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LABOUR ANALGESIA AND PREGNANCY OUTCOME IN CARDIAC DISEASE COMPLICATING PREGNANCY.

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ABSTRACT:

Background: Pregnancy makes a significant demand on the cardiovascular system. Cardiac disease is the most common cause of mortality in pregnancy. Cardiac disease has the potential to remain undiagnosed; it may present with cardiovascular decompensation during pregnancy, at the time of delivery, or immediately post-partum. The main aim is early risk assessment, optimization, regular monitoring for deterioration, planning of delivery, and surveillance for deterioration in the immediate post-partum period.One of the most severe pain experienced by a woman is during child birth. Hence, relief of labour and childbirth pain, including cesarean delivery is essential.**Objective of this study:** To assess the impact of labour analgesia and the pregnancy outcome and cardiac events during labour. It is important to understand the pain transmission for providing labour analgesia. Hemodynamic status fluctuates greatly during labour. Therefore, pregnant women with cardiovascular disease need epidural anaesthesia during labour depending upon the type of cardiovascular disease. **Methodology**: This is a prospective observational study conducted at SreeMookambikainstitute of medical sciences in 50antenatal women with cardiac disease complicating pregnancy during the period of June 2022 to May 2024 (2 years). **Results**: A total of 50 antenatal women with cardiovascular disease admitted in the department of obstetrics and gynaecology over a period of two year out of which 30 patients had epidural

analgesia during labour and 20 patients had no epidural analgesia during labour.Cardiovascular events significantly reduced in epidural group (30 patients) and there was no increase in cesarean section in epidural group. **Conclusions:** There was significant decrease in cardiovascular events related to arrhythmia hence decreased maternal morbidity and mortality. There was no associated increase in cesarean section rate but slight increase in instrumental vaginal delivery.

Keywords: Cardiac disease complicating pregnancy, Labour Analgesia, Epidural anesthesia,Instrumental delivery , Arrhythmia, Labour maternal morbidity and mortality.

INTRODUCTION:

Pregnancy makes a significant demand on the cardiovascular system. Cardiac disease is the most common cause of mortality in pregnancy. Cardiac disease has the potential to remain undiagnosed; it may present with cardiovascular decompensation during pregnancy, at the time of delivery, or immediately post-partum.

Women with underlying cardiac disease may not always accommodate the physiological changes of pregnancy, and ventricular dysfunction leads to cardiogenic heart failure. A few women with severe cardiac dysfunction can experience evidence of heart failure before mid-pregnancy. In others, heart failure may develop after 28 weeks' gestation, when pregnancy-induced hypervolemia and cardiac output reach their maximum. In most, however, heart failure develops peripartum, when labour, delivery, and several common obstetrical conditions add undue cardiac burdens. Some of the latter include preeclampsia, hemorrhage and anemia, and sepsis.[1]

Clinical indicators of cardiac disease in pregnancy are: [1]

World Health Organization (WHO) Risk Classification of Cardiovascular Disease and Pregnancy with Management Recommendations[1] are as follows:

Risk Category	Associated Conditions
WHO 1—Morbidity or mortality risk no higher than general population	Uncomplicated, small, or mild: Pulmonary stenosis Patent ductus arteriosus Mitral valve prolapse with no more than trivial mitral regurgitation Successfully repaired simple lesions: Ostium secundum atrial septal defect Ventricular septal defect Patent ductus arteriosus Total anomalous pulmonary venous drainage Isolated ventricular extrasystoles and atrial ectopic beats
• Cardiology consultation once or twice during pregnancy. Local hospital care suitable	
WHO 2—Small increase in risk of maternal mortality and moderate increase in morbidity risk	If otherwise uncomplicated: Unoperated atrial or ventricular septal defect Repaired Fallot tetralogy Most arrhythmias Turner syndrome without aortic dilation
• Cardiology consultation each trimester. Local hospital care suitable	
WHO 2 or 3—Intermediate increase in maternal mortality risk and moderate to severe rise in morbidity risk	Mild left ventricular impairment Hypertrophic cardiomyopathy Native or tissue disease not considered WHO 1 or 4 Marfan syndrome without aortic dilation Repaired coarctation Prior heart transplantation
• Cardiology consultation bimonthly. Care at referral hospital	
WHO 3—Significantly increased risk of maternal mortality and severe increase in morbidity risk	Mechanical valve Systemic right ventricle Post-Fontan operation Unrepaired cyanotic heart disease Other complex congenital heart disease Moderate left ventricular impairment Prior peripartum cardiomyopathy with no residual effect Moderate mitral stenosis Severe asymptomatic aortic stenosis Moderate aortic dilation (40–50 mm) Ventricular tachycardia
• Cardiology consultation monthly or bimonthly. Care at tertiary-care hospital	
WHO 4—Very high risk of maternal mortality or severe morbidity; pregnancy contraindicated and termination discussed	Pulmonary arterial hypertension Severe systemic ventricular dysfunction (NYHA III–IV or LVEF <30%) Prior peripartum cardiomyopathy with residual effects Severe left heart obstruction Severe aortic dilation Severe coarctation Fontan procedure with residual complications
• Pregnancy contraindicated • If pregnancy occurs, cardiology consultation monthly. Care at tertiary-care hospital	

Summarized from European Society of Gynecology, 2018; Nanna, 2014; Thorne, 2006.

The main aim is early risk assessment, optimization, regular monitoring for deterioration, planning of delivery, and surveillance for deterioration in the immediate post-partum period.[2]

Pregnancy is a stress test of cardiovascular reserve. The clinical classification of the New York Heart Association (NYHA) is based on past and present disability and is uninfluenced by physical signs[1]:

• Class I. Uncompromised—no limitation of physical activity.

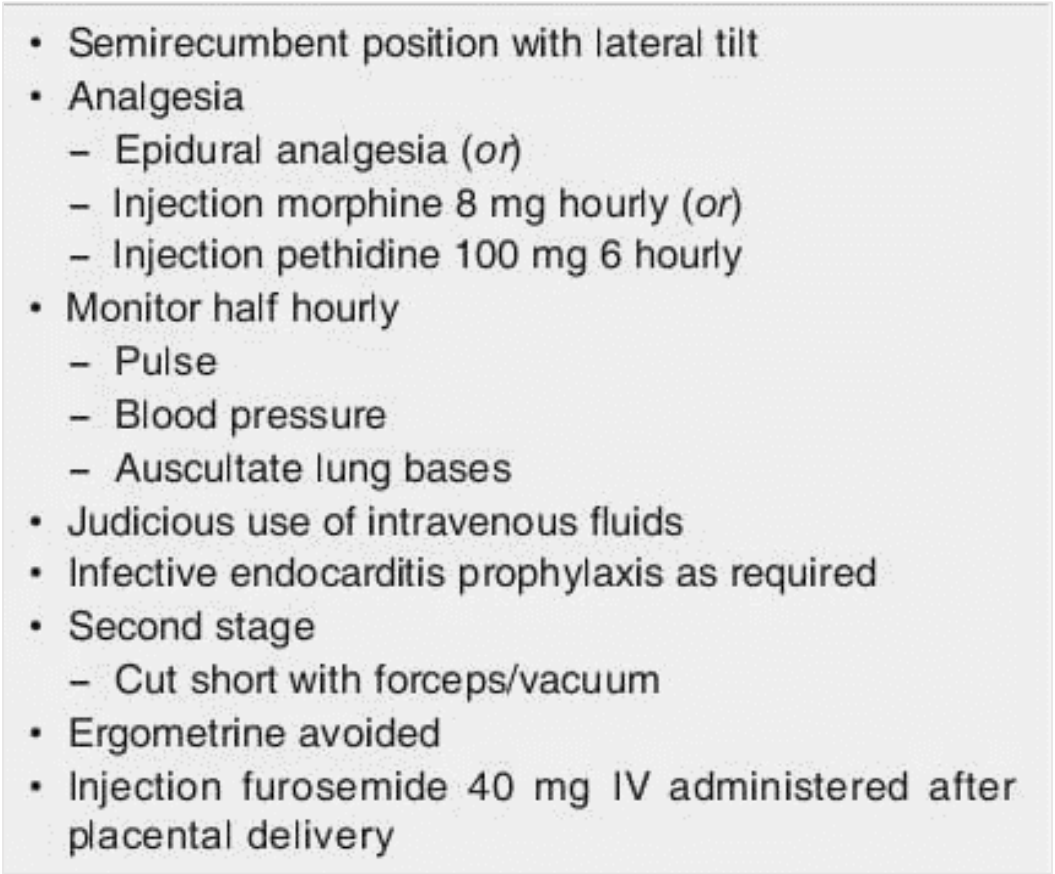
• Class II. Slight limitation of physical activity.

• Class III. Marked limitation of physical activity.

• Class IV. Severely compromised—inability to perform any physical activity without discomfort.

Women with NYHA Class 1 or 2 usually present little problem in pregnancy or labour and those with NYHA class 3 or 4 may not tolerate the physiological changes of pregnancy as they approach 20th - 28th week of gestation. Potential maternal problems include arrhythmia, heart failure, hypoxaemia and deep venous thrombosis.One of the most severe pain experienced by a woman is during child birth.Epidural analgesia removes the stress response to pain during labour in cardiac patients and facilitates an uneventful delivery although, previous studies have shown that vaginal delivery rates are affected by epidural analgesia.[5,6]

Management of cardiac disease complicating pregnancy is as follow[3] :



Labor pain is caused by uterine contractions and cervical dilation is transmitted through visceral afferent sympathetic nerves entering the spinal cord from T10 through L1. Later, perineal stretching transmits painful stimuli through the pudendal nerve and sacral nerves

from S2 through S4. Cortical responses to pain and anxiety are complex and may be influenced by multiple factors. Various nerve blocks provide pain relief during labor and/or delivery. These include pudendal, paracervical, and neuraxial blocks such as spinal, epidural, dural-puncture epidural, and combined spinal-epidural techniques.[1]

Epidural analgesia is a central nerve blockade technique which involves the injection of local anaesthetic into epidural space of the spine. It blocks the painful impulses generated from the nerves of the contracting uterus during labour. Afferent impulses from the Uterus and Cervix are transmitted via Aδ and C fibres which travel with sympathetic nerves via the hypogastric plexus to enter the sympathetic chain. Central connections to the spinal cord are via the dorsal root ganglion and lateral divisions of the posterior roots of T10 -L1(visceral pain). Afferent transmission from the Vagina and pelvic outlet is also via Aδ and C fibers but with parasympathetic bundle in the pudendal nerves S2, S3, S4 (Somatic pain). Therefore, the anaesthesia must cover the dermatomes from L2 to S5. First stage pain is visceral pain best relieved by a narcotic analgesic. Second stage pain is somatic in nature best relieved by a local anaesthetic. Thus, neuraxial analgesic technique that use combination of local anaesthetic and narcotic in low doses are considered the most versatile technique of pain relief in labour.[4]

Complete analgesia for the pain of labor and vaginal delivery necessitates a block from the T10 to the S4 dermatomes. For cesarean delivery, a block extending from the T4 to the S1 dermatomes is desired. The effective spread of anesthetic depends upon the catheter tip location and the dose, concentration, and volume of anesthetic agent used. Individual variations in anatomy or synechiae or septa in the epidural space may preclude a completely satisfactory block. Last, the catheter tip may migrate from its original location during labor.[1]

Epidural analgesia via a catheter in the epidural space is typically used for relief of labor pain, although it can also be used for anesthesia during operative vaginal and cesarean delivery. Spinal analgesia is typically given as a single intrathecal injection of a local anesthetic at the time of operative vaginal or cesarean delivery.[1]

Relief of labor and childbirth pain, including cesarean delivery, can be accomplished by injection of a local anesthetic agent into the epidural space. This potential space contains areolar tissue, fat, lymphatics, and the internal vertebral venous plexus. Entry for obstetrical analgesia is usually through a lumbar intervertebral space. Although only one injection may be given, usually an indwelling catheter is placed for subsequent bolus administration or continuous infusion.[1]

Labour should be conducted in the left lateral decubitus position to decrease the haemodynamic fluctuations associated with contraction. In third stage, there is always risk of pulmonary edema caused by fluid shift which can be minimized by decreased after load associated with epidural analgesia. A graded epidural anaesthesia should be planned to maintain hemodynamic stability and to maintain optimum systolic blood pressure, diastolic blood pressure, heart rate, central venous pressure and to prevent further rise in pulmonary vascular resistance.[4]

METHODOLOGY:

This is a prospective observational study conducted at SreeMookambika institute of medical sciences on 50 antenatal women with cardiac disease complicating pregnancy during the period of June 2022 to May 2024 (2 years).

Inclusion criteria:

- Antenatal mother with cardiac disease confirmed by ECHO.
- Normal body mass index (BMI<25 Kg/m^2).
- Under the age of 40 years.
- Singleton cephalic presentation.

Exclusion criteria:

- Patients with other associated medical complications.
- Foetal congenital abnormalities.
- Multiple pregnancies.

The primary aim of our study is to investigate the effect of epidural analgesia and the delivery outcome in women with cardiac disease complicating pregnancy.

Maternal data recorded include age, BMI at booking visit, type of heart disease, labour and delivery data which includes drugs used for augmentation, time taken in second stage of labour, mode of delivery (normal vaginal delivery, instrumental vaginal delivery and caesarean section), indications for instrumental delivery and caesarean section. Neonatal data recorded are birth weight, APGAR score at 1 and 5 minutes and admission to neonatal unit (NICU).

Our study included 50 antenatal women with heart disease of which 30 patients had epidural analgesia (Group A) and 20patients didn't have epidural analgesia (Group B).In our study for Group A patient's Epidural catheter are placed at the L2 - L3 or L3 - L4 interspace when women have a cervical dilatation of ≥3 cm. Blood pressure monitoring was done. Epidural anaesthesia was stopped 2 hours after delivery.

RESULTS:

This is a prospective observational study included a total of 50antenatal women with cardiac disease complicating pregnancy of which mean maternal age at delivery was 27.6 years, the mean BMI was 22 kg/m^2; 35 were primigravida and 15 were multigravida. During labour, Group-A= 30 patients (60%) out of 50 had an epidural analgesia for pain relief and the instrumental delivery rate was 60% in Group-A and over all caesarean section rate in Group-Awas 40% . The mean birth weight was 2.56 kg with 4% of all new-born were admitted to neonatal units.

Table 1: Mode of delivery

Mode of delivery	Group A- 30 Epidural group	Group B- 20 Non-Epidural group
CAESAREAN SECTION	12(40%)	6(30%)

INSTRUMENTAL VAGINAL DELIVERY	18(60%)	14(70%)

According to Table 1, During labour, of30 patients who had epidural analgesia 60% had instrumental vaginal delivery and 40% had LSCS. Among 20 patients in non-epidural group 70% had instrumental vaginal delivery and 30% had LSCS.

Table 2: Gravida wise distribution

PARITY	N=number
PRIMIGRAVIDA	35(70%)
MULTIGRAVIDA	15(30%)

Among 50 cases, 70% were primigravida and 30% were multigravida as shown in Table 2.

Table 3: Indications of Instrumental delivery

Indications	Instrumental delivery
Prolonged second stage of labour	16(32%)
Maternal exhaustion (failed maternal efforts)	12(24%)
CTG abnormalities	4(8%)

Most common indication for Instrumental delivery is prolonged second stage of labour (32%) followed by maternal exhaustion (24%) and CTG abnormalities (4%) as shown in Table 3.

Table 4: Indications of Caesarean section

Indications	Caesarean section
Failed induction	8(16%)
Arrest of labour	4(8%)
CTG abnormalities	4(8%)
Failed Instrumental delivery	2(4%)

Most common indication for caesarean section is failed induction (16%) followed by arrest of descent (8%) , CTG abnormalities (8%) and failed instrumental delivery (4%) as shown in Table 4.

DISCUSSION:

Previous studies have shown that the vaginal delivery rate is affected by epidural anaesthesia. In this study the vaginal delivery rate was affected by epidural anaesthesia consistent with previous studies. A prolongation of the second stage of labour due to epidural anaesthesia has been reported. Patient on epidural analgesia fail to strain during delivery and hence an increase in instrumental delivery has been found. But there was no significant increase in cardiovascular events or blood loss during delivery nor it affected the neonatal outcome. The increase of venous return associated with uterine contraction was controlled by epidural anaesthesia. While the activation of sympathetic nerve is controlled by decreasing the pain

due to uterine contraction, the rise in blood pressure and induced arrhythmia can be controlled. Extreme fluctuation in blood pressure can lead to breakdown of hemodynamic status hence we compared the systolic blood pressure before labour and during labour. In epidural group there was no significant variation in systolic BP and we can conclude that epidural anaesthesia is effective.Women with epidural analgesia in our study when compared to those without epidural analgesia had no significant difference in the rate of caesarean delivery overall.

According to the study done by Segodan et al, at Tamil Nadu, India in 2020 concludes, Epidural anesthesia allows a gradual onset of block with avoidance of hypotension by intermittent fluid bolus. Keeping the underlying pathophysiology in view, we aimed to maintain hemodynamic stability by maintaining an optimum systemic vascular resistance, preload, heart rate, sinus rhythm and decrease in pulmonary vascular resistance. This was achieved by epidural anesthesia in a graded manner using small fractionated doses of local anesthetics to ensure a gradual onset of block and minimize hemodynamic changes resulting from sympathetic autonomic blockade. They administered oxytocin by slow IV infusion to avoid tachycardia and diastolic hypotension. Agent that increased peripheral vascular resistance such as methylergometrine, prostaglandin F2 alpha, hypothermia, hypoxia and inadequate analgesia were strictly avoided.[4]

In a study by Anim et al, based on Cochrane Database Syst Rev. 2018 ,they found that women with epidural analgesia had prolonged second stage of labour and there were more instrumental vaginal deliveries. However, there was no increase in cesarean section. There was reduced event of arrhythmias.[7]

As per study done by Chen et al in 2016 in Taiwan,it has been reported that the motor block was the chief complication of labour epidural analgesia which might have resulted in prolonged labour and therefore increase the rates of instrumental assisted delivery.[8]

Based on the systemic review of trails done by Reynolds et al, states that theEpidural analgesia is associated with improved neonatal acid-base status, suggesting that placental exchange is well preserved in association with maternal sympathetic blockade and good analgesia. Although epidural analgesia may cause maternal hypotension and fever, longer second stage of labour and more instrumental vaginal deliveries, these potentially adverse factors appear to be outweighed by benefits to neonatal acid-base status.[9]

There is certain limitation to be considered about our study, as our database does not have a mandatory field for recording the epidural regimen that was used. There is literature evidence showing that different epidural analgesia formulas exhibit a different effect on the course of labour and the delivery outcome based on the study done by Singh et al.[10]

CONCLUSION:

Augmentation of labour, prolongation of second stage of labour and instrumental delivery were increased as a result of epidural anaesthesia. There were no events that adversely affected the maternal outcome. The vaginal delivery rate, blood loss during delivery and neonatal outcome were not affected by epidural anaesthesia. Cardiovascular events (like arrhythmias) significantly occurred during labour in non-epidural group.

In Epidural group there was significant decrease in cardiovascular events related to arrhythmia hence decreased maternal morbidity and mortality. There was no associated increase in cesarean section rate but slight increase in instrumental vaginal delivery. Epidural anaesthesia provides a safe parturition to women with cardiac disease complicating pregnancy.

Successful management necessitates strict vigilance and an extremely cautious approach to maintain the hemodynamic stability throughout the peripartum period. Good analgesia minimizes the cardiovascular changes which accompany labour. The widespread use of dilute local anaesthetic solution and epidural opioids for labour analgesia has increased the use of labour analgesia in antenatal mother with cardiac disease.

Vaginal delivery with low dose regional analgesia and careful fluid management is the preferred delivery mode in most cases of cardiac disease complicating pregnancy.

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Conflicts of interest :

There are no conflicts of interest.

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