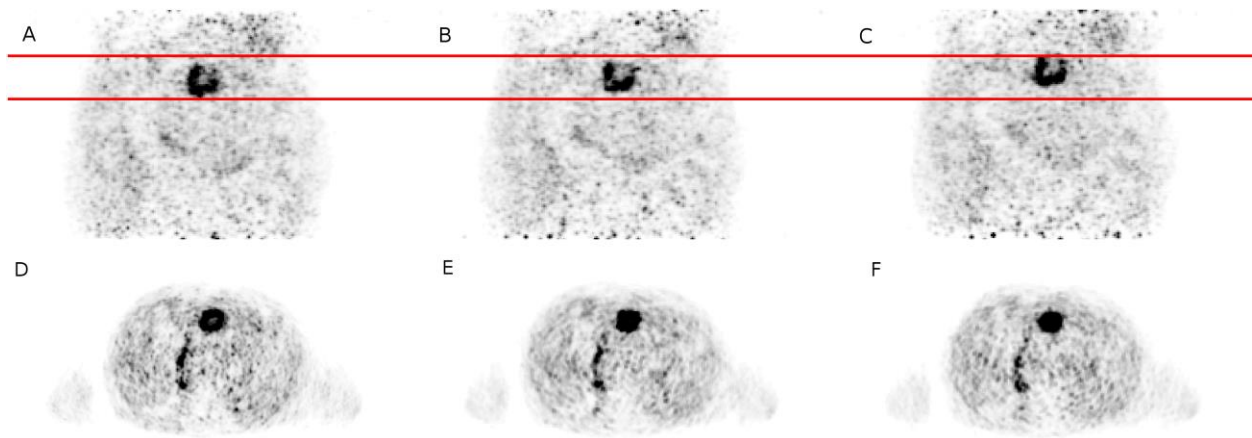
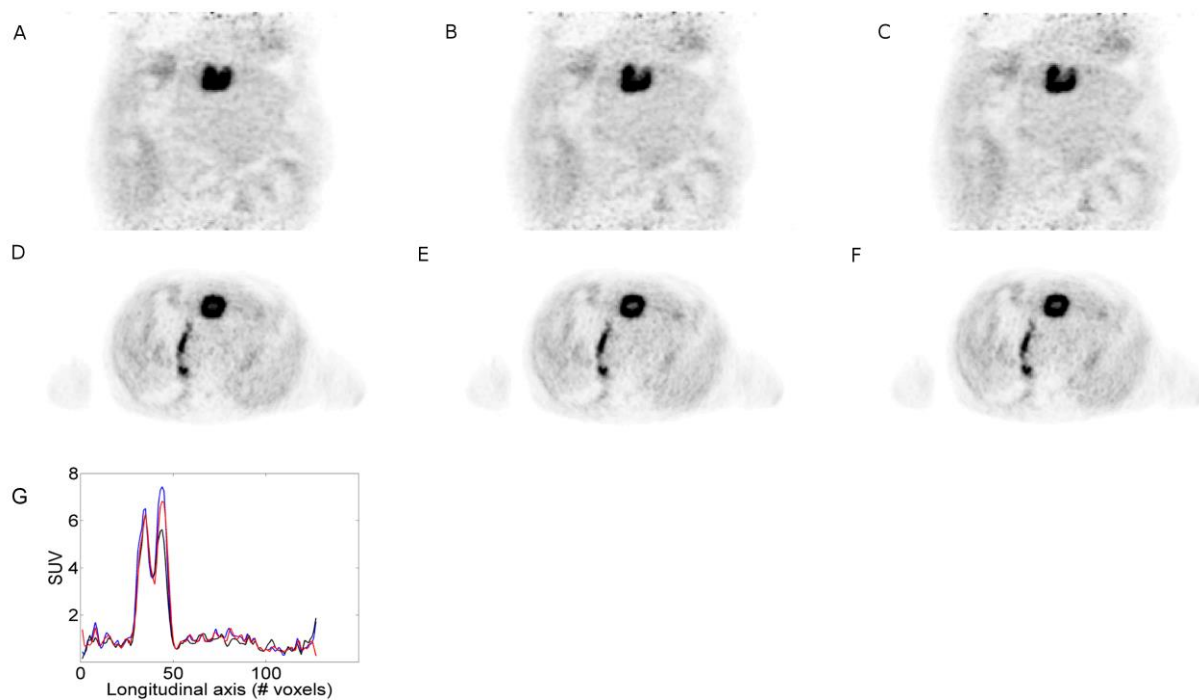


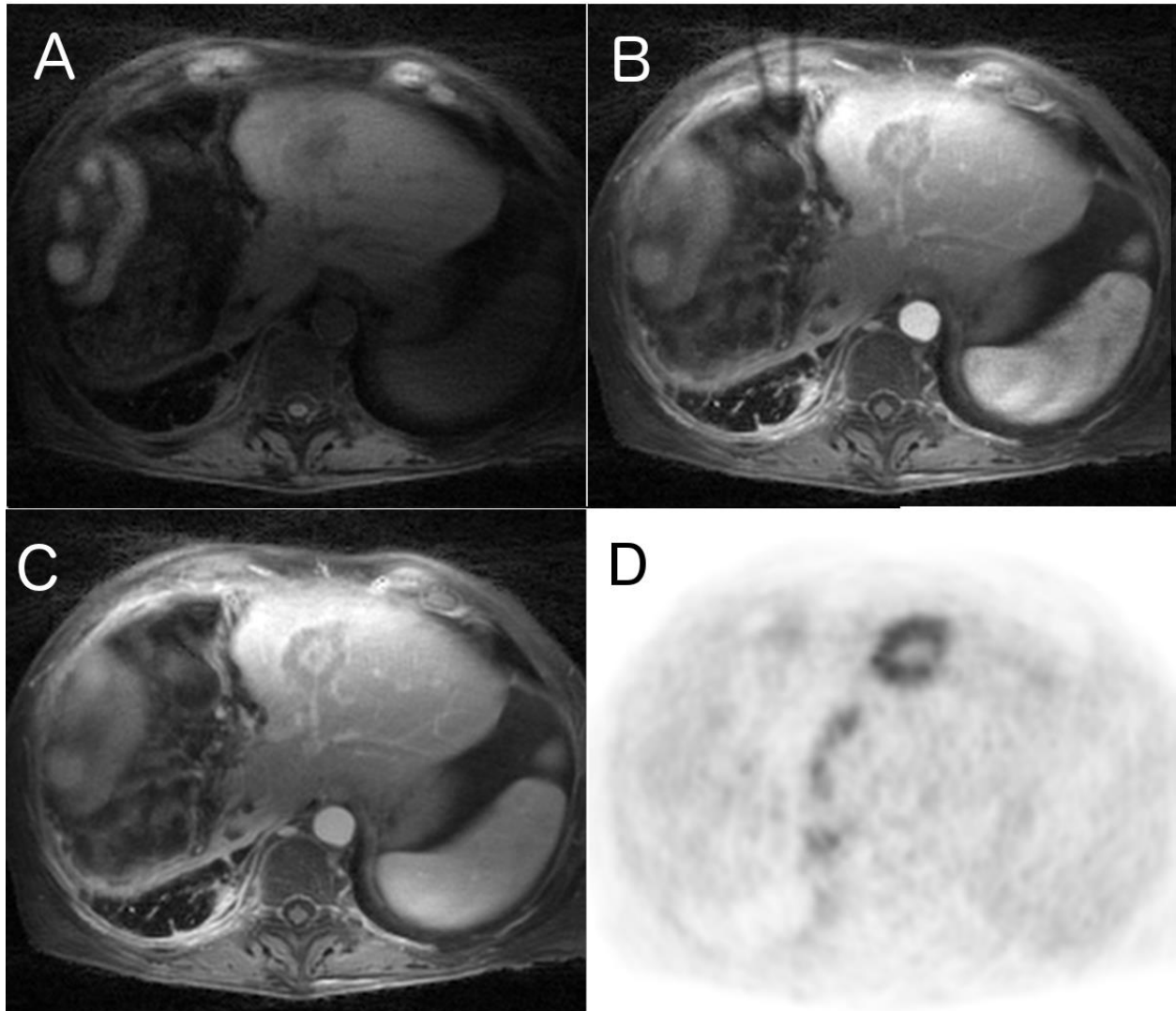
**Supplemental Figure 1:** MRI images for the end-of-inspiration (A,C,E) and end-of-expiration (B,D,F) respiratory phases for patient 1. Supplemental Figs. 1A and 1B a 6 min radial\_VIBE acquisition using GRASP reconstruction ( $MC_{6\text{-min}}$ ); C,D show a 1 min radial\_VIBE acquisition using GRASP reconstruction ( $MC_{1\text{-min}}$ ); and Supplemental Figs. 1E and 1F show a 1 min radial\_VIBE acquisition using non-iterative reconstruction ( $MC_{1\text{-ift}}$ ).



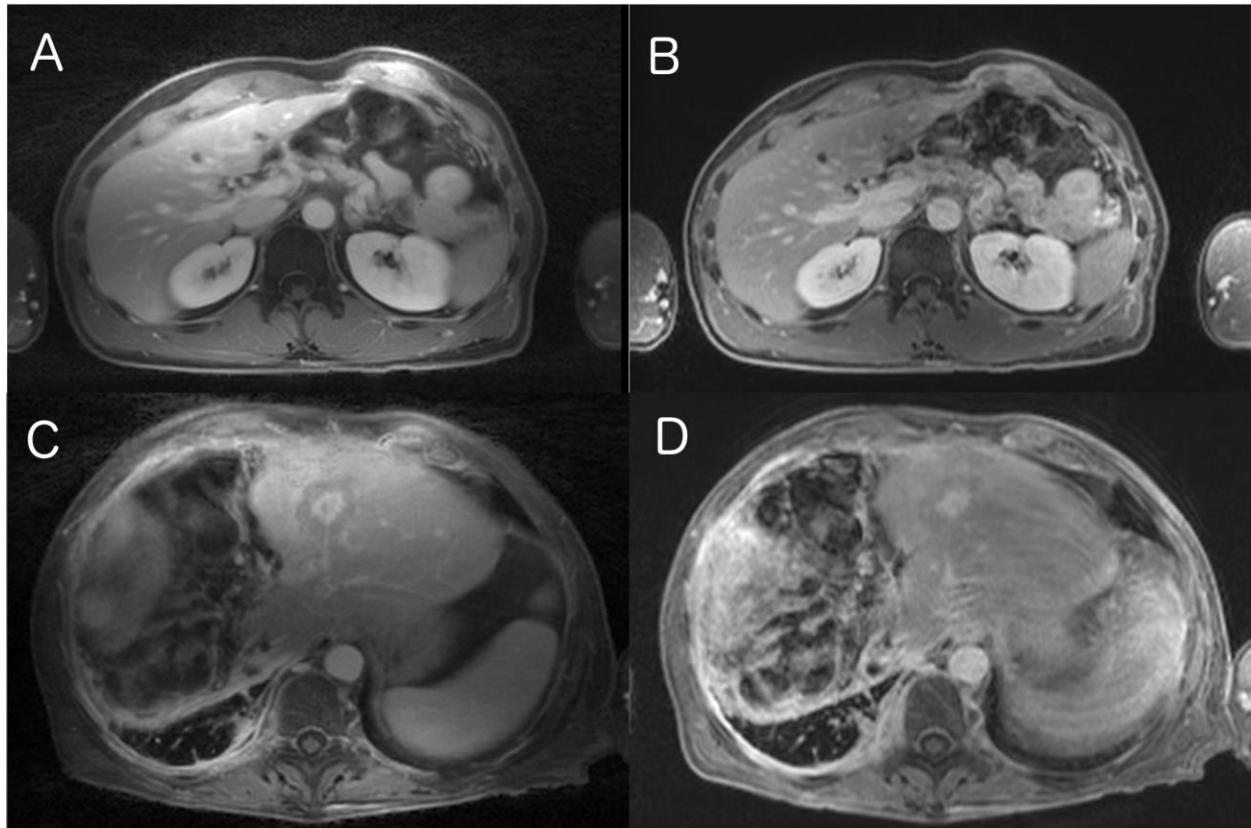
**Supplemental Figure 2:** PET reconstructions for different respiratory gates, showing a coronal slice (A,B,C) and an axial slice (D,E,F) through a lesion in the liver of patient 8. Supplemental Figs. 1A and 1D show an end-inspiration motion phase; Supplemental Figs. 1B and 1E show an intermediate phase; and Supplemental Figs. 1C and 1F show an end-of-expiration phase.



**Supplemental Figure 3:** Comparison of uncorrected (A,D), MC<sub>1-min</sub> (B,E) and MC<sub>6-min</sub> (C,F) PET reconstructions for patient 8; showing the coronal slice presented in Supplemental Fig. 2. The plots in Supplemental Fig. 2G show line profiles through the lesion for the three reconstructions methods: black - non motion-corrected; red - MC<sub>1-min</sub>; and blue - MC<sub>6-min</sub>.



**Supplemental Figure 4:** DCE-MRI images of the liver using moco\_GRASP reconstruction (A,B,C), together with the corresponding motion-corrected PET image (D), showing an axial slice through a lesion in the liver of patient 8. Supplemental Fig. 3A shows the non-contrast enhanced phase, Supplemental Fig. 3B shows the hepatic arterial dominant phase, and Supplemental Fig. 3C shows the portal venous phase.



**Supplemental Figure 5:** Comparison of late phase of DCE-MRI images obtained from radial\_VIBE acquisitions using the moco\_GRASP reconstruction method (A,C), and from cartesian bh\_VIBE acquisitions (B,D). Supplemental Figs. 4A and 4B show an axial slice through the liver of patient 4 and Supplemental Figs. 4C and 4D show an axial slice through a lesion in the liver of patient 8.