بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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Effectiveness and Adherence to Hospital Infection Control Preventive Practice In Cardiac Implantable Electronic Devices

Thesis

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Michel Lotfy Kolta Gadalla

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List of Abbreviations

CIED : Cardiac implantable electronic devices,

CKD : Chronic kidney disease,

CRT : Cardiac resynchronization therapy,

DDD : Dual chamber device,

DM : Diabetes mellitus,

DRI : Device related infection,

HTN : Hypertension,

ICD : Implantable cardioverter defibrillator.

VVI : Ventricular demand pacing,

SSI : surgical site infection.

Introduction

The first experimental pacemaker was developed in nineteenth century at 1932 and was consisting of an electrical source and a wire introduced percuteneously to the heart chamber [1].

Twenty years later short term pacing through oesophageal electrode was successfully achieved however long term pacing couldn't be done yet [2].

The development of the first Trans venous bipolar catheter was achieved at 1958 using external power source, then the appearance of the first self-containing pacemaker connected to the heart via pericardial leads [1, 3].

Through the following decades better pacemaker leads were developed with the appearance of endocardial system and improvement of battery technology and programmability, lithium batteries and implantable loop records were developed with more and more longevity and convenience [4,5,6].

Cardiac Implantable electronic devices (CIED) are the main units in use nowadays in management of brady arrhythmias with great enhancement in programmability, battery life and sizes [7,8].

It is well known now that ventricular pacing alone is not the physiological pacing, the development of atrial synchronous ventricular pacing, atrioventricular sequential and dual chamber pacing were more physiological and

overcome the complications of single ventricular pacing alone [8, 9].

Implantable cardiac electronic devices are used also nowadays in management of ventricular tachyarrhythmias, The development of different diagnostic algorithms of single and dual chamber implantable cardiac defibrillator (ICDs)and improvement in generator sizes added in better management and differentiation between ventricular and supraventricular tachycardia with better avoidance of unnecessarily shocks[9, 10].

In cases of LV dysfunction with evidence of dyskinetic contractions, cardiac resyncronization therapy (CRT) can synchronize the heart by pacing left and right ventricles simultaneously so increasing overall cardiac output, this can be achieved by pacing left ventricle through alead placed in the coronary sinus, with clear evidence of symptomatic and mortality improvement [11].

Advances in implantable electronic devices included MRI compatible devices, the first FDA approved ICD during MRI scans was at 2015, then next year expansion included CRT systems and other pacing systems [12].

Other advances included FDA approved leadless pacemakers in which the entire device is placed in the right ventricles, with better life (10 years) and less pacemaker lead related complications [12, 13].

Complications related to pacemaker insertion includes pneumothorax, hemothorax, subclavian artery laceration, nerve injury, thoracic duct injury, thromboembolic complications related to lead placement, tricuspid injury and tricuspid regurgitation, arrhythmias, perforation with or without tamponade, displacement or dislodgement of the leads, pacing loss, pericarditis, perforation with or without tamponade, Battery failure, circuit failure and lead failure due to insulation failure or coil fracture [14, 15, 16].

Infection of the cardiac implantable electronic devices is one of the most challenging situations in medical practice and represents a great burden on hospitals, medical staff and the patient himself [17, 18].

This burden is not only related to the cost of the device, lead extraction and the new device implantation but also to the financial burden of many other factors including prolonged hospital stay, different procedures required for diagnosis and medications used to control infection [18].

Aim of the study

Evaluate adherence to infection control measures in device implantation at Ain shams university cath laboratory.

Analyze the short term effectiveness of applying infection control measures in reducing cardiac device implantation related infection at Ain shams university hospital.

Complications of cardiac implantable electronic devices

In cardiac device implantation axillary, subclavian, cephalic, venous access is used for most patients with the pulse generator placed in a pocket subcutaneously or sub muscular in the pectoral region, the lead may be fixed actively or passively in the right atrium and right ventricle[19, 20].

Pace maker related Complications may be related to the procedure itself or biophysical factor, many factors favor infection including increasing procedure time and more difficult techniques, also type of patient and experience of the operator plays a major role[19].

The physician should work hard by every mean of art and science known in this field to protect his patient from complication, the progression in medicine and engineering such as availability of contrast and ultrasound guided vein puncture and extra thoracic subclavian puncture made intervention easier and safer with less complications[14].

Regular follow up of patients with cardiac devices should not only focus on optimizing battery life but also emphasize on detection of complications early and patient education about it[15].

CIED related complications can occur during pacemaker insertion such as

- Pneumothorax, hemothorax, hemopnemothorax.
- Subclavian artery laceration.
- Nerve injury, thoracic duct injury.
- Thromboembolic complications related to lead placement.
- Tricuspid injury and tricuspid regurgitation.
- Arrhythmias.
- Perforation with or without tamponade

Pacemaker related Complications might include also displacement or dislodgement of the leads, pacing loss, pericarditis, perforation with or without tamponade, Battery failure, circuit failure and lead failure due to insulation failure or coil fracture [14, 14, 16].

The rate of this complication is low, of about 0.79% per year for pacemakers and this rate was higher in ICDs and much more higher in cases of CRTs and cases which need system upgrade [16, 21, 22].

Other common pace maker related complications include thrombosis and obstruction of the axillary and subclavian veins[14].

CIED infection represents the greatest challenge which may progress to septicemia with or without endocarditis, higher rates noted in cases of CRTs, device replacement and cases of system upgrade or revision [15, 16].

Pocket related complications such as hematoma in the pocket, dehiscence of the wound and erosions increased long term risk of device infection even with empirical antibiotic use [21].

At 2009 the heart rhythm society published a document on the standard of care of device infection concluded that any infection (including erosions)must be considered as infected by contamination and should be approached with the following[22].

- Complete system removal including debridement of the fibrotic capsule and infected material.
- Use of intravenous antibiotics.
- Device re implantation at another site at a separate surgery at a time determined by the clinical course.

Infection in cardiac implantable electronic devices

The last decade showed significant increase in the number of CIED implanted worldwide, the majority of those patients are over 65 years old with coexisting illness, and with the use of the more complicated dual chamber devices [23, 24].

Device related infection is defined as infection related to any part of the implanted device starting from the superficial area of skin and subcutaneous tissue related to the device and extending to the endovascular and endocardial components [25].

Several studies were done to determine the risk factors for infection in cardiac implantable electronic devices and all agreed that the most significant patient related risk factors involved includes renal dysfunction with glomerular filtration rate less than 60 ml / min, diabetes mellitus specially if uncontrolled and heart failure, some studies added the use of oral anticoagulant as a risk factor for infection, the use of corticosteroids on the long run as an independent risk factor for cardiac implantable electronic devices infection, other risk factors includes fever within the previous 24 hours before intervention, pre procedural use of transient wire pacing, early re intervention and lack of pre intervention antibiotic prophylaxis, those factors have the strongest association with infection[26, 27, 28].