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ANESTHETIC MANAGEMENT OF VENTRICULAR BIGEMINY IN A 35-WEEK ANTENATAL PATIENT: A CASE REPORT

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Abstract

The anesthetic care of a 33-year-old gravida 2 para 1 at 35 weeks gestation with hypothyroidism and recently discovered ventricular bigeminy is presented in this case study. Ventricular bigeminy was detected on an electrocardiogram (ECG) during a regular prenatal check-up, which led to further testing. Serum electrolytes, thyroid function, magnesium, calcium, and renal and liver function tests, as well as a complete blood count, were all normal. 60% of the ejection fraction, according to an echocardiography, and 43% of VPCs and no R on T phenomena were observed during Holter monitoring. Metoprolol was prescribed to the patient, who was identified as having a significant cardiac risk. Under general anesthesia, a planned elective cesarean section was scheduled. Careful planning, induction with propofol and atracurium, and intubation after lidocaine injection were all part of the intraoperative treatment. The patient maintained hemodynamic stability in spite of the ongoing ventricular bigeminy. Analgesia was achieved postoperatively with a bilateral transversus abdominis plane block. On the seventh postoperative day, the patient was released with a follow-up plan for further cardiac examination. This instance emphasizes the significance of careful anesthetic preparation and interdisciplinary care for individuals with heart problems who are high-risk during pregnancy.

Keywords: Ventricular Bigeminy, Antenatal Patient, Hypothyroidism, Cesarean Section.

INTRODUCTION

Significant complications arise in the care of prenatal patients with comorbid diseases, especially when these conditions involve endocrine abnormalities and cardiac arrhythmias. (1) Ventricular bigeminy, a form of arrhythmia where a premature ventricular contraction (PVC) follows each normal heartbeat, is an uncommon but serious condition that complicates the anesthetic management of pregnant patients (2).

Physiological changes in the cardiovascular system occurs during pregnancy. Ventricular ectopy, especially bigeminy, is particularly a concern in these patients. (3) Hormonal changes also affect cardiac function. Pregnancy raises blood volume, cardiac output, and heart rate. These alterations have the potential to worsen arrhythmias, which can be anywhere from harmless to fatal. (4) Particularly ventricular bigeminy can cause severe hemodynamic instability, which raises the possibility that more serious arrhythmias like ventricular tachycardia or ventricular fibrillation may develop. (5) Therefore, the detection and management of ventricular bigeminy in pregnant patients necessitate a comprehensive and vigilant approach to ensure maternal and fetal safety.

Thyroid hormones play a crucial role in maintaining normal cardiac function. (6) During pregnancy, the demand for thyroid hormones increases, making adequate management of hypothyroidism essential. Thyroid hormones affect myocardial contractility, heart rate, and vascular tone, and their deficiency can lead to bradycardia,

reduced cardiac output, cardiomyopathy and other cardiovascular dysfunctions. (7) In the context of arrhythmias, hypothyroidism can exacerbate the risk and severity of these pre existing arrhythmias. (8) (9)

The anesthetic management of pregnant patients with ventricular bigeminy and hypothyroidism requires meticulous planning and a multidisciplinary approach. Key considerations include maintaining hemodynamic stability, preventing the exacerbation of arrhythmias (10). Anesthetic agents and techniques must be chosen carefully to minimize cardiac stress and avoid triggers for arrhythmias. The perioperative period involves extensive monitoring and readiness for immediate intervention in case of cardiac events (11).

Preoperative optimization is crucial, which is done by the attending cardio-obstetric team. Intraoperative management includes the use of advanced monitoring techniques, careful induction and maintenance of anesthesia, and preparedness for emergency interventions. Postoperative care focuses on continued monitoring of cardiac function, with a plan for managing any potential complications. (12)

The anesthetic management of pregnant patients with significant comorbidities such as ventricular bigeminy and hypothyroidism is complex and requires a tailored, multidisciplinary approach. This case underscores the critical need for thorough preoperative assessment, careful intraoperative management, and vigilant postoperative care to optimize outcomes for both the mother and fetus. By exploring the interactions between pregnancy, cardiac arrhythmias, and thyroid dysfunction, this case report aims to contribute to the broader understanding and clinical knowledge necessary for handling similar high-risk scenarios in obstetric anesthesia.

Case Presentation:

For a normal prenatal check-up, a 33-year-old gravida 2 para 1 living 1 ($G_2P_1L_1$) 35 weeks of gestation who had previously had a lower segment cesarean section (LSCS) arrived to Saveetha Medical College and hospital. She had been diagnosed as hypothyroid during the first trimester of her current pregnancy, managed with levothyroxine (T Thyronorm) 25 mcg daily. This was her first visit to our hospital during the current pregnancy. Reports of previous antenatal visits at other institutes couldnot be traced.

Ventricular bigeminy was discovered on an electrocardiogram (ECG) during a regular checkup. Additional tests revealed that the thyroid function test (TFT), serum electrolytes, magnesium (Mg), calcium (Ca), liver function test (LFT), renal function test (RFT), and complete blood count (CBC) were all within normal limits. Following a consultation with a cardiologist, an echocardiogram (ECHO) revealed ventricular premature contractions (VPCs) and an ejection fraction (EF) of 60%. The echocardiogram indicated normal chamber dimensions, valve function, and pressure gradients. Holter monitoring revealed 43% VPCs (total ventricular ectopy [VE] – 60,438, ventricular pairs [V-Pair] 513, ventricular runs [V-Run] 723, longest V-Run 9), with no recorded R on T phenomenon. The patient was started on metoprolol 50 mg (divided dose of 25 mg) and was informed of the high cardiac risk associated with surgery.

It was decided to conduct an elective cesarean section under general anesthesia (GA) due to the elevated cardiac risk. A thorough anesthetic strategy was created, with special attention to careful monitoring and readiness for any cardiac problems. After

being taken to the operating room (OT), the patient had two large-bore intravenous (IV) cannulas placed. A defibrillator with continuous electrocardiogram (ECG) monitor, non-invasive blood pressure (NIBP), and pulse oximetry were fitted as standard monitors. A cardiologist with transvenous pacer was on standby. Emergency medications, such as lidocaine (preservative free; infusion), noradrenaline, adrenaline, amiodarone, phenylephrine, and isoprenaline, were kept ready.

Adequate preoxygenation was performed with 100% oxygen for five minutes. Glycopyrrolate 0.2 mg IM was administered 30 minutes prior to induction to reduce secretions. Anesthesia was induced with propofol 1.5 mg/kg IV and atracurium 0.5mg/kg IV. Apneic ventilation was performed along with Sellicks manouver . Lidocaine 1mg/kg IV was given 90 seconds before intubation to blunt the intubation response. Direct laryngoscopy was performed with a MAC 4 blade and intubation was completed with a size 7 endotracheal tube (OETT).

After the fetus was delivered safely, oxytocin (15 units) was started as slow infusion. Inj Fentanyl 2 mcg/kg IV was administered as an analgesic. The patient had persistent ventricular bigeminy/trigeminy, although she remained hemodynamically stable throughout the procedure. Following the procedure, postoperative analgesia was achieved with a bilateral transversus abdominis plane (TAP) block using 15 ml of levobupivacaine 0.25% on each side. Inj Glycopyrolate 0.01mg/kg IV followed by Inj Neostigmine 0.05mg/kg IV was used to reverse the neuromuscular blockade. The IV lidocaine dosage of 60 mg was repeated prior to the uneventful extubation.

The patient was transferred to the post-anesthesia care unit (PACU) for observation and subsequently moved to the ward on postoperative day (POD) 1. The postoperative period was uneventful, and the patient was discharged on POD 7 with a plan for an electrophysiological study and cardiac MRI at a later date.

DISCUSSION

Managing a pregnant patient with ventricular ectopy, specifically bigeminy, requires careful consideration of several factors.Ventricular ectopy has the propensity to progress to more severe arrhythmias such as ventricular tachycardia or fibrillation. Avoiding the R on T phenomenon by maintaining an appropriate heart rate is critical. The impact of pregnancy hormones on ventricular ectopy also plays a significant role. Estrogen can be pro-arrhythmic due to its action on L-type calcium channels, while progesterone can be either anti-arrhythmic or pro-arrhythmic. The hormonal variations in pregnancy create a higher risk for arrhythmias.

Cardio-obstetric team with anesthesiologist as team lead plays a key role in the preoperative evaluation and optimisation, intraoperative management and post operative care in these patients. Preoperative optimization focused on controlling the frequency of ventricular ectopy. Intraoperative management included the use of advanced monitoring techniques, careful induction and maintenance of anesthesia, safe delivery of the fetus and preparedness for emergency interventions, if need arises. Postoperative care emphasized continued monitoring of cardiac function with a plan for managing any potential complications.

Pregnant individuals with major comorbidities such ventricular bigeminy and hypothyroidism have complicated anesthetic treatment that calls for a customized strategy. In order to maximize outcomes for the mother and the fetus, such cases emphasize the significance of accurate preoperative assessment, attentive

intraoperative treatment, and watchful postoperative care. In order to manage comparable high-risk situations in obstetric anesthesia, this paper adds to the body of clinical information and a better understanding of the relationship between pregnancy and cardiac arrhythmias

Ventricular bigeminy, a type of ventricular ectopy where every alternate heartbeat is a premature ventricular contraction (PVC), poses significant risks in the peripartum period. The presence of frequent PVCs, as observed in this patient, can escalate the risk of developing more severe arrhythmias such as ventricular tachycardia (VT) or ventricular fibrillation (VF). This is particularly concerning in pregnancy, where the cardiovascular system undergoes substantial changes, including increased blood volume, cardiac output, and heart rate which compromises the fetal well being.

Holter monitoring in this patient revealed 43% VPCs, which suggests a significant ectopy load. It was comforting that there was no R on T phenomenon—a situation in which a PVC falls on the T wave of the beat before, perhaps leading to VT or VF, which could be fatal. Nonetheless, considerable vigilance was still necessary due to the high incidence of PVCs. The choice to start metoprolol medication, by cardiologist, was made in an effort to lessen the burden of ectopic episodes and lower the possibility that they might escalate to more serious arrhythmias. The beta-blocker metoprolol is useful in regulating heart rate and lowering the incidence of PVCs, but when used during pregnancy, dosage adjustments must be made carefully to prevent fetal bradycardia and other possible adverse effects.

The impact of pregnancy hormones on cardiac electrophysiology cannot be overlooked. Estrogen, known for its pro-arrhythmic effects through modulation of ion channels, can increase the susceptibility to arrhythmias. Progesterone, on the other hand, has complex effects and can be both anti-arrhythmic and pro-arrhythmic depending on the context. The fluctuating levels of these hormones during pregnancy create a dynamic and sometimes unpredictable risk environment for arrhythmias. In this patient, the combination of high ectopic burden and the hormonal milieu of late pregnancy necessitated a cautious approach to anesthetic management. The decision to proceed with general anesthesia for the cesarean section was based on the need for controlled airway management and the ability to respond rapidly to potential cardiac events.

The anesthetic plan included the use of propofol and atracurium for induction, providing hemodynamic stability. Preoxygenation and the administration of glycopyrrolate helped optimize oxygenation and reduce secretions, respectively. Lidocaine was used to blunt the intubation response, mitigating the risk of arrhythmias triggered by laryngoscopy.

The treatment of the patient throughout surgery was carefully organized, including ongoing ECG monitoring and defibrillation preparation. The provision of emergency medications, such as isoprenaline, amiodarone, adrenaline, phenylephrine, and noradrenaline, guaranteed readiness in the case of a cardiac attack. Transversus abdominis plane (TAP) blocks reduced the demand for systemic analgesics in the immediate postoperative period and reduced the incidence of tachy/bradyarrhthmias which can increase ventricular ectopy.

The patient's ventricular bigeminy/trigeminy persisted during the surgery, although she remained hemodynamically stable. The cautious use of anesthetics and the prompt handling of any problems are responsible for this stability. Following surgery, the

patient was kept under observation in the PACU and then moved to the ward, where she recovered without any problems. The anesthetic management of a pregnant patient with ventricular bigeminy presents unique challenges, as evidenced by our case report. To better understand these complexities, it's insightful to draw comparisons with other similar case studies in the literature.

Gumber et al. (2022) highlighted “a rare instance of parathyroid carcinoma during pregnancy, where a 38-year-old pregnant woman experienced repeated hospital admissions for symptoms including palpitations, headaches, dizziness, and polydipsia. These symptoms were due to severe hypercalcemia and ventricular bigeminy, diagnosed via blood investigations and a 24-hour ECG. This case underscores the difficulty of diagnosing hypercalcemia during pregnancy due to its overlapping symptoms with common pregnancy disorders. The timely surgical intervention and multidisciplinary approach were pivotal in managing the patient’s condition and preventing maternal and fetal complications. This parallels our case in the importance of early recognition and multidisciplinary management of complex conditions during pregnancy to optimize outcomes”. (13)

Aravind et al. (2023) investigated the “elevated risk of arrhythmias in pregnancy, even in women whose hearts are anatomically sound. An emergency cesarean delivery was necessary for a pregnant woman, 25, who had a history of ventricular bigeminy and idiopathic ventricular tachycardia (VT). The fetus was in distress. The patient was managed with epidural and general anesthesia, along with careful hemodynamic monitoring and the injection of magnesium sulfate to treat the arrhythmias. The need for quick and adaptable anesthetic planning in emergency settings is demonstrated by this example, which is comparable to our method of treating the high-risk cardiac disease in a monitored elective context”. (14)

Truong et al. (2023) “highlight the potential for serious cardiac complications in pregnant women with mitral valve prolapse (MVP). They report a case of a 34-year-old pregnant woman who experienced cardiac arrest due to torsades de pointes, a form of ventricular arrhythmia. This case emphasizes the necessity of recognizing high-risk profiles in patients with MVP, as ventricular arrhythmias, although infrequent, can have catastrophic outcomes. In our case, while the patient had a structurally normal heart, the presence of ventricular bigeminy posed significant risks, necessitating careful anesthetic planning and intraoperative monitoring to prevent arrhythmic complications”. (15)

Ventricular bigeminy, a type of dysrhythmia, can complicate pregnancy and labor, as discussed in the study by Sanikop et al. (2015). They reported on a 21-year-old woman undergoing elective lower segment cesarean section (LSCS) managed with general anesthesia and intraoperative administration of loxicard and metoprolol to address ventricular ectopics. This case underlines the importance of a detailed medical history, clinical examination, and the judicious use of antiarrhythmic agents during pregnancy to prevent asymptomatic ventricular ectopy from progressing to fatal arrhythmia. The successful management of our patient using a similar approach, with the addition of continuous ECG monitoring and the availability of emergency drugs, reflects these principles. (16)

The study by Ganny et al. (2005) highlighted the occurrence of ventricular bigeminy in patients undergoing various orthopedic procedures, emphasizing the need for continuous intraoperative ECG monitoring. Their findings suggested that causes of

ventricular arrhythmias included hypokalemia, inadequate analgesia, advanced age, previous rheumatic heart disease, and myocardial sensitization to catecholamines by anesthetic agents such as halothane. In our case, despite the patient's normal laboratory values, continuous monitoring and preparation for emergency interventions were crucial in maintaining hemodynamic stability throughout the procedure. This reinforces the importance of preoperative patient evaluations and intraoperative monitoring to manage potential arrhythmic events effectively. (17)

Lai et al. (2007) discussed a case where a healthy primiparous woman developed ventricular bigeminy after the administration of a phenylephrine infusion during an emergency cesarean section. They suggested that the arrhythmia was likely induced by increased ventricular afterload due to phenylephrine. This case highlights the potential proarrhythmic effects of phenylephrine, despite its effectiveness in managing maternal hypotension during spinal anesthesia. In our case, phenylephrine was part of the emergency drug preparation, but its administration was carefully monitored to avoid similar complications. (18)

Sundarsingh et al. (2024) present “a case of a 31-year-old pregnant woman with Sjogren’s syndrome (SS) who developed severe hypokalemia and respiratory acidosis, necessitating immediate intervention. This case highlights the physiological changes during pregnancy that can exacerbate underlying conditions and the importance of recognizing and managing electrolyte abnormalities. Although our patient did not have an autoimmune disorder, the management of her hypothyroidism and ventricular bigeminy required similar vigilance to prevent complications. The case underscores the importance of addressing coexisting medical conditions and their potential impact on pregnancy and anesthetic management”. (19) These literature consistently emphasizes the need for a multidisciplinary approach in managing pregnant patients with cardiac conditions.

CONCLUSION

The successful anesthetic management of this patient with ventricular bigeminy and hypothyroidism highlights the need for careful preoperative assessment, intraoperative vigilance, and postoperative monitoring. The interplay between pregnancy, cardiac arrhythmias, and thyroid dysfunction requires a nuanced approach to ensure maternal and fetal safety. Drawing on insights from related case studies, it is evident that early diagnosis, careful monitoring, and collaborative care are essential for preventing complications and ensuring favorable outcomes. Our case report contributes to the growing body of knowledge on the anesthetic management of high-risk cardiac conditions during pregnancy, emphasizing the importance of tailored anesthetic plans and vigilant intraoperative and postoperative care.

Acknowledgment:

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Conflict of Interest:

The authors declare no conflicts of interest related to this study.

Consent Declaration:

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

Figure A

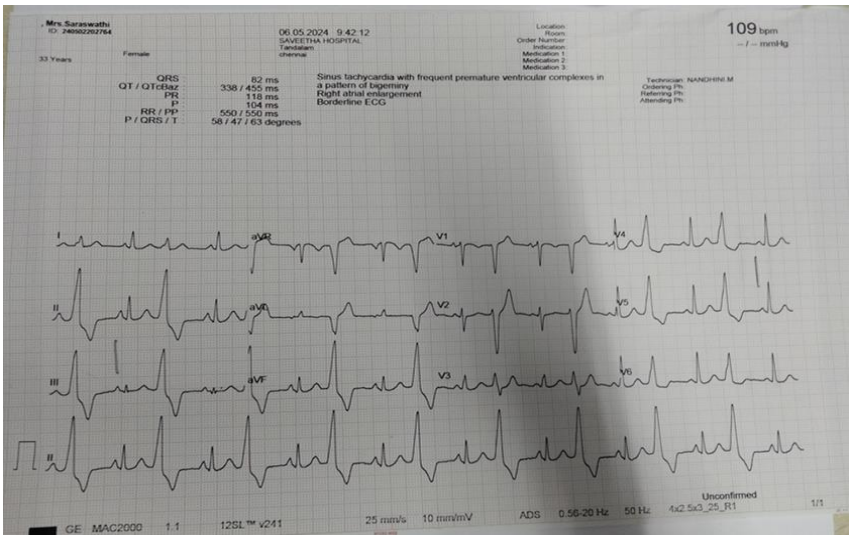
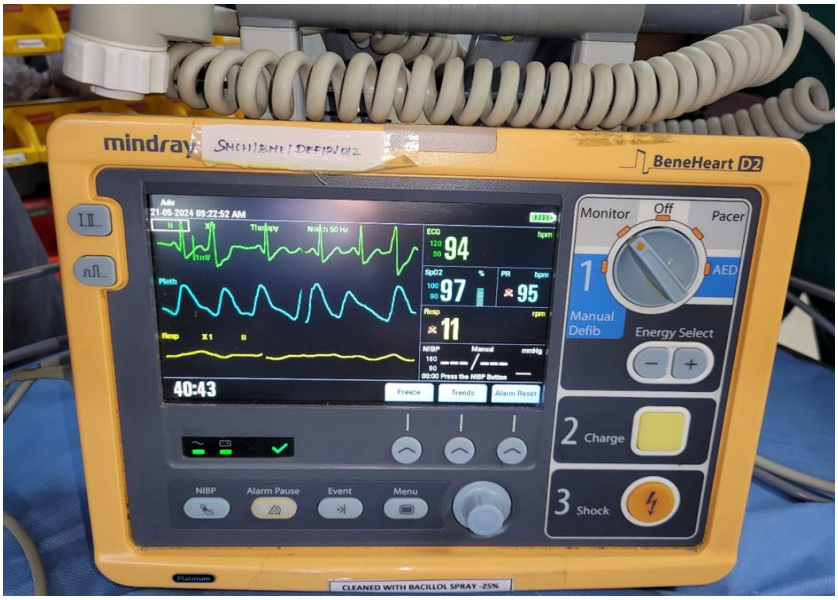


Figure B



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