ORIGINAL ARTICLE

FREQUENCY OF CAVUM VELI INTERPOSITI IN NON-PSYCHOTIC POPULATION: A MAGNETIC RESONANCE IMAGING STUDY

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SUMMARY

This prospective MRI investigation was performed to determine the incidences of the cavum veli interpositi (CVI) in 505 (242 Male, 263 Female) non-psychotic persons. The mean age of the population was 39,179 ± 0,904 (40,461 ± 1,395 Male, 38 ± 1,166 Female). There was no significant difference between the means of age in male and female groups (t-test, DF = 479, p > 0,05).

The incidences of the CVI were 5.77 %, 1.89 %, 5.66 %, 8.24 %, 5 %, 7.94 %, 3.03 % for age group of 0-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79 respectively. There was no significant difference between the incidences of the CVI in age-groups (χ² = 3.804, DF = 7, p > 0.05).

The incidences of the CVI were 5.54 %, 6.61 %, 4.56 % for whole, male, and female populations respectively. There was no significant difference between the incidences of the CVI in both sexes (χ² = 1.01, DF = 1, p > 0.05).

Key words: cavum velum interpositum, cavity, velum interpositum, midline brain anomalies.

INTRODUCTION

The prosencephalon subdivides into telencephalon and diencephalon during the embryological development. The delination between the two parts is revealed on the external surface of the budding cerebral vesicle by telencephalic-diencephalic sulcus (sulcus hemisphericus). This sulcus has two parts; a dorsal medial part that corresponds to the velum interpositum and a basal medial portion that corresponds to a thickened part of the lamina terminalis, called the comissural plate [16].

The velum interpositum (figure 1) is the fold of piamater (tela choroidea) occupying the transverse cerebral fissure (choroidal fissure) between the diencephalon and corpus callosum. It is located caudal to the interventricular foramen. The velum interpositum is a triangular fold of pia mater interposed between the corpus callosum and fornix above and the roof of the third ventricle and thalamus below. The subarachnoid space between its two...
laminae (cavum veli interpositi, cisterna interventricularis, CVI) is filled with cerebrospinal fluid and blood vessels; it is continuous posteriorly with cisterna superior. This side forms the base of the triangle. The apex of the triangle is located rostrally at the two interventricular foramina, while the two sides of the triangle extend laterally into each lateral ventricle. The pial vascular bed of the apex and two sides combines with the ependyma of the lateral ventricles and interventricular foramina to form the choroid plexuses of the lateral ventricle and interventricular foramina. After passing through these foramina, the choroid plexus continues as a single midline structure extending from the apex to the middle of the base of the triangle. This is the choroid plexus of the third ventricle, formed by the union of the vascular plexus of the pia with the ependyma in the roof of the third ventricle of the diencephalon. The deep cerebral veins drain toward the regions of the interventricular foramina to form two internal cerebral veins located within the velum interpositum just above the choroid plexus of the third ventricle [13, 19].

Inclusion of this midline cavity in midline malformations of the brain [15], arises the question that whether the relation between midline malformations of the brain and psychiatric disorders [5-7, 10, 17, 18, 21, 23] is valid for CVI. To determine whether it is or is not the case first of all the determination of the frequency of the CVI in non-psychotic population is needed.

The statistical analysis was performed using Apple Macintosh Colour Classic computer with InStat for Mac and StatView II softwares. Alternate Welch t, chi-square with Yates correction (\(\chi^2\)) tests were used. A statistically significant difference was considered to be present when the two-sided p value was less than 0.05.

### Material and Methods

In this prospective study, MRI scans were obtained on a 1-Tesla imager (Picker International, Highland Heights, Ohio, USA). T1-weighted scans were acquired using spin echo technique with a repetition time (TR) of 540 milliseconds, echo time (TE) of 16 milliseconds in transverse, coronal, and sagittal planes. T2-weighted images were obtained with a TR of 2,140 milliseconds, TEs of 20 and 80 milliseconds. The slice thicknesses were defined as 5 and 6 mm.

Five hundred five cases (242 M, 263 F) who had applied to EMARAY Imaging Center with various pre-diagnosis between December 1995 and May 1996 were evaluated in this study. All of the cases were especially selected from the non-psychotic population. A rising data were classified into three categories according to age, sex, and the presence of CVI. The cases were at the age of 2 months to 79 years in males, and 4 months to 79 years in females. The mean age of the population was 39.17 0.904 (40.46 \(\pm\) 1.395 for Males, 38 \(\pm\) 1.166 for Females). There was no significant difference between the means of the male and female groups (t-test, DF = 479, p > 0.05). The class range was determined to be 10 years for the age-groups.

The sample MRI images of the CVI were given in figures 2 and 3.

### Results

The distribution of the CVI cases according to age and sex groups is given in Table I. Sample MRI images of the CVI were given in figures 2 and 3.

### Table I. — The distribution of the cavum veli interpositi (CVI) cases according to age and sex (n = number of cases, \(N\) = total number of cases at this age group).

<table>
<thead>
<tr>
<th>Age</th>
<th>Male CVI n %</th>
<th>Male CVI n %</th>
<th>Male CVI n %</th>
<th>Total CVI n %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>28 10.71 %</td>
<td>24 10.71 %</td>
<td>3 52.94 %</td>
<td>52 5.77 %</td>
</tr>
<tr>
<td>10-19</td>
<td>25 4.55 %</td>
<td>28 4.55 %</td>
<td>1 53.03 %</td>
<td>53 5.46 %</td>
</tr>
<tr>
<td>20-29</td>
<td>32 9.38 %</td>
<td>28 9.38 %</td>
<td>3 53.03 %</td>
<td>53 6.56 %</td>
</tr>
<tr>
<td>30-39</td>
<td>45 6.67 %</td>
<td>45 6.67 %</td>
<td>7 85 8.24 %</td>
<td>85 8.24 %</td>
</tr>
<tr>
<td>40-49</td>
<td>63 11.11 %</td>
<td>63 11.11 %</td>
<td>5 100.00 %</td>
<td>100 10.00 %</td>
</tr>
<tr>
<td>50-59</td>
<td>34 6.25 %</td>
<td>34 6.25 %</td>
<td>3 53.03 %</td>
<td>53 5.46 %</td>
</tr>
<tr>
<td>60-69</td>
<td>36 6.11 %</td>
<td>36 6.11 %</td>
<td>5 63 7.94 %</td>
<td>68 7.94 %</td>
</tr>
<tr>
<td>70-79</td>
<td>10 2.22 %</td>
<td>10 2.22 %</td>
<td>1 33 3.03 %</td>
<td>34 3.43 %</td>
</tr>
<tr>
<td>Total</td>
<td>12 2.54 %</td>
<td>12 2.54 %</td>
<td>1 33 3.03 %</td>
<td>33 3.32 %</td>
</tr>
</tbody>
</table>
In twenty-eight of the 505 cases examined (5.54%) the CVI was determined. Sixteen of these cases (16/242; 6.61%) were male and 12 of them (12/263; 4.56%) were female (chart 1). There was no statistically significant difference in the frequency of CVI between the two sexes ($\chi^2 = 1.01$, $DF = 1$, $p > 0.05$).

The incidences of cases according to age groups (chart 2) were as follows: 5.77% (0-9), 1.89% (10-19), 5.66% (20-29), 8.24% (30-39), 5% (40-49), 4.55% (50-59), 7.94% (60-69) and 3.03% (70-79) in whole population. There was no statistically significant difference in the frequency of the CVI between age groups ($\chi^2 = 3.804$, $DF = 7$, $p > 0.05$). This statistical indifference was also valid for both sexes ($\chi^2 = 5.564$, $DF = 7$, $p > 0.05$ for males, $\chi^2 = 5.836$, $DF = 7$, $p > 0.05$ for females).

**DISCUSSION**

The CVI is a cisternal space that contains the internal cerebral veins and posterior medial choroidal...
artery. The pial vasculature of the velum interpositum and ventricular ependyma form the choroid plexus of the lateral and third ventricles. The anterior boundary of the cistern is the foramen of Monro, where the columns of the fornix appose one another; laterally, the cistern of the velum interpositum extends to the choroid plexus of the lateral ventricles. It opens posteriorly into the quadrigeminal cistern and also communicates with the lateral wing of the ambient cistern (transverse cerebral cistern) and, thence, with choroidal fissure. A cyst of the velum interpositum represents a progressive enlargement of the normal cistern [20].

It is reported that the CVI is a normal developmental phase of the infant’s brain and it has no pathological meaning [14]. However, it is also reported that a 9-year-old boy with psychomotor retardation and epileptic seizures had a large CVI, diagnosed by CT and MRI. This patient was treated by endoneurosurgical fenestration of the CVI [8]. Similar to the treatment of other midline cystic dilatation of brain [4, 11-12], the aim of the fenestration in this cystic CVI case is to remove the compression caused by the cyst [8].

A pneumoencephalographic study of 158 children younger than 2 years old showed the frequent presence of a large CVI in early infancy (under 3 months 43%, 3 to 6 months 28%, 6 to 12 months 24%); however, by age 12 months (12 to 24 months 5%) it was a rare occurrence. The authors found no correlation between a CVI and numerous pathological conditions [14]. Our findings (5.54% in whole population, 6.61% in males, and 4.56% in females) is parallel to this study which the CVI incidence is 5% up to age of 12 months.

The CVI has to be distinguished primarily from cavum septi pellucidi (figure 4) and cavum Vergae (figure 5). The cavum septi pellucidi and the cavum Vergae are the major types of the cavitation anomalies of the septum pellucidum [1, 2] which are closely related with psychiatric disorders [5-7, 10, 17-18]. A cavum Vergae without a cavum septi pellucidi is unexpected [2]. However, such a case had been reported in the literature [3], which suggests that either the embryologic events in this region may not always occur in the usual sequence or the cavum Vergae may be confused with CVI. It is not difficult to distinguish a cavum septi pellucidi (figure 4) from a CVI, since it lies in front of the foramen of Monro, whereas the CVI lies behind it. It appears to be more difficult to distinguish the CVI from a cavum Vergae. The first criteria for distinguishing the CVI from cavum Vergae is the presence of cavum septi pellucidi in all cavum Vergae cases [2, 22]. Secondly, it should be remembered that a cavum Vergae can not reach further backward than

**Fig. 4.** — The axial section of the cavum septi pellucidi. A row indicates the cavity.

**Fig. 4.** — Coupe axiale des cavum septi pellucidi. La flèche indique la cavité.

**Fig. 5.** — The axial section of the cavum septi pellucidi et cavum Vergae. A row indicates the cavum septi pellucidi and asterisk indicates cavum vergae.

**Fig. 5.** — Coupe axiale des cavum septi pellucidi et vergae. La flèche indique les cavum septi pellucidi et l’astérisque indique les cavum vergae.
the splenium of the corpus callosum, whereas the CVI occasionally reaches much further backward and merges with the cister of the great vein of Galen, which turn reaches down to the quadrigeminal plate [22]. A dditionally, a CVI can be differentiated from a cavum Vergae by its position below the fornix and because it does not extend anterior to the foramina of Monro into the septum pellucidum [9, 16, 20]. Typically, the internal cerebral veins are depressed by a cavum or cyst of the velum interpositum [20]. According to us, the incidences of the CVI can be another criteria for distinguishing the CVI from cavum Vergae. The frequencies of cavum Vergae are reported to be 2.89 %, 2.66 % and 2.77 % in male, female and whole population respectively. In other words, it can be suggested that the frequency of the CVI is twice as frequent as the cavum Vergae. This seems to be important for the differential diagnosis of both cavities.

Besides, inclusion of this midline cavity (CVI) in midline malformations of the brain [15], raises the question that whether the relation between midline malformations of the brain and psychiatric disorders [5-7, 10, 17-18, 21, 23] is valid for CVI. To determine whether it is or is not the case first of all the determination of the frequency of the CVI in non-psychotic population is needed. Present study was carried out in a non-psychotic population. The frequency of the CVI in psychotic population is still needs to be clarified and, the authors of the present study suggest that this is a subject of matter that is of great value for a future investigation.

REFERENCES