Complications associated with 64 temporary pacing wires implanted at a district general hospital – should this procedure be reserved for specialist centres?

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Abstract

This study assessed complication rates in 64 emergency temporary pacing procedures, of which atrioventricular block formed the largest group (72%). Of the in-hospital deaths, most (76%) were due to myocardial infarction, and none due to the procedure. Immediate complications occurred in 22%: arrhythmia or arterial puncture, and one hemiparesis. Late complications occurred in 34%: loss of capture, infection including one instance of staphylococcal septicaemia. No complications occurred in 59%. Involvement of a consultant in the procedure did not reduce complication rates. In such potentially unstable patients, the risks of not pacing or delaying pacing probably far outweigh those of immediate intervention.

Key words: cardiac pacing, temporary cardiac pacing.

Introduction

Concern has been expressed regarding the complication rates associated with temporary transvenous pacemaker wire insertion, particularly where the procedure is performed in a district general hospital[1,2] by inexperienced staff.[3,4] Petch[5] has called for the responsibility for implanting temporary pacing wires to be taken away from general physicians and recommends that junior staff should always be supervised by a cardiologist. We have also heard the opinion that patients requiring temporary pacemaker wires should be transported to the nearest specialist centre by ambulance, rather than be subjected to the procedure locally. We reviewed 64 such procedures at Wansbeck Hospital, a district general hospital providing advanced permanent pacing facilities (including multisite pacing). The results were analysed according to the seniority of the doctor involved and whether or not they had specialist cardiologist training, so as to provide evidence as to whether Petch's recommendations should be implemented. In addition, screening times and complication rates were assessed and compared to the published literature.

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Patients and methods

A retrospective review of hospital records of patients receiving a temporary pacemaker at our hospital over a three-year period was undertaken. Data were collected to yield information broadly comparable to two similar previous studies.[1,2] A total of 129 temporary pacing wires were implanted in 118 patients. Of these, adequate records were obtained for 69 procedures. Five more were excluded (four elective trials of dual chamber pacing in patients with hypertrophic obstructive cardiomyopathy and one elective overdrive pacing for atrial flutter). The remaining 64 emergency temporary pacing wires implanted into 60 patients form the basis of this study.

Results

The average age of patients in the study was 72 years (range 49–93 years). The primary indication for pacing was atrioventricular block in 43 (72%) patients. Sick sinus syndrome/sinus bradycardia was the indication in 15 (25%) patients. One patient was in slow atrial fibrillation. The indication was noted as multiple organ failure due to septicaemia in another patient. Some 26 (43%) patients were suffering from complications of acute myocardial infarction (MI). Four of the 60 patients in the study required a second temporary wire: two patients after clinical deterioration following initial wire removal; one confused patient removed his wire himself; in the fourth, loss of ventricular capture prompted a new procedure.

Twenty one (35%) of the patients died during the admission, 16 following MI. Of these 16 deaths due to MI, 11 occurred within 12 hours of their temporary wire insertion. One further patient died from cardiac tamponade, also within 12 hours of the temporary wire being implanted. The patient with multiple organ failure identified above died. Of the final three deaths, one had atrioventricular block, one had sick sinus syndrome and lastly one had sinus bradycardia.

Senior house officers implanted the temporary pacing wires

Table 1. X-ray screening times during pacing procedure

	Number of screenings recorded	Mean screening time (minutes)
Senior house officer	23	7.8
Registrar	2	5.4
Consultant	29	5.6
Cardiologist involved	20	7.3
No cardiologist involved	34	6.0
Consultant cardiologist called to assist	4	9.3
Totals	**54**	**6.5**

Table 2. Immediate complications during the pacing procedure

	Total	Senior house officer	Consultant
Arrhythmia - AF	1	1	-
VT	2	-	2
VS	4	2	2
EMD	3	2	1
Arterial puncture	3	1	2
CVA	1	-	1
Total	**14**	**6**	**8**

Key: AF = atrial fibrillation; VT = ventricular tachycardia; VS = ventricular standstill; EMD = electromechanical dissociation; CVA = cerebrovascular accident

in 35 procedures (55%), registrars in two cases (3%), and consultants in 27 cases (42%). Of the 35 procedures carried out by a senior house officer, 11 were supervised, either by consultants (seven procedures), or other senior house officers (four procedures). Therefore, a consultant was involved from the outset (either operating or supervising) in 34 of the 64 pacings (53%). In addition, a consultant was called to assist with a temporary pacing already in progress on a further five occasions. This includes physicians in non-cardiac specialties. With respect to specifically cardiologically trained doctors, our institution has two consultant cardiologists and one cardiology senior house officer; these three individuals were involved in 25 of the 64 procedures (39%).

The right subclavian vein was first choice for venous access in 28 cases (44%) and on only one occasion was this unsuccessful, requiring use of the right internal jugular vein. The left subclavian vein was used three times (5%). The right internal jugular vein was initially chosen 22 times (35%), but on five occasions access via a second vein was needed. This was attained three times via the right subclavian vein, once via the right femoral vein, and once via a second attempt at the right internal jugular. The right femoral vein was first choice 10 times (16%), with three failures. This necessitated twice switching to the right internal jugular, and a second attempt at the right femoral once. The left femoral vein was used once.

Table 3. Late complications after the pacing procedure

	Total	Senior house officer	Registrar	Consultant
Loss of capture	9	3	1	5
Repositioning needed	4	1	1	2
Site infection	5	3	-	2
Septicaemia	1	1	-	-
Perforation	2	1	-	1
Pericarditis	1	-	-	1
Total	**22**	**9**	**2**	**11**

The X-ray screening time provides a yardstick for competence and difficulty of the procedure. This was recorded for 54 of the 64 pacings (see table 1). The mean screening time was 6.5 minutes. Where a senior house officer was operating alone, it is recorded under 'senior house officer'. Where a more senior doctor was present, either operating or supervising, then it is recorded under the heading 'registrar' or 'consultant'. The screening times were available for four of the five occasions when a consultant cardiologist was called to assist with a procedure already underway - this is also recorded in table 1.

Complications

Immediate complications were defined as those occurring during the procedure. A total of 14 immediate complications (22% of procedures) occurred in 13 patients (table 2). The majority were arrhythmias requiring emergency treatment, which were likely occurrences and were not necessarily a direct result of the pacing procedure. There was one suspected cerebrovascular accident, when hemiparesis was noted during manipulation of the pacing wires. This was in a patient admitted with an MI and complete heart block, and who died shortly afterwards. There were also three arterial punctures, all of which were controlled without further complication.

Table 2 indicates whether the procedure was performed by a senior house officer alone ('senior house officer') or whether a consultant was involved, either operating or supervising ('consultant').

Late complications were defined as those that occurred during the hospital admission after the pacing procedure which could have been caused by the temporary pacemaker. There were a total of 22 late complications (34% of procedures), which occurred in 16 patients (table 3).

The most common was loss of ventricular capture, which on one occasion led to the pacing wires needing to be repositioned. Repositioning was also required for two patients who had a perforation (the wire tip was noted to be in a pericardial location on chest X-ray), and for one patient who dislodged the wire himself.

There were five reported infections (8%) of the venous access site, all of which were treated with systemic antibiotics. Only one of these patients also developed septicaemia, the organism being *Staphylococcus aureus*. Some 21 pacing wires (33%) were left *in situ* for more than three days and these were responsible for three of the five site infections, including the case of septicaemia. (There has only ever been one infected permanent pacemaker site at our institution and this occurred in a patient after this reported series.)

The late complication data have again been broken down into 'senior house officer', 'registrar' and 'consultant', which refers to the status of the highest qualified doctor present at the temporary wire insertion, whether operating or supervising.

In 38 of the 64 procedures (59%), no complications occurred. When registrars or consultants were present, complications occurred in 15 out of 36 pacings (42%), whereas when senior house officers carried out the procedure unaided, complications occurred in 11 out of 28 pacings (39%). There were complications noted in eight of the 25 procedures carried out when a cardiologist was present (32%), compared with 18 of the 39 without a cardiologist (46%).

Discussion

There is possible bias in the 60 patients reviewed here in that the deceased patients' notes were more readily obtained of the original 118 patients. Thus the patients of this study would have been likely to have had a greater mean severity of disease than the whole population of patients receiving temporary pacemakers. There were 21 deaths arising from the 60 patients in this study (35%), whereas 28% of Murphy's patients died,[1] and only one out of 145 died in the study by Winner and Boon.[2] This increases the chance that the Wansbeck patients would have experienced complications and could have adversely affected the results of this study.

Consultants were involved in 53% of the procedures. This was much higher than in the figures published by Murphy of 14%, a study that showed a much greater involvement of registrars (30% *vs.* our 3%).

The findings of this study contradict the recommendations of the Medical Practice Committee and Council of the British Cardiac Society,[6] who prefer the internal jugular vein approach over the right subclavian vein. We observed fewer failures of venous access on the first attempt using the right subclavian vein (4% *vs*. 23% for the right internal jugular vein in our series), and a lower rate of complications for the right subclavian vein (29% *vs.* 64% for the right internal jugular vein). The right femoral vein, however, had a failure rate of 30% and a complication rate of 40%. We suggest that venous access site should be determined by the experience of the operator and patient characteristics (such as anticoagulation status), making 'recommended' veins an irrelevance.

The mean X-ray screening time for the pacings with consultant involvement was over two minutes shorter than for senior house officers operating alone, which could suggest that they were more efficient and skilled in the procedure. However, the mean screening time for pacings when consultant cardiologists were present was actually over a minute longer than when no cardiologists were involved. This could have been affected by bias, in that cardiologists are called to more difficult procedures. Given the consultants' lower complication rate, shorter screening times do not necessarily correlate well with a benefit to the patient, or with the level of experience of the operator.

This study found a complication rate of 41%, which is difficult to compare with other published data. Winner and Boon[2] found an overall complication rate of 51%, which included pacings when more than one vein had to be attempted – this would give our study a rate of 45%. Murphy[1] quotes a complication rate of 68 cases out of 194 (35%), but it is not clear whether this includes the patients for whom the use of a second vein was required. Andrews and Skehan[3] found complications in 52.5% of patients referred from other hospitals with temporary pacing wires *in situ* – but this figure excludes all immediate complications.

Analysing results on the basis of experience yielded some interesting results. We decided to carry out this analysis using the highest grade of doctor present, since it was their level of expertise that was available to the patient. No difference was found between the complications experienced by senior house officers (39%), or by the registrars and consultants (42%). It is possible that these results could have been affected by more experienced doctors choosing to pace the seriously ill patients. A difference in complication rates was found when the results were analysed for the presence of a cardiologist (32%) compared to those without a cardiologist present (46%). These figures are both lower than the overall rates found by many studies, such as those quoted above.

Petch[5] comments on the high risk of septicaemia in temporarily paced patients and the increased likelihood that a subsequent permanent pacemaker would become infected in patients who had had temporary wires. Murphy found confirmed or suspected septicaemia in 10 of the 53 patients whose pacing wires were *in situ* for greater than 48 hours. We found only one case of septicaemia in this study and had 40 patients who were paced for this length of time.

Conclusion

The results of this study dispute Petch's claims that general phys-

Key messages

- Acute bradycardia requiring pacing is potentially life-threatening and immediate insertion of a temporary pacing wire is optimum
- Complications will occur – none as dangerous as atrioventricular block itself
- Guidelines for temporary pacing should be locally agreed, and not set centrally

icians should no longer be expected to perform temporary pacemaker insertions. Every effort should be made for patients to be temporarily paced locally and with a minimum of delay. Delay in pacing acutely symptomatic patients, especially in atrioventricular block, may place the patients at risk of death that far outweighs any of the complications found in this study. Transfer of such patients unpaced in ambulances is also likely to be dangerous. The use of isoprenaline infusion may precipitate an acute coronary syndrome in some patients. We suggest that arrangements for this procedure should be agreed locally depending on the expertise and outcome data available at each institution. Much more careful evaluation of alternatives is required before abandoning temporary pacing wire implantation at district general hospitals.

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