# A Multiple Coil Array Approach for Mouse Brain Tumor Imaging

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**Introduction:** Multiple Mouse MR imaging is used in early preclinical cancer research to increase throughput. This approach significantly reduces the imaging time and allows large cohorts of animals to be studied at identical conditions. This capability is critical in applying MRI to genetically engineered, orthotopic, and metastasis mouse tumor models in order to evaluate experimental therapeutic compounds. In the present study, we demonstrate the use of a four-mouse coil surface array system with a 3.0 T whole-body clinical scanner in a serial imaging study of a mouse brain metastasis model.

**Materials and Methods:** The four mouse SENSE array system is shown in Figure 1a. It consists of four 22 mm diameter coils made of two loops of 16 gauge magnet wire with a 30 mm center to center spacing. Mouse beds, nose cones, waste gas recovery, and heating system are incorporated in order to facilitate animal handling in a single construction fabricated with polycarbonate [1]. Images were acquired in a 3.0 T whole-body clinical scanner (Achieva, Philips Healthcare, Best, NL). The animals tail veins were catheterized, the animals were anesthetized with isoflurane, and placed in the coil in a supine position so that the mouse brains were in the center of the each coil. Respiratory pillow sensors were taped around the abdomen of each mouse. Multislice T2-weighted turbo spin echo (T2W-TSE) followed by a 3D T1-weighted Fast Field Echo (3D T1W-FFE) were acquired. The latter scan was repeated after administration of Gd contrast media (Magnevist) through the catheters using a multiple syringe infusion pump.

Serial multiple mouse brain imaging sessions were performed on 18 mice every week for six weeks after intracardiac injections of a brain-selective cancer cells in athymic/nude mice. The metastatic cancer cell sub-line used in the study was produced from MCF7-Her-2 human breast cancer cells after four rounds of cycling intracardiac injections and metastasis to the brain through athymic/nude mice.

**Results and Discussions:** The onset of the tumors was detected as hyperintense regions in the T2W-TSE images as early as 4 weeks post intracardiac injection (Figure 1b). Post contrast T1W-FFE images showed significant enhancement of the tumor periphery with relatively dark tumor core. The images demonstrated the development of a large metastasis in the mouse brain. However, tumors did not occur or grow similarly among the animals and brain tumors were detected in only six of the 18 mice. The imaging time was about 35 minutes so that the whole cohort took less than four hours to image with the 4-mouse array. If performed individually, it would have taken over 12 hours to image the whole cohort. For a study involving a larger cohort, we can shorten imaging time by eliminating the contrast injection which also added significant set-up time since the T2W images were sufficient to detect the tumor.

In conclusion, imaging of multiple mouse brains with a four mouse array produced high quality scans suitable for following metastatic lesions to the brain. The use of a multiple mouse brain coil in a whole-body clinical scanner significantly improves the efficiency of an MRI experiment involving the serial imaging of multiple small animals.

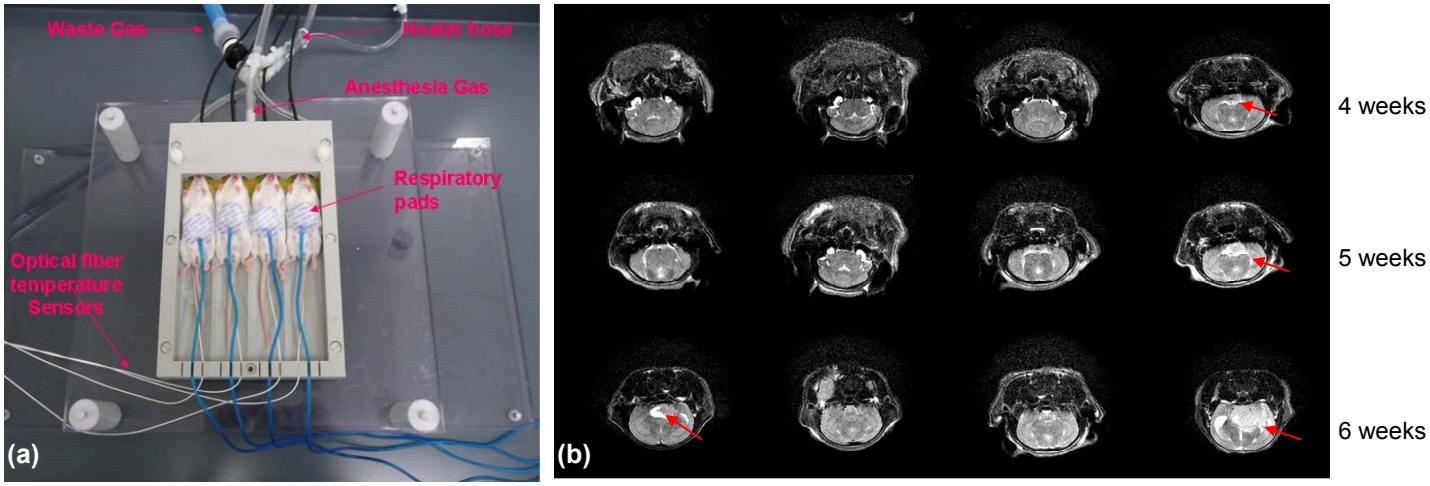


**Figure 1.** (a) The four mouse array coil with incorporated mouse beds, nose cones, waste gas recovery, and heating system; (b) T2w images obtained on four mice with the coil array show tumor progression in 3 consecutive weeks. TE 100 ms, SENSE P4, FOV 120, 0.5mm 36 slices, Matrix 1024.

## Reference:

[1] Bernardo M. and Choyke P., Proc. Intl. Soc. Mag. Reson. Med. **17**, 4737 (2009).