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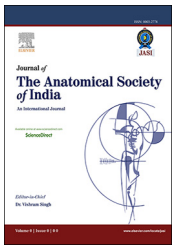

Original Article

Normative values for Evan's index on CT scan for apparently healthy individuals

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ABSTRACT

Introduction: Limited data are available from India that describe the normative volume and size of ventricular system. We add our experience with normative values of Evan's index to measure the ventricular size on CT scan in apparently healthy individuals.

Methods: A total of 326 patients were included in the study, in whom brain CT scan was performed for various indications and it was apparently normal. Evan's index ratio was obtained by measuring maximum frontal horn width to the maximum transverse diameter of the inner table in the same section. The data entry and statistical analysis were done using StatsDirect® version-3. Data were expressed as mean, standard deviation, actual numbers, and percentages.

Results: We divided the Evan's index into two categories, <0.3 and >0.3, which indicates ventriculomegaly to find out % of abnormality. The mean Evan's index in these patients was 0.25 ± 0.02. There was no trend in Evan's index with increasing age. It was appreciated that there was not much variation in calculation of Evan's index from CT scan. It was found that Evan's index could be calculated fairly accurately by multiple observers, which could be appreciated in the form of very small standard deviations.

Discussion: In summary, the normative values of Evan's index in a group of persons were similar to as described in literature. Less than 5% of patients were having ventriculomegaly but there were no clinical symptoms related to ventriculomegaly.

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1. Introduction

In adults, the measurement of the ventricular size is an important parameter to suspect or confirm a diagnosis of ventricuolomegaly, particularly clinically significant hydrocephalus.[1,2] A number of strategies have been described to describe the ventricular size and volume in literature.[1,2] Only limited studies from India describe the normative volume and size of ventricular system (that too in children).[2] We add our experience with normative values of Evan's index to measure the ventricular size on CT scan in apparently healthy individuals.

2. Material and methods

The present study was conducted from November 2014 to April 2014 at Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India. A total of 326 patients were included in the study, in whom brain CT scan was performed for various indications and it was apparently normal in all the cases for age and gender and all other investigations were found to be normal. CT was performed using GE 128-slice optima CT using tube Voltage 120–140 kVp, Collimation of 0.625 mm, tube current of 250–300 mA, slice thickness of 5 mm, and Pitch 1 mm. Evan's index ratio was obtained by measuring maximum frontal horn width to the maximum transverse diameter of the inner table in the same section (Fig. 1). Cases with motion artifacts, major head tilt, were excluded from the study for accuracy in the measurement. Patients' minor degree of head tilts/obliquity was included after doing data correction by swivel tool.

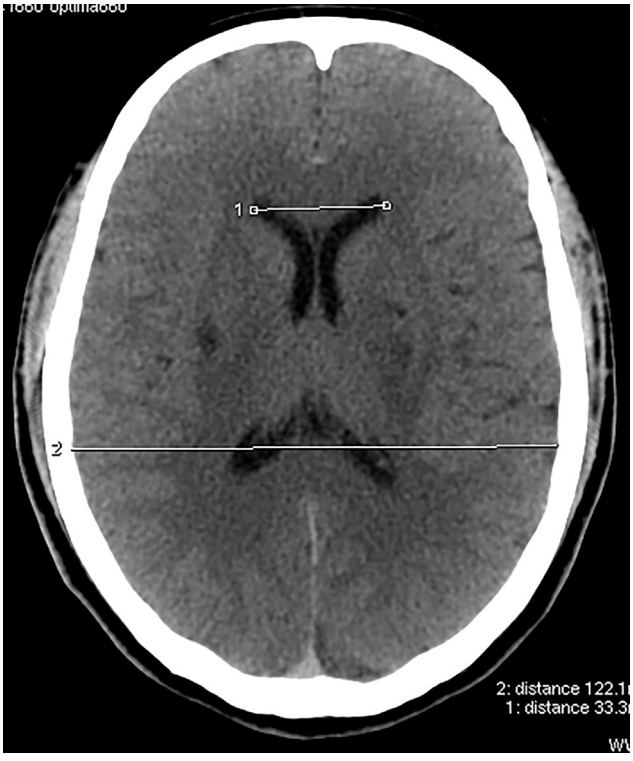

Fig. 1 – CT images showing method used to measure Evan's index by using maximum frontal horn distance maximum biparietal diameter.

3. Statistical analysis

The data entry and Statistical analysis were done using StatsDirect® version-3. Data were expressed as mean, standard deviation, actual numbers, and percentages. We divided the Evan's index into two categories, <0.3 and >0.3, which indicates ventriculomegaly to find out % of abnormality.

4. Results

There were a total of 326 healthy individuals between 1 and 99 years, with a mean of 41.34 ± 19.44. There were 220 (67.5%) males and 106 (32.5%) females. The mean Evan's index in these patients was 0.25 ± 0.02 (Fig. 2). There is no trend in Evan's index with increasing age (Fig. 2). From Fig. 2, it can be appreciated that there is no much variation in calculation of Evan's index from CT scan. Evan's index can be calculated fairly accurately by multiple observers, which can be appreciated in the form of very small standard deviations. We found that less than 5% of patients were having ventriculomegaly but there were no clinical symptoms related to ventriculomegaly.

5. Discussion

Evan's ratio was originally obtained by dividing the transverse diameter of the anterior horns of the ventricles by the maximum internal diameter of the skull on encephalographic films.[3] The wider availability of the CT scan makes it an easy to use modality to measure the size of the ventricular system,[4,5] particularly in resource limited settings and where the affordability is a major constraint. Evan's suggested that in a ''normal'' group the ratio between 0.20 and 0.25 was most common and it was shown statistically that this ratio was not influenced by the age or by the size of the skull.[6] Values between 0.25 and 0.30 were considered borderline enlargement and values above 0.30 were suggested as a pathological dilatation of the ventricles.[6] These observations have been confirmed by many authors in the past.[7–9] Our data also are in agreement with the literature that the normal value of mean Evan's Index in adults ranges from 0.22 to 0.28.[1,10] Although we had 14 persons with Evan's index >0.30, none of them had symptoms related to ventriculomegaly.

Although Evan's index is known as an objective measurement tool for the ventricular volume to diagnose ventriculomegaly, now with the advancements in imaging techniques, many other better measurement systems to describe the size of the ventricular have been discussed (to name a few, Huckman Number, Bicaudate-Frontal (ventricular) Index, Schiersmann's Index, Bicaudate Index).[10,11] Many of these tools (volumetry, which measures the intraventricular volume) may need advanced imaging modalities (i.e. MRI), are time consuming, and partially operator dependent.[12–14]

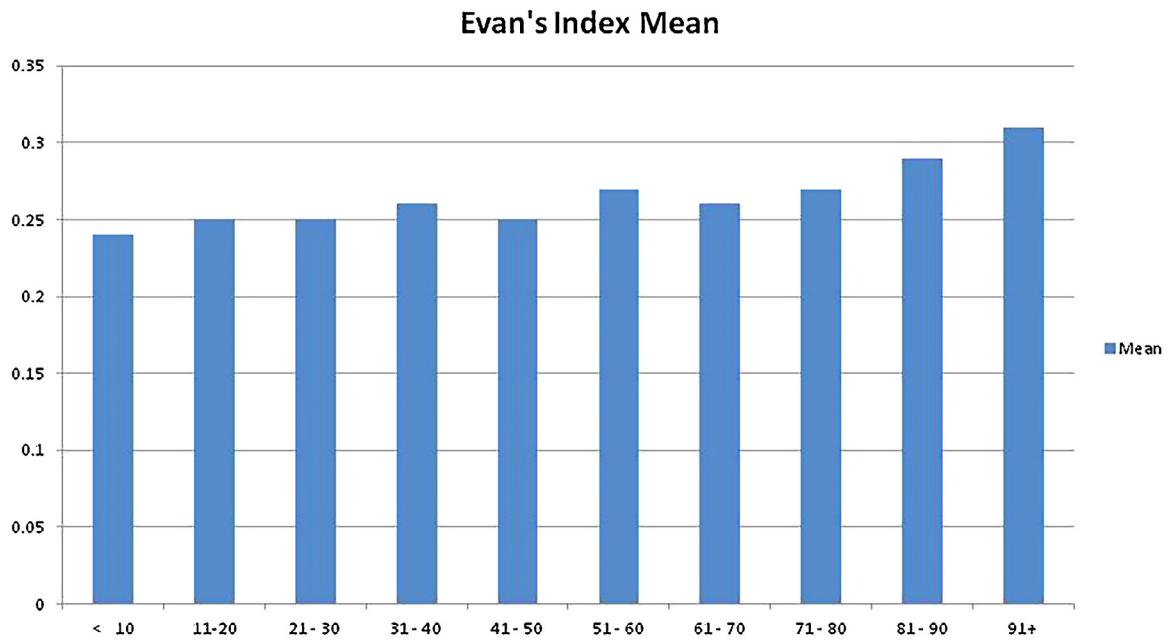

Fig. 2 – Showing the distribution of the means of Evan's index across the age groups.

Ultrasonography has been well investigated in young children where the fontanels are open to measure the size of the ventricular system;[2,15,16] however, this modality cannot be used in adults due to obvious reasons.

6. Conclusion

In summary, the normative values of Evan's index in a group of persons are similar to as described in literature. Although many newer imaging modalities are available to measure the size of ventricular system, still Evan's can be a useful tool particularly in resource limited settings.

Conflicts of interest

The authors have none to declare.

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