Effectiveness of the Evans Index in Differentiating Normal Pressure Hydrocephalus and Alzheimer's Disease

Kyle Simon, MS; Zachary Miles; Ivan DeQuesada, MD; James-Michael Blackwell, MPH

RESEARCH QUESTION

In people with a diagnosis of normal pressure hydrocephalus (NPH) who had a lumbar puncture or ventriculoperitoneal shunt that yielded resolution of symptoms, is the Evans index an appropriate imaging tool for diagnosis of normal pressure hydrocephalus when trained radiologists evaluate the MRI imaging? Secondly, is the Evans index useful to differentiate NPH from Alzheimer's disease and normal, healthy controls?

BACKGROUND

Timely diagnosis of neurodegenerative diseases like Normal Pressure Hydrocephalus (NPH) and Alzheimer's disease (AD) is imperative to treatment. Differentiation of these diseases is difficult as both are characterized by insidious progression of cognitive and ambulatory impairment with ventriculomegaly on brain imaging. The Evans Index (EI) has excellent intra- and inter-observer reliability as a measure of ventriculomegaly in diagnosing NPH. We intend to reinforce the existing body of research demonstrating EI's value in distinguishing NPH from AD.

View poster online

Our results confirmed EI reliably differentiates NPH versus AD and the inter-rater reliability is sufficient for clinical use to support early intervention. A limitation of this study is that gold standards for diagnosing NPH and AD are based on subjective clinical factors.

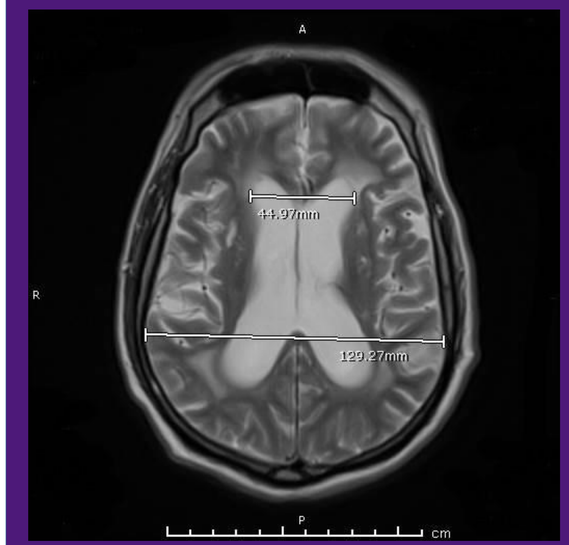

Figure 1: Measurement of EI in a patient with NPH (EI = 0.35)

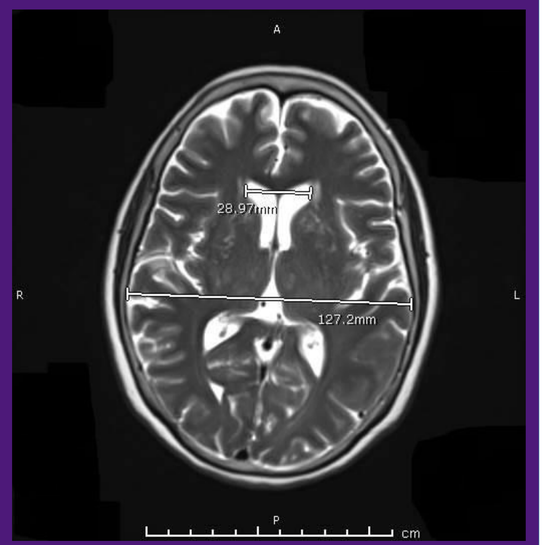

Figure 2: Measurement of EI in a patient with AD (EI = 0.23)

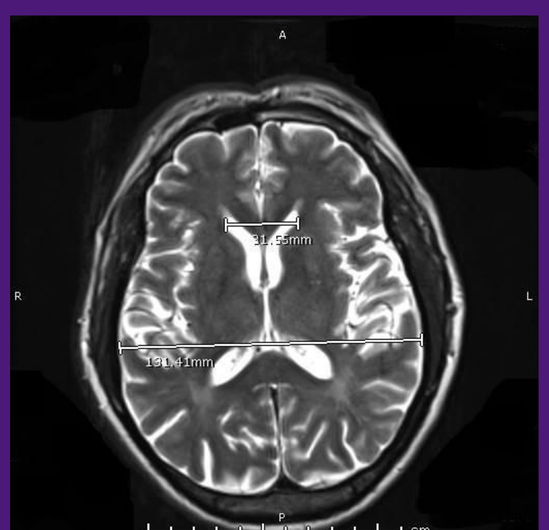

Figure 3: Measurement of EI in a normal patient (EI = 0.24)

METHODS

This was a retrospective data analysis of MR imaging at a large community hospital in Fort Worth, TX. Reports containing "Normal Pressure Hydrocephalus" or "Alzheimer's Disease" were reviewed and patients with a clinical diagnosis of NPH or AD were included. A total of 18 NPH cases, 23 Alzheimer's cases, and 23 controls with normal MRI reports were included. Cases were deidentified, randomized, and EI was measured by three blinded neuroradiologists. Friedman's Two-way Nonparametric ANOVA was used to analyze group EI values and inter-rater reliability.

RESULTS

There were significant differences in EI between the NPH group and the combined AD and Normal group (p value < 0.0001). There was no significant difference between the radiologists' measurements (p value = 0.67).

FUTURE DIRECTIONS

Our results confirmed EI reliably differentiates NPH versus AD and the inter-rater reliability is sufficient for clinical use to support early intervention. A limitation of this study is that gold standards for diagnosing NPH and AD are based on subjective clinical factors.

Future study could use general radiologists who might demonstrate less inter-rater reliability.