Case Presentation

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Anaesthetic challenges in cardiac surgery for a pregnant patient with pulmonary embolism

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ABSTRACT

Cardiac diseases during pregnancy carry poor prognosis due to increase metabolic demands on the heart leads to decompensation. Cardiac surgery during pregnancy leads to increased mortality and morbidity in comparison to non-pregnant woman. Due to hormonal and mechanical causes, risk of DVT and pulmonary embolism is increased during pregnancy. Pulmonary embolism carried very high risk in pregnant woman because delay of starting anticoagulation or surgery to delivery will increase the risk of extension of emboli and risk of death.

We reported a case of pulmonary embolism in a woman in her 32 weeks of pregnancy. Investigation showed right ventricular and main pulmonary artery emboli which need surgical evacuation. The treatment was based on ensure maturation of the lung of the foetus by using dexamethasone injections, use of low molecular weight heparin. Then delivering the baby by using anaesthetic drugs that have little effect on the uterine contraction. We maintained normothermia and good oxygenation. After delivery of the baby cardiac surgery was done to remove the thrombi. Patient was discharged home in good medical condition.

Key words: pregnancy, Pulmonary embolism, Open Heart Surgery.

INTRODUCTION

Cardiac diseases during pregnancy carry poor prognosis and account for 10-15 % of non-obstetrical causes of maternal mortality.[1] The increased metabolic demand of pregnancy increases the burden on the heart and leads to decompensation. Because the morbidity and mortality of cardiac surgery is greater in parturient than in non-pregnant with the same cardiac disease, every effort should be made to treat such patient conservatively. Should medical treatment not feasible, or carry risk to the fetus or the underlying pathology carry grave risk to the mother then cardiac operation should be the management line[1] despite the high risk of maternal mortality (1-5%) and higher risk of fetal death (16- 33%).[2]

The challenge of anaesthesia in cardiac surgery become double folded in pregnancy and triple folded by the associated co-morbidities. The risk of deep vein thrombosis (DVT) during pregnancy is increased due to hormonal effect (oestrogen) and mechanical effect (pressure by gravid uterus on pelvic veins). Pulmonary embolization carries a poor prognosis and postponing intervention carries an eminent risk of massive pulmonary embolism with sudden maternal death, but cardiac bypass is associated with high fetal mortality in best centres, this is due to bypass machine and its non-physiological continuous nonpulsatile flow result in placental under-perfusion, duration of surgery and hypothermia[3] with its risk of acidosis, arrhythmia, coagulopathy as well as premature uterine contraction both due to dilutional effect on progesterone and re-warming associated uterine contraction.[1] The above make delivering the baby before bypass if organogenesis has completed (24-28 weeks gestational age) more prudent action. Otherwise, when operation is unavoidable and fetal maturation is suboptimal then bypass should be conducted in special way fashioned to meet the needs of pregnancy:

1. Maintain Hb level during bypass more than 8 g/dl to keep O2 carrying capacity of the blood to meet fetal need, this may entail priming the bypass machine with blood.
2. Maintain high bypass machine output at 3 L/m2/min to meet the increased vascular bed volume associated with placenta. In ordinary adult patient it is 2.4 L/m2/min.
3. Maintain blood pressure above 70 mmHg as placental blood flow is not autoregulated and it is pressure dependant.
4. Avoid hypothermia: maintain patient core temperature above 32 C°.[1]

CASE PRESENTATION

A pregnant lady with 32 weeks amenorrhoea presented with dyspnea secondary to DVT, her functional state was NYHA class IV. Echocardiographic findings suggested right ventricle (RV) and main pulmonary artery (PA) thrombi. Her condition further complicated by ischemia of right toes (thought secondary to paradoxical embolization via patent foramen ovale), impairment of renal function (blood urea 81 mg/dl, serum creatinine 1.46 meq/L), thrombocytopenia with platelets count of 56000/mm^3 (thought it was secondary to consumptive coagulopathy). Her previous miscarriages made the current baby a precious one.

The obstetrician fear of possible sub-optimal neonatal care might have negative impact on this precious baby lead to a primary anaesthetic plan to maintain pregnancy despite the above demerits. The plan had multi-facets:

- Dexamethasone started few days before operation to accelerate lung maturation should delivering the baby become inevitable. Enoxaparine started also to prevent extension of the thrombi and it was preferable to heparin which has a greater risk of inducing thrombocytopenia.
- Patient positioning: left lateral inclination of the patient with wedge inserted under her right pelvis to prevent aorto-caval compression by gravid uterus with subsequent hypotension and placental under-perfusion.
- Maintain normothermia with using air warmer (bair hugger machine).
- Avoidance of femoral approaches for both vessels because venous cannulation can induce further embolization and arterial cannulation can add to the query pathology that lead to ischemia of the right toes.
- Cardiac anaesthesia is opioid based (fentanyl) and this carry the risk of respiratory depression to the baby if a decision to deliver the baby is taken, so luckily an antidote (naloxone) made available at induction, short half life of remifentanil made it a good maintenance option. Other anaesthetic agents (medazolam, propofol and pentothal) carry the risk of reduction of systemic vascular resistance so invasive monitoring is mandatory if possible before induction but severe shortness of breath precluded such procedure. Ketamine although has a preferable haemodynamic profile, in a dose greater than 1 mg/Kg it carries the risk of inducing premature uterine contraction.[4] Inhalation agents (sevoflurane, halothane or isoflurane) may be beneficial in reducing uterine tone but they have dose dependant negative haemodynamic effects (both on contractility and peripheral vascular resistance).
- Maintaining blood pressure using pressor agents (noradrenalin or adrenalin) may have negative impact on toes ischemia.
- Patient monitoring: the usual ECG, invasive blood pressure, pulse oximetry, temperature with nasal probe, arterial blood gas, activated clotting time, capnography, urine output as well as fetal heart monitoring.
- Trans-oesophageal echocardiography: although it has an important role in delineation of emboli, diagnosing any associated pathology and patient monitoring, probe insertion not attempted because patient thrombocytopenia may accentuate upper airway bleeding from any possible mucosal injury might be encountered during probe insertion.

The severe dyspnea hindered the option of pre-induction radial artery cannulation, the patient remained in sitting position until just prior to induction which carried out with fentanyl 5 µ/Kg, propofol 20 mg and rocuronium 1mg/Kg. Her radial pulse was feeble so ultrasound guided approach used, her internal jugular veins were collapsed despite head down positioning and underlying pathology that supposed to impair venous return and engorge her veins!!

Uterine contraction although it was ameliorated with increasing sevoflurane concentration leads the obstetrician to deliver the baby with caesarean section (CS), the described approach of giving heparin and inserting the cannulae for bypass prior to CS[1] was not pursued because the fear of prolonged ACT may hinder proper haemostasis during CS; pitocin 20 U bolus given and maintenance infusion started; misoprostol pessaries inserted and good uterine contraction obtained. Luckily the girl baby breathed spontaneously, naloxone not used and she was admitted to neonatal care unite.

Unsatisfaction about durability of radial artery per-operatively and in the ICU leads us to insertion of left femoral artery catheter. Anaesthesia maintained with remifentanyl infusion,

Figure 1: Transthoracic echo showing aortic valve short axis (AVSAX) view with large thrombus in right ventricle (arrow head).

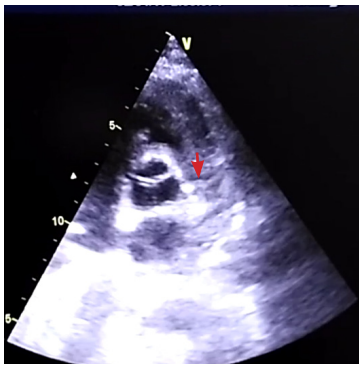

Figure 2: AVSAX view during systole the thrombus impinge on pulmonary valve (arrow head) prolapsing into pulmonary artery.

propofol infusion with boluses of fentanyl, medazolam and rocuronium upon bypass. After cardioplegia the right atrium opened and large thrombus removed from right ventricle which had extension into proximal pulmonary artery with almost 85% obstruction of its lumen. The lung looked unhealthy with gross appearance suggestive of previous multiple infarcts. Fentanyl with rocuronium was given at heart closure along dopamine infusion, lignocaine, and aminophylline to stimulate the heart again. Cardioversion needed once to terminate her VF. Protamine in a dose 1:1 used to reverse heparin effect and to bring her ACT back to baseline level. Haemodynamic stability maintained after ICU admission with stable condition in the follow up period until discharge.

DISCUSSION

The pregnancy might be a precipitating factor for DVT in this patient which might had a tendency for vasculopathy. Despite her not elevated ESR she developed ischemia in her right toes and contrary to our primary assumption of paradoxical embolization no patent foramen ovale had been found, although such paradox could still happen through pulmonary artery but vasculitis is more plausible explanation for her peripheral vascular insufficiency. Placental insufficiency and uterine contraction might play a good role in protecting the baby from the respiratory depressant effect of fentanyl and again her placental insufficiency might be due to vasculitis. Her previous history of miscarriage should be carefully scrutinized along with her current condition to find out possible aetiology behind her condition as systemic lupus erythematosus (SLE) which has a spectrum of presentations could cover all her findings. Attempts to keep the baby in such patient not only carry a high risk of intrauterine death but also make our embolectomy line of management a futile one with an obvious risk of re-embolization from her DVT. Intrauterine death might deteriorate her thrombocytopenia with serious consumptive coagulopathy that make evacuation of the conceptus inevitable to save the mother but in such post-cardiac surgical patient this task is not an easy one. We were lucky enough to pursue the course of management we followed with success not possible without the incredible efforts on the part of the obstetrician, the haematologist, neonatologist, the cardiac surgeon, the perfusionist, ICU personnel along with tailored anaesthetic plan produced in accordance with the best of what we know & best of what we can do.

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Abbreviation list: Aortic Valve Short Axis (**AVSAX**), Caesarean Section (**CS**), Deep Vein Thrombosis (**DVT**), Electrocardiography (**ECG**), Erythrocyte sedimentation Rate (**ESR**), Haemoglobin (**Hb**), Intensive Care Unit (**ICU**), New York Heart Association (**NYHA**), Oxygen (**O2**), Pulmonary Artery (**PA**), Right Ventricle (**RV**), Systemic Lupus Erythematosus (**SLE**), Ventricular Fibrillation (**VF**)

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