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Predictive potential of *cavum septi pellucidi* (CSP) in schizophrenics, alcoholics and persons with past head trauma

A post-mortem study

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Abstract The increased presence of *cavum septi pellucidi* (CSP) was reported among people suffering from schizophrenia, alcoholism or it could be a remnant of an old head trauma. We have tried to compare not only prevalences, but also lengths, widths and depths of the obtained cava in an effort to emphasize the importance of linear parameters in routine diagnostics. On 479 cadavers, 310 male and 169 female, aged 22 to 89; 110 brains had a CSP: 40 persons had no data about prior neuropsychiatric disease, 25 were schizophrenics, 25 alcoholics and 20 received a serious head blow during their lifetime. The prevalence of CSP in the entire group was 22.96%; among normal persons 10.61%; in schizophrenics 83.33%, in alcoholics 58.14% and in persons with sustained prior head trauma 68.96%. There was a statistically significant difference in ratings, lengths and widths of CSP between schizophrenics, alcoholics, head traumatized and normals. Both length and width were revealed as parameters of importance for CSP selection. CSP is more frequent, longer and wider in persons who are suffering from schizophrenia, alcohol addicts and those who had sustained one or several head blows in the past. Its linear parameters are advisable to be measured.

Key words septum pellucidum · cavum · schizophrenia · alcoholism · head trauma

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Introduction

The increased prevalence of *cavum septi pellucidi* (CSP) among schizophrenics, people who faced a repeated head trauma and alcoholics have been reported elsewhere (Degreef et al. 1992a, 1992b; DeLisi et al. 1993; Filipovic et al. 1996; Nopoulos et al. 1996, 1997; Bodensteiner and Schaefer 1997; Filipovic and Teofilovski-Parapid 1998).

In this study, we hypothesized that cava in schizophrenics, alcoholics and individuals who suffered a prior head trauma morphologically differ from one another and that those differences could be of potential applicability in routine diagnostics.

Materials and methods

The investigation was performed on 479 autopsied cadavers (310 male and 169 female), aged 22 to 89 (mean 57.44 ± 15.37). The main criterion for the selection of brain suitability for this study was the absence of macroscopic changes on brain parenchyma and that time of death did not exceed 12 hours. Data obtained from families of the deceased, clinical and medical reports about neuropsychiatric diseases and disorders were matched with the intra-autopsy finding. The criteria for the diagnose settlement were used according to the Tenth Revision of International Classification of Diseases (ICD-10). In our sample 110 CSP were obtained, involving 40 normal individuals, 25 schizophrenics, 25 alcoholics and 20 persons with verified prior head trauma (excluding the same diagnose as the cause of death).

Unfixed frozen (on -15°C) brains were cut axially, to 1.5 mm thick slices. When present, CSP on such sections were mostly triangular in a shape. Measurements were taken of every slice with CSP, and a mean value was marked as a definitive in the data base. Length (the approximate height of the triangle) and width (length of the base of the triangle) of CSP were obtained. Clefts at least 2 mm (mean value) long and wide were considered as *cavum septi pellucidi* and were included in this study.

The differences obtained were tested by one-way analysis of variance (ANOVA) with *post priori* Bonferroni correction for parametric, and chi-square and Fisher's exact probability test for non-parametric data. The stepwise discriminant function analysis was used to determine which variables discriminate between two or more observed groups. For each group in our sample, we determined the location of the point that represents the means for all variables in the multivari-

ate space defined by the variables in the model (*centroids*). For each case we then computed the Mahalanobis distances (of the respective case) from each of the group centroids. Entire testing was performed on the 95 % probability level.

Results

In our sample of 479 brains, 110 cava (75 males and 35 females) were obtained (total prevalence = 22.96 %; Table 1). The chi square test did not reveal significant male–female differences among obtained frequencies: $\chi^2 = 0.985$, $DF = 3$, $p > 0.05$, respectively.

Extreme and mean values with standard error (SE) of the lengths and widths of CSP in the groups are shown in Table 1. The *Bonferroni post hoc* test delineated cava in schizophrenics as the longest and widest in the sample.

The *discriminant function analysis* extracted length and width as the parameters of importance for the prediction to which group a newly obtained CSP might belong. The general equation and Fisher's linear function formulas for eventual CSP classifications are shown in Table 1.

Discussion

In this paper, we intended to study the importance of detecting the presence of *cavum septi pellucidi*, measure its linear parameters (length and width), and present findings comparable to most MRI guided or similar studies that examined the CSP in 1.5 to 3 mm slices (Nopoulos et al. 1997; Kwon et al. 1998; Rajarethinam et al. 2001). Reported prevalences gradually increased from 20 and 30 % (Degreef et al. 1992a; Jurjus et al. 1993; De Lisi et al. 1993) to 40–75 % (Nopoulos et al. 1996; Rajarethinam et al. 2001; Hagino et al. 2001). The highest prevalence was estimated by Kwon and his associates (1998) – 85 % among normal individuals. Results of MRI guided studies (Bodensteiner et al. 1998; Pauling et al. 1998; Aldur et al. 1999), on the other hand, revealed prevalence of about 2 % or less. Prevalence among normal individuals (10.61 %) in our study is closer to values reported by Breeding et al. (1991), who calculated a prevalence of 14.4 %. Estimated CSP prevalence among schizophrenic patients ranged from 45 to 80 % (De Lisi et al. 1993; Kwon et al. 1998; Rajarethinam et al. 2001; Hagino et al. 2001). Our prevalence slightly surpasses evaluated ranges, probably due to the limiting factor that not many schizophrenics undergo autopsies.

Many authors (Spillane 1962; Bogdanoff and Natter

Table 1 Prevalences, mean values (\pm SE), ranges and results of discriminant function analysis of the observed parameters

| Parameter | Group (prevalence in the sample – %) | | Mean \pm SE in millimeters (minimum – maximum) | Remarks |
|--------------------------------|--------------------------------------|------------|--|--|
| Length | Without symptoms | 10.61 %* | 7.13 \pm 0.24 (2.5–8.20) | ANOVA $F_{3,106} = 37.177$; $p < 0.001$ |
| | Schizophrenics | 83.33 %** | 11.9 \pm 0.90 (6.0–23.0) | |
| | Alcoholics | 58.14 %*** | 8.07 \pm 0.48 (3.50–12.40) | |
| | Head traumatized | 68.96 % | 8.37 \pm 0.71 (2.0–16.20) | |
| | Totally in the sample | 22.96 % | 7.56 \pm 0.40 (2.0–23.50) | |
| Width | Without symptoms ^a | | 2.74 \pm 0.12 (2.10–4.0) | ANOVA $F_{3,106} = 79.531$; $p < 0.001$ |
| | Schizophrenics ^b | | 7.82 \pm 0.44 (4.80–12.30) | |
| | Alcoholics ^c | | 4.19 \pm 0.22 (2.0–6.0) | |
| | Head traumatized | | 4.09 \pm 0.18 (3.30–5.50) | |
| | Totally in the sample | | 4.47 \pm 0.22 (2.0–12.30) | |
| Discriminant function analysis | Centroids | | Section points ^e | <i>General equation^d:</i> $-4.055 + 0.166 \times \text{LENGTH} + 0.626 \times \text{WIDTH}$ <i>For post priori classification:</i> For normal individuals: $-4.274 + 0.399 \times \text{LENGTH} + 1.504 \times \text{WIDTH}$ For cava in schizophrenics: $-25.011 + 1.151 \times \text{LENGTH} + 4.287 \times \text{WIDTH}$ For cava in alcoholics: $-9.376 + 0.816 \times \text{LENGTH} + 2.241 \times \text{WIDTH}$ For cava in persons who suffered a head blow: $-9.414 + 0.855 \times \text{LENGTH} + 2.173 \times \text{WIDTH}$ |
| | Without symptoms | –1.652 | –0.878 | |
| | Head traumatized | –0.104 | | |
| | Alcoholics | 0.093 | –0.005 | |
| | Schizophrenics | 2.819 | 1.456 | |

Bonferroni post hoc test:

* Persons without required symptomatology versus (vs) other groups: for all $p < 0.001$

** Schizophrenics vs normal individuals, alcoholics and head traumatized: for all $p < 0.001$

*** Values in alcoholics did not differ statistically from the lengths in persons who had a serious head trauma

^a Persons without required symptomatology versus other groups: for all $p < 0.01$

^b Schizophrenics vs normal individuals, alcoholics and head traumatized: for all $p < 0.001$

^c Values in alcoholics did not differ statistically from the widths in persons who had a serious head trauma

^d General equation serves for primary classification

^e Section points are the averages of the centroids

1989; Bodensteiner and Schaefer 1997; Moseley 2000; Grosso et al. 2001) stated that CSP was a result of survived repeated head blows. Despite prior reports (Jurjus et al. 1993; Nopoulos et al. 1997; Rajarethinam et al. 2001), in our study, no male-female difference was revealed in CSP prevalences in obtained groups.

In available studies, the threshold between normal and abnormal CSP ranges between 6 and 7.5 mm in length (Shunk 1963; Kwon et al. 1998; Nopoulos et al. 1998). Width of CSP of about or more than 1 cm was stressed as important as a predictor of neurodevelopmental disorders (Bodensteiner and Schaefer 1990; Mott et al. 1992). Pauling and associates (1998) calculated an average width of 8.76 mm in adults and 4.57 mm in children. Our values were closer to latter ones. *Cava septi pellucidi* in schizophrenics were the widest, but only 4 exceeded 10 mm. Morphological similarity between CSP in alcoholics and head traumatized has already been reported (Filipovic et al. 2000). The discriminant function analysis defined both linear parameters as necessary for classification of a CSP into the groups obtained.

In conclusion, the appearance of cavum septi pellucidi is certainly more frequent in persons who are suffering from schizophrenia, alcohol addicts and those who sustained one or several head blows in the past. Our results indicate that length and width are the parameters necessary to classify CSP into one of the obtained groups.

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