Pulmonary veins anatomy monitoring before and after RF ablation using a dynamic contrast enhanced MR angiography

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Introduction

Recently, the RF ablation intervention became an efficient method to treat atrium fibrillations. Contrast enhanced (CE) MRA has been already shown as useful tool offering valid information about pulmonary veins anatomy for ablation planning. We use CE MRA to compare size of pulmonary veins before and after the ablation and to monitor possible changes in vessel cross-sectional area (CSA) in long time follow-up.

Method

Group of 16 patients were examined before and after RF ablation, 8 of them also after 3 month.

CE MRA were done on Siemens Vision 1.5T with 3D GE FLASH sequence (TE=1.2 ms, TR=3.2 ms, α=90°). Volume of 30 slices (THK=3.4 mm) was scanned 3-4 times with simultaneous application of contrast agent (20ml of Multihance, AltanaPharma, rate 3 ml/s). Interpolated spatial resolution was 1.4x1.7x1.7 mm, time resolution 6-9 s.

CSA was measured semi-automatically using manually selected multi-planar reconstructions positioned perpendicularly to main vessel direction. After selection of the hot point inside the vein, CSA was found as all connected pixels having the signal intensity not lower then 66% of the average value from the hot point neighborhood. If necessary, manual editing to correct the auto-procedure was used. The area of vein cross-section was measured in several MPR slices running from atrium inlet to the first relevant bifurcation (10-20 mm). Then the CSA function was interpolated into the resolution of 2 mm along the entire measured distance and these courses from all examinations were compared both graphically and quantitatively for each main pulmonary vein separately.

Results

After RF ablation, 5 (8%) significant stenosis with the CSA decreased below 50 % were found. However we also found diffuse decrease of CSA down to 50-80% in next 20 veins (31%). A situation for all patients and 4 main veins is shown in fig.1. Only 8 subjects from 16 could be examined also after 3 months (black columns in fig.1). During this follow-up control, an improvement in 7 cases of CSA mild reduction (from 11 affected veins in the post-ablation control) was found but both checked veins previously reported with high degree stenosis remained unchanged.

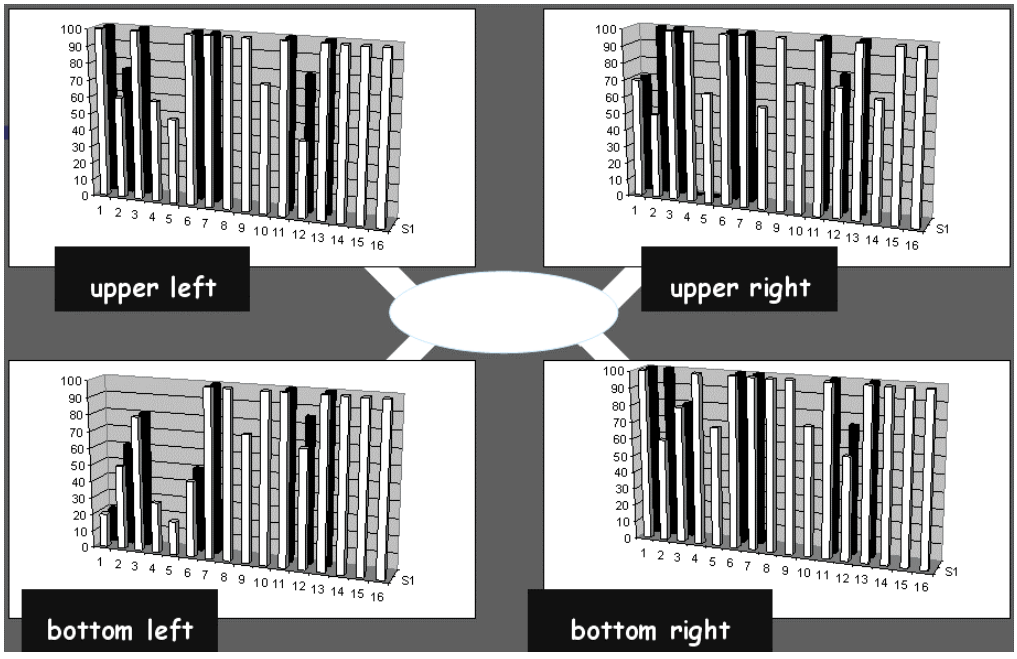

Fig.1. A relative change of CSA [%] immediately after the RF ablation (white columns, 16 subjects) and also after 3 months (black columns, 8 subjects) in 4 main pulmonary veins is shown. Since subjects are sorted according to the time of the treatment, the tendency of the reduction of the RF ablation incidence on the vein CSA is apparent. This could be also due to the technological improvement of the RF ablation procedure including the use of complete morphological information from CE MRA during the procedure planning.

Discussion

CE MRA is an ideal tool to visualize and control pulmonary vein anatomy before and after the RF ablation. Our data suggest that in more cases of insignificant decrease of CSA due to the ablation there is a tendency of reparation (in 7 from 11 veins, 64%). However, all examined significant stenosis remained stable after 3 month. The most affected vessel in our group of patients was bottom left vein.

This project was supported by IGA MZCR NA 7381-3/3003