Published in final edited form as:
J Clin Neurosci. 2014 March ; 21(3): 536–537. doi:10.1016/j.jocn.2013.07.001.

Reducing post lumbar puncture headaches with small bore atraumatic needles

Eric D. Vidoni[a], **Jill K. Morris**[a], **Kayla Raider**[b], **Jeff Burns**[a,*], and **for the Alzheimer's Disease Neuroimaging Initiative**[1]

[a]University of Kansas Alzheimer's Disease Center, 4350 Shawnee Mission Parkway, MS 6002 Fairway, KS 66205, USA

[b]University of Kansas School of Medicine, Kansas City, KS, USA

Abstract

Lumbar puncture for testing of Alzheimer's disease pathophysiology for diagnostic confirmation is likely to become more common in the coming years. Minimizing adverse effects from this testing will be essential for clinical practice. Small bore, atraumatic needles reduce the occurrence of post-lumbar puncture headache (PLPH). Our goal was to extend this recommendation specifically to a well-characterized aging population. We assessed PLPH in the Alzheimer's Disease Neuroimaging Initiative cohort and found that PLPH occurrence was reduced only when using a 24 gauge atraumatic needle. We recommend that lumbar punctures for clinical and research purposes in Alzheimer's disease be conducted with 24 gauge atraumatic needles.

Keywords

Alzheimer's; Biomarkers; Dementia

1. Introduction

Clinical assessment to confirm Alzheimer's disease (AD) pathophysiology, amyloid and tau, through lumbar puncture (LP) is likely to become more common clinically.[1] Although LP is generally well-tolerated, one side effect is post-lumbar puncture headache (PLPH).[2] Both invasive and non-invasive techniques have been used to manage PLPH when it occurs,[3-5] but many of these effective therapies, such as a blood patch or use of oral or infused pharmaceutical agents, represent additional costs and burden to the health care system and the patient. The occurrence of PLPH may be affected by needle size and type, [6] providing the opportunity to prevent a large number of PLPH from ever occurring. The American Academy of Neurology currently recommends small bore, atraumatic needles[7] over "cutting" needles to reduce PLPH incidence. However, these recommendations have not

*Corresponding author. Tel.: +1 913 588 0555; fax: +1 913 945 5035. jburns2@kumc.edu. .

[1]A complete list of ADNI investigators is available at http://adni.loni.ucla.edu/wp-content/uploads/how_to_apply/ADNI_Authorship_List.pdf).

Conflicts of Interest/Disclosures The authors declare that they have no financial or other conflicts of interest in relation to this research and its publication.

been universally adopted in clinical and research practice for AD biomarker testing. The Alzheimer's Disease Neuroimaging Initiative (ADNI), a multi-site longitudinal study of AD progression and biomarkers, affords a unique opportunity to evaluate PLPH incidence in three well-characterized cohorts of older adults undergoing research evaluations for AD pathophysiology using several LP methods. Our objective was to test whether current recommendations were supported in this well-characterized, highly specific cohort.

2. Methods

Data were obtained from the ADNI/GO/2 database on 5 October 2012. We included only the first LP visit to avoid bias against headache susceptibility. ADNI LP were performed at 71 centers in the morning, after fasting, using two needle types (atraumatic or cutting), five needle sizes (18 gauge [g], 20 g, 22 g, 24 g, and 25 g), and two cerebrospinal fluid (CSF) withdrawal methods (gravity drip *versus* negative pressure). Use of 18 g and 25 g needles was infrequent, thus we combined the 18 g (n = 2) with the 20 g needle and the 25 g (n = 13) with the 24 g needle sizes. Participants were contacted 24 hours after the LP and any reported headache was classified as PLPH.[8]

Differences in PLPH frequency between needle type, diagnosis and withdrawal method were evaluated using two-sided Fisher's Exact Test (FET) followed by proportion tests against the overall PLPH frequency of the ADNI study. Age differences between those who did and did not experience PLPH were tested using Welch's t-test to correct for unequal variance. Analyses were conducted using R (v. 2.15.3; R Foundation, Vienna, Austria).

3. Results

The incidence of PLPH was 5.3% (n = 28) for the 525 baseline LP conducted. PLPH were largely mild and self-limited with three requiring a blood patch, each associated with a standard cutting needle (20 g or 22 g). PLPH frequency was not associated with diagnosis (FET $p = 0.23$) although individuals who had PLPH were younger (mean 70.3 years ± 8.4 standard deviation [SD]) than those who did not have PLPH (74.4 years ± 7.3 SD; t = 2.50 [corrected degrees of freedom = 29.3], $p = 0.02$). The overall mean age was 74.2 years ± 7.4 SD. PLPH incidence differed by needle type (FET $p = 0.002$). Specifically, PLPH incidence was lower only when 24 g atraumatic needles were used (1.3%, $p = 0.013$). There was no difference in PLPH occurrence when CSF was withdrawn by gravity drip *versus* negative pressure (6.7% *versus* 3.7%, respectively; FET $p = 0.31$) (Table 1).

4. Discussion

A low overall incidence of PLPH (5.3%) was observed for research LP in ADNI. The incidence of PLPH was 1.3% when a 24 g atraumatic needle was used, consistent with the 2% rate of PLPH reported in a large multi-site clinical trial.[9] These data support and extend prior findings that needle type and size are important determinants of PLPH and argue for further refinement of recommendations[7] for the broad use of atraumatic needles to include a specific recommendation to use a 24 g bore size. The results from this study indicate that using the 24 g atraumatic needle could eliminate one PLPH for every 15 LP performed with another needle. Broad clinical use of 24 g atraumatic needles may result in even greater opportunity to avoid PLPH because PLPH incidence in clinical settings is likely higher than those observed in ADNI[10] and only 2% of neurologists currently use atraumatic needles.[11] We thus recommend that LP for clinical and research purposes in AD be conducted with 24 g atraumatic needles.

Acknowledgments

Dr. Burns is supported by the KU Alzheimer's Disease Center, P30 AG035982, and by R01 AG034614 and R01 AG033673. Dr. Morris is supported by the University of Kansas Biomedical Research Training Program and the KU Alzheimer's Disease Center, P30 AG035982. Dr. Vidoni is supported by the Heartland Institute for Clinical & Translational Research, University of Kansas Medical Center's CTSA, KL2 TR000119, UL1 TR00001 and the KU Alzheimer's Disease Center, P30 AG035982. Ms. Raider has no disclosures. Additionally, data collection and sharing for this project was funded by the Alzheimer's Disease Neuroimaging Initiative (ADNI) (National Institutes of Health Grant U01 AG024904). ADNI is funded by the National Institute on Aging, the National Institute of Biomedical Imaging and Bioengineering, and through generous contributions from the following: Alzheimer's Association; Alzheimer's Drug Discovery Foundation; BioClinica, Inc.; Biogen Idec Inc.; Bristol-Myers Squibb Company; Eisai Inc.; Elan Pharmaceuticals, Inc.; Eli Lilly and Company; F. Hoffmann-La Roche Ltd and its affiliated company Genentech, Inc.; GE Healthcare; Innogenetics, N.V.; IXICO Ltd.; Janssen Alzheimer Immunotherapy Research & Development, LLC.; Johnson & Johnson Pharmaceutical Research & Development LLC.; Medpace, Inc.; Merck & Co., Inc.; Meso Scale Diagnostics, LLC.; NeuroRx Research; Novartis Pharmaceuticals Corporation; Pfizer Inc.; Piramal Imaging; Servier; Synarc Inc.; and Takeda Pharmaceutical Company. The Canadian Institutes of Health Research is providing funds to support ADNI clinical sites in Canada. Private sector contributions are facilitated by the Foundation for the National Institutes of Health (www.fnih.org). The grantee organization is the Northern California Institute for Research and Education, and the study is coordinated by the Alzheimer's Disease Cooperative Study at the University of California, San Diego. ADNI data are disseminated by the Laboratory for Neuro Imaging at the University of California, Los Angeles. This research was also supported by NIH grants P30 AG010129 and K01 AG030514.

References

1. McKhann GM, Knopman DS, Chertkow H, et al. The diagnosis of dementia due to Alzheimer's disease: recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. Alzheimers Dement. 2011; 7(3):263–269. [PubMed: 21514250]
2. Evans RW, Armon C, Frohman EM, Goodin DS. Assessment: prevention of post-lumbar puncture headaches: report of the therapeutics and technology assessment subcommittee of the american academy of neurology. Neurology. 2000; 55(7):909–914. [PubMed: 11061243]
3. Ergun U, Say B, Ozer G, et al. Intravenous theophylline decreases post-dural puncture headaches. J Clin NeurosciOct. 2008; 15(10):1102–1104.
4. Huseyinoglu U, Huseyinoglu N, Hamurtekin E, Aygun H, Sulu B. Effect of pregabalin on post-dural-puncture headache following spinal anesthesia and lumbar puncture. J Clin Neurosci. 2011; 18(10):1365–1368. [PubMed: 21775146]
5. Olsen KS. Epidural blood patch in the treatment of post-lumbar puncture headache. Pain. 1987; 30(3):293–301. [PubMed: 3313201]
6. Hammond ER, Wang Z, Bhulani N, McArthur JC, Levy M. Needle type and the risk of post-lumbar puncture headache in the outpatient neurology clinic. J Neurologic Sci. 2011; 306(1-2):24–28.
7. Armon C, Evans RW. Therapeutics, Technology Assessment Subcommittee of the American Academy of N. Addendum to assessment: Prevention of post-lumbar puncture headaches: report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. Neurology. 2005; 65(4):510–512. [PubMed: 16116106]
8. ADNI. [Accessed July 5, 2013] ADNI Procedures. 2013. http://www.adni-info.org/Scientists/ADNIStudyProcedures.aspx
9. Peskind E, Nordberg A, Darreh-Shori T, Soininen H. Safety of lumbar puncture procedures in patients with Alzheimer's disease. Curr Alz Res. 2009; 6(3):290–292.
10. Strupp M, Schueler O, Straube A, Von Stuckrad-Barre S, Brandt T. "Atraumatic" Sprotte needle reduces the incidence of post-lumbar puncture headaches. Neurology. 2001; 57(12):2310–2312. [PubMed: 11756618]
11. Birnbach DJ, Kuroda MM, Sternman D, Thys DM. Use of atraumatic spinal needles among neurologists in the United States. Headache. 2001; 41(4):385–390. [PubMed: 11318885]

Table 1

Post-lumbar puncture headache frequency tested against different variables

		Total LP	PLPH frequency (n)
Diagnosis			
Non-demented		114	2.6% (3)
MCI		311	6.4% (21)
AD		100	4.0% (4)
Collection method			
Gravity		214	3.7% (8)
Syringe suction		300	6.7% (20)
Unknown		11	0% (0)
Needle type and size			
Cutting	20 g	61	8.2% (5)
	22 g	147	8.2% (12)
	25 g	13	7.7% (1)
Atraumatic	22 g	73	9.6% (7)
	24 g	231	1.3% (3)*

* Only the 24 gauge atraumatic needle reduced the frequency of PLPH compared to the Alzheimer's Disease Neuroimaging Initiative average frequency of 5.3% ($p = 0.002$).

AD = Alzheimer's disease, g = gauge, LP = lumbar puncture, MCI = mild cognitive impairment, PLPH = post lumbar-puncture headache.