Comparison of different SUV-based methods for monitoring cytotoxic therapy with FDG PET.

Abstract:

PURPOSE: Fluorine-18 fluorodeoxyglucose positron emission tomography (FDG PET) is a promising tool for monitoring cytotoxic therapy in tumours. Due to the limited data available, a standard imaging protocol for the prediction of tumour response has not yet been approved. The aim of this study was to compare commonly applied imaging protocols and calculations of the standardised uptake value (SUV) for the early prediction of histopathological response to chemotherapy.

METHODS: Serial FDG PET scans of 43 patients with gastric carcinomas were retrospectively analysed. All patients received two consecutive scans (one bed position at 40 min p.i. and four bed positions at 90 min p.i.) at baseline and during the first cycle of cisplatinum-based chemotherapy. Reconstruction of the images was performed by filtered back-projection (FBP) and using an iterative algorithm (OSEM). SUVs were calculated with and without correction for the blood glucose level using normalisation by body weight, body surface area and lean body mass. Relative percentage changes between SUVs at baseline and follow-up were calculated and analysed for their potential to predict histopathological response to chemotherapy (ROC analysis). Response was defined as less than 10% viable tumour cells in the tumour specimen obtained by surgery 3-4 weeks after the completion of chemotherapy.

RESULTS: Eight of 43 patients were histopathological...
responders to chemotherapy. The percentage changes in SUV(body weight) for responders and non-responders were -52.2 (+/-13.2) and -25.2 (+/-15.2), -54.7 (+/-18.2) and -24.5 (+/-16.1), -53.9 (+/-24.2) and -22.7 (+/-21.3), and -56.7 (+/-21.6) and -26.1 (+/-18.9) for serial scans at 40-min FBP, 40-min OSEM, 90-min FBP and 90-min OSEM, respectively (responders versus non-responders: p<0.01 in each case). According to ROC analysis, neither the scan protocol nor correction for blood glucose significantly influenced the accuracy (approx. 80%) or the cut-off value (approx. -40% change in tumour SUV) for the prediction of response. Normalisation of SUVs by body surface area or lean body mass instead of body weight yielded essentially identical results. CONCLUSION: In gastric carcinomas the prediction of response to chemotherapy on the basis of relative tumour SUV changes is not essentially influenced by any of the methodological variations investigated (time delay after FDG administration, acquisition protocol, reconstruction algorithm, normalisation of SUV). This demonstrates the robustness of FDG PET for therapeutic monitoring and facilitates the comparability of studies obtained at different institutions and with different protocols. However, whichever method is used for therapy monitoring with FDG PET, a highly standardised protocol must be observed to take the dynamics of tumour FDG uptake into account.