Does Needle Gauge or Tip Design Prevent Postdural Puncture Headache?

TAKE-HOME MESSAGE

Atraumatic needle-tip design reduces the incidence of postdural puncture headache compared with traumatic needle-tip design.

METHODS

DATA SOURCES

The review authors searched the Cochrane Central Registrar of Controlled Trials, MEDLINE, EMBASE, the Cumulative Index of Nursing and Allied Health, Literatura Latino Americana em Ciencias da Saude, and the World Health Organization International Clinical Trials Registry Platform through September 2016. The authors also hand searched the reference lists from retrieved studies, information from clinical trial registration Web sites, and conference proceedings.

STUDY SELECTION

The authors included randomized controlled trials of patients undergoing dural puncture, comparing the following interventions: needle-tip design used for lumbar puncture (traumatic versus atraumatic bevel design), needle gauge (16 to 32 gauge) versus another gauge of needle using the same type of tip (traumatic or atraumatic) design, or any combination of these 2 inclusion criteria. Two authors independently reviewed and selected studies for eligibility, using Early Review Organizing Software. They reviewed the titles and abstracts of all identified studies to determine potential

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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: **Arevalo-Rodriguez I, Munoz L, Godoy-Casasbuenas N, et al. Needle gauge and tip designs for preventing post-dural puncture headache (PDPH). *Cochrane Database Syst Rev.* 2017;4:CD010807.**

Results

Summary results of the risk of postdural headache based on needle-tip design.

Comparison	Studies	N	RR (95% CI)	I^2, %
Traumatic needle-tip design	36	9,378	2.14 (1.72–2.67)	9

The meta-analysis identified 66 studies including 17,067 patients, of which 36 studies (n=9,378 patients) were included in the primary analysis. The indication for the lumbar puncture among these 36 studies was anesthesia (30 studies), myelography (3 studies), and diagnostic lumbar puncture (3 studies). Traumatic needle tips resulted in a higher risk of postdural puncture headache compared with atraumatic needle tips (RR 2.14; 95% CI 1.72 to 2.67). The quality of evidence was moderate, noting concerns about allocation concealment and random sequence generation. In a subgroup analysis of studies determined to be at low risk of bias (3 studies; 802 patients), the results were similar (RR 2.78; 95% CI 1.26 to 6.15; I^2=51%). When comparing larger-gauge with smaller-gauge needle-tip design, the authors were unable to pool data for either traumatic needles (10 studies; 2,288 patients) or atraumatic needles (13 studies; 3,134 patients) because of

inclusion. They reviewed the full text of the selected potentially eligible studies for inclusion in this meta-analysis in accordance with the inclusion criteria. A third author resolved any disagreement.

DATA EXTRACTION AND SYNTHESIS

Three review authors independently used a predesigned form to extract study data including the following parameters: study participants, randomization methods, use of blinding, study interventions, study comparisons, number of participants assigned by study arm, subsequent losses to follow-up, and study outcomes. The primary outcome was the onset of postdural puncture headache, defined in accordance with the International Headache Society recommendation[1] as a headache that worsened within 15 minutes of sitting down and improved after 15 minutes of lying down after a lumbar puncture. Secondary outcomes were the incidence of severe postdural puncture headache (according to the definition used among the studies) and any headache subsequent to lumbar puncture defined as a postdural puncture headache according to the definition of each included study. Two authors independently assessed the risk of bias of the included studies, using the *Cochrane Handbook for Systematic Reviews of Interventions*.[2] The authors used Grading of Recommendations Assessment, Development and Evaluation system methodology[3] and the I^2 statistic[2] to assess the overall quality of evidence and heterogeneity among the included studies, respectively. The authors presented the results with composite risk ratios (RRs) accompanied by their respective 95% confidence intervals (CIs), using a random-effects model.

significant heterogeneity between studies. Incidence of any headache was also higher with traumatic needle tips (RR 1.35; 95% CI 1.17 to 1.57). There were no differences in other secondary outcomes addressing adverse events.

Commentary

Headache after diagnostic lumbar puncture is a common complication of a procedure that is performed frequently in emergency departments (EDs). The frequency of postdural puncture headache has been reported to be as high as 36% after diagnostic lumbar puncture.[4] It has been hypothesized that the pathophysiology for postdural puncture headache may be due to cerebrospinal fluid leak after trauma to the dura that is caused by the lumbar puncture needle.[5-7] The majority of patients who experience postdural puncture headache are managed conservatively with analgesia and rarely have long-term consequences. However, patients may require longer hospital stays and take longer to return to normal functional level.[8] Interventions such as bed rest,[9,10] intravenous fluids,[10] caffeine,[11] and needle-tip bevel positioning[12] have been proposed as preventive measures for reducing the risk of postdural puncture headache, but none of these interventions has been demonstrated to be efficacious or has definitive evidence to support its use. Therefore, there is a need to identify interventions that reduce the risk of postdural puncture headache.

This meta-analysis examines the type of needle affecting the incidence of postdural puncture headache.[13] Traumatic needles such as the Quincke (Becton Dickinson, Rutherford, NJ) are those that have a beveled tip that cut the dura and were included among the studies of this meta-analysis. Atraumatic needles, including Whitacre (Becton Dickinson), Atraucan (Braun Medical, Melsungen Germany), Sprotte (Rüsh, Rommelshausen, Germany), and Polymedic (Te Ma Na Sar, Bondy, France), have a pencil-point tip that in theory creates a separation of tissue fibers, rather than cutting, which may allow easier healing after removal. The meta-analysis showed that patients who had a lumbar puncture with a traumatic needle had just over double the risk of experiencing postdural puncture headache compared with those who had a lumbar puncture with an atraumatic needle; however, atraumatic needles are used less frequently.[14-16]

This meta-analysis had limitations. Few included studies involved diagnostic lumbar puncture. Most examined dural puncture in anesthesia and, to a lesser extent, myelography. This analysis also intended to compare the frequency of postdural puncture headache among large- and small-gauge needles. However, the definition of large or small needles varied between studies, making analysis difficult with significant heterogeneity. Furthermore, among the trials studying traumatic versus atraumatic needle types with a low risk of bias, there was a moderate degree of heterogeneity detected for preventing the outcome of postdural puncture headache. Additionally, this meta-analysis attempted to compare different atraumatic needle gauges for postdural puncture headache, yet the

nonstandardized comparison among the needle gauges used in the analysis similarly precluded pooling of the data. Finally, this meta-analysis did not identify or include any study that predominantly included ED patients undergoing lumbar punctures.

This meta-analysis gives moderate-quality evidence that clinicians should use needles with an atraumatic needle-tip design to prevent postdural puncture headache, yet the use of atraumatic needles for lumbar puncture is infrequent.[14-16] Further studies are warranted to identify barriers to atraumatic needle use for emergency lumbar punctures in the ED and establish the ideal gauge.

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