

Case Report

Pregnancy and maternal uncorrected tetralogy of Fallot: A case report and review of the literature

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Abstract

Tetralogy of Fallot (TOF) is the most common congenital heart defect associated with systemic cyanosis. During pregnancy and delivery, dramatic alterations in cardiovascular physiology occurred. Pregnancy in women with unrepaired TOF may have a worsening in right to left shunt with an increase of the cyanosis and may imply an elevated risk of maternal and fetal morbidity and even mortality.

We report and discuss a case of a 26 years old woman with uncorrected TOF. A multidisciplinary team was involved in the management of the case with the aim to minimize maternal and fetal complications. One of the main endpoint was to maintain an adequate oxygen saturation and good haemoglobin levels. A caesarean section was performed at 30 weeks and 5 days of gestation without any maternal or fetal complications. During the puerperium, the woman had an embolic occlusion of the right middle cerebral artery with any sequelae.

Key words:

Delivery, erythropoietin, heart diseases, high risk pregnancy, maternal tetralogy of Fallot,

Introduction

Tetralogy of Fallot (TOF) represents around the 6% of the congenital heart disease and it is the most common congenital cardiovascular defect associated with systemic cyanosis. The syndrome is caused by a single developmental defect, due to an abnormal anterior and cephalad displacement of the infundibular part of the interventricular septum in its infundibular portion. Four anomalies arise from this alteration: pulmonary stenosis, right ventricular hypertrophy, overriding aorta and nonrestrictive ventricular septum defect [1]. With the last advances in reparative cardiovascular surgery, prognosis of the women with corrected TOF definitely improves and they now survive until their

childbearing age (94% up to the age of 20 years and 85% up to the age of 36 years) [1]. Although the excellent reported prognosis and the good quality of life, some late complications, still occur. Otherwise, natural survival without any surgical correction into the fourth decade is extremely rare (about 3%), but there is a tendency of increasing number of women with cyanotic congenital heart disease living 3 to 4 decades and becoming pregnant [2,3]. As largely described, during pregnancy, there are many physiologic cardiovascular changes. Systemic vascular resistance decreases, resulting in a fall of the blood pressure, plasma and erythrocyte volume grow, cardiac output enhances secondary to the increased heart rate, the stroke volume and the left ventricular hypertrophy (Figure 1) [4,5]. All of the processes described above could be dramatic for women with a cardiovascular disease. Maternal risk assessment in women with cardiovascular disease should be performed according to the modified World Health Organization (WHO) classification. In agreement with the WHO classification, the repaired TOF is ranked in class II and

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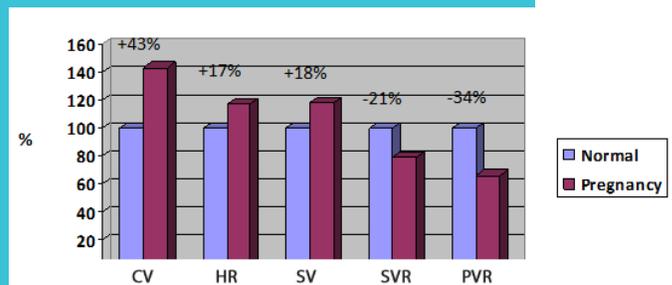
the cyanotic unrepaired heart diseases in class III. Pregnancy in unrepaired TOF carries major risks of maternal morbidity (60%), including heart failure, arrhythmia and endocarditis, and even maternal mortality (10%) [5,6]. Women with uncorrected TOF and cyanosis, oxygen saturation < 80%, have an increased risk of miscarriage, fetal growth restriction, fetal loss and thromboembolism, secondary to the reactive polycythemia. Their chance of a live birth has been quoted to be less than 20% [7]. In these patients, as a result of the fall in peripheral vascular resistance that occurs during a normal pregnancy, there may be an increase in right to left shunt, with subsequent worsening of the cyanosis. Delivery is indeed problematic since the blood loss associated with the process may induce hypotension and eventually exacerbate the shunt [7]. Risks are particularly high when the average systemic oxygen saturation falls below 80-85% [2].

Case presentation

A 26 years old Romanian woman with uncorrected TOF was referred to the division of Obstetrics and Gynecology of the Mauriziano Hospital of Turin (Italy) at 26 weeks and 2 days of gestation. She suffers from congenital TOF that was not repaired in the childhood. In the past, she was treated for pulmonary tuberculosis. In 2009, she had a vaginal delivery of an alive baby at 27 weeks of gestational age without any complications. In 2012, she required an abortion during the first trimester. In 2012, she underwent palliative intervention of cardio-vascular surgery for making a systemic-pulmonary shunt. Postoperative complications of acute liver failure, cardiac tamponade with cardiac arrest and post-anoxic coma followed the surgery without any sequelae. After the procedure, she was living with continuous oxygen therapy (3 liters per minute) and an average oxygen saturation of 86%. At hospital admission, she complained with severe dyspnea, although oxygen therapy (8 liters per minute). A multidisciplinary team, including anesthesiologists, cardiologists, pulmonologists, heart surgeons, obstetrics and pediatricians, visited the woman. The oxygen saturation at hospitalization was 80%, the blood gas analysis showed a pH of 7,39, a pCO₂ of 31,6 mmHg, a pO₂ of 45 mmHg and a HCO₃-of 18,9 mEq/l. Hemoglobin was 13,2 g/dl and hemato-

crit was 40 %, general blood values resulted normal. The maternal echocardiogram showed that the aorto-pulmonary shunt was closed and the dilatation of the ascending aorta of 45 mm. Heart failure was classified as NYHA (New York Heart Association) III-IV. Fetal ultrasonographic examination and nonstress test were normal. During the hospitalization, we monitored the mother blood pressure, heart frequency, oxygen saturation and temperature three times daily and we performed blood test each three days. In order to check fetal condition, we performed cardiotocography once a day and fetal heart auscultation three times a day, a level II obstetric ultrasound (fetal growth and doppler velocimetry) was made once a week and an office obstetric ultrasound examination to control amniotic fluid index and fetal movements was made three times a week.

Figure 1.



Hemodynamic changes in pregnancy. Percentage of change in cardiac output (CO), heart rate (HR), stroke volume (SV), systemic vascular resistance (SVR), pulmonary vascular resistance (PVR) with pregnancy

During the recovery, the therapy included continuous oxygen therapy (Median: 3 liters per minute), furosemide 25 mg on alternate days, prior monitoring of the maternal blood pressure and the fetal amniotic fluid, LMWH 4000 UI/day and erythropoietin 4000 UI twice a week since the twenty-ninth week of gestation. Beclomethasone 12 mg two doses with a 24-hour interval was administered at 30 weeks and 3 days gestation, for enhancing fetal lung parenchymal maturity. During the recovery, the patient showed a good clinical

course, the fetal growth was regular and the nonstress tests were normal; median oxygen saturation was 79% and median hemoglobin value was 12.9 mg/dl. Oxygen saturation and hemoglobin trends are reported in figures 2-3.

and only oxygen supplementation was administered. For the postpartum anti-hemorrhage prophylaxis, sulprostone 0,5 mg i.v. was used for 24 hours after the delivery. The histological examination of the placenta was performed and it showed a regular preterm placenta.

Table 1 Predictors of maternal and neonatal outcomes in pregnancy with cardiac disease

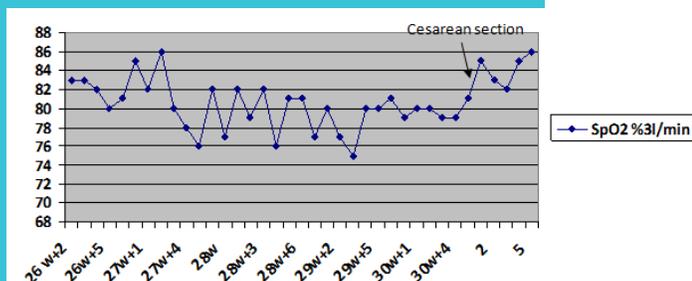
Predictors for a maternal cardiac event	Predictors for adverse neonatal events
<ul style="list-style-type: none"> • Prior cardiac event (heart failure, transient ischaemic attack or stroke) or arrhythmia • Baseline NYHA class >II or cyanosis (Oxygen saturation < 80%) • Left heart obstruction (mitral valve area <2 cm², aortic valve area <1.5 cm² or peak ventricular outflow tract gradient >30 mmHg by echocardiography) • Reduced systemic left ventricular function (ejection fraction < 40%) 	<ul style="list-style-type: none"> • NYHA class >II or cyanosis during the baseline prenatal visit (Oxygen saturation < 80%) • Maternal left ventricular obstruction • Maternal smoking • Multiple gestation

In accordance with the patient and the medical team, considering the clinical situation and the and the scarcity of data in literature, a cesarean section was planned at 30 weeks and 5 days of gestation. It was performed in spinal anesthesia in the cardio-vascular theatre where facility for extracorporeal membrane oxygenation (ECMO) was readily available. Antibiotic prophylaxis with amoxicillin and gentamicin was administered before skin incision. The cesarean section was carried out without complications, no episode of hemodynamic instability occurred and the ECMO was not required. The baby weighted 1230 g and showed an Apgar score 5 at 1 minute and an Apgar score 8 at 5 minutes after delivery, no intensive measures were necessary

During the first twenty-four hours after the cesarean section, the patient was monitored in the cardio-vascular intensive care unit, the general conditions were stable and oxygen saturation was 92% with oxygen therapy (5 liters per minute). Last dose of LMWH prior the cesarean section was administered 12 hours before and the next dose 6 hours after the delivery. In the first postoperative day, she complained dysesthesia and difficulty of mobilization of the left arm and the left part of the face, caused by an embolic occlusion of the right middle cerebral artery. National Institution of Health Stroke Scale (NIHSS) was 14 and blood saturation 80%. Intravenous thrombolysis was contraindicated because of the recent delivery. She was transferred to the

Neuroradiology Department and she underwent endoscopic thromboembolectomy. After the procedure, she spent two days in the stroke unit and she restored sensitive and motor functions. One week after the cesarean section, she was discharged home with oxygen support and LWMH, to replace with warfarin 6 weeks after childbirth. At the moment, six months after the cesarean section, she is well, no other complications were registered and cardiological and neurological follow-up are regular.

Figure 2.



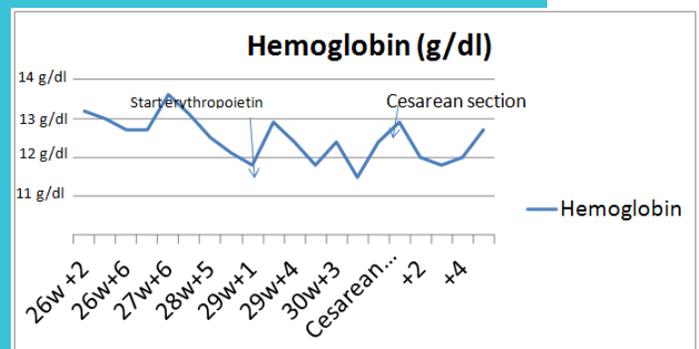
Blood oxygen saturation trend during the recovery, the time is intended as weeks of gestation.

Discussion

Maternal heart diseases complicate 0.2 to 3% of pregnancies and congenital heart lesions now constitute at least half of all these cases. The most commonly encountered congenital cardiac defect in pregnancy (10%) is the tetralogy of Fallot. Nowadays, the great majority of patients with TOF underwent surgical correction; very rare cases remain uncorrected and reach the age of childbearing. In the absence of guidelines or shared recommendations in literature, the reported case opens to many topics. Is important to allow women with TOF to become aware of all the risks associated with the pregnancy. Maternal cardiovascular events and fetal risks - including intrauterine growth restriction, premature birth, intracranial haemorrhage and stillbirth - have to be largely discussed with the couple [8]. In case of pregnancy continuation, it is classified as high risk pregnancy (WHO III-IV) [8]. Total bed rest

and supportive care are strongly suggested to minimize the maternal and fetal complications. Patients have to be informed that repairing procedure of cardiac anomalies are not recommended during pregnancy. Predictors of maternal and neonatal outcomes in pregnancy with cardiac disease are reported in Table 1 [5]. In patients with uncorrected TOF, the most important prognostic factor for maternal and fetal outcomes is oxygen saturation [9]. A 32% of incidence of severe cardiovascular complications -pump failure, thromboembolic events, life-threatening arrhythmias, infective endocarditis- have been reported in pregnancies of women with cyanotic heart disease. In addition, the frequency of abortions, premature birth, fetal distress, and congenital malformation of the child was 57% [8]. In order to minimize these risks, in addition to keep oxygen saturation over 80% with an adequate continuous oxygen therapy, an high hemoglobin level is recommended. For that reason, in our case, erythropoietin was used. Because of the molecule's large size, recombinant erythropoietin does not appear to cross the placenta [9]. Sienas et al. have not reported any fetal morbidity or mortality [10]. In our case, we have successfully used erythropoietin since the twenty-ninth week of pregnancy.

Figure 3.



Hemoglobin trend during the recovery, the time is intended as weeks of gestation. We underlined the moment of the start of erythropoietin and of the cesarean section.

The choice of the timing and the modality for the childbirth was a compromise between maternal conditions and fetal maturity. A cesarean section in spinal anesthesia was performed to avoid an excessive physical activity. We have chosen regional anesthesia in order to avoid the hypoxic effect of general anesthesia on the fetus. Guidelines published in 2006 about maternal heart diseases and pregnancy aim to reduce the maternal stress associated with labor by performing an elective or early instrumental delivery. In cases of severe functional cardiac impairment instrumental delivery is performed electively, but in most cases, it is performed if the woman has not given birth after 30 minutes of active pushing [11]. Both general and regional anaesthesia have been employed successfully in parturient with TOF. For some authors general anaesthesia is probably the technique of choice [12]. In their opinion, general anaesthesia with endotracheal intubation provides airway protection, eliminates work of breathing and may reduce oxygen consumption. She refused tubal sterilization during the cesarean section. After the cesarean section, we used sulprostone 0,5 mg i.v. in the 24 hours after the delivery for the post

partum anti-hemorrhage prophylaxis. We avoided the use of oxytocin because of its role on pulmonary pressure. During the puerperium and after a surgical intervention, the higher risk of thromboembolic events is known; in patients with right-left shunt this risk is dramatically increased. As known, prognosis of woman with uncorrected defect is poor and it is worsened after a pregnancy [9]. The management of pregnancy in patients with uncorrected TOF remains critical. The goal is to maintain a good oxygen saturation and an high hemoglobin level in order to avoid a cardiac overload. Erythropoietin during the second trimester resulted a good choice in our experience. We recommend an attentive post-operative monitoring and an early start of heparin in order to minimize thromboembolic complication that are the more frequent. Multidisciplinary team effort is mandatory in order to ensure a favorable outcome [13].

Conflict of Interest

Authors have no relationships with companies that may have a financial interest related to the information contained in the manuscript.

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