Cardioneuroablation for treating functional bradyarrhythmias. How much is enough?

Cardioneuroablation is an endocardial atrial catheter ablation technique proposed in the 1990s, to obtain enough vagal denervation to treat functional bradyarrhythmias without a pacemaker [1].

The distinguished Indian Pacing and Electrophysiology Journal presents us this interesting study of Mesquita D et al. “Anatomic guided ablation of the atrial right ganglionated plexi is enough for cardiac autonomic modulation in patients with significant bradyarrhythmias” [2]. It is another notable contribution to this highly promising new technique. Publications that reproduce the original technique adding new methods are extremely valuable to prove reproducibility and feasibility. Several authors have been trying to simplify the CNA [3,4]. Unfortunately, it is not easy. Some aspects deserve to be carefully analyzed. The high complexity of cardiac innervation restrains these efforts and may cause frustration. The main concerns to some publications may be the diversity of mapping techniques, the absence of direct denervation control in many articles, the lack of a solid endpoint, the possible placebo effect, the short follow-up, the question of the learning curve.

Significant challenges of this method were already apparent in the first series of patients and deserve to be shortly commented.

1. How to select the patient?

Identifying an essentially functional disorder is crucial, ruling out an organic involvement and showing a good functional reserve. The electrophysiological study and the atropine test are essential to feed current anatomical maps and understand the physiopathology. Furthermore, it gave rise to Fractionation Software, created in 2005 [1,9], a close and simplified form of spectral analysis. The initial approach may be based only on the estimated position of the GPs in the electroanatomical model. However, mainly in AV blocks, and/or when an adequate response is not achieved, fractionation mapping is decisive considering the substantial anatomical variability in GP.

2. How to identify the neuromyocardial interface?

There are several techniques to identify endocardial innervation [1,3,7]; however, the best is to have good control of the degree of denervation, gradually obtained as the procedure progresses, independent of the technique, by using vagal stimulation [4]. The AF-Nests spectral mapping [8], proposed in the initial study, was essential to feed current anatomical maps and understand the physiopathology. Unfortunately, not. The complexity of AV node innervation demands higher accuracy of the technique in at least three different accesses and at least two GP. It is usual to obtain an acute reduction in the AH interval and increase of the Wenckebach’s point. However, a short vagal stimulation [6] usually shows a hide high-degree AV block, mainly during atrial pacing.

3. How to assess the degree of denervation?

Assessment of the innervation degree is a fundamental parameter and has been indirectly and even subjectively evaluated in many publications. However, it is critical for the control and endpoint of the CNA. Modification of electrophysiological parameters and atropine challenge at the ablation completion are indirect and not totally reliable [10]. Extracardiac vagal stimulation reproduces the cardioinhibition of the tilt-test and may be repeated until the effect is completely eliminated. Even if it is impossible to abolish the vagal response, it is essential to have this information to follow each patient and compare and improve the technique in a multicenter collaboration.

4. How to prevent reinnervation?

Reinnervation is natural and unavoidable, occurs in all cases and can almost completely restore the natural innervation. Due to the massive distribution of nerve endings, there is a significant overlap. Therefore, the denervation of one area may be replaced by the other GPs and the numerous surrounding micro-GP [11]. However, reinnervation of 30–50% is even desirable. The best way to prevent enough reinnervation to invalidate the acute effect is to perform
extensive denervation in the first procedure. That is not possible to be made by presumption. The rational way is the vagal effect abolishment controlled by vagal stimulation [6]. In this approach, there will still be a good vagal effect attenuation after the reinnervation in the long term, even if reinnervation is higher than expected [12].

5. How to evaluate the result?

Many CNA studies are being published with a very short follow-up. Depending on how the ablation is controlled, ending up with an apparently good result does not mean long-term success. Unlike a delta wave WPW ablation, CNA is a procedure that can easily have an undesirable placebo effect. Therefore, we need to evaluate the results directly and strictly, as much as possible, and/or for a long time [13]. For this reason, the first study was only published six years after performing the first case [1].

6. Conclusion

Publications by highly recognized groups are extremely valuable for the CNA evolution. However, it is difficult to say how much is enough. Despite being a procedure that has shown great reproducibility and clear benefit to patients, it is necessary to be very cautious due to the complexity of cardiac innervation. It is a method with a long and challenging learning curve that is being improved daily by numerous investigators. Vagal stimulation has been shown to be essential to control, to complete the procedure, and to allow a rational comparison of techniques and results between groups.

Disclosures

None.

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