Novel Method to Detect and Characterize F-18 FDG Infiltrations in PET Injections

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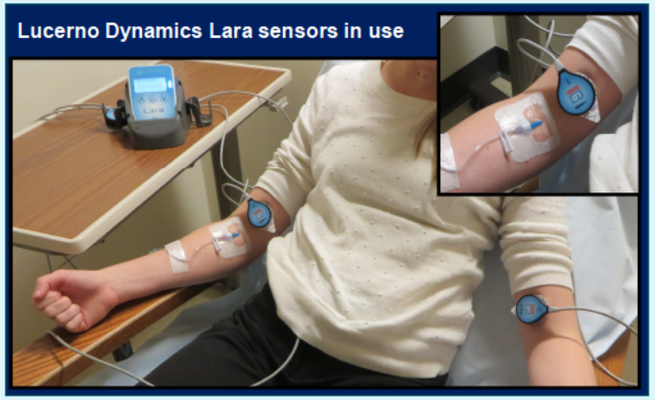
BACKGROUND

- Since the introduction of PET/CT, numerous studies have shown that whole-body dual-modality imaging is better than PET or CT alone for staging and restaging most cases of cancer. (1-4)
- The use of PET/CT has been advocated as a first-line imaging technique for whole-body tumor staging, restaging, and assessing response to therapy for different types of neoplasms. (5)
- The standardized uptake value (SUV) is commonly used as a relative measure of the labeled tracer uptake. The SUV is a ratio of the radioactivity concentration in an area of interest to the decay-corrected amount of radiolabeled tracer divided by the patient's weight.
- Variability in PET/CT protocols affects image quality and quantification; F-18 FDG infiltrations may be a contributing factor.
- Because infiltrations impact both the rate of delivery and the dose, the image quality and effect on SUVs can vary dramatically. (6)
- Reported infiltration rates (9-21%) are underestimated because injection sites can fall outside of standard imaging Field Of View (FOV). (7-10)

Lucerno Dynamics Lara sensors in use



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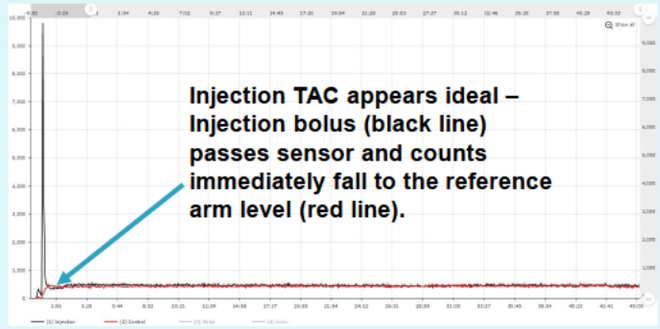
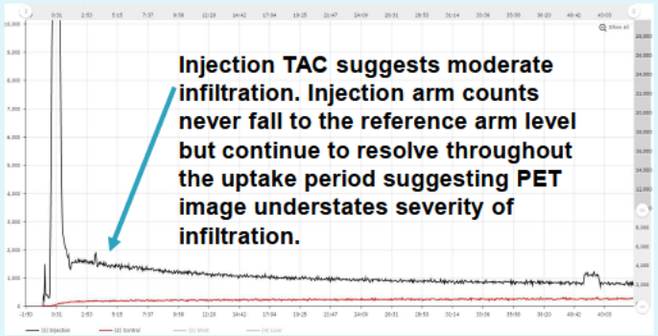
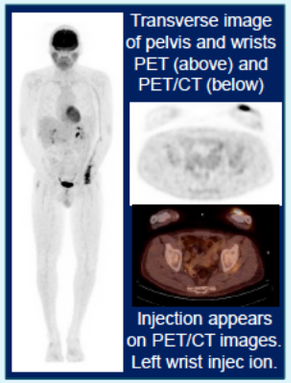
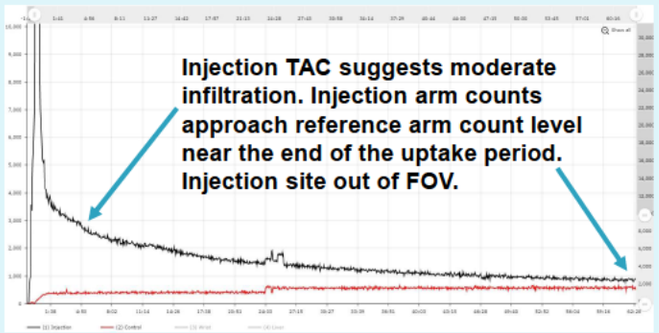


PET/CT image recorded ~25 minutes post-TAC.



PET/CT image recorded ~27 minutes post-TAC.





PET/CT image recorded ~10 minutes post-TAC.

OBJECTIVES

A novel Quality Control (QC) device uses Time Activity Curves (TACs) to dynamically characterize the quality of an F-18 injection during the uptake period. The study has two aims: Aim 1 - validate sensor TACs, and Aim 2 - compare standard clinical PET images to sensor results for infiltration detection/characterization.

MATERIALS AND METHODS

- Before injection of F-18, gamma sensors were applied to patient's skin with adhesive pads near the injection site and mirrored on the other arm.
- Patients were asked to relax during their standard clinical uptake with the sensors still in place.
- Head-to-toe FOV PET/CT images were acquired ~70 minutes post injection.
- Injection sites were examined for presence of moderate or significant infiltrations. TACs generated from the applied sensors were independently examined and then compared to image reports.

RESULTS

- Dynamic images were acquired in 16 patients and agreed with the sensor Time Activity Curves in 100% of cases.
- Physician review of static images using head-to-toe FOV for 27 patients, undergoing standard clinical image uptake processes, found visible evidence of moderate or significant infiltration in 5/27 cases (18.5%).
- Sensor Time Activity Curves on the same 27 cases the physicians reviewed identified moderate or significant infiltration in 6/27 (22%) cases. In one patient the sensor TAC identified a moderate infiltration that was not visible on the image since the hand injection site was outside the FOV. Additionally, two Time Activity Curve infiltrations were classified differently than the physician report.

CONCLUSIONS

Dynamic images support sensor TAC results. Sensor TACs provide valuable information to identify infiltrations even if injection sites are outside the FOV. Since injection sites are often out of the FOV and since infiltrations impact image quality and quantification, sensor TACs can be a valuable QC tool. Reducing the rate of infiltrations may help minimize variability in PET/CT results.