Excellence in EP: A Career in Cardiac Electrophysiology (EP) and Device Therapy is for all High Quality Trainees, including Women

Forward from Dr Edward Rowland, Consultant Cardiologist and Electrophysiologist, Past President of Heart Rhythm UK, (2011 - 2012)

Supported by Dr Stephen Furniss, Consultant Cardiologist, President of Heart Rhythm UK (2011 - 2014)

It is a great pleasure to introduce and encourage this initiative. Cardiac electrophysiology has been a growth area in cardiology for at least a decade and shows no sign of diminishing that upward trend. The epidemic of atrial fibrillation and the value of device therapy in the treatment of heart failure are just two obvious areas that represent clinical priorities. These will drive health service priorities, attract research grants and encourage medical industry investment. As a profession, we have a responsibility to showcase the value of our work and to attract the best clinical staff. We need to demonstrate to those entering their medical careers what a rewarding and stimulating specialty we work in. Who amongst us cannot fail to be thrilled by making the diagnosis of heart block as a cause of syncope, curing a teenager of Wolff-Parkinson-White syndrome or seeing the evidence on interrogating an ICD that it has recognised and reverted VT within a few seconds. These are a few obvious examples – whether it is diagnosis, interventional treatments or research, there are exciting and valuable contributions to be made.

Amongst the initiatives to attract the very best doctors and physiologists into cardiac electrophysiology, we must recognise how valuable it would be to our specialty to increase the number of women working as EP specialists. The work of the group leading this initiative has described the issues, and outlined some of the ways in which this can be achieved.

Our vision is to demonstrate the multitude of opportunities and to work with leaders to develop career structures which are attractive. Not all posts in arrhythmology involve endless hours in the cath lab. Indeed one of the challenges for us is to define how we recognise and prevent rhythm problems at earlier stages than at present.
This initiative is designed to show that a career in cardiac EP provides challenges and rewards that can be the equal of any in medicine. A greater representation of women in electrophysiology would enhance and improve our specialty enormously.

Introduction

Cardiac electrophysiology (EP) and device therapy is an exciting field with rapidly evolving technologies and therapies for patients of all ages with a variety of pathologies, presenting acutely or chronically. It is intellectually stimulating and challenging, with many opportunities for research. Training opportunities exist in cardiac electrophysiology and device therapy as well as device therapy with heart failure.

HRUK appreciate that a proportion of our highest quality trainees, particularly women, feel daunted at the prospect of entering this subspecialty, and there may be several reasons for this. HRUK aspire to achieve a cardiac EP/device therapy trainee cohort which would ideally include 25% women by 2012, 30% by 2015 and 40% by 2020.

There are solutions to many of the issues which deter women from entering a career in EP/device therapy. Whereas some of these issues are particular to women, many are not gender specific.

Why is a career in EP/device therapy for me?

- Exciting and expanding field
- Hands On
- Many opportunities for research
- Interaction with other subspecialties
- Rewarding
- Job satisfaction
- Treatment of patients of all ages with varying arrhythmia substrates
- Curative aspect of many procedures
- Out of hours workload low

‘EP is not for a woman’: common misconceptions

- ‘Pregnancy will reduce my training time as I could not be exposed to radiation’
- ‘Part time posts are not accepted by male counterparts as these suggest lack of commitment’
- ‘A fellowship is required to ensure adequate training due to increasing number of trainees and few centres which offer EP and/ or device therapy training, particularly out of London’
• ‘Lack of exposure to EP during core cardiology training makes it difficult to commit to the subspecialty; it seems very different to other aspects of cardiology and therefore, I do not feel that I would be any good at it’
What happens to my training if I become pregnant?

The risks posed to the foetus by radiation during an EP/ device case are low and minimal after twelve weeks. Certainly, exposure is less than interventional cases as the latter require better quality imaging and thus, a higher radiation dose.

There is no robust data outlining what doctors specialising specifically in EP/ device therapy must do during pregnancy. Whether a doctor would like to continue working as first operator is ultimately the individual’s choice, and many will continue to do so. Under Ionising Radiation Regulations (1999), UK employers must ensure that once they have been notified of the pregnancy, the maximum permitted dose to the foetus does not exceed 1 millisievert (mSv) for the remainder of the gestational period. This is achieved by keeping the dose at the surface of the abdomen at less than 2mSv. This is a relatively cautious approach as in the USA, the maximum permitted dose to the foetus is 5mSv. In any case, it is highly unlikely that such doses would be reached and in fact, the average background radiation dose is often more than that achieved during an EP/ device case.

Close monitoring during pregnancy is advised by wearing a film badge at the level of the abdomen and informing medical physics of pregnancy so that they may perform more regular film badge readings.

It is stressed that if one opts not to work as first operator, training is not impaired in any way. There are several skills which a trainee must obtain, regardless of gender, in order to become a proficient electrophysiologist/ device specialist. Many of these do not require exposure to radiation, and are often undervalued.

Professor Richard Schilling, Cardiac Electrophysiologist, St Bartholomew’s Hospital and founder of the HRUK Excellence in EP group writes:

“One of the most useful and important periods of my career was as a clinical research fellow. During research cases, I performed very few clinical procedures but spent much of my time working with cardiac physiologists to put together the EP kit in preparation for the case, collecting and analysing data at the back of the lab and eventually helping to guide the consultant to the diagnosis and successful location. Prior to this, I had spent many hours in the ICD and pacing clinic at Hull learning how the devices worked and how to optimise programming. These were undoubtedly the periods of training when I learned the most and I am sure that this did not detract from my ability to perform practical procedures later in my career.
a) **Role in the Cardiac Catheter Laboratory**
An EP case involves more than manipulating catheters. The use of a system that displays and allows the analysis of electrograms and 3D mapping systems are integral to the case. The operator of these systems does not scrub, is exposed to a minimal dose of radiation, not harmful to the foetus, or is not exposed to radiation at all as the systems are often placed in a viewing area, separate to the catheter laboratory. It can be argued that competency at using these systems should be achieved prior to acquiring skills in catheter manipulation.

i) ‘Setting up’ the patient
This involves setting up the ECG, electrophysiology recording system, 3D mapping and/ or remote catheter navigation system, along with catheters being used so that they may be ‘read’ by the relevant systems. This allows an understanding of how such systems work and therefore enables troubleshooting when things inevitably go wrong.

ii) **Use of the electrophysiology recording system**
Electrophysiology recording systems provide software for data acquisition and analysis of intracardiac electrograms. The interpretation of electrograms is key to the understanding of arrhythmia generation and to achieving successful ablation. The operator at the electrophysiology recording system has a central role in guiding the procedure to a successful conclusion.

![Electrophysiology Recording System](image)

**Electrophysiology Recording System:** Electrograms are visualised on the monitors shown. A ‘live’ screen records real time electrograms and the monitor adjacent to this allows one to view electrograms and make measurements at any point during the case, as well as offline. In this picture, a monitor displaying a 3D mapping system is also shown.

iii) **Competence at use of 3D Mapping Systems**
3D mapping systems (Carto XP, Carto 3 and NavX) allow the construction of 3D geometry of any chamber within the heart. These are acquired through a catheter in the relevant chamber. Through such systems, various maps can be generated, for example, activation maps which can show the point of arrhythmia generation for focal tachycardias and hence, help guide the operator to the point of successful ablation.
**AVI Atrial Tachycardia** – available to view on website only under Careers Information tab. *This file illustrates a Carto image of an atrial tachycardia arising from the posterior wall of the left atrium; red denotes the point of earliest activation and blue, the latest*

3D mapping systems have decreased fluoroscopy times as these allow the visualisation of catheters which can be guided by the operator through the chamber of the heart.

The operator is also able to mark ablation points and points of interest. Competent use of these systems allows better 3D spatial awareness.

*iv) Remote Catheter Navigation Systems: Hansen robotics and Stereotaxis*

These systems are kept in the viewing area, therefore, there is no exposure to radiation. The operator can also remain seated during the procedure, decreasing fatigue.

The Hansen robotic system was developed to allow accurate positioning, manipulation, and stable control of the catheter and catheter-based technologies during electrophysiology procedures through a robotic arm operated by a ‘joystick’.

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*Dr Aaisha Opel, Specialist Registrar in Cardiology (EP and Devices, London) and Lead Ambassador for the HRUK Excellence in EP group, using the Hansen Robotic System; the catheter is operated by the joystick under the central monitor where it is visualised. The monitor to the left displays intracardiac electrograms and to the right, a 3D mapping system is displayed.*
Stereotaxis utilises magnetic technology and remote computer control to navigate catheters through the heart.

Dr Sabine Ernst, Consultant Cardiologist and Electrophysiologist, The Royal Brompton Hospital, London, using Stereotaxis; the catheter is manipulated by the joystick to the right of the keyboard. This can be visualised on the monitor, together with a 3D map.

**v) Device implantation during pregnancy**

Devices implanted include permanent pacemakers, internal cardioverter defibrillators (ICDs) and cardiac resynchronisation therapy (CRT) with or without an ICD, Reveal devices as well as generator (box) replacements. A patient having a device implant should be set up by the trainee. Creating a pocket, obtaining vascular access, securing the leads, closing the wound, device programming and box changes are all essential elements that can be performed in the absence of X-rays. Reveal device implantation requires no X-rays.

Controlling the device programmer is also an important part of training, and imperative to the implant procedure. This includes making measurements during the implant procedure to ensure that the lead is working correctly and adequately placed, and checking the device post implant. Cardiac device interrogation, programming and troubleshooting are essential skills for the device specialist of tomorrow. HRUK and IBHRE accreditation requires that trainees are familiar with device follow-up.
Defibrillation threshold testing (DFT) is performed via the programmer; for an ICD, a DFT is performed at the end of the implant and involves inducing ventricular fibrillation (VF) to ensure that the ICD will respond appropriately and effectively.

Dr Alison Seed, Consultant Cardiologist, Heart Failure and Device Therapy, Blackpool Victoria Hospital; 8 months pregnant and scrubbing for a device implant.
b) Attendance at ICD, CRT and pacing clinics
Many trainees do not have time set aside to attend these clinics. It is imperative to be able to program a device and troubleshoot. This is extremely rewarding, and regular attendance helps one to understand the various functions particular to a device.

c) Research
Cardiac EP and device therapy is an expanding field. There is great need for research in order to further our understanding. Both clinical and basic science research opportunities are available in many centres in the UK. No time is wasted if research is performed during pregnancy.

Proposed timetables for those training in EP and devices are given overleaf. For those training in both EP and devices, timetables may be combined.
**Proposed Timetable during Pregnancy: EP**

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Proposed Timetable during Pregnancy: Devices

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What if I would like to work part time?

Many feel that to train and work part time displays lack of commitment and as a result, male counterparts are given more opportunities. This attitude is not supported by HRUK.

Part time trainees tend to be in a single centre for longer and are likely to invest more per hour worked than a rotating full time trainee. Such trainees tend to be more senior and therefore, often require less supervision.

*Proposed Timetable for Part Time Trainees*

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- On call: 1 in 8 (or as negotiated)
- Ward cover: 1 in 7 (week shared with another part time trainee if available)
• Weekly clinical and monthly research meeting
• Lab sessions include training in AF/ Atrial tachycardia/ SVT/ all devices and emergency cases eg VT
• Sessions can be moved if half days preferable

**Proposed Timetable for Part Time Consultant**

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- **On call:** negotiated with trust
- Ward rounds may alternatively be performed at beginning of day when ‘consultant on call’
- Attendance at weekly clinical and monthly research meetings
- Sessions could be moved if working half days preferable
- Where half day lab sessions are worked, remainder of day covered by other part time consultant or full time consultant where other half of day spent doing administration or clinic
Do I have to do a fellowship to complete training; I am reluctant to have to move away from or with my family?

A fellowship should be undertaken only for the sake of interest and to allow exposure to a procedure not performed at or to a group of patients not referred to the training centre. The UK does have some of the world’s leading EP centres. Trainees often view fellowships as a means of ‘making up numbers’ which is incorrect. Neither Professor Schilling nor Dr Rajappan (co-lead of the HRUK Women in EP group) did fellowships.

Lack of exposure to EP in early training makes it difficult to commit to this as a subspecialty

It is true to say that during core cardiology training, many hospitals are able to provide good exposure to echocardiography and coronary angiography with intervention but few trainees have basic EP training. Many therefore, feel more comfortable committing to a career in imaging or intervention than EP. A few deaneries offer rotations to 3rd year trainees which include 3-4 months of EP with device therapy. However, it is important to remember that a significant and highly rewarding part of EP is pacing and devices. These technologies and procedures are widely available and it is common that trainees have access to pacing clinics and implant procedures.

How do I decrease my exposure to radiation?

The remote catheter navigation systems mentioned above are a means to achieve this. Where these systems are not available, alternating between catheter manipulation and running the electrophysiology recording systems and 3D mapping systems can also decrease exposure to radiation whilst maintaining high quality training. It is stressed that both activities provide invaluable training opportunities.

Radiation protection cabins are now available; the operator stands behind a lead shield and places her or his hands through an aperture (see picture on following page). These cabins allow negligible exposure to radiation whilst providing protection to the face, as well as the remainder of the body.
Dr Vivienne Ezzat, Specialist Registrar in Cardiology (EP and Devices, London), using a Radiation Protection Cabin; the operator is protected from radiation whilst being able to manipulate catheters alongside the patient.

**How do I alleviate fatigue from wearing lead and standing for long periods of time?**

Lightweight lead prevents fatigue and strain on the back. Also, alternating between catheter manipulation and running the Electrophysiology recording and/ or 3D mapping systems, or the use of remote catheter navigation systems can help.
EP always involves working long hours

Cardiologists often work long hours, regardless of subspecialty. It is fair to say that success within any career can sometimes mean working more than 9am to 5pm. Within EP/ device therapy, procedure times are decreasing with increased experience, understanding of arrhythmia and with the advent of new technologies.

Certain procedures may be shorter than others, for example, a typical atrial flutter ablation is a shorter procedure than a redo permanent atrial fibrillation ablation. With increased patient load and further specialisation, there is a role for electrophysiologists who only perform atrial flutter and SVT ablation where the working day may be shorter and more predictable. This may make a career in EP a more attractive career option for some.

EP is a ‘man’s game’ and men have more training opportunities than women

HRUK endorse training for all and are addressing the current gender imbalance by encouraging all high quality trainees to consider a career in this exciting subspecialty. Therefore, HRUK are strong advocates for equal opportunities in training in EP and device therapy.

EP is definitely not a ‘man’s game’. We treat a wide ranging group of conditions and have to develop a spectrum of skills from the ability to counsel patients empathically when they, or a loved one is at risk of sudden death, to correctly diagnosing and treating an abnormal reentry circuit passing through 3-dimensional space from the limited information provided by a percutaneous catheter. It is a game for innovative, caring thinkers.

Opportunities for Leadership

Given the dearth of women in EP/ device therapy and the lack of female role models, there is a wealth of leadership opportunities for women who are currently training or who will be in the future.

Experiences of the Experts

‘The treatment of arrhythmia patients is a challenging and fulfilling career, and is rapidly expanding. It deals with all age groups, with both acute and chronic problems. It is truly curative for many, and potentially life-saving for some. The traditional perception of this being a rather esoteric and difficult specialty needs to be dispelled - atrial fibrillation is a pandemic and will need a lot of specialists to cope with the demand that is coming, and the ever expanding role of device therapy means that we need more people who can implant them. But the invasive component is not the only challenge - expertise in management of patients with channelopathies and basic science investigation are critical to the translation of science to clinical practice and this needs a methodical and academic approach. As a parent, the specialty allows me to have something of a decent work-life balance that might not be possible with other interventional/surgical specialties, and in my
opinion any high quality trainee, male or female, is capable of becoming an accomplished practitioner, whether they train full time or part time. I cannot recommend it strongly enough and the only way to find out is to give it a try - you will not regret it!

*Dr Kim Rajappan, Consultant Cardiologist and Electrophysiologist, John Radcliffe Hospital, Oxford, Co-lead of the HRUK Excellence in EP group*

‘I strongly believe that women are particularly well "equipped" to do invasive electrophysiology. EP needs a systematic and thorough approach and is never the same! Multitasking is a daily exercise and it's in my opinion the most exciting subspecialty in invasive cardiology. The potential radiation exposure should not prevent any female colleague to consider specialised training in EP’.

*Dr. Sabine Ernst, Consultant Cardiologist and Electrophysiologist, Research Lead Electrophysiology, Royal Brompton Hospital, London*

‘I thoroughly enjoy cardiac electrophysiology and as a woman, have no regrets in choosing this exciting field as my area of expertise. I enjoy the detective nature of the subspecialty, whether this is diagnosing an arrhythmia during an EP study to localising the point of arrhythmia generation or deciphering why a patient is receiving inappropriate shocks. I especially enjoy invasive work, and that I encounter patients of all ages with a variety of arrhythmia substrates, both acquired and inherited who require ablation and/or device therapy, with or without medical management.

It is extremely rewarding to cure a patient of their symptoms or to potentially prolong life by protecting a patient from life threatening arrhythmias. My working week is varied; EP studies and ablation one day, device implants the next, troubleshooting in ICD and pacing clinic, meeting new patients in clinic and accepting that complicated VT patient requiring ablation! There are a breadth of basic science and clinical research opportunities, which ensures that EP remains an ever-evolving field.

Women are excellent multitaskers, are logical thinkers and their dedication to a career in cardiology is reflected in the quality of their work. There are plenty of opportunities for women with families and during pregnancy when in fact, high quality training continues. This ensures success with the potential to become a leader in EP’.

*Dr. Aaisha Opel, Specialist Registrar in Cardiology (EP and devices) and British Heart Foundation Research Fellow, London Deanery (NE Thames), Lead Ambassador for the HRUK Excellence in EP group*
‘I found it difficult to get a clear answer from the radiographers and occupational health departments about how one should approach the issue of radiation exposure in the cath lab whilst pregnant. I spoke to female colleagues in radiology and did some of my own research to inform my decisions. I carried out all my normal duties whilst pregnant: I always wore a 2 piece lead apron (extra abdominal protection), I was particularly careful with my use of X-rays, I wore my monitoring tags religiously and informed the radiation control bodies that I was pregnant and would need closer monitoring. Some people choose to avoid the cath lab completely or as much as possible during various stages of pregnancy (first 12 weeks or when heavily pregnant). I only started to avoid the lab when I was over 34 weeks pregnant as I found that I couldn’t easily reach the patient across the bed and I was uncomfortable. Prior to that, I made great use of the stool which helped protect my back during long cases. EP/Devices is one of the better invasive specialities for a pregnant woman as there is always the device programmer or the EP system to master and interpret which means that choosing not to scrub in does not mean there is no training opportunity’.

Dr Honey Thomas, Specialist Registrar in Cardiology (Devices), Northern Deanery, Ambassador for the HRUK Excellence in EP group

‘It is possible to continue as an EP/device therapy trainee while pregnant. I am currently in this situation and I don’t find my pregnancy a barrier to my training. Naturally, in the mind of any expectant mother are the potential hazards posed to her unborn child, and in cardiology it is the risks posed by ionizing radiation. Although there are no published guidelines, the general consensus is that radiation exposure should be avoided as far as possible in the first trimester, and during this period of my current pregnancy I spent more time in clinics, and in the EP lab, I stayed as second operator or behind the screens learning about the set up and running of the recording equipment and mapping systems. These skills are core for anyone training in electrophysiology, regardless of gender or gravidity.

In my experience, being pregnant does not preclude one from training in invasive EP procedures, as it is not entirely necessary to avoid all radiation exposure during the middle and last trimesters of pregnancy as long as it is monitored carefully and as long as precautions are taken to minimise exposure. I feel I don’t want to miss out on training opportunities by doing no EP work as first operator so I wear a Thermo Electronic Personal Dosimeter (EPD2) monitor on my waistband. This is a dose monitor that measures exposure in microsieverts and is very sensitive. Health Physics in my hospital have been very helpful and supportive and provide guidelines about what is considered "safe" exposure limits to the foetus. Overall, I have been advised to limit my exposure to 8 microsieverts in an 8 hour working day, and to aim to accrue no more than 1 millisieverts for the duration of the pregnancy. Obviously wearing lead aprons and using lead screens and skirts, and minimising screening times are paramount and our radiographers accept no compromise with safety, especially when an operator is pregnant. In fact with appropriate precautions, foetal exposure is negligible. As an example, my last pathway ablation as first operator took around 2 hours and with the above precautions, using fluoroscopy I totalled zero radiation exposure on my monitor! Subsequently, I found that my 40 minute drive home resulted in 2 microsieverts of background radiation exposure when I
forgot to turn the monitor off! I find wearing the monitor very reassuring. Obviously not everyone will make this choice to continue with exposure prone procedures during pregnancy but from personal experience it can be continued as long as exposure is carefully monitored.

I expect that my expanding abdomen may become a physical barrier to training as pregnancy progresses. Regardless, it should still be possible to prepare and consent patients, set up the mapping system, insert the sheaths and position the electrode catheters. Thereafter, I anticipate I will spend more time interpreting the electrograms than manipulating the catheters as I have no doubt that it will become difficult to stand for the full duration of complex ablation procedures. Overall, I hope to continue to work as first or second operator as long as I am physically able to do so, with the help of a handy stool and some TED stockings!

Dr Ashley Nisbet, Specialist Registrar in Cardiology (EP and devices), West of Scotland Deanery, Ambassador for the HRUK Excellence in EP group

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