Catheter ablation of atrioventricular nodal re-entrant tachycardia: Humans vs. Machines?

Antonio Creta MD [1,2], Rui Providencia MD PhD [1,3]

[1] Barts Heart Centre, St Bartholomew's Hospital, Barts Health NHS Trust, London, United Kingdom;
[2] Campus Bio-Medico, Unit of Cardiology, University of Rome, Rome, Italy;
[3] Institute of Health Informatics Research, University College of London, London, United Kingdom.

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After developments in the ablation technique and in the field of cardiac electrophysiology in the late 80s and early 90s [1-3], catheter ablation of one of the pathways involved in the re-entrant mechanism of of atrioventricular nodal re-entrant tachycardia (AVNRT) has now become a part of modern cardiology. The 2015 *American College of Cardiology / American Heart Association / Heart Rhythm Society Guidelines* state that *"catheter ablation of the slow pathway is recommended"* for the ongoing management of AVNRT (class I recommendation, level of evidence B) [4], and the last *European Society of Cardiology* recommendations (a joint ESC/American guideline from 2003) are also clear about the role of ablation for recurrent symptomatic AVNRT, giving it a class I recommendation with level of evidence B [5].

Slow pathway ablation was adopted worldwide during the 90s, and due to the high success rate of this procedure (>99% reported by some highly experienced centers), the Cardiac Electrophysiology community thought that it was a case of "case closed" for AVNRT. Subsequently, after the late 90s seminal publication by Haïssaguerre et al. [6], the attention shifted to atrial fibrillation, and AVNRT started to be considered a "simple arrhythmia", and catheter ablation of the slow path way a "simple procedure".

However, this is not by any means a risk free procedure and it should made clear to EP trainees that start to get catheter manipulation experience that not only should they become experts in interpreting signals, and performing the diagnostic manoeuvres to confirm an AVNRT diagnosis, but they should also develop skills allowing them to keep the catheter in a stable position, preventing it to migrate during the ablation part of the procedure, and maintaining enough contact-force throughout the application so that they can deliver an effective lesion. Also, they need a very quick "endocavitary-signals-to-brain connection" to immediately abort the application in case of fast junctionals or at the earliest signs of atrioventricular conduction damage. In this procedure, the minor mistake can lead to lifelong consequences (need of a permanent pacemaker) in patients who are very frequently young. In the hands of very experienced centers and operators complete atrioventricular block has been

reported to be 0.4% [7], but in the real world the incidence of this complication may, in fact, be much higher.

Acknowledging this about procedural aspects, is proof that research in the area is not over. Debate has been ongoing regarding the most effective and safest ablation energy (cryo vs radiofrequency) [7], whether or not 3D mapping systems should be routinely used [8] (and in case of using 3D mapping systems, is there a role for substrate mapping? [9-11]), zero-fluoro procedures vs. very short screening times [12], and regarding a potential role of contact-force sensing for ablation the slow pathway [13].

However, a different question should be asked: is the human being good enough to manipulate the catheters? Should manual catheter manipulation be preferred, or are alternatives like remote magnetic navigation a better and safer approach?

Further evidence into this matter of the *"battle of machines vs. humans"* has been elegantly provided by *Parreira* and colleagues in the in this issue [14]. Unlike previous studies where comparisons involved very small samples, short follow-up durations and even catheters which are currently not in use, this study performs a fair comparison of 2 different ablation technologies using current "day and age" technology in the hands of an experienced operator. Remote magnetic navigation ablation with the Niobe II MNS (Stereotaxis) was used and compared with manual ablation performed by the same operator in a different setting. The authors should be praised for number of patients included (over 200 patients) and their very long follow-up (more than 3 years in average). The study demonstrates that x-ray exposure of the operator is clearly lower (5 minutes in average) using remote magnetic navigation (MN), which is expected to translates into a clear long-term benefit for the operator.

MN proved to be as safe as manual ablation. As there were concerns about lower contact-force with MN, longer ablation times were observed in the MN group. Whether or not this contributed to the lower relapse rate observed with MN remains to be explained. However, the non-significant difference due to the lack of statistical power, corresponds to an absolute risk difference of 3%, which is of importance as it corresponds to 30 patients being referred to MN ablation to avoid one relapse. This

number is considerable as it will lead to further admissions to the emergency room, redo procedures, and prescriptions which is important from a health resource utilization perspective. A cost-effectiveness study taking into account these aspects may be of importance.

Findings of this study are thought-provoking. A future study randomized study using contact-force sensing (which is currently becoming the standard) and aiming to answer this question is warranted.

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