

Single Chamber Pacemaker Implant

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Abstract

Pacemaker is a medical device that generates the electrical impulses to regulate the heart's rate. It is minimally invasive procedure through which the impulse generator and the pacemaker leads are implanted in the Human Body.

The Pacemaker can be temporary or Permanent depending on the signs and symptoms of the Patient. The main function of the pacemaker is to maintain the rhythm of the heart.

Some patients might faint under the stress conditions whereas in some heart beats very fast. To avoid major risks associated with the erratic rhythm of the heart, Pacemakers are implanted.

These are externally programmable devices which provides optimal pacing to imitates the natural contraction and relaxation of the heart.

Keywords: Single-chamber Pacemaker; Minimally invasive surgery; Arrhythmias, Implant procedure.

Introduction

The Sino-atrial node acts as the natural pacemaker of the heart. It governs the rhythm of the atria and the ventricles. The normal rhythm of the heart is regular with minimum fluctuation, when this rhythm becomes irregular, too slow, or too fast, this is called arrhythmia.

Arrhythmias can be detected by Electrocardiogram, which is done to check the irregular beating of the heart. Patients with the defect in the conduction system may

experience dyspnea (shortness of breath), syncope (fainting), fatigue, heart failure symptoms, chest pain or cardiac arrest [1].

Methodology

Implant procedure

The patient's preparation for implant

Patient must arrive the day before the procedure. Some tests (blood analysis etc.) are performed. The physician explains the implant procedure. He will receive some information to read, and a document called

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Accepted Date: 11-12-2020

Published Date: 12-13-2020

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“patient informed consent” which he will have to sign.

Equipment required:

- Introducers
- Pacing leads
- Sterile testing cables
- Pacemakers
- Programmer & analyzer
- Other sterile pacemaker accessories

Pre-implant preparation

- Decision on indications for pacing and modality of pacemaker
- Clinical characteristics
- Patient information-Risks involved and the impact of pacemaker in daily life
- Fasting (ensure adequate I.V. hydration)
- Ipsilateral peripheral catheter-contrast injection for venous access

- Chest X-ray
- Skin preparation- shaving and antiseptic scrubs
- Prophylactic antibiotics. e.g., Flucloxacillin 1-2g I.V. (Vancomycin 1g iv if penicillin allergy) 1 hour before the procedure

Implantation procedure

Preparation

- Patient should be comfortable on table
- Use of adhesive defibrillator patches - risk of requirement for backup pacing (LBBB)-high-risk patient (poor LVEF, heart failure)
- Skin cleaning
- Draping+skin film
- Sedation/analgesics (optional)
- Local anesthesia

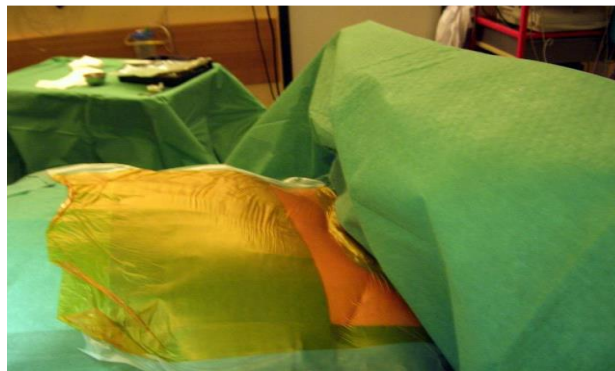


Figure1: Patient draped before procedure on table.

Approach

The best approaches to implant the pacemaker inside the body to reach the heart are Pectoral Axillary and Femoral.

Incision

Incision can be taken Horizontally or Vertically. Both give access to cephalic, sub-clavian and axillary veins.

Length of incision depends on:

- device size and shape
- thickness of subcutaneous tissue (obese patients may require wider incision for better exposure of muscular plane)

- too small an incision may hinder proper placement of leads and generator in pocket
- usually, 4cm for a pacemaker.

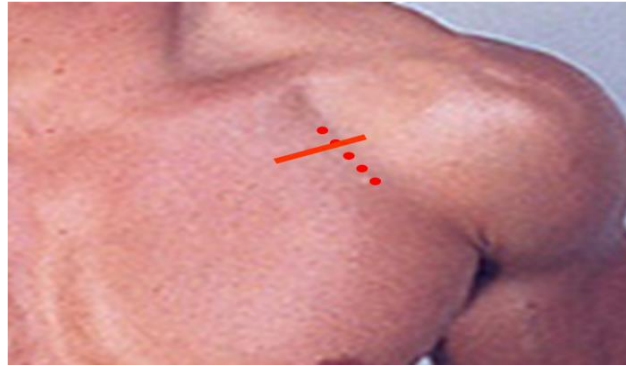


Figure 2: Vertical and horizontal incision.

Dissection

- Blunt dissection with scissors
- Electrocautery (“cut” at 35-45W)
- Down to pectoralis major muscle
- Clear view of deltopectoral groove
- Treat bleeding points (electrocautery “coagulation”)

- The flexible guidewire is passed through the needle
- By inserting a small catheter (introducer) into the vein
- The proximal end of the wire is directed into the region of the right atrium
- The needle is removed a Dilator and an introducer are placed over the guidewire
- The dilator is removed, and the lead is placed in the introducer.

Venous access through sub-clavian puncture

- A small incision is done in the skin
- The puncture of the vein with a needle



Figure 3: Sub-clavian vein and the venogram showing the puncture location.

Lead Placement

Lead is then advanced through sheath. Once lead is in place, sheath is cracked and removed.

Ventricular and Atrial lead positioning:

Ventricle lead can be positioned at 3 different locations for pacing and sensing. These are Right Ventricular apex, Septum wall (High, mid, or low) and Outflow tract.

The atrial lead is placed either in the lateral wall of the atrium or the right atrial appendage.

Lead manipulation

Stylets that come in lead packages are used to direct leads in the heart. Physician should have water bath or damp cloth available to prevent blood from hands getting onto stylets and cause stylets sticking in leads. Lead manipulation may cause ectopy in chamber

being addressed. “V’s” are a sign that ventricular lead is in ventricle.

To Measure the Lead Values

To check the lead measurements, connect lead with the analyzer. This is the cable to connect to the analyzer with four connections, two for the atrial lead and two for ventricular lead.

Pocket Creation

The Physician may create the pocket before venous access and lead placement. The location of the pocket varies patient to patient. Pre-pectoral, Sub pectoral, Sub mammary, Axillary, Abdominal are the common locations to perform.

Adequate analgesia is rubbed on the location where pocket must be made. Clear plane of separation is followed and in case of oozing, cauterize and/or use adrenaline on gauze and rub into pocket.

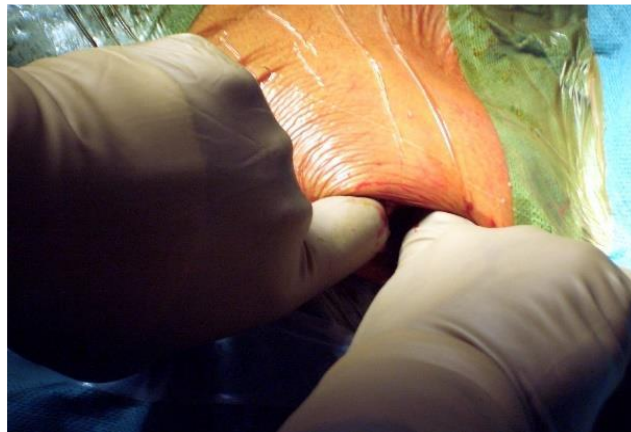


Figure 4: Pocket creation in the pectoral groove.

Inserting leads into header

Ensure setscrew has not settled down into ports during shipping. If so, back it out with wrench before insertion of the lead into the

port. Screwdriver is used to vent air out of port as lead is inserted. Lead is connected to the generator. Clean off blood on the connector pin. Do not kink the lead when

pushing it into the connector block. Make sure that the pin is pushed as deep as possible in the connector block. 1 or 2 set screws, depending on pacemaker mode.

Placement of generator and leads in pocket

Avoid kinking the lead. Don't stuff the lead in the pocket.

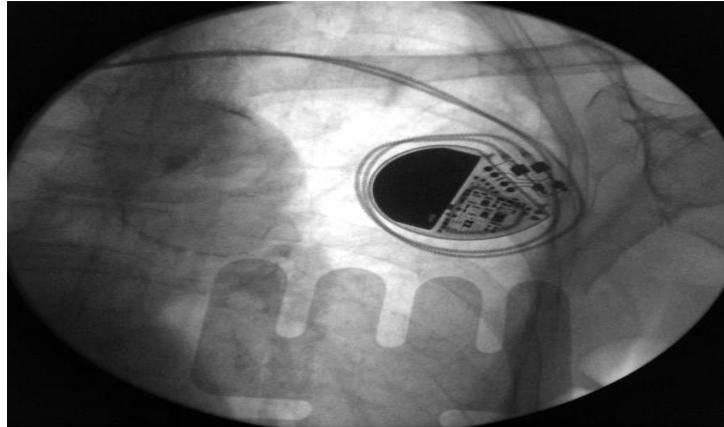


Figure 5: Pacemaker fettled in pocket.

After the Device is connected

- You should see pacing at first
- Make sure that it looks correct
- Pocket is closed
- Dressing is applied
- Rep usually needs to do a final interrogation of settings & measurements

Postoperative instructions for Patient and Family

- Bedrest for specified period
- Do not raise the arm above the shoulder for 8 weeks
- Do not lift anything heavier than 5-10 Lbs. for 8 weeks
- Always carry pacemaker identification card
- Avoid powerful magnets
- Working on car Engines
- MRI studies

- Tell all your doctors that you have a pacemaker
- Show your ID card at the airport and they will hand search
- Stress the importance of regular pacemaker follow-up
- Increases battery life of pacemaker
- Adjust pacemaker so that the patient feels better
- Provides opportunity to ask questions
- Ensures that the pacemaker is working safely [3-5].

Conclusion

Cardiac pacing has developed over the years, it has reduced the risks associated with the irregularity in the contraction and relaxation of the atria and ventricles.

Although single chamber pacemaker has some limitations like synchronization of the contraction of the heart muscle

doctors prefer dual chamber pacemaker [6,7].

It is a minimally invasive procedure that involves minimum mortality risk during the surgical procedure.

The patients with the pacemaker implant must take care of the guidelines explained by the Electro- physician.

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