Ten years on: has competence and training in temporary transvenous cardiac pacing improved?

Ten years ago in the pre-Calman era, Davis and Roberts (1996) examined the practice of temporary cardiac pacing in north-west England. Now, in the post-Calman and Modernising Medical Careers era, a new survey has found no improvement in this important practice.

Introduction

Temporary transvenous cardiac pacing is a potentially life-saving emergency procedure. Appropriate training and competence in this skill are therefore essential components of general professional training. This procedure is performed by various grades of doctors with varying technical knowledge and skills in both district general hospitals and tertiary centres. Complications related to transvenous cardiac pacing are common when it is performed by inexperienced trainees, as Winner and Boon (1989) and Betts (2003) have suggested.

The authors conducted a questionnaire survey involving senior house officers (SHOs) and registrar grade doctors (specialist registrars, clinical fellows) in general medicine in north-west England aiming to determine the level of technical skill, experience, training and knowledge of the performance of this procedure as well as knowledge of the management of procedure-related complications. The other objective of this survey was also to elucidate the need for a formal structured training programme for this procedure.

Methods

This survey was conducted over a 4-month period from January to April 2006. Junior medical staff (SHOs and registrars) from 15 acute hospitals in north-west England were asked to complete an anonymous questionnaire detailing their individual experience in attaining central venous access, temporary pacing wire positioning and management of complications. They were also asked about their radiation practices, current training and suggestions for improvements in formal training for this procedure. The detailed questionnaire can be obtained from the corresponding author.

Dr Rajiv Sankaranarayanan *is Cardiology Research Registrar and Honorary Lecturer, Taunton Hospital, Taunton TA1 5DA,* **Dr Adel Msairi** *is Cardiology Clinical Fellow and* **Dr Gershan Davis** *is Consultant Cardiologist, University Hospital Aintree, Liverpool*

Correspondence to: Dr R Sankaranarayanan

Results

The characteristics of the respondents are shown in *Table 1*. One hundred questionnaires were sent out and the response rate was 56%. Out of the 56 respondents, there were 37 medical registrars (66% of respondents) and 19 medical SHOs (34%); 14 of the respondents were cardiology trainees (11 registrars and three SHOs). The level of experience in medicine, indicated by the average number of years since qualification, was a mean of 2.5 years for SHOs and 8.5 years for registrars. Of the respondents 36 out of 56 (64%) had passed the Membership examination of the Royal College of Physicians. The average time spent in the current post was 1.6 years for SHOs and 3.5 years for registrars. Most doctors (33 out of 56; 59%) preferred to use the internal jugular route for central venous access with the subclavian route being second choice (30%) (*Table 2*). Of the doctors surveyed 52 out of 56 (93%) had learnt to perform central venous cannulation and temporary pacing wire insertion by observing senior colleagues while four out of 56 (7%) had attended formal training courses (*Table 2*).

Table 3 outlines the other important parameters measured. About 25% of respondents had never performed temporary transvenous cardiac pacing while 36% (20 out of 56) had inserted fewer than five temporary pacemakers in their career. Only a quarter of the doctors surveyed had performed more than 10 such procedures in their career, and 49 out of 56 (87%) had performed fewer than five such procedures in the last 12 months.

The estimated median duration of the procedure when performed by SHOs was 35 minutes and by registrars was 25 minutes. The median duration was 30 minutes in 75% (42 out of 56) of all the doctors surveyed. Nineteen doctors (34%) frequently needed help with obtaining central venous access, with 12 (21%) failing to obtain access in the last 12 months. Thirty

Table 1. Characteristics of respondents

Respondents	Number	Average time since qualification	Average time in post	MRCP
Senior house officers	19	2.5 years	1.6 years	1
Registrars	37	8.5 years	3.5 years	35

Table 2. Training in central venous access

		Senior house officers (n=19)	Registrars (n=37)
Route of central vein access	Internal jugular	10 (53%)	23 (62%)
	Subclavian	5 (26%)	12 (33%)
	Femoral	4 (21%)	2 (5%)
Trained in procedure by	Observing senior colleagues	16 (84%)	36 (97%)
	Courses	3 (16%)	1 (3%)
Frequently need help for central venous access		15 (79%)	4 (11%)

Table 3. Important parameters measured

Parameters	Senior house officers (*n*=19)	Registrars (*n*=37)	Cardiology trainees (*n*=14)*	Total (*n*=56)
Never performed temporary pacing	11 (69%)	3 (12%)	0	14 (25%)
Performed 1–5 procedures in career	5 (31%)	12 (46%)	3 (21%)	20 (56%)
Performed 6–10 procedures in career	0	5 (19%)	3 (21%)	8 (14%)
Performed >10 procedures in career	0	6 (23%)	8 (57%)	14 (25%)
Average duration of procedure	35 min	30 min	25 min	30 min
Frequently have difficulty in positioning temporary leads	15 (94%)	14 (38%)	2 (14%)	31 (55%)
Cannot perform post-implant threshold checks	15 (94%)	16 (43%)	2 (14%)	33 (60%)
Attended radiation protection course	0	2 (8%)	9 (65%)	11 (20%)
Would consider removing lead in presence of infection	0	8 (31%)	10 (71%)	18 (32%)
Expressed confidence in performing procedure	0	13 (50%)	13 (93%)	26 (46%)
Felt that training for procedure inadequate	16 (100%)	23 (41%)	3 (21%)	42 (75%)

*Cardiology trainees were at both senior house officer and registrar levels

one doctors (55%) frequently had difficulty in positioning temporary pacing leads with the consultant having to come in to help on a few occasions. In the last 12 months 20 out of 56 (36%) had failed to obtain a satisfactory lead position and 38% of doctors surveyed had to call in a second colleague (in six instances from outside the hospital). Of respondents, 60% could not personally perform post-implant threshold checks. There were also two instances of pneumothorax as a complication of the procedure in the last 12 months.

Although 30% of respondents have had to reposition a pacing lead in the last 12 months, 68% would not consider removing the lead even in the presence of systemic signs of infection. Also 80% (45 out of 56) had not attended a radiation protection course, 68% did not know if their screening time was recorded and 75% of doctors surveyed did not routinely wear a radiation badge during the procedure. The majority of respondents expressed a lack of confidence in performing temporary transvenous cardiac pacing and felt that training for this procedure was inadequate. They also strongly felt that they would significantly benefit from structured formal training courses to develop this skill.

Discussion

This survey aptly illustrates the considerable variation in temporary pacing procedures in terms of the grade of operators, experience and techniques used. This is a procedure performed for potentially life-threatening emergencies like acute haemodynamic compromise caused by bradyarrhythmias with or without episodes of asystole. Some of these patients have acute myocardial infarction although this is less common in the current thrombolytic era and with treatment of acute myocardial infarction with primary percutaneous coronary intervention. The incidental finding of unstable complete heart block or decompensated slow atrial fibrillation constitute the majority of the other cases.

The procedure itself is associated with complications some of which can lead to fatal consequences. The procedure of temporary transvenous cardiac pacing can be broken down into two major components: gaining central venous access and positioning the temporary wire. Possible complications are local trauma, pneumothorax, arrhythmias and cardiac perforation (Murphy, 2001) but could also include infection and thrombo-embolism caused by the presence of a foreign body (Gammage, 2000). Gammage (2000) also stated that failure to gain venous access, pneumothorax or haemothorax relating to subclavian puncture are more common in inexperienced hands.

Studies by Winner and Boon (1989), Andrews and Skehan (1992) and Murphy (1996) have shown that complications are associated with this procedure in one third to half of cases and that these complications lead to delays in permanent pacing (Betts, 2003). Winner and Boon (1989) and Andrews and Skehan (1992) have also shown that between 17% and 20% of patients transferred to cardiac centres for permanent pacing arrived with a non-functioning temporary pacing system. Winner and Boon (1989), Murphy (1996) and Betts (2003) all have illustrated that these high complication rates have changed little over the last two decades. Betts (2003) showed that immediate complications are related to operator rather than patient factors, with greater experience and cardiology training resulting in shorter procedure times and fewer early complications. Winner and Boon (1989) demonstrated that the incidence of complications is inversely related to the experience of the operator.

This survey showed that up to a third of junior physicians frequently needed help obtaining central venous access and also revealed two instances of pneumothorax in the preceding 12 months. What is especially concerning is that while a quarter of the respondents had never performed temporary transvenous cardiac pacing, another 36% had performed less than five such procedures in their entire career.

Guidelines from the American College of Physicians/American College of Cardiology/American Heart Association Task Force on Clinical Privileges in Cardiology (1994) state that the minimum number of temporary transvenous cardiac pacing procedures which should have been performed by an operator to be deemed competent in this procedure is twenty five. If these criterion are applied, 87% (49 out of 56) of the junior physicians in this survey would be considered incompetent in this procedure. This reflects the lack of training for this procedure and also a lack of opportunity to perform it.

This survey also reflected the difficulty in keeping up to date with their skills in this procedure as a majority in this survey (87%) had performed less than five procedures in the last 12 months. It is hardly surprising that most respondents expressed a lack of confidence in their skills for temporary cardiac pacing. The American College of Physicians/American Heart Association/American College of Cardiology Task Force on Clinical

Privileges in Cardiology (1994) as well as the Medical Practice Committee and Council of the British Cardiac Society guidelines (1993) for temporary pacing recommend the internal jugular route, particularly for inexperienced operators, and 59% of the doctors in this survey preferred to use this route. This is in contrast to studies by Davis and Roberts (1996) and Murphy (1996) in Britain which showed a preference for the subclavian route. This study also showed that the vast majority of doctors did not attend a radiation protection course, despite the European Community directive which governs the use of fluoroscopy and recommends that attending a radiation protection course is mandatory.

Traditionally, this procedure has been in the realm of medical SHO or registrar training grades, many of whom are not cardiology trainees and have little experience in either central venous cannulation or temporary wire manipulation as illustrated by Davis and Roberts (1996). Murphy (1996) also showed that consultant involvement in temporary transvenous cardiac pacing is only seen in up to one in every six cases.

SHOs have little experience or supervision for temporary cardiac pacing as demonstrated by Winner and Boon (1989) and Murphy (1996). Wheatcroft and Maxwell (1997) also found that they have mostly learnt at the bedside by observing on average two temporary pacing procedures by registrars, performing two under observation and then performing them independently. This practice in itself is medicolegally dangerous, and is further complicated by the fact that the number of patients requiring temporary pacing has steadily dwindled thereby further reducing the exposure to bedside training. This is mainly a result of better management of acute coronary syndromes and improvement in access to permanent pacemaker services. Other major reasons for the decline in temporary pacing are the widespread adoption of transcutaneous pacing, which obviates the need for a wire in a significant proportion of bradyarrhythmias, and increased awareness of the indications for the procedure (i.e. not necessarily needed in stable complete heart block, or bradyarrythmias complicating inferior myocardial infarction).

In addition the European Working Time Directive reduction in working hours has reduced the exposure of trainees to train in this procedure at the bedside. Proficiency in temporary cardiac pacing is a part of the core curriculum skills for general internal medicine specialist registrar training according to the Joint Committee on Higher Medical Training, Royal College of Physicians (2003) as well as the specialty training curricula released by the Joint Royal Colleges of Physicians' Training Board (2006). As demonstrated in this survey, most junior physicians do not perform enough procedures to keep up with their skills and hence lack confidence to perform this procedure. A previous survey of specialist registrars training in general medicine by Murphy et al (2001) revealed that fewer than half felt competent to provide cover for temporary pacing at consultant level.

In small district general hospitals, the on-call physician still provides cover for temporary pacing service whereas in the larger district general hospitals and tertiary referral centres, the on-call cardiologist is responsible for this service in case the on-call team is not successful in temporary pacing attempts. As Winner and Boon (1989) illustrated, it is in small district general hospitals that problems with temporary transvenous cardiac pacing are frequent and complication rates highest. According to Murphy (2001), it is unrealistic to expect all general physicians to provide temporary cardiac pacing, and most district general hospitals do not have enough consultant cardiologists to provide 24-hour cover.

This survey has shown that showed that junior physicians in north-west England lack the necessary experience, knowledge and confidence to perform temporary transvenous cardiac pacing. This is a likely consequence of lack of formal structured training for this procedure. But this study does not throw up any startling conclusions. There have been similar such studies before – one of them done 10 years ago in the north-west region by one of the authors of this study (Davis and Roberts, 1996). The results of that survey were similar to another done in the north east and a study carried out in the south west. The current survey demonstrates vividly that despite the rather abysmal results of previous studies of temporary pacing experience in the UK, little has been done to improve training for this skill.

The bottom line is the implication for general medical training. Although not as frequently required as a few years back, temporary transvenous cardiac pacing is still a life-saving skill – is bedside training for this emergency procedure sufficient? Structured formal training for junior physicians should instead involve mannequin-based training and simulated teaching to supplement bedside teaching. The process of restructuring medical training has already started and competency-based assessment forms the core of this training structure for junior doctors previously called specialist registrars and SHOs who have been renamed as 'specialty registrars'. If temporary transvenous pacing should remain a core proficiency, it is imperative that the Royal College of Physicians defines standards of structured training for this core competency skill and also establishes a minimum number of such procedures that an operator has to perform to maintain competence in this skill.

Conclusions

The current practice of temporary cardiac pacing in British hospitals is unacceptable (Murphy, 1996). It is medicolegally dangerous to expect junior doctors to perform temporary cardiac pacing without adequate training. Most small district general hospitals do not have enough cardiologists and hence it is unrealistic to expect them to be on call for out-of-hours temporary cardiac pacing. There are two options – one is the introduction of regular structured training courses for the use of ultrasound guidance to obtain central venous access and training with simulators, videos and mannequins to improve skills in temporary cardiac pacing. Overburdening anaesthetists for help with obtaining central venous access for temporary pacing should only be used as an alternative but not as first resort.

The other option would be for temporary transvenous pacing to be removed from the general medical core curriculum and to be made a cardiology-only procedure. This would also require district general hospitals, depending on the local expertise, to set up a regular system for liaison with regional cardiac centres for out-of-hours transfer of patients requir-

ing emergency pacing after alternative measures like external pacing have been employed. This process may actually be safer than having the procedure performed by an inexperienced operator. If adequate training in temporary cardiac pacing cannot be provided for general medical trainees then it should no longer be an essential procedure for training in general medicine. Also, if the current practice of temporary pacing in the UK is allowed to continue without any changes or improvement in training, it will not only be relegated beyond the remit of the general internal medicine trainee but it is likely that complications from this procedure will rise further as a consequence. Competency-based training is the core of the newly reformed training structure for junior doctors and it is imperative that both training standards and competency assessment for temporary transvenous pacing are clearly defined for all junior doctors. **BJHM**

Conflict of interest: none.

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KEY POINTS

- Temporary transvenous cardiac pacing is a potentially life-saving procedure which is one of the core competency procedures for medical specialist registrars training in the UK.
- This survey demonstrates that, 10 years after a similar survey in north-west England and despite the introduction of structured training for medical specialist registrars, training for the core curriculum skill of temporary transvenous cardiac pacing is still inadequate.
- This survey emphasizes the need for regular structured training courses if this procedure is to remain a core curriculum skill.
- If general medical trainees cannot be trained adequately in this procedure, the only other option is to make it a 'cardiology-only' procedure.