MODELS OF CARE AND PROVISION OF SERVICES

KEY POINTS - WORKFORCE AND LOCAL SERVICES:

1. Modern effective treatments for cardiac arrhythmias need to be made much more widely available.
2. Wherever possible, arrhythmias services should be provided as close to patients' homes as is practical. However, cardiac arrhythmia treatments represent a range of complexity, and some treatments can only be provided in a "tertiary" setting because of skill shortages or the need to cluster experience in a few doctors hands to ensure good outcomes.
3. Providing treatments for urgent arrhythmia care in the hospital where a patient is admitted has a huge impact on bed-occupancy and wasted resources.
4. Some arrhythmia services can only be provided by inter-hospital transfer, but simpler services, e.g. cardiac pacing, has been available for over 40 years, is taught to all cardiology trainees, and should now be made available to patients in all DGHs, offering huge dividends for patients and for cost-efficacy.
5. Permanent cardiac pacing providing permanent cardiac pacing and follow-up clinics in every DGH is a major challenge for staffing and other resources, but DGH cardiologists should be freed from acute unselected medical duties as soon as is practical, so that time can be provided for planning and implementing permanent pacing locally.
6. Complex device therapy can be provided in DGHs, and must always be built upon the foundation of an established permanent pacing service, which will provide basic skills to be developed to achieve good results.
7. Some cardiologists near conurbations may develop shared facilities with other local DGHs so that more complex device therapy can be delivered on a "sector' basis to cluster implantation and follow-up skills, specialist nursing and other support, and also achieve economies of scale.
8. Technological developments, especially remote device monitoring and follow-up, may increase workforce efficiency and reduce the burden of travel away from local services for patients.
9. Databases, data-collection and audit require a national strategy, and much easier access. Web-browser based databases and information resources need to be developed.

KEY POINTS - WORKFORCE AND SPECIALIST SERVICES:

1. There are far fewer cardiologists and interventional cardiac rhythm management specialists (electrophysiologists) in the UK compared to other European countries, and delivery of adequate cardiac rhythm management service in the UK will require major expansion of infrastructure, medical staff and allied professionals.
2. The latest UK CCAD database returns suggests that only about 40 hospitals in the UK can provide these services, and only 16 of these achieve more than 100 cases per annum.
3. In the UK there are thought to be about 65 consultants taking a particular interest in cardiac arrhythmias. In contrast, the USA there are 2,400 full-time or part-time cardiac electrophysiologists. The need in the UK is for about 600 such specialists in due course.
4. Interventional electrophysiology if offered in district general hospitals would bring care closer to patients but would involve development of infrastructure that is likely to be inefficiently used and again a hub and spoke model should be considered. However, catheter ablation is often completely curative, and should be made much more available with a 10-year plan to expand the workforce and

skill-base, possibly bringing these highly effective treatments to patients in their local hospitals.

5. All interventional centres need to be properly staffed and equipped for performing safe effective diagnostic electrophysiology and catheter ablation.
6. Specific centres should be designated for the treatment of arrhythmia complicating adult congenital heart disease and possibly other conditions requiring concentration of experience for optimal care.
7. Specific centres should be designated for the treatment of infected devices, which require extraction so as to concentrate experience for optimal care.
8. Skilled cardiac technical help is very scarce, and needs a major workforce initiative, with resources, proper audit and regular performance review.
9. Skilled electrophysiologists are in very short supply and this requires a coordinated programme of advanced arrhythmia training posts for junior cardiologists, linked to need based on a 10-year plan, and funded publicly, (see chapter 32).

KEY POINTS - WORKFORCE AND BLACKOUTS/T-LOC:

1. Patients with blackouts are often very poorly managed, and current acute medical admission audits are beginning to bring this to light.
2. Blackouts, along with other arrhythmias feature in the top 10 causes for hospital admission, and are a major source of re-admission because of difficulties with arriving at a correct diagnosis and providing definitive treatment.
3. Misdiagnosis rates for epilepsy and falls are significant and costly.
4. Blackouts management requires close collaboration across neurology, cardiology, falls clinics and neuropsychiatry.
5. Currently national guidelines epilepsy, falls and arrhythmias ***are being developed separately in isolation*****,** and this risks confusion and further waste and duplication.
6. Novel models of care, such as rapid-access specialist-nurse led blackouts triage clinics, have the potential to cut waste and achieve better outcomes. These should be trialled, carefully monitored and rolled-out across the NHS as indicated
7. Such provision cannot be achieved without “joined-up” planning.

KEY POINTS - WORKFORCE AND SUDDEN CARDIAC DEATH IN THE YOUNG:

1. Sudden cardiac death in the young represents a major healthcare challenge and a huge burden of grief for affected victims and families.
2. About 400 children and young people suffer tragic unexplained death each year in the UK.
3. Determining the cause of such tragedies and trying to prevent further tragedies requires a concerted collaborative effort.
4. Screening for inherited causes of life-threatening arrhythmia and death in patients and their families needs coordination of electrophysiolgists, cardiomyopathy services and genetics across the NHS.
5. Government and the healthcare professions owe victims of tragedies, (and their relatives), an explanation of their loss wherever possible to help the grieving process and achieve some closure. Pathological services with expertise to perform detailed analysis of material in such cases are scarce and patchy
6. Pathological services for victims of sudden cardiac death in the young require a concerted national strategy across the NHS.
7. Where transfer of tissues from the base pathology department after a sudden death in the young is impractical or legally untenable, a system of outreach services should be developed to ensure that all victims receive the fullest examination in trying to reach a conclusion on cause of death and family risk.

INTRODUCTION

The management of cardiac arrhythmias has become a highly technical field. Developments are very rapid for implantable devices for bradyarrhythmias and especially for ventricular arrhythmias, heart failure treatment and for prevention of sudden cardiac death [1,2,3]. Also rapidly developing are techniques for curative catheter ablation [4,5,6]. As the applications of ablation progress, its value as hybrid therapy with ICD's for treatment of highly symptomatic and life-threatening cardiac arrhythmias is also becoming clear. Arrhythmias had previously to be treated with powerful drugs with severe side-effects, can now be approached by ablation, often in conjunction with drugs, pacemakers and devices. Much more can be done now than could be done 10 years ago to provide more and better quality life.

Arrhythmias received no attention in the original NSF for Coronary Heart Disease. Many arrhythmia treatments, such as pacing and curative ablation, provide excellent benefits, and are very cost effective (7,8). The evidence base for both clinical and cost efficacy of these therapies is at least as robust and often more robust than n the evidence base supporting coronary revascularization strategies [9, 10, 11].

For the NHS, delivery of effective arrhythmia treatments needs to address the following shortcomings:

- Lack of an adequate skilled workforce - there are many fewer cardiac electrophysiologists and essential support staff than in other European countries:

Table 1. Total Cardiac Electrophysiologists in Europe and the USA – estimate by European Society of Cardiology CRT Taskforce [12].

USA	France	Germany	UK	Italy
2400	240	320	60	140

- Lack of infrastructure and dedicated arrhythmia facilities such as pacemaker laboratories.
- Implantation facilities in every DGH, (see chapter 33).
- Lack of a coordinated approach to streamlined care delivery between primary and secondary care and between secondary care and tertiary care.

Delivery of arrhythmia care can be considered under three broad headings:

- Implantable devices.
- Catheter ablation.
- Management of blackouts/T-LOC.

All are dependent on an adequate skilled workforce and the provision of an appropriate infrastructure. All require a blend of complex interventional care, invasive (in-patient) and non-invasive (out-patient) investigations and therapies. The rapid pace of technological development and rapidly expanding indications for device/intervention treatment demand novel ways of delivering arrhythmia services. Technology may help meet demand until the workforce can be expanded and new facilities built. Novel workforce management may also help, (see chapters 31, 32).

IMPLANTABLE DEVICES FOR MANAGING ARRHYTHMIAS

Implantable devices consist of bradycardia-pacemakers, ICDs (also included in the management of atrial fibrillation), biventricular devices and ILRs.

OVERVIEW OF CURRENT SERVICE

Current implantable device service provision

There are currently 132 centres implanting pacemakers. Seventy-five per cent of implanters implant <25 devices per year [13]. There are 51 ICD implanting centres implanting at a rate of 35/million population. There are 86 senior implanting cardiologists. Each centre has 3-7 technicians trained in device implantation and follow up. Work is currently underway [14] to identify postcode variations in implant rate and the mechanisms that underlie them.

Device Referral Pathway

Patients are referred from primary care with symptoms of bradyarrhythmia electively or as an emergency. In the latter case they will usually present to an emergency department. They may be admitted if a bradyarrhythmia is evident. They may receive temporary pacing to support heart rate, and they will be paced locally, (rarely), or referred to another hospital for pacing, (commonly). Transfer-times for pacing vary markedly, but usually patients wait far too long and are at risk of cardiac arrest, (failure of a temporary pacemaker), infection and hospital-acquired complications during their wait for transfer. After permanent pacing, many patients should be fit for discharge within 24 hours, since many elective pacemaker and ICD implants are now done as day-cases. However, all too frequently, discharge is delayed because of problems acquired during waiting times for transfer.

The care-pathway for ICD implantation is very similar, although very few DGH hospitals are providing this service, and implanting centres are less well equipped for ICD services than pacemaker services. Coupled with the need for many ICD patients to undergo evaluation and other investigations, such as coronary angiography, before ICD implantation, waiting times for ICD transfer and implantation are longer than for pacing.

Therefore, a “hub-and-spoke” model is in operation in the UK. Workforce availability & skills-base tends favour ICD implantation in specialist centres. ICD patients tend to be followed up in tertiary centre clinics, which soon become overloaded. Often patients have separate device records, (to streamline that part of their care), but too often records are entirely paper-based, and the full patient record is not available at a device clinic. This creates problems in caring successfully for the whole patient with other cardiac co-morbidities, e.g. heart failure, and huge problems for co-existing non-cardiac conditions.

Some patient details are submitted by implanting centres to the CCAD National Database. This is not accessible directly, and lags behind the rapidly expanding portfolio of devices and indications. Clinical follow up is overwhelmingly paper-based, enthusiast-driven and dependent long-standing stalwarts of pacemaker services in key centres. Web-browser based systems need to be developed urgently.

In order to move forward:

- Information management systems must change and embrace IT.
- IT must be provided at every point of patient contact.
- Patient clinical profile, procedural data and follow-up course must be accessible when seeing that patient again.
- The details of a patient's implanted materials must be logged meticulously so that they are immediately available if any of these materials has an advisory notice or recall.

PACEMAKER THERAPY

Pacemaker implantation (for bradyarrhythmia indications) is relatively simple and many UK cardiologists have excellent pacing skills. Nevertheless the UK implant rate remains low compared to Western Europe (figure 1).

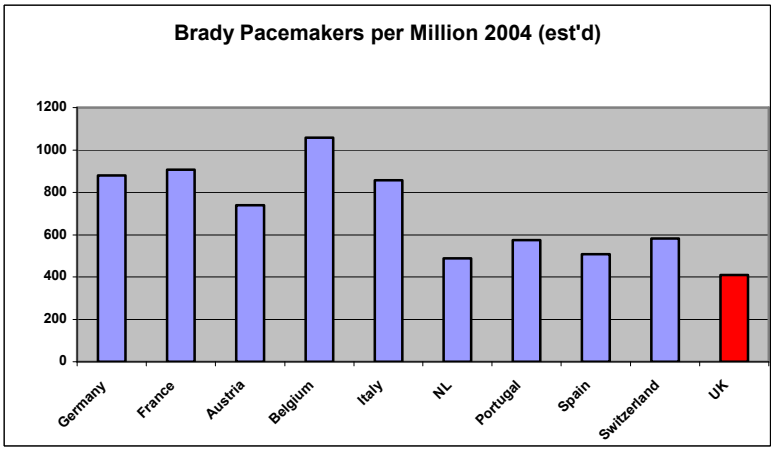

Figure 1. Brady Pacemaker Implants per Million Population 2004 (estimate from industry sales provided by Medtronic and Guidant personnel

Failure of appropriate referral is the likely explanation. It is likely that this is due to substandard care of patients with intermittent bradyarrhythmias causing syncope/bradyarrhythmia-related falls in the elderly, even though patients with obvious bradyarrhythmias are appropriately managed. It is anticipated that the population requiring pacemaker implantation in Europe is set to grow at about 3.5% per annum over the next decade (industry estimation) but improved pick up rate of patients with pacemaker indications could double pacemaker implantations in the UK.

Follow-up of patients with implants is set to change with developments in remote management strategies, based on long-distance interrogation and programming of devices through networks. However, the overall burden of care will still increase with increasing patient numbers. In the UK pacemaker follow up has been delegated largely to technical staff, and they are now seriously overstretched (figure 2). This is of great concern, and every effort needs to be made to ensure that experienced staff are retained in the NHS during the "Agenda for Change" regrading.

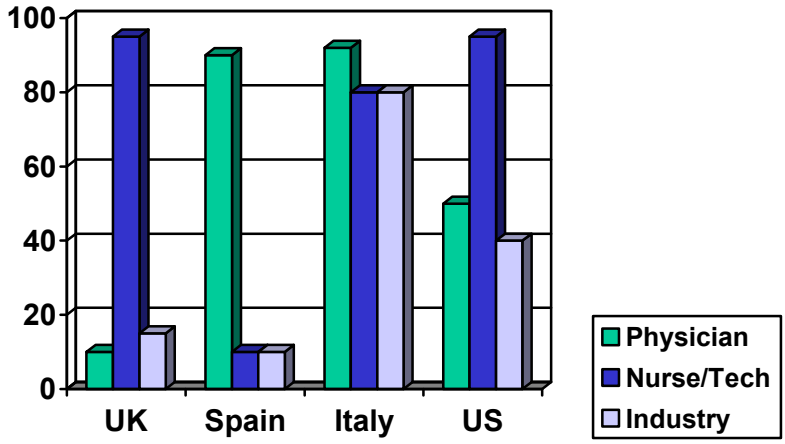

Figure 2. Follow Ups (100's) by Staff Type in 2002 – Medtronic practice survey

PAEDIATRIC PACING

Paediatric pacing is performed in low volumes by small number of operators. There are particular technical challenges in infants and neonates, related to size of patients and equipment designed for adults, and the long-term behaviour of implantable materials. This experience is has been focussed in tertiary centres equipped to offer the full range of paediatric cardiac services, and this will continue. Paediatric pacemaker follow up requires specialised paediatric pacemaker clinics and centres have in place strategies to enable urgent management and troubleshooting as this population which may be more vulnerable to device complications than the adult population.

ICD THERAPY

ICD implantation rates are also low in the UK compared to other European countries (figure 3) and particularly in comparison with the United States.

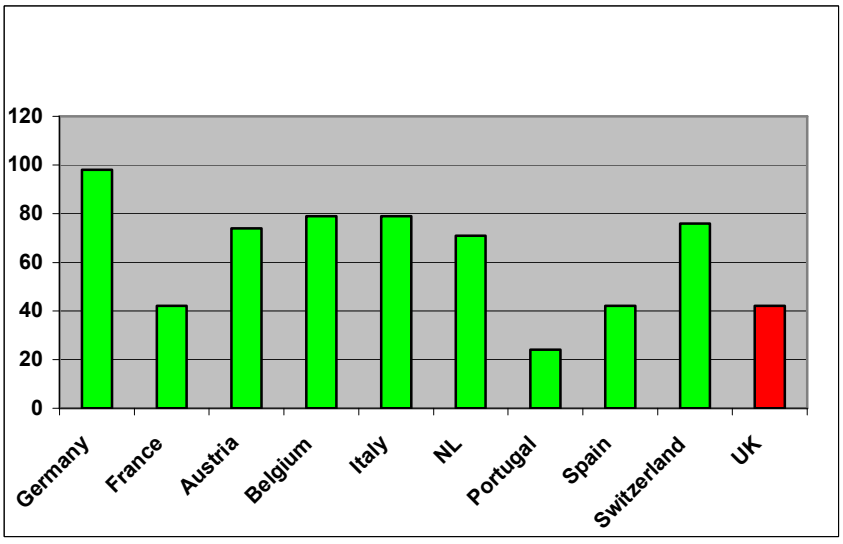

Figure 3. ICD Implants per Million Population 2004 (estimate from industry sales provided by Medtronic and Guidant personnel

Modest NICE recommendations for ICD implantation from 2000 have not been met. ICD implantation rate is set to increase slowly as more staff and facilities become available, unless NICE guidance becomes inappropriately restrictive. Historically, ICD implantation developed in tertiary centres as implantation could only be achieved by opening the chest to place the device on the outside of the heart and in the abdomen. There is now less often a requirement for EPS in patient assessment. As the technology has matured, non-thoracotomy devices have enabled greater ease of implantation.

In 2004 ICD implantation is often performed as a day case or overnight stay procedure. Use of conscious sedation rather than general anaesthesia for implantation has become the norm. However, it should be recognised that ICD implantation is more challenging than pacemaker implantation. Patients are often sicker, defibrillation threshold (DFT) assessment requires VF induction, and device placement requires more implantation skill than for pacemakers. In patients with inadequate DFTs successful implantation requires an understanding of all the available ICD options. Implanters need to be assisted by experienced support personnel with adequate training. Such individuals have often been provided by industry to support implants and this adds to the costs.

Technical follow-up, as with pacemakers, has become easier. However, follow-up clinics still need experienced medical and technical staffing to get good results. ICD centres also need properly established patient groups, run by nurse specialists with technical and medical input.

CARDIAC RESYNCHRONISATION THERAPY

The evidence base supporting use of CRT is robust [3] and uptake of CRT devices is set to increase (figure 4).

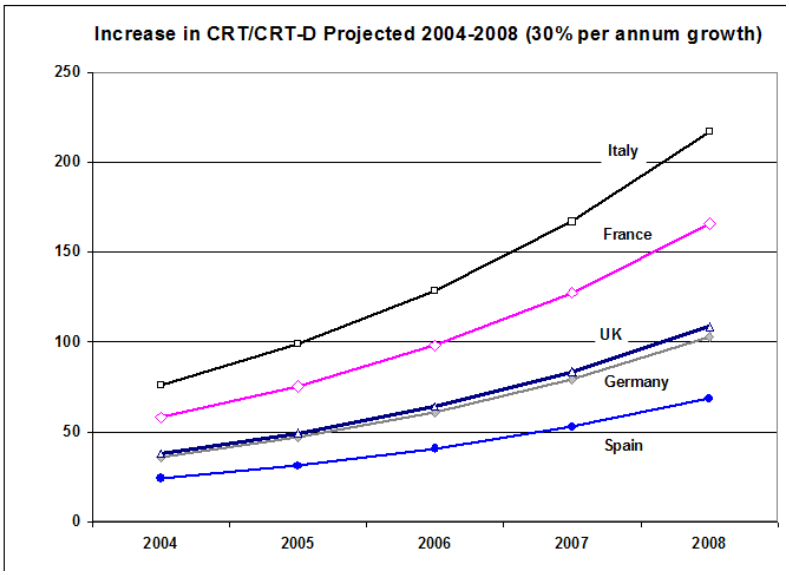

Figure 4: Increase in CRT/CRT-D per Million Population Projected 2004-2008 (30% per annum growth) (estimate from industry sales provided by Medtronic and Guidant personnel

Technical developments have made CRT implantation easier, but CRT is still much more complex than routine ICD and pacemaker therapy. Much higher levels of surgical and catheterisation skills are needed, and device implantation times are typically 90-120mins (twice that of ICDs and three times that of pacemakers).

In the UK, workforce constraints make it unlikely that all patients that may benefit will be catered for many years to come. Although follow-up is likely to get easier with remote management and data handling systems. CRT patients, with heart failure will require more direct contact with doctors than is likely to be needed for pacemaker and routine ICD follow-up.

Dr John Morgan, Southampton General Hospital

DIAGNOSTIC DEVICES

Diagnostic devices (implantable loop recorder/haemodynamic monitors) are currently used in small numbers. They are easy to implant requiring no fluoroscopy and minimal surgical skill. They find most use at present in diagnosis of unexplained syncope and unexplained palpitation. Follow up is simple, but currently requires direct face-to-face contact to retrieve information. This is likely to change as monitoring can be done remotely on-line from a distance.

FUTURE MODELS OF DELIVERY OF DEVICE THERAPY

This is considered in four sections:

1. Does my patient need a device?
2. Implant procedures
3. Device follow up
4. Clinical follow up

IDENTIFYING PATIENTS FOR DEVICE THERAPY

BLACKOUTS/T-LOC

It is increasingly clear that patients with blackouts/T-LOC are poorly managed at high cost, and often misdiagnosed, if they are diagnosed at all. Poor understanding and anxiety about missing a serious cause often results in patients with blackouts/T-LOC being admitted repeatedly, undergoing expensive tests over a prolonged period in hospital, and being discharged without clear conclusions and a safe care-plan. Many primary care physicians complain that there is no clear referral pathway for these patients, which means that many may be referred inappropriately to neurologists or general physicians.

Having a local alternative care-pathway for blackouts/T-LOC will save admissions, save money and concentrate experience and expertise. This should lead to fewer admissions, more accurate diagnoses and fewer re-admissions (see chapters 10, 32, 35). Goes into detail about care pathways and triage for blackouts/T-LOC in rapid-access specialist nurse- led clinics.

These Rapid Access Blackouts Triage Clinics in secondary/tertiary care should offer access to tilt testing, ambulatory monitoring and implantable loop recorders.

SCD RISK STRATIFICATION – CHD

The great majority of patients requiring risk stratification (to assess indication for ICD implantation) for sudden cardiac death suffer from coronary artery disease and poor LVEF[15]. The need for this process will become clearer with further scientific information and development of European guidelines and NICE guidance after proper consideration of the evidence base and cost efficacy assessments. It is likely that will be driven by protocols that can be applied in primary and secondary care and which also should become the subject of primary care targets. Screening using non-invasive risk stratification techniques and assessment of LVEF could become primary care tasks, with echocardiography provided in primary care centres or by direct access from hospitals.

RISK STRATIFICATION FOR SUDDEN CARDIAC DEATH – NON CHD

A much smaller group of patients are at risk of sudden cardiac death from the inherited channelopathies to hypertrophic cardiomyopathy and right ventricular dysplasia cardiomyopathy, (see chapters 24, 26).

These conditions can be difficult to diagnose and risk stratify. The evidence base that justifies device management in some of these patient groups is less robust than that for coronary artery disease and as such is less amenable to management by protocol. Consideration should be given to the creation of regional, tertiary centre-based services that interact to provide seamless management of these patients groups across regional boundaries. These regional services need to be equipped by appropriate support systems (e.g. geneticists and experts in cross sectional imaging of cardiac disease).

IMPLANT PROCEDURES

Pacemakers and ICDs

All DGHs should offer a local bradyarrhythmia pacing service and local pacemaker follow-up by 2008. DGHs should aim to have at least two competent independent pacemaker implanters and two fully-trained cardiac technicians to support implantation and conduct local pacemaker follow-up.

As DGH cardiology acquires more staffing and facilities in line with the Fifth Report, ICDs and CRT implants may be undertaken. ICD and CRT services should be built on the basis of an established pacemaker service. In large conurbations with many DGHs providing local services, ICD and CRT experience may be focussed on “sectors”, with DGH cardiologists providing a pacing service locally, but “hosting”, or travelling to a host-DGH to be involved in ICD and CRT provision. As an alternative, consideration should be given to the development of day treatment centres dedicated to device implantation. These could allow provision of care much closer to the patient. This model has been successfully adopted in the USA and is being considered in some European countries [16, 17]. Support resources can then be centralised in a centre, including specialist-nurse led Patient Support Groups (see chapter 30,31),.although follow up services are likely to be increasingly independent of traditional centres (see below).

DEVICE FOLLOW UP

Short to Medium Term – 1- 6 years

Over the coming years, the current labour-intensive, centralised model of follow-up clinics may change. Remote data management systems are evolving (18,19). Systems for device management have been introduced to the American market and will follow in Europe. In the UK data from implanted devices will be continuously/regularly harvested by home-based systems and held remotely on servers. The Electronic Patient Record will link with device data. Device follow-up will be managed remotely by centre-based device technicians. Implanting centres will develop models for communication between technicians and clinicians. Troubleshooting can follow protocol driven mechanisms with involvement of clinical specialists in troubleshooting and other patient management (e.g. heart failure treatments, arrhythmia ablation). It is important that the DoH addresses the issues relating to patient confidentiality and management of electronically stored data so that patients can benefit from the technology now becoming available.

Medium to Long Term – 4 - 10 years

When remote data management communication systems are established and accepted, it would seem optimal to expect industry to take on the role of device technical monitoring, reporting clinical issues to patients and the clinicians responsible for the patient's clinical care. All device data will be held and managed by industry developed, owned and managed systems and it is a natural step to then expect those systems to be able to provide a comprehensive remote follow up service. This would free patients from centre control and dependence and free resources within the centres to be directed towards clinical care (figure 6).

CRT Device Follow Up

CRT will probably need a different model of care, because patients with CRT devices need heart failure care. There needs to be discussion with heart failure services for planning care.

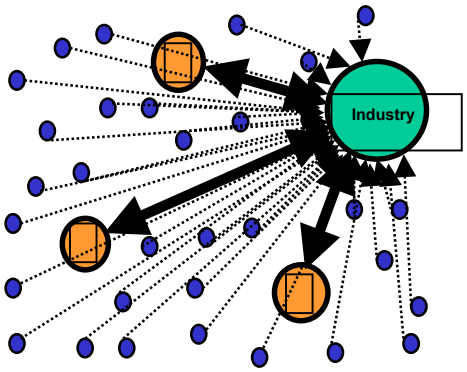

Figure 5: Individual patient follow up by industry. Central servers owned by industry take data from patients and manage and monitor that data. They then report to clinical care centres / reporting to primary/secondary care clinicians

Clinical follow up – Managing other cardiology

There will need to be continued supervision of more general care at primary care level. There will be referral for more complex clinical issues to secondary and tertiary care.

ADDITIONAL SPECIALIST DEVICE SERVICES
Device Extraction

System infection or technical failure may require systems to be removed. This can be dangerous. Extraction is usually done under general anaesthesia and sometimes needs special tools that can be costly. This may best be done in centres with experienced personnel and with the full range of equipment. Tertiary centres should be charged with providing extraction services for a population area given the significant requirement for urgent life saving cardiac surgical intervention.

CATHETER ABLATION

Ablations in Europe in 2004

In 2002 there were 59000 RF ablation procedures in Europe, and 61500 in 2003 [20].

Current UK Care Provision

In 2004, there are 28 centres performing catheter ablation procedures with a total of 62 operators [13]. Most electrophysiological laboratories are not dedicated facilities and are also used for other procedures (device implantation, PCI, diagnostic angiography. There are 38 complex mapping systems in use in addition to standard systems for recording intracardiac electrograms (industry information).

Levels of ablation activity and need are based on an understanding of prevalence of arrhythmias in community studies and ablation activity in the US and European countries. Annual ablation rates, (including AFL, AF, VT and ablation for congenital heart disease) could be expected to be between 250 and 300 per million of the population. This is based on the current understanding of the incidence and prevalence of arrhythmia amenable to catheter ablation [21,22].

Current Models of Care

In the UK, ablation services initially developed in tertiary referral centres. Training and complexity dictates that ablation procedures are undertaken by cardiologists devoting all or a major part of their time to arrhythmias. Some expansion into DGHs has occurred as discussed below. Planning is required for basing services on tertiary centres, DGHs or both.

In the South West of England a series of smaller units has performed lower volumes of catheter ablations because of enthusiasm amongst cardiologists for arrhythmia management services. 141 ablation procedures were performed in 2001 for the 1.6 million population of the Peninsula. This group shares clinical information and procedural experience. Audit data shows a low complication rate and good success rates. Long distances and poor transport facilities support this model of care in that region. There should be debate about whether it is a sensible development for other parts of the UK. This level of activity compares with Wessex ~ 250 ablations for 2.2 million, Oxford ~ 150 ablations for 2.4 million and Brighton ~ 100 per 1 million population.

In areas of greater conurbation, other service models might work better, for example establishing a single centre for large cities, and inviting all cardiac electrophysiologists to bring their patients there and pool experience and resources. Each operating facility at any one time requires a minimum of 2 nursing staff, one technician, one senior cardiologist and ideally one training fellow

FUTURE MODELS OF CARE

Routine Ablation

For many parts of the UK with large conurbations and university cities, it makes sense to centralise resources to some extent in order to achieve economies of scale, high volumes and good results. Specialists have their principal clinical base in the specialist centre from which they provide their core services but also have responsibility for outreach work at a series of feeder hospitals. This model would allow the development of electrophysiological teams with specialists having clinical responsibility at the centre whilst also providing specialist input into the district services. The increasing independence of device therapies and interventional electrophysiology allows peripheral centres to provide high quality care without regular recourse to specialist electrophysiologists and so facilitates this model. The majority of patients needing to travel to the specialist centre for intervention would need to do so for only single items of care (not long term follow up). Given that in most areas of the UK specialist centres are within 90 minutes of feeder hospitals this would seem sensible allowing technology

investment for complex ablation and supportive services (e.g. cross sectional cardiac imaging) to be focussed and care optimised.

The alternative is to expand interventional electrophysiology into all district hospitals. This clearly brings care geographically closer to patients but will dilute specialisation which may have disadvantage for therapy efficacy. Each district would need a minimum of 2 specialists to make any effective use of infrastructure. The introduction of the new consultant contract and working practices will also result in under use of expensive infrastructure with this model.

"Complex" Ablations

It seems inappropriate to consider development of centres specific to particular arrhythmias (e.g. a VT ablation centre). The volume of these patients is not large but nevertheless is sufficient for any regional centre to have adequate experience. Particular centre experience in specific conditions (e.g. an interest in right ventricular cardiomyopathy) may justify case centring. Occasional requests for cross boundary referrals for certain expertise and therapy mechanisms need to be developed to allow this to occur without impediment from purchasers.

Atrial Fibrillation

This deserves particular consideration because of the volume of cases that AF ablation could generate and the infrastructure needed to support that.

The innovations in ablation of atrial fibrillation in recent years have resulted in an increased population of patients likely to undergo therapeutic procedures for this arrhythmia [23, 24]. The clinical efficacy of atrial fibrillation ablation in specific patient groups is well established and with technological development, evidence base development and patient awareness it is likely that there will be significant numbers of patients undergoing complex ablation procedures for atria fibrillation management.

It is difficult to judge the impact of atrial fibrillation services on the ablation requirement for the UK. It is likely that within the next 5 years this condition and its therapy will demand increased and significant resources. Atrial fibrillation management in primary care is to be the subject of NICE review but there may also be consideration of curative ablation techniques. The UK electrophysiological community is focussed on developing the UK service with a programme adopting commonality of approach and standards. Initially tertiary centres are best equipped to commence the service. A profession-sponsored working group should be developed to monitor the field and develop the best model for UK patient care, with expansion of the therapy.

In addition to specialised atrial fibrillation ablation techniques, the broad spectrum of this condition could be managed in the context of atrial fibrillation clinics. These could be a blend of primary and secondary care pathways with responsibility for anti-thromboembolic strategies, rhythm management and links with tertiary centres providing ablation therapies.

Arrhythmias in Congenital Heart Disease

This is a particularly complex patient group the numbers of which are small compared to the total, but which nevertheless are increasing. This is due to the improvements that have occurred in corrective/palliative surgery and post surgical intensive care management. This patient group requires a lot of time and effort (e.g. ablation of these complex arrhythmias is associated with prolonged procedure times). Ablation requires a detailed understanding of the anatomy and haemodynamics [25]

.

Given that the total patient numbers are small and the complexity of the patient group (requiring involvement of multidisciplinary care teams), there should be an attempt to concentrate clinical experience in a limited number of centres (probably no more than 3

centres for the UK although this will need to be reviewed in the light of developing clinical demands). Any centre providing this service should have expertise in paediatric and adult congenital heart disease, appropriate surgical expertise (a significant number of patients will require specific arrhythmia rather than or in addition to haemodynamic surgery) and cross sectional imaging of congenital heart disease, (see chapters 21, 24).

Paediatric Age Group Ablations

Ablation of arrhythmias in children poses significant challenges. Procedures should be performed by individuals with previous training in paediatric catheterisation techniques and performance of ablation in this age group in conjunction with paediatric cardiologists, (see chapter 27).

Cardiac Surgical Ablation

There has been recent enthusiasm for AF surgery as an adjunct to mitral valve repair, surgical revascularisation and other routine cardiac surgical procedures [26]. There has been little demand for stand-alone AF surgery. VT surgery, formerly an area of debate as to its appropriateness for centre designation, has largely been superseded by ICD therapy. Rarely performed but highly effective procedures such as right ventricular removal and re-implantation for right ventricular dysplasia, should be performed by a handful of chosen trained surgeons in designated centres.

Training and Continuing Competency For Service Provision

Cardiac Electrophysiologists

1. Electrophysiologists spending all or a major part of their time managing arrhythmias and receiving arrhythmia referrals from other cardiologists, should spend at least 2 years in dedicated advanced EP training in electrophysiology, catheter ablation and device therapy.
2. This training will be over and above that received as part of a 6-year cardiology SpR scheme
3. This plan fits in with the ESC initiative to provide advanced training in arrhythmias and interventional cardiology over and above core training.
4. Cardiac electrophysiologists are likely to drop other duties, such a PCI.

Several electrophysiology training fellowships exist for subspecialty training for individuals who are close to completing Calman training. We will further need:

- More training schemes that provide at least 2 years experience over and above basic cardiology training.
- Funding from the NHS.
- A system of appraisal and overview for trainees, trainers and training institutions.
- Dropping of general medical commitments early in training?

Allied Healthcare professionals

Electrophysiology nurse practitioners are needed to support arrhythmia services, (see chapters 33, 30).

The role of nurse practitioners in linking with Patient Support Groups is vital in ICD management.

Technical staff involved in arrhythmia care need much greater recognition for their skills in the “Agenda for Change”. In particular there is a need for a formalised training programme that equips technicians in junior grades with new skills and the ability to take on additional responsibilities. This role could be formalised by planned degree level courses (for example a MSc course in device-based therapy, partly sponsored by the NHS Modernisation Agency, is planned at Southampton University).

Catheter/operating room staffing should be further considered. Cross-training of staff supporting PCI procedures staffing is being evaluated. Cross-training should be extended to interventional electrophysiology. Combined nurse/technician roles should be developed and this could be extended into environments outside of the catheter laboratory. Such roles are common in Western Europe and the USA.

Primary Care Interfaces

General Practitioners with a Special Interest, (GPSIs), should be trained and recruited to support arrhythmia care and boost a very small workforce, (see chapters 33, 34).
Primary care services for non-invasive investigation should be developed with support from centre specialists.

Database and Audit

National standards of databasing and audit must be developed to monitor outcomes, (see chapter 35).

LAY SUMMARY

Treatments for abnormal heart rhythms have evolved rapidly over the past 2 decades. Abnormal heart rhythms vary from minimally irritating and entirely safe variations of normal heart rhythm, to very disabling and frequent palpitation and sometimes sudden and unexpected death. There are a series of very effective treatments for the cure or help of people who suffer with these problems and also treatments available to protect individuals who are at risk of sudden death from abnormality of heart rhythm.

It is largely unappreciated that sudden cardiac death is the major cause of cardiac death in the developed world and as such is a huge burden to society. It has a major impact on the families of those who die as the victims are often in the prime of life and could continue to lead active and economically fruitful lives if they had been saved. We have treatments that can prevent the tragedy of sudden death.

Despite these facts, these conditions and their treatment have received much less attention than the diseases and treatments related to coronary artery narrowing (ischaemic heart disease). The consequence is that these they are poorly resourced and inadequately treated in the UK. The care shortfall is readily apparent if one compares the level of cardiac rhythm management treatment provided in other European and Western countries with those provided in the UK. This chapter sets out the current patterns of care and service provided in the UK and suggests how they might evolve to provide better treatment for patients.

Dr John Morgan, Southampton General Hospital

REFERENCES:

1. Moss AJ. MADIT-I and MADIT-II.J Cardiovasc Electrophysiol. 2003 Sep;14(9 Suppl):S96-8.
2. Bristow MR, Saxon LA, Boehmer J, Krueger S, Kass DA., De Marco T, Carson P, DiCarlo L, DeMets D, White BG, DeVries DW,. Feldman AM, for the Comparison of Medical Therapy, Pacing, and Defibrillation in Heart Failure (COMPANION) Investigators. Cardiac-Resynchronization Therapy with or without an Implantable Defibrillator in advanced chronic heart failure. N Engl J Med 2004; 350:2140-2150.
3. Morgan JM.The MADIT II and COMPANION studies: will they affect uptake of device treatment? Heart. 2004 Mar;90(3):243-5.
4. Morady F. Catheter ablation of supraventricular arrhythmias: state of the art. J Cardiovasc Electrophysiol. 2004 Jan;15(1):124-39.
5. Della Bella P, Riva S, Fassini G, Giraldi F, Berti M, Klersy C, Trevisi N. Incidence and significance of pleomorphism in patients with post-myocardial infarction ventricular tachycardia; Acute and long-term outcome of radiofrequency catheter ablation. Eur Heart J. 2004 Jul;25(13):1127-38.
6. Walsh EP. Arrhythmias in patients with congenital heart disease. Card Electrophysiol Rev. 2002 Dec;6(4):422-30.
7. Hogenhuis W, Stevens SK, Wang P, Wong JB, Manolis AS, Estes NA 3rd, Pauker SG. Cost-effectiveness of radiofrequency ablation compared with other strategies in Wolff-Parkinson-White syndrome. Circulation. 1993 Nov;88(5 Pt 2):II437-46.
8. Cheng CH, Sanders GD, Hlatky MA, Heidenreich P, McDonald KM, Lee BK, Larson MS, Owens DK. Cost-effectiveness of radiofrequency ablation for supraventricular tachycardia.Ann Intern Med. 2000 Dec 5;133(11):864-76. Erratum in: Ann Intern Med 2001 Nov 20;135(10):933.
9. Rocha-Singh KJ, McShane KJ, Ligon R, Sung CH. One-year clinical outcomes and relative costs of primary infarct artery stenting versus angioplasty following systemic thrombolysis for acute myocardial infarction. Catheter Cardiovasc Interv. 2000 Feb;49(2):135-41.
10. 10 Cundiff DK. Coronary artery bypass grafting (CABG): reassessing efficacy, safety, and cost. MedGenMed. 2002 Jun 19;4(2):7.
11. 11 Morgan JM; American Heart Association; North American Society of Pacing and Electrophysiology (NASPE). New device indications: practice and cost implications in Europe. Card Electrophysiol Rev. 2003 Jan;7(1):49-53.
12. 12 Compiled by JMM; data source national societies.
13. 13 Cunningham AD. BPEG Database. Pers comm.
14. 14 Charles R. Pers comm.
15. 15 Zareba W, Moss AJ. Noninvasive risk stratification in postinfarction patients with severe left ventricular dysfunction and methodology of the MADIT II noninvasive electrocardiology substudy.J Electrocardiol. 2003;36 Suppl:101-8.
16. 16 Bogun F, Morady F. Outpatient radiofrequency catheter ablation. Herz. 1998 Feb;23(1):42-6.
17. 17 Heuser RR. Outpatient coronary angiography: indications, safety, and complication rates. Herz. 1998 Feb;23(1):21-6.
18. 18 Schoenfeld MH, Compton SJ, Mead RH, Weiss DN, Sherfesee L, Englund J, Mongeon LR. Remote monitoring of implantable cardioverter defibrillators: a prospective analysis.Pacing Clin Electrophysiol. 2004 Jun;27(6 Pt 1):757-63.
19. 19 Sjogren LH, Tornqvist H, Schwieler A, Karlsson L. The potential of telemedicine: barriers, incentives and possibilities in the implementation phase.J Telemed Telecare. 2001;7 Suppl 1:12-3
20. 20 Stokoe G. For the ESC CRT Taskforce, pers comm.
21. 21 Orejarena LA, Vidaillet H Jr, DeStefano F, Nordstrom DL, Vierkant RA, Smith PN, Hayes JJ. Paroxysmal supraventricular tachycardia in the general population.J Am Coll Cardiol. 1998 Jan;31(1):150-7.
22. 22 Crystal E, Connolly SJ. Atrial fibrillation: guiding lessons from epidemiology.Cardiol Clin. 2004 Feb;22(1):1-8.

23. 23 Feld GK. Catheter ablation of atrial fibrillation: what is the best technique for achieving a high cure rate with acceptable risk?J Am Coll Cardiol. 2004 Jun 2;43(11):2054-6.
24. 24 Oral H, Morady F. Ablation of atrial fibrillation.J Cardiovasc Electrophysiol. 2004 Jan;15(1):112-3.
25. 25 Betts TR, Roberts PR, Allen SA, Salmon AP, Keeton BR, Haw MP, Morgan JM. Electrophysiological mapping and ablation of intra-atrial reentry tachycardia after Fontan surgery with the use of a noncontact mapping system.Circulation. 2000 Jul 25;102(4):419-25.
26. 26 Melo JQ, Santiago T, Gouveia RH, Martins AP. Atrial ablation for the surgical treatment of atrial fibrillation: principles and limitations.J Card Surg. 2004 May-Jun;19(3):207-10.