Close the gap to get a circle! The role of visual gaps during circumferential pulmonary vein isolation

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This editorial refers to ‘Acute electrical isolation is a necessary but insufficient endpoint for achieving durable PV isolation: the importance of closing the visual gap’ by M.A. Miller et al., on page 653

Since Michel Haïssaguerre in the late 1990s delineated the importance of pulmonary vein (PV) triggers and drivers in the pathogenesis of atrial fibrillation (AF), PV isolation has become the cornerstone of successful interventional treatment of AF. Initially, segmental or focal PV disconnection was the main treatment strategy. With the awareness of the role of PV antra in the initiation and maintenance of AF, ablation targets have moved away from isolating PVs inside the atria. Nowadays, circumferential ablation around PVs is the main approach.

Different energy sources such as radiofrequency, cryo, and laser have been introduced to produce electrical conduction block between PVs and the atrial tissue by creating precise tissue damage. By placement of a circular ablation line around PVs, these are electrically isolated and consequent conduction block can be confirmed by additional (circular) mapping catheter inside PVs and/or by pacing manoeuvres.

Depending on the amount and quality of tissue injury, this block can be transient or durable. Furthermore, atrial tissue adjacent to the targeted area reacts with reversible oedema or thermal stunning, which may result in acute conduction block. However, over time, this myocardium can recover and lead to PV reconnection. Imaging of the atrial myocardium at the ablation site allows identification of ‘visual gaps’ within the circumferential ablation line despite acute electrical PV isolation. After a waiting period and/or administration of agents such as adenosine, the quality of ablation lines and completeness of PV isolation can be reviewed.

Miller et al. report on 28 patients who underwent circular mapping catheter-guided circumferential ablation of the ipsilateral PVs with contiguous point-by-point lesions. Despite evidence of acute electrical isolation confirmed by the presence of entrance block within the PV, ‘visual gaps’, corresponding to unablated myocardium, were present in three quarters of targeted PVs.

This kind of acute isolation without complete circumferential ablation could be a pitfall during circular mapping catheter-guided PV isolation and may prompt the operator to attempt to close the ‘visual gap’ with less care, i.e. without creating transmural and durable lesions. Without adequate assessment after ablation, including the waiting period, adenosine administration, or pacing manoeuvres, this may potentially lead to low mid- and long-term success rates.

In the study by Miller et al., during a 5 min waiting period only three PV pairs spontaneously reconnected. Despite the finding that all reconnections were observed in unablated areas, the rate is quite low and may have been due to the short waiting period. A previous study reported up to 50% reconnection rates within 20 to 60 min waiting periods. In the majority (68%) of ‘visual gaps’, pace capture was present. Unfortunately, there is no information about the presence and/or quality of local electrograms within these areas.

Administration of adenosine revealed dormant conduction in 19% (8 of 42) PVs with ‘visual gaps’. Only three of these PVs showed no pace capture prior to adenosine infusion. This finding indicates that a significantly higher rate of unablated areas can be identified by pacing manoeuvres within the intended ablation area than by adenosine administration and highlights that, in addition to the electrogram amplitude reduction, impedance fall of ~10% or energy delivery up to a defined time period, non-excitability during pacing could be an indicator of adequate lesion formation.

Only the minority of patients underwent a second procedure with the possibility of repeat invasive mapping of PVs. After a follow-up of 389 ± 63 days, 92% of 12 re-studied PVs showed durable isolation. However, a conclusion on the impact of acute...
PV isolation compared with electrical isolation only after placing a fully circumferential lesion set could not be made due to the limited sample size and lack of data on clinical outcome of the studied cohort. Nevertheless, Miller et al. properly delineated the value of different electrophysiological manoeuvres to prove the durability of PV lesions and accentuated the role of ‘visual gaps’ during circular catheter-guided PV isolation.

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