DEM Journal Club

Article Appraisal

Article: Atraumatic vs traumatic lumbar puncture needles: a systematic review and meta-analysis.

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Background and Study Objective(s):

Post dural puncture headaches (PDPH) occur in up to 35% patients who undergo dural punctures. The mechanism of this headache is thought be a result of CSF leak through the dura. There is a real cost to both patients and the healthcare system in managing this common complication. Examples include IV fluids, analgesia, increased hospital stay, repeat visits to the ED, blood patches, etc. The use of atraumatic needles have been shown to reduce complications after lumbar puncture. However, surveys have demonstrated that clinical use of atraumatic needles to perform a lumbar puncture remains low. The authors of this article performed a systematic review and meta-analysis to compare patient outcomes after lumbar puncture with atraumatic needles vs conventional needles.

Study Design:

This article is a systematic review and meta-analysis. They independently searched 13 different databases with no language or publication restrictions. The database search was supplemented by manually screening references of relevant articles, proceedings of pertinent meetings, and contacting clinical experts in the field. Article selection was done by three independent reviewers and if there was disagreement it was resolved by consensus and if not possible a fourth reviewer was consulted.

Inclusion criteria:

- Study design: randomized controlled trials with no publication type or language restrictions
- Population: patients of any age group and demographic undergoing lumbar puncture as a part of their clinical care
- Intervention: lumbar puncture with atraumatic needle
- Control: lumbar puncture with traumatic needle
- Outcomes: clinical outcomes such as incidence of post-dural puncture headache (PDPH; primary outcome), any headache, backache, hearing disturbance, nerve root irritation, traumatic tap, severity of PDPH, duration of PDPH, number of patients requiring intravenous fluids/controlled analgesics or blood patch, failure rate, success on the first attempt and number of attempts required to obtain CSF

Exclusion criteria:

- Observational studies, reviews, commentaries, and letters
- Randomized trials comparing atraumatic and conventional needles in which no dural puncture was done (epidural injections)

- Randomized trials without a comparative conventional needle control group

Data Analysis:

Analyses for all outcomes were done on an intention to treat basis. They pooled population-level data from included studies. For dichotomous outcomes they calculated the RR with 95% CI. For continuous outcomes, such as the number of attempts and the duration of PDPH, they calculated weighted mean difference with 95% CI. They calculated a number needed to treat to prevent harm from the primary outcome. They considered a p value of less than 0·05 statistically significant and they assessed heterogeneity using the *I2* statistic.

Results:

110 trials totaling 31 412 patients, published between 1989 and 2017 in 29 different countries, met their inclusion criteria. These are the results.

The primary outcome:

- The incidence of post-dural puncture headaches (PDPH) differed significantly between the two groups. Incidence of PDPH occurring in 4.2% of patient in the atraumatic needle group compared to 11% in the conventional needle group
- The risk of PDPH was 60% lower if an atraumatic needle was used compared to a conventional needle
- NNT of 5

The secondary outcomes:

- A significant reduction in the incidence of mild, severe PDPH, any HA, nerve root irritation, and hearing disturbances in the atraumatic group compared to the conventional group
- A significant reduction in the need for epidural blood patches, IVF and controlled analgesia in the atraumatic group compared to conventional needle group
- The mean number of attempts did NOT differ between groups
- NO significant difference between backache, success on first attempt, or failure rate

The last two bullets points may indicate there is no significant difference between needle types in regard to their ease of use.

Validity of Results:

The authors were thorough in their assessment of the articles which included looking at the quality evidence, assessing for bias, and following their previously published study protocol. Overall the internal validity of this paper is reasonable with the caveat that it is a meta-analysis. A meta-analysis of this nature (110 articles, published over a 28 year time span, from three different clinical settings, looking at a multitude of outcomes) will invariably be susceptible to cofounders that cannot be accounted for in their analysis. The overall validity of this article is reasonable with the limitation of it being a meta-analysis study.

Generalizability of Results:

One criticism of this paper is that the bulk of the data came from anesthesia papers. One could wonder if the overall results were affected by the fact that an anesthesiologist has more comfort using atraumatic spinal needles compared to other physicians (neurologist, radiologists, or emergency physicians). The authors considered this and did an a priori subgroup analysis. Figure 4 illustrates the results of this subgroup analysis. It found that regardless of age, needle gauge, indication for LP, clinical specialty of physician performing the LP, patient position, etc that there were fewer complications in the atraumatic needle group and this did not differ across all subgroups. These findings speak to the generalizability of this article and supports the extrapolation these results to the emergency department.

The Bottom Line:

The incidence of PDPH, and many other clinical complications were reduced when an atraumatic needle was used to perform a lumbar puncture. We as emergency physicians, who perform lumbar punctures frequently, should become familiar and comfortable with the use of atraumatic needles. Our residency programs should provide EM

trainees with the opportunity to learn and practice with atraumatic needles. Lastly, our emergency departments should have atraumatic needles stocked in an easily accessible location to encourage clinical adaptation of their use.

Lastly, this article outlined the benefits for the patient but did not perform a cost analysis. Perhaps future studies will address whether there is an additional benefit for the health care system to use atraumatic needles for lumbar punctures as well.