CASE REPORT

Sudden cardiac arrest during emergency caesarean delivery in a 31-year-old woman, due to accelerated structural valve degeneration of an aortic valve bioprosthesis

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SUMMARY

The choice of prosthetic valve to implant in women of childbearing age requiring a valve replacement is challenging. Mechanical valves mandate the use of oral anticoagulation (OAC) for the prevention of thromboembolic complications, but the use of OAC during pregnancy can lead to maternal and fetal complications, in particular, warfarin embryopathy. Conversely, the use of bioprosthetic valves during pregnancy eliminates the need for OAC, but can instead be associated with accelerated structural valve degeneration. We present the case of a 31-year-old woman with a bioprosthetic valve in the aortic position, who developed undetected accelerated structural valve degeneration 5.5 years following implantation of a Mitroflow bioprosthetic aortic valve, and who suffered a catastrophic complication during emergency caesarean delivery as a result.

BACKGROUND

The two major types of prosthetic heart valves (ie, mechanical prostheses and bioprostheses) provide advantages as well as providing limitations among women of childbearing age requiring heart valve implantation. The main areas of difference are durability, incidence of thromboembolism, valve haemodynamics and requirement for anticoagulation. In general, mechanical prostheses are far more durable than bioprostheses, but the requirement for oral anticoagulation (OAC) can lead to maternal and fetal complications during pregnancy. Coumarin derivatives (eg, warfarin) cross the placenta and can lead to embryopathy (eg, mid-facial hypoplasia, hydrocephalus and optic atrophy of the embryo).¹ Conversely, the use of bioprostheses eliminate the need for OAC, but structural valve degeneration (SVD) is a more frequent complication with these valves. We describe the case of a 31-year-old woman with a bioprosthetic valve in the aortic position, who ultimately required an emergency caesarean section owing to fetal distress and subsequently suffered an intraoperative cardiac arrest because of structural degeneration of a Mitroflow tissue bioprosthesis in the aortic position.

CASE PRESENTATION

A 25-year-old African woman, originally from the Ivory Coast, but living in Switzerland since 2008,

with a history of rheumatic heart disease, underwent isolated surgical aortic valve replacement (AVR) in December 2009, with a 23 mm Mitroflow (model LX; Sorin Group, Inc) bioprosthesis because of severe aortic regurgitation. The patient delivered her first child 2 years later, in June 2012, via emergency caesarean section at 40+5 weeks gestation, without any maternal or fetal complications. The patient conceived her second child in August 2014. A routine transthoracic echocardiogram (TTE) at the end of August 2014 revealed a normally functioning aortic valve bioprosthesis, with a transvalvular mean gradient of 9 mm Hg, a maximum gradient of 15 mm Hg and trace aortic regurgitation. The left ventricle was hypertrophied but the left ventricular ejection fraction (LVEF) was within normal range (65%). The patient had concomitant mild mitral regurgitation, which remained stable. The patient underwent a cardiology assessment in March 2015, at 33+1 weeks gestation of her second pregnancy. A TTE revealed an aortic bioprosthetic transvalvular mean gradient of 36 mm Hg and a maximum gradient of 65 mm Hg with concomitant mild mitral regurgitation. The treating cardiologist interpreted the increased valvular gradient to be related to the pregnancy-induced augmented cardiac output and cleared the patient for delivery. Although the patient wished to have a normal spontaneous vaginal delivery, a precautionary preoperative assessment was made by an anaesthesiologist in April 2015. The anaesthesiologist concluded that there were no contraindications for a caesarean section, should the need arise.

In May 2015, 5.5 years following AVR, the now 31-year-old patient ultimately underwent an emergency caesarean section at 39+4 weeks gestation because of recurrent late decelerations on the cardiotocogram (CTG), suggestive of fetal distress. Immediately following the successful delivery of a normal infant, the patient went into cardiac arrest in the operating room (OR), due to pulseless electrical activity. Cardiopulmonary resuscitation (CPR) was immediately performed on the OR table and the patient had return of spontaneous circulation following two cycles of CPR and 1 mg of epinephrine.

INVESTIGATIONS

The patient was transferred to the intensive care unit, where a TTE revealed a markedly elevated

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Figure 1 Transthoracic echocardiographic showing the transaortic valvular gradient (mean gradient 82 mm Hg; maximum gradient 131 mm Hg) measured using continuous wave Doppler (A), and colour flow Doppler demonstrating moderate transprosthetic aortic regurgitation in the apical 5-chamber view (B).

Video 1 Transoesophageal echocardiography showing the long-axis view of the aortic valve at 123°, demonstrating a degenerated bioprosthesis with moderate transprosthetic aortic regurgitation.

mean gradient of 80 mm Hg, a maximum gradient of 130 mm Hg and moderate transvalvular aortic regurgitation (figure 1). Transoesophageal echocardiography revealed a

severely degenerated, partly calcified aortic valve bioprosthesis with severe stenosis (mean gradient 64 mm Hg; max gradient 104 mm Hg), moderate transvalvular aortic regurgitation and mild mitral regurgitation (video 1). The left ventricular systolic function was normal (LVEF 65%). Serial mean and maximum transvalvular aortic gradients revealed a rapidly ascending gradient in the latter stages of pregnancy (figure 2).

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for the observed findings include SVD, pannus formation on the valve cusps, thrombosis of the valve and infective endocarditis.

TREATMENT

The patient wished to have further pregnancies and therefore the relative pros and cons of implanting a mechanical versus bioprosthetic valve were discussed in detail with the patient. The patient ultimately decided to opt for a bioprosthetic valve as she was very concerned about the risk of warfarin embryopathy, which may occur with OAC therapy during pregnancy in a patient with a mechanical heart valve. The patient therefore underwent a successful redo conventional surgical AVR, 2 weeks

Figure 2 Serial echocardiographic measurements of the mean and maximum transvalvular aortic valve gradients over time between implantation of the bioprosthetic aortic valve on 08 December 2009 until the second emergency caesarean section 5.5 years later on 12 May 2015.

Figure 3 View of the explanted Mitroflow bioprosthesis (Sorin Group, Inc) following redo surgical aortic valve replacement on 26 May 2015 (A). Histology of the explanted bovine pericardial leaflets of the valve revealed a mild inflammatory infiltrate and degenerative calcific changes (B).

following the caesarean section, in May 2015, with a Trifecta 23 mm (St Jude Medical, Inc) bioprosthesis. The explanted bioprosthesis revealed severe degenerative changes, which was confirmed by histopathological examination (figure 3). The patient made an excellent recovery and was discharged in early June 2015. Discharge TTE revealed a mean transvalvular gradient of 9 mm Hg, maximum gradient of 20 mm Hg and no evidence of a paravalvular leak.

OUTCOME AND FOLLOW-UP

The patient was reviewed in the cardiology outpatient clinic 6 weeks following discharge and was completely asymptomatic. The baby was also progressing normally. TTE revealed well-functioning bioprosthesis with a mean gradient of 7 mm Hg, a maximum gradient of 14 mm Hg and no evidence of aortic regurgitation (video 2).

DISCUSSION

The use of bioprosthetic valves in women of childbearing age reduces the risk of thromboembolism and anticoagulation associated with mechanical valves during pregnancy, but is associated with a high risk of SVD, as highlighted in the present case.² There is ongoing debate as to whether pregnancy accelerates the rate of bioprosthetic SVD.^{3–5} Some studies have reported accelerated SVD of bioprosthetic valves during pregnancy,^{3,4} but others have not confirmed this.⁵ Furthermore, a recent study reported an unpredictable accelerated pattern of

SVD in Mitroflow aortic bioprosthesis, which constitutes a life-threatening condition.⁶ It is important to emphasise, in the present case, that the bioprosthetic valve functioned perfectly well during the first pregnancy, but during the second pregnancy, there was rapid degeneration of the valve after about 7 months gestation. This raises questions regarding the durability of tissue valves in young women undergoing >1 pregnancy and suggests that further studies are needed to assess this.

Learning points

- ▶ The use of bioprosthetic (tissue) valves in pregnancy eliminates the need for oral anticoagulation but these valves are far less durable than mechanical heart valves.
- ▶ Regular transthoracic echocardiography at relatively short intervals should be performed in a pregnant woman with a bioprosthetic heart valve, particularly if it is the second or subsequent pregnancy with the same bioprosthetic heart valve.
- ▶ There is ongoing debate as to whether or not pregnancy accelerates the rate of bioprosthetic structural valve degeneration.
- ▶ Data on the rates of structural valve degeneration among women undergoing >1 pregnancy with a bioprosthetic heart valve in situ are lacking.
- ▶ If a rapid progression of transprosthetic gradient is observed during pregnancy, an intervention should be considered with either caesarean section or valve replacement (eg, transcatheter aortic valve implantation).

Contributors CJO drafted the manuscript. EBL performed the echocardiogram and collected the data. DP performed the histopathological analysis of the aortic valve bioprosthesis. FE critically revised the manuscript.

Competing interests None declared.

Patient consent Obtained.

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Video 2 Transthoracic echocardiography in the zoomed parasternal long-axis position taken 6 weeks following redo aortic valve replacement with a St Jude Medical Trifecta bioprosthesis (23 mm) showing a normally functioning tissue valve.

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