within the quoted incidence range for this com-