EP 19.09. Assessment of fetal brain vascularization in fetuses affected by Late Onset Fetal Growth Restriction using Three-Dimensional power angiography
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Objectives
The aim of this study was to assess perfusion of different cerebral regions in normal fetuses and in those affected by fetal growth restriction (FGR) using 3D power Doppler angiography (3DPDA) comparing to Bi-Dimensional (2D) Velocimetry. 3D-PDA, in contrast to 2D method that measures the flow in a vessel, represents the perfusion in a voxel of tissue.

Methods
3D-PDA examinations were performed on 90 FGR pregnancies and 225 appropriate-for-gestational age (AGA) fetuses between 24 and 36 weeks of gestation. Three FGR fetuses groups were considered: Group 1: Late-onset FGR (GA>34 weeks) with normal 2D Doppler flow of umbilical artery (UA) and middle cerebral artery (MCA); Group 2: Early-onset FGR (GA<34 weeks) with abnormal UA pulsatility index (PI), normal MCA PI; Group 3: Early-onset FGR with abnormal 2D flow measurements both in UA than MCA. We proposed to scan 2 region of interest (ROI) of fetal brain using anatomical landmarks. Power Doppler signals from the fetal brain were recorded in the plane of section that traverses the third ventricle and thalami in the central portion of the brain. The cavum septi pellucidi (CSP) must be visible in the anterior portion of the brain and the tentorial hiatus in the posterior one. The calvaria was smooth and symmetric bilaterally. The first ROI (“Frontal Zone”), sprinkled mainly by anterior cerebral artery, was obtained tracing a contour passing through the anterior side of CSP surrounding part of the temporal and frontal bones. The second ROI (“Temporal Zone”), sprinkled by MCA, was that zone of the brain defined by a rectangle obtained tracing a contour from temporal bones including the width of CSP.

We studied the 3DPDA vascular indexes (VI=vascularization, FI=flow, VFI=vascularization and flow). We performed anterior cerebral artery (ACA) bidimensional velocimetry for all the fetuses studied.

Results
In early-onset FGR, 3DPDA showed increase of perfusion in temporal zone, compared to AGA fetuses, in both FGR groups with and without abnormal MCA 2D findings. In late-onset FGR vascularization assessed by 3DPDA was increased in the frontal region, while vascularity in the temporal one was decreased, comparing to AGA. Our data revealed a statistically significant correlation between increased blood flow demonstrated by 3D-PDA and vasodilatation of ACA revealed by bidimensional technique.

Conclusion
3DPDA revealed preferential increment in bloody supply to the temporal region in “early onset IUGR” (both with and without abnormal MCA 2D Velocimetry) demonstrating a “Temporal Brain Sparing”.
3DPDA recognized the “Frontal Brain Sparing” in “late onset IUGR” without any pathological 2D MCA velocimetry demonstrating a vascular redistribution with preferential increment in bloody supply to the frontal region in according with vasodilatation of ACA revealed by bidimensional technique. We can consider this increased frontal perfusion of fetal brain as the earliest adaptive response to brain hypoxia.