ORIGINAL ARTICLE

Audit of Anesthetic Management of Parturients with Cardiac Diseases Posted for Obstetric Procedures in a Tertiary Care Hospital

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Abstract

The obstetric patient with heart disease challenges the anesthesiologists' skills. Pregnancy and labor due to hemodynamic burden and the hypercoagulable state compromise an already stressed cardiovascular system. In developed countries, congenital heart disease (CHD) is the most common cause whereas in developing countries, still rheumatic heart disease remains the major concern.

Results: Over a period of 6 months, we encountered 30 patients with cardiac disease posted for different obstetric procedures. Anesthesia management was decided according to severity and pathophysiology of cardiac lesion and urgency of procedure. In this article, we have mentioned our experience with cardiac parturients with CHD, rheumatic heart disease, peripartum cardiomyopathy, and Takayasu arteritis.

Conclusion: Effective management of obstetric patient with cardiac disease includes antepartum counseling, risk stratification, an optimization, monitoring and tailored anesthesia plan for labor, delivery, and obstetric procedure, and intensive care unit care in the immediate postpartum period.

Keywords: Anesthesia, Cardiac monitoring, Cardiac parturients, Labor analgesia.

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Introduction

Incidence of heart disease in parturients is 0.2–3% of pregnancies. It affects fetal and maternal morbidity and mortality.[1] The obstetric patient with heart disease challenges the anesthesiologists' skills. Pregnancy and labor due to hemodynamic burden and the hypercoagulable state compromise an already stressed cardiovascular system. So, the combined approach involving cardiologist, obstetrician, neonatologist, and anesthesiologist will help for better outcome.

In developed countries, congenital heart disease (CHD) is the most common cause, whereas in developing countries, still rheumatic heart disease remains the major concern.[2] Patients with CHD are living to reproductive age because of advanced medical and surgical management.[3] In addition, the incidence of ischemic heart disease is also increasing.

Over a period of 6 months, we encountered 30 patients with cardiac disease posted for different obstetric procedures. Out of that, 12 were CHD, 16 were rheumatic heart disease, 1 Takayasu aortoarteritis, and 1 peripartum cardiomyopathy (PPCM). Procedures were varied from medical termination of pregnancy (MTP), cervical encirclage, labor analgesia to and lower segment cesarean section (LSCS) (Table 1).

As our hospital is a tertiary institute, most of the patients were referred here for safe confinement, availability of perioperative cardiac consultation, intensive care unit (ICU) backup, and neonatal intensive care. Manier times, as patients are not registered here in antenatal care (ANC), they get admitted in unoptimized state or without specific investigations, such as electrocardiogram (ECG) and 2D echo. We have shared our experience of perioperative anesthetic management of these cases.

Anesthesia management was decided according to severity and pathophysiology of cardiac lesion and urgency of procedure.[4] Disease-specific goals of management were kept in mind to preserve the hemodynamic parameters for better outcome. They are listed as follows:

- Treat specific pathophysiological changes that exacerbate the disease
- Continue cardiac medications
- Special investigations: ECG, 2D echo cardiography, ABG, and coagulation profile
- High-risk consent, defibrillator standby
- Infective endocarditis prophylaxis—cyanotic and obstructive lesions
- O_2 supplementation and Lt lateral position
- Aspiration prophylaxis
- Goal-directed fluid therapy
- Invasive cardiac monitoring, such as central venous pressure (CVP), intra-arterial blood pressure (IABP) (whenever required) along with standard American Society of Anaesthesiologists (ASA) monitors
- Appropriate anesthesia technique with multimodal analgesia

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Table 1: Audit of anesthesia techniques for cardiac parturients during obstetric procedures

Disease	*Surgery*	*Anesthesia*
Four ventricular septal defect with PS	Two elective LSCS	Epidural anesthesia
	Two emergency LSCS	Low-dose SAB
ASD operated, ASD with device closure ostium secundum	Emergency LSCS	Low-dose SAB
	Cervical encirclage	Epidural analgesia
	Emergency LSCS	
	Labor analgesia	
Two TOF unoperated TOF operated	First trimester MTP	TIVA
	Second trimester MTP	Epidural anesthesia
	Elective LSCS	
CHD, pulmonary stenosis	Labor analgesia	Epidural analgesia
Seven cases of rheumatic heart disease (RHD), balloon mitral valvotomy (BMV) done, mod. mitral stenosis (MS), mild/mod. pulmonary hypertension (PH)	Labor analgesia	Epidural analgesia
	Elective LSCS	Epidural anesthesia
	Two emergency LSCS	Low-dose SAB
	Cervical encirclage	Low-dose SAB
	Two MTP	TIVA
Three RHD, mod MS, MR, TR	Elective LSCS	Epidural anesthesia
Two cases of RHD, mild/mod MR, dilated LV	Two emergency LSCS	Low-dose SAB
RHD severe MR, AR, TR, mod PH with AS	Elective LSCS	Epidural anesthesia
	MTP	TIVA
Two RHD, MVR done, TR, AR	MTP	TIVA
Takayasu arteritis and Chr HT	Elective LSCS	Epidural anesthesia
Peripartum cardiomyopathy 30% EF	Elective LSCS	Combined spinal epidural anesthesia (CSE) low-dose spinal with epidural anesthesia

ASD, atrial septal defect; SAB, subarachnoid block; CHD, congenital heart disease; EF, ejection fraction; TOF, tetralogy of Fallot; TIVA, total intravenous anesthesia; LSCS, lower segment cesarean section

- Minimization of postdelivery hemodynamic changes caused by autotransfusion, relief of vena caval obstruction, oxytocic agents, and hemorrhage
- Perioperative intensive care

Epidural Analgesia

For cardiac parturients, vaginal delivery is the safe mode of delivery.[5] Labor analgesia was achieved with the lumbar epidural technique resulting in good hemodynamic stability. The opioids as adjuvants along with low-dose local anesthetic agent improve the quality of labor analgesia without causing sympathetic blockade.[6] Adequate analgesia decreases complications associated with Valsalva's maneuver during the second stage of labor. This regional analgesia will also help forceps delivery. In cases of time restrain, a low-dose spinal anesthetic can be used.

Continuous or intermittent lumbar epidural analgesia with local anesthetics such as bupivacaine (0.0625–0.125%) and adjuvant opioids such as fentanyl 2 µg/mL was given.

Epidural analgesia with maximum sensory level up to T10 can also be used in the second trimester MTP.

Epidural Anesthesia

For elective LSCS cases, epidural anesthesia was preferred for hemodynamic stability. Epidural catheter was put at the L2–L3 level. Test dose was given with 3 cm^3 of 2% xylocard and then bolus with 6–8 cm^3 of 0.375–0.25% bupivacaine and 50 µg fentanyl. Sensory level upto T10 was achieved within 8–10 minutes. Further top up was tailored according to hemodynamics with 2% xylocard, which was given to achieve maximum sensory level up to T6 and maximum duration required was around 12–14 minutes. During intraoperative period, vitals, such as heart rate, blood pressure, CVP, peripheral capillary oxygen saturation, and U/O, were monitored.

- Low-dose subarachnoid block (SAB). It was low dose of hyperbaric bupivacaine mixed with fentanyl and normal saline. But volume of the spinal drug was maintained for adequate level upto T6 and hemodynamic stability. For LSCS, spinal drug upto 1.4 cm^3 of 0.5% hyperbaric bupivacaine was mixed with 10 µg fentanyl and 0.4 cm^3 of NS.

Maximum sensory level upto T6 was achieved within 5 minutes. Motor blockade Bromage scale 2 was attained within 8 minutes. Two-segment regression happened within 45 minutes. Intraoperative vitals were well maintained.

- Total intravenous anesthesia (TIVA). Liberal use of opioid along with etomidate was done for hemodynamic stability. One hundred percent of oxygen was supplemented, and spontaneous ventilation was maintained.

Discussion

Effective management of obstetric patient with cardiac disease includes antepartum counseling; risk stratification; an optimization, monitoring, and tailored anesthesia plan for labor, delivery, and obstetric procedure; and ICU care in the immediate postpartum period.[7]

Thorough cardiac evaluation, echocardiography, and electrocardiography will give the idea for residual ventricular dysfunction, valvular function, pulmonary hypertension, and arrhythmias. The fetus is evaluated for congenital anomalies and growth restriction. Incidence of neonatal complications, such as

premature birth, IUGR, and respiratory distress syndrome, is more in cardiac parturients.[8]

Conservative therapy includes bed rest in the left lateral position and prudent use of diuretics and cardiac drugs. Treatment of other comorbidities, such as anemia, infection, and hypertension, will help in better outcome. Parturients who had repair of cardiac lesion and have good hemodynamic status generally have successful term pregnancies.[4]

The physiological changes associated with pregnancy can cause symptoms and signs similar to cardiac disease. Also, many times asymptomatic patients with cardiac ailments get diagnosed and worsened due to this.

Physical findings suggestive of heart disease include signs of heart failure, cyanosis, clubbing, palpable thrill, diastolic murmurs, cardiomegaly, presence of dysrhythmias, and loud P_2 sound.

High-risk parturients having critical lesions should undergo corrective procedures during the second trimester of pregnancy, such as balloon valvuloplasty in severe stenotic valvular lesion.

Siu has developed a risk index incorporating following risk factors: NYHA class III and IV, cyanosis, ejection fraction (EF) <40%, and left heart obstruction.[9]

In a parturient with heart disease without any other morbidities, the chance of a cardiac event (arrhythmia, stroke, pulmonary edema, or transient ischemic attack) is about 5%, increasing to 25–75% depending on the number of associated risk factors.

Preoperative Optimization

For hemodynamic stability, the following factors are important—(1) preload, (2) afterload [systemic vascular resistance (SVR)], (3) myocardial contractility, (4) heart rate, and (5) pulmonary vascular resistance (PVR). These five parameters can be managed by tailored anesthetic techniques and with the use of cardiac drugs, such as digoxin, diuretics, and beta blocker drugs.

Vigilant monitoring and prompt treatment of any significant hemodynamic instability related to the operative procedure or peripartum period, such as blood loss or fluid overload, has to be done.

Monitoring

ASA standard monitoring which includes noninvasive BP (NIBP), ECG, pulse oximetry, respiratory rate, and input–output charting is required in all cardiac parturients during the peripartum period.[4]

Advanced cardiac monitoring is preferred in cases of parturients with significant ventricular dysfunction (low cardiac output states, such as heart failure, stenotic lesion, and dilated cardiomyopathy).[10] Invasive ABP, CVP, and transthoracic echocardiography are indicated to predict and prevent maternal cardiac event. In selected cases, hemodynamic monitoring can be continued in the postoperative period in ICU setup.

Use of noninvasive cardiac output monitoring, such as PiCCOTM, LiDCOTM, or FloTracTM, is advised in the cardiac parturient.

Antibiotic prophylaxis is required during labor and delivery for cardiac parturients except those with repaired patent ductus arteriosus (PDA), isolated ostium secundum atrial septal defects (ASDs), and mitral valve prolapse (MVP) without regurgitation.[7]

Intravenous (IV) fluid input should be optimized to prevent both a lack of and excess of fluids. Adequate intravascular volume maintains maternal preload, SVR, and hemoglobin–oxygen saturation.

Vasopressor of Choice

The vasopressor of choice in these patients is low-dose phenylephrine. Prophylactic ephedrine administration should be avoided.[7]

Uterotonic drugs can have deleterious cardiovascular effects. Oxytocin causes decrease in SVR and increase in PVR. It can cause cardiovascular collapse with fast IV bolus, so low-dose infusions are safe. Ergometrine and carboprost should be avoided in impaired ventricular conditions because they cause pulmonary and systemic vasoconstriction.[5] Per rectal (PR) misoprostol has no cardiac side effects and so it can be used safely. In cases of uterine atony at cesarean section, uterine compression sutures are taken to stop bleeding.

In obstetric cardiac patient, assisted vaginal delivery with labor epidural analgesia is the safe mode of delivery.[5] The decompensation can be avoided by early epidural analgesia due to decrease in cardiac afterload and pain-related sympathetic drive. Even vasodilation of epidural will compensate the deleterious effect of postpartum autotransfusion.

Different techniques and associated risks and benefits are discussed in Table 2.

The anesthesiologist has an important role in dealing with postoperative pain management. Epidural analgesia is helpful in reducing the stress response and perioperative deep vein thrombosis. Sympathectomy generally improves microvascular flow.

CHD in Pregnancy

Common congenital acyanotic cardiac defects are PDA, ASD, and ventricular septal defect. When anesthetizing patients with CHD, precautions should be taken to avoid accidental IV infusion of air bubbles. So for epidural space identification, saline is used instead of air.[4,10] Avoid hypoxemia, hypercarbia, and acidosis to avoid increase in PVR and reversal of shunt flow. Pregnancy is contraindicated in cases with Eisenmengerization.

Patients with corrected cardiac lesion and now asymptomatic can be treated as normal parturient. Infective endocarditis prophylaxis is recommended.[11,12]

Tetralogy of Fallot and Anesthesia Implications

It is the most common cyanotic CHD. Poor prognostic signs are as follows: Hct >60%, SaO_2 <80%, right ventricular hypertension, and syncopal episodes.[13]

We have to choose an anesthesia technique which will maintain adequate SVR, venous return, and myocardial contractility, so as to avoid increase in the R–L shunt. For general anesthesia, narcotic induction with etomidate is preferred. Neonatal depression can be managed with bag and mask ventilation if required. Titrated induction with epidural is preferred over conventional SAB.[14]

Rheumatic Heart Disease

During pregnancy, stenotic lesions have more morbidity and mortality compared to regurgitant lesions.[15]

Stenotic valvular lesions, such as mitral and aortic stenosis, are fixed cardiac output states. The congenitally bicuspid valve is the common cause of aortic stenosis in pregnant patients. Due to this, the physiological changes in pregnancy, such as tachycardia and increased blood volume, cause pulmonary edema.[10]

Table 2: Anesthesia techniques, their risks and benefits

Anesthesia technique	*Advantages*	*Disadvantages*
Epidural anesthesia	Gradual onset of sympathectomy	Slow onset
	Slow fall in SVR and BP and no increase in PVR	Less dense block, rarely missed segment
	Avoidance of airway manipulation and stress response	
	Prolonged anesthesia and postoperative analgesia	
	Better APGAR score	
	Less chances of thromboembolism	
Low-dose SAB	Quicker to perform, faster onset, reliable block	No postoperative analgesia PDPH C/I—fixed low cardiac output (severe stenotic lesions), Eisenmengerization
	Better hemodynamic stability compared to conventional SAB minimal anesthetic drug requirement	
General anesthesia	Better oxygenation in cyanotic heart disease	Sympathetic stimulation of intubation extubation
	Stable hemodynamics	Myocardial depression, increase in PVR and decrease in SVR
	Preferred in patients with cardiac failure, on anticoagulation, right to left shunt, fixed cardiac output, and coarctation of aorta	Failed intubation
		Aspiration
		PONV
		No postoperative analgesia
		Fetal drug depression
		Risk of DVT in cyanotic hypercoagulable state

SVR, systemic vascular resistance; BP, blood pressure; PVR, pulmonary vascular resistance; SAB, subarachnoid block; PONV, postoperative nausea and vomiting; PDPH C/I, post-dural puncture headache, contraindicated; DVT, deep vein thrombosis

Anesthetic considerations are to maintain a slow heart rate, preload, and afterload. Aortocaval compression and pulmonary vasoconstriction should be avoided. For maintaining adequate coronary perfusion and cardiac output, atrial fibrillation has to be treated with rate control therapy.[10]

Both general anesthesia and regional techniques can be used depending on the severity of lesion.

Epidural anesthesia is preferred in these patients with mild-to-moderate lesions. Operated patients of valve replacement are on anticoagulant, so central neuraxial blockade increases the risk of epidural/spinal hematoma.

The European Society of Cardiology had put forward the following recommendations regarding peripartum anticoagulation management:

- Replace warfarin with either low-molecular-weight heparin or unfractionated heparin (UFH) from 36 weeks gestation
- Low-molecular-weight heparin should be replaced by IV UFH at least 36 hours before planned delivery. Unfractionated heparin should be continued until 4–6 hours before planned delivery and restarted 4–6 hours after delivery if there are no bleeding complications.[16]

Regurgitant Lesions—Mitral and Aortic Regurgitation

Anesthetic considerations focus on reducing labor pain to prevent increases in SVR. Bradycardia can increase regurgitant flow. Atrial fibrillation can lead to hemodynamic instability. So, any heart rate variation should be treated promptly.

Pregnancy induced a hypercoaguable state and stasis as regurgitation cause increased the chances of systemic embolism.

Regional or general anesthesia can be planned. Due to decrease in SVR, epidural anesthesia causes forward flow of blood and reduces regurgitant flow.[17]

Mitral valve prolapse is much more common among pregnant women. Women with MVP usually tolerate pregnancy well. Most patients are asymptomatic and can be managed as regurgitant lesion.

Peripartum Cardiomyopathy

Peripartum cardiomyopathy is a severe myocardial dysfunction, similar to dilated cardiomyopathy. Parturient presents with heart failure in the third trimester of pregnancy or within 5 months postpartum having no preexisting heart disease (EF less than 45% on echo).[18]

Anesthetic management will be same as those for severe cardiomyopathy. Primary goals are to avoid myocardial depression, optimum fluid management (use of diuretics and vasodilators), maintenance of normal heart rate, and sinus rhythm. Both regional and general anesthesia can be used, but slow titrated induction is preferred.

Using low-dose spinal anesthesia and opioid combination along with epidural can also be instituted depending on the urgency of cesarean section and clinical expertise.

For patients with severe left ventricular dilation, anticoagulation is needed.

If general anesthesia is planned, then opioid induction with etomidate is preferred. The intermittent positive-pressure ventilation causes decrease in venous return and increase in PVR. Inhalational agents cause negative inotropic effects.

Postoperative ICU care with hemodynamic monitoring upto 72 hours is advisable for better outcome.

Takayasu Arteritis

Takayasu arteritis is a form of granulomatous panendarteritis resulting in occlusion and thrombosis of the aorta and pulmonary arteries, arterial aneurysms, and carotid occlusion.[19]

Hypertension and cerebral dysfunction are main complications affecting the anesthetic management of these patients. Perioperative steroid replacement is advisable to prevent Addisonian hypotensive

crisis. In cases of regional anesthesia, clinical neurologic monitoring in an awake patient in intraoperative period is easy. The rate of thrombosis will also be decreased. General anesthesia avoids sympatholysis. But, it can cause hypertensive episode leading to cerebral/cardiac events, so cerebral function monitoring is needed.

Conclusion

The skill and knowledge of the anesthesiologist about cardiac disease in parturient on frequent intraoperative scenarios and quick management of hemodynamic disturbances are more important than the type of anesthesia technique or agent used. The anesthetist working as a perioperative physician is need of the hour.

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