Lesion concordance, image quality and artefacts in PET/CT: results of a multicenter study.

Abstract:
This study had three major objectives: 1.) to record the number of concordant (both in PET and CT) pathological lesions in different body regions/organs, 2.) to evaluate the image quality and 3.) to determine both, the quantity and the quality of artefacts in whole body FDG PET/CT scans. Routine whole body scans of 353 patients referred to FDG-PET/CT exams at 4 university hospitals were employed. All potentially malignant lesions in 13 different body regions/organs were classified as either concordant or suspicious in FDG-PET or CT only. In the latter case the diagnostic relevance of this disparity was judged. The image quality in PET and CT was rated as a whole and separately in 5 different body regions. Furthermore we investigated the frequency and site of artefacts caused by metal implants and oral or intravenous contrast media as well as the subjective co-registration quality (in 4 body regions) and the diagnostic impact of such artefacts or misalignment. In addition, the readers rated the diagnostic gain of adding the information from the other tomographic method. In total 1941 lesions (5.5 per patient) were identified, 1094 (56%) out of which were concordant. 602 (71%) out of the 847 remaining lesions were detected only with CT, 245 (29%) were only PET-positive. As expected, CT particularly depicted the majority of
lesions in the lungs and abdominal organs. However, the diagnostic relevance was greater with PET-only positive lesions. Most of the PET/CT scans were performed with full diagnostic CT including administration of oral and intravenous contrast media (> 80%). The image quality in PET and CT was rated excellent. Artefacts occurred in more than 60% of the scans and were mainly due to (dental) metal implants and contrast agent. Nevertheless there was almost no impact on diagnostic confidence if reading of the non attenuation corrected PET was included. The co-registration quality in general was also rated as excellent. Misalignment mostly occurred due to patient motion and breathing and led to diagnostic challenges in about 4% of all exams. The diagnostic gain of adding PET to a CT investigation was rated higher than vice versa. As the image quality in both PET and CT was more than satisfying, CT-artefacts almost never led to diagnostic uncertainties and serious misalignment rarely occurred, PET/CT can be considered as suitable for routine use and may replace single PET- and CT-scans. However, additional reading of the non attenuation corrected PET is mandatory to assure best possible diagnostic confidence in PET. Since approximately half of all lesions found in PET/CT were not concordant, at least in a setting with a diagnostic CT the exams need to be reported by both a nuclear medicine physician and a radiologist in consensus.