

# Prophylactic Measures Reduce the Risk of Permanent Pacemaker Infection : An Analysis of 480 Cases

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**Infection remains a serious complication after permanent pacemaker implantation. Although better surgical techniques has decreased the pacemaker infection rate dramatically but infection of the pacemaker pocket or the pacing lead still remains a potential complication after pacemaker implantation<sup>(1-4)</sup>. In a prospective study carried out at Cardiology Dept. Mayo Hospital Lahore from 1st Jan.1993 to 31<sup>st</sup> Dec.1999, 480 patients were implanted with permanent pacemaker. The infection rate was 7% till June 1998. After adopting new techniques which include scrubbing the patient thrice before the start of procedure, better antibiotic prophylaxis both parental and local and decreasing the procedure time dramatically reduced the rate of infection from 7% to 1.7%.**

**Key words: Infection, pacemaker, lead, permanent**

According to the literature the incidence of infected pacing systems ranges from 0.5% to 5.1% in both retrospective and prospective studies<sup>1,2,3,4,5,11</sup>. The role of antibiotic prophylaxis remains controversial with a variety of techniques used. The difference in technique varies from oral to parental antibiotics, pocket irrigation versus no irrigation, through cephalic vein lead insertion versus direct subclavian vein puncture approach long implantation time versus short duration etc. In a study of 52 patients with lead-related endocarditis, hospital mortality was 7.6% and overall mortality was 26.9% after a mean follow up of 20 months<sup>7</sup>. In 1986 an article published in Lancet wrote, "Most of the operators routinely prescribe an antibiotic prophylaxis at the time of implantation to prevent such complications, although there is no present evidence that this strategy is beneficial"<sup>8</sup>. However after twelve years a meta analysis published in Circulation in 1998 suggested that systemic antibiotic prophylaxis significantly reduces the incidence of potentially serious infective complications after permanent pacemaker implantation<sup>9</sup>. This meta-analysis also support the use of prophylactic antibiotics at the time of pacemaker insertion to prevent short term pacemaker pocket infection. Bluhm G in his study showed that systemic antibiotic prophylaxis was important in generator replacements<sup>4</sup>. In another study which was carried out by Bluhm G et al. the infection rate was only 2% in patients where prophylactic antibiotics were used as compared to 14% in control group where no antibiotics were used<sup>13</sup>. Ramsdale Dr. et al have observed that if careful preoperative skin preparation and close post operative follow up are made then the incidence of pacemaker infection decreases dramatically<sup>14</sup>.

Analysis of different studies have shown that Infection rate varies between 0.5% to 5.1%, both in retrospective and prospective studies. Bacteremia which is reported in 0.5% of the cases going for permanent pacing, when present carry a high morbidity and mortality rate<sup>6</sup>. Infection can be localized to pocket only or it may

disseminate to blood if the lead becomes infected<sup>4</sup>. It is currently considered that virulent organism like Staphylococcus aureus are seeded during implantation<sup>4,10</sup> and cause early infection after implantation while coagulase negative Staphylococci like staphylococcus epidermidis are responsible for delayed infection. Aggarwal R.k in his study published in British Heart Journal observed no difference in infection rate between dual and single chamber systems<sup>11,12</sup>.

## New Surgical Technique

From July 1998 the following procedure was adopted to decrease the infection rate. 24 hours before elective permanent pacemaker implantation procedure the entire skin of the chest, shoulder joints, both sides of the neck, axilla and upper arms were scrubbed with povidone-iodine by the cath. room technician, 12 hours after the first scrub the procedure was repeated by the staff nurse in the evening and third time early in the morning. Thirty minutes before starting the procedure 1-2gm i.v. Ceftriaxone was given so that peak serum levels could be achieved while giving incision to the skin. Then the same antibiotic was continued for the next five days.

In the cardiac cath lab. the patient was again scrubbed by the doctor performing the procedure. After covering the patient with sterilized sheets, an opsite (sterile polyurethane dressing) of standard size was used to cover the bared area for incision. After giving 2% Xylocaine as local anesthesia incision was given in the 1.5 to 2.5cm below the middle part of the clavicle, the subcutaneous tissue were separated with the help of curved artery forceps, cephalic vein was identified and dissected in the Delto-pectoral groove, if of sufficient size then three threads made of non absorbable suture material were looped around the vein, one distal and two proximal. After lifting the vein with the distal thread venotomy of 1/3<sup>rd</sup> diameter of the vein was carried out between two proximal and one distal thread loops. The lumen was identified with the help of vein lifter and the lead was inserted through it.

After lead insertion the distal end of the vein was tied. Before lead positioning the pocket was made between the subcutaneous tissue and the muscle using index finger to split the layer. After positioning the lead in the right ventricular apex, confirming on lateral view, the lead was tied with the two proximal loops ensuring the vein tissues and polyurethane sleeve covering the lead at the site of tie.

If the cephalic vein was of small size or could not be dissected out then subclavian vein was punctured with the help of introducer set avoiding placing the entry site in a location where the lead body can be clamped between the clavicle and the first rib. A more lateral approach was tried to avoid the risk of first rib clavicular crush. It was always tried to complete the procedure as soon as possible. In the end after cleaning the pocket from clots and securing full haemostasis antibiotic containing Neomycin and bacitracin was sprayed in the pocket and on the pacemaker. The same spray was also used after stitching the wound. The wound was closed in layers using absorbable sutures for the subcutaneous tissue and for the skin closure. Skin was closed using continuous subcutaneous technique and burying the both ends in the wound so that there was no need to remove the stitch later on.

### Material and Results

From 1<sup>st</sup> January 1993 to 31<sup>st</sup> Dec.1999 480 permanent pacemakers were implanted. The infection rate from January 1993 to June 1998 was 7% in 370 implants during this time. With the introduction of the new technique from July 1998 to 31<sup>st</sup> Dec.1999 110 pacemakers were implanted. Only 2(1.7%) patients had infection while rest of the patients were having smooth recovery. The age range was from 16 years to 90 years. 254(53%) patients were male patients while 226(47%) were females. 75(72%) patients have temporary pacing wire already. 70 patients were approached through cephalic vein, 38 patients were approached through subclavian puncture while the rest three patients were approached through external jugular vein. Average procedure time was 55 minutes ranging from 25 minutes to 80 minutes.

### Discussion

Infection after pacemaker implantation procedure may be a life threatening complication, mortality and morbidity is reported to be high<sup>7</sup>. Its prevention will greatly benefit from a better knowledge of source of infection and proper prophylactic use of antibiotics. Local wound contamination/ seeding during the procedure is usually described as the major mechanism predisposing to local or systemic pacemaker infection. As pacemaker is a foreign body, it can predispose to infection, skin erosion or necrosis may also lead to infection, microorganisms can also colonize pacemaker lead which is a foreign body through haematogenous route<sup>(4)</sup> thus can cause infective endocarditis. Better preoperative work up and preparation of the patient can dramatically reduce the incidence of infection as shown in our study.

### Conclusion

Results of our study shows that better pre surgical preparation, prophylactic systemic antibiotic use significantly reduces the risk of potentially serious infective complications after permanent pacemaker implantation. Most of the early pacemaker infection was due to seeding of the organisms while implanting<sup>12,3,4</sup>. Results of our study are almost similar as carried out by other authors<sup>13-14</sup>. We support strict preoperative surgical preparation of the skin not only for pacemakers but all procedures where foreign body has to be inserted like in orthopedics, urology etc. Preoperative preparation not only decreases the incidence of infection but also reduces the cost of antibiotics, duration of hospitalization and stress trauma to the patient. The use of local as well as systemic antibiotic at the time of pacemaker implantation procedure further reduces the risk pacemaker pocket infection, skin erosion, septicemia or endocarditis etc.

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