

## 6. Summary

### VENOUS MR ANGIOGRAPHY USING SUPERPARAMAGNETIC IRON OXIDE PARTICLES AS AN ANGIOGRAPHIC CONTRAST MEDIUM: EXPERIMENTAL STUDIES IN RATS WITH THROMBI DIFFERENT AGES

A study was performed to detect and characterize thrombi in venous vessels by MR Angiography. This was for the first time done using iron-based nanoparticles (DDM 43/34) at a dosage of 30 micromol/kg. For histologic demonstration of the nanoparticles, 42 rats having received DDM 43/34 (6 thrombus age groups each comprising 7 animals) and 3 controls without DDM 43/34 administration were examined. One animal each was killed to examine intravascular thrombus induction by laser and electric current. The 42 animals examined angiographically and histologically immediately after administration of DDM 43/34 all showed a thrombus about 1 cm in length which did not extend beyond the vascular diameter of 2 mm.

Another aim was to establish a thrombus model in rats. Histology showed that thrombus induction by electric current and laser beams did not produce adequate results. Histology and MR angiography (1.5-Tesla clinical MR imager) of thrombi of different age induced surgically by means of thrombin in the jugular vein of Wistar rats yielded the following results:

- Thrombi are depicted by MR angiography as signal voids.
- SPIO-enhanced MR angiography achieves adequate vessel contrast and reliable thrombus detection in animal experiments.
- As a result of the size of the lesions (thrombi), incomplete histologic specimens and partial volume effects at MR angiography make it difficult to compare the results of angiography and histology.
- Clinical MR imagers have a lower resolution than light microscopy and image acquisition time is very long, resulting in poor image quality in living animals due to blurring.
- The contrast medium DDM 43/34 has angiographic effects at extremely low doses.
- This study for the first time used nanoparticles for the visualization and characterization of thrombi. Further investigations are worthwhile and more promising if, for instance, the particles can be coupled with suitable antibodies directed against epitopes of thrombi (and the resolution of MR imagers is improved further).
- With current technology, the use of DDM 43/34 in MR angiography provides good information on presence or absence but only moderate information on the morphology of thrombi in rats.