

Permanent pacemakers in pregnancy

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Summary

Advances in cardiology and cardiovascular surgery have increased the use of permanent pacemakers in young adults such that there are more women with pacemakers becoming pregnant. This case report describes the pregnancy and delivery of a young woman with a demand pacemaker and reviews the principles of management of cardiac pacemakers in pregnancy. As part of the multidisciplinary team including cardiology, anesthesia, nursing and caring for these patients, it is important that obstetricians be informed and follow the principles of management of cardiac pacemakers in pregnancy to continue to achieve successful pregnancy outcomes.

Key words: Pregnancy; Artificial pacemaker; Cardiac arrhythmias.

Introduction

The use of permanent pacemakers is not confined to the elderly, and an increasing number of children and adolescents require permanent pacing for various indications [1]. Moreover, advances in pediatric cardiology and surgery have resulted in markedly improved survival of individuals with congenital heart disease [2], some of whom require permanent pacing as symptomatic heart block can occur as a consequence of a congenital heart defect or its repair. These factors have increased the coexistence of pacemakers in pregnancy.

Case Report

A 17-year-old primigravida with a demand pacemaker was referred to the Perinatology Clinic for consultation at 27 weeks' plus three days gestation for assessment of fetal and maternal wellbeing.

Review of her past medical history was significant for syncope episodes at age 16 due to intermittent heart block with sinus pauses, necessitating implantation of a single lead atrial synchronous ventricular inhibited pacemaker (VDD). Cardiology assessment in her second trimester revealed new onset of atypical syncopal spells, and no other cardiac symptoms. Evaluation of her pacemaker revealed normal function with good sensing and pacing thresholds. The ECG showed sinus arrhythmia with a first degree AV block. Normal biventricular size and function with no significant valvulopathy was seen on echocardiogram. A 24-hour Holter monitor was arranged to investigate her recurrent syncopal spells. It confirmed appropriate functioning of the pacemaker as the patient was predominately in sinus rhythm with intermittent pacing, thus suggesting that the recurrent spells were most likely vasovagal in origin.

Serial ultrasonography was performed every two weeks at the Perinatology Clinic for fetal surveillance. Normal fetal anatomy, good interval growth and no evidence of fetal compromise were identified. The patient was referred to an obstetrician-gynaecologist at a tertiary care hospital for ongoing prenatal care and delivery. Maternal surveillance was reassuring with no evidence

of gestational hypertension or diabetes. An antenatal anaesthesia consultation was obtained.

The patient had regular surveillance with her cardiologist throughout the pregnancy. At 36 weeks' gestation, it was felt that she had sufficient cardiovascular reserve to withstand the hemodynamic stress of labor and delivery. Her pregnancy progressed uneventfully to term and she was induced at 40 weeks' gestation with amniotomy and intravenous oxytocin. She received an epidural anesthetic and progressed to full dilatation. Electronic fetal monitoring revealed variable decelerations in the second stage. A low-vacuum delivery was performed for fetal heart rate abnormalities and maternal exhaustion after two hours of pushing. A live female infant weighing 4,450 g was delivered without complications. Apgar scores were 9 at 1 min and 9 at 5 min. Umbilical cord gases were normal. The placenta delivered spontaneously with traction and a first degree perineal laceration was repaired. Despite a postpartum hemorrhage with an estimated blood loss of 800 ml, the patient was transferred to the postpartum unit in stable condition and had an uneventful recovery in the postpartum period.

Discussion

Since the first reported case of an implanted cardiac pacemaker in pregnancy in 1962, many women have gone on to have successful pregnancy outcomes with pacemakers in situ [3]. There are many types of permanent pacemakers and the choice depends on the specific abnormality present. To facilitate their use and understanding, a standard nomenclature is used to describe the type of pacemaker. The first position reflects the chamber(s) paced and the second, the chamber(s) sensed with "A" indicating atrium, "V" ventricle, and "D" dual for both atrium and ventricle. The third position refers to the response of the pacemaker to a sensed event, with "I" indicating inhibition or "D" indicating dual function, either inhibition or triggering. Our patient had a VDD pacemaker indicating that only the ventricle was paced, both chambers were sensed, and the pacemaker either inhibited itself in response to a sensed ventricular event, or triggered ventricular output by an event sensed in the atrium without native ventricular response.

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Our patient's pacemaker was also known to be rate responsive, incorporating a sensor to adjust its programmed paced heart rate in response to patient activity. This feature may be beneficial to pregnant women requiring permanent pacemaker therapy. Physiologic heart rate variations during pregnancy and caesarean delivery have been reported with a rate responsive pacemaker [4]. Extensive adaptation of the cardiovascular system occurs during pregnancy, labor and delivery and in the postpartum period. Antepartum, circulating blood volume and heart rate increase and peripheral vascular resistance decreases to perfuse the developing fetal-placental unit. Labor is associated with a dramatic increase in cardiac output to facilitate the work of delivery, followed by a significant decrease in blood volume postpartum.

A report of over 20 pregnancies with permanent cardiac pacemakers demonstrates favorable pregnancy outcomes with minimal maternal or fetal complications [4]. In particular, cardiopulmonary problems were extremely rare when the cardiac pacemaker was implanted pre-pregnancy. One case report describes recurrent pulmonary emboli and thrombus attached to a permanently implanted pacemaker wire in pregnancy [5]. The most common maternal complication was skin irritation and ulceration at the site of pacemaker implantation secondary to breast hypertrophy during pregnancy [6].

In the majority of cases, pregnancies were carried to term with vaginal delivery [3]. For women with cardiac disease, including women with permanent pacemakers, the indications for caesarean delivery are the same as those for women in the general population. Exceptions to this occur when significant adverse risk would be incurred by vaginal delivery and caesarean delivery could be justified on the basis of a severe underlying cardiac abnormality. If a caesarean delivery is required in a woman with a permanent pacemaker, it is recommended that the pacemaker be reprogrammed to continuous asynchronous mode (VOO) to avoid electromagnetic interference from electrocautery causing the pacemaker to inappropriately inhibit itself [7]. The pacemaker should be returned to the usual pacing mode postoperatively as VOO is asynchronous with the cardiac rhythm with the potential for R on T induced arrhythmia. Other operative considerations include placing the grounding plate as close to the operating site and as far from the pacemaker as possible [7]. Despite precautions, pacemaker failure can still occur and in certain clinical circumstances placement of a temporary intravenous pacemaker may be indicated.

Conclusion

This case highlights the importance of multidisciplinary care of pregnant women with cardiac disease, including permanent pacemakers. If possible, preconception counseling by both perinatology and cardiology is advocated to optimise maternal health, discuss pregnancy risks and develop management plans. Depending on the indication for the pacemaker, such as long QT syndrome, consultation with medical geneticists may be warranted. Antepartum anaesthesia consultation may be considered, especially in those with structural cardiac disease, who may benefit from detailed antepartum evaluation, medical optimisation and often planned elective delivery [8].

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