ΔSUV evaluation in DLBCL

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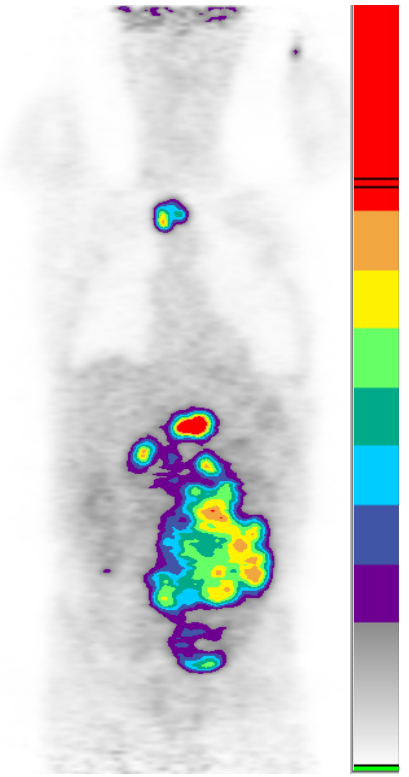
Criteria for interim PET assessment

Quantitative analysis in AOM00152

- Retrospective analysis
- 92 pts with DLBCL, median f-u 4 y

- Baseline PET :
  - SUV_{max} in the most active lesion
  - whichever CT size or location
- Interim PET :
  - if (+) $\rightarrow$ in the most active lesion
  - if (–) $\rightarrow$ in the area of PET_0 tumor
- Calculation of % of SUV_{max} reduction
- Optimal cut-offs determined by ROC

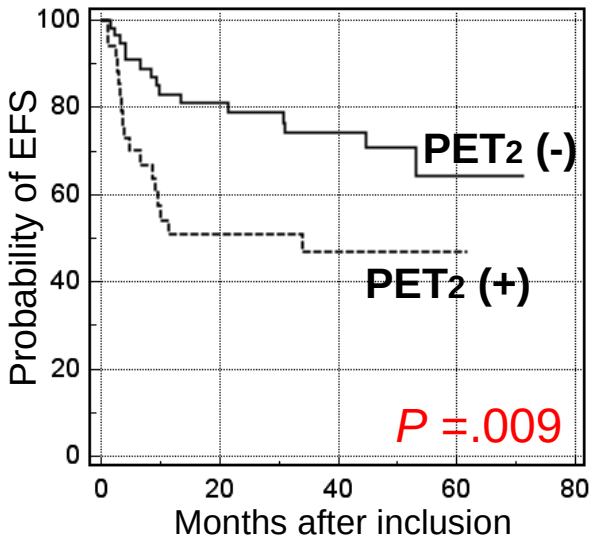


Lin, **Itti** et al. ***J Nucl Med*** 2007;48:1626-32

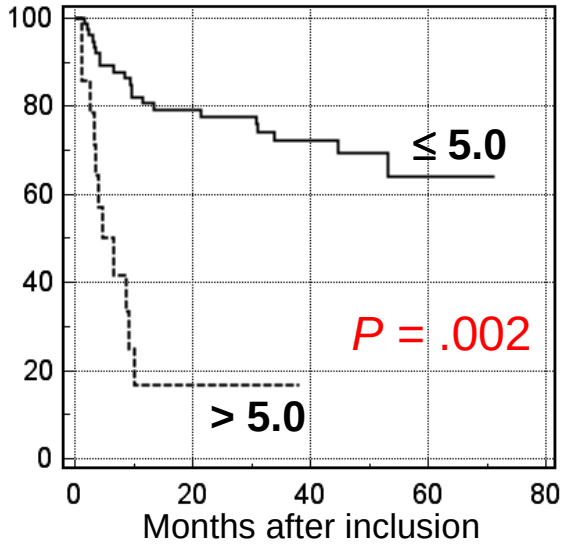
Visual vs. quantitative analysis

2 cycles, n=92

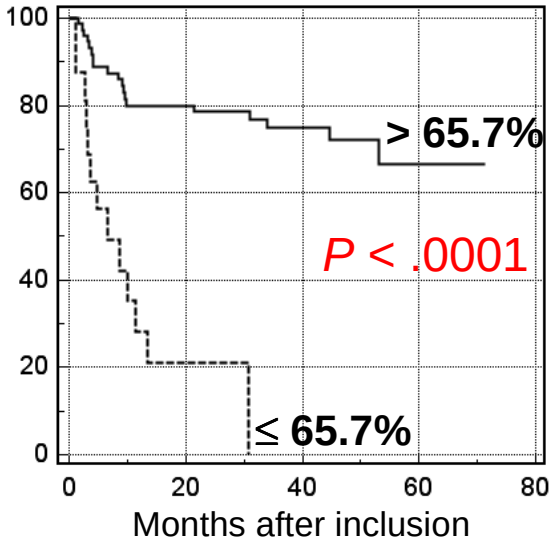
Visual analysis
(Créteil, MRU)



Quantitative analysis
(SUVmax at 2 cycles)



Quantitative analysis
(% reduction SUVmax)



→ Reduction of 14/17 false positives

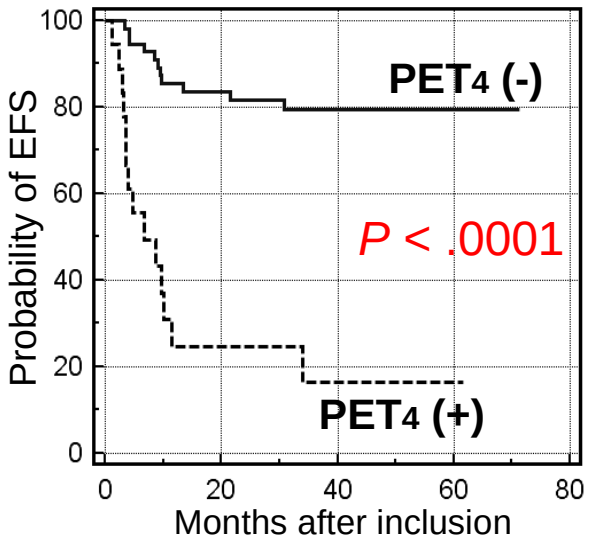
→ Cut-off may vary with histology, treatment, PET center

Lin, **Itti** et al. ***J Nucl Med*** 2007;48:1626-32

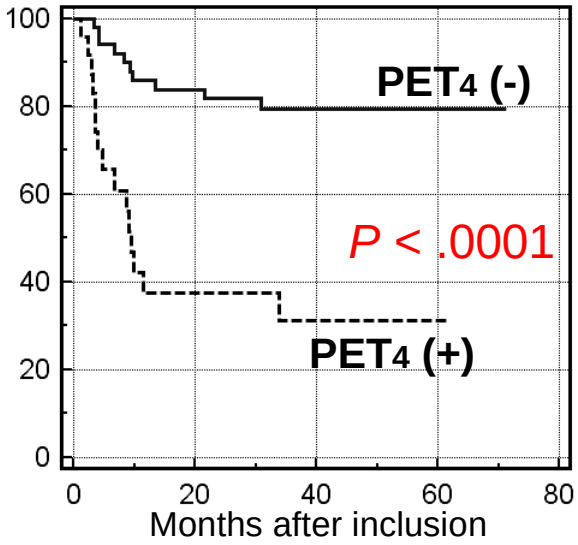
Visual vs. quantitative analysis

4 cycles, n=80

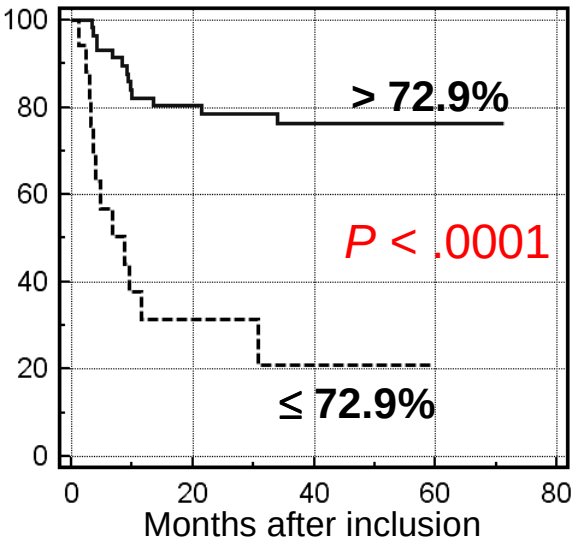
Visual analysis
(Créteil, MRU)



Visual analysis
(Juweid, IHP)



Quantitative analysis
(% reduction SUVmax)



→ Reduction of false positives if we wait for 4 cycles
→ Juweid criteria acceptable, Créteil slightly better
→ Visual analysis reliable, ΔSUV more objective

Itti et al. ***J Nucl Med*** 2009;50:527-33

Qualitative assessment at 4 cycles

Independent prognostic factor

Overall Model Fit

Null model -2 Log Likelihood	154,74219
Full model -2 Log Likelihood	134,96769
Chi-square	19,7745
DF	5
Significance level	P = 0,0014

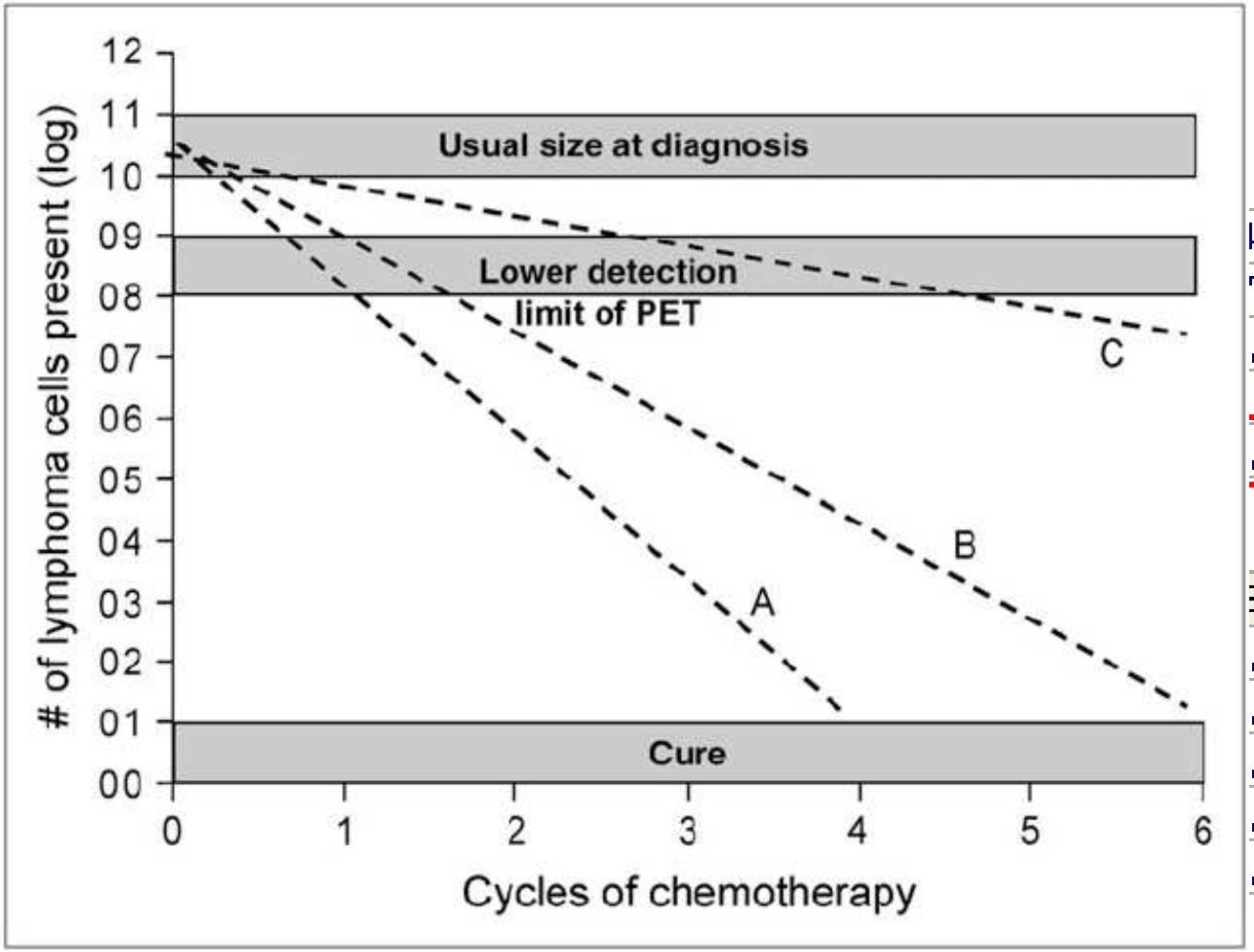
Coefficients and Standard Errors

Covariate	b	SE	P	Exp(b)	95% CI of Exp(b)
PET4vis	1,9252	0,4775	0,0001	6,8563	2,7023 to 17,3960
IPI	0,2145	0,1907	0,2606	1,2392	0,8545 to 1,7973
ASCT	-1,1057	0,5192	0,0332	0,3310	0,1203 to 0,9110
GC_NGC	0,0465	0,4602	0,9196	1,0476	0,4270 to 2,5701
Ritux	-0,3421	0,4812	0,4771	0,7103	0,2779 to 1,8152

→ Independent from IPI, treatment regimen, gene profiles

Quantitative assessment at 2 cycles

Independent prognostic factor



→ ΔSUV reflects tumoral destruction kinetics

Association of both

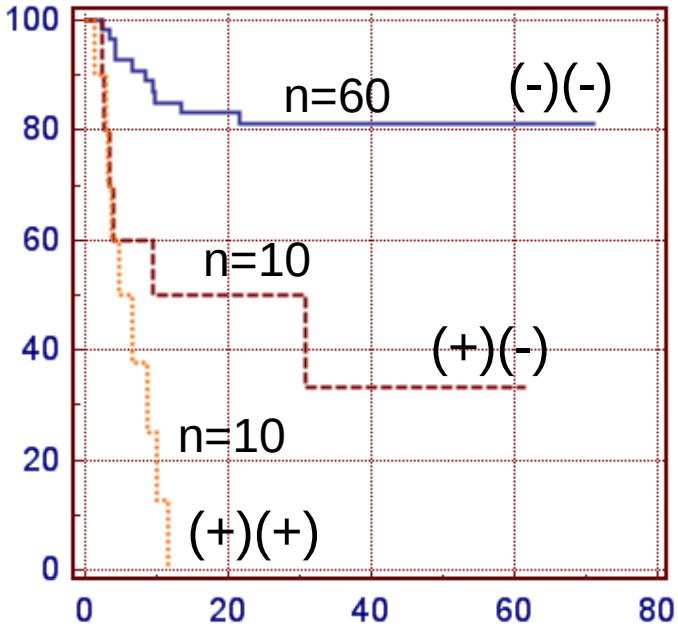
ΔSUV-PET2 and visual-PET4

Overall Model Fit

Null model -2 Log Likelihood	154,74219
Full model -2 Log Likelihood	130,92093
Chi-square	23,8213
DF	5
Significance level	P = 0,0002

Coefficients and Standard Errors

Covariate	b	SE	P	Exp(b)	95% CI of Exp(b)
PET2red4vis	1,2301	0,274	0,0000	3,4215	2,0050 to 5,8389
IPI	0,1147	0,2053	0,5764	1,1215	0,75
ASCT	-0,8722	0,5177	0,0920	0,4180	0,15
GC_NGC	0,2953	0,4776	0,5364	1,3435	0,52
Ritux	-0,2408	0,4791	0,6153	0,7860	0,30

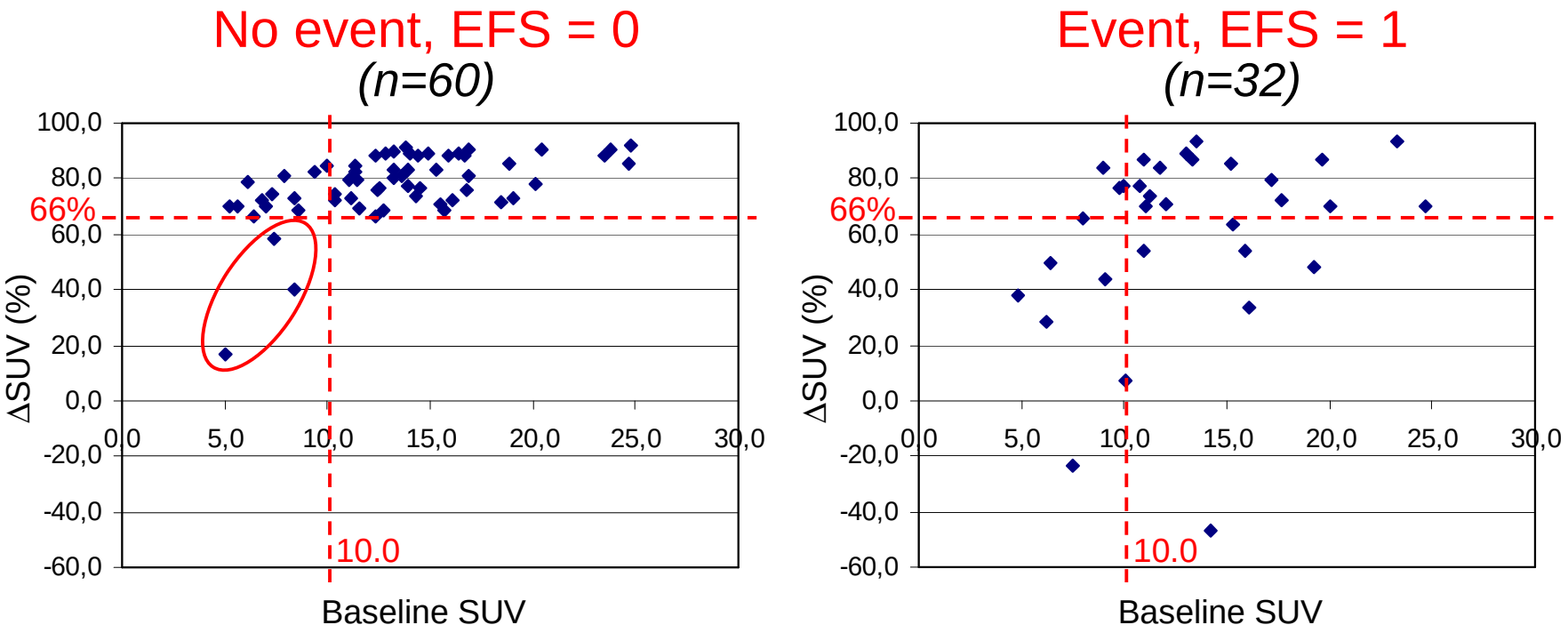


Limitations of ΔSUV

- Necessity of a baseline PET
- Tumors with baseline uptake <10.0
- SUV variability/normalization to internal bkg
- No external validation

Tumors with baseline uptake <10.0

influence of baseline SUV on ΔSUV

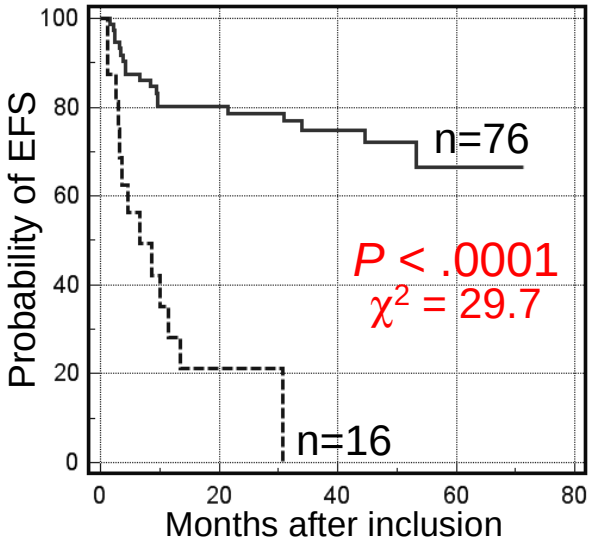


→ 3 FP pts w/ baseline SUV<10.0, ΔSUV<66%, no event

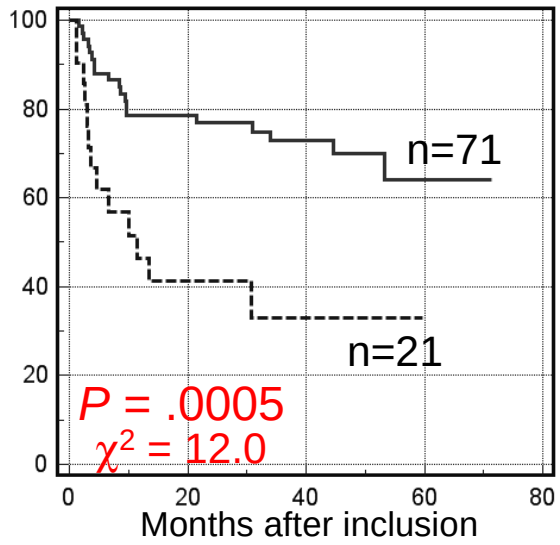
SUV variability

normalization to liver activity

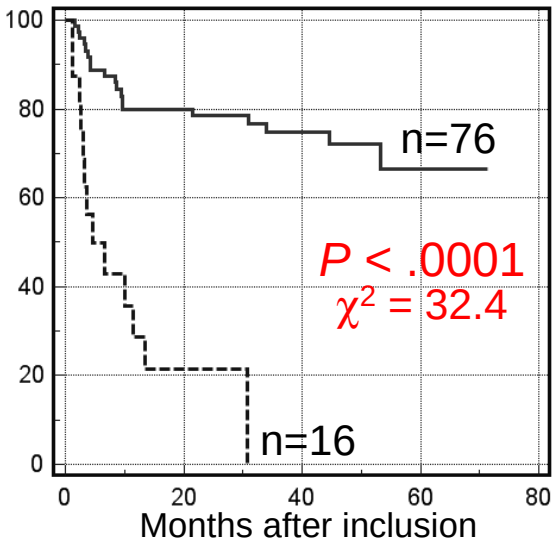
Raw ΔSUV
(cut-off 66%)



ΔSUV / liver
(cut-off 66%)



ΔSUV / liver
(cut-off 60%)

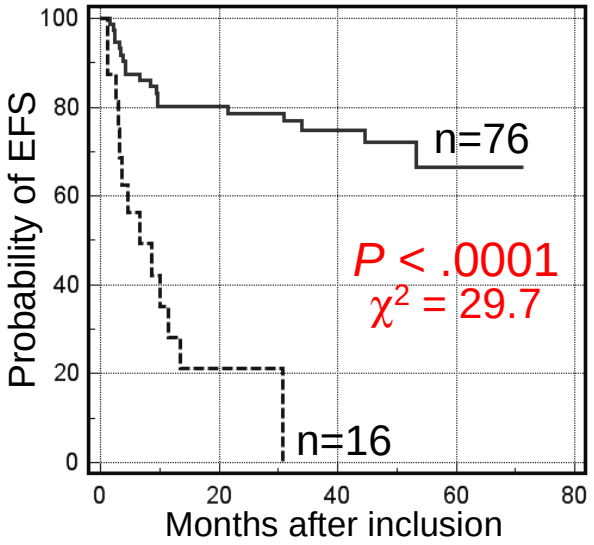


$$\Delta SUV = 100 \times \frac{SUV_{T1}/SUV_{L1} - SUV_{T2}/SUV_{L2}}{SUV_{T1}/SUV_{L1}}$$

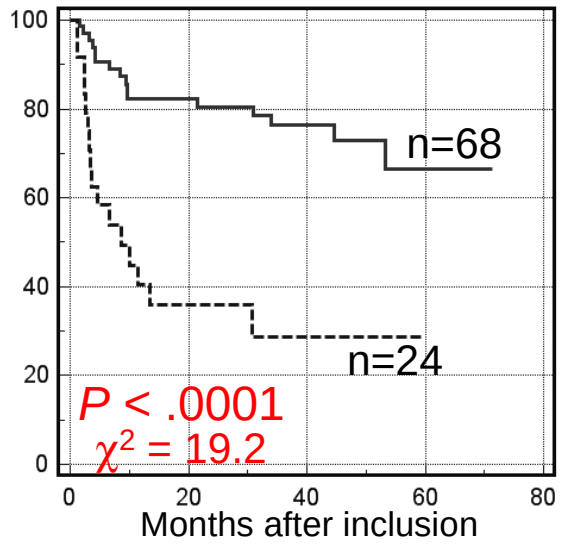
SUV variability

normalization to MBP activity

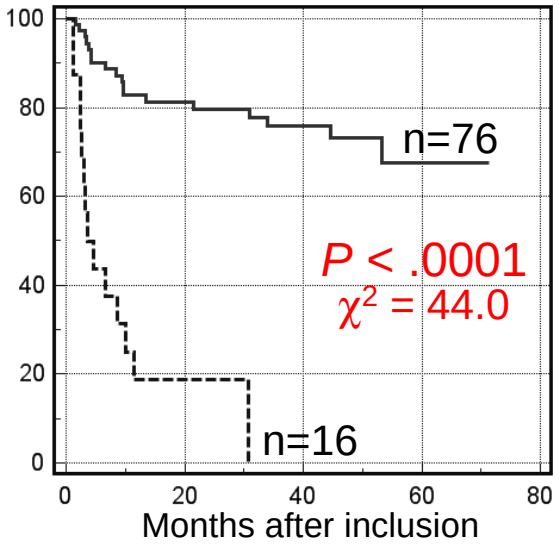
Raw ΔSUV
(cut-off 66%)



ΔSUV / MBP
(cut-off 66%)



ΔSUV / MBP
(cut-off 61%)



$$\Delta SUV = 100 \times \frac{SUV_{T1}/SUV_{M1} - SUV_{T2}/SUV_{M2}}{SUV_{T1}/SUV_{M1}}$$

Conclusions

- Must follow strict procedure for injection, delay between injection and scanning, glucose level
- Same procedure to identify SUVmax, with help of the MIP, graded color scale
- No need for an internal reference
- External validation : ongoing (PETAL, IVS)