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IMAGE OF THE MONTH

Impact of patient motion on parametric PET imaging

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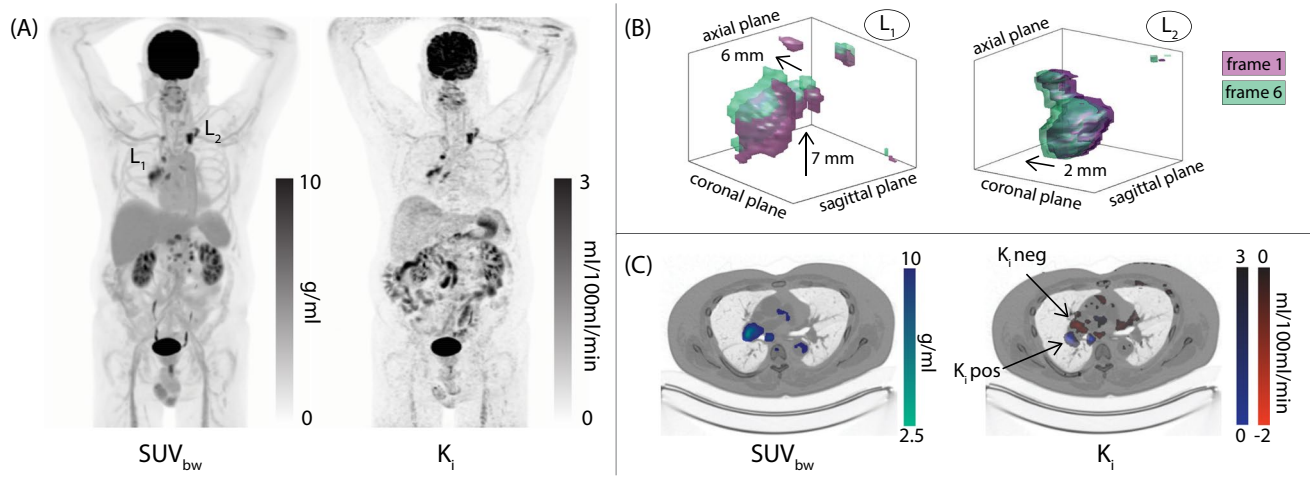

A 64-year-old male patient, newly diagnosed with Hodgkin lymphoma, underwent dynamic total-body [^{18}F]FDG PET/CT imaging. The PET list mode data was binned into frames, and the tomographic images were reconstructed following a previously published protocol [1]. The net influx rate (K_i) image was obtained from dynamic PET images by applying the Patlak graphical method, and subsequently, it was compared with the standardized uptake value image normalised to body weight (A). The patient displayed hypermetabolic lymph nodes in the mediastinum (referred to as lesion L_1) and in the left lung (L_2). Upon comparison between PET frames, a misalignment in the lung position, and consequently in the lesion positions, were observed and ultimately associated with the patients' respiratory motion patterns. The largest misalignment was observed between the first and last frames, and the corresponding frame overlap is depicted in Figure (B). The position of the lesion L_1 across the PET frames varied, amounting to approximately 6–7 mm along the coronal and axial plane (B-left), while a modest movement of approximately 2–3 mm was detected for lesion L_2 (B-right). These mismatches in the lesion position throughout the acquisition window led to inaccurate parametric net influx rate assessments. The K_i image showed (i) a reduced volume of the L_1 lesions ($\Delta V = 3.3$ cm^3, -15%) and (ii) the emergence of negative K_i values, primarily within the regions most affected by motion (C). The K_i image artefacts compromise the accuracy of tumour metabolic rate evaluation, carrying significant clinical implications, especially within the domain of oncology [2]. Considering the expanding role of parametric analysis in clinical practice [3, 4], the effective identification and correction of artefact sources in parametric image data represent a central challenge in the translation of this research into clinical application.

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Author contribution All the authors contributed to the study conception and design. Material preparation and data collection were made by Johannes H. van Snick and Joyce van Sluis. Data analyses were performed by Alessia Artesani under the guidance of Joyce van Sluis, Laura Providência, and Charalampos Tsoumpas. Walter Noordzij had the clinical oversight of the study. Charalampos Tsoumpas was responsible for the overall project. The first draft of the manuscript was written by Alessia Artesani and Charalampos Tsoumpas, and all the authors commented on the previous versions of the manuscript. All the authors read and approved the final manuscript.

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Data availability The datasets generated during and/or analysed during the current study cannot be available due to ethics restrictions.

Declarations

Ethics approval This is an observational study. The UMCG Research Ethics Committee has confirmed that no ethical approval is required.

Consent to participate Informed consent was obtained from the participant included in the study.

Consent for publication The authors affirm that human research participant provided informed consent for publication of the images in Figure.

Competing interests Authors J. S. and CT declare collaboration and funding from Siemens Healthineers. All the other authors declare they have no financial interests.

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