

Metabolic tumor volume

Clinical data

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Prognostic value of Total Metabolic Tumor Volume

Total Metabolic Tumor Volume (evaluation of disease burden) \neq maximum dimension of the largest mass (classical bulk)

- prognostic value?
- relationships with the response?
- relationship with the bulk



Exploratory studies

- Two studies in DLBCL:

121 patients

ancillary study LNH073B (prospective PET2 and 4 driven therapeutic strategy)

114 patients

ancillary study IVS²⁰¹², retrospective, no change treatment on PET2

- One study in early and advanced HL:

59 patients

Retrospective, no change treatment on PET2 and 4

MTV0 computation

VOI fitted manually to individual lesions and adapted to morphology using predetermined shapes

Lesion MTV :

41% SUVmax thresholding (EANM 2010)

$MTV_0 = \sum MTV \text{ lesions}$

Rules for VOI setting

- Contiguous lesions:

a single VOI if $\neq \text{SUVmax} < 10\%$

several VOI \neq if $\neq \text{SUVmax} > 10\%$

- Spleen:

focal uptake VOI on the foci

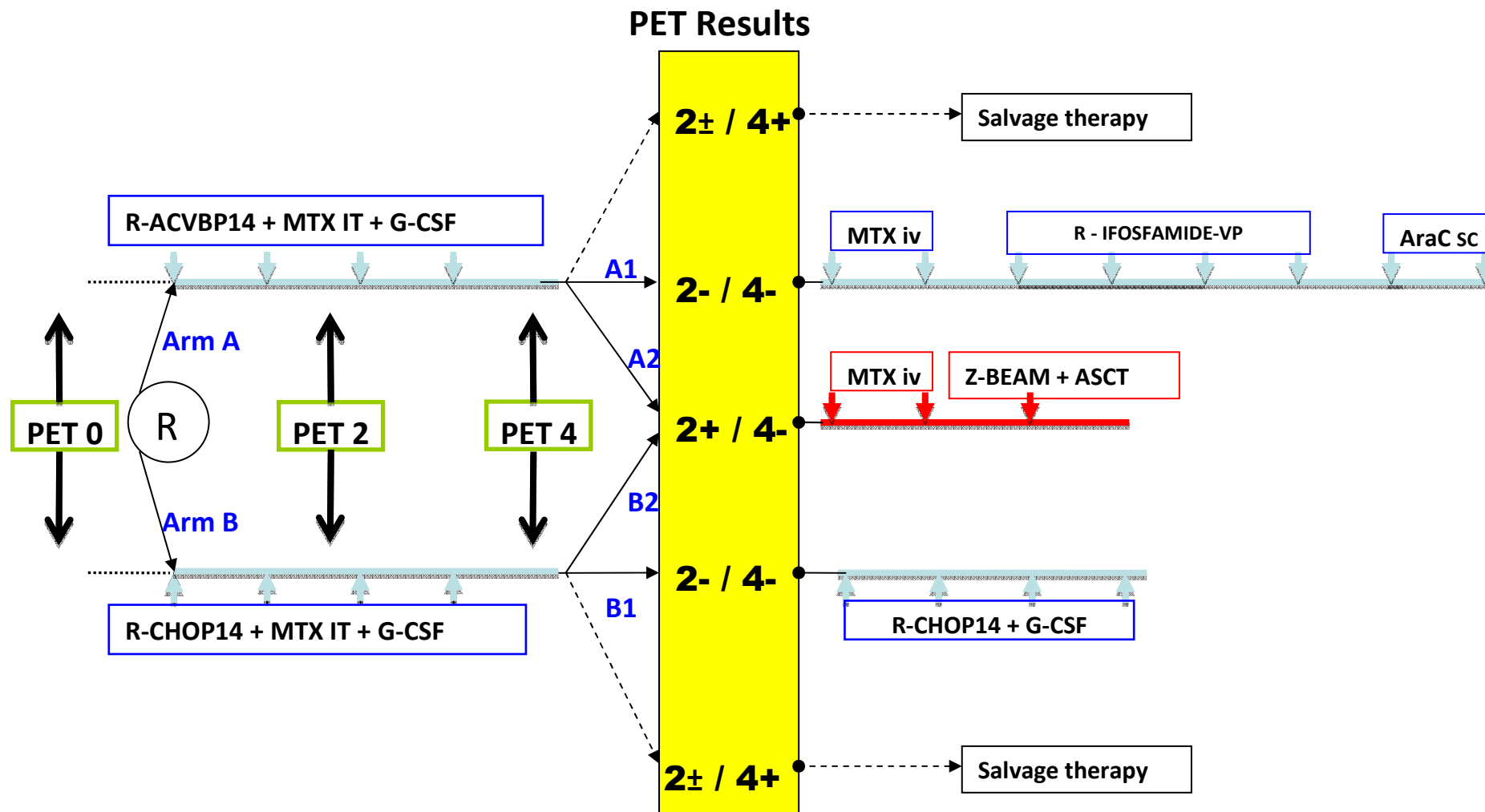
diffuse uptake VOI on the spleen if $> 15 \text{ cm}$ or $\text{SUVmax} > 50\%$ liver SUVmax

- Bone marrow:

VOI only on focal lesions

DLBCL: 18-60 y, aaIPI=2-3

220 patients included



LNH073B Ancillary study

DLBCL 18-60 y, aaIPI=2-3

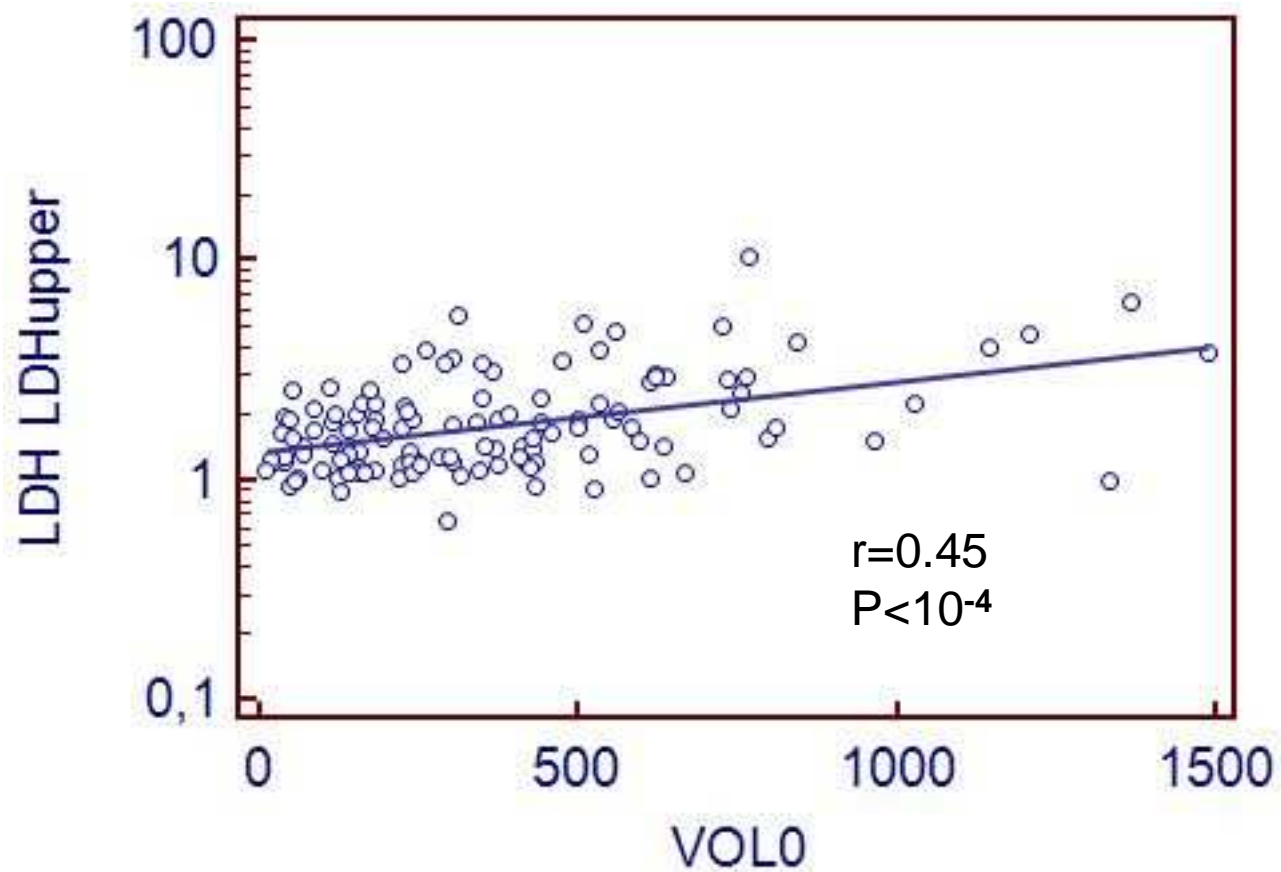
- 121 patients
- 45 centres
- All patients whose all acquired images could be retrieved from the imaging data base of our department.
- Demographic and clinical data similar to the whole population of the trial (young patients with high risk DLBCL)
- Median follow up: 28 months
- MTV0 base line, Bulk > or < 10cm baseline
- Δ SUVmax(%) PET0-PET4

MTV0

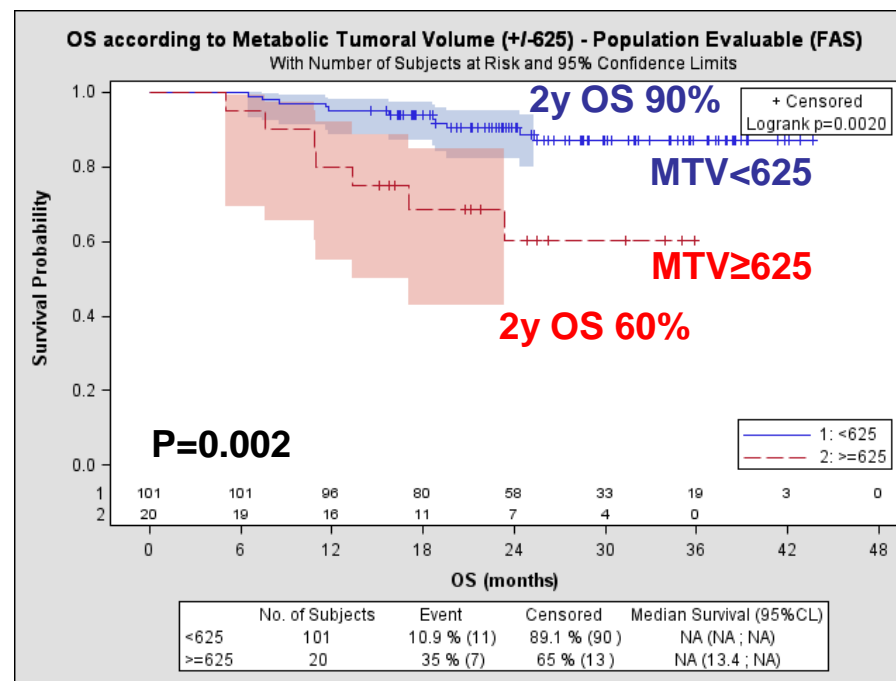
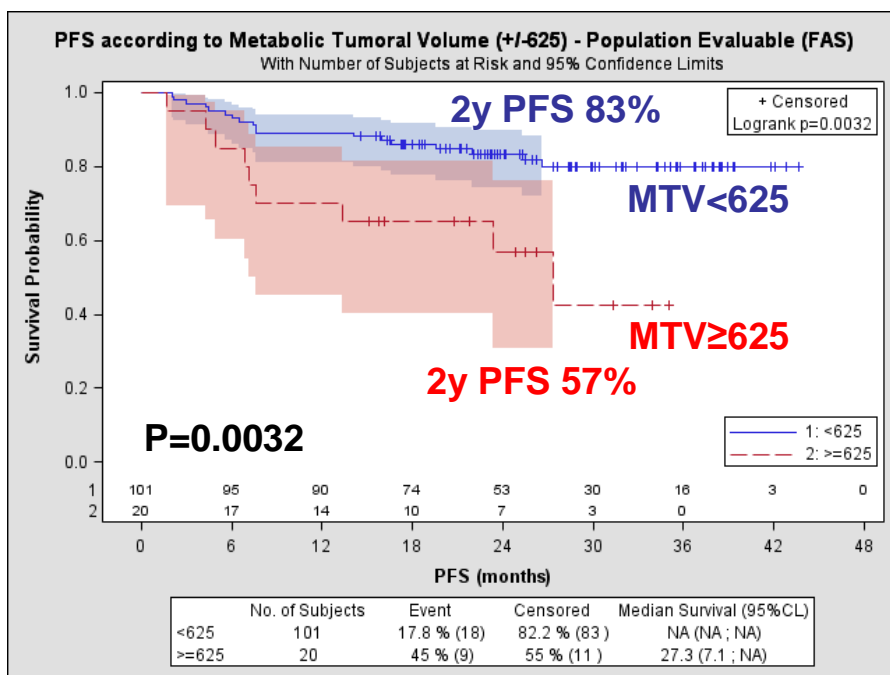
121 patients LNH073B

- Median MTV0 = 303 cc (17-1448)
- ROC MTV0 cut off for PFS and OS: 625 cc

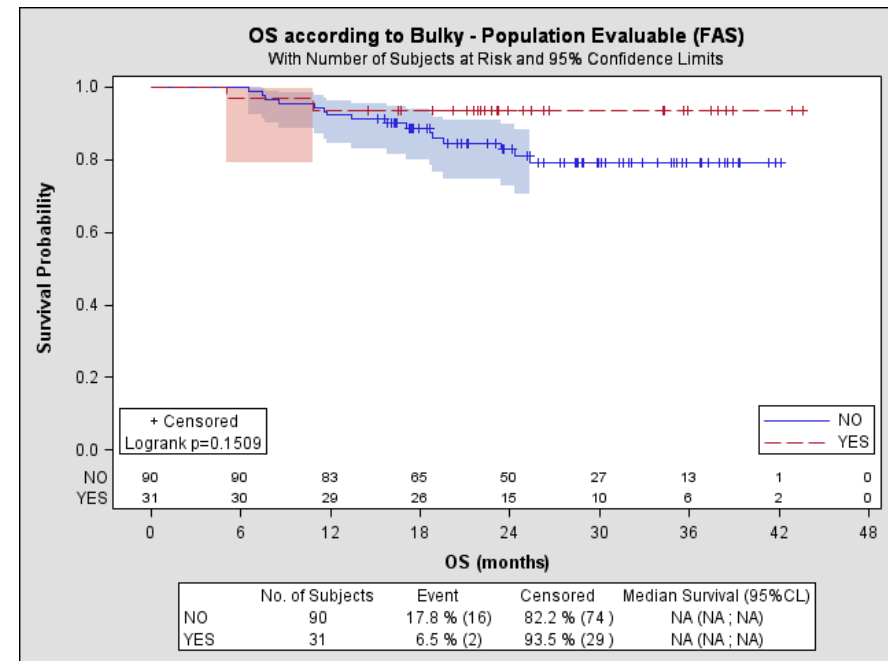
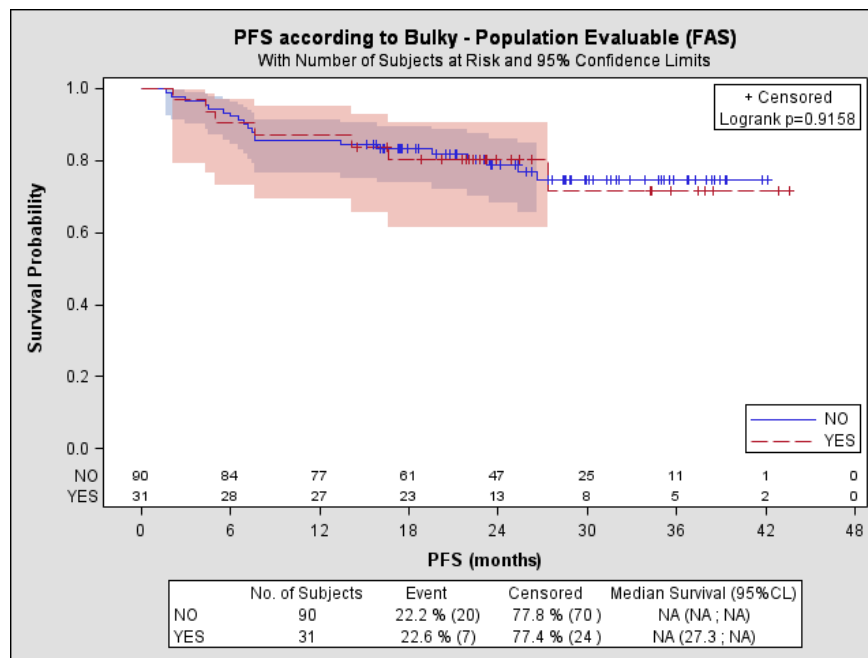
Correlation LDH/Volume



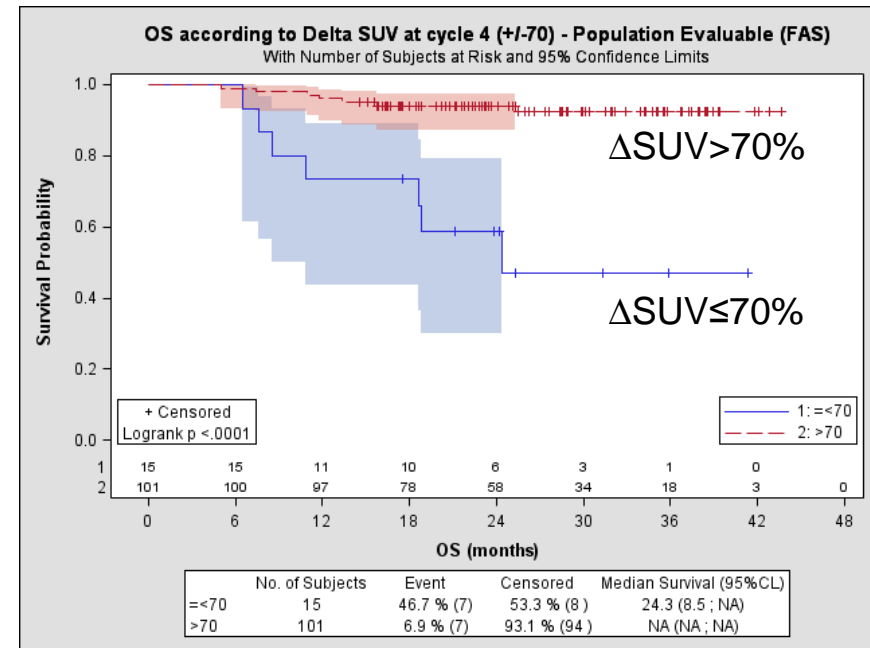
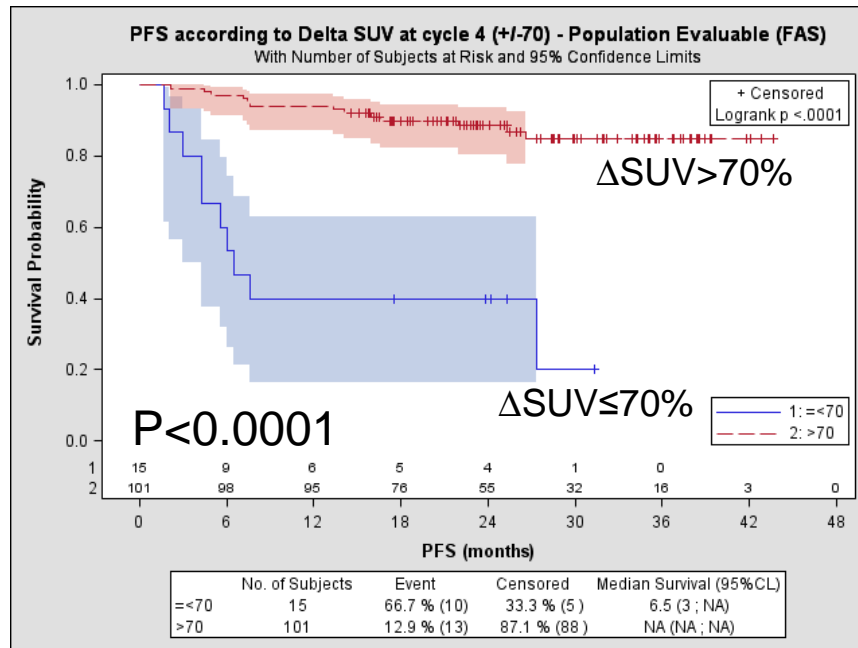
PFS and OS according to MTV0



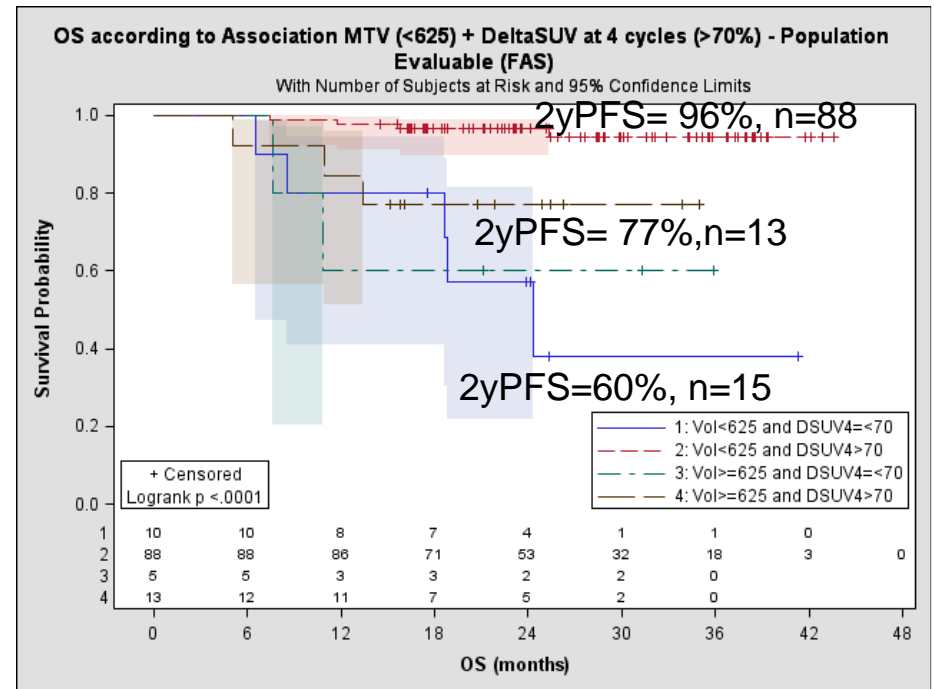
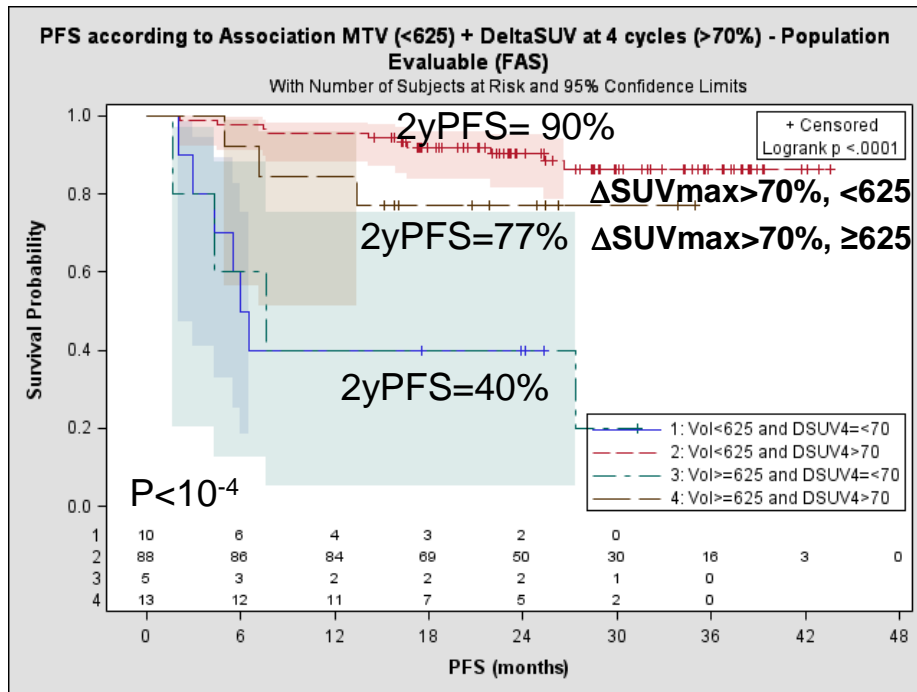
PFS and OS according to tumor bulk at base line



PFS and OS according to Δ SUVmax reduction at PET4



PFS and OS according to MTV0 and Δ SUVmaxPET0-4



IVS ancillary study

- 114 DLBCL patients,
- 5 centers (4 European, 1 USA)
- 23-80 y, aalPI=0-3,
- 31% >60y, 35% aalPI 0-3
- R-chemo regimen
- No modification of therapeutic strategy based on PET
- Median follow up: 39 months
- MTV0 base line ,
- Δ SUVmax 0-2 (%), PET0-PET2

Sasanelli, Itti, 2012

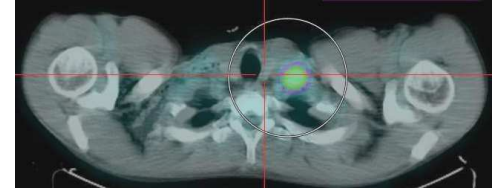
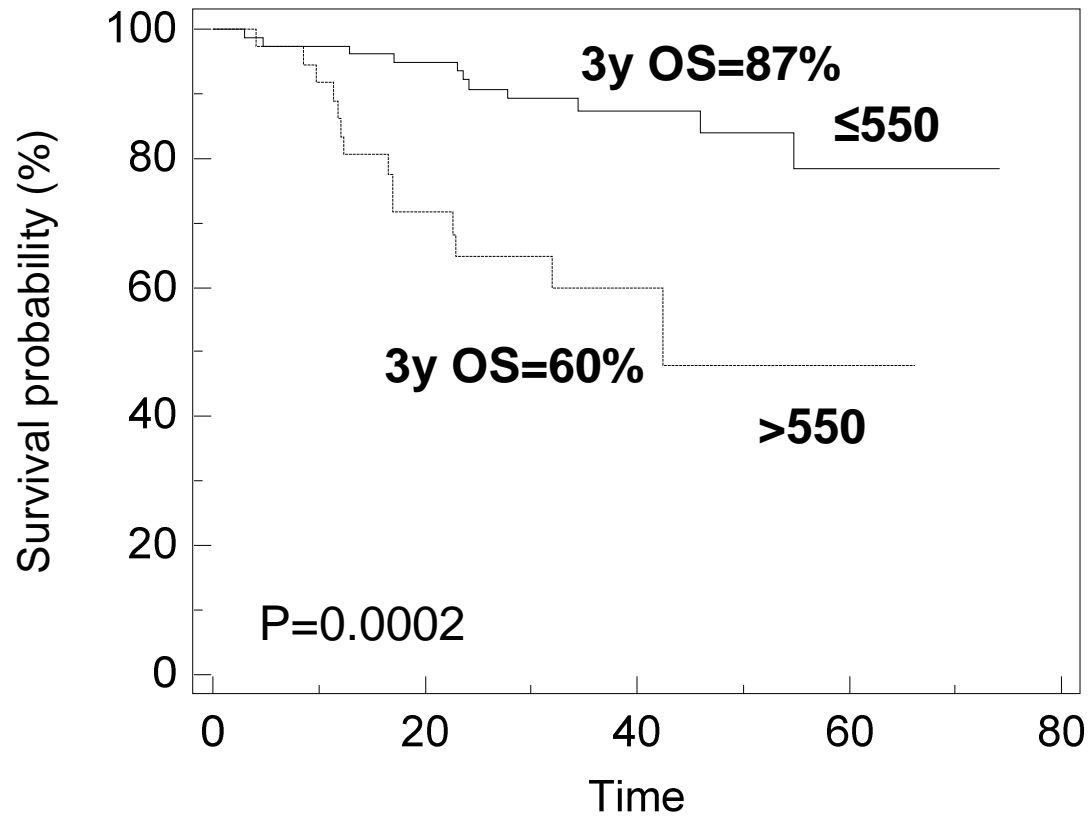
MTV0

114 patients DLBCL IVS

Median MTV0 = 304 cc (3,9- 2654)

ROC MTV0 cut-off for OS: 550cc

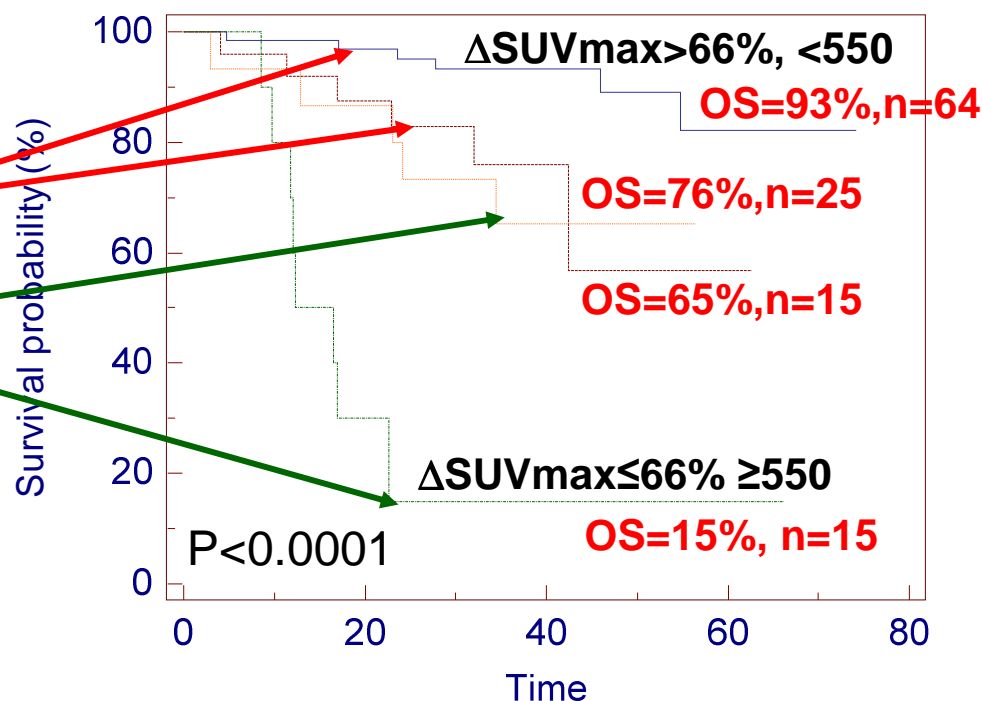
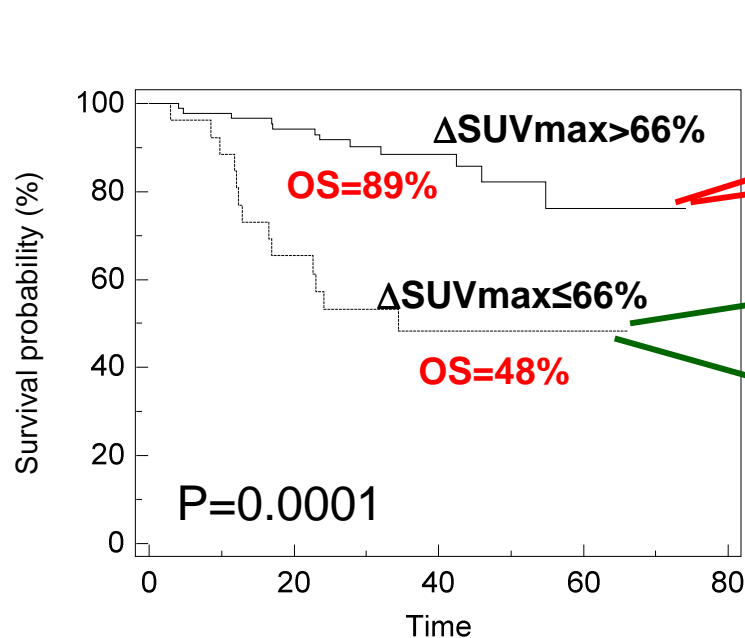
MTV0 predicts 3y-OS



MTV0 combined with the response at 2 cycles

$\Delta\text{SUVmax}_{0-2}$ reduction predicts 3y OS.

Adding MTV0 splits the curves and identifies different risk categories.



3yr OS according to $\Delta\text{SUVmax}_{0-2}$ reduction

3yr OS combined MTV0 and ΔSUVmax

MTV0 and Δ SUVPET2 are
independent predictors of OS

MTV0 $p=0.002$, RR=3.6

Δ SUV $p=0.0005$, RR=4.1

Conclusions in DLBCL

MTV0 : metabolic tumor burden at staging

- Good predictor of OS before initiation of therapy
- More relevant than the bulk
- Combined with response at 2 cycles or 4 cycles identifies very good and very poor prognosis patients
- Helps increasing the **predictive value** of interim PET

Hodgkin lymphoma: 59 patients

- Retrospective
- First diagnosis of HL from 01/2007 to 01/2010
- One single center
- Median FU= 39 months (6-62)
- PET0 and PET2
- MTV0 base line
- Δ SUVmax% 0-2, PET0-PET2

		n = 59	%
Age	< 40	37	62
	\geq 40	23	38
Gender	Male	39	66
	Female	20	34
Ann Arbor Stage	I	5	8
	II	17	29
	III	10	17
	IV	27	46
IPS score	0-2	23	39
	\geq 3	36	61
Treatment	ABVD	50	85
	BEACOPP	9	15
Number of course	2 to 4	21	36
	5 to 8	38	64
Radiotherapy	Yes	14	24
	No	45	76

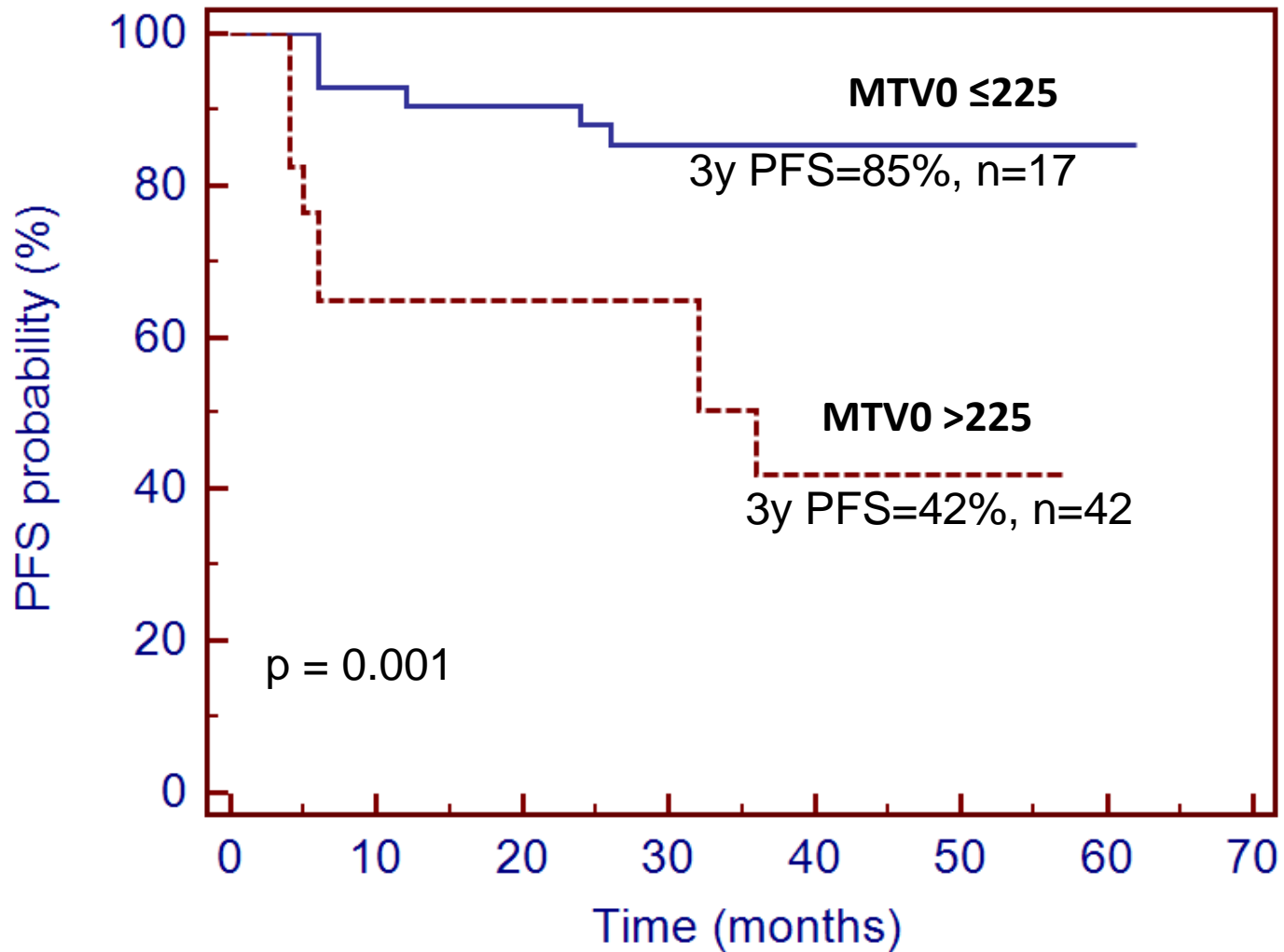
Kanoun, Casasnovas, 2012

MTV0 in 59 patients with HL

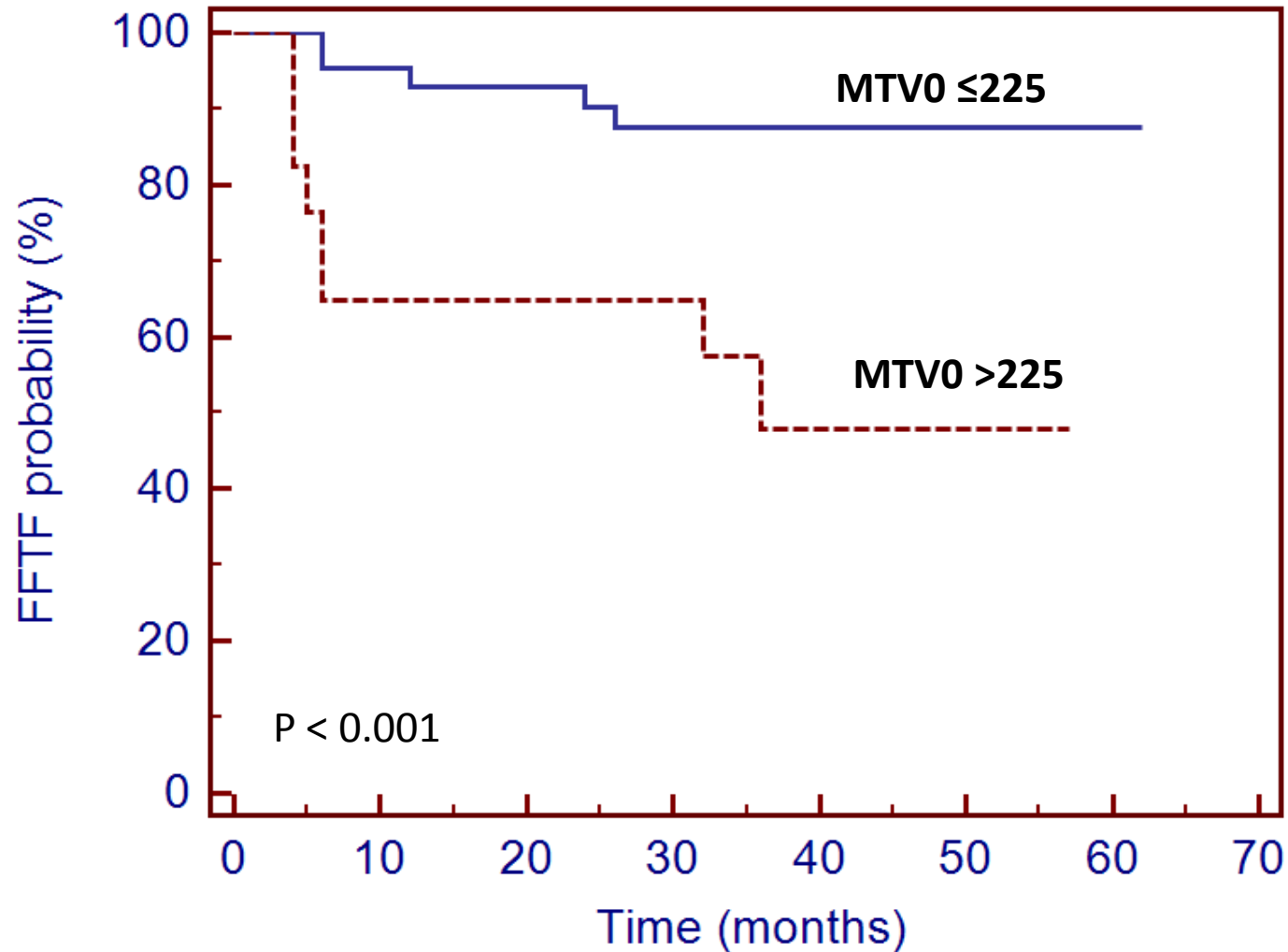
Median MTV0 = 120 cc (10 – 1610)

ROC MTV0 cut-off : 225cc

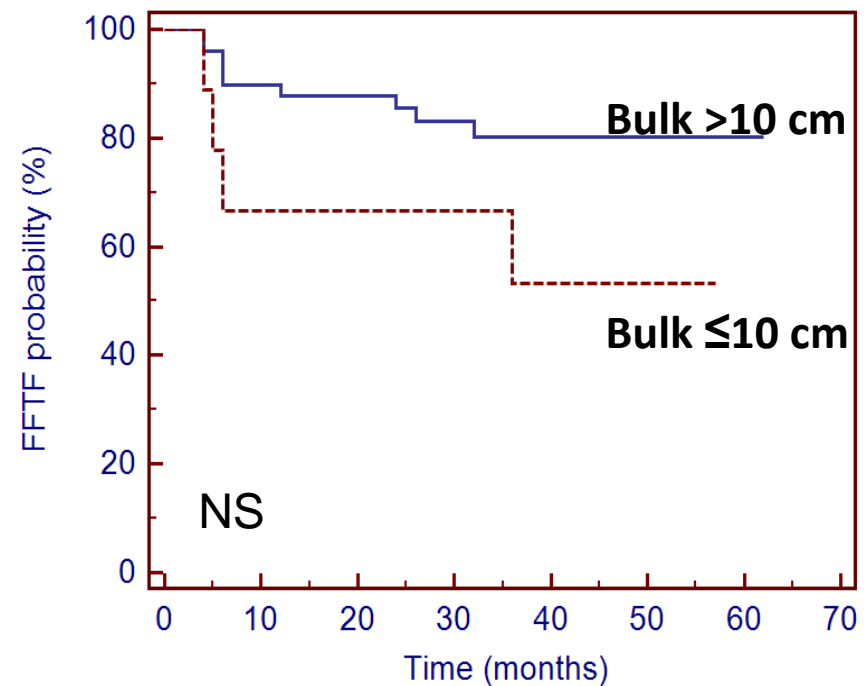
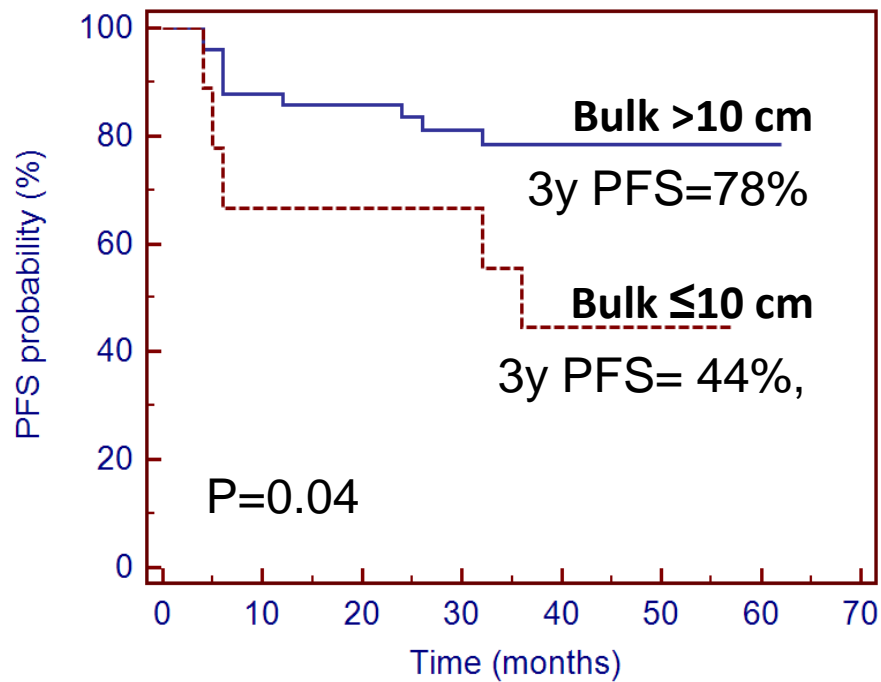
PFS according to MTV0



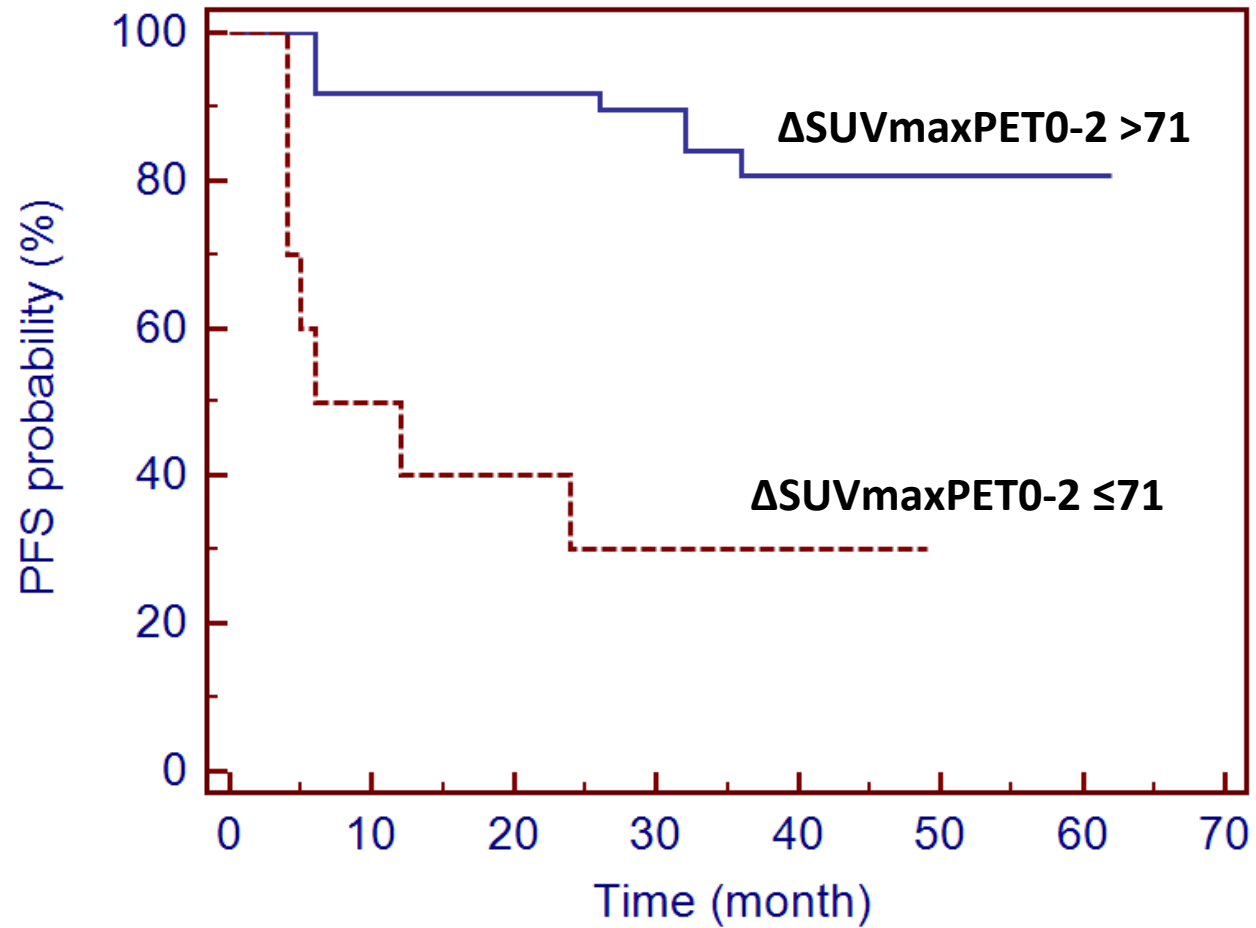
FFTF according to MTV0



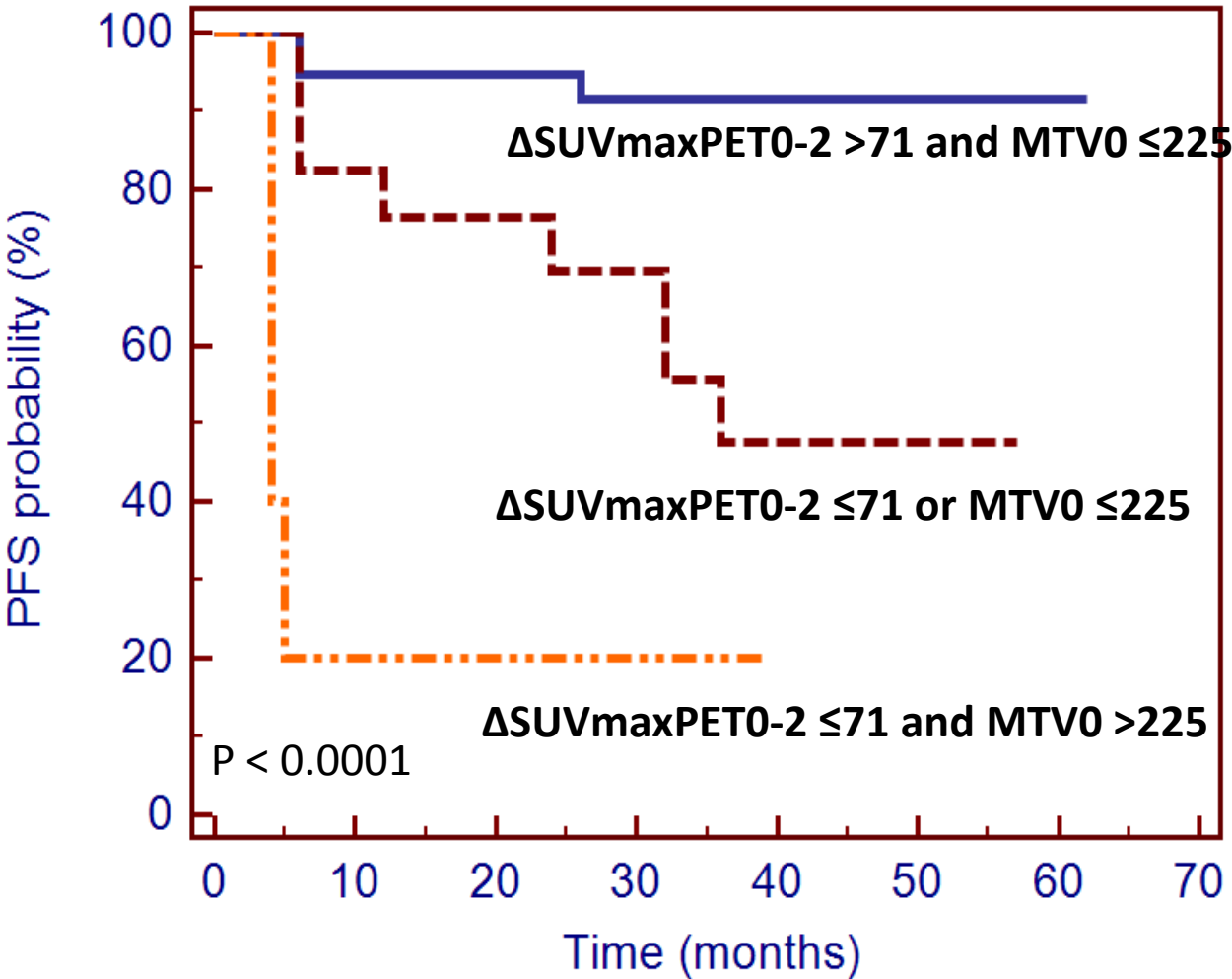
PFS and FFTF according to tumor bulk at baseline



PFS according to $\Delta\text{SUVmaxPET0-2}$



PFS according to MTV0 and $\Delta\text{SUVmaxPET0-2}$



Multivariate analysis

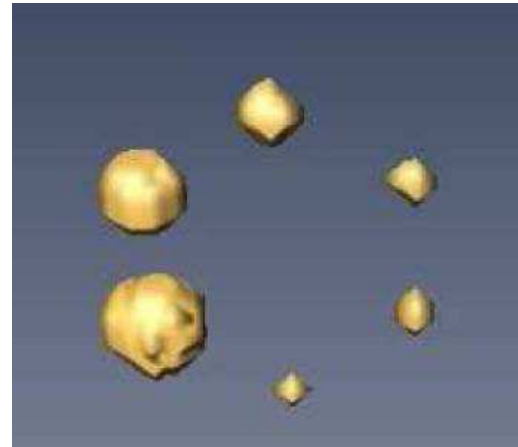
- Only $\Delta\text{SUVmaxPET0-2}$ and MTV0 remained independent predictors
- PFS
 - $\Delta\text{SUVmaxPET0-2}$, $p=0.0005$; $\text{RR}= 6.4$,
 - MTV0 , $p< 0.007$; $\text{RR}= 4.2$,
- FTF
 - $\Delta\text{SUVmaxPET0-2}$, $p= 0.0002$; $\text{RR}=8.2$
 - MTV0 , $p=0.01$; $\text{RR}= 4.4$

Conclusions

- MTV0 seems more relevant than tumor bulk to predict outcome in patients with DLBCL and HL
- High MTV0 is a negative prognostic factor (value depending on the disease)
- MTV0 adds significant prognosis insights in interim PET response assessment
- Combined with $\Delta\text{SUVmaxPET0-2}$ or PET0-4 MTV at base line identifies subsets of patients with different outcomes that may help clinicians to guide therapeutic strategy.

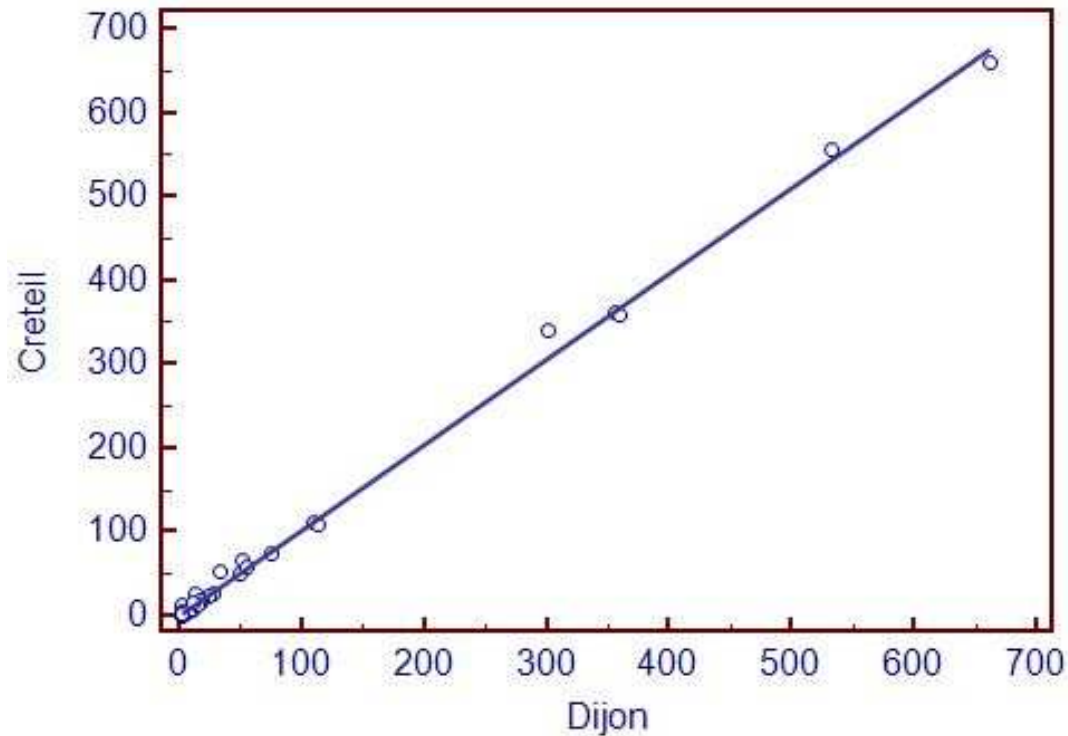
Key areas of Research

- Improve metabolic volume measurement (semi automatic technique)?



- Way to standardize
- Confirm these results in prospective multicentre trials in different disease type?
- Is MTV0 prognostic value differs between the stage/ relationship with bulky
- Is the MTV0 useful for staging?

High interobserver reproducibility:
2 Independent observers, 36 tumors
in 10 patients



R=0.998
P<10⁻⁴