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ORIGINAL ARTICLE

Reduction in camera-specific variability in [^{123}I]FP-CIT SPECT outcome measures by image reconstruction optimized for multisite settings: impact on age-dependence of the specific binding ratio in the ENC-DAT database of healthy controls

Ralph Buchert[1] · Andreas Kluge[2] · Livia Tossici-Bolt[3] · John Dickson[4] · Marcus Bronzel[2] · Catharina Lange[1] · Susanne Asenbaum[5] · Jan Booij[6] · L. Özlem Atay Kapucu[7] · Claus Svarer[8] · Pierre-Malick Koulibaly[9] · Flavio Nobili[10] · Marco Pagani[11,12] · Osama Sabri[13] · Terez Sera[14] · Klaus Tatsch[15] · Thierry Vander Borght[16] · Koen Van Laere[17] · Andrea Varrone[18] · Hidehiro Iida[19]

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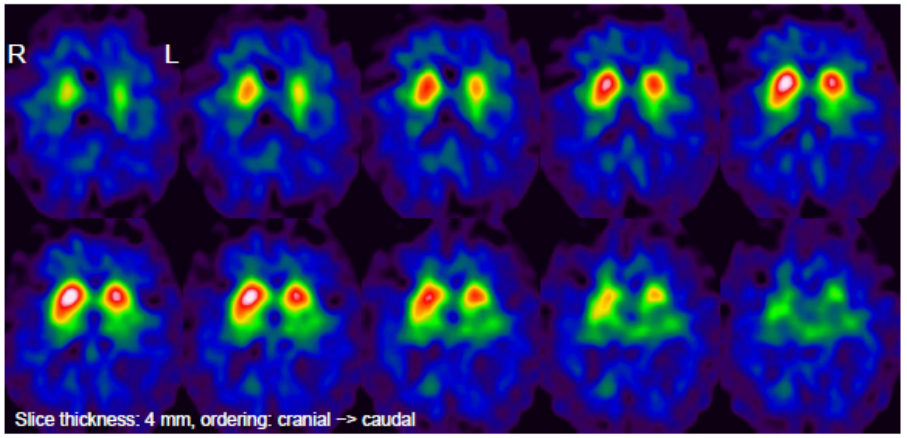
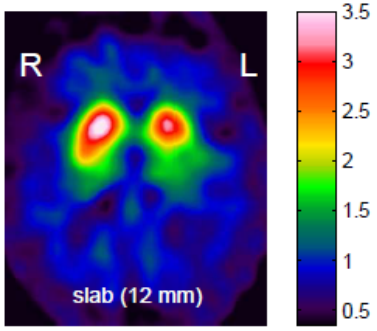
(Semi-)quantitative analysis

Name: sname, pname
Date of birth: 01.01.1900
Date of DaTSCAN: 30.01.2016
Patient ID: 4711

CHARITÉ
UNIVERSITÄTSMEDIZIN BERLIN
Klinik für Nuklearmedizin



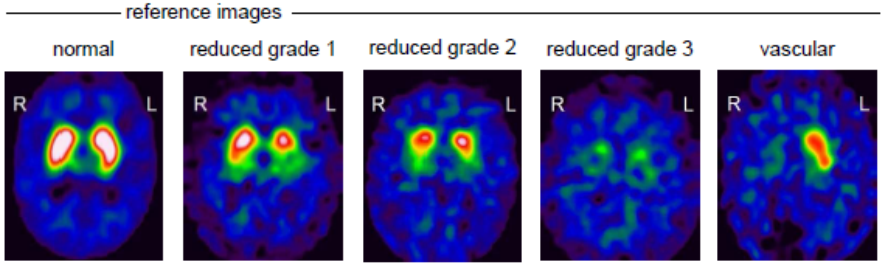


Dose: 180 MBq
Start of scan: 4 h p.i
Stereotactical normalization: MNI (SPM8)

Quantitative DVR analysis (104 controls):
Striatum: R = 2.73, L = 2.33 (Norm: >2.65)
Caudate: R = 3.13, L = 2.74 (Norm: >3.02)
Putamen: R = 2.36, L = 1.84 (Norm: >2.18)
Put/Caud: R = 0.64, L = 0.48 (Norm: >0.52)
Asym (%): Caud = 20.6, Put = 47.0 (Norm: <11.1)

cut-offs are site-specific…

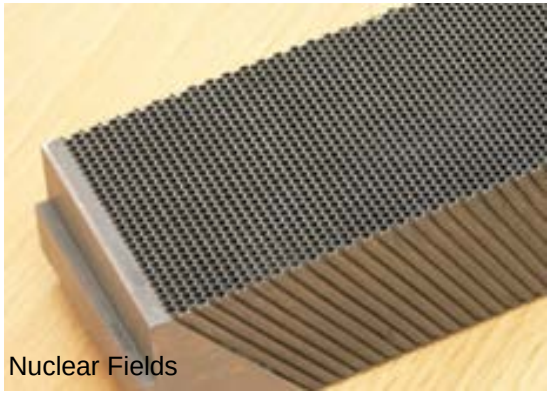
reference images



…depend on

- SPECT system

SPECT hardware



Nuclear Fields

+

reconstruction software

Samchannel

- analysis software (ROI, reference…)

QSPECT (Quantitative SPECT) by Hidehiro Iida et al.

to reduce SPECT system dependence by

- camera specific correction for scatter and septal penetration by transmission-dependent convolution subtraction
- automated detection of the outer contour of the head
- iterative OSEM reconstruction including attenuation correction
- camera specific calibration to kBq/ml.

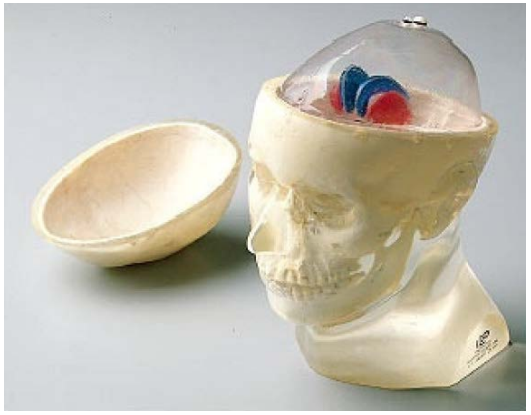
multicenter I-123-Iodoamphetamine brain perfusion SPECT

- Iida et al. JNM 2010; 51: 1624-31
- Yoneda et al. JCBFM 2012;32:1757–64

ENC-DAT patient data

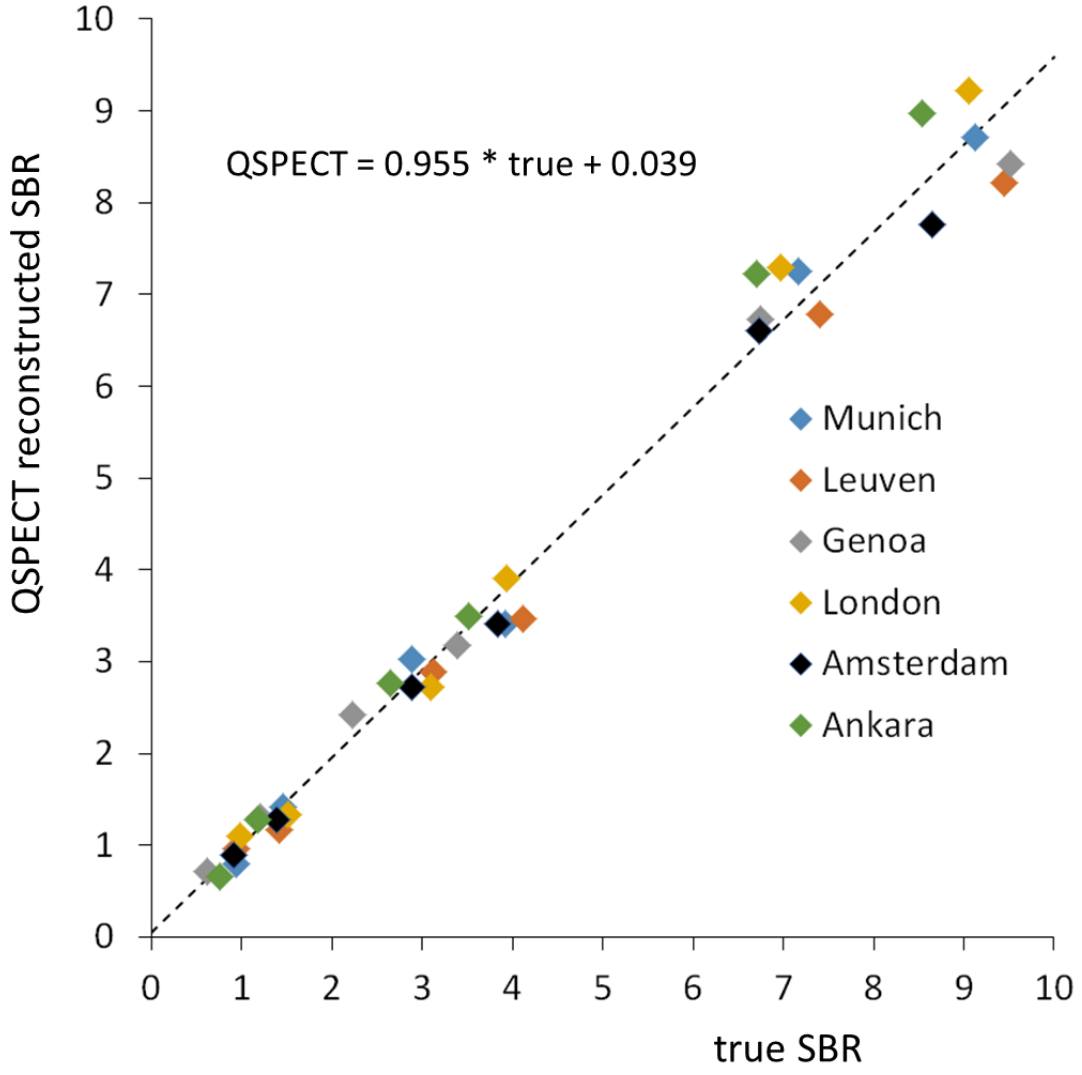
Centre	SPECT camera	n (male / female)	specific FP-CIT dose (MBq / kg bodyweight) mean ± SD (range)	Age range (mean ± SD)
Munich	Siemens Symbia	14 (7 / 7)	2.47 ± 0.49 (1.78-3.54)	23-74 (52 ± 17)
Leuven	Siemens ECAM	15 (9 / 6)	2.59 ± 0.40 (2.01-3.48)	20-78 (52 ± 18)
Genoa	GE Millennium VG	14 (7 / 7)	2.90 ± 0.58 (2.05-3.96)	27-82 (54 ± 19)
London	GE Infinia Hawkeye 4	10 (6 / 4)	2.37 ± 0.40 (1.62-3.09)	25-78 (61 ± 17)
Amsterdam	Siemens ECAM	7 (3 / 4)	2.40 ± 0.38 (1.94-2.89)	56-70 (63 ± 5)
Ankara	GE Infinia GP4	10 (5 / 5)	2.20 ± 0.42 (1.69-3.00)	21-74 (38 ± 16)
all		70 (37 / 33)	2.52 ± 0.50 (1.62-3.96)	20-82 (53 ± 18)

ENC-DAT anthropomorphic striatal phantom data

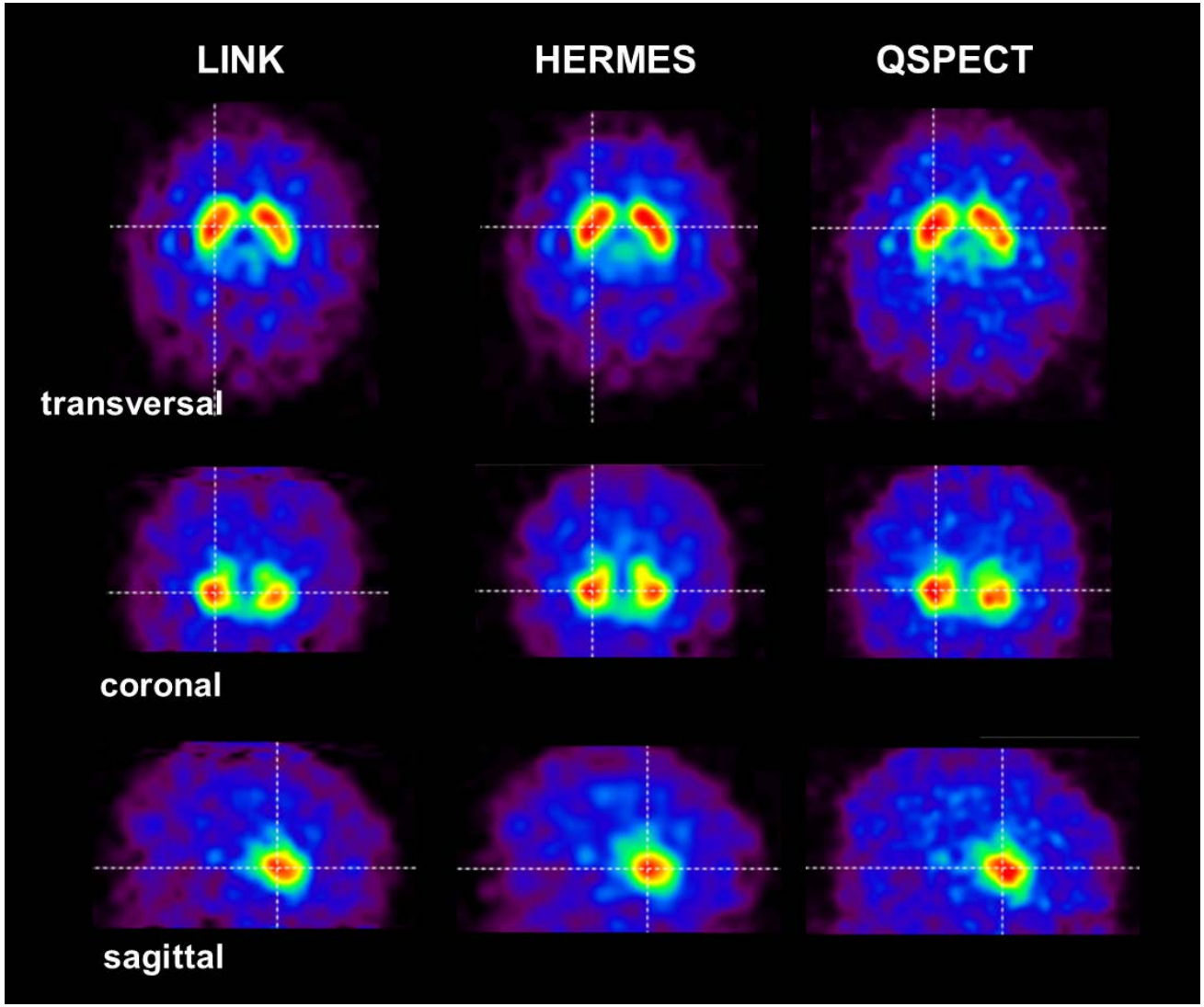


Tossici-Bolt et al.

EJNM 2011, 38:1529-40



Sample image

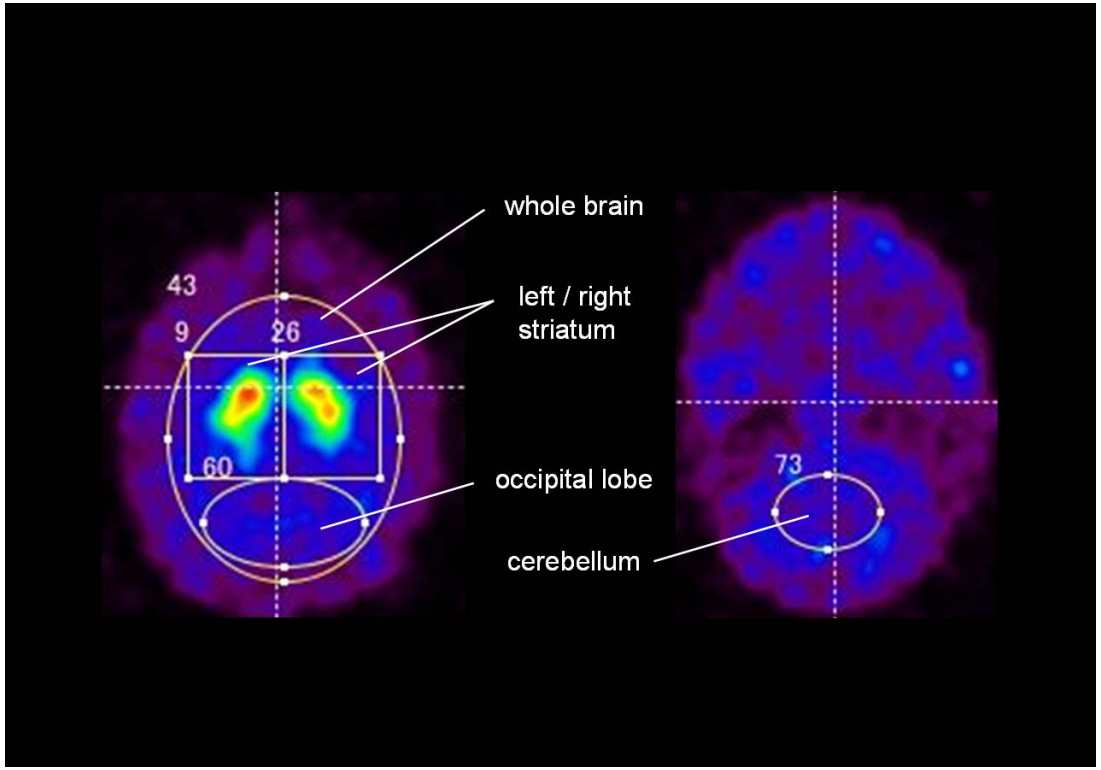


Southampton method: Specific Uptake Size Index (SUSI)

Fleming et al. Phys Med Biol 2004, 49: N227-34

$$SUSI = (T - C_R * V) / C_R$$

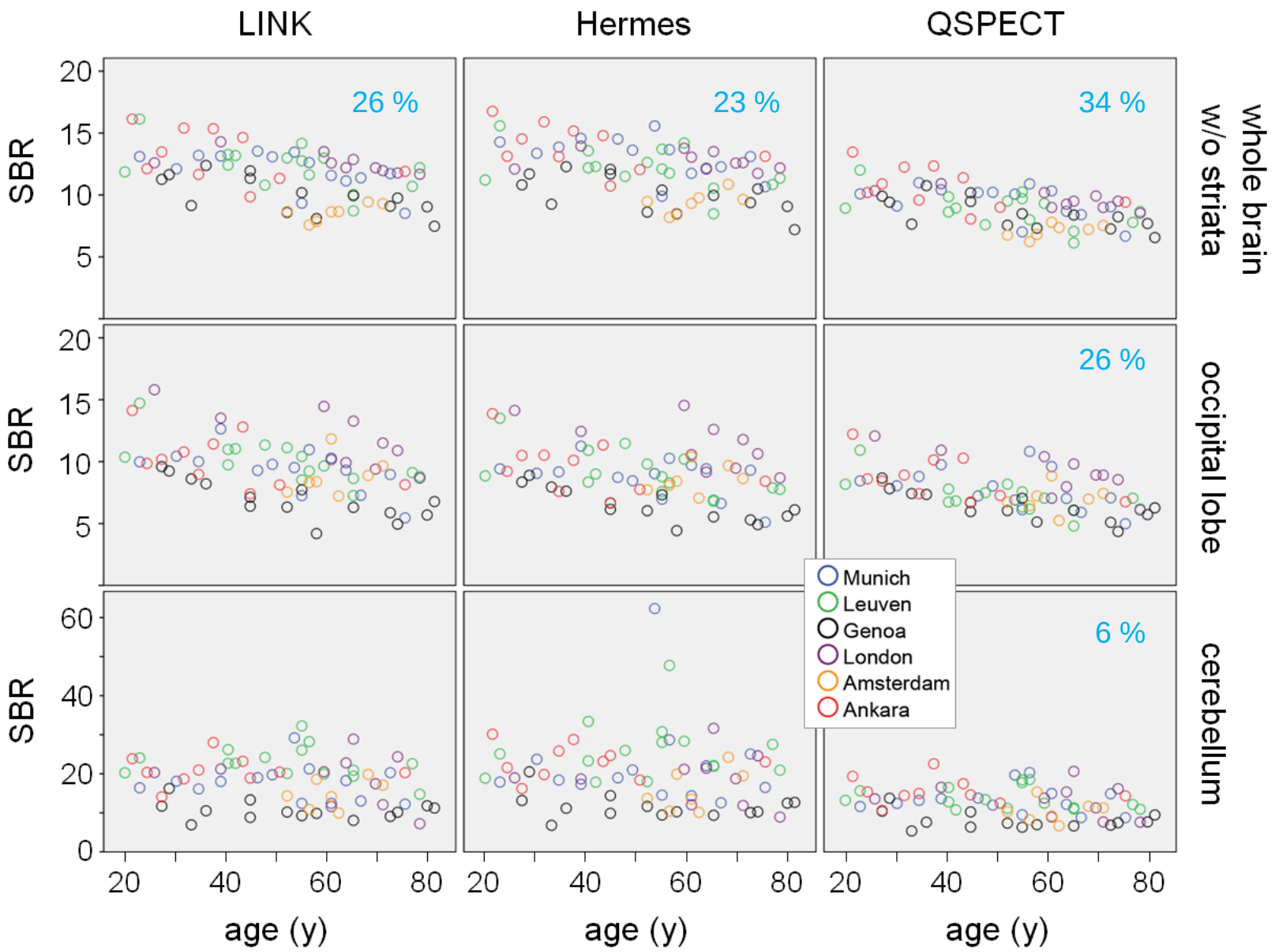
$$SBR = SUSI / Vs$$



not dependent on spatial resolution

Results

percentage of variance explained by age



Conclusions

- QSPECT reduces camera-specific inter-subject variability -> useful in multi-site and single-site multi-camera settings

- whole brain excluding striatal binding as reference provides more stable quantitative estimates than occipital or cerebellar binding