

Preferred tools and techniques for implantation of cardiac electronic devices in Europe: results of the European Heart Rhythm Association survey

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The aim of this European Heart Rhythm Association (EHRA) survey was to assess clinical practice in relation to the tools and techniques used for cardiac implantable electronic devices procedures in the European countries. Responses to the questionnaire were received from 62 members of the EHRA research network. The survey involved high-, medium-, and low-volume implanting centres, performing, respectively, more than 200, 100–199 and under 100 implants per year. The following topics were explored: the side approach for implantation, surgical techniques for pocket incision, first venous access for lead implantation, preference of lead fixation, preferred coil number for implantable cardioverter-defibrillator (ICD) leads, right ventricular pacing site, generator placement site, subcutaneous ICD implantation, specific tools and techniques for cardiac resynchronization therapy (CRT), lead implantation sequence in CRT, coronary sinus cannulation technique, target site for left ventricular lead placement, strategy in left ventricular lead implant failure, mean CRT implantation time, optimization of the atrioventricular (AV) and ventriculo-ventricular intervals, CRT implants in patients with permanent atrial fibrillation, AV node ablation in patients with permanent AF. This panoramic view allows us to find out the operator preferences regarding the techniques and tools for device implantation in Europe. The results showed different practices in all the fields we investigated, nevertheless the survey also outlines a good adherence to the common standards and recommendations.

Keywords

Cardiac implantable electronic devices • Cardiac resynchronization therapy • EHRA survey • EP wire • Implantable cardioverter-defibrillator • Tools • Techniques

Introduction

The rate of cardiac implantable electronic devices (CIEDs) implantation has steadily increased as the indications have expanded.^{1–3} The approach to cardiac pacemaker (PM) and defibrillator implantation has evolved during the past decades and the advent of cardiac resynchronization therapy (CRT) has resulted in the increased level of complexity of the procedures. Furthermore, technological research in the instruments employed has been constantly evolving, to facilitate the procedures; however, in some cases, novel techniques and approaches may cause problems and concerns.^{3–5} We aimed to investigate the procedural practice in relation to the tools and techniques used for CIED implantation in Europe.

Methods

A questionnaire was administered to the centres involved in the European Heart Rhythm Association (EHRA) research network. In this questionnaire, we asked for technical data regarding CIED implantation procedures posing 30 questions. The response rate was 95%.

Participating countries

Responses were received from 62 of the EHRA research network members. The country-specific distribution of the centres was as follows: Italy, 10 centres; UK, 9; Spain, 6; Denmark, 5; Greece, 5; Netherlands, 4; Argentina, 3; Germany, 3; Belgium, 2; France, 2; and Romania, 2. There were responses from a single centre in the remaining nine

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countries (Armenia, Austria, Estonia, the Helvetic Confederation, Lithuania, Norway, Portugal, Sweden, and Tunisia). Two university hospitals did not disclose their affiliation.

Characteristics of the centres

The majority (70%) of the centres were university hospitals, 16% were private hospitals, and 14% other type of hospital. A cardiac surgery service was available in 87%. In the previous calendar year, 49% of the respondent centres performed <100 implantable cardioverter-defibrillator (ICD) implantations [including CRT defibrillator (CRT-D)], 26% performed 100–199 procedures, and 25% reported implanting 200 or more devices. Regarding PMs, 67% of the centres declared implanting >200 devices in the last calendar year, 23% implanted 100–199 PMs, and 10% <100 PMs.

The total number of endocardial catheter ablations for all types of arrhythmias was <100 procedures in 31% of the centres, 100–199 in 24% of the centres, 200–399 in 19% of the centres, and 400 or more in 26% of the centres. Ablation for atrial fibrillation (AF) accounted for 20% of the procedures, but the proportion of ablations for AF increased to 44% at the high-volume centres which performed 400 or more ablation procedures.

Results

Techniques, approaches, and tools for device implantation

Side of implant

Left-side approach for device implantation was reported as a preferred method by 79% of the centres, the right side was preferred by 10%, whereas 11% declared implanting at the left side in the right-handed and at the right side in the left-handed individuals. The majority (74%) of operators did not modify their side approach or different device type: PM, ICD, or CRT implant.

Surgical techniques for pocket incision

Electrocautery has always been used at 62% of the centres, whereas 23% never use it and 15% avoid it in the case of replacement. The use of electrocautery on or around leads has been reported by 55% of the respondents.

First venous access for lead implantation

Cephalic vein as the first approach has been preferred by 60% of the centres, whereas 40% start the procedure from the subclavian vein. In the case of the subclavian approach, 48% of the centres reported using an extrathoracic (axillary vein) access, and 52% declared performing an intrathoracic access (Figure 1).

Implantable cardioverter-defibrillator leads: coil number

In the case of ICD implantation, 43% of the operators prefer a single-coil ventricular lead, 45% choose a dual-coil lead, and 12% reported no preference (Figure 1).

Right ventricular lead in pacemaker patients: first option for pacing site

Half of the centres prefer to position the right ventricular (RV) lead tip at the apex, 47% at the interventricular septum (30% mid-, 12% high-, 5% low-septum), and 3% in the outflow tract (Figure 1).

Preference of lead fixation

For the right atrial (RA) pacing lead, 66% of the centres prefer active-fixation leads, 24% prefer passive leads, while 10% reported no specific preference (Figure 2). For the RV pacing lead, 76% of the centres prefer active-fixation leads, 12% passive leads, and 12% have no preference. For the RV ICD lead, 86% of the centres prefer active-fixation leads, 7% passive leads, and 7% reported no preference. For the coronary sinus left ventricular (LV) lead, 9% of the centres prefer active-fixation leads, 76% passive leads, and 15% reported no preference.

Generator placement site

The majority of centres (96%) prefer pectoral subcutaneous implantation. In the case of ICD implantation (including CRT-D), 12% of the centres prefer a pectoral submuscular location.

Subcutaneous implantable cardioverter-defibrillator implantation

Fifty-three percent of the centres declare implanting subcutaneous ICD, with 60% performing the procedure under local anaesthesia, and 40% under general anaesthesia.

Specific tools and techniques for cardiac resynchronization therapy implantation

Sequence of lead placing during cardiac resynchronization therapy device implantation

The majority of responders (56%) prefer to implant RV lead (pacing or ICD) first, then the atrial lead, and finally, the LV lead, whereas 31% of the centres prefer to implant the RV lead (pacing or ICD) first, followed by the LV lead, and then the atrial lead. The other possible combinations were reported by 13% of the respondents.

Coronary sinus cannulation techniques and tools

Thirty percent of the centres prefer a direct cannulation with the delivery system only to engage the coronary sinus, 26% reported preferring cannulation with a guidewire and delivery system, 34% opt for cannulation with an electrophysiological catheter, and 10% of the centres prefer to cannulate the coronary sinus with other tools (Figure 3). The majority of centres (90%) declared systematically obtaining a coronary sinus angiogram during CRT implantation (73% of them employ a balloon catheter), 9% after the unsuccessful LV lead placing attempt, and only 1% never perform a venography during CRT implantation. The quadripolar LV lead type is chosen by 52% of the centres, bipolar by 47%, whereas only 1% opt for a unipolar lead.

Target site for left ventricular lead

When implanting the LV lead, 66% choose the target site for pacing by anatomical criteria (mainly postero-lateral region), 19% choose the region with latest mechanical activation (after an echocardiographic evaluation), 12% opted for the site with late electrical activation, and 3% choose the site where it is easy to achieve a stable position of the lead (Figure 3).

Strategy in the case of left ventricular lead implant failure

In the case of LV lead implant failure, 74% of the centres choose an epicardial (surgical) approach, 15% prefer an endocardial LV

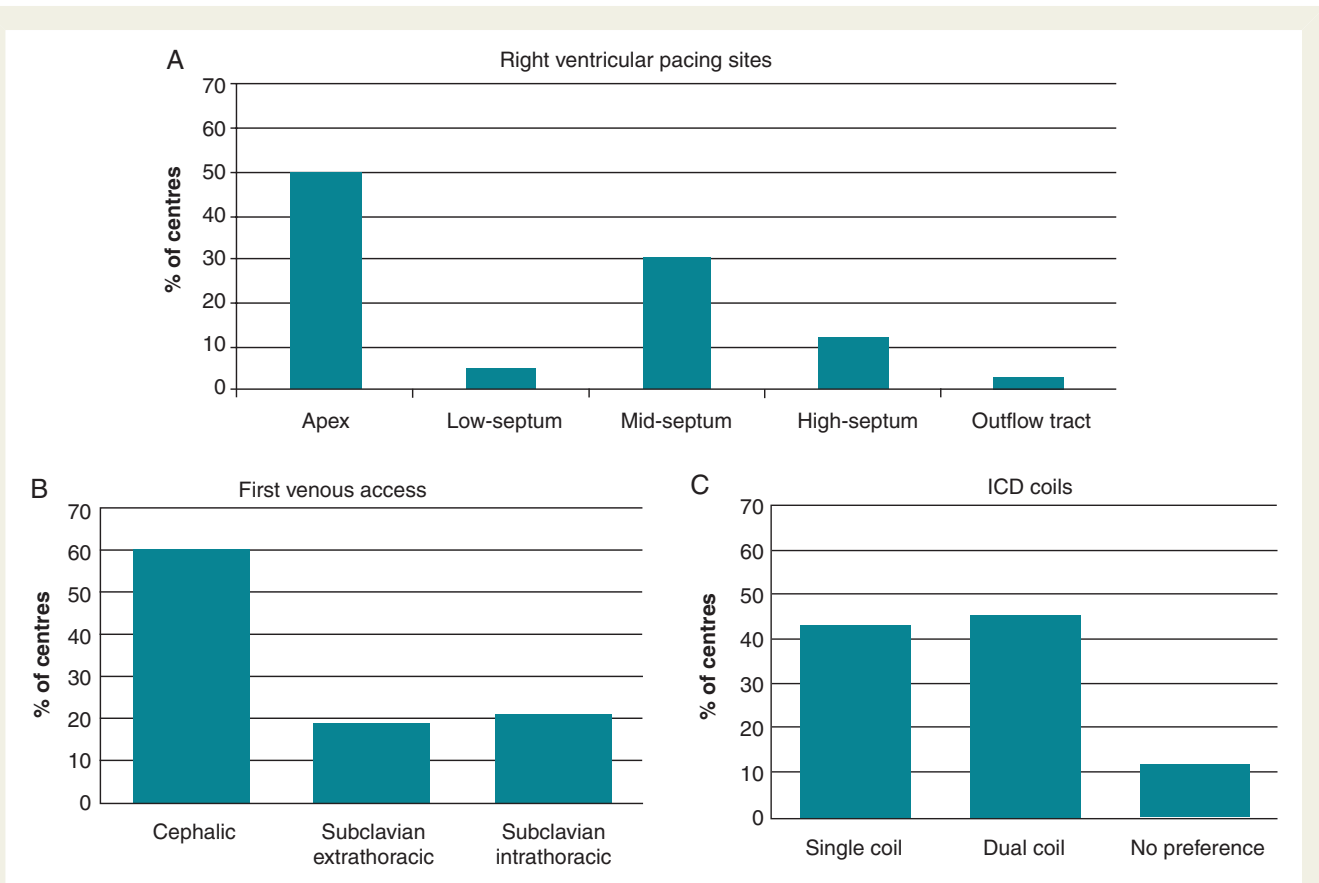


Figure 1 Centre preferences for right ventricular pacing site (A), first venous access (B), and ICD coils (C).

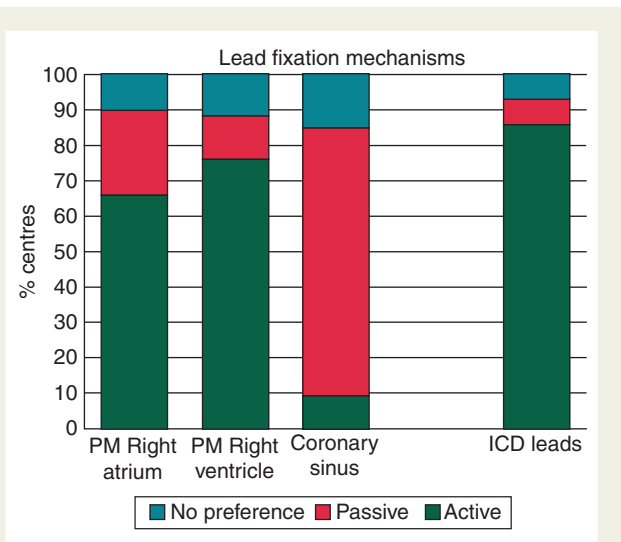


Figure 2 Centre preferences for lead fixation. ICD, implantable cardioverter-defibrillator; PM, pacemaker.

implant, 5% opt for RV bifocal pacing, and 5% implant a system without CRT, while only 1% pursue a second attempt.

Cardiac resynchronization therapy implantation time

Thirty-six percent of the centres reported an average total implantation time ranging from 60 to 89 min, 36%—from 90 to 119 min, 17% <60 min, and 11% > 119 min (Figure 3).

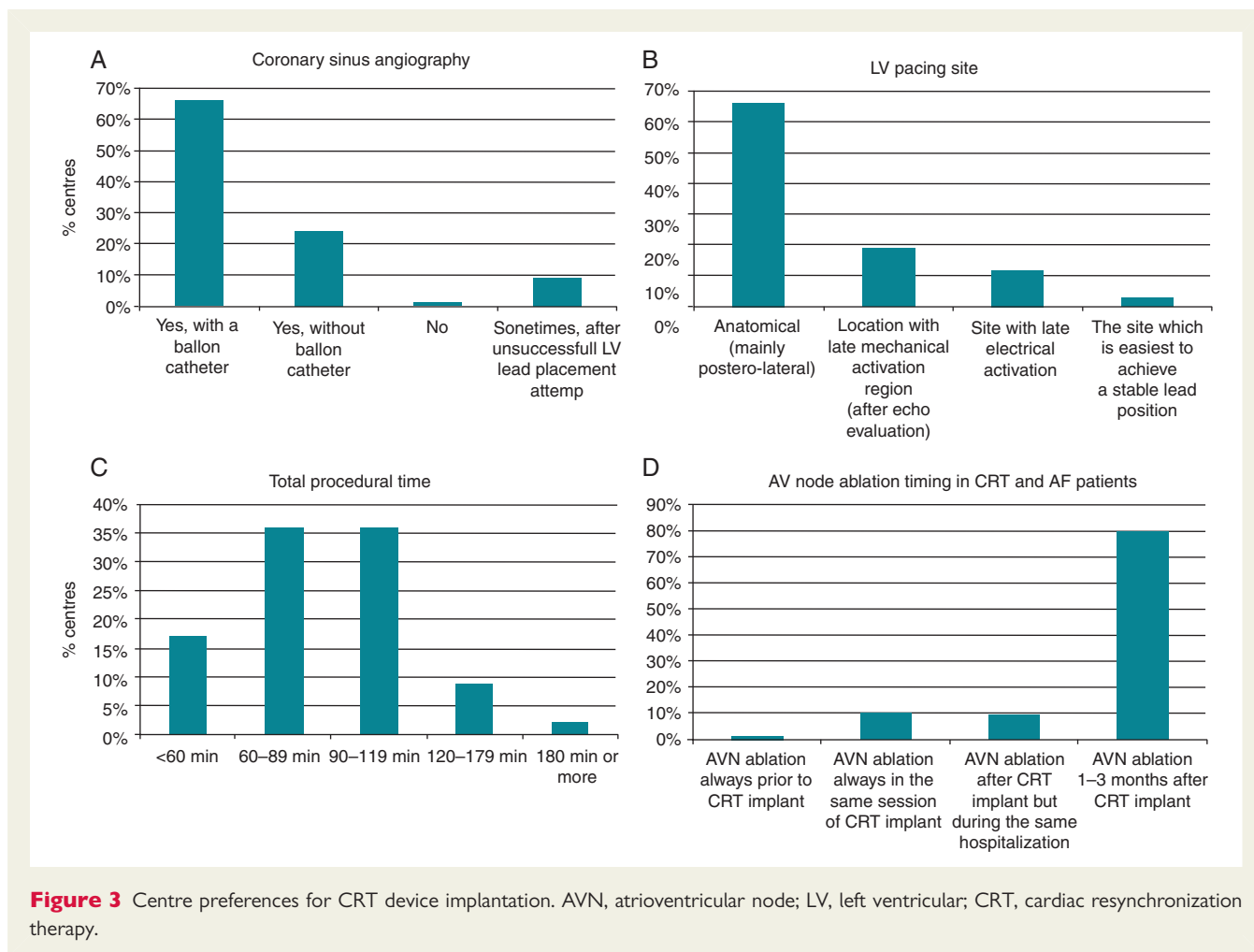
Optimization of atrioventricular and ventriculo-ventricular intervals at the end of implantation

Optimization of atrioventricular (AV) and ventriculo-ventricular intervals at the end of a CRT device implantation is not routinely performed by 31% of the respondents, whereas 25% do it manually under the control of wave morphology and QRS width on the electrocardiogram, 23% employ automatic algorithms of the device, and 21% use echocardiographic support.

Cardiac resynchronization therapy implant in patients with permanent atrial fibrillation

Right atrial lead implantation

The majority (73%) of the centres implant RA lead only if justified based on the atrial size and/or recent onset of AF, 14% always implant it in the hope that sinus rhythm may be restored, while 4% never implant the RA lead.



Atrioventricular node ablation

Fifty-seven percent of the centres perform AV node ablation in <20% of CRT patients with permanent AF, 16% of the centres in 20–29% of patients, 8% of the centres in 30–49% of patients, 19% of the centres ablate the AV node in 50% or more of their patients. About 80% take the decision to perform AV node ablation at 1–3 months after CRT implant, whereas 10% always opt for AV node ablation in the same session as CRT implant, and 9% perform AV node ablation after CRT implant but during the same hospitalization. Only 1% of the respondents always perform it before the CRT device implant (Figure 3).

Discussion

Despite an increased number of implantations of CIED systems and updates of the guidelines for CIED implantation and management, there are still limited data on how these indications are applied in clinical practice. Specifically, it remains unknown how the centres choose among the wide variety of approaches and available tools.^{3–7} The aim of this EP Wire survey was therefore to investigate the choices of leads and approaches that the implanters make in Europe.

Regarding the side of implantation, the majority of centres prefer the left-side approach that makes the procedure of lead placement

easier.^{3–5} Furthermore, although it is known from the literature that the cephalic approach is more beneficial than subclavian access in preventing complications, 40% of the centres still choose the subclavian vein as the first approach and more than half use an intrathoracic one.⁸

Concerning the lead fixation mechanism, there is a clear preference for active-fixation leads, probably for their stability, giving the possibility of a quick discharge of the patient and taking into account the ease to extract.^{3–5} Dual-coil ICD leads are preferred by more than half the centres, although there is evidence that they may not be more effective than the single-coil leads and may even be more difficult and risky to extract.^{9,10}

With regard to new technologies, subcutaneous ICD is an important and significant improvement that is increasing in Europe, as indicated by the observation that more than half of the centres claim to perform this procedure.¹¹ Further development in the field has been reported.¹²

There is a growing experience in the implantation and management of CRT devices among the EHRA research network members who have achieved excellent results: the average time of implantation is reduced significantly to under 2 h in most centres (89%) with presumed reduction of risk of infection, which is closely related to the procedure time.^{3,5,13} The use of coronary sinus imaging, which facilitates LV lead placement and is recommended by the guidelines, was reported by 90% of the centres.¹⁴ The majority

of centres (66%) choose the target site by anatomical criteria, placing the lead tip mainly in the postero-lateral region. Only 19% follow the criteria of late mechanical activation from the echocardiographic evaluation, which probably reflects certain lack of collaboration between the echocardiography and the catheter labs in routine clinical practice. It is desirable that new technological improvements should provide accurate information on LV mechanical activation directly in the catheter lab during coronary sinus angiography.^{3–6}

In the case of LV lead implant failure, the majority of centres choose an epicardial surgical approach which showed good safety and long-term efficacy.^{15,16}

In patients with permanent AF, 72% of the centres implant RA lead only if it is justified by the possibility of restoration of sinus rhythm (e.g. recent onset of AF and the absence of advanced atrial remodeling). Atrioventricular node ablation is performed within 1–3 months after CRT device implant at 80% of centres, which is in line with the current recommendations.^{3,5,17}

Conclusion

This panoramic view of operator preferences regarding the techniques and tools used in device implantation outlines a good general adherence to the guidelines and recommendations for device implantation. Excellent data are reported for very important parameters such as the timing of CRT implantation, the use of coronary sinus angiography, and the site of LV lead placement. However, there is still a trend, in some cases, to maintain some traditional approaches, probably related more to 'old habits' than to real motivation and patient benefits. We hope this EP Wire survey will help all the physicians to critically consider their choices to motivate some changes in their clinical and implanting practice to improve patient care.

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