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EDITORIAL COMMENT

The 10 commandments for setting up a successful conduction system pacing program

Os 10 mandamentos para a criação de um programa de *pacing* do sistema de condução

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In this edition of the journal, Saleiro et al.[1] report their initial experience with conduction system pacing (CSP) implantation at their institution (and the first published prospective series in Portugal). A total of 21 patients underwent His bundle pacing (HBP), among whom the implant success rate was 91%; 23 patients underwent left bundle branch pacing (LBBP) which was successful in all cases. The success rate was superior to that reported previously in multicenter experiences (81% for HBP[2] and 90% for LBBP[3]), and is commendable, bearing in mind that the report includes the initial learning curve of the operators. As previously reported elsewhere,[4] LBBP was associated with superior electrical parameters and shorter fluoroscopy times. There were no acute complications, but lead revision was required in three (6.5%) patients with HBP due to lead dislodgement (one patient) or increased capture thresholds (two patients), which is in line with previous data reporting a 6% rate of HBP lead revision.[5]

There are several hurdles that need to be overcome when initiating a CSP program. A structured approach may help overcome these hurdles, and may be outlined as follows:

1. Inform yourself (and get trained)

In a recent European Heart Rhythm Association (EHRA) survey, the main obstacle to adopt CSP is lack of training.[6] An EHRA consensus document and practical guide on CSP implantation technique is due for 2023, and will serve as a framework for standardizing the procedure. Simulator-based courses would be ideal to acquire skills in a safe and effective manner. In the meantime, review articles on implantation technique and peer-to-peer exchange of information remain important means of gaining knowledge.

2. Involve your colleagues (and get them on board)

Conduction system pacing implantation requires a different patient setup compared to standard device implantation, with a 12-lead ECG, different lab setup, new measurements to confirm conduction system capture,[7–9] and longer procedure durations. It is in your interest to involve your colleagues in this new adventure (physicians, nurses, technicians, etc.), as they will play a part in achieving success. Inform them of the rationale for CSP, the procedure steps, and of their tasks (e.g., which measurements to perform).

3. Optimize lab setup (to streamline the procedure)

Although CSP implantation may be performed in an operating room using pacing system analyzers (PSA), a mobile C-arm and a standard 12-lead ECG recorder, it is much more comfortable to do the procedure using an electrophysiology recording system. This enables continuous recording,

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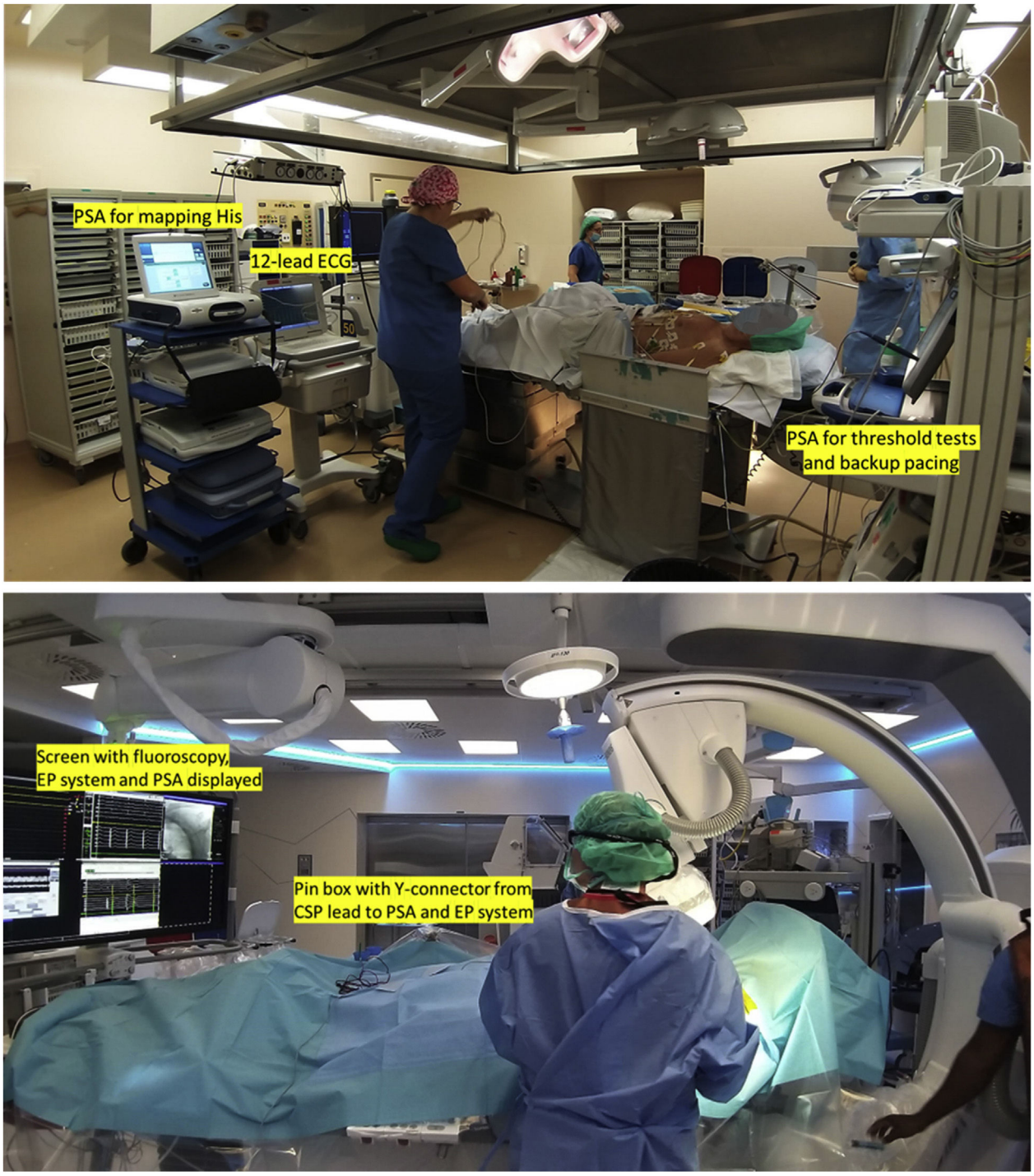

Figure 1 Top panel: Conduction system pacing setup at the University Hospital of Geneva in 2017 at the initiation of His bundle pacing. Bottom panel: Conduction system pacing since 2020 in the hybrid electrophysiology/device lab with an optimized setup. *Legends:* CSP: conduction system pacing; ECG: electrocardiograph; EP system: electrophysiology recording system; PSA: pacing system analyzer.

display of filtered and unfiltered electrograms (to evaluate current of injury which is important to recognize LBBP lead perforation[10]), and precise measurement of intervals to confirm conduction system capture.[7–9] Fluoroscopy systems which display viewing angles and allows the operator to display reference images such as His position, facilitates CSP lead positioning. Y-connectors, which split the signals from the CSP lead to the EP recording system and the PSA are useful to avoid having to continuously exchange cables during the procedure (e.g., when performing threshold tests). Figure 1 shows two different setups.

4. Choose the right patient (and avoid nightmares)

It is wise to start with low-risk patients (e.g., not pacemaker-dependent) to avoid dramatic events which may result from complications (e.g., lead dislodgement), which are part of the learning curve. Some operators started CSP in patients who had pacemaker implantation for sick sinus syndrome. Another option is patients in chronic atrial fibrillation who undergo cardiac resynchronization therapy (CRT) implantation. Instead of plugging the atrial port, a CSP lead may be implanted in addition to the right ventricular and coronary sinus leads, which offers the option of His-optimized or left-bundle-optimized CRT (or standard biventricular pacing in case of CSP lead dysfunction) with the safety of backup biventricular pacing.

5. Choose the right tools (to facilitate the procedure)

Most CSP implantations are currently performed using the Medtronic 3830 lumenless lead.[6] The 4.1F isodiametric profile facilitates penetration of the interventricular septum, and the sturdy design forgives rough handling (e.g., when repositioning the lead after having screwed it into fibrous tissue). Stylet-driven leads are also becoming popular,[6] as the backup offered by the stylet enables more push to penetrate the interventricular septum for LBBAP, and continuous pacing to monitor changes in QRS morphology. In the event of lead dislodgement, stylet-driven leads may be repositioned to a conventional pacing site (right septum or apex) without having to regain new venous access (contrary to lumenless leads). Implant success rates were comparable between lumenless and stylet-driven leads in the MELOS registry.[3]

6. Choose the right technique (to maximize safety and efficacy)

As mentioned above, the EHRA consensus document and practical guide on CSP implantation due early in 2023 will serve to standardize the procedure. It is important to be fully aware of the criteria which confirm conduction system capture (although this endpoint may not always be reached). One should avoid performing para-Hissian pacing or deep right ventricular septal pacing (the benefit of which has never been shown). Transseptal access with LBBP is associated with new complications such as septal perforation or lesions to the coronary vessels, which should be recognized and appropriately managed. As mentioned in the 2021 European Society of Cardiology pacing guidelines,[11] a backup pacing lead for HBP should be considered in specific situations (e.g., atrioventricular node ablation, infra-nodal block, pacemaker-dependency).

7. Set your limits (and respect them)

Although it is likely that CSP will replace right ventricular pacing (and, even in some instances, CRT) evidence is still being gathered regarding its superiority over conventional pacing. Therefore, it is useful to limit CSP implant attempts to a reasonable duration (e.g., 30 minutes), and to switch to a conventional method if a good result is not achieved by then, instead of insisting any further. This will avoid patient complications and will also be appreciated by your colleagues.

8. Optimize programming and follow-up (to ensure proper patient care)

A good CSP program not only depends on successful implantation, but also on proper programming and follow-up. Current devices are not designed for CSP and require adequate programming.[12,13] A 12-lead ECG is mandatory for confirming conduction tissue capture during follow-up.

9. Keep track of your results (and monitor your performance)

Prospective data capture (ideally in electronic health records which allow ready data extraction, or e.g., in an Excel file directly after each implant) allow monitoring of parameters such as implantation volume, success rate, procedure duration, complications etc. and are important for quality control and for clinical research.

10. Stay up to date (and keep evolving)

Conduction system pacing is a rapidly evolving field, and the implanting physician should stay informed regarding new techniques which may be useful in daily practice. The device industry is also developing new tools which will facilitate CSP implantation (as was the case with CRT implantation).

By following these 10 commandments, the device specialist will find the holy grail of a successful CSP program, with minimal penitence!

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