The Requirement of Fluoroscopy During Pacemaker Battery Replacement

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ABSTRACT

A 32-year-old woman was referred to us for a routine pacemaker (PM) control procedure. A DDDR (dual chamber) PM was implanted in 2010 and an elective replacement indicator (ERI) alert was given 2 months and 21 days ago. Before battery replacement, a temporary PM lead was implanted through the right subclavian vein under the guidance of bedside echocardiography and the pacing threshold was found to be 1 Volt. When the ventricular lead of the permanent battery was removed from the generator, it resulted in cardiac arrest. On fluoroscopic view, the lead of the temporary PM was found in the right atrium. However, a wide QRS and a left bundle-branch block (LBBB) pattern rhythm was observed during a threshold test before the surgery. The activity of the atrium was sensed by the atrial lead of the permanent PM that worked on the atrial-sensed ventricular- (As/Vp) mode. Thus, there was a wide QRS and LBBB pattern and at the rate of equal to temporary PM's rate rhythm had been occurred during the threshold testing.

In the absence of adequate intrinsic cardiac activity, if battery replacement is performed on DDDR-mode devices, the temporary PM lead must be implanted under fluoroscopic control and it must be ensured that it is in the ventricle.

Key Words: Pacemaker replacement; fluoroscopy; complication; DDDR devices

Pacemaker Batarya Replasmanında Floroskopi Gereksinimi

ÖZET

Otuz iki yaşında kadın hasta rutin pacemaker (PM) kontrolü için başvurdu. 2010 yılında DDDR (çift odacıklı) PM implante edilmiş ve 2 ay 21 gün önce "Elektif Pacemaker Indikatör (ERI)" uyarısı verdiği tespit edildi. Batarya replasmanı öncesi geçici kalp pili leadi yatak başı ekokardiyografi eşliğinde sağ subklavian ven yoluyla takıldı ve uyarı eşiği 1 Volt olarak bulundu. Ne zaman ki kalıcı kalp pilinin ventrikül leadi bataryadan çıkarıldığında kardiyak arrest gelişti. Bunun üzerine floroskopi yapıldı ve geçici kalp pili leadinin sağ atriyumda olduğu tespit edildi. Oysa eşik testi esnasında geniş QRS ve sol dal bloğu paterninde ritm oluşturduğundan geçici kalp pili etkin bulunmuştu. Atrial aktivite kalıcı kalp pilinin atriyum leadi tarafından algılanarak ventrikülü kalıcı kalp pilinin ventriküler leadi stimüle etmekteymiş.Yani kalıcı kalp pili As/Vp modunda çalıştığından geçici kalp pilinin eşik testi yapılırken geniş QRS, sol dal bloğu paterninde ve aynı geçici kalp pilinin hızı ile eşit bir ritm oluşmaktaydı.

Şayet hastanın yeterli hızda kendine ait ritmi yoksa ve replasmanı yapılacak olan cihaz DDDR modunda ise geçici kalp pili leadi mutlaka floroskopi altında yerleştirilmelidir. Ayrıca leadin atriyumda değil de ventrkülde olduğundan emin olunmalıdır.

Anahtar Kelimeler: Kalp pili değiştirme; floroskopi; komplikasyon; DDDR cihazları

INTRODUCTION

The incidence of chronic diseases are increase each year due to the increasing longevity of human life. Cardiovascular diseases are well-known sample for chronic disease. Inadequacy heart rate is also chronic heart disease and first choice treatment The lack of an adequate heart rate is one of the conditions in this disease. The first choice for the treatment of a symptomatic slow heart rate is pacemaker (PM) implantation. The longevity of a PM depends on the necessity of pacing, mode of PM, pacing thresholds, lead impedances and other additional features of the PM. In general, battery replacement is performed when the PM is exhausted. Battery replacement is considered to be an easy procedure but serious unexpected complications may occur.

CASE REPORT

A 32-year-old woman was referred to us for a routine PM control procedure. A DDDR (dual chamber) PM (St. Jude Medical) was implanted in 2010 due to syncope. Three months

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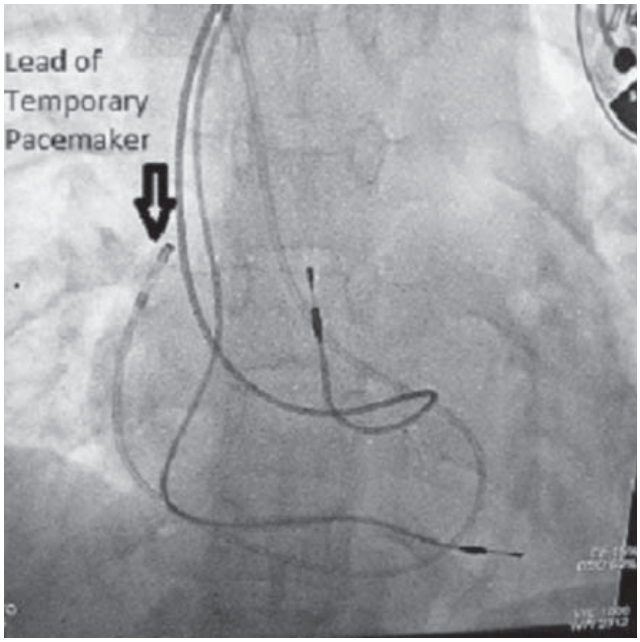

Figure 1. Anteroposterior fluoroscopic view of temporary and permanent pacemaker leads.

after the implantation, the atrial lead was dislocated and a repositioning operation was performed but the atrial lead could not be implanted at the desired location. Therefore, the threshold of the atrial lead was 2.4 Volt with 0.8 millisecond pulse width. Accordingly, the PM exhausted earlier than expected. There was no additional known disease. On physical examination, the patient had a temperature of 36.6°C, blood pressure of 90/55 mmHg, pulse of 80 bpm and respiratory rate of 14 breaths/min. There was a scar in the left infraclavicular area at the point where her PM was implanted. On PM analysis, an elective replacement indicator (ERI) alert was given 2 months and 21 days ago. The pacing rate of the PM was reduced to 30 bpm but no intrinsic activity was recorded. The patient was hospitalised due to sudden failure of PM functions and the absence of adequate intrinsic heart rate. Before battery replacement, a temporary PM lead was implanted through the right subclavian vein under the guidance of bedside echocardiography by a different team of physicians. The temporary PM was tested at the rate of 100 bpm and the threshold was found to be 1 Volt. Thereby, no additional imaging technique was required to determine the location of the temporary PM lead. Later, the temporary PM was adjusted to 100 stimulations/min and 5 Volt output, and the operation of the permanent battery replacement was initiated without fluoroscopic control. When the ventricular lead of the permanent battery was removed from the generator, it resulted in cardiac arrest. The lead was reconnected to the battery immediately, and the old rhythm was maintained again with wide QRS and a rate of 100 bpm. Later, the rate of the temporary PM was increased to 120 stimulations/min and wide QRS rhythm was observed; accordingly, a rate of 120 simulations/min suggested appropriate functioning of the temporary PM. However, when the ventricular lead of the permanent battery was removed, it resulted in cardiac arrest. Subsequently, fluoroscopy was performed with anteroposterior (AP) projection and an image was obtained, as shown in Figure 1. As seen in Figure 1, she had a really large right atrium and the lead of the temporary PM was found in the right atrium instead of the right ventricle, and it had been pacing the right atrium during the threshold testing before the operation. Then the activity of the atrium was sensed by the atrial lead of the permanent PM that worked on the atrial-sensed ventricular-paced (As/Vp) mode. Thus, there was a wide QRS and left bundle-branch block (LBBB) pattern and at the rate of equal to temporary PM's rate rhythm had been occurred. In other words, the rhythm with wide QRS complex and LBBB pattern did not occur by a direct stimulation of the temporary PM but as a result of the As/Vp function of the permanent PM.

After the fluoroscopy, the lead of the temporary PM was placed in the right ventricle and the replacement of the battery was performed successfully.

DISCUSSION

The main reason for PM replacement is battery exhaustion[1]. Battery replacement operations are considered to be easy procedures but unexpected serious complications may occur. When a lead of a permanent PM is cut accidentally during battery replacement in the absence of patient's intrinsic activity and a temporary PM, serious consequences may arise. Further, the infection rate is also found to be higher in replacement procedures than in initial implantation. The underlying causes of this are insufficiency of natural protective mechanisms, such as the disturbance of tissue integrity and poor blood circulation in the battery pocket. Another complication reported by Kolb C. et al. is the development of a ventricular tachycardia storm during an implantable cardioverter defibrillator (ICD) battery replacement operation; they suggested a ventricular tachycardia stimulation procedure before ICD battery replacement in high-risk patients[2]. During ICD battery replacement, if there was a cross-talk between the defibrillation lead and the lead of the temporary PM, an ICD could not deliver a shock therapy in the course of defibrillation threshold testing (DFT) and external defibrillation was required[3]. The first incorrect approach in our case was the implantation of a temporary PM lead without fluoroscopic control. If the battery of the PM was exhausted, the patient would have developed cardiac arrest due to the absence of her intrinsic cardiac activity. The second incorrect approach was to not use fluoroscopy before the replacement surgery. If the PM was in a VVI (single chamber) and not DDDR mode and the temporary PM was found to be effective during threshold testing, the replacement operation could be performed without fluoroscopic control. However, we cannot be sure of the location of the temporary PM lead based on its stimulation response owing to the As/Vp function of DDDR PMs. Thus, in our case, the lead of the temporary PM had moved to the right atrium and it stimulated the atriums first. Then the atrial activity was sensed by the atrial lead of the permanent PM and the ventricle was stimulated via the ventricular lead of the

permanent PM as a result of the As/Vp mode of DDDR PM. The heart rate was also equal to the temporary PM's stimulation rate. Therefore, it was assumed that the ventricle was stimulated by the lead of the temporary PM.

If there had been adequate intrinsic cardiac activity, the replacement surgery could have been performed without fluoroscopic control.

CONCLUSION

In the absence of adequate intrinsic cardiac activity, if battery replacement has to be performed on DDDR-mode devices, the temporary PM lead must be implanted under fluoroscopic control and it must be ensured that it is appropriately placed in the ventricle.

REFERENCES

1. Liu XL, Ren LH, Ye HM. Reasons and complications of pacemaker replacement operation: clinical analysis of 69 case-times. Zhonghua Yi Xue Za Zhi 2008;88:1989-91.
2. Kolb C, Zrenner B, Schmitt C. Near-fatal incident on routine induction of ventricular fibrillation at the replacement of an implantable cardioverter defibrillator. Int J Cardiol 2006;112:e74-5.
3. Jimenez A, Dickfeld T, Saliaris A, Shorofsky S. Pacemaker/implantable cardioverter-defibrillator interaction. Heart Rhytm 2010;7:1157-60.