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Addendum to assessment: Prevention of post-lumbar puncture headaches

Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology

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Abstract—Review of the literature on prevention of post-lumbar puncture headaches (PLPHAs) since the publication of the original assessment in 2000 yielded one study comparing use of cutting to atraumatic needles in diagnostic lumbar punctures, providing Class I evidence in favor of the atraumatic needle. Taken in conjunction with data from most studies in the anesthesiology literature, the Therapeutics and Technology Assessment Subcommittee concluded that use of an atraumatic spinal needle in adult patient populations reduces the frequency of PLPHA (Level A recommendation). It affirmed a previous conclusion that smaller needle size is associated with reduced frequency of PLPHA (Level A recommendation).

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Background. Since publication of the original assessment on prevention of post-lumbar puncture headaches (PLPHAs) in 2000,¹ additional literature has appeared on the subject. The purpose of this update is to classify the new literature and to affirm or modify the recommendations of the original assessment, as appropriate. A particular focus of this update was to identify any new evidence to support the use of the atraumatic or pencil-point needle over use of the conventional “cutting” needle in performance of diagnostic lumbar punctures (LPs) to reduce PLPHA. This had been one of the directions for future research identified by the original article because data for diagnostic LPs were less adequate than for LPs in anesthesiology practice.

Methods. A MEDLINE search was conducted by one of the authors in June 2004, using the terms “post lumbar puncture headache” and “postdural puncture headache.” Articles linked electronically to the original assessment¹ were also considered. Abstracts of articles comparing needle types were reviewed. Full texts only of articles pertaining to

diagnostic LPs were retrieved for detailed analysis. Accompanying editorials and related letters to the editors were reviewed for relevant critique. Articles were classified for the quality of the evidence that they contained, based on the American Academy of Neurology classification system (Appendix), as modified below.

In comparing atraumatic to cutting needle design, articles had to meet the following criteria, specified in the original assessment,¹ to be considered class I evidence:

1. Prospective study design.
2. Randomization.
3. Double masking: neither patient nor evaluator of PLPHA aware of needle design used.
4. Equal needle diameter.
5. When using cutting needle, needle bevel parallel to dural fibers stated explicitly.
6. Stylet replaced before needle withdrawn documented explicitly.
7. Active ascertainment of occurrence of PLPHA by the investigators.

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For the purposes of this update, any article failing in one of these areas was automatically classified as Class IV. The classification of the articles and the underlying justification are summarized in the annotated reference list and expanded selectively in the results section.

Analysis of evidence. Five articles were identified initially, reporting on diagnostic LPs.²⁻⁶ Three^{2,3,6} of these were classified as Class IV evidence. One article⁵ was a prospective study/case series that did not compare atraumatic to cutting needle types but affirmed the importance of known demographic factors and needle size (Class II). (See annotated references.)

One Class I article⁴ reported 12.2% frequency of PLPHA in 115 patients who had a diagnostic LP using an "atraumatic" 22G Sprotte needle compared to 24.4% of 115 patients in whom a 22G "cutting" Quincke needle was used ($p < 0.05$). The mean value of the intensity of the complaint was not significantly different between the two groups. The authors note that the frequencies of PLPHA in both their groups are higher than reported in other series due to the relatively young age of their study population (mean 40 years). While blinding of the neurologist performing the LP to needle type was part of the protocol, this may have been difficult to maintain; however, outcome was assessed by individuals masked to needle type, retaining the quality of the study.

One additional case series⁷ confirmed the importance of having the bevel parallel to the dural fibers, and another⁸ reported a 4% frequency of PLPHA when a thin, 25-gauge atraumatic needle and a syringe were used to withdraw CSF under negative pressure for research purposes.

Discussion. The current update relies primarily on data from one Class I study⁴ in patients undergoing diagnostic LPs. It compared two specific 22-gauge needle brands. It cannot be construed as endorsement of those brands, and the results may not be generalized to other cutting or atraumatic needle brands. The specific results may be expressed in terms of eight patients needed to treat to prevent occurrence of PLPHA in one patient. The number of patients needed to treat to prevent one instance of PLPHA will be greater in populations less likely to develop PLPHA (older, male, no headache at the time of the tap), or if smaller bore needles are compared. The reported case series⁸ suggests that use of small-bore, noncutting needles provides the lowest frequency of PLPHA. When expressed in terms of number needed to treat to prevent occurrence of PLPHA in one patient, even the seemingly large reduction from 24.4% frequency of PLPHA with a 22-gauge Quincke needle to 4% frequency with a 25-gauge atraumatic needle translates into five patients needed to treat to prevent occurrence of PLPHA in one patient. These measures of the efficacy of atrau-

matic needles in preventing PLPHAs need to be considered in light of the greater technical expertise needed to use them, implying a learning curve. Initially, there may be a higher failure rate with their use. An extreme example of the learning curve is reflected in the study in which house staff beginning the neurology rotation were taught to perform spinal taps with both needle types.³ The procedure was abandoned in two of 99 patients, one failing after multiple attempts with both needle types and one failing after prolonged attempts with the cutting needle. Of the remaining patients, 49 patients were allocated to atraumatic needles and 48 allocated to standard needles. More than one attempt was required in 11 of 48 patients tapped using the standard needle and in 18 of 49 patients using the atraumatic needle (difference not significant). LP was unsuccessful after four attempts with the atraumatic needle in eight patients. All patients subsequently underwent successful LP after one attempt with the standard needle. For comparison, the LP was unsuccessful after four attempts in one of the 48 patients assigned to the standard needle type. The increased risk of failure, as reflected in need for multiple attempts with the atraumatic needle, was related to body mass index (greater if >25). In contrast, there was no comment regarding failure with either needle type when experienced neurologists compared the two needles.⁴ Special consideration may be given to using an atraumatic needle in individuals at greatest risk of PLPHA (e.g., younger, female, headache at the time of the tap), particularly in nonemergent situations. Technical difficulties due to a thick ligamentum flavum may be less likely in this population. Comparisons of opening pressures obtained with traumatic and atraumatic needles and flow rates have been reported previously (see table 3 in Carson and Serpell⁹) and are comparable or favor the atraumatic brand tested, when comparing equal-caliber needles.

Conclusions and recommendations. 1. *New conclusion:* Most studies in the anesthesiology literature, across several needle sizes, and now also one study providing Class I evidence in a patient population undergoing diagnostic LPs with a 22-gauge needle support the use of an atraumatic spinal needle to reduce the frequency of PLPHA (Type A recommendation).

2. *Reaffirmation of a previous conclusion:* Class I and Class II data in the anesthesiology and the neurology literature show that smaller needle size is associated with reduced frequency of PLPHA (Type A recommendation).

Recommendations for future research. 1. Develop and disseminate standardized training materials for practitioners who wish to become proficient in use of the atraumatic needles.

2. Track acceptance and implementation within the neurologic community.

Disclaimer. This statement is provided as an educational service of the American Academy of Neurology. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all the circumstances involved.

Appendix 1

Classification of evidence

Class I: Prospective, randomized, controlled clinical trial with masked outcome assessment in a representative population. The following are required:

- Primary outcome(s) is(are) clearly defined.
- Exclusion/inclusion criteria are clearly defined.
- Adequate accounting for dropouts and crossovers with numbers sufficiently low to have minimal potential for bias.
- Relevant baseline characteristics are presented and substantially equivalent among treatment groups or there is appropriate statistical adjustment for differences.

Class II: Prospective matched group cohort study in a representative population with masked outcome assessment that meets A through D above OR a randomized, controlled trial in a representative population that lacks one criterion A through D.

Class III: All other controlled trials including well-defined natural history controls or patients serving as own controls in a representative population in which outcome assessment is independently assessed or independently derived by objective outcome measurement (objective outcome measurement is an outcome measure that is unlikely to be affected by an observer's (patient, treating physician, investigator) expectation or bias [e.g., blood tests, administrative outcome data]).

Class IV: Evidence from uncontrolled studies, case series, case reports, or expert opinion.

Appendix 2

Classification of recommendations

- A = Established as effective, ineffective, or harmful for the given condition in the specified population. (Level A rating requires at least two consistent Class I studies.)
- B = Probably effective, ineffective, or harmful for the given condition in the specified population. (Level B rating requires at least one Class I study or at least two consistent Class II studies.)
- C = Possibly effective, ineffective, or harmful for the given condition in the specified population. (Level C rating requires at least one Class II study or two consistent Class III studies.)
- U = Data inadequate or conflicting given current knowledge; treatment is unproven.

Appendix 3

Therapeutics and Technology Assessment Subcommittee members: Douglas S. Goodin, MD (Chair); Yuen T. So, MD, PhD (Vice-Chair); Carmel Armon, MD, MHS; Richard M. Dubinsky, MD, MPH; Mark Hallett, MD; David Hammond, MD; Cynthia Harden, MD; Chung Hsu, MD, PhD (ex officio); Andres M. Kanner, MD (ex officio); David S. Lefkowitz, MD; Janis Miyasaki, MD; Michael A. Sloan, MD, MS; James C. Stevens, MD.

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- Vilming ST, Kloster R, Sandvik L. The importance of sex, age, needle size, height and body mass index in post-lumbar puncture headache. *Cephalalgia* 2001;21:738-743. (Class II: prospective study/case series: no comparison of traumatic to cutting needle types. Findings are consistent with previous reports regarding demographic and physical risk factors, and needle size.)
- Aamodt A, Vedeler C. Complications after LP related to needle type: pencil-point versus Quincke. *Acta Neurol Scand* 2001;103:396-398. (Class IV evidence: no randomization; direction of bevel type in cutting needle not specified; nonrigorous PLPHA ascertainment protocol: equal frequency of PLPHA (23 to 24%) reported in both 22-gauge groups; severity worse in pencil-point group [small numbers, statistical significance not provided; probably NS].)
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