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The pattern of FHR-NHR around the perinatal stage reflects the prognosis of the neonates. But there have been so many technological difficulties to monitor heart rates seriously during the perinatal stage. By changing the place of negative pole of FECG electrode step by step before delivery, from fetal head, maternal thigh to fetal back, noises could be decreased. After delivery NECG was monitored by telemeter for about 1 hour. We studied in 68 cases, 60 cases in nondistressed conditions and 8 in distressed conditions.

The typical patterns of normal cases are following. Just before birth the FHR-baseline decreased but the baseline variability was present and after birth the NHR achieved peaks of approximately 180 bpm with first crying, then recovered gradually within 1 hour to the level of FHR-baseline.

On the contrary, distressed cases remarkably decreased the baseline variability just before birth and the surge pattern of NHR could not be developed just after delivery.

4 of 8 distressed cases showed these abnormal findings, and the others were in normal patterns.

Decreasing the FHR-variability especially just before birth and the lack of the surge pattern just after birth means the poor reserve of fetus and poor prognosis of the neonates.

# 222. M-mode Echocardiographic Assessment of Human Fetal Right Ventricle

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M-mode echocardiographic evaluations of right ventricular function in 86 human fetuses at 20 to 41 weeks of gestation were carried out on pregnant women with a regular menstrual cycle and no complications of pregnancy. Right ventricular diastolic dimension (RVDd), right ventricular systolic dimension (RVDs), right ventricular fractional shortening (RVFS), the ratios of RVDd to left ventricular diastolic dimension (RVDd/LVDd), RVDs to left ventricular systolic dimension (RVDs/LVDs), and RVFS left ventricular fractional to shortening (RVFS/LVFS) were assessed.

RVDd correlated well with the gestational age (r=0.76, p<0.001), as did RVDs (r=0.71, p<0.001). A negative correlation between RVFS and gestational age was evident (r=-0.37, 0.001<p<0.005). The inci-

dence of ratios 1 or over 1 was about 50%, particularly in case of paradoxical interventricular septal motions over 50%. Therefore, the right ventricular function of the fetal heart in utero may be more dominant than the left.

# 223. Human Fetal Systolic Time Intervals with Fetal Ultrasound Cardiogram and Electrocardiogram

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M-mode echocardiographic and electrocardiographic studies were carried out on 115 randomly chosen human fetuses in utero, ranging from 21 to 41 weeks of gestation. The objective was to determine the systolic time intervals (STI). Pre-ejection periods measured with the motion of aortic valves (PEPAo) were  $60.3 \pm 11.3$  ms, and these same periods measured with the motion of left ventricular wall (PEPvw) were  $61.8 \pm 8.9$  ms. Ventricular ejection times measured with the motion of aortic valves (VETAo) were  $168.7 \pm 14.3$  ms. The pre-ejection periods (PEPpv) and ventricular ejection times (VETpv) measured with the motion of pulmonary valves were 52.2 ms, and 171.6 ms, respectively. RTc intervals assessed according to the motion of tricuspid valves (RTc) were  $24.8 \pm 13.5$  ms, and RMc intervals measured with the motion of mitral valves (RMc) 18.2 ± 8.4 ms. Isometric contraction times (ICT) of the left ventricle were 29.3  $\pm$  11.4 ms, and ICT of the right ventricle 26.8 ms. In this study, the STI from the abnormal pregnancies were discussed.

# 224. The Fetal Systolic Time Intervals as an Indicator of Fetal Hemodynamics

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The fetal systolic time intervals (fetal STIs) were studied based on 126 antepartum and 50 intrapartum fetuses by means of noninvasive technique which is the fetal STIs monitoring system developed by us. The results were as follows: 2160

The duration of electro-mechanical delay (EMD), isometric contraction time (ICT), pre-ejection period (PEP), and PEP/VET were prolonged with advance of fetal age. On the other hand, the duration of ventricular ejection time (VET) was shortened. When observed on FHR-baseline alone, the PEP and VET were almost constant. The duration of VET had negative correlation with fetal heart rate. Patterns of PEP prolongation and VET shortening were observed at the time of FHR-acceleration and variable deceleration. Another pattern was also observed at the time of variable deceleration, that is PEP prolongation and VET prolongation immediately after shortening.

These results suggest that there may be the functional adaptation mechanism of cardio-vascular system with progress of fetal growth and by conditions. By analyzing the fetal STIs, the interpretation of fetal hemodynamics will be clearer in near future.

# 225. Study of Perinatal Fetal and Neonatal Left Ventricular Function by Ultrasound Cardiogram

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We investigated fetal cardiographies of 96 cases at 29-42 weeks' pregnancy, obtained by real-timedirected M-mode (TOHIBA SSL-53M). The left ventricular stroke volume (SV) was calculated from the left ventricular echogram by Pombo's method. Then we investigated the relationship of birthweight with ventricular stroke volume, biparietal diameter (BPD), fetal cardiac transverse diameter (FCTD) and cardiac output (CO). We also investigated the changes between prenatal and postnatal stroke volume. Relationship between birthweight and stroke volume showed the best correlation: y=1.26 + 434.20, r=0.88. Estimated birthweight calculated by SV showed the lowest mean value of errors, 208 + 166 g., among BPD, FCTD, SV and CO. And we found the tendency that lower weight group was overestimated and heavier weight group was underestimated. The relationship between fetal and neonatal ventricular stroke volume revealed the regression line: y=1.27x +390.81, r=0.49. It suggested that postnatal ventricular stroke volume increased about 1.3 times as large as prenatal stroke volume.

### 226. A Fundamental Study on Fetal Circulation by Pulsed Doppler System

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In order to estimate the dynamics of fetal circulation system, we performed blood flow study on the fetal abdominal aorta with pulsed doppler system. Study was done on 31 fetus of 25 to 40 gestation including 2 cases of intrauterine growth retardation (IUGR). Estimated flow volume was determined as a product of an integra of mode velocity upon time and a lumen area.

Max velocity and estimated flow volume were plotted against gestational week. Max velocity had no clear pattern of change before 34 weeks, ranging from 60 to 80 cm/sec, after which it increased stepwise, ranging from 100 to 120 cm/sec. Estimated flow volume increased from 100 to 500 ml/min along with gestational weeks from 25 to 40 week. Correlation coefficient was 0.749. A significant deviation was not observed with our cases of IUGR.

In this series we experienced a case in which flow volume per minite decreased while FHR short term variability had disappeared and late deceleration had appeared. This case was finally diagnosed as a fetal destrees and the cesarian section was done succeedingly.

It was concluded that flow volume yield to the index of estimating the fetal wellbeing.

# 227. Dynamics of Feto-placental Blood Flow in the 3rd Trimester and Intrapartum —Associated with Uterin Contraction and FBMs—

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With a Pulsed Doppler ultrasound, observing realtime B-mode at once, we have measured feto-placental blood flow in several vessels, Ascending Aorta, Pulmonary Artery, Descending Aorta, Carotid Artery, Arteria Cerebri Anterior, Basilar Artery, Superior Vena Cava, Inferior Vena Cava, Umbirical Cord Vein, Umbirical Cord Artery, and Umbirical