Active Brown Fat During F-FDG PET/CT Imaging Defines a Patient Group with Characteristic Traits and an Increased Probability of Brown Fat Redetection.

Brown adipose tissue (BAT) provides a means of nonshivering thermogenesis. In humans, active BAT can be visualized by F-FDG uptake as detected by PET combined with CT. The retrospective analysis of clinical scans is a valuable source to identify anthropometric parameters that influence BAT mass and activity and thus the potential efficacy of envisioned drugs targeting this tissue to treat metabolic disease. We analyzed 2,854 F-FDG PET/CT scans from 1,644 patients and identified 98 scans from 81 patients with active BAT. We quantified the volume of active BAT depots (mean values in mL ± SD: total BAT, 162 ± 183 [ = 98]; cervical, 40 ± 37 [ = 53]; supraclavicular, 66 ± 68 [ = 71]; paravertebral, 51 ± 53 [ = 69]; mediastinal, 43 ± 40 [ = 51]; subphrenic, 21 ± 21 [ = 29]). Because only active BAT is detectable by F-FDG uptake, these numbers underestimate the total amount of BAT. Considering only 32 scans of the highest activity as categorized by a visual scoring strategy, we determined a mean total BAT volume of 308 ± 208 mL. In 30 BAT-positive patients with 3 or more repeated scans, we calculated a much higher mean probability to redetect active BAT (52% ± 25%) as compared with the overall prevalence of 4.9%. We calculated a BAT activity index (BFI) based on volume and intensity of
individual BAT depots. We detected higher total BFI in younger patients (p = 0.009), whereas sex, body mass index, height, mass, outdoor temperature, and blood parameters did not affect total or depot-specific BAT activity. Surprisingly, renal creatinine clearance as estimated from mass, age, and plasma creatinine was a significant predictor of BFI on the total (p = 0.005) as well as on the level of several individual depots. In summary, we detected a high amount of more than 300 mL of BAT tissue. BAT-positive patients represent a group with a higher than usual probability to activate BAT during a scan. Estimated renal creatinine clearance correlated with the extent of activated BAT in a given scan. These data imply an efficacy of drugs targeting BAT to treat metabolic disease that is at the same time higher and subject to a larger individual variation than previously assumed.