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Hybrid 123I-mIBG SPECT/CT cardiac imaging for identification of left atrial ganglionated plexi in healthy individuals and patients with atrial fibrillation

Authors:
N Nikitin¹, S Minin¹, A Romanov¹, V Shabanov¹, D Losik¹, D Elesin¹, I Stenin¹, I Mikheenko¹, R Baavour²,
E Pokushalov¹, ¹Meshalkin National Medical Research Center - Novosibirsk - Russian Federation, ²Spectrum Dynamics Medical - Caesarea - Israel

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Background
123I-metaiodobenzylguanidine (mIBG) solid-state SPECT has been reported as a non-invasive approach to identify left atrial (LA) ganglionated plexi (GP) in atrial fibrillation (AF) patients for guidance of catheter ablation procedures (CAP). However, differences in anatomical distribution and patterns of GP in healthy individuals (HI) and AF patients have never been demonstrated.

Purpose
To describe anatomical distribution and patterns of LAGP, and their natural variation over time in HI, and also in comparison with AF patients.

Methods
15 HI and 15 paroxysmal AF patients were included in the study. All participants underwent SPECT imaging 4 hours after injection of 370MBq mIBG using a dedicated cardiac solid-state gamma camera. SPECT data were automatically co-registered with cardiac CT data. Discrete mIBG uptake areas (DUA) were identified according to proximity to LA walls and pulmonary veins (PV) ostia and assigned confidence level (CL) from low, moderate to high based on discreteness, average mIBG uptake and proximity to known anatomical GP locations. Follow-up mIBG imaging was acquired 5-7 days after initial procedure for HI and 5-7 days after CAP (PV isolation and GP ablation) for AF patients.

Results
At baseline a total of 36 DUA were identified in HI, 16 (44%) of which (median per individual 1 [1;1]) had moderate-high CL. 5/16, 4/16, 4/16 and 3/16 moderate-high CL DUAs were located around the left sided-, right sided PV ostia, LA walls, right atrium (RA) or superior vena cava (SVC), respectively. The average mIBG uptake of moderate-high CL DUA was 1417.5 [1240;1940]. At follow-up a total of 33 DUA were identified, 16 (48%) of which (median per individual 1 [1;1], p=0.5 vs baseline) had moderate-high CL. Moderate-high CL DUAs had generally the same location (5/16 left sided PV ostia, 4/16 right sided PV ostia, 3/16 LA walls, 4/16 RA or SVC), and the same average mIBG uptake 1977 [1560;2503] as baseline procedure (p=0.36).

A total of 47 DUA were identified in AF patients at baseline, 37 (79%) of which (median per patient 2 [2;3], p=0.01 vs HI) had moderate-high CL. For moderate-high CL DUA the most common locations were left sided PV ostia (13/37) and LA walls (14/37) and the average mIBG uptake was 1336 [1003;1770] (p=0.42 vs HI). After CAP a total of 30 DUA were identified, 15 (50%) of which (median per patient 1 [0.25;1], p<0.01 vs baseline) had moderate-high CL. For moderate-high CL DUA the most common locations were left sided PV ostia (7/15) and right sided PV ostia (6/15) and the average mIBG uptake was 1327 [867;1879] (p=0.78 vs baseline).

Conclusion
There are significant differences in the total number and the moderate-high CL number of DUA between HI and AF patients on baseline imaging. mIBG image guided catheter ablation of DUA in AF patients reduces the
number of DUA on post-procedure follow-up mIBG imaging. The average number of moderate-high CL DUA in post ablation AF patients is similar to that seen in HI.