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Abnormalities of the Midline Cavities of the Brain: A Computerized Tomography Study

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Abstract: This is a preliminary study carried out on the adult population of the Sivas region. The aim was to determine the incidence of Cavum Septum Pellucidum (CSP), Cavum Vergae (CV) and Cavum Velum Interpositi (CVI) and to compare the results with the data of previous studies and the relevant literature.

A total of 442 computed tomography (CT) scans (302 males, 140 females), in axial plane, from the archive of the Department of Neurosurgery at Cumhuriyet University were examined to find out the brain midline cavities. Among the 442 CT scans, 69 (15.61%) had these brain midline cavities. Out of these 69 cases, 20 (4.52%) were Cavum Septum Pellucidum (CSP), 12 (2.71%) were Cavum Vergae (CV), 32 (7.24%) had Cavum Velum Interpositi (CVI), 3 (0.68%) had Cavum Septum Pellucidum (CSP) with Cavum Vergae (CV) and 2 (0.46%) had Cavum Septum Pellucidum (CSP) with Cavum Velum Interpositi (CVI). In this prospective study, the incidences of CSP and CVI were lower but the incidence of CV was higher than in previous studies.

Key Words: Cavum Septum Pellucidum, Cavum Vergae, Cavum Velum Interpositi, Computed Tomography.

Introduction

During intrauterine life there are three potential midline cavities among the ventricles in the cerebrum. These three cavities regress between the seventh month of intrauterine life and the second year of postnatal life. In adults, in cases of persistence of these three midline cavities, from anterior to posterior, Cavum Septum Pellucidum (CSP), Cavum Vergae (CV) and Cavum Veli Interpositi (CVI) occur respectively. The diagnosis of these three cavities was first made at autopsy and afterwards by pneumoencephalogram.

Cavum Septum Pellucidum (CSP)

It is also called the fifth ventricle (1). The CSP is the potential space which develops between the two leaflets of the septum pellucidum (2-6). The CSP is triangular (1,7) and demarcated anteriorly by the genu of corpus callosum, posteriorly by the corpus and columns of the fornix, superiorly by the body of the corpus callosum, and inferiorly by the rostrum of the corpus callosum (1,6).

Cavum Vergae (CV)

It is called the sixth ventricle. It is bounded superiorly by the body of the corpus callosum, inferiorly by the hippocampal commissure, laterally by the crus of the fornix, and posteriorly by the splenium of the corpus callosum (6,8). The aqueductus caudae septi or aqueductus ventriculi Vergae is a communicating duct between the CSP and CV (6).

Cavum Veli Interpositi (CVI)

Cavum velum interpositum, cisterna interventricularis, ventriculi tertii, transverse fissure and sub-trigonal fissure are also used instead of CVI (1). CVI is a fusion defect of the velum interpositum found in the roof of the third ventricle. The boundaries of the CVI are the hippocampal commissure and corpus callosum superiorly, the tela choroidea inferiorly and the crus of the fornix on each side laterally. It may extend anteriorly in the roof of the third ventricle as far as the interventricular foramina and caudally it opens into the cisterna venae magnae (6).

In this study the incidence of these defects was determined in the adult population of the Sivas region and compared with the data from previous studies and the relevant literature.

Materials and Methods

A total of 442 CT scans in the axial plane from patients under medical treatment at the Department of Neurosurgery, Cumhuriyet University, School of Medicine were examined. None of the patients had any clinical findings associated with brain midline cystic abnormalities. All the cases who had the midline gliding defect due to an intracranial mass or a lesion and who were under the age of 18 were excluded. CT slices were performed at 4 mm intervals using the Toshiba 60 AX system.

Findings

Of 442 cases (302 male and 140 female), 69 (15.61 %) had the brain midline cystic abnormality. Of the 69 cases, 47 were male and 22 were female. The average age of these cases was 45.43. The incidence of CSP, CV and CVI was 4.52% (20), 2.71%(12) and 7.24% (32) respectively. In addition to these cases, in 3 cases (0.68%) both CSP and CV, and in 2 cases (0.46%) both CSP and CVI was detected together (Fig. 1-3).

Discussion

The CSP may communicate with one or both of the lateral ventricles, or occurs in a separate cavity (1,6). In some cases it may communicate with the third ventricle (2,3,9,10). In the present study, the incidence of the CSP was 4.52% in the adult population which is lower than in previous findings. The occurrence of the CSP was 100% in premature infants, 97% in full-term neonates, 41% in 3-month old infants, 15% in 6-month old infants (6), and 10% in adults (5). In boxers the incidence of the CSP was 77%, which is significantly higher than that of the general population (6,9). Of course it is contrary to the fact that the CSP is a brain midline cystic abnormality in embryonal life. This high incidence given for boxers possibly depends on the number of cases, because only 15 boxers were examined in this study (9,15). According to a study carried out on 1000 patients the incidence of the 5th ventricle is 5.5% (1). On the other hand, the CSP has been described as with fenestration or without fenestration of the septum by Corsellis, et al. (10). In Turkish people, this incidence has been observed to be a 1.39% (7/505) by Aldur, et al. (16); 4.2 (142/3400) by Sindel, et al. (17). Our findings were in agreement with those of Sindel, et al. (17).

The CV lies behind the CSP as the posterior extension of the CSP in fetal life (1,11). The incidence of the CV was observed as 60% in premature infants, 7% in the

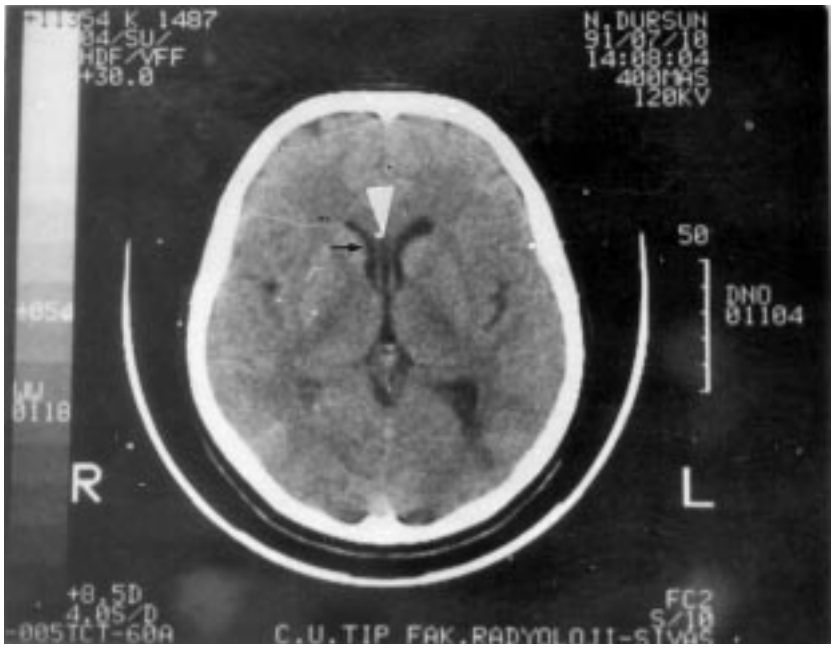

Figure 1. Axial brain computed tomographic scan showing CSP. (white arrow-CSP, arrow-lateral ventricle).

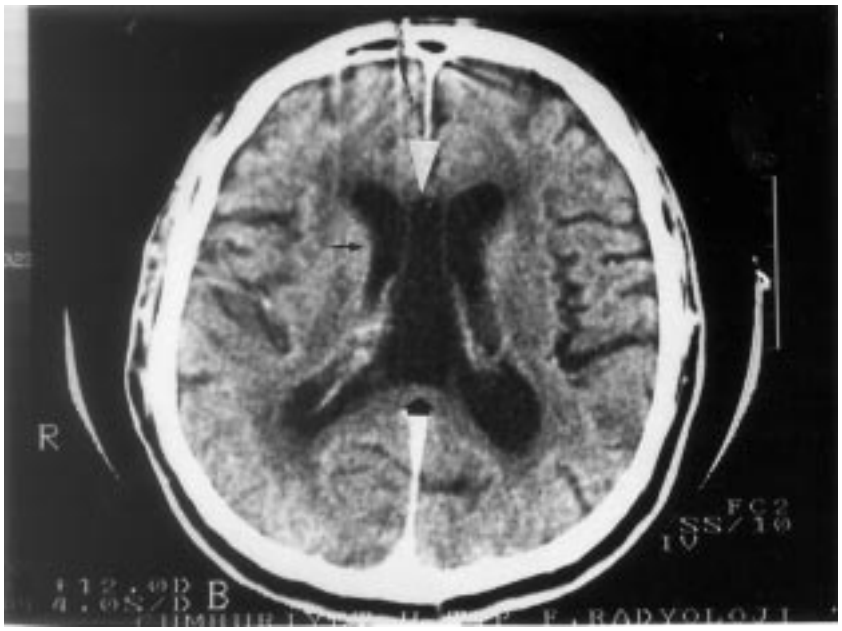

Figure 2. Axial brain computed tomographic scan showing CSP with CV. (white arrow-CSP, thick arrow-CV, arrow-lateral ventricle).

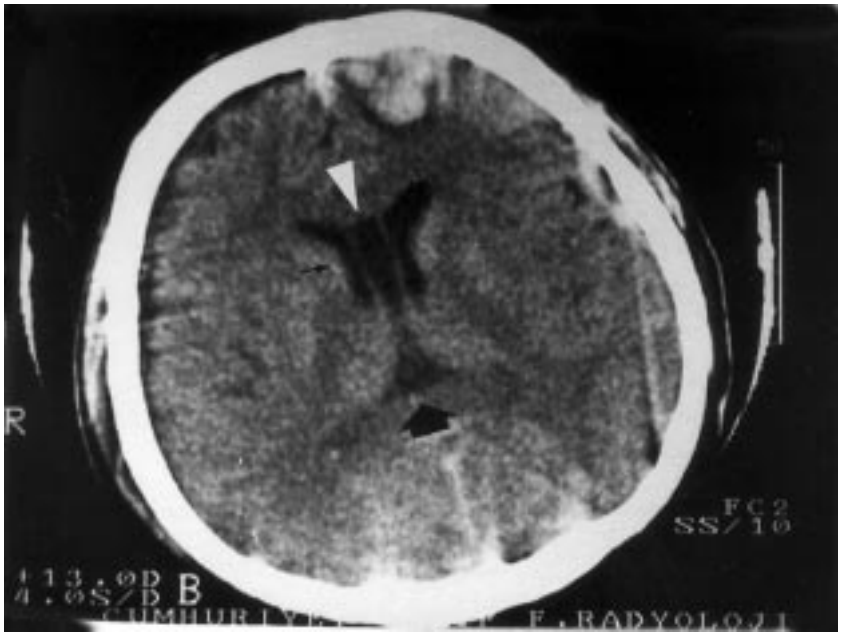

Figure 3. Axial brain computed tomographic scan showing CSP with CVI. (white arrow-CSP, thick arrow-CVI, arrow-lateral ventricle).

full-term neonates but not detected in any of the 1 month-old infants (6,8). In the study of Macpherson and Teasdale the incidence of the CV was 0.5% (9). This incidence has been calculated as 5% in the first two years of life by Nakano et al. In their study there was no CV observed at the age of ten (12). According to Sindel, the incidence of the CV was 1.9% (64/3400), (17). In our series, the incidence of the CV was 2.71% (12/442), which is higher than in previous studies.

In a study related to the CVI, the incidence of the CVI was not significantly different between children and adults. In Macpherson and Teasdale's study, the incidence of the CVI in children and adults was given as 9.2% and 9.5% respectively. It has been reported that the CVI is frequently observed in infants while it is much less frequently seen in children over the age of 2 or in adults (1).

Among all the cases of brain midline cystic abnormalities in our series the CVI had the highest incidence by 7.24 percent. In the present study it was the only incidence given for CVI in the adult population because cases under the age of 18 were not included in our study.

In some cases CV can be found with CSP or it can be a posterior extension of the CSP (1,6). In the literature the incidence of the CV plus CSP is 2.3 percent. Oteruelo has reported that only one CV in conjuction with CSP was seen in his series of 89 brains (13).

In our cases, the CSP was found together with CV in 3 cases (0.68%) (Fig. 3). Similar results were found by Sindel (0.8%), (17). The incidence reported by Aldur is comparatively high (4.16%), (16). As these three cavities in the cerebrum are not lined by ependyma or choroid plexus cells, they are not considered part of the ventricular system. In one study, a syndrome has been proposed which is characterized by a progressive increase in head size without intracranial hypertension, moderate ventricular dilation, and CVI (6).

It was also reported that the interventricular foramen can be blocked by the periventricular tumoral lesions, causing hydrocephalus. These potential cavities do not make it difficult to reach the periventricular or intracranial mass lesions during operations but in cases of obstructed hydrocephaly it is necessary to apply a shunt (14).

In some patients who have an aneurysm of the anterior communicant artery hemorrhage can be seen in the CSP, and in some cases this hemorrhage can stay limited in the CSP or this hemorrhage may perforate the wall of the CSP. Also, these midline cysts may cause an error during operations on the ventricular system. Although these intracranial cystic remnants have been examined several times in neuroradiological studies, there are few reports them about them in the neuroanatomical literature. We conclude that the incidence of these defects should be known well by surgeons.

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