20th World Congress in Fetal Medicine

The 11-14 weeks interhemispheric cyst-like midline structure

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Objective

During normal embryogenesis, transient fluid filled structures can be visualized between 11 and 14 weeks in the fetal central nervous system. Previously, an interhemispheric cyst-like midline structure that is seen in the first trimester has been described as either the third ventricles or the cavum veli interpositi (CVI). As such the aim of our study was to determine the identity and prevalence of the structure at 11-14 weeks gestation.

Methods

This is a retrospective study that included singleton gestations who had undergone first trimester scans (FTS) over a three-month period, with a fetal CRL of 45-84 mm, an adequate axial sweep of the fetal head, a normal fetal CNS on second-trimester scan and known neonatal outcome. The sweep was considered adequate if it was a true axial sweep commencing superior to the ventricles and extending to the base of the skull. Five independent reviewers examined the sweeps and designated the presence or absence of the fluid-filled space in the suprathalamic region. The majority selection (≥80% present or absent) was adopted. A mixed-effects logistic regression analysis was conducted to investigate the association between the presence of the structure and the type of ultrasound examination (transabdominal vs. transvaginal). The binary outcome variable was the presence or absence of the structure. The fixed effect in the model was the type of scan performed (transabdominal or transvaginal), while a random intercept was included for the physician ID to account for the clustering of observations within physicians. The analysis was performed using the PROC GLIMMIX procedure in SAS 9.4. A series of generalized estimating equations (GEE) were conducted to analyze the associations between the designation of a binary outcome of “structure present or not” and the independent variables of maternal body mass index (BMI), gestational age, crown-rump length (CRL) and biparietal diameter (BPD). The GEE analyses accounted for the clustering of observations within physicians. The GEE analysis was performed using the PROC GENMOD procedure in SAS. The link function used was logit, and an independent correlation structure was assumed. The results were reported as odds ratios (OR) with corresponding 95% confidence intervals (CI) and p-values. $P< 0.05$ was considered significant. Descriptive statistics, including mean, standard deviation, and range, were calculated for each variable using SAS. The fetuses that were identified as a majority selected CVI present had their second trimester ultrasound further reviewed to see if the CVI remained visible.

Results

A total of 223 patients were reviewed and 104 met inclusion criteria. The interhemispheric cyst-like midline structure was present in 25/104 (24%) of fetuses and identified as the CVI based on its level and visualization of the third ventricle separately in some fetuses. The mixed-effects logistic regression analysis revealed no statistically significant difference in the presence of the fetal structure between transabdominal and transvaginal ultrasound examinations (estimate: 0.1503, standard error: 0.2118, p-value: 0.4784). There is a non-significant increase of odds of the structure being present for transvaginal ultrasound compared to transabdominal ultrasound of 1.16 (p=0.4784). The results of the GEE analyses are listed in Table 1 and Figure 1. Maternal BMI: For every 10-unit increase in BMI, the odds of the structure being present was reduced by a factor of 0.66, holding all other factors constant. The 95% CI for this effect ranged from 0.41 to 1.05, and although not statistically significant (p=0.0777), we noted a trend. Gestational age: The odds of the structure being present for each 10-day increase in gestational age was not significant, holding other factors constant. The 95% CI for this effect ranged from 0.80 to 1.89, (p=0.3477). CRL: The odds of the structure being present increased by a factor of 1.32 for each 10-millimeter increase in CRL, holding all other factors constant. The 95% CI for this effect ranged from 1.16 to 1.50, and the effect was statistically significant (p=<0.0001). BPD: The odds of the structure being present increased by a factor of 1.88 for each 10-millimeter increase in BPD, holding all other factors constant. The 95% CI for this effect ranged from 1.29 to 2.75, and the effect was statistically significant (p=0.0011). After reviewing the second trimester screen in the fetuses that were determined to have the CVI present by a majority of reviewers, the CVI remained visible in 11/25 (44%), a cavum vergae was identified in 8/25 (32%), a CVI + cavum vergae was visible in 1/25 (4%) and 5/25 (20%) no longer had a CVI visible.

Conclusion

Our study identified the CVI as the interhemispheric cyst-like midline structure in the suprathalamic region and determined its presence in 24% of normal fetuses between the 11th and 14th week of gestation. There is a statistically significant correlation between its presence and the fetal BPD and CRL. The CVI or a cavum vergae was visible in 80% of follow-up second trimester scans in these fetuses. As such, caution should be exercised when it is identified as it should be recognized as a physiologic structure and should not be a cause for undue parental anxiety. Larger longitudinal prospective studies, using CNS volumes, may further elucidate its natural progression.