TAKE-HOME MESSAGE
In adults, ultrasonographic guidance for lumbar puncture reduces the risk of failure and traumatic procedures.

SYSTEMATIC REVIEW SNAPSHOT

METHODS

DATA SOURCE
The authors followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. They searched for clinical trials, observational studies, or diagnostic studies, using OVID, EMBASE, and the Cochrane Central Register of Controlled Trials. Additionally, the bibliographies of these studies were searched.

STUDY SELECTION
Randomized or quasi-randomized trials that enrolled subjects having lumbar puncture or epidural catheterization in the lumbar area were included if they (1) randomly assigned subjects to ultrasonographic guidance versus a nonimaging technique for needle placement; and (2) reported at least 1 of the prespecified primary or secondary outcomes.

DATA EXTRACTION AND SYNTHESIS
The authors extracted the event rate of failed lumbar puncture or epidural catheterization, traumatic procedures, needle insertion attempts, and needle redirections. Two authors assessed the risk of bias, using the CLEAR-NPT (checklist to evaluate a report of a non-pharmacological trial) tool. They calculated the absolute risk reduction in event rates between the ultrasonographic arm and the nonimaging arm. The findings were summarized with a random effects model.

RESULTS

Failed procedures with ultrasonographic guidance versus standard anatomic landmarks.

<table>
<thead>
<tr>
<th>Type of Study</th>
<th>Number of Studies</th>
<th>RR (95% CI)</th>
<th>NNT (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All included studies (LP and epidural)</td>
<td>12</td>
<td>0.21 (0.10–0.43)</td>
<td>16 (12–25)</td>
</tr>
<tr>
<td>Emergency physicians (LP only)</td>
<td>4</td>
<td>0.15 (0.05–0.50)</td>
<td>6*</td>
</tr>
</tbody>
</table>

RR, Relative risk; CI, confidence interval; NNT, number needed to treat; LP, lumbar puncture.

*95% CI not provided.

The study team identified 2,494 relevant articles, of which 14 met the inclusion criteria. Of these studies, 5 reported data on lumbar punctures (4 in the emergency department [ED]), and 9 reported data from epidural catheterizations. Epidural catheterization studies were conducted in variable settings and for various clinical indications (obstetric, surgical, and anesthesia). The primary outcome of procedure failure (lumbar puncture and epidural catheterization) was recorded in 12 studies (1,234 patients). Overall, there was evidence of a reduction in failed procedures, and a subgroup analysis demonstrated a reduction in failed lumbar puncture (Table).

Secondary outcomes, including traumatic procedures (relative risk=0.27), insertion attempts, and needle redirections, were also decreased.

COMMENTARY

Lumbar puncture represents a commonly performed ED procedure for the evaluation of intracranial pathology, particularly subarachnoid hemorrhage and meningitis. Failed lumbar puncture may result in a loss of data, inability to diagnose, or a delay in definitive treatment. Additionally, data may be compromised by a traumatic procedure in up to 15% of patients.¹

Proper lumbar puncture needle placement depends on clearly identifying the bony landmarks through palpation. Although epidural catheteriza-
tion requires needle placement in the epidural space as opposed to the subarachnoid space, the same approach to landmark identification is used for both procedures. However, physician palpation for anatomic landmarks may be inadequate because of patient factors such as anatomic variation, edema, or obesity. Shah et al\(^2\) reported difficulty with lumbar puncture in 32% of ED patients. Ultrasonography reliably identifies pertinent structures in the majority of patients, including those identified as having “difficult-to-palpate landmarks.”\(^3\)

Emergency physicians have already adopted ultrasonography to facilitate various procedures, including abscess drainage, nerve blocks, and peripheral intravenous line placement.\(^4\) Ultrasonography has previously been shown to reduce the failure rate of both peripheral intravenous access\(^5\) and central line placement.\(^6\) The results of this systematic review may not be applicable to children because none of the “lumbar puncture only” studies included pediatric patients (there was 1 study of pediatric epidural catheterizations).

Editor’s Note: This is a clinical synopsis, a regular feature of the *Annals* Systematic Review Snapshot (SRS) series. The source for this systematic review snapshot is: Shaikh F, Brzezinski J, Alexander S, et al. Ultrasound imaging for lumbar punctures and epidural catheterizations: systematic review and meta-analysis. *BMJ*. 2013;346:f1720.


*Michael Brown, MD, MSc, Alan Jones, MD, and David Newman, MD, serve as editors of the SRS series.*