MedCrave
Step into the World of Research

Journal of Cardiology & Current Research

Cardiopulmonary Bypass in Pregnant Patient

Abstract

The physiology of the female is modified due to the pregnancy. This modification of physiology normally well tolerated in healthy women. However, 2% to 4% of women of child bearing age have some degree of concomitant heart disease, and these changes may compromise cardiac function. Some patients who do not respond medical treatment needs surgical correction. The mortality rate of the mother is improved but fetal mortality remains high (33%) [1]. Here in, we describe the approach in a pregnant patient who is admitted in our hospital with Mitral Valve disease. This technique may facilitate ambulation and recovery in selected patients.

Case Report

Volume 5 Issue 5 - 2016

Asif Mushtaq*[1] and Zafar Tufail[2]

[1]*Department of Perfusion Sciences, Punjab Institute of Cardiology, Pakistan*

[2]*Department of Cardiothoracic Surgery, Punjab Institute of Cardiology, Pakistan*

***Corresponding author:** Asif Mushtaq, Department of Perfusion Sciences, Punjab Institute of Cardiology, Pakistan, Tel: 924214380804; Email: asif_mushtaqpk2000@yahoo.com

Received: July 02, 2014 | **Published:** May 18, 2016

Introduction

In developed countries the coincidence of cardiovascular disease and pregnancy is decreased. But in developing countries still present a higher incidence of heart diseases, specially rheumatic valvular disease, among pregnant women.An average international figure can be represented by an incidence of 1 to 4% of maternal cardiovascular disease during pregnancy [2,3]. The pregnant woman with cardiac disease even if well compensated, can be affected by heart failure in face of the increased cardiorespiratory requirements during pregnancy. Medical therapy is not always sufficient to drive a heart with a reduced functional reserve or acute complications, in a pregnant woman. Mitral valve is the most common lesion encountered, although its incidence is on the decline. Aortic valve disease is less common. Cardiac diseases in pregnant patient varies in different countries, most physicians agree that cardiovascular disease is the leading cause of death during pregnancy and delivery [4].

About 30-40 years ago it is advised to the female patient suffered with heart disease to avoid the pregnancy. In present day's improvements of cardiac surgery and cardiac care, it is possible for cardiac disease patient to have a normal pregnancy to deliver a healthy baby. If clinical condition of the patient with cardiac disease is not improved with maximum medical management then surgical treatment will be necessary to restore the cardiac function. In the past close mitral valvotomy was used for pregnant patient safely. It is still the procedure of choice in certain parts of the world. In 1959 cardiopulmonary bypass was used for first time in the pregnant patient [4]. The optimal management of pregnant patients who are undergoing CPB is the control of temperature, perfusion pressure, and the nature of the bypass flow.

Influence of fetal age

Gestational age should be noted because it is influenced the mortality and morbidity of the fetus. Surgical intervention should be avoided during first trimester. Best time of surgical intervention is first half of the second trimester because fetal development complete and less chance of complications.

Cardiopulmonary bypass and pregnancy

There are several factors of cardiopulmonary bypass which disturbed the natural equilibrium between mother and the fetus during extracorporeal circulation. Most important factors are as the changes in coagulation, alterations in the function of cellular and protein components of the blood, release of vasoactive substances from leukocytes, complement activation, particulate and air embolism, non pulsatile flow, hypothermia and hypotension [5,6].

Effect of Anesthesia

The concern over the effects of anesthetic agents on the fetal development and teratogenicity during cardiac surgery and CPB for pregnant patients exists whenever any drug is administered to pregnant women, especially during the first trimester when fetal organogenesis occurs, but it appears that most anesthetic agents, intravenous, inhalatory, and paralyzing agents are devoid of teratogenic effects and can be safely employed in a pregnant patient [7]. Hypocarbia as a result of mechanical hyperventilation leads to a decrease in uterine blood flow by 25%. Although theblood pressure remains unchanged during hyperventilation, adverse effect on uterine blood flow was attributed to a decrease in venous return and cardiac output [6,8].

Pump flow

Arterial flow should be 20 to 40% higher than flows used for routine CPB in non pregnant patients, to sustain adequate fetoplacental gas exchange during nonpulsatile flow.

Mean arterial pressure

The best demonstration of an adequate arterial pressure is the fetal response to CPB, and the pump flow should be sufficient to maintain a mean arterial pressure above 70 mmHg (70 to 90 mmHg). During CPB on pregnant patients, high perfusion flows, high mean arterial pressure and a normal cardiotocography usually present a clear correlation.

Drugs

Blood flow to the uterus is under a strong alphaadrenergic control. Vasopressor with alpha adrenergic receptor effects can reduce uterine and placental bloodflow. Whenever a peripheral vasodilatory effect is required during CPB an infusion of hydralazine can be administeredwithout any untoward effects. Ephedrine and low dose dopamine does not appear to influence the uterine blood flow.

Case Study

A 28-years-old, 26 weeks' pregnant patient was admitted in the Punjab institute of Cardiology with a diagnosis of severe MS and moderate MR.Being short of breath and complaining of easy fatigability. Her blood pressure was 90/60 mmHgand her heart rate was 82 beats per minute and regular. She had a tapping apex beat, loud first heart sound, loud pulmonary component of the second heart sound and a grade 3/4 diastolic murmur heard loudest at the apex.

The echocardiography confirmed the diagnosis of severe MS and MR, right ventricular pressure of 42 mmHg and ejection fraction of 50%. The patient was hospitalized until 27 weeks' gestation. During this period blood pressures of 95/50 to 100/55 mmHg and heart rate of 60–84 beats per minute. Management included bed rest and foetal monitoring by non-stress tests and ultrasound.

Preoperatively the patient was haemodynamically stable with a blood pressure of 112/69 mmHg and a heart rate of 101 beats per minute. Ultrasonography showed a viable foetus of 27 weeks' gestation and an estimated weight of 1600 gm. Premedication consisted of diazepam after preoxygenation, general anaesthesia was induced with the patient supine and with left lateral tilt to avoid aorto-caval compression, using intravenous fentanyl 5 µg/kg for three to five minutes. Stranded sternotomy was performed, aortic and venous cannulationdone. Circuit was setup and primed with 1400 ml ringer lactate solution. After completion this procedurecardiopulmonary bypass was started safely. A cardiac index of 3.0 to 3.2 L/min/m^2 was maintained. Epinephrine was used on bypass to increase the blood pressure of the patient. We did not cool the patient and temperature was maintained at 36 degree centigrade.

Aorta was cross clamped and retrograde cold crystalloid cardioplegia given and aspirated from the aortic root due to avoidance of excessive hemodilution and potassium. Excessive potassium may be arrested the fetus heart, therefore it is aspirated from aortic root. The cross clamp time was only 22 minutes. During this time patient was rewarmed at the temperature 37°C. After completion of rewarming the patient cardiopulmonary bypass terminated without any difficulty and within a short period of time the fetus heart rate returned to the base line. The total cardiopulmonary bypass time was 40 min.

Anaesthesia was maintained using a morphine, tracium, sevoflurane 1%, and FiO_2 of 0.7%. Intraoperative monitoring included electrocardiography, pulse oximetry, end-tidal carbondioxide measurement, nasopharyngeal temperature probe, urinarycatheter for fluid balance, intra-arterial blood pressure monitoring and central venous pressure measurement. Foetal heart rate was monitored using cardiotocography. Perioperative monitoring data are summarized in Table 1.

Inotropic support with dobutamine infusion at 5 µg/kg/minute and 500 ml of salvaged blood was administered after weaning from CPB surgery and continued postoperatively in the intensive care unit. Foetal bradycardia was noted during the initiation of CPB surgery, which resolved with restoration of maternal temperature and normalising of circulation. During sternal closure, heparin was neutralised with 180mg of protamine. The duration of anaesthesia and surgery was three hours and 30 minutes. The patient was extubated after six hours in the intensive care unit, after which she received oxygen by face mask. Mother and fetus tolerated the operation well. Patient was discharged on the seventh post operative day with haemoglobin 11.0 gm/dl. Two blood units was used. After 12 weeks she delivered a healthy baby at Fatima Memorial Hospital Lahore.

Table 1: Perioperative monitoring data.

	Pre-Induction	Post-Induction	Pre-CPB	CPB	Post CPB	Conclusion
MAP/F. Rate	80mmHg	85mmHg	72mmHG	70mmHg	65	60
HR	101	90	76		106	100
CVP	5		12	0	16	17
FiO_2	1	0.7	0.7	0.7	0.7	0.7
SaO_2	99	99	99	99	99	99
PaO_2	130	239	239	250	180	200
$EtCO_2$	36	36	28		28	
Temperature	37	36	36	35.5	37	37
pH	7.43	7.43	7.38	7.42-7.55	7.42	7.42
B.E	-3.6	-3.6	-5.4	-0.4----2.5	1.0	1
Potassium	4.7	4.7	4.8	4	4.3	4.3
Hemoglobin	11.5	11.6	11.2	6.5 - 8.9	9.5	9.5
ACT		120	489	500	110	110
FHR	110–120	120-125	110-120	100	120-129	120-129

Discussion

Open-heart surgery is best avoided during pregnancy because of many potential adverse effects on mother and foetus [9-12]. These include maternal and foetal death [9-12] intrauterine growth restriction, low postnatal birth weight and congenital malformations [7]. Sustained uterine contractions reduce uterine blood flow (UBF), which results in foetoplacental insufficiency and subsequent foetal hypoxaemia [9,11]. Foetal bradycardia, an indicator of foetal asphyxia [3], may occur during CPB surgery initiation and emergence there from [9-12] and may potentially be caused bythe following factors: reduced systemic vascular resistance, low, haemodilution, hypothermia, particulate or air embolism, obstruction of venous drainage during inferior vena cava cannulation, activation of inflammatory processes or maternal narcotic administration [10-12]. High foetal mortality is attributed to the above factors, which can affect fetal oxygen delivery during CPB surgery. Intraoperative fetal monitoring can help to correct someof the potential hazards that result in inadequate fetaloxygen delivery.

References

1. Born D, Massonetto JC, de Almeida PA, Moron AF, Buffolo E, et al. (1995) Heart surgery with extracorporeal circulation in pregnant women: analysis of materno-fetal outcome. Arq Bras Cardiol 64(3): 207-211.
2. Parry AJ, Westaby S (1996) Cardiopulmonary Bypass during Pregnancy. Ann Thor Surg 61(6): 1865-1869.
3. Conroy JM, Bailey MK, Hollon MF, Cooke JE, Baker JD 3rd (1989) Anesthesia for Open Heart Surgery in the Pregnant Patient. South Med J 82(4): 492-495.
4. Dubourg G, Broustet H, Bricaud H, Fontan F, Tarieux M, et al. (1959) Complete correction of a triad of Fallot, in extracorporeal circulation, in a pregnant woman. Arch Mal Coeur Vaiss 52: 1389-1392.
5. Strickland RA, Oliver WC Jr, Chantigian RC, Ney JA, Danielson GK (1991) Anesthesia, cardiopulmonary bypass, and the pregnant patient. Mayo Clin Proc 66(4): 411-429.
6. Hammon JW Jr, Edmunds LH Jr (2003) Extracorporeal circulation: Organ damage. In: Cohen LH & Edmunds LH Jr. (Eds.), Cardiac surgery in adult. McGraw-Hill, New York, USA, 2: 361-388.
7. Duncan PG, Pope WDB, Cohen MM, Greer N (1986) Fetal risk of anesthesia and surgery during pregnancy. Anesthesiology 64(6): 790-794.
8. Levinson G, Shnider SM, deLorimier AA, SteffensonJL (1974) Effects of maternal hyperventilation on uterine blood flow and fetal oxygenation and acid base status. Anesthesiology 40(4): 340-347.
9. Bath WH Jr (2009) Cardiac surgery in pregnancy. Clin Obstet Gynecol 52(4): 630-646.
10. Chandrasekhar S, Cook CR, Collard CD (2009) Cardiac surgery in parturient. Anesth Analg 108(3): 777-785.
11. Patel A, Asopa S, Tang AT, Ohri SK (2008) Cardiac surgery during Pregnancy. Tex Heart Inst J 35(3): 307-312.
12. Agarwal RC, Bhattacharya PK, Bhattacharya L, Jain RK (2004) Pregnancy and cardiopulmonary bypass. Indian J Anaesth 48(4): 259-263.

Citation: Mushtaq A, Tufail Z (2016) Cardiopulmonary Bypass in Pregnant Patient. J Cardiol Curr Res 5(5): 00179. DOI: 10.15406/jccr.2016.05.00179