

Personnel, equipment, and facilities for electrophysiological and catheter ablation procedures in Europe: results of the European Heart Rhythm Association Survey

Heidi L. Estner^{1*}, Jian Chen², Tatjana Potpara³, Alessandro Proclemer⁴, Derick Todd⁵, Carina Blomström-Lundqvist⁶, and Scientific Initiative Committee, European Heart Rhythm Association

¹Department of Cardiology, I. Medizinische Klinik, Ludwig-Maximilians-Universität, Campus Großhadern, Marchioninistrasse 15, 81377 München, Germany; ²Department of Heart Disease, Haukeland University Hospital and Department of Clinical Science, University of Bergen, N-5021 Bergen, Norway; ³Cardiology Clinic, Clinical Centre of Serbia, School of Medicine, University of Belgrade, Belgrade 11000, Serbia; ⁴Department of Cardiothoracic Science, University Hospital S. Maria della Misericordia, 33100 Udine, Italy; ⁵Institute of Cardiovascular Medicine and Science, Liverpool Heart and Chest Hospital, Thomas Drive, UK; and ⁶Department of Cardiology, Institution of Medical Science, Uppsala University, 75185 Uppsala, Sweden

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Clinical electrophysiology (EP) and catheter ablation of arrhythmias are rapidly evolving in recent years. More than 50 000 catheter ablations are performed every year in Europe. Emerging indications, an increasing number of procedures, and an expected high quality require national and international standards as well as trained specialists. The purpose of this European Heart Rhythm Association (EHRA) survey was to assess the practice of requirements for EP personnel, equipment, and facilities in Europe. Responses to the questionnaire were received from 52 members of the EHRA research network. The survey involved high-, medium-, and low-volume EP centres, performing >400, 100–399, and under 100 implants per year, respectively. The following topics were explored: (i) EP personnel issues including balance between female and male operators, responsibilities within the EP department, age profiles, role and training of fellows, and EP nurses, (ii) the equipments available in the EP laboratories, (iii) source of patient referrals, and (iv) techniques used for ablation for different procedures including sedation, and peri-procedural use of anticoagulation and antibiotics. The survey reflects the current EP personnel situation characterized by a high training requirement and specialization. Arrhythmia sections are still most often part of cardiology departments and the head of cardiology is seldom a heart rhythm specialist. Currently, the vast majority of EP physicians are men, although in the subgroup of physicians younger than 40 years, the proportion of women is increasing. Uncertainty exists regarding peri-procedural anticoagulation, antibiotic prophylaxis, and the need for sedation during specific procedures.

Keywords

Catheter ablation • Personnel • Equipment • Facilities • Electrophysiology laboratory • Training • Techniques • EHRA survey • EP wire

Introduction

Today, due to considerable progress made in recent years in the diagnosis and treatment of cardiac arrhythmias, catheter ablation is the first or second choice of treatment for all types of tachyarrhythmias. The procedural complexity varies with the type of arrhythmia targeted, the presence of a structural abnormality, and the anatomical location, which underlines the necessity of adequate competence of the operators and a dedicated environment. The Accreditation Committee of the European Heart Rhythm Association^{1,2} as well

as national organizations have recently published curricula for clinical electrophysiologists to fulfil comparable qualifications.³ However, guidelines for invasive electrophysiology (EP) procedures, that are as generally accepted as the ones for atrial fibrillation (AF) ablation,⁴ are lacking.⁵ Specific national guidelines concerning the competence, performance, or required standards for the practice of cardiac EP are rare.⁶ As a consequence, the clinical routine concerning invasive EP procedures is likely to vary widely. The purpose of this European Heart Rhythm Association (EHRA) survey was therefore to assess the different local standards and requirements for EP personnel,

* Corresponding author. Tel: +49 89 4400 76036; fax +49 89 4400 78675. E-mail address: Heidi.estner@med.uni-muenchen.de

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equipment, and facilities, among members of the EHRA EP research network.

Methods and results

Participating centres

This survey is based on a questionnaire sent via the Internet to the EHRA EP research network centres. Overall, 59 institutions responded and 58 were included into analysis (1 blank submission). Forty-three (74%) of the centres were university hospitals, seven (12%) private hospitals, and eight (14%) were other type of hospitals. In the previous calendar year, 16% of the responding centres performed <100 catheter ablations, 16% between 100 and 199, 36% between 200 and 399, and 33% reported >400 catheter ablations per year. Overall, in 84% of the centres cardiac surgery was provided in-house.

Electrophysiology personnel and training

Electrophysiology is part of cardiology departments in the majority of centres, 51 of 57 (89%) and in only 6 centres (11%) have an independent department for EP specialty. Invasive EP is the main area of expertise of the head of cardiology departments in only 15 of 57 (26%) institutions (Figure 1). The majority (79%) of the heart rhythm specialists performed ablations only, but in 21% they also performed percutaneous coronary interventions (50% of them only partly).

During the ablation procedures, two physicians are most frequently present (42%), sometimes present (31%), and present only in complex cases (19%), while the minority of responders reported

that two physicians were always present or only one physician was present (10 and 19% of the centres, respectively). Consultants and physicians in training in EP department were predominantly men (Figure 1). In total, EP personnel included 173 men (86%) and 28 women (14%) consultants and 80 men (63%) and 46 women (37%) physicians in training. Whereas a male consultant was employed in every institution, 63% of the participating centres reported no female consultant. In total, 193 male and 41 female physicians performed ablations; 125 (65%) men and 18 (44%) performed ablation procedures as an independent operator. Male physicians were mainly 40–50 year-old (34%), younger than 40 years (29%), and older than 50 years (31%). In contrast, the corresponding figures for female physicians were 67, 25, and 8%. Six (8%) female EP physicians and 20 (8%) male physicians worked part-time.

In their first year of training, EP fellows learn to get vascular access (98%), run the stimulator (95%), operate the EP recording system (93%), navigate the three-dimensional (3D) mapping system (63%), and perform simple ablation procedures as stand-alone operators (57%). In their second year, they are mainly taught to perform stand-alone ablation in complex procedures (96%), ablations in children (98%), and in patients with congenital heart disease (98%). Many institutions require participation in a course (54%) before a physician is allowed to perform invasive EP and ablations, whereas an examination is only necessary in 4%. In 42% of all institutions, no specific training or course is required before performing invasive EP.

While in 23 (44%) of 52 centres EP nurses are independent of a cardiac interventional department, in 12 (23%) of them take part in night shifts at the cardiac interventional department. In 17 of 52 (33%) hospitals, EP nurses serve both EP and cardiac interventions in daily practice. Physicians are mainly responsible for the ablation generator and the stimulator, whereas the 3D mapping system is routinely run by a company representative and the EP recording system by a trained nurse (Table 1).

Equipment

All institutions have at least one EP recording system (53% have one only, 31% have two, 14% have three, and 2% have four). At least one catheter laboratory is almost exclusively (>90%) used for EP procedures in 94% (44 of 47) of all responding centres, 26% (12/47) of centres have two, and 9% (4 of 47) of all centres have even three catheter laboratories which are exclusively used for EP. Most (43 of 48, 90%) of the institutions have at least one 3D mapping system, 18 of 48 (38%) have one, 21 of 48 (44%) have two, 2 of 48 (4%) have three, and 2 of 48 (4%) have four systems. A Stereotaxis system is available in 6 of 48 (13%) institutions, in one of them even two systems. Two institutions (4%) are equipped with a Hansen system and one (2%) with the Amigo robotic system.

Patient consent for invasive EP procedures is obtained before hospital admission in >90% of cases in 14 of 52 (27%) of the centres, between 50 and 89% of cases in 17 of 52 (32%), in <50% in 4 of 52 (8%), and in <10% of cases in 9 of 52 (17%) of the centres, respectively. In 8 of 52 (15%), patient consent is not a requirement. A referring physician is the main source of patients in 23% (12 of 52), outpatient clinic is the only source in 6% (3 of 52), but in the majority of centres (37 of 52; 71%) patients are referred via both ways.

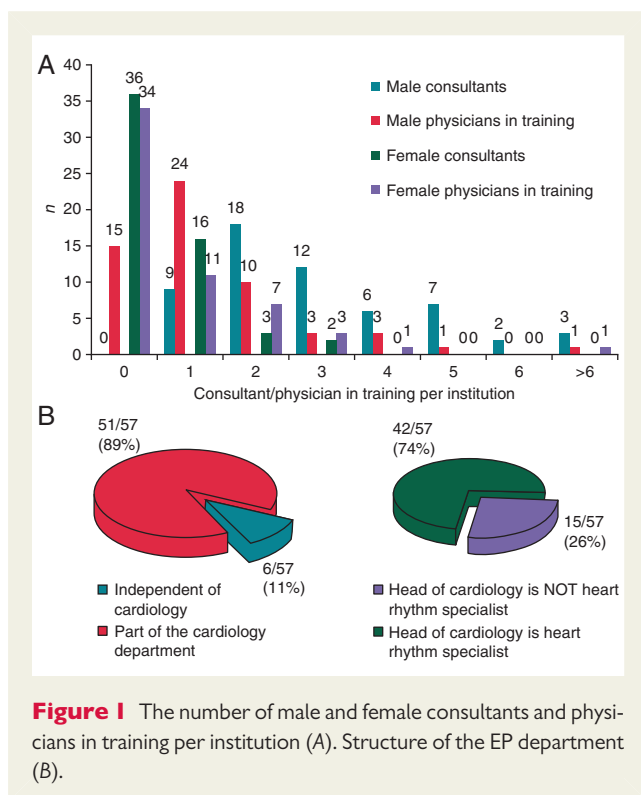


Figure 1 The number of male and female consultants and physicians in training per institution (A). Structure of the EP department (B).

Table 1 Electrophysiology personnel available during ablations (centres, %)

	Nurse	Special trained nurse	Cardiac physiologist	Technician	Company representative	Physician
EP recording system	5/80 (6%)	23/80 (29%)	14/80 (18%)	9/80 (11%)	8/80 (10%)	21/80 (26%)
Stimulator	6/72 (8%)	17/80 (24%)	14/72 (19%)	7/72 (10%)	4/72 (6%)	24/72 (33%)
3D mapping system	1/71 (1%)	14/71 (20%)	8/71 (11%)	10/71 (14%)	22/71 (31%)	16/71 (23%)
Ablation generator	12/70 (17%)	18/70 (26%)	12/70 (17%)	4/70 (6%)	4/70 (6%)	20/70 (29%)

Routinely, physicians are responsible for the ablation generator and the stimulator, whereas the 3D mapping system is mainly run by a company representative and the EP recording system by a special trained nurse.

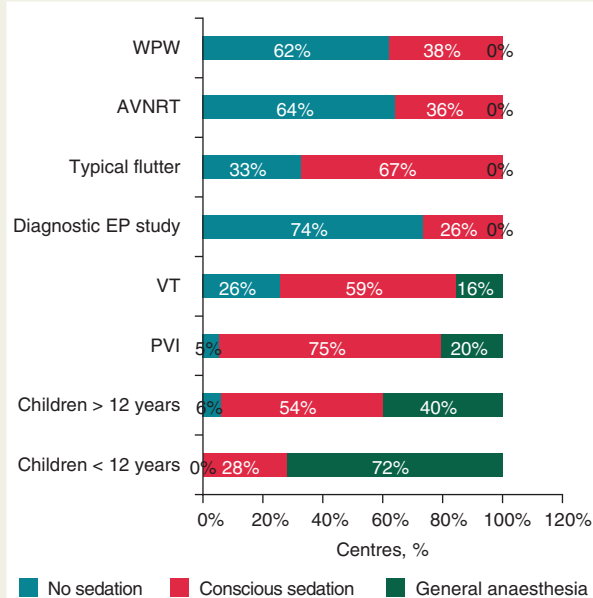


Figure 2 Type of sedation during electrophysiological procedures. AVNRT, atrioventricular nodal reentrant tachycardia; EP, electrophysiology; PVI, pulmonary vein isolation; WPW, Wolf–Parkinson–White syndrome.

Catheter ablation procedures

The preferred access for left-sided accessory pathway ablation is a retrograde aorta approach (21 of 52; 40%), a transseptal approach (20 of 52; 38%), and both approaches (11 of 52; 21%). Left ventricular tachycardias are mainly ablated using a retrograde approach in 34 of 52 (65%), a transseptal approach in 12 of 52 (23%), and using both types of access in 3 of 52 (6%). None of the centres reported an epicardial access as a routine approach. Three centres did not perform ablation of ventricular tachycardia. Most hospitals do not use routine sedation for diagnostic EP procedures and ablation for Wolf–Parkinson–White syndrome and atrioventricular nodal reentrant tachycardia. During pulmonary vein isolation, 75% use conscious sedation, whereas 22% routinely use general anaesthesia (Figure 2).

A routine peri-procedural antibiotic regime is rarely used, except for patients with prosthetic valves and devices, and the type of antibiotics used is varying. The choice of peri-procedural anticoagulation

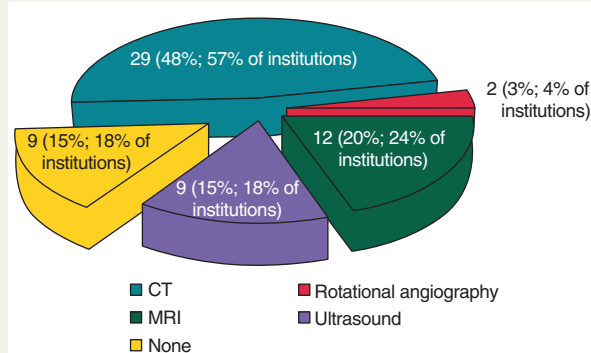


Figure 3 Preferred imaging prior to ablation for AF. CT, computed tomography; MRI, magnetic resonance imaging.

differs substantially, except for AF ablation, where heparin under activated clotting time (ACT) control is used in 87%.

The most frequently used type of energy for AF ablation is radio-frequency (RF) energy, which is used in 40 of 51 (78%) centres; however, many laboratories, 10 of 51 (20%), use cryoenergy (cryoballoon) and only 1 of 41 (2%) centres use laser energy. Most participants ablate paroxysmal (43 of 51; 84%) and also persistent AF (34 of 51; 67%) routinely. Atypical flutter ablation is an inherent part of routine ablations in 71% (36 of 51) of institutions. Ablation of long-standing persistent AF is not performed at all in 27% of the centres, only rarely performed in 43%, and is done routinely in 31% (Figure 2). Several imaging methods are used before AF ablations, mainly computed tomography angiography (57%), followed by magnetic resonance imaging (24%), but 18% of participants do not use any imaging method before AF ablation (Figure 3).

Discussion

Catheter ablation is the treatment of choice for most supraventricular tachycardias. More than 50 000 interventions are performed every year in Europe.⁷ Nevertheless, these procedures require well-trained cardiologists with comprehensive knowledge of heart rhythm disorders, suitable equipment, and contemporary facilities to ensure both patient safety and efficacy.

This EP Wire survey has shown that the principal standards are similar, although there is no European guideline that is generally

accepted. The core curriculum for heart rhythm specialists and relevant expert consensus statements for the treatment of arrhythmias⁴ are followed by the responding centres.

Electrophysiology personnel

Despite the fact that EP is a rapidly expanding and highly demanding subspecialty in cardiology with increasing complexity of ablation procedures (e.g. AF, ventricular tachycardia, and device therapy), only about 26% of the cardiology departments are led by the physicians specialized in EP. It is also remarkable that it is routine for some EP consultants to maintain skills for coronary interventions.

In this context, it is surprising, that in most, 29 of 52 (56%) institution EP nurses are required to be part of cardiac interventional services including night shifts, thus making EP and interventions an equal part of their daily practice. Moreover, it is clearly evident that a high level of training is necessary for nurses to assume responsibility for the stimulator, EP recording system, the 3D mapping system, or the ablation generator in most hospitals (Table 1).

Only 22% of the physicians in EP training are females and there are even a lower proportion of female cardiology consultants (14%). Whereas all centres employed a male consultant, only 37% had a female consultant among their EP staff. This finding is consistent with previous reports.⁸ This gender imbalance is however expected to change in the future, as in many European countries women represent the majority of medical students. Of interest, only 29% of male physicians are younger than 40 years old but 67% of female physicians performing EP studies are younger than 40 years.

There seems to be an accepted curriculum of training and knowledge for EP fellows in their first and second year. While simple skills such as vascular access, running the stimulator, the EP recording system, and the 3D mapping system and performing stand-alone ablations for simple procedures are mainly taught in their first year, more advanced skills are expected to be acquired during their second year in the majority of centres (stand-alone ablation in complex procedures, ablations in children and patients with congenital heart disease). On the contrary, there is a greater inconsistency regarding the physician's qualification to perform any invasive EP study. For example, a course is required in only 54% of institutions, an examination is necessary in only 4%, and surprisingly in 42% of institutions no specific training or course is required before performing invasive EP.

Equipment

In the core curriculum for heart rhythm specialists,¹ it is stated that a training centre should be equipped with the state-of-the-art equipment to offer current technology treatment approaches.^{7,9} The centre should have the following equipment available onsite: (i) up-to-date monitoring equipment, which was available in all participating institutions; (ii) a modern catheter laboratory; 94% of the responding centres had at least one laboratory which was almost exclusively used for EP; and (iii) 3D electroanatomical mapping defined as a prerequisite for performing complex ablation procedures, which was available in 90% of the institutions. In this respect, most of the European centres fulfilled the recently suggested requirements for training centres.

Peri-procedural management

In our survey, the relatively frequent use of a transeptal approach for left-sided accessory pathways and left ventricular tachycardia ablations highlights the current high expertise in transeptal approaches in modern EP units. Probably due to the high rate of AF ablations in most institutions, the transeptal puncture has become a routine procedure and therefore is used for other arrhythmias as well.

Although most centres still use RF energy for AF ablation procedures, the cryoballoon seems to have gained a more widespread use. As many as 22% of the centres routinely use general anaesthesia for AF procedures. It is not surprising that a relevant proportion of centres performing AF ablation treat consecutive left atrial arrhythmias (71%). Long-standing persistent AF is still rarely ablated in most participating centres, which probably reflects the uncertainty of treatment success and recommended techniques.

The peri-procedural administration of antibiotics is quite rare and is reserved for patients with prosthetic valves and devices; the choice of antibiotic differ significantly. Also, uncertainty exists regarding the choice of peri-procedural anticoagulation. There is even no clear trend regarding use of low-molecular weight or unfractionated heparin during most procedures. Except for AF ablation, the majority of participants used heparin under ACT control, reflecting the high level of research in that field.^{10–13}

Conclusion

The survey highlights the current EP personnel situation with high training requirements and specialization. However, the head of cardiology is most often not a heart rhythm specialist and the requirements of courses and exams within the EP specialty are low and highly variable. These observations warrant more resources to be focused on EP training and examination facilities. Currently, male physicians are clearly most dominant within the EP society, although in the subgroup of physicians younger than 40 years, the proportion of females is increasing. Uncertainty exists in the peri-procedural anticoagulation, antibiotic prophylaxis, and the type of sedation during specific procedures.

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