

Neuraxial anaesthesia in parturient with cardiac disease

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ABSTRACT

Parturient with corrected or uncorrected cardiac problem may undergo neuraxial anaesthesia for several reasons and in different trimesters. The altered physiological state in a parturient is further deranged in the presence of a cardiovascular lesion, producing the added risk to the parturient undergoing a neuraxial block. A detailed evaluation, knowledge regarding cardiovascular disease state, more vigilant monitoring, and a team approach can lead to a successful outcome.

Key words: Anticoagulation, heart disease, neuraxial anaesthesia, pregnancy

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INTRODUCTION

Heart disease is the third most common cause of maternal death, and 20% of the patients suffering from cardiac disease have severe haemodynamic instability related to the underlying cardiac problem.^[1] Parturients with cardiac disease often undergo surgery and neuraxial anaesthesia for various reasons and in different trimesters. There are few reports in the literature describing the management of parturients with cardiac disease during neuraxial anaesthesia. This article reviews current data and discusses important aspects of heart disease in relevance to neuraxial anaesthesia in a parturient. As labour and delivery are the most important aspect of pregnancy, the major focus of this article is on this segment.

The physiological changes occurring in the cardiovascular system due to pregnancy are exaggerated in the presence of a cardiac lesion.^[2,3] These cardiovascular changes along with coagulation abnormalities may discourage the use of neuraxial blockade due to the sympathetic blockade produced with the resulting haemodynamic changes. The author searched electronic databases including the following: MedLine, PubMed, and the Cochrane Central register of controlled clinical trials (until June 2018) and applied

the following search terms: neuraxial block, spinal and epidural anaesthesia (EA), heart disease, surgery, and pregnant patient. Only the relevant English literature reports are considered in this review.

Approximately 60%–80% of parturients suffering from cardiac disease have congenital heart disease.^[3] The commonest ones are tetralogy of Fallot, septal defects, and Eisenmenger's syndrome. Valvular heart disease comprises 15% cases, of which rheumatic mitral stenosis is the most common. Table 1 lists the common cardiac diseases in which successful use of neuraxial anaesthesia has been performed.

PHYSIOLOGICAL CHANGES DURING PREGNANCY THAT CAN HAVE IMPACT ON NEURAXIAL BLOCK

The four major changes that are important in the presence of cardiovascular disease are as follows:

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Table 1: Common cardiovascular conditions in a parturient

Cardiovascular conditions	Disease
Corrected	Prosthetic heart valve cardiac transplant Corrected congenital heart lesions (tetralogy of Fallot being most common) Fontan circulation Glenn shunt Blalock-Taussig shunt
Uncorrected	Valvular heart disease Congenital Cyanotics: tetralogy of Fallot, total anomalous pulmonary venous connection, truncus arteriosus, Eisenmenger's syndrome Acyanotics: patent ductus arteriosus, ventricular septal defect, atrial septal defect, coarctation of aorta Pulmonary thromboembolism Pulmonary artery hypertension Aortic aneurysm Coronary artery disease Patients with pacemakers Cardiomyopathies Infective endocarditis

1. Normal pregnancy is associated with a 30%–50% increase in blood volume, corresponding increase in plasma volume, and increase in cardiac output (CO). There is dilutional anaemia in spite of an increase in red cell mass over the third trimester because of an increase in plasma volume.^[2] Stroke volume (SV) normally increases by 25%–35% with the remaining increase in CO being accounted for rise in heart rate (HR). Cardiac compromise with pulmonary oedema or biventricular failure may present in parturients earlier making the management of neuraxial anaesthesia more difficult. The early signs of cardiac compromise may become apparent in the first trimester and peak during second trimester, around 24 weeks when CO reaches the maximum and remains high till delivery
2. There is a progressive decrease in systemic vascular resistance (SVR) throughout gestation, and hence mean arterial pressure (MAP) is preserved at normal values despite an increase in CO. This has importance in patients with aortic stenosis and those with right to left shunt lesions
3. During labour, CO further increases by 10%–20% due to pain, anxiety, and autotransfusion during uterine contractions. SV and HR increase and decrease with each contraction, with peaks as high as 50% above the prelabour values. In

the immediate postpartum period, CO peaks as the evacuated uterus contracts and blood from myometrial veins is autotransfused into the systemic venous system and gradually decreases thereafter. After vaginal delivery, the increase in CO and SV persists for 60–90 min, whereas HR decreases and blood pressure remains unchanged. After caesarean delivery, MAP remains unaltered and CO increases by 30%–50%, compared with predelivery values. These changes usually persist for 10–15 min and may precipitate pulmonary oedema in a decompensated heart

4. Hypercoagulability associated with pregnancy and the possible need for anticoagulation (e.g., patients in chronic atrial fibrillation (AF), prosthetic heart valve, and pulmonary thromboembolism) increase the risk of thrombosis or bleeding during neuraxial block. Table 2 represents the major haemodynamic changes in different cardiac conditions.

Apart from the physiological responses towards pregnancy and delivery, the other factors that affect haemodynamic status during neuraxial block include gestational age, intravascular fluid status, positioning of the patient, and the route, dose, and choice of uterotonic agents.

INDICATIONS AND CONTRAINDICATIONS OF NEURAXIAL BLOCK

Not all the parturients suffering from cardiac disease are fit to undergo a neuraxial block. The following lines depict some indications and contraindications of neuraxial anaesthesia in parturients with cardiac disease.

Indications

1. Patient's demand
2. Associated preeclampsia
3. Breech delivery or multiple pregnancy
4. Trial of pregnancy and labour after previous caesarean delivery
5. Obese parturient.

Contraindications

1. Patient refusal
2. Expected severe bleeding when on anticoagulant treatment
3. Uncontrolled haemorrhage
4. Severe hypovolemia
5. Severe spinal deformity.

Table 2: Haemodynamic state in different cardiac diseases

Cardiac condition	Preload	Afterload	Contractility	HR	PVR
Mitral stenosis	N/↓	N	N/↑	↓/↑	N/↓
Mitral regurgitation	N/↑	↓	N/↑	N/↑	N
Aortic stenosis	↑	↑~	N/↑	↓~	N
Aortic regurgitation	N/↑	↓	N/↑	N/↑	N
Pulmonary stenosis	↑	N/↑	↑	↓	↓
Atrial septal defect	↑	↓	N	N	↑
Ventricular septal defect	↑	↓	N	N	↑
Patent ductus arteriosus	↑	↓	N	N	↑
Coartation of aorta	↑	↓/N	N	N	N
Eisenmenger's syndrome	N	↑	N	N	↓
Dilated cardiomyopathy	↑	↑	↓	↑/N	~
Hypertrophic cardiomyopathy	↑	↑	↑	↑	↑
Pulmonary thromboembolism	N/↓	↑	N	N	↑
Tetralogy of Fallot	N	↑	N/↑/~	N/↑/~	N/↓
Transposition of great vessels	↑	N/↑	N	↑	N
Idiopathic subaortic aortic stenosis	↑	↑/↓	↓/~	↓/~	N

↑ – Increase; ↓ – Decrease; ~ – Equivocal; N – Normal; HR – Heart rate; PVR – Pulmonary vascular resistance

PREANAESTHETIC CONSIDERATIONS

Parturient may require neuraxial anaesthesia during labour, delivery, or during the second trimester for procedures such as appendectomy and ovarian cyst removal. Many reports have been published of successful administration of neuraxial blockade in parturient with cardiac disease coming for these procedures.

A detailed evaluation of the underlying cardiac problem including risk stratification is essential to consider for extensive monitoring/switch over to general anaesthesia and need for the help of a specialised team with experience of cardiovascular anaesthesia and intraoperative echocardiography. Pertinent cardiac testing (angiography, computerised tomography, or magnetic resonance imaging) apart from the routine echocardiography can determine the disorder that can affect the anaesthesia management. If available, serum β -type natriuretic peptide can be done for the parturient with the potential to develop heart failure during additional stress of surgery or anaesthesia. Patients with coartation of aorta are at increased risk of hypertension and ecampsia and neuraxial block should be avoided. Bleeding at the time of surgery/delivery is more common in patients having cyanotic heart disease and/or on anticoagulation.

Infective endocarditis (IE) prophylaxis is needed in parturient with highest risk of IE, for example, those with prosthetic heart valve, history of IE before, and with some complex congenital lesions. In high-risk parturient, the preferred regime is ampicillin 1.5 mg/kg (maximum 120 mg) given intravenously

30 min before neuraxial block followed by ampicillin 1 g given intravenously/intramuscularly or amoxicillin 1 g given orally 6 h later.^[4] The parturient needs to undergo some risk assessment scores, for example, CARPREG or ZAHARA and KHAIRY score to predict maternal cardiovascular events.^[4] Patients with NYHA class >II, with a prior cardiac event (heart failure, stroke, or arrhythmia), critical mitral or aortic stenosis, severe left ventricular dysfunction, presence of a valve prosthesis or severe pulmonary regurgitation, and smoking history have an increased risk of both maternal and neonatal events during the course of pregnancy, labour, and delivery.

MONITORING

The extensiveness of monitoring depends on the severity of disease. In case of mild disease, monitoring includes noninvasive blood pressure measurement, electrocardiography (ECG), tocodynamometry, and foetal HR monitoring. In moderate to severe disease, the following additional monitoring aids may be applied depending on the availability. External defibrillator paddles should be placed before surgery in patients especially prone to intractable tachyarrhythmia. Filter in all intravenous lines in patients with shunt lesion to prevent paradoxical air embolism.

Pulse oxymetry: For rapid detection of desaturation, for example, tetralogy of Fallot's patient developing hypercyanotic spell.

ECG: Continuous five lead monitoring and ST segment monitoring is required for the detection of myocardial

ischemia in patients with aortic stenosis (AS), coronary artery disease (CAD), or hypertrophic obstructive cardiomyopathy (HOCM) or arrhythmia in other patients.

Intra-arterial catheter: In moderate to severe disease patients for minute-to-minute monitoring of arterial pressure, arterial blood gas sampling, and management of vasoactive drugs, if any.

Central venous pressure (CVP): In high-risk patients especially those who are prone to hypotension, pulmonary oedema, or peripartum haemorrhage, a CVP line is a guide to fluid therapy and administration of inotropes and vasodilators.

Pulmonary artery catheter: Rarely used, for example, in a patient with severe pulmonary hypertension in which it guides titration of pulmonary vasodilators.

Echocardiography: Have some role in assessment of ventricular function both pre and post surgery or delivery and direct visualisation of the ventricles to know the volume status.

NEURAXIAL ANAESTHESIA

Neuraxial anaesthesia [Table 3] is the preferred technique if (a) the surgery is nonemergent and (b) the cardiac

disease is mild to moderate. The indications are (1) in the second trimester: torsion ovarian cyst, hysterotomy, lower limb surgeries, etc; (2) and most importantly for conduct of labour and delivery. It is preferred over general anaesthesia for the following reasons:

1. Attenuates pain
2. Decreases the release of catecholamines
3. Allows a passive stage 2 of labour
4. Provides adequate surgical anaesthesia.

Mitral stenosis is the commonest lesion in pregnancy in our country. The symptoms depend on the severity of stenosis. However, the usual features are breathlessness, palpitation, chest pain, haemoptysis, pulmonary oedema, and thromboembolism. Knowing the severity of mitral stenosis (MS) is of paramount importance [Table 4] to manage neuraxial block during labour and delivery. AF is common in parturients. An increase in HR decreases left ventricular filling time and thereby a fall in CO. This in combination with an increase in plasma volume as well as increase in preload (due to autotransfusion) following delivery may lead to pulmonary oedema.^[5] The anaesthetic goals in these parturients are as follows: maintenance of acceptable HR, immediate treatment of acute AF, avoidance of aortocaval compression, maintenance of adequate venous return and normal blood pressure,

Table 3: Types of neuraxial anaesthesia, advantages and disadvantages, drug, and doses

Types	Advantages	Disadvantages	Drug	Dose	Adjuvant drug and dose
Spinal	Rapid onset	Hypotension	Bupivacaine 0.5% Ropivacaine 0.2% Lidocaine 1.5%	5.0-7.5 mg 2-4 mg	Morphine: 0.1-0.2 mg Fentanyl: 5-25 µg Sufentanyl: 2.5-15 µg
Epidural	Re-dosing is easy	-	Bupivacaine Ropivacaine	Initial bolus: 10-15 mL of a 0.25%-0.125% solution Continuous infusion: 0.0625%-0.125% solution at 8-15 mL/h Initial bolus: 10-15 mL of a 0.1%-0.2% solution Continuous infusion: 0.5%-0.2% solution at 8-15 mL/h	Morphine: 2-3 mg Fentanyl: 50-100 µg Sufentanyl: 25-50 µg
Combined spinal-epidural	Rapid onset re-dosing is easy	-	Bupivacaine (0.5-0.75%) (intrathecal) plus Bupivacaine/levobupivacaine (0.25-0.5%) (epidural top-ups) Ropivacaine (double the dose of bupivacaine)	7.5-15 mg 10-40 mg	Morphine: 10-20 mg Fentanyl: 20-25 µg Fentanyl: 25 µg Sufentanyl: 2.5-5 µg
Sequential combined spinal-epidural	Rapid onset Less dose Better haemodynamic stability	-	Hyperbaric bupivacaine (0.5%) (intrathecal) Bupivacaine (0.2-0.5%) (epidural top-ups)	5-7.5 mg 10-50 mg	Morphine: 10-20 mg Fentanyl: 20-25 µg Fentanyl: 20-25 µg Sufentanyl: 5-10 µg

adequate analgesia, as well as avoidance of hypoxia, hypercarbia, and acidosis.

Management of labour

Combined spinal epidural with intrathecal opioid such as fentanyl in the first stage followed by titrated dose of local anaesthetic (LA) in the second stage is beneficial to prevent stress-related tachycardia. The addition of fentanyl to dilute LA mixture enhances the quality of analgesia without contributing to the sympathetic blockade. The fall in SVR in this stage is managed with small bolus (50–100 µg) of phenylephrine. Ephedrine is avoided unless there is relative bradycardia (HR <70/min). For a critically ill parturient, opioid alone may be administered through epidural/intrathecal route. Adequate perineal and segmental analgesia reduce stress-induced increase in HR and potentiate the urge to push. This allows foetal descent to be accomplished by uterine contractions and avoiding the deleterious effects of Valsalva maneuver

Table 4: Gradation of severity of mitral stenosis

Parameters	Normal	Mild	Moderate	Severe
Mean transvalvular pressure gradient (mmHg)	<2	2-6	6-12	>12
Mitral valve area (cm ²)	4-6	2.5-1.5	1.5-1	<1
Pulmonary artery pressure (mmHg)	10-20	<30	30-50	>50

during the second stage of labour. Low SA (when EA is not used) may be administered for a controlled second stage and delivery.

Management of caesarian delivery

In moderate to severe disease, SA is avoided due to acute fall in SVR following the block. EA with titrated dose of LA is preferred over SA as the former results in better control of haemodynamic state due to slower onset of blockade. Prophylactic use of vasopressors and intravascular volume loading are best avoided. A careful titration of anaesthetic and analgesic dose allows judicious and appropriate volume supplementation in a critical parturient. These parturients are prone to hypotension not only because of EA, but also due to venous pooling, prior beta-adrenergic blockade, and diuretic therapy. About 50–100 µg of phenylephrine or 20–40 µg of metaraminol is used in case of hypotension with little or no untoward effect on uteroplacental circulation. Caution use of oxytocin is warranted.

Few details about the anticipated changes during neuraxial block in parturients with other cardiovascular disease, anaesthetic goals, and neuraxial block of choice that anaesthesiologists should know are described in Table 5.

Table 5: Physiologic changes during neuraxial block, anaesthetic goal, and neuraxial block of choice

Disease/significant haemodynamic changes	Anaesthetic goal	Anticipated problem during labour and delivery	Changes during neuraxial block	Neuraxial block of choice and adjuvant
Mitral stenosis Gradual ↑ in transvalvular gradient till delivery (due to ↑ in blood volume and ↓ in SVR)	Avoid tachycardia (impaired diastolic filling) and fall in SVR Maintenance of adequate preload	Sudden ↑ in blood volume in the immediate postpartum is poorly tolerated due to fixed CO	Sudden ↓↓ in SVR after spinal block (poorly tolerated)	Segmental EA Fentanyl and other opioids (epidural or intrathecal route) Low SA (when EA is unavailable) Avoid ephedrine and prophylactic intravascular volume loading Metaraminol or low dose (20-40 µg)/phenylephrine to treat hypotension ^[5]
Mitral regurgitation Chronic volume overload of LV Pulmonary venous congestion	Avoid Bradycardia Myocardial depression ↑ in SVR	Uterine contraction may lead to ↑ in regurgitant volume leading to heart failure	↓SVR during neuraxial block is beneficial (↑ CO by forward flow) Early analgesia prevents rise in SVR due to pain	EA or CSE ^[6] Fentanyl/sufentanyl/remifentanyl
Aortic stenosis	Avoid both tachycardia and bradycardia Maintenance of adequate preload		Parturient with transvalvular gradient >50 mmHg may not tolerate the ↓ in CO and SVR associated with neuraxial block ^[7]	EA with or without fentanyl ^[8]

Contd...

Table 5: Contd...

Disease/significant haemodynamic changes	Anaesthetic goal	Anticipated problem during labour and delivery	Changes during neuraxial block	Neuraxial block of choice and adjuvant
Aortic regurgitation Chronic volume overloading leading to dilation and hypertrophy of LV ↑ myocardial oxygen requirement	Avoid Tachycardia, thus preventing catecholamine induced ↑ in SVR Bradycardia to ↓ regurgitant volume and flow Myocardial depressant which may provoke heart failure	Congestive cardiac failure	Same as mitral regurgitation	Same as mitral regurgitation ^[9]
Left-to-right shunts Mild to moderate lesions: well-tolerated Associated PH or severe disease may ↑ left-to-right shunt, cardiac failure, reversal of shunt (Eisenmenger's syndrome) and hypoxemia	↑ in HR and SVR: poorly tolerated leading to ventricular failure Avoid ↑ in SVR and ↓ in PVR No pulmonary vasodilator, thus avoid the ↑ in shunt fraction and shunt reversal Hypervolemia	PH Supraventricular arrhythmia and left ventricular failure especially in ASD	Spinal block lead to ↓ SVR thus ↓ the incidence of complications related to shunt reversal	Slow and titrated doses of EA along with opioid is well-tolerated by minimising the changes in HR and SVR ^[10]
Eisenmenger's syndrome Hypoxemia Arrhythmias Pulmonary hypertension	Avoid ↓ in SVR Hypotension Myocardial depression	Pulmonary hypertension Thromboembolism Sudden death	SA: poorly tolerated	Epidural/CSE Avoid epinephrine in the test dose (↓ in SVR because of peripheral β-adrenergic effect) ^[11-12]
Right-to-left shunts Right ventricular failure and low CO	Avoid ↓↓ in SVR and ↑ in PVR (from hypoxia, hypercarbia, or acidosis) Cautious use of oxytocin		Spinal anaesthesia is a relative contraindication	Epidural or segmental epidural if SVR is maintained (with opioids as an adjuvant) ^[13-14]
Cardiac tachyarrhythmias	Ventricular rate control (verapamil, digoxin, and β-blocker) Correct electrolytes and ABG Adequate hydration	High incidence of CHF and thromboembolism	SA: relative contraindication because maternal hypotension may lead to reflex tachycardia, foetal insufficiency	EA ^[15]
Pulmonary thromboembolism and PH	Avoid ↑ in PVR	See ES	See ES	EA, CEA ^[16,17]
Coronary artery disease May or may not be symptomatic ↑ myocardial oxygen in response to stress leading to myocardial ischemia	↓ myocardial work load (beta-blockers, nitrates, etc., continue till postpartum period) Supplemental O ₂ if required Avoid anaemia, respiratory depression, sudden ↓ in SVR	↑ Incidence of MI (37%-45%) during labour and delivery ^[18]	Minimise pain and stress (↓ incidence of myocardial ischemia) ↓ both preload and after load and thus a ↓ in myocardial work.	Early institution of CSE and EA ^[19] Omit epinephrine from test dose
Aortic aneurysms Cardiac pacemakers	Same as cardiac tachyarrhythmia Programming of pacemaker Use of bipolar cautery			Segmental EA ^[20,21] EA/CEA
Cardiomyopathies Hypertrophic Dilated Restrictive	High SVR is desirable (to prevent preload cavity collapse and thereby LVOTO) Avoid ↑ HR, ↑ contractility and ↑ preload Labetolol 0.25 mg/kg increments up to total dose of 1 mg/kg Maintain preload, HR, and contractility towards a little higher side	Exaggerated symptoms and sudden death ^[22]	Sudden ↓ in SVR during SA leading to ↑ LVOTO and ↓ CO (contraindicated)	Low EA with or without an opioid with slow titration ^[23-25] Blocker to control HR Phenylephrine 50 µg increments to treat hypotension Diluted oxytocin is well-tolerated CEA/low EA ^[26] CEA/low EA Same as dilated cardiomyopathy EA
Primary pulmonary hypertension (PAP > 25 mmHg at rest)	Avoid ↓ in SVR and ↑ in PVR Use vasopressor with caution under invasive monitoring	RVF Thromboembolism		Use oxytocin with caution ^[27]

Contd...

Table 5: Contd...

Disease/significant haemodynamic changes	Anaesthetic goal	Anticipated problem during labour and delivery	Changes during neuraxial block	Neuraxial block of choice and adjuvant
Postcardiac transplant Transplanted heart devoid of any nerve supply hence unresponsive to vagolytic Associated CAD, impaired cardiac function	Adjust the dose of immunosuppressants 2. strict asepsis, test dose antibiotics Avoid tachycardia (more sensitive to β adrenergic), myocardial depressant, hypertension, and aorto caval compression Maintain preload stress dose of steroid	\uparrow Risk of graft rejection, preterm delivery, hypertension, foetal growth retardation and dysrhythmia	No bradycardia during neuraxial block SA give rise to uncontrolled haemodynamics	CEA with low concentration of local anaesthetic solution with an opioid ^[28]

\uparrow – Increase; \downarrow – Decrease; LV – Left ventricle; SVR – Systemic vascular resistance; PVR – Pulmonary vascular resistance; HR – Heart rate; CO – Cardiac output; PH – Pulmonary hypertension; MI – Myocardial infarction; RVF – Right ventricular failure; EA – Epidural anaesthesia; ES – Eisenmenger syndrome CEA – Combined spinal epidural anaesthesia; SA – Spinal anaesthesia, PAP – Pulmonary artery pressure; LVOTO – Left ventricular outflow tract obstruction;

Table 6: Palliative cardiac shunt lesions

Shunt circuit	Anastomosis	Result
Blalock-Taussig	Subclavian artery to PA anastomosis	\uparrow PBF
Glenn	Superior venacava to PA anastomosis	\uparrow PBF in univentricular heart/tricuspid atresia
Fontan	Connecting right atrium with pulmonary trunk through a synthetic graft	\uparrow PBF in univentricular heart/tricuspid atresia
PA band	Constriction band around pulmonary artery	\downarrow PBF

PBF – Pulmonary artery blood flow; PA – Pulmonary artery

Table 7: Duration to discontinue/continue anticoagulant before/after neuraxial block

Drug	When to discontinue? Before block	When to restart? After block
Warfarin	5 days INR <1.5: proceed >1.5-1.8: oral vitamin K 1-2 mg before block, keep some FFP ready	After catheter removal
Aspirin	-	-
Low-molecular-weight heparin (prophylaxis)	12 h	2-4 h
Low-molecular-weight heparin (therapeutic)	24 h	2-4 h
Unfractionated heparin (SC)	4-6 h	>1 h
Unfractionated heparin (IV)	2-4 weeks, check APTT (should be normal)	>1 h
Rivaroxavan	12-18 h	6 h
Fondaparinox	36 h	>6 h

SC – Subcutaneous; IV – Intravenous; FFP – Fresh frozen plasma; APTT – Activated prothrombin time

SPECIAL GROUPS

Congenital cardiac lesions with a palliative surgery

Successful palliative repair for a cardiac lesion before pregnancy is associated with some degree of maternal foetal risk even in best of hands. There are few reports available describing the successful use of EA or combined spinal epidural anaesthesia in these lesions. Table 6 represents the most common palliative intracardiac shunt in which successful pregnancy and delivery happened.^[29-32]

Prosthetic heart valve and anticoagulation

Parturient receives anticoagulation for several reasons, of which prosthetic heart valve is one. Chronic use of anticoagulation may give rise to thrombocytopaenia. The

ideal level of platelets before neuraxial block should be more than $100,000/\text{mm}^{-3}$ according to different studies. There are some suggested durations for discontinuation of anticoagulant administration before and after neuraxial block and epidural catheter [Table 7].^[33-36]

Postoperative analgesia in these cases is usually with an opioid or α -agonist or a combination of opioid and nonsteroidal anti-inflammatory drugs intravenously. Patient-controlled analgesia is an alternative mode of analgesia in these group of patients.

SUMMARY

Optimal management during neuraxial anaesthesia requires a thorough assessment of the anatomic and

functional capacity of the diseased heart along with an analysis of how the described major physiologic changes are likely to affect the specific limitations imposed by the intrinsic disease, patient's tolerance to pain during labour or surgery, impact of uterine contraction-induced autotransfusion, postpartum changes induced by relief of vena caval obstruction, potential for postpartum haemorrhage, and use of uterine oxytocic agents.

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Conflicts of interest

There are no conflicts of interest.

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