Normative Parameters of Evans Index using Computerized Tomographic Scan in Individuals of Kashmiri Ethnicity

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ABSTRACT

Introduction: Knowledge of the ventricular size is important for the initial and precise diagnosis of hydrocephalus. Evans index is a valuable parameter in diagnosis of the NPH, follow up cases of VP shunt, dementia and many other pathologies. Therefore, having a baseline reference data of the Evan’s index will be helpful in a wide range of clinical pathologies. Our aim was to establish normal values for Evans index in a Kashmiri indian population as none has been found in the Kashmiri medical literature.

Material and Methods: Axial computerized tomographic brain scans of 300 normal subjects were reviewed. EI was measured as the linear ratio of the widest anterior horn width of the lateral ventricles to the widest inner diameter of the skull.

Results: Of them, 185(61.66%) of the patients were males and 115 (38.33%) were females; their ages ranged from 6 to 96 years with a mean age of 47 years. The images were acquired using a 16 slice CT machine. The mean value for Evans index for the studied population was 0.264 ± 0.03. The EI increased with age and it was slightly higher among males. The difference in Evans value in males and females was not statistically significant. Individuals above 60 years old had the highest Evans values in both sexes.

Conclusion: This study established the ranges of normal value for Evans index in a kashmiri population. It agrees with the diagnostic cut-off value of > 0.3 for hydrocephalus and it compares well with that of the Caucasians.

Keywords: Lateral ventricle, Computerized tomography, Evans index, Kashmiri, Hydrocephalus

INTRODUCTION

Ventricles constitute 2 percent of brain volume.82 percent of the ventricular volume is contributed by lateral ventricles.¹ Ventricular enlargement caused due to Imbalance in the production and absorption of cerebrospinal fluid is called hydrocephalus.² For the precise and early diagnosis of type of hydrocephalus, knowledge of ventricular size is essential. Computed Tomography (CT) is an accepted procedure in the identification of wide range of pathologic abnormalities and measuring the ventricular size accurately. In Kashmir scenario, CT still remains an easily available, affordable and faster mode of brain imaging. Ventricular size can be obtained by linear or volumetric measurements, out of which the linear ratios of the width of ventricles to the width of brain or skull is an easiest reproducible method. Evan’s Index is one such ventriculographic index. It is the ratio which compares the maximum width of the frontal horns of lateral ventricles to the maximum transverse diameter of inner table of the skull at the same level.³ For the diagnosis of Normal Pressure Hydrocephalus (NPH), follow up cases of ventriculoperitoneal shunt⁴, alcoholism, dementia, this index is an important parameter. Thus developing a baseline reference data of Evan’s index will be useful in a wide range of clinical conditions for this population where such data is unavailable. Our aim was to establish normal values for Evans index in a Kashmiri indian population as none has been found in the Kashmiri medical literature.

MATERIAL AND METHODS

Ethical consideration does not permit that healthy individuals with no clinical symptoms be subjected to ionizing radiation. Therefore, CT scans of neurologic patients which were reported to be normal were reviewed for this study. Being a retrospective study, patient consent was not required however; this research was approved by the ethics committee of govt medical college Hospital. Scan reports of 450 patients that were reported as normal were reviewed independently alongside their images by two radiologists. However, a total of 300 patients were finally selected and were analyzed for the study. They consisted of 185 males and 115 females and ranged between 6 and 96 years old. CT images were obtained from the local database of the CT machine and back up compact discs from the CT archives. The study was done using the department's Siemens 16 slice CT scanner 3mm slice thickness. The images were than viewed on computer monitor using a meter rule with which, following measurements were made as seen in Figure 1. EI = a/b

Exclusion criteria

Seven patients whose study has been deteriorated due to movement were not included in the study population. Also, two patients were not selected who had only descriptive report of normal without a final conclusion.

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We used it in determining the inter-observer. 5-9 The reason being brain parenchyma shrinks with age, while cerebrospinal fluid spaces which also include the ventricles increase in size, to compensate for the atrophying brain substance. However this physiologic ventricular enlargement does not cause Evans ratio to exceed 0.3. No statistically significant difference in the Evans ratio between males and females was found in our study. Haug has reported that females as compared to males has a smaller ventricular system above 15 years of age, while values were reverse in the individuals below 15 years old in the same study.10

Idiopathic normal pressure hydrocephalus consists of triad of dementia, urinary incontinence and gait disturbance and is potentially a reversible cause of dementia in the elderly. It responds well to CSF shunting procedures. The disruptive effects of severe cerebral atrophy on memory, autonomic function and cognitive ability and could then be averted.5 The ventricular enlargement could be quantitatively assessed by Evans index, with diagnostic cut off value of >0.3 based on international guidelines.7 In presence of the clinical symptoms EI could be adequate for the diagnosis. Our finding also supports that this defining criterion (EI > 0.3) could be used in the diagnosis of hydrocephalus in our own environment. EI is also an acceptable predictive index in post-traumatic ventriculomegaly as stated by Poca et al11 while Odeboide et al.12 used it in determining the inter relation of visual function and ventricular size in children suffering from hydrocephalus. Here is the comparison of different studies measuring EI in different populations.

| Study | Evans’s Index |
|-------|---------------|
| Present study | 0.264 ± 0.03 |
| Hamidu AU et al.,13 | 0.252 ± 0.04 |
| Patnaik P et al.,14 | 0.27 ± 0.035 |
| Kosourov AK et al.,15 | 0.22 to 0.28 |
| Wilk R et al.,16 (Pediatric sample) | 0.218 to 0.312 |
| Sari E et al.,17 (Pediatric sample) | 0.23 to 0.28 |

CONCLUSION

In this presentation, the authors have determined the range of normal values of Evans index in a Kashmiri indian population using computerized tomography.

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