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Twin pregnancy complicated by total placenta previa in a Fontan-palliated patient: A case report

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ABSTRACT

We present a case of a twin pregnancy in a Fontan-palliated woman that was complicated by total placenta previa. The patient was diagnosed with tricuspid atresia type II, and underwent the Fontan operation at 11 years of age. At 32 years of age, she was shown to have a dichorionic diamniotic twin pregnancy. A placenta previa was also noted. At 26 weeks' gestation, she had difficulty breathing, cardiomegaly, and worsening mitral regurgitation. At 29 weeks' gestation, an emergency cesarean section was performed, as the patient had massive genital bleeding. A postoperative cardiac catheterization demonstrated a leak from the lateral tunnel to the atrium, which was considered a cause of hypoxemia during the peripartum period. The cardiac workload in a twin pregnancy is greater, which places a Fontan-palliated patient at increased risk. Careful follow-up monitoring with multidisciplinary expertise is recommended.

1. Introduction

The Fontan operation is performed to provide palliation for patients with several forms of complex congenital heart disease characterized by a single functional ventricle. Increasing numbers of women who have undergone the Fontan operation in childhood are now reaching reproductive age and becoming pregnant; however, nearly all of the knowledge regarding the pregnancy-related risks of such women is based on reports of singleton pregnancies, and reports on twin pregnancies are scarce. Here, we present a case of a twin pregnancy in a Fontan-palliated woman.

2. Case

A 32-year-old primigravida woman was referred to us at 6 weeks' gestation with a dichorionic diamniotic (DD) pregnancy following ovulation induction with clomiphene citrate. The patient had congenital cyanotic heart disease, and the diagnosis of tricuspid atresia type II was confirmed at 2 years of age. When she was 9 years of age a central shunt was placed, and at 11 years of age she underwent the Fontan operation with an arterial septal defect enlargement (lateral tunnel). The morphologic left ventricle was the systemic ventricle. Postoperatively, she had stable cardiac function, and the left ventricular ejection fraction (EF) was >60%. She was prescribed warfarin, imidapril, and carvedilol. At 23 years of age, she married. At 24 years of age, a lateral tunnel leak and left pulmonary stenosis were noted (SpO_2 = 96%), and percutaneous balloon dilatation was successfully performed. After surgery, the patient was classified as New York Heart Association (NYHA) class I, and she could engage in household work without any difficulty. She did not have an atrial arrhythmia, and the preconception brain natriuretic peptide (BNP) level was 25.6 pg/mL. Pregnancy was not achieved with spontaneous ovulation; therefore, assisted infertility treatment using clomiphene citrate was used (the Japanese health insurance system does not currently recognize the use of metformin alone as an indication for ovulation induction).

On referral, the physical examination revealed a regular heart rate of 86 beats per minute, a blood pressure of 106/74 mmHg, and an oxygen saturation of 96%. There was normal jugular venous pressure, no peripheral edema, and good peripheral pulses. Echocardiography showed a single left ventricle (53.8 mm end-diastolic diameter) and preserved EF of 60.1%. First-degree mitral valve regurgitation (MR) was noted. Both atria communicated *via* a large atrial septal defect (18.1 mm). At 6 weeks' gestation, imidapril was discontinued, and warfarin was substituted for low-dose heparin by subcutaneous injection. After we carefully explained to her and her family the possible risks of cardiovascular deterioration, the patient wished to continue the pregnancy.

At 22 weeks' gestation, she was admitted, and low-dose heparin, administered by subcutaneous injection, was substituted for a continuous intravenous infusion for ease of dosing. Thereafter, the dose of the continuous intravenous infusion of heparin was adjusted to maintain an activated partial thromboplastin time that was 1.5–2.0 times the control

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value. At 26 weeks' gestation, she complained of difficulty in breathing. A blood gas analysis revealed a SaO_2 of 92. Echocardiography showed that the MR had worsened (from 1st to 2nd degree). The EF was preserved at 54.1%. A chest X-ray revealed cardiomegaly with a cardiothoracic ratio of 55% (Fig. 1). A diuretic (20 mg/day) and oxygen (2 l/min) were started. The hemoglobin level was 10.3 g/dl, and so packed red cells were transfused. Treatment afforded temporary relief of symptoms. Despite concerns about failure of maternal circulatory adaptation to the considerable hemodynamic changes in the twin pregnancy, we did not recommend cesarean delivery, because of the extreme prematurity. The placenta was above the internal os, suggesting placenta previa (Fig. 2). From 28 weeks of gestation, the patient had intermittent bleeding with uterine contractions. At 29^{+1} weeks' gestation, she suddenly had massive genital bleeding. After discontinuing the heparin, a cesarean section was performed. The first twin was a female weighing 1010 g; the second twin was a female weighing 980 g. The placenta was delivered intact. The total amount of blood loss during the operation was estimated at 1480 ml. The postnatal course for both twins was good, and they were discharged from hospital 82 days after delivery.

On the third post-operative day, warfarin was resumed. As the patient subsequently experienced difficulty breathing and weight gain, the diuretic dose was increased to 40 mg/day. Supplemental oxygen was required due to exertional breathlessness and a saturation level of 91%. Domiciliary oxygen therapy was applied to counter her low oxygen saturation, and the patient was discharged from hospital on the 30th post-operative day. On the 50th post-operative day, echocardiography revealed a worsening EF, of 49.9%, and third-degree MR. Cardiac catheterization demonstrated a leak from the lateral tunnel to the atrium, which was considered to be a cause of hypoxemia during the peripartum period. At the time of writing, five months since the surgery, the patient had already withdrawn from domiciliary oxygen therapy.

3. Discussion

Until recently, data on the perinatal risk of Fontan-palliated patients had been derived from anecdotal case reports or small case series; however, the perinatal outcomes of pregnancies for comparatively large numbers of women with a Fontan circulation have now been reported [1–4]. Although data are still limited, women with a Fontan circulation are deemed to be at a significantly increased risk of obstetric and cardiovascular complications. The most significant complication in pregnancies with a Fontan circulation is premature delivery [1–4]. Some premature deliveries are caused by spontaneous onset of labor, and some are artificially introduced after cardiovascular events. The two most commonly reported cardiac complications are atrial arrhythmia and decline in ventricular function [1]. In addition, hematologic complications, including thromboembolic/hemorrhagic events, are also a matter of concern [1,5]. Most of our knowledge regarding the pregnancy-related risks of women with a Fontan circulation is based on reports of singleton pregnancies, and reports of twin pregnancies are rare.

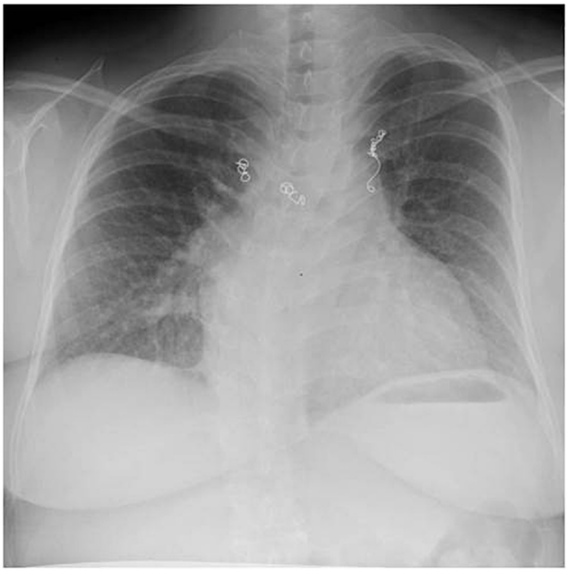

Fig. 1. Chest X-ray at 26 weeks of gestation showing cardiomegaly and enhancement of pulmonary vascular shadow.

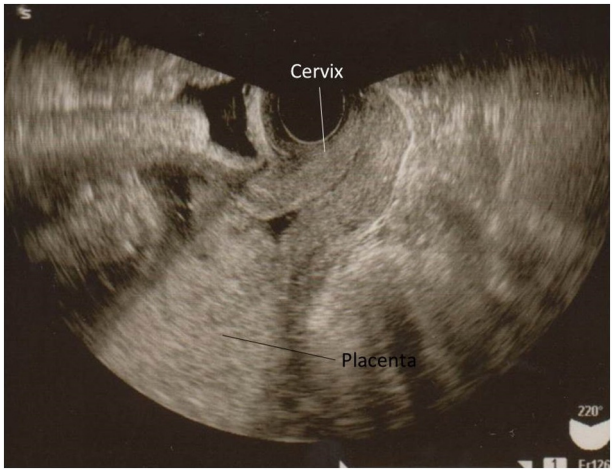

Fig. 2. Transvaginal sonographic image at 26 weeks of gestation showing the placenta located above the internal os.

Pregnancy places a high physiologic demand on the cardiovascular system. In normal singleton pregnancies, cardiac output continues to increase until mid-pregnancy, when the cardiac output is 45% higher than in non-pregnant women [6,7]. The cardiac workload in a twin pregnancy is known to be greater, and the cardiac output in a twin pregnancy is reported to be 15% higher throughout pregnancy [8,9]. These changes are well-tolerated in healthy women; however, a Fontan-palliated patient is dependent on venous return and the ability to increase the stroke volume is limited. Thus, the main question regarding a post-Fontan woman with a twin gestation is the ability of the univentricular heart to tolerate the hemodynamic changes during pregnancy. Indeed, the approval guide for pregnancy in women with a Fontan circulation includes NYHA class I or II functional status, sinus rhythm, and no or only slight cyanosis [10]; however, particular risks in twin pregnancies are not taken into consideration. Only 4 cases of twin pregnancies in women with a Fontan circulation have been reported. Among the 4 cases, 2 were described in detail as case reports [11,12], and 2 were included in research articles where detailed information on clinical course was lacking [1,4]. In a case reported by Nair et al., the patient had significant deterioration in cardiovascular function at 33 weeks' gestation, necessitating emergency cesarean section [11]. Nir et al. reported a case involving a patient who complained of shortness of breath after climbing two flights of stairs (functional class II) at 30 weeks' gestation [12]. A woman with a Fontan circulation and a twin pregnancy seems to be at extremely high risk.

In our patient, cardiac function did not recover sufficiently postpartum. A leak from the lateral tunnel to the atrium contributed to the clinical course. Furthermore, the time interval between the initial development of subjective symptoms and delivery was 3 weeks, which likely aggravated cardiac function. Generally, in the management of pregnancies in Fontan-palliated patients, the left ventricular EF on echocardiography, serum BNP level, and chest X-ray findings serve as markers of cardiac function. In addition, subjective symptoms, such as effort dyspnea and general fatigue, are also predictive of cardiac insufficiency. Our patient also had an echocardiographic examination and

chest X-ray every 2 weeks. When subjective symptoms developed, echocardiography revealed that MR had worsened, and mild cardiomegaly was noted; however, due to concerns regarding prematurity, the pregnancy was continued, with administration of oxygen and a diuretic, and a blood transfusion. On the 50th post-operative day, the patient was shown to have a declining EF on echocardiography, and hypoxia. Cardiac catheterization showed a leak from the lateral tunnel to the atrium. This leak was initially demonstrated 7 years before the pregnancy; however, it was not then accompanied by hypoxia. We speculate that the volume overload resulting from the twin pregnancy resulted in an increase in venous pressure and an increase in the shunt flow from right to left, which promoted hypoxia. The intrinsic risk in a twin pregnancy in a Fontan-palliated patient was reaffirmed. Fetal reduction is not legal in Japan; however, this may be an option in some countries. Furthermore, although the termination of pregnancy for Fontan patients during the 2nd trimester is associated with high risks, we believe that this option should be considered for some extremely high-risk patients.

Infertility is frequently observed in women after Fontan palliation [1,13]. This is attributed to the combination of chronic hypoxemia before and chronic venous congestion after palliation, which results in ovarian dysfunction. In the analysis by Gouton et al. [1], 6 of 29 patients (21%) were diagnosed with infertility and required ovulation stimulation or *in vitro* fertilization. The evidence shows that infertility treatment using clomiphene citrate contributes significantly to the incidence of multiple gestation [14]. The risk of placenta previa is increased in pregnancies conceived by assisted reproduction technology (ART) [15]. Multiple gestation and placenta previa are management challenges, especially for women after Fontan palliation. ART for women with Fontan palliation should be performed with caution, after proper counseling about the risks.

Contributors

Aoi Morita participated in acquisition of data and drafted the article.

Saki Kido was involved in patient management.

Masahiro Hachisuga was involved in patient management.

Hazumu Nagata assisted in the management for the patient as a specialized cardiologist.

Nobuhiro Hidaka participated in critical revision of the article for important intellectual content.

Kiyoko Kato participated in critical revision of the article for important intellectual content.

All authors saw and approved the final version.

Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this case report.

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Provenance and Peer Review

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