

of fetal deterioration. Abnormal DV flow patterns have been associated with adverse fetal outcomes and increased perinatal mortality. We describe pathological ductus venosus waveforms with intermittent reverse-flow in the presence of otherwise normal Doppler measurements in severely growth-restricted fetuses with normal echocardiography.

Methods: We performed repeated detailed fetal monitoring including Doppler and CTG in two cases with severe IUGR from 26 weeks of gestation onwards. Perinatal outcome was obtained in both cases.

Results: Fetal size was below the 3rd percentile (abdominal circumference) in both cases. There were no signs of fetal abnormalities and no chromosomal abnormalities. Doppler measurements revealed a markedly increased uterine resistance in both cases. However, umbilical artery and fetal arterial Doppler were normal at the beginning of the monitoring period. Computerized CTG analysis registered normal short-term variations. DV waveforms showed considerable variation in the pulsatility index including intermittent reverse flow during atrial contraction in the first case, and persistent reverse or zero flow during atrial contraction in the second case. Over the course of several weeks we observed a flattening of the fetal growth curve and arterial redistribution. In both cases elective Cesarean section was performed at 37 and 33 weeks of gestation with birth-weights of 1604 g and 690 g, respectively. The infants were admitted to the neonatal ICU for further management.

Conclusion: While we still strongly believe that the flow measurements of the ductus venosus are an important and useful indicator of the fetal situation, these cases are an example of rare exceptions in which the pathology of the DV should not be interpreted as a sign of fetal decompensation, if other fetal Doppler findings are contradictory.

P46.10 Changes in the ductus venosus in fetuses with growth restriction

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Objectives: To demonstrate differences in the diameter and pulsatility index (PI) of the ductus venosus (DV) and in the cerebroplacental ratio (CPR) in fetuses with intrauterine growth restriction (IUGR).

Methods: This was a cross-sectional cohort study at Thammasat University Hospital. At least three measurements were made in each fetus during fetal quiescence. The fetuses with IUGR were classified as a study group. Controls were matched by gestational age (GA). Abnormal DV diameter or PI was defined as greater than the 95th percentile for GA. Abnormal CPR defined as less than 1.08. All fetuses were compared with GA matched normal fetal Doppler studies.

Results: Thirty-three fetuses with IUGR were compared against 33 normal fetuses. There was significantly more abnormal DV diameter in the study group ($P = 0.01$). Of study group, 6/33 had abnormal DV diameter, while three of 33 had abnormal DV PI. There were 2/33 cases of abnormal CPR; all had both abnormal DV size and DV PI.

Conclusion: The tissue of the DV is likely sensitive to fetal cerebral oxygen content. Relative cerebral hypoxia in fetuses with IUGR results in a dilation of the DV which then increases the blood flow through the DV toward the fetal heart and head. These changes in the DV occur before abnormal CPR.

	Case	Control	P value†
Abnormal DV diameter	6/33 (18.18%)	0/95 (0%)	0.01*
Abnormal DV PI	3/33 (9.09%)	0/95 (0%)	0.076
Abnormal CPR	2/33 (6.06%)	0/95 (0%)	0.151

†, Chi-square test; *, ≤ 0.05 : significant

P46.11 Changes of the ductus venosus in intrauterine growth restriction fetuses during maternal hyperoxygenation

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Objectives: To demonstrate the changes of the ductus venosus (DV) pulsatility index (PI) and diameter in intrauterine growth restriction (IUGR) fetuses during maternal hyperoxygenation.

Methods: This was a cross-sectional study at Thammasat University Hospital, Thailand. At least three measurements were made in each fetus during fetal quiescence. Patients identified with an IUGR fetus ($< 10^{\text{th}}$ percentile) were evaluated before and during maternal hyperoxygenation (60% oxygen via face mask). Fetuses with structural heart disease or aneuploidy were excluded. Measurements included DV PI and diameter, umbilical artery (UA) and middle cerebral artery (MCA) PI. Abnormal DV diameter or PI was defined as greater than the 95th percentile for gestational age (GA). Abnormal MCA PI defined as lower than 5th percentile for GA.

Results: Eleven fetuses were identified, GA range from 31–39 weeks. By average, the DV diameter decreased 26.93% while three cases of abnormal DV PI did not change with maternal hyperoxygenation. Three cases of absent or reversed end diastolic (ARED) flow UA still had ARED. MCA PI, which had been abnormal in room air, normalized in one of three fetuses.

Conclusion: The diameter of the DV changes with maternal hyperoxygenation. The tissue of the DV is likely sensitive to fetal cerebral oxygen content and maternal hyperoxygenation. Relative cerebral hypoxia in fetuses with IUGR results in a dilation of the DV.

P46.12 Evaluation of the steroid effect on the placenta circulation with use of a new Doppler technique (Pixel-Flux) in cases of abnormal and normal fetal growth

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Objectives: To evaluate the betamethasone effect on the placenta circulation in cases of intrauterine growth retardation and cases of imminent premature labor, but normal fetal growth, with the use of a new Doppler technique.

Material: Five cases of IUGR and five cases with normal fetal growth at gestational ages 28–33 weeks.

Methods: Placenta perfusion measurement: Placenta perfusion is recorded under strictly standardized conditions. DICOM-color Doppler sonographic clips of 3 seconds duration are recorded in two sections orientated perpendicular to each other (sagittally and transversally) to cut the insertion site of the cord. Placenta perfusion is measured with a dedicated software (PixelFlux www.chameleon-software.de). This software calculates perfusion intensity as product of perfusion velocity and perfused area inside an anatomically predefined region of interest (ROI). Each pixel is assigned a momentary velocity value by comparison with the individual color scale and a momentary perfusion area value. The mean perfusion intensity of each single image is calculated then, encompassing the nonperfused area too. The software automatically detects beginning and end of a complete heart cycle to calculate the mean perfusion intensity of the ROI. Placenta is sliced into three horizontal layers: maternal, central and fetal section. Each section's perfusion is calculated. Unpublished results demonstrated significant perfusion

intensity differences between these layers. Measurements taken before and after betamethasone has been given.

Results and Conclusion: The study is ongoing. Results will be presented at the Congress.

P46.13

Effect of oral supplementation with nitric oxide donor on fetomaternal hemodynamic

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Introduction: NO is a potent vasodilator and antiplatelet agent in the human cardiovascular system. Strong evidence for the role of NO deficiency in pathogenesis of gestational hypertensive disorders as well fetal growth restriction resulted in attempts to use exogenous form of this molecule in treatment of above-mentioned pregnancy complications.

Material and methods: 202 women (mean age 27.96 ± 5.35 years) with pregnancies complicated by PIH and IUGR were randomly assigned to one of the following groups: 124 patients of study group, and 78 patients of control (placebo) group. Parallel to the standard antihypertensive therapy, patients from study group were administered orally 3g of L-arginine daily in three divided doses, whereas controls received placebo tablets. Fetal biometry, as well as Doppler blood flow velocimetry in uterine, umbilical and middle cerebral arteries was performed before, on the 1st day of therapy, in one week, and every two weeks until delivery. Result of measurements before treatment as well as the latest result before delivery were taken into considerations and compared.

Results: After oral L-arginine supplementation, in the study group there was a reduced incidence of abnormal umbilical artery blood flow (5.36% vs. 24.24% in placebo group, $P = 0.016$) and uterine artery early – diastolic notching (for right uterine artery: 19.64% vs. 47.06% in placebo group, $P = 0.008$; for left uterine artery: 19.64% vs. 41.18% in placebo group, $P = 0.03$), whereas no alterations in middle cerebral blood flow and uterine artery PI were observed.

Conclusions: Oral administration of L-arginine seems to be beneficial for fetoplacental circulation, but further studies are necessary to establish the influence of L-arginine on uterine artery blood flow. The fragmentary effect of L-arginine administration on uterine artery blood flow can be result of a too small dose of this substance used in study protocol.

P46.14

Fetal motor activity as a diagnostic tool in IUGR fetuses

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Objectives: Fetal motor activity is expression of SNC function. In this paper we studied if the GM were influenced from SNC compromise degree in IUGR fetuses.

Methods: Video recording of 30 fetuses come from normal pregnancies as a control group. Video recording of 30 IUGR fetuses as a study group, at the same gestational age. However, this method of evaluation of GM is independent from gestational age. These recordings were reviewed during afternoon session by the first two authors. During these sessions we evaluated general movements as defined by HFR Prechtl "GM involving the whole body. They may last for a few seconds to several minutes or longer; what is particular about them is the variable sequence of arm, leg, neck and trunk movements. They wax and wane in intensity, force and speed and they have a gradual beginning and end. The majority of sequence of flexion and extension movements of arm and leg is complex with superimposed rotations and often slight changes in direction of the movement. These additional components make the movements

fluent and elegant and create the impression of complexity and variability". In each GM we evaluated: sequence, length, intensity, complexity, start and the end. Following these parameters each GM was evaluated as normal or abnormal.

Results: The length of each general movement in control group was 2 minutes \pm 1 minute, in group of IUGR fetuses the length was 1 minute \pm 30 seconds. All fetuses in control group were considered normal as GM. In the IUGR fetuses group GM evaluation gave rise to a more gradual response. In fact, the quality of GM gradually worsen as the fetal conditions do. Also, we observed that in abnormal GM the most altered variable was length and intensity.

Conclusion: From our data we can show that fetal motor activity, as evaluated by ultrasound, is expression of SNC impairment that gradually worsen as the fetal conditions do.

P46.15

Clinical usefulness of fetal urine production in borderline oligohydramnios

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Objectives: Amniotic fluid index (AFI) is generally used to evaluate AF volume and to predict abnormal perinatal outcome. But its use is limited in both extreme sides, oligohydramnios and polyhydramnios. Particularly if AFI is within borderline range of oligohydramnios, its clinical meaning becomes more obscure. We undertook this study to compare usefulness of fetal urine production rate (UPR) with that of AFI in borderline oligohydramnios for prediction of abnormal perinatal outcome.

Methods: We enrolled 17 pregnant women with borderline oligohydramnios, which was defined as $5 \leq \text{AFI} \leq 10$. Fetal bladder volume was measured using a rotational method of VOCAL (Virtual Organ Computer-aided AnaLysis) with 3D ultrasound and fetal UPR was calculated from serial measurement of bladder volume. To adjust GA, each standard deviation ratio of UPR(UPR_SD) was calculated according to each GA. Previous published data from normal 154 pregnancies was used to get mean UPR and SD of UPR of each GA and each percentile value. (UPR_SD = (estimated UPR – mean UPR of each GA)/SD of UPR of each GA)

Results: Fetuses with decreased urine production had worse perinatal outcome in terms of low birth weight, Cesarean section rate for fetal distress. But comparing perinatal outcomes between cases with more decreased AFI ($5 \leq \text{AFI} < 8$) and those with less decreased AFI ($8 \leq \text{AFI} \leq 10$) did not show any significant difference.

	HFUPR_SD ≤ -1.0 (n = 3)	HFUPR_SD > -1.0 (n = 14)	P
GA at measurement (weeks, mean \pm SD)	35.6 \pm 3.2	37.8 \pm 2.4	0.287
GA at delivery (weeks, mean \pm SD)	36.0 \pm 3.2	39.4 \pm 1.3	0.090
Birth weight (g, mean \pm SD)	1706.7 \pm 652.4	3106.7 \pm 410.8	0.009
Cord ABGA at delivery (mean \pm SD)	7.246 \pm 0.036	7.271 \pm 0.048	0.347
C/S	2 (66.7%)	2 (16.7%)	0.154
C/S for fetal distress	2 (66.7%)	0 (0%)	0.029
1 min AS < 7	1 (33.3%)	0 (0%)	0.200
5 min AS < 7	0 (0%)	0 (0%)	
NICU Admission	2 (66.7%)	1 (8.3%)	0.081

Conclusions: Decreased fetal urine production is associated with adverse perinatal outcome, suggesting better clinical usefulness of fetal UPR than AFI in borderline oligohydramnios.