AUDIT

Permanent pacemaker practice at a Scottish district general hospital between 1987 and 1993

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Abstract

Background—Raigmore is a district general hospital offering a permanent pacemaker service to its catchment population of 233 500. It has been argued that the British public would be better served by a less centralised pacing service. There also exists the view, however, that a lower rate of complications and best follow up practice are achieved by specialised centres. The pacemaker practice over a 79 month period (January 1987 to July 1993) was thus reviewed with these issues in mind.

Methods—The pacemaker records of all new implantations for the period under observation were reviewed retrospectively. Data were acquired under the headings age, sex, symptoms, electrocardiographic (ECG) indications, and complications (early and late). Comparison was made with United Kingdom national data, a previous audit from Raigmore, and two recently published large series from specialist centres (one British and the other French).

Results—The mean age of patients who underwent implantation was 74 years and 47.5% were male. The most common presenting symptoms were syncope (46%), dizzy spells (24.5%), and heart failure (11.5%). The most common ECG indications for pacing were complete heart block (wide QRS) (28%), atrial flutter/fibrillation with bradycardia (21.6%) and complete heart block (narrow QRS) (9.6%). The implantation rate was 184/million population/year in 1993. The early and late complication rates were low (2.48%).

Conclusions—The presence of a pacing centre in a remote part of the United Kingdom fulfils a necessary service and has low complication rates, with implantation rates and patterns that are comparable with those in other parts of the country.

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It has been argued that the British public, especially the elderly, would be better served by a less centralised pacing service.¹ The low rate of implantation in the United Kingdom as a whole compared with that of Continental Europe or the United States has been attributed to a conservative approach by physicians (especially non-cardiologists) in referring patients for pacing^{1,2} and it has been shown that the appointment of a cardiologist or physician with an interest in cardiology to a district general hospital can lead to a significant increase in pacemaker implantation for the locality.³ There is a contrary view, that a lower rate of complications and best follow up practices are achieved by large specialised centres.⁴ A previous report from this centre reviewed our practice from December 1978 to December 1986 and commented on complication rates and the effect of establishing a pacing service at a district general hospital.³ These issues and the practice of dual chamber pacing introduced in 1990 are reviewed in the present audit performed between January 1987 and July 1993. Our data are compared with United Kingdom national values⁵ and with two recently published large series from specialist centres.^{4,6}

Background

The facilities at Raigmore District General Hospital remain largely unchanged since the first pacemaker was implanted in December 1978. All procedures are carried out by an experienced operator (FK), a consultant physician with an interest in cardiology, apart from a small number of implantations performed by two middle grade staff on short rotation from large cardiological centres. The service was confined to single chamber implantation until the introduction of dual chamber pacing in 1990. As for our previous audit, implantations continue to be carried out under local anaesthesia in a surgical theatre using fluoroscopic screening. Antibiotic prophylaxis is given routinely using a combination preparation of ampicillin/flucloxacillin or cefuroxime for patients with penicillin allergy. The subclavian vein is the preferred route of access. Assisting staff comprise two theatre nurses, one technician responsible for physiological measurements, and one radiographer.

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Age and sex distribution of patients having new implants between 1987 and 1993.

Method

The pacemaker records of all new implantations for the period under observation were reviewed. Of a total of 254 procedures performed over the 79 month period, 201 were new implants, 42 pulse generator replacements, 10 total system reimplantations, and one electrode replacement. Data were acquired retrospectively under the headings age, sex, symptoms, electrocardiographic (ECG) indications, and complications for patients with new implanted systems. The modes of pacing used were also reviewed.

Replacement procedures (pulse generator and total system) were performed on a routine basis on a different cohort of patients to that audited here and includes those moving to this area who had implants performed elsewhere.

Results

The figure shows the age and sex distribution of patients with new implants, with a peak for men and women in the 70–79 age group. The mean age was 74 years and 47.5% were male. The values are similar to United Kingdom national data 1992 (mean age 71.9 years;

male 56%).⁵ In the previous Raigmore audit the mean age was also 74 years and 46% were male.³

The most common presenting symptoms were syncope (46%), dizzy spells (24.5%), and heart failure (11.5%). Table 1 gives United Kingdom national data (1992)⁵ and recently published audit data from Papworth Hospital⁶ juxtaposed to the Raigmore data.

Table 2 outlines the ECG indications at the time of implantation. Complete heart block (wide QRS) was the most common indication (28%), followed by atrial flutter/fibrillation with bradycardia (21.6%) and complete heart block (narrow QRS) (9.6%). The total percentage for all forms of atrioventricular block was 56.4% (2.4% first degree block, 15.4% second degree block, 38.6% complete heart block). Current national data for ECG indications are again juxtaposed with those from our audit. Additionally, the Papworth data,⁶ also juxtaposed, show similar patterns of ECG indications for pacemaker implantation to those of our own.

Of patients who underwent pacing at Raigmore hospital, only 12.7% had sick sinus syndrome which is lower than the UK national average (17.72%)⁵ or the Papworth value (20.9%).⁶

A total of 164 single chamber units were implanted during the period under review of which 151 were VVI, 11 atrial pacemakers, and two VVIR.

Dual chamber pacing was started at Raigmore hospital in 1990 and up to the time of audit, 37 new systems had been implanted (all DDD); 54% were implanted for complete heart block, 27% for second degree heart block, and 8.1% for sick sinus syndrome. Two patients with VVI systems were upgraded to DDD in view of pacemaker syndrome.

Early complications were defined as those occurring in the 6 weeks after implantation and late complications as those occurring thereafter. Infection requiring removal of the system occurred in only one case; no organisms grew on culture. There were three cases of pocket haematoma formation which required evacuation. One cardiac arrest (asystole) requiring external cardiac massage occurred during implantation and responded to isoprenaline; the patient was an elderly woman with complete heart block whose pacemaker was implanted under general anaesthesia due to poor patient cooperation. The overall early complication rate was 2.48% and is compared in table 3 with data from two large centres with recently published series.

The only complicated dual chamber system presented with unexplained superficial wound erosion at 4 months. Because this continued to recur, consideration was given to patient induced artefact but this was never proven. Superficial erosion continues intermittently and is managed by wound dressing. This system was complicated by atrial lead adaptor disconnection at 14 months but

Table 1 Presenting symptoms leading to pacemaker implantation

	Raigmore District General Hospital (%)	Papworth Hospital (%) ⁶	United Kingdom national data 1992 (%) ⁵
Syncope	46	58	37.5
Dizzy spells	24.5	23	24
Bradycardia	1.9	9.3	6.5
Heart failure	11.5	9	4.3
Unspecified	5.2	0	21

Table 2 Electrocardiographic indications for pacemaker implantation

	Raigmore District General Hospital (%)	Papworth Hospital (%) ⁶	United Kingdom national data 1992 (%) ⁵
AV block	56.4	55.6	40.93
Sick sinus syndrome	12.7	20.9	17.72
Atrial fibrillation/flutter with bradycardia	21.6	13.2	12.1
Bundle branch block	5	6.1	2.62
Other	4.3	< 5	22.22

AV, atrioventricular.

Table 3 Complications of pacemaker implantations

	Complication rate (%)
Early complications	
Raigmore District General Hospital	2.48
Papworth Hospital ⁶	2
St Cloud group ⁴	2.8
Late complications	
Raigmore District General Hospital	2.48

Table 4 Numbers and rates of new implantations

Year	No of new implantations at Raigmore hospital	Implantation rate (no/million population/year)	
		Raigmore hospital*	United Kingdom national data ⁵
1987	17		
1988	23		
1989	38		148
1990	27		
1991	28		
1992	45		202
1993	43†	184	

*Values for 1978 and 1986 were 22 and 152 respectively. †Updated to 12 months.

because of wound problems this has not been repaired.

All other late complications occurred in VVI systems. Loss of telemetry occurred in a single case because of radiotherapy for breast carcinoma 3 years after insertion and rendered interrogation of the generator impossible. The pulse generator was replaced. An 84 year old man with complete heart block presented 5 months after implantation with pulse generator erosion and evidence of *Staphylococcus aureus* infection. It was possible to replace the pulse generator and retain the electrode. The third late complication in a VVI system occurred in a 65 year old woman with Mobitz 2 block. In 1988 an epicardial system was inserted in view of difficulty in obtaining a stable lead position in the ventricle. This was complicated by a high threshold and impaired sensing; the pulse generator could not be reprogrammed and thus a transvenous pacemaker with a screw in electrode was inserted in 1992. The transvenous system remains complicated by a high pacing threshold at 4 V. The overall late complication rate was 2.48%.

Table 4 reviews in profile the implantation level since 1987. There has been a sustained increase in pacing levels with an implantation rate for 1993 at 184/million/population/year.

Discussion

Since our last review, the rate of pacemaker implantation has almost doubled (201 new implants in 79 months *v* 129 implants in 96 months). Our average implantation rate over the 67 months (130/million population/year) compares with the United Kingdom national 1989 value of 148/million population/year.⁵ An update on United Kingdom pacing data showed the implant rate for 1992 to be 202/million population/year⁷; our implant rate for 1992–1993 was 184/million population/year. Clearly, the stimulus provided by creating a pacemaker service at this district general hospital has led to a sustained increase in pacing levels.

Insertion of dual chamber systems was started at Raigmore in 1990 and the dual chamber implantation rate over the period 1991–1992 was 28% of total implants which is close to the United Kingdom national average (24%),⁵ although lower than North American rates (32%).⁸ The trend towards an increased rate of insertion of dual chamber systems is in accordance with pacing guidelines from the British Pacing and Electrophysiology Group 1991.⁹

Maintenance of atrioventricular synchrony in patients with atrioventricular block has been shown to improve effort tolerance and subjective variables such as dyspnoea, palpitation, and general wellbeing.¹⁰

We agree with findings from the Freeman hospital, however, that in patients with limited mobility, especially the elderly, other factors must be taken into account and the potential benefits of physiological pacing weighed against the disadvantages.¹¹ Accordingly, most elderly patients with bradyarrhythmia other than sick sinus syndrome were given a VVI system. Those patients given a dual chamber system were selectively chosen according to expectations of exercise capacity and general physical condition.

It is our policy for patients with sick sinus syndrome to use an atrial pacemaker in the absence of any evidence of atrioventricular block. There is consensus on the advantages of atrial pacing in sinus node dysfunction with a reduction in the incidence of atrial fibrillation, systemic embolism, and heart failure and possible prolongation of life.^{12 13} The incidence of atrioventricular block in sinus node disease has been estimated at only 0.6% each year with about 2% of patients requiring upgrade of their atrial pacemaker to a dual chamber system.¹⁴ We do acknowledge that some investigators have reported a higher incidence of atrioventricular conduction disturbance¹⁵ but, to date, none of our patients with an atrial lead for sinus node disease has required an upgrade to dual chamber pacing.

The proportion of patients receiving a pacemaker for sinus node disease is low compared with United Kingdom national rates.⁵ This may be explained by our policy to restrict pacing in sinoatrial disorder to patients who are symptomatic. There is no evidence that pacing asymptomatic patients with sinus node disease improves prognosis.¹⁶

Our complication rates for single and dual chamber implantations are low and compare favourably with two large recently published reviews of single chamber pacing at specialist units.^{4 6} Guidelines from the 1970s suggested that a complication rate >5% should raise questions regarding the overall quality of an implantation programme.¹⁷ The Papworth group experienced a 2% early complication rate in implanting 1136 single chamber ventricular permanent pacemakers.⁶ The St Cloud group experienced an early complication rate of 2.8% for 1951 single chamber ventricular permanent pacemakers implanted between 1987 and 1992.⁴ The French group

suggest that pacemaker implantation and follow up should be performed in only specialised centres but the Papworth group clearly showed that an experienced operator can achieve complication rates < 3% even when undertaking < 12 implants each year. An experienced operator at Raigmore hospital has achieved a low early complication rate (2.48%) while implanting an average of 31 new systems a year.

Our late complication rate of 2.48% is low, although there are few data in the literature with which to compare. Equally, there is little in the literature with which to compare complication rates in dual chamber implantation. The transition to more complex forms of pacing at this centre, however, was achieved without any increase in complication rates.

We believe that our low complication rates vindicate the role of the district general hospital as a pacing centre. Additionally, the presence of a pacing centre in a remote part of the United Kingdom continues to stimulate an increasing demand for cardiac pacing with implantation rates that are comparable with those in other parts of the country.

We thank Ms Helen Brough, clinical audit assistant, Hilton Hospital, Inverness who computerised the data and Dr Richard G Charles, consultant cardiologist, Broadgreen Hospital, Liverpool with whom Dr F Kerr gained initial experience of dual chamber implantation. The source for the Highlands and Islands population figures was Scottish Health Statistics (1993).

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before any clinical component of their course; recent recommendations that all applicants to medical school should be screened, and immunised if appropriate, have far-reaching implications and have provoked controversy.^{17 18}

In conclusion, among invasive cardiologists in the United Kingdom there is clear scope for improvement in vaccine uptake, particularly in completion of the immunisation regimen. Screening of patients, as recommended, should also be performed. Careful practice to avoid needle stick injury should continue and immunisation should also be offered to nursing and other ancillary staff caring for patients undergoing invasive cardiac procedures.

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CORRECTIONS

Failure of "effective" treatment for heart failure to improve normal customary activity. *J T Walsh, R Andrews, A Evans, A J Cowley (Br Heart J 1995;74: 373-6).*

Exercise ventilation after balloon dilatation of the mitral valve. *A P Banning, N P Lewis, J S Elborn, R J C Hall (Br Heart J 1995;74:386-9).*

We regret that the incorrect volume number was given in the strap lines and at the foot of the abstracts of these papers. The correct volume number is 74.

Permanent pacemaker practice at a Scottish district general hospital between 1987 and 1994. *J G Doherty, F Dawson, F Kerr*

We regret that an error appeared in the second sentence of the discussion on page 477 of this article (*Br Heart J* 1995;73:475-8) which should have read, "Our average implantation rate over the 79 months (130/million population/year) compares with the United Kingdom national 1989 value of 148/million population/year."⁵

NOTICES

The 1996 Annual General Meeting of the **British Cardiac Society** will take place at the Scottish Exhibition & Conference Centre, Glasgow from 7 to 9 May.

The **Fourth Annual Molecular Symposium at UCL Medical School on Ischaemic Preconditioning and Adaptation to Ischaemia** will take place on 12 December 1995 in London. For further information please contact Jan Wenley, Symposium Administrator, Department of Molecular Pathology, 46 Cleveland Street, London W1P 6DB (tel: +44 171 380 9343; fax: +44 171 387 3310).