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### *Reply:*

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# REPLY:

We thank Onder and Hanalioglu for their comments on our article, "Lumbar Puncture Test in Normal Pressure Hydrocephalus: Does the Volume of CSF Removed Affect the Response to Tap?" Our work, though retrospective, casts doubt on the use of a high-volume spinal tap of >30 mL in the assessment of patients with normal pressure hydrocephalus (NPH). The practice of using a high-volume spinal tap has theoretic but no empiric foundation and, now, some evidence to question its use. Further investigation including Onder and Hanalioglu's suggestion of repeat studies in the same patients, though difficult to perform in an often-frail elder population, could provide important additional evidence.

Onder and Hanalioglu raise a legitimate point that given that headaches may compromise the results of lumbar tap test (LTT), higher volume taps may have more associated headaches and this will explain why higher volume taps perform worse. In response to their point, we reviewed our own cases of LTT and noted that severe headaches were extremely rare, occurring in <1% of patients with NPH. It would be unlikely for headaches to be affecting the results of our study.


We agree that the needle gauge findings were not definitive in our investigation, but results were promising, trending toward

significance ( $P = .06$ ) at 24-hour walk time testing and significant ( $P = .04$ ) at 4-hour walk time testing in those subgroups that responded at these end points. We suggest that future research consider how post-lumbar puncture epidural CSF leakage may influence the clinical response beyond that induced by the volume drained during the procedure itself. We plan to continue to investigate needle gauge effects using larger bore needles to explore this relationship.

Nevertheless, ongoing prospective research to define invasive and noninvasive diagnostic end points that predict shunt response in the NPH syndrome is highly desirable.

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