



Letter to the Editor

Reply: Letter to The Editor on “Idiopathic normal-pressure hydrocephalus and obstructive sleep apnea are frequently associated: A prospective cohort study” *Journal of the Neurological Sciences* 395 (2018) 164–168


We thank Professor Kawada for his comments on our report [1] on the frequent association of idiopathic normal-pressure hydrocephalus (iNPH) and obstructive sleep apnea (OSA). He correctly indicated the similarities existing between our iNPH cohort of 31 patients (mean age 77.5 years, 68% males) and the 17 patients with iNPH (mean age 72.2 years, 70% males) reported in 1998 by Kristensen et al. [2] at Umea University Hospital, Sweden. Twenty years later, we were able to confirm their findings that sleep-disordered breathing (SDB) is very common in iNPH, ranging in prevalence from 65% of their cases to 90.3% in our cohort. Given that neither lumbar cerebrospinal fluid (CSF) drainage nor shunting improves the respiratory disturbance index we also confirmed that SDB is not a consequence of the hydrocephalus but an overlooked etiological factor. Given the importance of sleep on cognition, Kristensen et al. [2] found a high direct correlation between the severity of oxygen desaturation during sleep and the degree of cognitive dysfunction. Since then, large volumes of data have confirmed that SDB in a major risk factor for vascular disease [3] and dementia [4]. Moreover, recent research has underlined the importance of deep sleep in the pathogenesis of iNPH. Ringstad et al. [5] utilized magnetic resonance imaging (MRI) with intrathecal gadobutrol in subjects with iNPH and observed delayed clearance of the CSF tracer due to glymphatic flow resistance. It is postulated that absence of delta sleep and rapid eye movement (REM) sleep resulting from SDB probably contributes to the pathogenesis of Alzheimer's disease most likely to the decreased clearance of beta amyloid during deep sleep.

Kawada also refers to the experience of Magaldi et al. [6] on 177 patients (mean age 74.7 years, 70% women) with memory complaints evaluated at the geriatric outpatient clinic of the University of São Paulo, Brazil (2002–2007). This group found OSA in only 2 patients (1.2%) and a single case (0.6%) had NPH. In contrast, with routine use of sleep questionnaires in our memory clinic in Houston, Texas, USA, 48% of patients fulfill Medicare criteria for abnormal sleep; of those, 240 patients underwent nocturnal polysomnography (PSG) and we found moderate to severe OSA in 40% [1]. SDB affects about 20% of community people above age 65 and up to 44% of patients with Alzheimer's disease in clinic and community-based studies [1]. The main difference with the Brazilian patients [6] is the presence of excessive body weight and obesity, which occur in 59% of our population [1].

In conclusion, we believe that a major problem in recognizing the association of OSA and NPH is the fact that these two eminently treatable conditions are quite common in the elderly but both are under-recognized and exceedingly underdiagnosed. According to Williams and Malm [7], approximately 700,000 persons may have iNPH in the

United States, compared with 400,000 with multiple sclerosis. It is our hope that as the knowledge of the link between OSA and NPH spreads more widely among neurologists and geriatricians the existing voids in our knowledge will be resolved.

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Potential conflicts of interest

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Gustavo C. Román*, Aparajitha K. Verma, Yi Jonathan Zhang,
Steve H. Fung
Houston Methodist Hospital, Houston Neurological Institute, Houston, TX
77030, USA
E-mail address: gcroman@houstonmethodist.org (G.C. Román).

* Corresponding author.

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