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# Unduly Small Ventricle of the Brain on Computed Axial Tomography

Cem ORHON[x], Aydın PAŞAOĞLU[xx]

**Summary:** In this paper, 71 patients with excessively small ventricles on computed axial tomography are reviewd. Computed axial tomography has made it possible to observe excessively small ventricles in a variety of disorders of the CNS. This finding is presumably due to non-specific and diffuse swelling of brain parenchyma, and is illstrated in cases of trauma, neoplasm, encephalitis, pseudotumor cerbri, metabolic disorders, and probable anti epileptic effect. It is likely that other causes will be encountered in the future.

**Key words: Computed axial tomography, cerebral ventricle**

Since the report of Jacobson and Shapiro on pseudotumor cerbri in 1964 (3), no additional information pertaining to the smaller than normal cerebral ventricular system has been presented in literature. With the recent advent of computed axial tomography (CT) of the brain, it has been possible to observe the ventricular system in a wide variety of disorders of the central nervous system as demonstrated on CT scans, we believe that sufficient experience has now been gained to recognize abnormally small ventricles. This report presents some case material illustrating abnormally small ventricles in various pathological conditions.

## Material and Mathod

Seventyone patients with excessively small ventricles of the brain were reviewed. The patient population consisted of 38 male and 33 female. Age ranged from 10 to 69 years with a mean age of 24 years.

To supplement the qualitative evaluation of ventricular size as seen on CT scans with a quantitative assessment, the authors have suggested the bifrontal and bicaudate cerbroventricular indices (CVI) as reasonable measures of ventricular size. The CVI is the ratio of the with of the lateral ventricles to the width of the brain, expressed in percent, at the anterior extremity of the frontal horns (bifrontal CVI), or at the level of the mid portion of the head of the caudate nucleus (bicaudate CVI) (Fig 1).

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x *Assistant Professor of Neurosurgery, Erciyes Üniversity Medical School*
xx *Professor of Neurosurgery , Erciyes Üniversity Medical School*

**Results**

At the time of this writing approximately 1500 CT scans of the brain have been performed at the Erciyes University Medical Faculty Department of Neurosurgery. A review of the first one thousand consecutive CT scans of the brain revealed 71 patients whose ventricles appear unequivocally diminishedhed in size. Some examples are showen in Fig 2 and 3. Twelve representative patients have been selected from this group of 71 cases to illustrate the various disorders associated with excessively small ventricles. Table 1 summarizes the most relevant clinical parameters of these 12 patients. Infants and toddles were excluded from consideration because they may normally have very small ventricles.

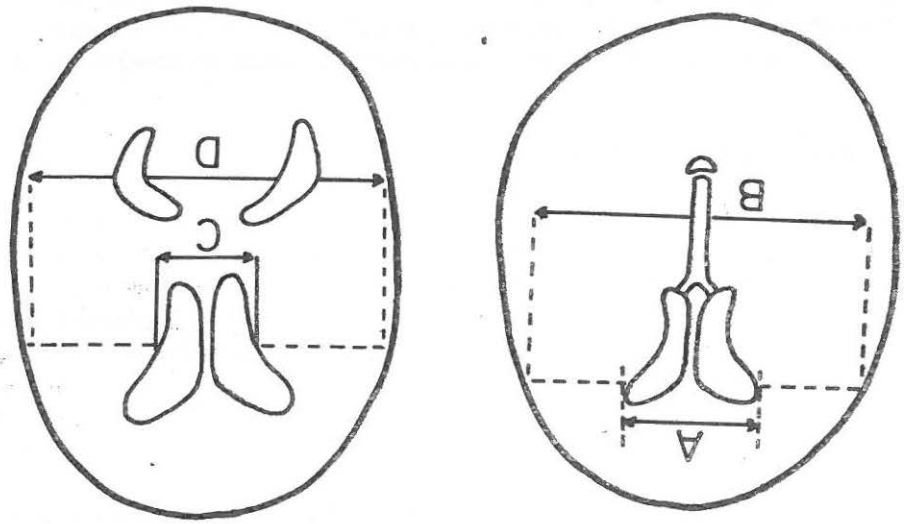
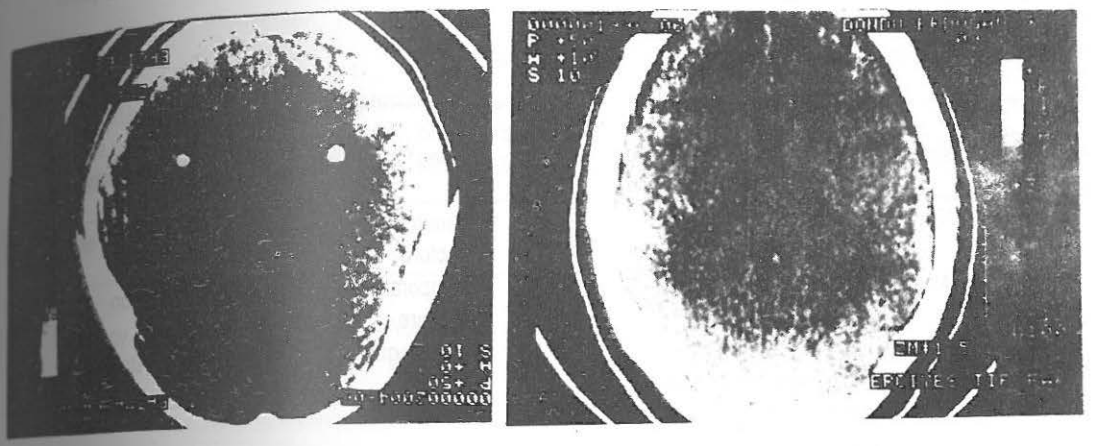



Fig 1a. Measurement of the normal bifrontal cerebroventricular index (CVI). The bifrontal

$$CVI = \frac{A}{B} \times 100\ \%$$ and has a normal value of 31 % ± 4.

Fig 1b. Measurement of the normal bicaudate cerebroventricular index. The bicaudate

$$\text{cerbroventricular index} = \frac{C}{D} \times 100\ \%$$ and has a normal value of 15 % ± 3 %.



+Fig 2. Case 1: The bicaudate CVI in this patient with a cerebral contusion is 9% . The frontal horns are collapsed. Case 2: The bicaudate CVI in this patient with pseudotumor cerebri is 8 %.

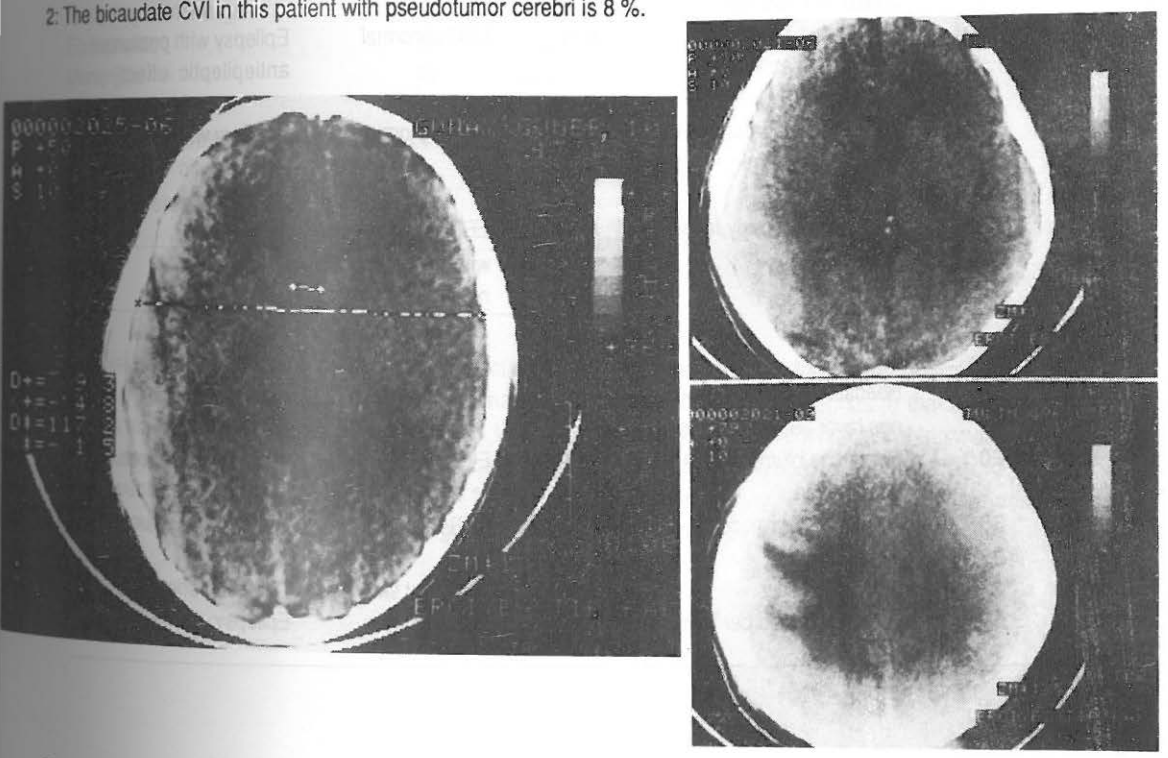


Fig 3. Case 3: The bicaudate CVI in this patient with cerebral metastasis is 9% . Case 4: The bicaudate CVI in this patient with epilepy on antiepileptic therapy is 8 %.

Table I. Summary of Cilinical data of 12 patients with smali ventricles

| Case | Age/sex | Relevant clinical data | Bicaudate CVI | Other studies | Ultemate CNS diagnosis |
|---|---|---|---|---|---|
| 1 | 47/F | Headache and unconsiciousnes | 9 % | Parietal skull fracture | Cerebral contusion |
| 2 | 14/M | Headache and unconsiciousnes | 8 % | Temporal skull fracture | Cerebral contusion |
| 3 | 39/F | Headache,unsteady gait, hemiparesis,weight loss, 5 months; uterus Ca 1 years ago | 9 % | Skull negative | Cerebral metastasis |
| 4 | 67/M | Headache, vomiting, hemiparesis,weight loss adeno carcinoma left breast, 2 years ago | 10 % | - | Cerebral metastasis |
| 5 | 10/M | Conculsive disorder,4 months,antiepileptic therapy | 8 % | EEG abnormal | Epilepsy with presumed antiepileptic effect |
| 6 | 13/F | Convilsive disorder 3 years antiepileptic therapy | 8 % | EEG abnormal | Epilepsy with presumed antiepileptic effect |
| 7 | 11/M | Headache,lethargy,fever 39.5$^{o}$C 7 days | 8 % | EEG abnormal with slow domi nant rhythm and altered arousal reaction | Encephalitis |
| 8 | 10/F | Headache, unconsicious-nes fever 39 $^{o}$C, 12 days | 9 % | EEG abnormal | Meninjitis |
| 9 | 20/F | Headache,blurred vision papilledema | 9 % | EEG negative | Pseudotumor cerebri |
| 10 | 33/F | Headache,papilleedema papilledema | 8 % | EEG negative | Pseudotumor cerebri |
| 11 | 27/M | Unconsiciousnes | 7 % | Temporal skull | Cerebral contusion |
| 12 | 42/F | Convulsive disorder?8 months | 10% | EEG negative | Epilepsy |

## Discussion

The conditions associated with, and presumably causally related to abnormally small ventricles in a group of 71 patients include pseudotumor cerebri (8 patients), brain contusion with or without space occupying hemorrhage (17 patients), encephalitis (5 patients), menenjitis (13 patients). Table 2 shows the pathologies and numbers of the patients.

Table II. Pathologies of the patients

| Pathology | Number of patients | % |
|---|---|---|
| Pseudotumor cerebry | 8 | 11.26 |
| Brain contusion with space occupying hemorrhage | 11 | 14.28 |
| Brain contusion without space occupying hemorrhage | 6 | 8.45 |
| Encephalitis | 5 | 7.04 |
| Menenjitis | 13 | 18.30 |
| Cerebral infarction | 14 | 19.71 |
| Spontan intracerebral hemorrahge | 4 | 5.63 |
| Epilepsy | 18 | 25.35 |
| Cerebral metastasis | 2 | 5.71 |
| Total | 71 | 100.00 |

It appears reasonable to suggest that the reduction in size of otherwise undistorted and undisplaced ventricles is secondary to diffuse swelling of brain parenchyma. It is, however, necessary to emphasize that infants and perhaps toddlers may normally have small ventricles (1,2). We have not examined a sufficient number of "normal" young children to have any meaningful quantitative information concerning relative ventricular size in children less than 10 years old. The cerebroventricular indices between the ages of 10-15 years do not seem to vary significantly from those observed in the adult although our experience with this age group is limited to 50 "normal" patients.

Recognition of the unequivocally abnormally small lateral ventricle is not difficult and the measurement of the bicaudate CVI serves primarily as confirmatory evidence. Whenever the ventricular system is small, the anterior portions of the frontal horns tend to be collapsed and are barely, if at all, recognizable; therefore, the bifrontal CVI is of little use in this condition.

The observation of excessively small ventricles in some epileptic patients who are on antiepileptic theraphy is unexplainable at present. While we have confirmed this observation in several additional patients who were examined subsequent to the first 1000 CT scans, to which this report is rectricted, we have not yet hnad the opportunity to examine these patients records in detail for other common parameters in terms of theraphy, dosage, etc. Therefore, this finding is being presented as an empirical observation without known cause.

It is likely that in the future other conditions will be shown to be associated with unduly small ventricles, since this finding probably represents a diffuse, nonspesific response of the brain parenchyma to a variety of insults.

**References**

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