WHY PREGNANCY AND CONGENITAL HD ?!

- Today, most female children born with congenital heart disease has reached childbearing age.

- Expanded diagnostic, medical, and surgical management options have improved the long-term survival of patients with CHD (Canobbio et al., 2017).
- Pregnancy in Women with complex CHD, carries a moderate to high risk for both the mother and her fetus.

- In those with complex CHD, pregnancy may be associated with an increased risk compared with women with milder forms, regardless of whether they are clinically stable at the time of conception or not. (Canobbio et al., 2017)

Number of maternal deaths related to cardiac disease in the UK between 1985 and 2008, stratified for underlying heart condition (modified from Cantwell et al. 7).

(M. Greutmann and P.G. Pieper, European heart journal 2015)

WHY PREGNANCY?

Haemodynamic changes during pregnancy, peripartum, and postpartum. (A) Pregnancy (weeks of gestation). Modified from Robson et al.12 (B) Peripartum. Modified from: Adams et al.13 BC, between contractions; Peak, at the peak of contraction; Stage 3, at the time of uterine contraction. (C) Postpartum. Modified from Robson et al.14,15 24 h pp, 24 h postpartum; 2w pp, 2 weeks postpartum. *For cohorts in (B) and (C), relative changes from baseline were compared with the baseline values of the cohort from (A). (M. Greutmann and P.G. Pieper, European heart journal 2015)
### WHO PREGNANCY RISK CATEGORY

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Risk Description</th>
<th>Maternal Risk Factors</th>
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<tbody>
<tr>
<td>I</td>
<td>No detectable increase in maternal mortality and no/mild increase in morbidity risk</td>
<td>Uncomplicated small/mild pulmonic stenosis, PDA, mitral valve prolapse</td>
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<td>Successfully repaired simple lesions (ASD, VSD, PDA, anomalous pulmonary venous drainage)</td>
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<td>Atrial or ventricular ectopic beats, isolated</td>
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<td>II</td>
<td>Small increase in maternal mortality and moderate increase in morbidity risk</td>
<td>If otherwise well and uncomplicated:</td>
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<td>Unoperated ASD, VSD</td>
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<td>Repaired TOF</td>
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<td>Most arrhythmias</td>
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<tr>
<td>II–III</td>
<td>Moderate increase in maternal mortality morbidity risk</td>
<td>Mild LV impairment</td>
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<td>Hypertrophic cardiomyopathy</td>
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<td></td>
<td>Native or tissue valvular disease (not considered risk category I or IV)</td>
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<td>Marfan syndrome without aortic dilation</td>
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<td>Aortic dilation &lt;45 mm in bicuspid aortic valve aortopathy</td>
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<td>Repaired coarctation</td>
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<td>III</td>
<td><strong>Significantly increased maternal mortality or severe morbidity risk.</strong> Expert counseling required. In the event of pregnancy, intensive specialist cardiac and obstetric monitoring needed throughout pregnancy, childbirth, and the puerperium.</td>
<td>Mechanical valve</td>
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<td>Systemic RV</td>
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<td></td>
<td></td>
<td>Fontan circulation</td>
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<td></td>
<td></td>
<td>Cyanotic heart disease (unrepaired)</td>
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<td></td>
<td>Other complex CHD</td>
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<td>Aortic dilation 40–45 mm in Marfan syndrome</td>
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<tr>
<td></td>
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<td>Aortic dilation 45–50 mm in bicuspid aortic valve aortopathy</td>
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<tr>
<td>IV</td>
<td>Extremely high maternal mortality or severe morbidity risk. <strong>Pregnancy is contraindicated</strong> In the event of pregnancy termination should be discussed. If pregnancy continues, care should follow class III recommendations.</td>
<td>Pulmonary arterial hypertension (of any cause)</td>
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<td>Severe systemic ventricular dysfunction (LV ejection fraction &lt;30%, NYHA class III-IV)</td>
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<td>Previous peripartum cardiomyopathy with any residual impairment of LV function</td>
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<td>Severe mitral stenosis, severe symptomatic aortic stenosis</td>
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<td>Aortic dilation &gt;45 mm in Marfan syndrome</td>
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<td>Aortic dilation &gt;50 mm in bicuspid aortic valve aortopathy</td>
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<td>Native severe coarctation</td>
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</tbody>
</table>
INVASIVE INTERVENTIONS

- Therapeutic catheterization
- Surgery

Catheterization

The intervention should be performed in the second trimester after completion of organogenesis but before the uterus has become very large.

Surgery

Open-heart surgery on cardiopulmonary bypass carries a high risk of fetal loss.

If cardiac surgery can be delayed until the 28th week of gestation, prior delivery after lung maturity induction should be considered.
Transcatheter diagnostic and interventional procedures performed during pregnancy

Necessary
No alternative is available
(experienced teams at tertiary care centers only)

**TIPS TO MINIMIZE FETAL RADIATION**

- Shortening fluoroscopic time
- Reducing the x-ray tube voltage
- Reducing the tube current, imaging frames per second to the lowest setting (usually 7.5 frames per second)
- Using single-plane fluoroscopy
- Avoiding cineangiography
- Internal jugular or subclavian/ radial approaches
- Avoiding femoral access
- TTE, ICE, TEE, and 3D MRI overlay techniques
TIPS TO MINIMIZE FETAL RADIATION

- The radiation exposure to the fetus arises predominantly from scattered radiation within the patient. *External lead shielding of the maternal pelvis is of limited value* although generally still used.

- The radiation dose absorbed by the fetus without shielding is only 3% higher than that with external shielding for all periods of gestation. *(Canobbio et al., 2017)*

THERAPEUTIC CATHETERIZATION
RV OBSTRUCTION

Are generally well tolerated during pregnancy
Intervention (BPV) only done

RV failure
Symptoms of RV pressure overload

CASE- AIN SHAMS

- 34 year old lady, 25th weeks pregnant
- She has 2 year old child, during her previous pregnancy she had dizziness and syncopal attacks during last trimester and at time of delivery
- C/O dyspnea NYHA III and loss of consciousness of 2 weeks duration
Do we need to intervene?

Dyspnea NYHA III

PPG=98 mm Hg RV hypertrophy

True syncope

RV strain RVH

12 hours

AFTER CATH
TRANSCATHETER OCCLUSION OF VARIOUS SHUNTS

- Rarely indicated during pregnancy

- Transcatheter closure of atrium-level shunts could be considered in pregnant women with cyanosis because of right-to-left shunting at the atrial level and poor fetal growth. However, this should not be done in the presence of elevated pulmonary arterial resistance or right heart failure.

Case Report

Successful percutaneous closure of an extremely large secundum atrial septal defect during pregnancy

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Abstract: Atrial septal defects (ASDs) are one of the most common acyanotic congenital heart lesions. Awareness of potential clinical presentations and complications during pregnancy is essential for those managing these patients. We report successful percutaneous closure of an extremely large secundum ASD, using the largest available percutaneous ASD closure device in a 27-year-old pregnant female. Large ASDs may have their initial clinical presentation and diagnosis during pregnancy. If indicated, percutaneous closure can be performed safely. Only a very small number of cases have previously reported this being performed safely during pregnancy.

Keywords: Atrial septal defect (ASD); percutaneous closure; pregnancy

20 weeks of gestation, NYHA III, 2016, first time to be diagnosed

38 x31x30 mm

40 mm occlutech device
Device closure of atrial septal defect during pregnancy for recurrent cerebrovascular accidents

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PlumX Metrics
DOI: https://doi.org/10.1016/j.ijcar.2009.10.049

Abstract
A 29 year old female presented at 8 weeks of gestation in her first pregnancy with an episode of left hemiplegia and sensory loss. There was a previous history of migraine, but the symptoms resolved completely within 24 h and were not associated with typical migrainous headache. Transthoracic echocardiography revealed a 23 mm secundum type atrial septal defect (ASD) positioned inferiorly and posteriorly near the mouth of the right inferior pulmonary vein. There was spontaneous flow of agitated saline contrast from the right to the left atrium.

SEVERE VALVULAR A.S

Severe aortic valve stenosis may be associated with maternal and fetal cardiac complications, including premature labor and heart failure

Transcatheter BAV

mobile, pliable valve
no more than mild aortic regurgitation
Balloon aortic valvuloplasty in pregnancy with severe aortic stenosis and infective endocarditis

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ABSTRACT
Twenty seven year old lady, previously diagnosed to have aortic stenosis, presented to the obstetric outpatient department at 19 weeks of gestation with fever and breathlessness, NYHA class 4, for the week. Tran D Echo revealed left ventricular hypertrophy, a severely stenosed, calcified bicupid aortic valve, with vegetations on aortic and mitral valves and severe mitral regurgitation. Blood cultures grew normally variant streptococci, and she was treated with aggressive penicillins and gentamycin. She stabilised clinically by 21 weeks, by which time, the risk of termination of pregnancy was comparable to continuing the pregnancy. She underwent balloon aortic valvuloplasty. Post balloon aortic valvuloplasty, she was stable. At 34+2 weeks, she underwent emergency LSCS, the indication being in utero reflex growth restriction with fetal compromise and breech presentation. She delivered a baby girl, 1.6 kg, APGAR 9 & 10. Our case report highlights the fact that a timely, balloon aortic valvuloplasty can be life saving for patients with pregnancy complicated by severe aortic stenosis and infective endocarditis.

Keywords: Pregnancy, Severe aortic stenosis, Balloon aortic valvuloplasty

Percutaneous Balloon Aortic Valvuloplasty in a Pregnant Adolescent

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Passo Fundo, RS - Brazil

We report the case of a 16-year-old pregnant patient with severe aortic stenosis and pulmonary congestion clinically uncontrolled. In 1999 percutaneous balloon aortic valvuloplasty was used as the first phase of treatment in an emergency procedure. The clinical findings, pathophysiology, diagnostic features, and indications for percutaneous treatment are reported.

Severe congenital aortic stenosis is rare in children and young individuals. Bicuspid aortic valve occurs in 3% to 6% of patients with congenital heart disease; when associated with commissural fusion, significant stenosis may be present in childhood. The association of severe congenital aortic stenosis and pregnancy is difficult to control clinically, carrying a high risk of maternal and fetal mortality, mainly when manifested with symptoms of pulmonary congestion.

Case Report
The patient is a 16-year-old pregnant white woman in the 27th gestational week, who was admitted with severe dyspnea and precordial pain. Her personal antecedent was a cardiac murmur without diagnosis or follow-up. When examined with a 4MHz ultrasonic device, the murmur was heard in the second left interspace.
Fig. 2 - Angiogram in left anterior oblique projection. A bicuspid aortic valve with severe stenosis is seen (the decrease in opacity indicates flow through the stenotic valve).

Fig. 4 - Angiogram in left anterior oblique projection. Final result showing mild aortic regurgitation and absence of the central jet.

Fig. 5 - Angiogram in right anterior oblique projection. Balloon dilation of the aortic valve. A constriction corresponding to valvular stenosis may be seen.

Clinical Dilemmas in Interventional Cardiology

Transcatheter Aortic Valve Replacement During Pregnancy

RobHodson MD; Eric Kikker MD; Jeffrey Swanson MD; Craig Walsh MD; MPE; Ethan C. Korgold MD; Sarah Ramelli MS

Case Presentation

A 22-year-old pregnant female patient presented with severe symptomatic AS (15 weeks' gestation). The patient was 165 cm tall, weighed 78 kg, with a body mass index of 27 kg/m² and body surface area of 1.84 m² at the time of presentation. The patient's clinical history includes congenital bicuspid aortic valve disease, which reappeared aortic valvuloplasty (BAV) at the age of 9 years. Throughout young adulthood, she had been asymptomatic with high levels of activity. Her chief complaints on presentation were increased dizziness, dyspnea on exertion, and chest discomfort. Echocardiography demonstrated a normal ejection fraction, an aortic peak flow velocity of 4.04 m/s, an aortic valve mean gradient of 38.22 mm Hg, an aortic valve area of 1.0 cm², and mild-to-moderate aortic insufficiency (AI). The ascending aorta was mildly enlarged (3.9 cm). There was mild narrowing of the left ventricular outflow tract with no Doppler gradient (Figure 1, Table 1). Stress echocardiography testing showed moderate AI and below-average exercise capacity. The patient completed 8 to 9 metabolic equivalents of exercise. Echocardiography documented a mean resting aortic valve gradient of 56 mm Hg and a postexercise mean gradient of 78 mm Hg (Table 2). The difference in aortic valve mean gradients between the routine and stress echocardiograms can be attributed to the difference in time and location of the 2 tests.
AORTIC COARCTATION

- Percutaneous intervention for re-CoA is possible during pregnancy, but it is associated with a higher risk of aortic dissection than outside pregnancy and should only be performed if severe hypertension persists despite maximal medical therapy and if there is maternal or fetal compromise.

- The use of covered stents may lower the risk of dissection.

CASE- AIN SHAMS

23 year old pregnant lady, 5 weeks pregnant with bicuspid AO.V and tight native AO. coarctation
Presented with severe uncontrolled hypertension, despite of max. medical TTT

WHO IV TERMINATION

Transcatheter COA stenting
2 pregnancies
• Balloon dilatation of previously placed stent
REPAIRED TOF

With residual severe PR and right sided heart failure not responding to conservative TTT Trans catheter valve implantation should be considered

2014

Pulmonary atresia
2 MBTs
Valved conduit, fenestrated VSD
Bil PA stenting, VSD closure
Degenerated conduit
Transcath PVR
ARRHYTHMIAS

- Direct current cardioversion is safe and may be used to treat hemodynamically unstable arrhythmias.

- Radiofrequency catheter ablation therapy is discouraged and should be considered only in drug-refractory, poorly tolerated arrhythmias (Canobbio et al., 2017)
CASE - AIN SHAMS

- 30 year old female, **L-TGA, VSD, P.S**
- **SATURATION 85%**
- **CHB** rate 45bpm SUPRAHISIAN
- Good child
- HD stable, mild dyspnea
- C-section, general anaesthesia

- After delivery: hypotension, T.W inserted then removed
- **HYPERCOAGULABLE STATE**
- Referred for **elective PPM insertion**

SURGERY

- Cardiothoracic surgery should be **avoided** during pregnancy unless absolutely necessary. When other treatment options fail

- Maternal mean ABP decreases during **CPB**, and there is a reduction in pulsatile uterine blood flow. These factors can cause **uteroplacental hypoperfusion**, which can precipitate uterine contractions.
SURGERY WITH HIGHEST RISK FOR FETAL LOSS

- Urgent surgery
- High-risk cardiac surgery
- Maternal comorbidities
- Operations performed at an early gestational age

TIPS TO DECREASE FETAL LOSS

- Avoiding hypothermia
- Minimizing intraoperative blood loss
- Using normothermic CPB
- Minimizing CPB times, maintaining a high CPB flow rate (>2.5 L·min⁻¹·m⁻²)
- Maintaining a mean arterial pressure >70 mmHg while the patient is on CPB
- In addition, maintaining uterine displacement to avoid aortocaval compression appears to provide fetal protection by avoiding impairment of uteroplacental blood flow. (placing the patient in the left lateral recumbent position during CPB)