

Role of a Fetal Ultrasound Clinic in Promoting Multidisciplinary and Inter-Facility Perinatal Care

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Background: With the increasing rate of high-risk pregnancies, there is an increased need for early evaluation of at-risk fetuses. Fetal ultrasound imaging has become a pivotal part of this evaluation.

Methods: To evaluate the role played by a fetal ultrasound clinic in promoting comprehensive perinatal care of patients with high-risk pregnancies, we retrospectively analyzed the indications and findings of fetal scans and the outcomes of the examined fetuses collected over the past 7 years (2014-2020) by our institute, which is reorganized as a perinatal medical center.

Results: During the study period, we conducted 345 fetal scans in high-risk pregnancy cases. Of these, 158 cases (46%) were referrals from other institutes. Eighty-nine neonates were admitted to our neonatal intensive care unit (NICU) after being evaluated, of which 10 neonates underwent surgery during their NICU stays. Thirty-nine pregnant women were referred to other tertiary care hospitals mainly due to fetal diagnoses with complex cardiac anomalies. Fourteen cases resulted in intrauterine fetal death or artificial abortion.

Conclusions: Fetal ultrasound clinics have established their role in facilitating sophisticated regional perinatal care via multidisciplinary and inter-facility cooperation for high-risk pregnancy cases. In addition, providing psychological support and counseling for pregnant women whose fetuses are diagnosed with severe congenital anomalies should not be neglected. (J Nippon Med Sch 2022; 89: 337-341)

Key words: fetal ultrasound, prenatal diagnosis, multidisciplinary perinatal care

Introduction

The number of high-risk neonates has been increasing with the advancing age of pregnant women in Japan¹. Detecting and evaluating the risks of these neonates before birth is beneficial for their survival and prognosis as this allows the obstetric and neonatal departments to reach to a consensus in advance, thereby facilitating the strategies of pregnancy management, optimal timing, mode of delivery, and neonatal care.

Fetal ultrasound imaging has become an integral part of routine obstetric practice². Significant advances in tech-

nologies, such as image resolution and blood flow analysis, have enabled us to precisely evaluate not only fetal structural abnormalities but also impaired physiological statuses. In cases where a fetus has a complicated problem, such as a surgical anomaly or abnormal intrauterine growth, multidisciplinary medical specialists should be involved. However, it is not always possible to totally manage these fetuses throughout their perinatal periods in a single hospital. Therefore, interhospital cooperation based on prenatal assessment along with the input of multidisciplinary specialists is crucial for appropriate pa-

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tient care^{3,4}.

In response to the growing number of high-risk pregnancy cases, our institute reorganized its departments to become one of the regional perinatal medical centers in Kanagawa prefecture by establishing both neonatal medicine and pediatric surgery facilities⁵. At our neonatal intensive care unit (NICU), we take care of early preterm infants (less than 28 weeks of gestation), including those with surgical problems. Nevertheless, we have to transfer infants with complex cardiac anomalies or neurosurgical disorders to other tertiary care facilities, where extensively specialized treatments are possible. Prenatal diagnosis of these infants has become an urgent need for our institute, being a regional perinatal medical center.

For the abovementioned reasons, our institute established a fetal ultrasound clinic for detecting high-risk pregnancy cases. A regional perinatal medical center was also opened where the departments of neonatal medicine, obstetrics, pediatric surgery, and general pediatrics could cooperate.

In this study, we reviewed our experience as a fetal ultrasound clinic for high-risk pregnancies and discussed the impact of such a practice on comprehensive perinatal care.

Subjects and Methods

A retrospective cohort study was carried out after obtaining approval from the Institutional Review Board at Nippon Medical School Musashikosugi Hospital (Approval Number: 513-31-42). We analyzed the indications of the fetal scans, evaluated the findings, and assessed the fetal outcomes from the prenatal medical records of pregnant women examined since the establishment of the fetal ultrasound clinic (from 2014 through 2020). At our institute, an obstetric doctor-in-charge of the regular outpatient check-up performed primary screening fetal scans and selected cases requiring closer examination for secondary, targeted fetal scans. In the secondary targeted fetal scans, neonatologists always participated, and also pediatric surgeons as needed. Cases referred from other institutions were also included. Indications of secondary targeted fetal scans, including abnormal or suspected abnormal fetal images, abnormal fetal growth or amniotic fluid volume, and history of adverse outcomes in a previous pregnancy or maternal disease, were categorized and analyzed. Structural fetal abnormality, when confirmed, was classified according to the detection site: craniofacial-cervical, thoracic, abdominal, or limb-skeletal. The outcomes of the fetus were divided and

analyzed as follows: admission to our NICU after being born in the obstetric department, referrals to other tertiary care hospitals, and cases of intrauterine fetal demise or artificial abortion.

Results

During the study period, a total of 345 pregnant women were examined at our fetal ultrasound clinic, each selected after a primary screening scan. Of these, 158 (46%) women were referred to our institute from other clinics or hospitals. The indications of the secondary targeted fetal scans were classified as abnormal or suspected abnormal fetal images for 181 cases, abnormal fetal growth or amniotic fluid volume for 125 cases, and history of adverse outcomes in a previous pregnancy or maternal disease for 39 cases. **Figure 1** illustrates the trends observed in the number of secondary targeted fetal scans. The following number of abnormalities were seen: 31 in craniofacial-cervical site, 60 in thoracic site, 50 in abdominal site, 9 in limbs-skeletal, and 14 in a combination of these sites, as shown in **Figure 2**. Neonatologists assess the medical urgency of the neonate immediately after birth and determine the management plan through a multidisciplinary team. Eighty-nine neonates were admitted directly to our NICU after being born in the obstetric department. Of these 89 neonates, 41 neonates had congenital anomalies with or without surgical problems, 39 neonates were preterm low birth weight infants, and 9 neonates suffered from both conditions. Ten neonates underwent surgical intervention during their NICU stays; five had atresia of the alimentary tract, two had massive chylothorax, one had meconium peritonitis, one had a giant ovarian cyst, and one had lymphangioma. Thirty-nine pregnant women (11% of all referral cases) were referred to other tertiary care hospitals because their fetuses were suspected of having complicated problems. Of these problems, complex cardiac anomaly was the leading diagnosis, followed by neurosurgical disorders (**Table 1**).

Fourteen cases, including four cases of severe fetal growth restriction, three of verified trisomy-18 by amniocentesis, two of anencephaly, two of fetal hydrops, one of pulmonary hypoplasia with renal agenesis, one of severe skeletal deformity, and one of congenital complete heart block, resulted in intrauterine fetal demise or artificial abortion at our institute.

We failed to detect 19 neonates with congenital anomalies among the high-risk pregnancies conducted secondary targeted fetal scans during the study period. The di-

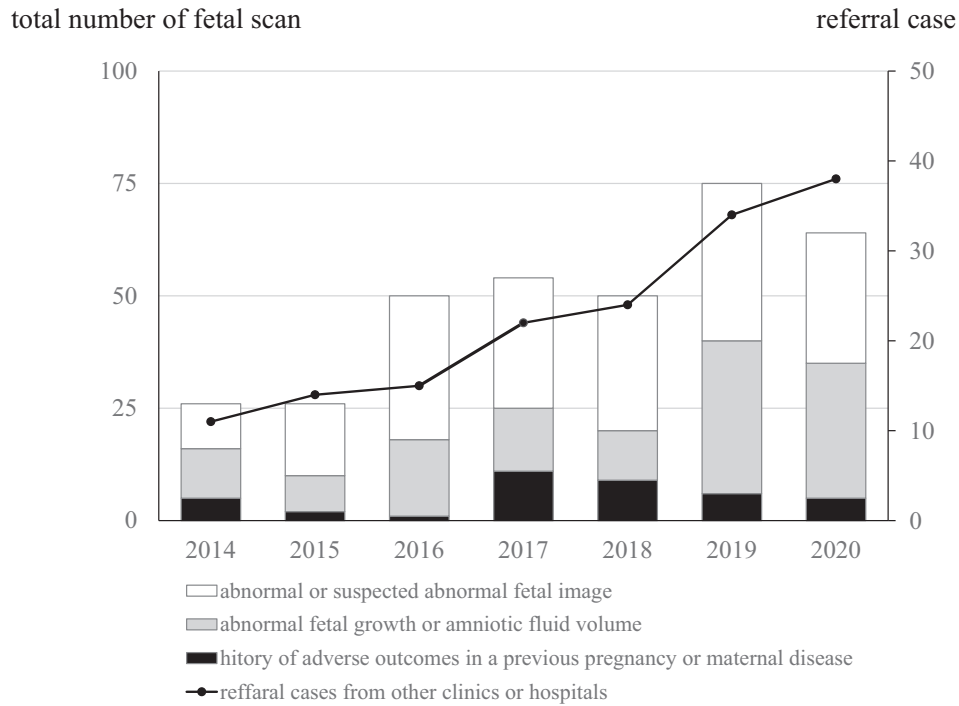


Fig. 1 Trends in the number of the fetal scan

Increasing trend in the number of fetal scans per year, particularly in referral cases from other clinics or hospitals. The indications of the fetal scan are color-coded in each column: abnormal or suspected abnormal fetal image in white, abnormal fetal growth or amniotic fluid volume in grey, and history of adverse outcomes in a previous pregnancy or maternal disease in black.

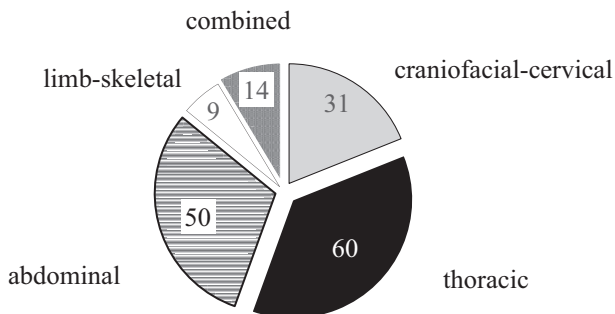


Fig. 2 Detection site of fetal structural abnormality. Each pie chart indicates the detection site of the findings. The number of cases is shown in each pie.

Discussion

The number of secondary targeted fetal scans has increased each year since the fetal ultrasound clinic was established at our institute, especially in cases referred from other clinics or hospitals (Fig. 1). The results of this study indicate that obstetric practitioners in our region shared awareness regarding high-risk pregnancies. An abnormal or suspected abnormal fetal image was the leading cause of referral to the fetal ultrasound clinic. However, abnormal fetal growth was reaffirmed as an equally prominent indication for referrals as this condition is closely related to preterm and low birth weight infancy. Indeed, 48 neonates (54% of all who were admitted to the NICU) were preterm or low birth weight infants, as evaluated at the fetal ultrasound clinic. Eleven of these 48 infants weighed less than 1,500 g at birth and were born via medically-indicated preterm birth due to the arrest of fetal growth or maternal hypertensive disorder. The ability of the obstetric and neonatal departments to reach prior consensus on case management policies allowed for prompt and smooth initiation of specialized care for these premature neonates, contributing to their favorable outcomes.

Prenatal detection of surgical anomalies is advanta-

agnoses revealed after birth were as follows; six had trisomy-21, five had small VSD (less than 3 mm), two had imperforate anus, two had hypospadias, two had craniosynostosis, one had total anomalous of the pulmonary venous return, and one had biliary atresia. We assessed the accuracy of all abnormal or suspected abnormal fetal findings by neonatal physical examination, laboratory tests, operative findings in case of a surgical anomaly and provided feedback to each specialist.

Table 1 Fetal diagnosis in the case referred to other tertiary care hospitals

Diagnostic category	Fetal diagnosis
Complex CHDs (21)	Single ventricle associated anomalies (8) CoA/IAA complex (4), TGA (3) VSD with imbalanced outflow tracts (4) Cardiac tumor (2)
Neurosurgical disorders (6)	Isolated hydrocephalus (3), Myelomeningocele (3)
Lung anomalies (4)	Congenital diaphragmatic hernia (2) Congenital pulmonary airway malformation (2)
Others (8)	Twin-to-twin transfusion syndrome (2) Short limbs with skeletal deformities (2) Requests from the family member (4)

CHD (congenital heart disease); CoA (coarctation of the aorta); IAA (interrupted aortic arch); TGA (transposition of the great arteries)

geous in complex therapeutic interventions as it can help medical professionals to avoid disturbing transitional physiology and stabilize preoperative conditions^{6,7}. Neonates with surgical anomalies are likely to be associated with unstable physiology, necessitating respiratory support and body fluid balance correction. In these cases, it is crucial to schedule an elaborate plan, including arranging NICU beds, medical staff, and special devices as needed, from birth to the date of surgical intervention, before any symptoms progress. Our team carried out the plan in satisfaction for all 10 neonates who underwent surgery during our NICU stay based on fetal ultrasound evaluations. For the same reasons, pregnant women diagnosed with a fetal complex cardiac anomaly or a neurosurgical disorder were referred to other tertiary care hospitals because more large-scale medical resources than those available at our institute would be necessary for these fetuses around the times of their births (Table 1). In particular, neonates with complex cardiac anomalies are highly likely to manifest hemodynamic derangement immediately after birth. Therefore, the advantage of prenatal diagnosis has been documented to improve pre-surgical mortality and reduce the risks associated with transport after birth⁸⁻¹⁰. Assessments carried out at our fetal ultrasound clinic have contributed to an inter-facility collaboration for the comprehensive treatment of neonates with cardiac anomalies, which is the most prevalent fetal malformation and a leading cause of mortality and morbidity in infancy.

The establishment of a fetal ultrasound clinic has enabled us to provide highly sophisticated perinatal medical care. However, due to the possibility of early detection of life-limiting, severe congenital anomalies, we have come to face difficult decisions of whether pregnancies

should be continued or terminated. In this study, 14 fetuses corresponded to this category. In general, many pregnant women experience a feeling of stress or anxiety in receiving prenatal testing, regardless of the results. Therefore, when abnormal findings are confirmed, we must pay the closest attention to all family members around the fetus and provide an overview of clinical course, psychological support, and genetic counseling¹¹⁻¹³. Clinical psychologists, preferably those who are specialized in perinatal care, should be involved in the team member and expected to play a central role.

In conclusion, the need for a fetal ultrasound clinic has increased by the year. Since its establishment, our clinic has facilitated interfacility cooperation and has contributed to sophisticated perinatal care, integrating specialists from different fields. At the same time, life-limiting, severe congenital anomalies can be detected in early pregnancy due to advances in medical technologies. In addition, providing counseling and psychological support for pregnant women and their family members should not be neglected.

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Conflict of Interest: The authors have no conflicts of interest to declare.

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