



## CHIRURGIE CARDIAQUE / CARDIAC SURGERY

### PERMANENT PACEMAKER IMPLANTATION IN ACCRA, AN 18-YEAR REVIEW

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#### Summary

**Background:** Permanent pacemaker implantation is an essential part of the practice of Cardiology and Cardiac Surgery worldwide. The National Cardiothoracic Centre in Accra, has been implanting permanent pacemakers since its establishment. We have decided to analyse this institutional data over the 18 years. It is expected that this analysis will help the doctors who implant the pacemakers, the referring doctors and prospective patients to make the appropriate decisions. The objective was to determine the changing trends, patient characteristics, implantation patterns and the outcome in permanent pacemaker implantation in this Centre over the 18-year period.

**Patients and Methods:** A retrospective search of the data on all patients who had permanent pacemaker implantation in the National Cardiothoracic Centre from 1992 to 2009 was reviewed. It was analysed with SPSS 16.

**Results:** A total of 355 pacemakers were implanted with males comprising 50.7% and females 49.3%, a male: female ratio of 1:1.03. The age ranged from 13 months to 94 years, with a mean of  $62.9 \pm 16.8$  years. Most of the patients (85.6%) were 50 years and above. Four cases were implanted in the first, as against 33 in the last year of the study. The commonest indication was complete heart block (63.9%). The mean duration of a pulse generator before replacement was  $7.8 \pm 1.7$  years. There was no procedure-related mortality. The complication rate was 7.0%.

**Conclusion:** Permanent pacemaker implantation is a very safe procedure, with a gradual increase in the number of cases performed annually, complete heart block was the commonest indication.

**Keywords:** Pacemaker implantation, complete heart block, exhausted pulse generator replacement.

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#### Résumé

**Contexte:** L'implantation de stimulateur cardiaque permanent est une partie essentielle de la pratique de cardiologie et de la chirurgie cardiaque dans le monde entier. Le Centre National Cardio-thoracique d'Accra, a implanté des stimulateurs cardiaques permanents depuis sa création. Nous avons analysé ces données institutionnelles au cours des 18 ans. Les auteurs espèrent que cette analyse aidera les docteurs qui implantent les stimulateurs cardiaques, les médecins référant et les éventuels patients à prendre des décisions appropriées. L'objectif était de déterminer les tendances changeantes, des caractéristiques des patientes, les modèles d'implantation et le résultat dans l'implantation de stimulateur cardiaque permanente dans ce centre au cours des 18 ans.

**Patients et Méthodes** : Une étude rétrospective des données sur tous les patients qui avaient une implantation de stimulateur cardiaque permanent dans le Centre National de Cardio-thoracique de 1992 à 2009, a été passée en revue. Il a été analysé avec SPSS 16.

**Résultats** : 355 stimulateurs cardiaques ont été implantés chez des patients de sexe masculin (50.7 %) et de sexe féminin (49.3 %) ; soit un sex-ratio de 1: 1.03. L'âge moyen était de  $62.9 \pm 16.8$  ans (extrême : de 13 mois à 94 ans). La plupart des patients (85.6 %) avaient plus de 50 ans. Quatre cas ont été implantés dans la première année, contre 33 la dernière année de l'étude. L'indication la plus commune était le bloc de branche complet (63.9 %). La durée moyenne d'un générateur d'impulsion avant son remplacement était  $7.8 \pm 1.7$  ans. La procédure n'a entraîné aucune mortalité. Le taux de complication était 7.0 %.

**Conclusion**: L'implantation de stimulateur cardiaque permanent est une procédure très sûre, avec une augmentation graduelle du nombre de cas exécutés annuellement. Le bloc auriculo-ventriculaire complet est l'indication la plus fréquente.

**Mots-clés**: implantation de stimulateur cardiaque, bloc auriculo-ventriculaire complet, remplacement de générateur d'impulsion épuisé.

## Introduction

Since the development of the trans-venous endocardial pacing technique in 1958 [1, 2, 3, 4], pacemaker implantation has become a very significant part of the practice of Cardiology and Cardiac Surgery worldwide. It is estimated that about 300,000 pacemakers are implanted yearly in the United States alone and 900,000 worldwide [1]. Any patient whose condition necessitates pacemaker implantation must have it as soon as possible because it is cost-effective [5], saves lives, improves the quality of life and enhances survival [1, 6]. Most patients who need pacemaker implantation are elderly. This is due to the increase in abnormalities of impulse generation and conduction that occur with age [5]. Over the years there has been a gradual increase in pacemaker implantations at our Centre. This study aims to analyse this and other changing trends in pacemaker implantation at the National Cardiothoracic Centre in Accra, Ghana.

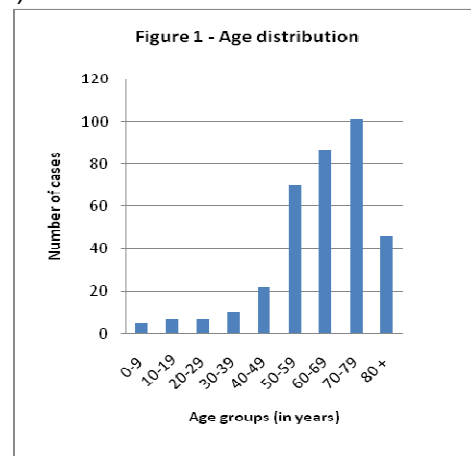
## Patients and Methods

A retrospective search was made of our peri-operative records from 1992 to 2009. All patients who had permanent pacemaker implantation over the period were entered into the study. A further search of the case notes of all these patients was carried out. The data was analysed with SPSS 16.

## Results

A total of 355 pacemakers were implanted over the period. There were 180 (50.7%) males and 175 (49.3%) females, in a male: female ratio of 1: 1.03. The mean age was  $62.9 \pm 16.8$  years (range 13 months to 94 years). The 13-month old child developed complete heart block after VSD repair. The 94-year old had a pulse generator

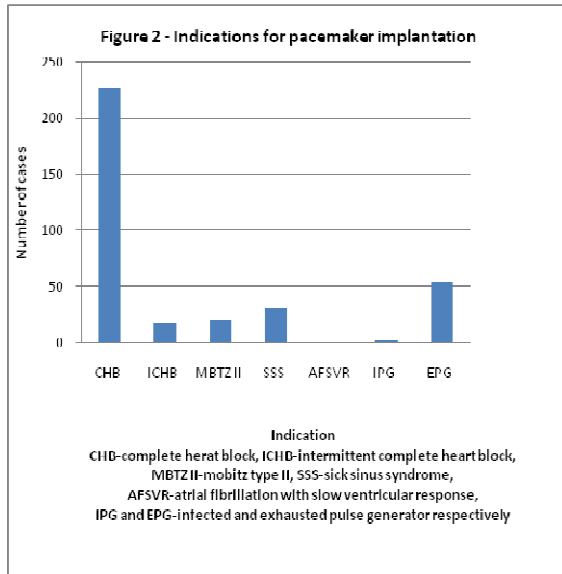
replacement. However, the oldest patient to have a new permanent pacemaker implanted was 93 years old. She had a complete heart block. The modal age group was 70 – 79 years. Patients from 50 years and above comprised 85.6% (n = 304).



The total new pacemaker implantations were 300 (84.5%), whilst implantations for exhausted pulse generator were 55 (15.5%). The commonest indication for a new pacemaker implantation was complete heart block (63.9%), followed by sick sinus syndrome (8.7%).

Three hundred and thirty-nine cases (95.5%) were performed under local anaesthesia and 16 (4.5%) under general anaesthesia. All were endocardial, except 2 (0.6%) that were epicardial implantations.

The shortest duration before the replacement of an exhausted pulse generator was 2 years 9 months. This was in an 82-year old lady with complete heart block. The longest duration was 10 years 11 months, in a 43-year old man also with complete heart block. The overall mean duration for the period was  $7.8 \pm 1.7$  years.



There was no procedure-related mortality. There were 25 complications (7.0%), the commonest being pacemaker lead-electrode dislodgement (4.8%). Others were pulse generator site infection, pulse generator site haematoma, pulse generator migration and erosion exposing the pulse generator (Table 1).

The dislodged lead-electrodes were repositioned. The duration varied from getting dislodged on the day of operation to postoperative day 56, with a mean of 18 days. There were 2 (0.6%) pulse generator site infections which necessitated removal of the pulse generators and implantation of new ones on the contralateral side, usually on the right. Appropriate antibiotics were given. There was 1 (0.3%) pulse generator migration towards the axilla in a 54-year old female who had implantation for complete heart block one year earlier. It was relocated in a new pocket on the same side. The pulse generator site haematomas were evacuated. Intermittent diaphragmatic pacing occurred in a 64 year old male with sick sinus syndrome. The electrode in the right atrial appendage was stimulating the right phrenic nerve leading to pacing of the right hemi-diaphragm. It was repositioned the same day but the problem persisted. He had repeat attempt at repositioning on the first postoperative day, but the diaphragmatic pacing still persisted. The atrial lead-electrode was removed altogether and pacing mode converted from dual to single chamber pacing.

Nine cases (2.5%) of the pacemaker implantations were as a result of complications of cardiac surgery (Table 2). Repair of Tetralogy of Fallot (TOF) was the most; 4 cases (1.1%), followed by VSD repair, double valve replacement, and aortic valve replacement.

**Table 1: Complications of Pacemaker Implantation**

Complications	No of patients		Mean onset
	n	%	
Pacemaker electrode dislodgement	17	4.8%	18 days
Pulse generator site infection	2	0.6%	3 months
Pulse generator site erosion	2	0.6%	5 months
Pulse generator site haematoma	2	0.6%	3 days
Pulse generator migration	1	0.3%	1 year
Diaphragmatic pacing	1	0.3%	Day of operation
<b>Total</b>	<b>25</b>	<b>7.0%</b>	

**Table 2: Permanent complete heart block as a complication of cardiac surgery**

Type of surgery	No. of patients		Mean day of permanent pacemaker implantation after the surgery
	n	%	
Intra cardiac repair of Tetralogy of Fallot (TOF)	4	1.1%	12
VSD repair	2	0.6%	11
Aortic and mitral valve replacement	2	0.6%	45
Aortic valve replacement	1	0.3%	16
<b>Total</b>	<b>9</b>	<b>2.5%</b>	

## Discussion

Over the 18-year period the total number of cases was 355. Four cases were performed in the first year of the study as against 33 in the last. The mean number of cases for the last five years of the study was 35 per year. There has been a gradual increase in the number of cases performed annually. This is expected. It is partly due to the increase in the population of the country and also the increased awareness of referring physicians about the availability of this treatment modality. Males comprised 50.7% and females 49.3%. This is similar to Aggarwal's finding of 51.2% males<sup>7</sup>. Harcombe had 59% males<sup>8</sup>. The mean age for the males was  $61.8 \pm 16.5$ , and females  $64.0 \pm 17.0$ . The overall mean was  $62.8 \pm 16.8$ . The modal age group was 70 – 79 years. This is also comparable to the finding in other studies<sup>7,8,9</sup>. Patients from 50 years and above comprised 85.6%, confirming that the diseases requiring permanent pacemaker implantation are mainly diseases of the middle ages and the elderly.

Complete heart block was the commonest indication, comprising 63.9%. Ekpe, also in the West African sub-region, had 65% which is also comparable<sup>9</sup>. Most of the cases (95.5%) were performed under local anaesthesia. General

anaesthesia, which comprised the remaining 4.5%, was used during the implantation in the children, and the adults who had epicardial implantations. Three hundred and fifty-three cases (99.4%) were by transvenous endocardial implantations and 2 (0.6%) were epicardial. This is the current practice since most pacemakers are transvenously passed and anchored in the endocardium under fluoroscopy. Exhausted pulse generator replacements accounted for 15.5%. This value is similar to the 16% accepted by the ACC/AHA/NASPE 2002 guidelines<sup>10</sup>. The shortest duration of a pacemaker before replacement was 2 years 9 months and the longest duration was 10 years 11 months with the mean duration of  $7.8 \pm 1.7$  years.

There was no peri-operative mortality. This means the procedure is quite safe. The complication rate was 7.0%. Most studies have found complication rates from 3.3 – 8.4%<sup>6,7,8,11</sup> with lead-electrode displacement being the commonest and pulse generator site erosion or haematoma among the least. This is also similar to our findings.

Permanent complete heart block as a complication of cardiac surgery formed 2.5% of the pacemaker implantations. Intra-cardiac repair of Tetralogy of Fallot was the commonest (1.1%). The next was isolated VSD repair (0.6%) and double valve replacement (0.6%). Aortic valve replacement was the least (0.3%). Liberman<sup>12</sup> found isolated VSD repair as the commonest, followed by A-V septal defect repair. In the case of the TOF and the VSD the cause of the complete heart block is most likely due to the interruption of the conduction pathway, which is in close proximity to the rim of the VSD where sutures for patch closure are placed. Similarly, in the case of the valve replacement the cause of the complete heart block is also most likely due to the interruption of the conduction pathway where it is in close proximity to the annulus of the mitral or the aortic valves. The children with Intra-cardiac repair of Tetralogy of Fallot and VSD repair in this study have been reported by Edwin<sup>13</sup> in another study.

### Conclusion

Permanent pacemaker implantation is a very vital part of Cardiology and Cardiac surgery. It is a safe procedure with low complication rates. There is a gradual increase in the number of cases performed annually in Accra, with a slight male preponderance. Most patients are elderly, with complete heart block as the commonest indication. It is life-saving, improves the quality of life and enhances survival.

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