Supplemental Fig. 1: Effect of the weighting factor on parametric imaging of FDG $K_i$ and $K_1$ for a patient dataset. (A) by a nonuniform weighting scheme; (B) by the uniform weight. While the $K_i$ images by the two schemes are similar, the uniform weighting may avoid a potential underestimation of $K_1$ in an osteolytic lesion.

Supplemental Fig. 2: Example of total-body dynamic FDG-PET images and regional TACs of two patients with metastatic renal cancer. Shown are maximum intensity projection (MIP) images. (A) and (B) show the results from a patient with lesions demonstrating higher FDG uptake in the late phase than the early phase. (C) and (D) from another patient show higher FDG uptake in the early phase (0-2 minutes) but lower FDG uptake in the late phase (40-60 minutes) in the lesions.
**Supplemental Fig. 3:** The impact of time delay correction on $K_1$ and $K_i$ quantification is increased with higher fractional blood volume $v_b$. (A) plot of the percent change in $K_1$ versus the fractional blood volume $v_b$; (B) percent change in $K_i$ versus $v_b$. The increased impact on kinetic quantification can be explained by that the vascular time course, as shown in Fig. 1B, may be estimated more accurately with time delay correction, which in turn improves the estimate of the extravascular time course significantly if $v_b$ is large, leading to the changes in the $K_1$ and $K_i$ estimates.

**Supplemental Fig. 4:** Comparison of standard SUV image with parametric images of FDG influx rate $K_i$, fractional blood volume $v_b$, FDG delivery rate $K_1$ and volume of distribution $V_0$ images of a healthy subject. Shown are maximum intensity projection maps.
**Supplemental Fig. 5:** SUV and multiparametric images of a patient with cancer. (A) SUV and $K_i$ images (overlaid on CT) of the liver; The solid and dashed arrows point to two liver lesions. Both lesions are more visible with higher contrast on the $K_i$ image; (B) SUV and $K_1$ images of the head. The solid arrow points to an osteolytic lesion and the dashed arrow points to the brain. While the SUV image (and $K_i$ image, results not shown) demonstrated high uptake in the brain background, the $K_1$ value was low in the brain but high in the osteolytic lesion.

**Supplemental Fig. 6:** Initial simulation study of the effect of temporal resolution on estimation of time delay and FDG $K_1$. (A) example of simulated noisy TAC with 2s/frame in the first minute. The simulation was conducted using a lesion kinetic parameter set ($t_d=7s$, $v_b=0.3$, $K_i=0.7$, $k_2=0.9$, $k_3=0.02$, $k_4=0$) that was extracted from one patient and with 1000 noisy realizations; (B) root mean squared error (RMSE) of time delay $t_d$ estimation. RMSE was lower with 2s/frame than with 10s/frame; (C) RMSE of FDG $K_1$ estimated with and without time delay correction (TDC). The RMSE
became higher with 2s/frame than with 10s/frame, hypothetically because of the higher noise in the 2-s time bins and different effect on different kinetic parameters.