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Life-Sustaining Rhythms: Pregnancy in a Patient with a Pacemaker

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Abstract

Cardiac pacemakers are essential electronic devices used to manage arrhythmias and conduction issues. The first documented case involving a pregnant woman with a pacemaker in 1962 underscores the evolving intersection of cardiac pacing and obstetrics. Primary indications for pacemaker implantation in reproductive-aged women include sinus node dysfunction and AV block, with various types chosen based on individual cardiac abnormalities. Pregnancy with a pacemaker generally proceeds well under multidisciplinary care, focusing on symptom monitoring and adjustments to pacemaker settings if required. Anaesthesia and surgical planning consider pacemaker status and electrolyte balance besides precautions during surgery to preserve pacemaker function.

A 23-year-old woman, G3P2L2NND1, who had previously undergone two lower segment caesarean sections (LSCS), presented at four months of pregnancy with a permanent pacemaker implanted two years earlier. Her first LSCS for twins was complicated by peripartum cardiomyopathy, managed in the ICU postpartum. Subsequently developing complete heart block, she underwent successful DDDR pacemaker insertion. Her subsequent pregnancies were managed similarly, with an emergency LSCS at 36 weeks during the second pregnancy and an elective LSCS with tubal ligation at 37 weeks during the third. Effective management of pregnancy with a pacemaker requires vigilant monitoring and collaborative care among obstetricians, cardiologists, and anaesthesiologists to optimize outcomes for both mother and foetus.

Keywords: pacemaker, VDD, asynchronous mode, PPCM, complete heart block

Abbreviations

LSCS lower segment caesarean section
ICU intensive care unit
ECG electrocardiogram
LVEF left ventricular ejection fraction
DDDR dual-pacing dual-sensing dual-response rate-adaptive
VDD single lead atrial synchronous pacing mode

RV right ventricle

SAV sino-atrio-ventricular

TR tricuspid regurgitation

AV atrioventricular

ACC/AHA American College of Cardiology/ American Heart Association

NASPE/BPEG The North American Society of Pacing & Electrophysiology (NASPE) and the British Pacing & Electrophysiology Group (BPEG)

Introduction

Cardiac pacemakers are electronic devices used to manage heart rhythms in individuals with arrhythmias or conduction abnormalities. The inaugural documented case of a pregnant woman with a pacemaker occurred in 1962, highlighting a significant advancement in comprehending the relationship between cardiac pacing and pregnancy. As cardiovascular and paediatric surgical techniques have progressed, obstetricians are increasingly encountering pregnant patients with implanted pacemakers. This convergence of pacemaker therapy and pregnancy introduces distinct challenges and considerations for both the patient and healthcare providers.

Case Report

A 23-year-old woman, G3P2L2NND1, with a history of two previous lower segment caesarean sections (LSCS), registered at our institution at four months of gestation. She had a permanent cardiac pacemaker implanted two years ago. Her first LSCS was performed in February 2022 at a peripheral hospital for twins, with the first twin in breech presentation. At that time, she had no history of cardiac disorders. Immediately postpartum, she was diagnosed with peripartum cardiomyopathy, which was managed conservatively in an ICU setting. She improved symptomatically and was discharged on postoperative day 10, although one of her twins succumbed to respiratory distress.

Two months after delivery, she experienced acute shortness of breath, palpitations, and a syncopal attack. She was admitted to the ICU, where her electrocardiogram (ECG) revealed complete heart block with a pulse rate of 50/minute. An echocardiogram showed an LVEF of 50%, mild generalized left ventricular hypokinesia, and mild pulmonary hypertension. After initial stabilization, she successfully underwent permanent pacemaker (DDDR type) insertion with final settings: [Mode: VDD, lower rate: 60/minute, upper tracking rate: 130/min, RV output 2.5 V @ 0.4 ms, SAV delay 150 ms].

Soon after, she conceived for the second time and registered at our institute. Her antenatal period, managed by a multidisciplinary team of obstetricians and cardiologists, was uneventful, and no changes to her pacemaker settings were needed. At 36 weeks in April 2023, she had an emergency LSCS, during which a technician from the pacemaker's manufacturing company was requested and given special privileges. Intraoperatively, the pacemaker settings were changed to asynchronous mode to facilitate the use of diathermy, which was particularly beneficial due to the need for extensive adhesiolysis. Postoperatively, the pacemaker settings were reset to VDD mode. She had an uneventful recovery and was discharged on day 7.

Six months later, she conceived again and registered at four months of gestation with her previous doctors. Her antenatal investigations and obstetric ultrasounds were normal. An ECG showed a paced rhythm with a heart rate of 80/minute, and an echocardiogram revealed an LVEF of 60% with trivial TR. At 37 weeks, she underwent an elective LSCS with concurrent tubal ligation. The same technician was called for

intraoperative modification of the pacemaker settings. She was discharged on day 7 after an uneventful recovery, going home with her 2.8 kg male child.

Discussion

An increasing number of women with implanted pacemakers are consulting their obstetricians, either planning pregnancy or already pregnant. Sinus node dysfunction is the primary reason for pacemaker implantation in reproductive-aged women, followed by atrioventricular (AV) block [1]. Less common indications include neurocardiogenic syncope and iatrogenic causes, such as AV node injury post-ablation for supraventricular tachycardia. According to ACC/AHA guidelines, third-degree AV block at any anatomical level, associated with bradycardia and symptoms presumed to be due to AV block, warrants permanent pacing, as seen in our patient [1].

Pacemakers consist of a pulse generator and electrode wires or leads, typically inserted through the cephalic, axillary, or subclavian veins. They can be programmed externally with radio waves. The NBG (NASPE/BPEG Generic) code classifies pacemakers using five letters: the first for the chamber(s) paced, the second for the chamber(s) sensed ("A" for atrium, "V" for ventricle, "D" for both), the third for the response to a sensed event, the fourth for rate modulation, and the fifth for multisite pacing. Various types of pacemakers exist today, and are selected based on the individual's specific abnormality. Our patient had a dual chamber fixed-rate type pacemaker in DDD mode, monitoring and pacing both atrial and ventricular chambers as needed. Atrial activity was tracked, and if absent, a ventricular stimulus was delivered. A fixed-rate pacemaker is programmed at a constant rate that does not adjust with patient activity. Multiple studies have demonstrated the safe use of fixed-rate pacemakers in pregnant patients, largely due to the increase in stroke volume when the pacing rate is set correctly [2].

Pregnant patients with pacemakers typically fare well, necessitating collaborative management with cardiology. Evaluation pre-conception or early in the first trimester includes ECG, echocardiogram, and pacemaker assessment to ascertain dependency. Vigilance for symptoms like palpitations, breathlessness, syncope, dizziness, confusion, and exercise intolerance is crucial throughout pregnancy, prompting potential pacing adjustments. Our patient remained asymptomatic during antenatal care, without complications for mother or foetus [3]. Pacemakers do not interfere with external foetal heart rate monitoring, compatible with ultrasonographic techniques. Vaginal delivery or caesarean section options are considered based on obstetric indications or concurrent conditions, with vaginal delivery deemed generally safe even with a pacemaker in situ [2].

Early anaesthetic consultation is recommended during pregnancy. Epidural anaesthesia can help mitigate changes in cardiac output. Delivery in the lateral decubitus position is also advised to minimize rapid hemodynamic fluctuations during bearing down. During caesarean delivery, the anaesthesiologist must consider the pacemaker's mode, implantation date, and battery life. Monitoring for reduced cardiac output and pacemaker malfunction using ECG and correcting electrolyte imbalances like hypokalaemia or hyperkalaemia before anaesthesia is critical as they affect pacing thresholds [3]. Anaesthesia should aim to prevent maternal hypotension to protect uteroplacental blood flow, thus favouring epidural over spinal anaesthesia due to lower risks of maternal hypotension and foetal bradycardia [3].

Bipolar electrocautery in brief bursts during the procedure should be used to minimize pacemaker

interference and prevent accidental resetting. Electrocautery disruptions can potentially induce asystole in pacemaker-dependent patients [4]. Reprogramming the pacemaker to asynchronous mode can mitigate electromagnetic interference, typically reserved for pacemaker-dependent cases [4]. After adjusting pacemaker settings pre-operatively, it's essential to restore them to their original configuration afterward. As a standard safety measure, the grounding plate for the electrosurgical unit should be near the surgical site and away from the pacemaker. If despite these precautions the pacemaker remains affected, temporary switching to continuous asynchronous pacing mode (VOO) via programming or magnet placement over the device can maintain uninterrupted pacing [4].

There is limited clinical information on adverse pregnancy outcomes related to pacemaker use. The most common non-obstetric complication associated with pacemakers is skin irritation and ulceration at the implantation site, often due to breast hypertrophy. Therefore, it is essential to position pacemakers in women of reproductive age in areas such as the sub-pectoral region rather than the abdomen or breast, which undergo skin changes during pregnancy or may be involved in procedures like caesarean sections. Thoughtful placement of pacemakers can also decrease the likelihood of complications such as pacemaker lead dislodgement or fracture, known as Twiddler's syndrome [3]. Other recognized complications, not specifically related to pregnancy, include chronic pain, battery failure, and extrasystoles [3].

Conclusion

In conclusion, managing pregnancy with a pacemaker requires vigilant monitoring and close collaboration between obstetricians, cardiologists, and anaesthesiologists is crucial for ensuring optimal maternal and foetal outcomes.

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