

# Integrating FDG PET data for lymphoma management

Michel Meignan, France



## Combining metabolic data

from baseline, interim or post treatment PET

PET Data can be combined:

1. Together
2. With baseline clinical or biological data
3. With other imaging techniques

Aim of this holistic approach:

- Obtain new prognostic index
- Tailor therapeutic strategy

# 1. Together

Data from baseline and interim PET combined together

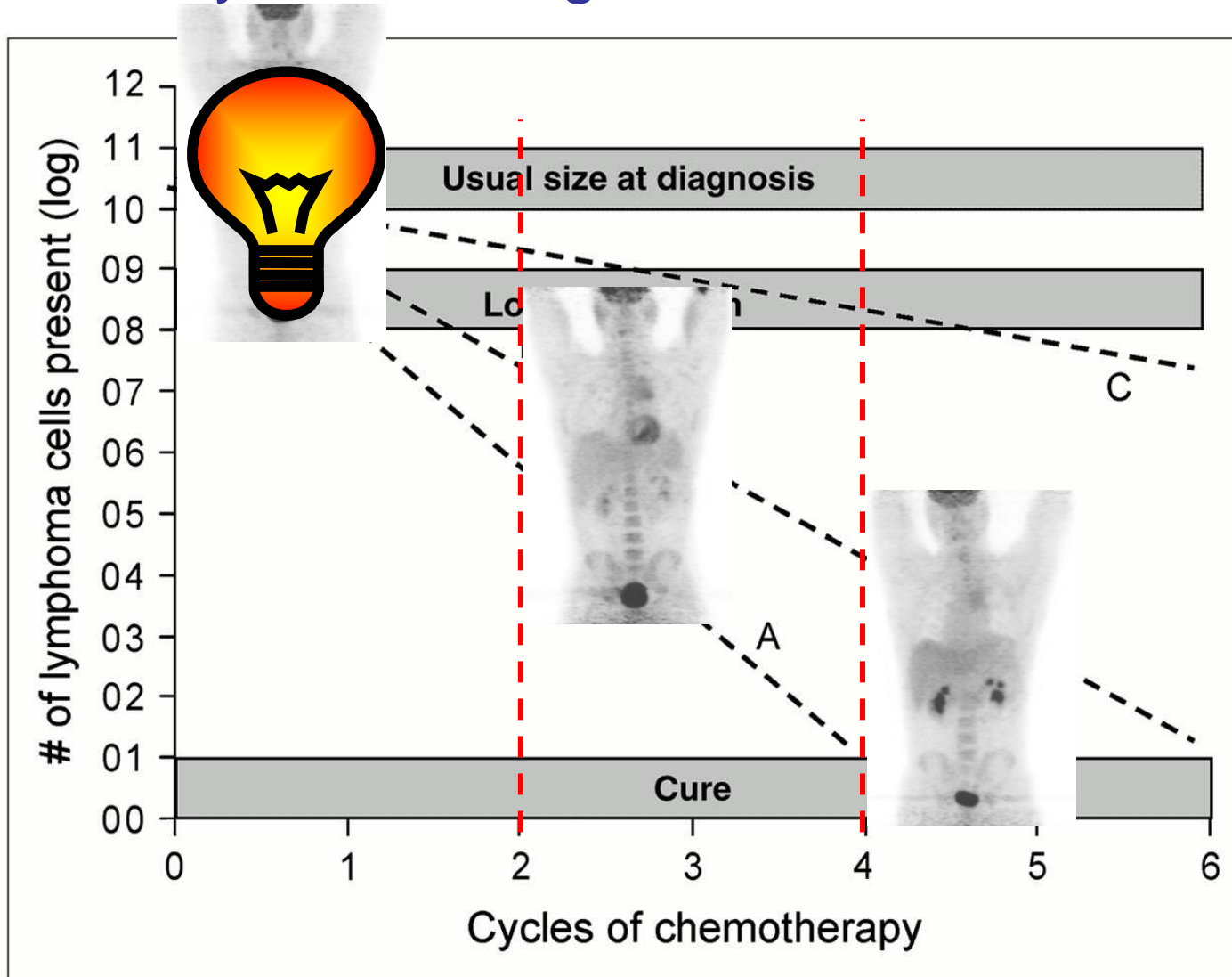
Could give:

better response assessment at interim

better risk assessment

# Kinetics of tumour destruction (DLBCL)

Studied by PET during induction chemotherapy



# Reporting interim PET in Diffuse Large B Cell Lymphoma: the Zeno's paradox

The “freezing” evaluation of the residual tracer uptake by visual scoring (DS) at one moment of this kinetics miss the entire phenomenon and remind us of the paradox of the Greek philosopher Zeno of Elea. At any instant of time the arrow has no motion, since time is composed of multiple freezing instances in succession.

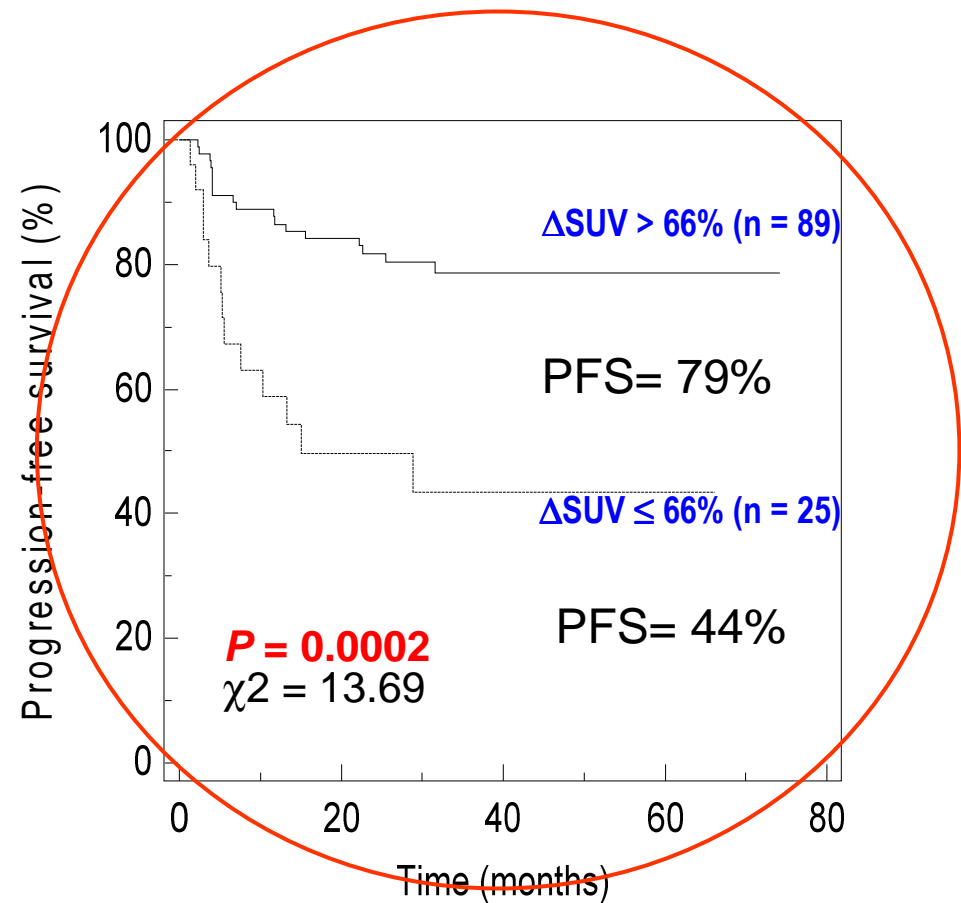
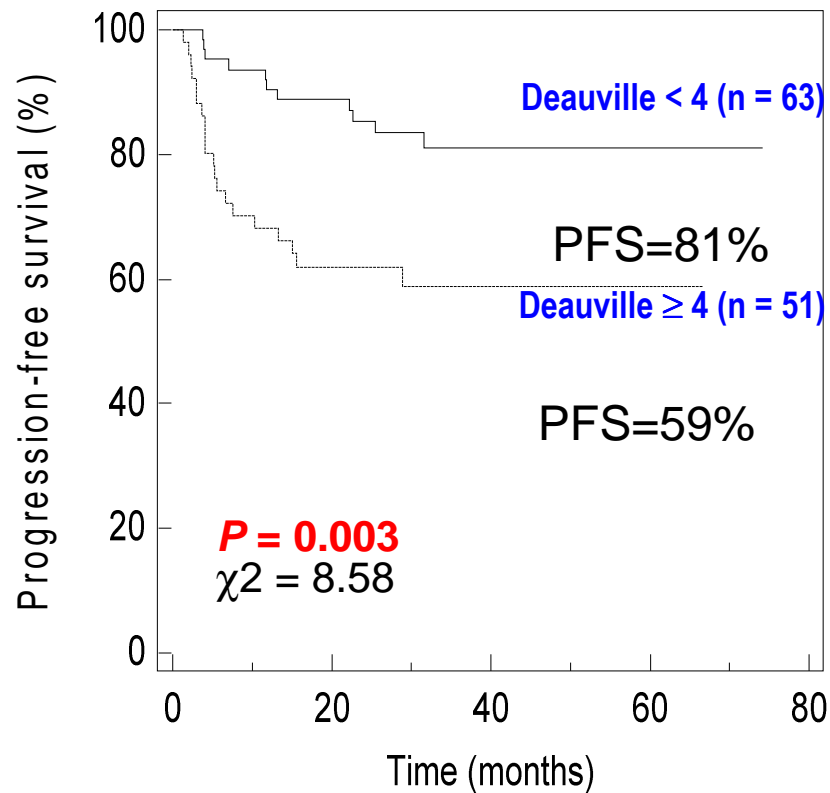
## Zeno's arrow

By contrast the quantitative approach combining SUVmax baseline and after treatment to obtain  $\Delta$  SUVmax between base line and either of the chemotherapy cycles integrates this kinetic information



# Reporting interim PET by Integrative $\Delta$ SUVmax more predictive of outcome than scoring residual activity at one step of the kinetics (DS)

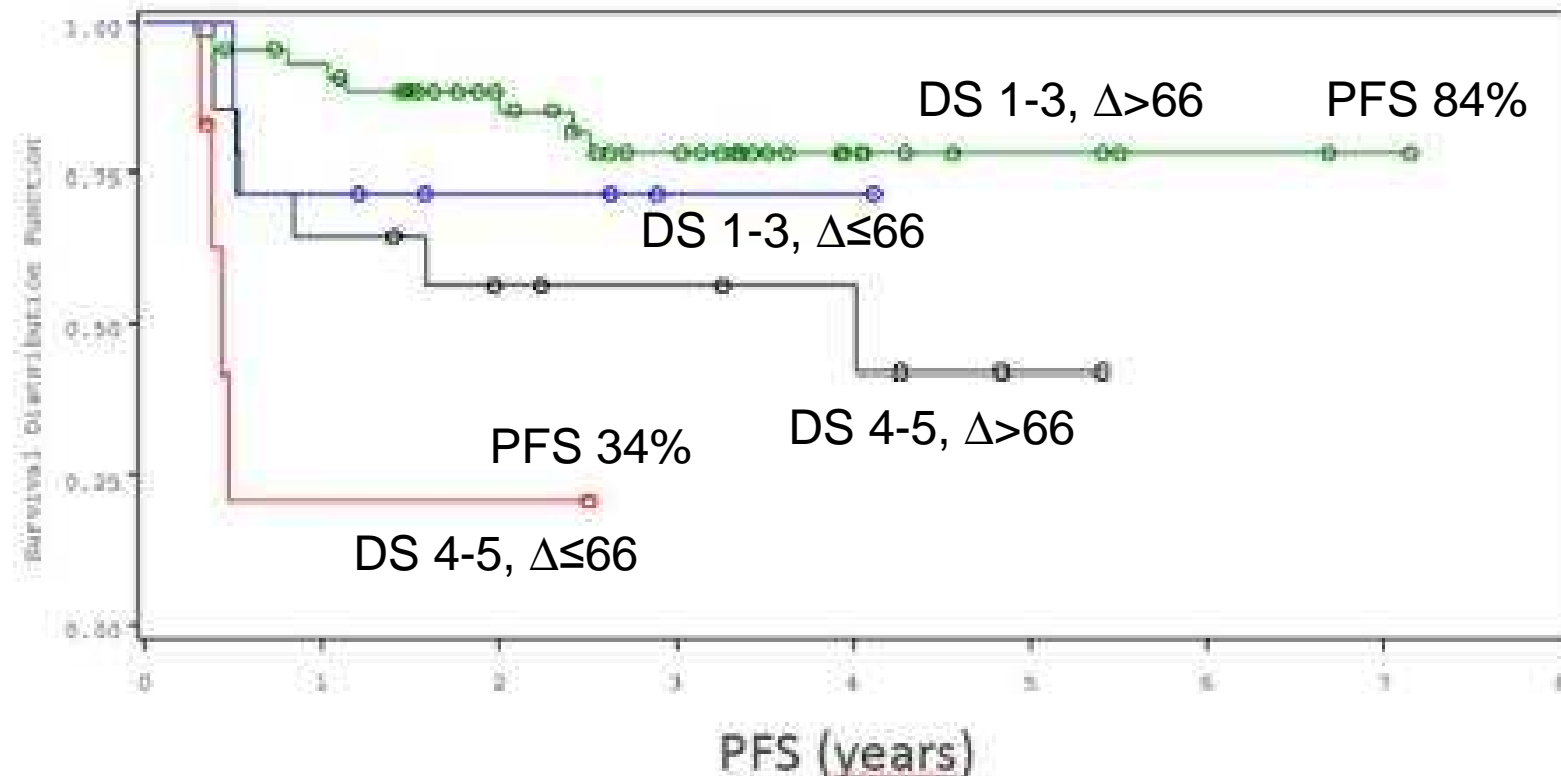
## DLBCL



IVS: **114 pts**, 5 centers, 3 observers,  
PET 2 cycles; med FU 39 months

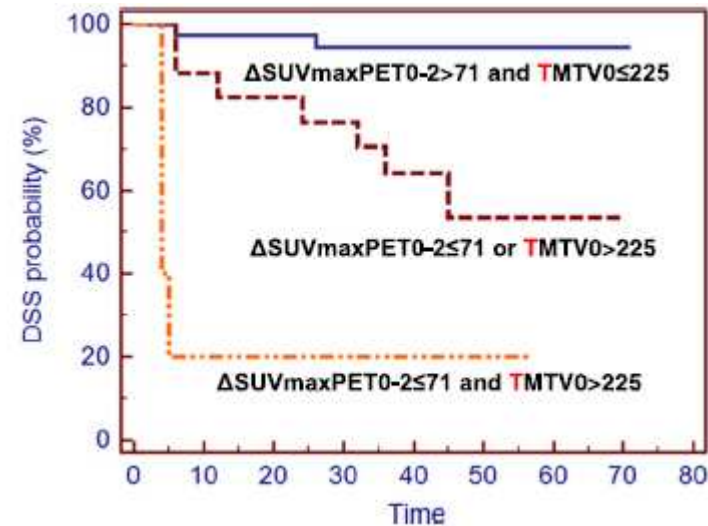
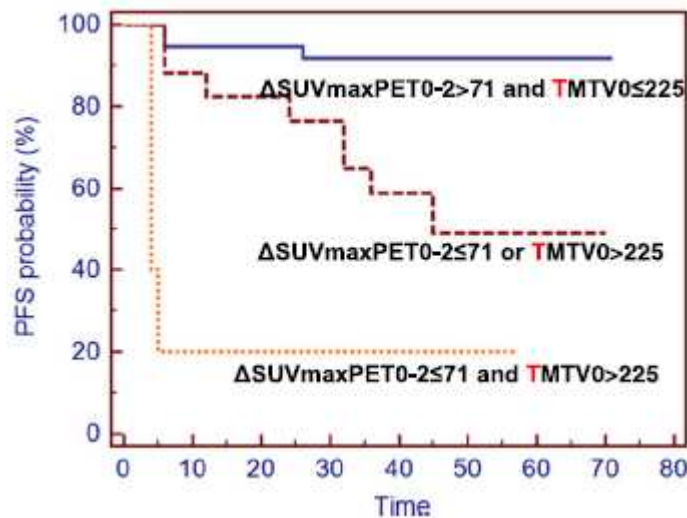
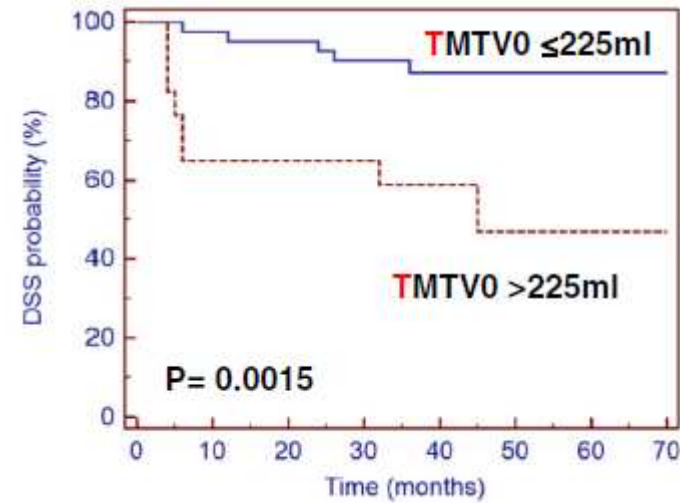
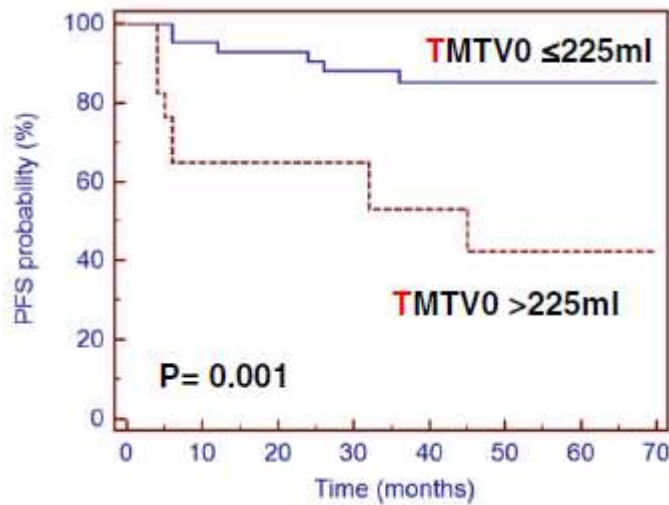
*Itti , 2013, Eur J Nucl Med Mol Imaging*

# Combining analysis of residual uptake (DS) with $\Delta$ SUV kinetic approach at 3-4 cycles in DLBCL (74 patients)



71% patients  
Double negative excellent outcome  
Double positive poor outcome

# Combining in HL base line data, TMTV and response data, $\Delta$ SUVmax (PET2)





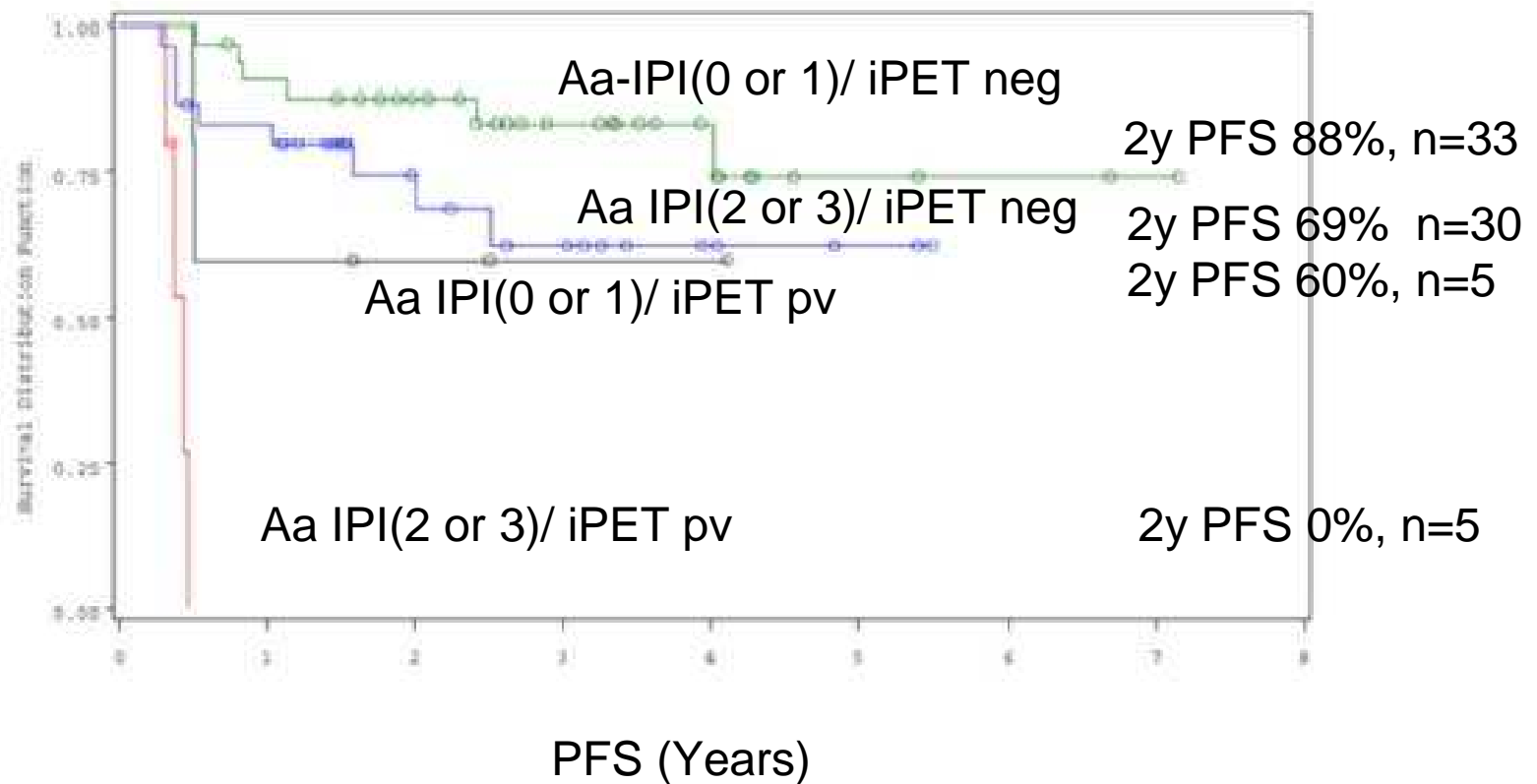
2. With baseline clinical and biological data

# Combining Aa IPI and iPET

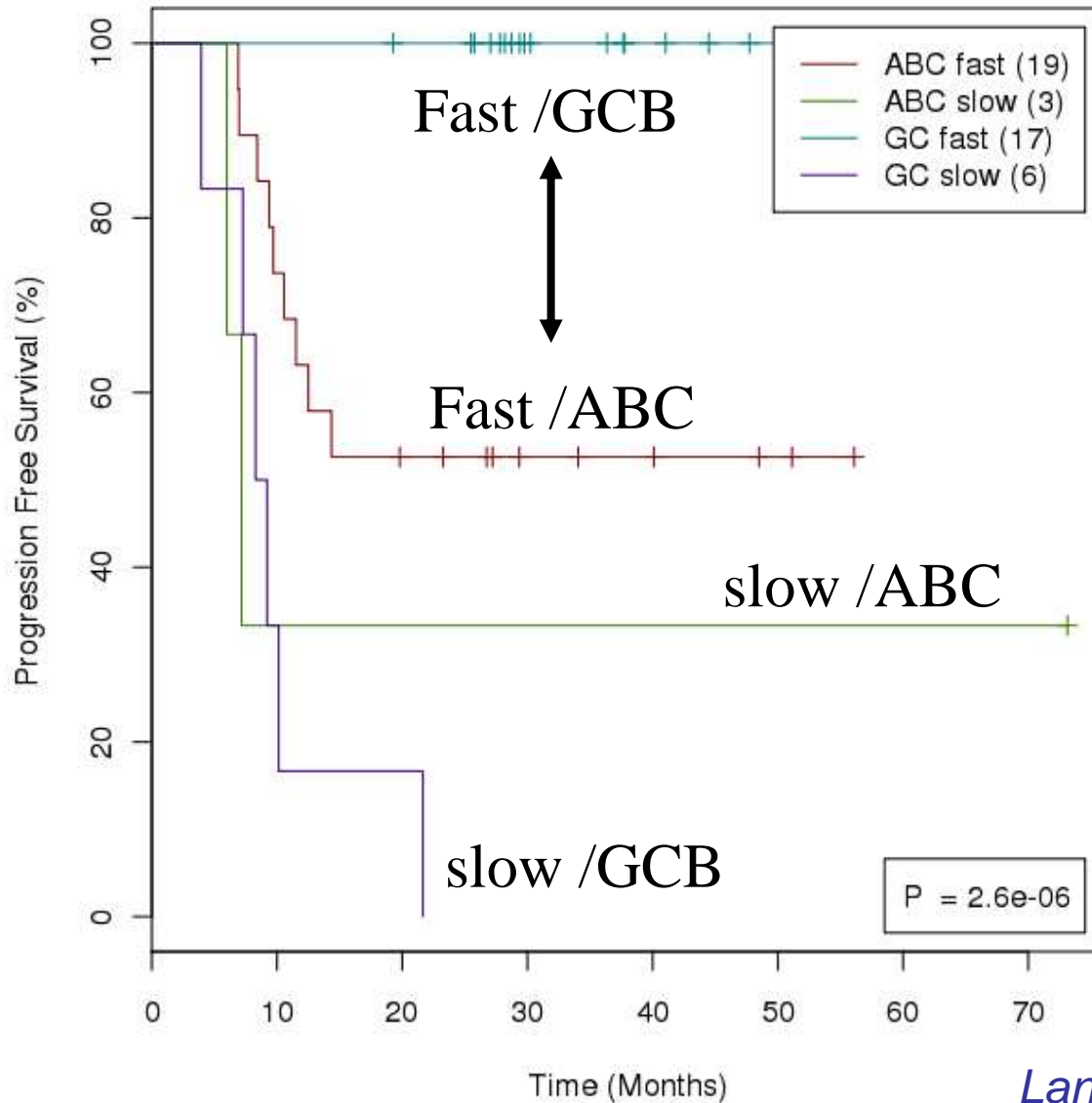
73 DLBCL, anthracycline based regimen (R-CHOP, ACVBP, mini CHOP)

Positive:  $DS \geq 4$  and or  $\Delta SUV_{max} \leq 66\%$

Negative:  $DS < 4$  and or  $\Delta SUV_{max} > 66\%$



# Combining GCB/ABC subtypes and $\Delta\text{SUV}/\text{max}$



DLBCL 57 patients

PET 3-4 cycles

$\Delta\text{SUV} > 70\%$

**Good risk group**

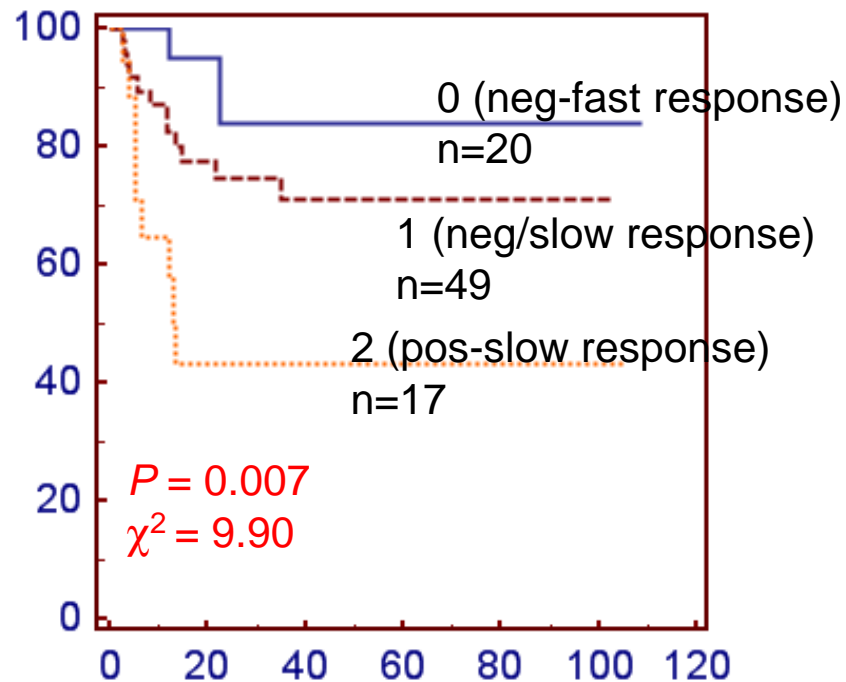
Fast / GCB

**Poor risk group**

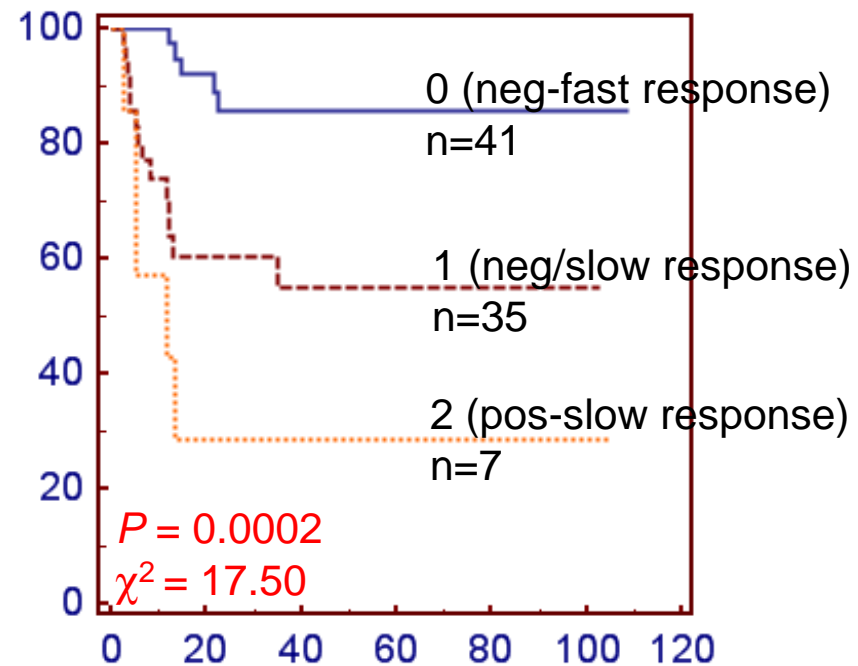
Slow GCB and ABC

*Lanic, Jardin 2011, Leuk Lymphoma*

## Combining BCL2 protein expression and BCL2 gene alteration with early PET response at 2 cycles in DLBCL allows improved stratification



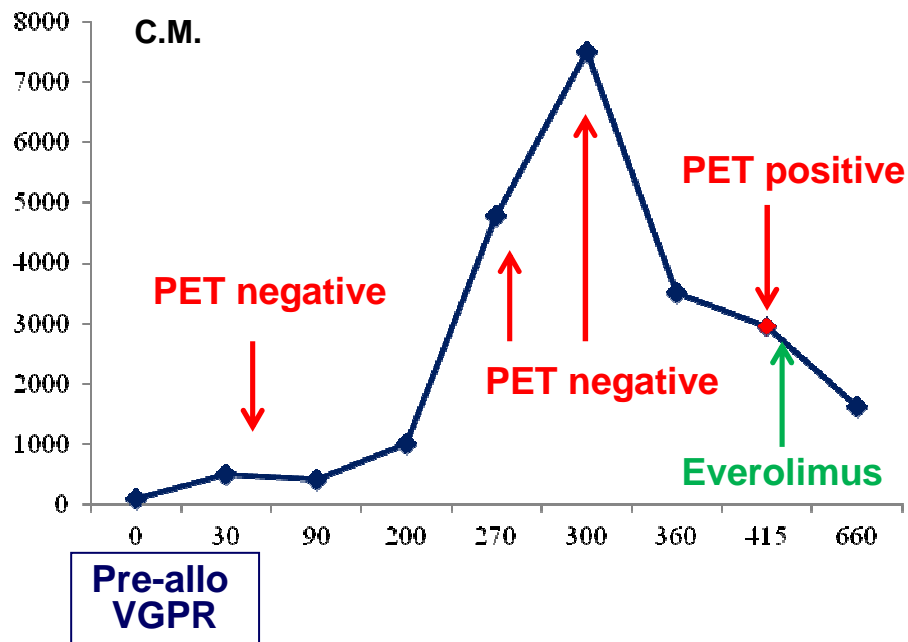
**BCL2 prot 50%+DS (n=86)**  
3-y PFS :83.8% vs. 71.1% vs.43.1%



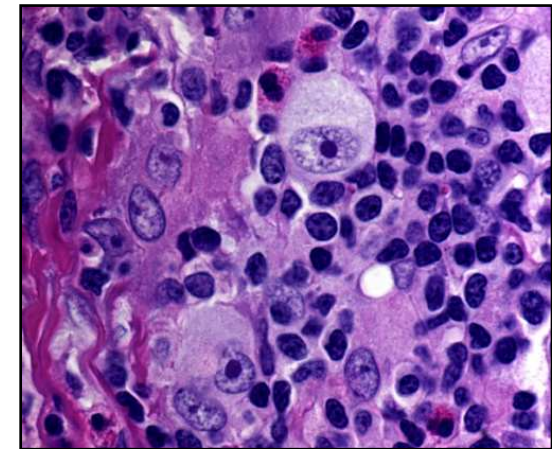
**BCL2-FISH+DS (n=83)**  
3-y PFS :85.7% vs. 55.0% vs. 28.6%

# Correlation kinetics of Thymus activation related chemokines (TARC) and PET in relapse/refractory HL

- In 4 patients who relapsed after alloSCT serum TARC increased progressively (median fold increase: 5,2) before PET scan became positive. TARC can predict metabolic relapse after alloSCT in HL



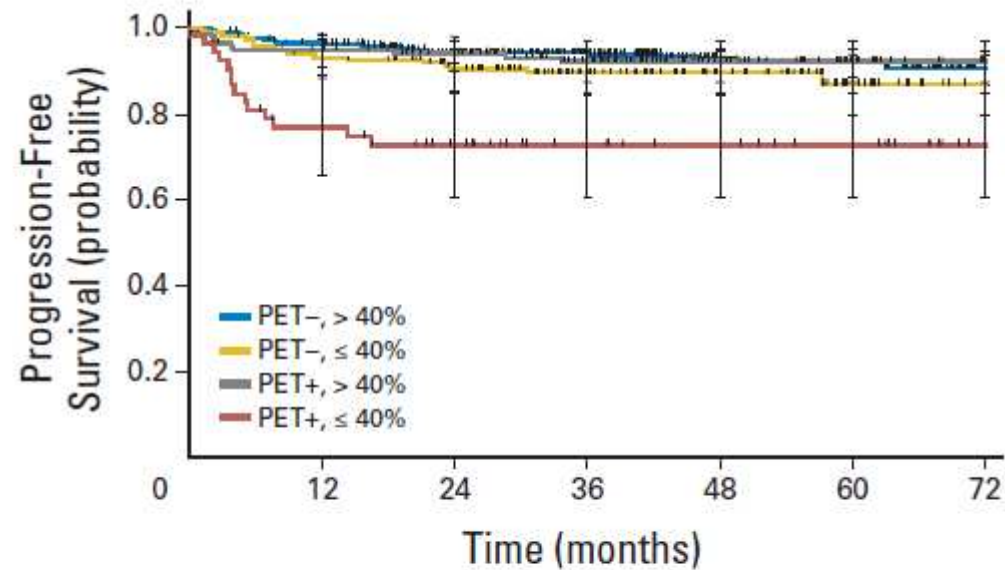
Accessory cells show a very high metabolic activity and are responsible for FDG uptake. Ma Y.: Blood 2008; 111, 2339-2346



3. With other imaging techniques

# Combining FDG/PET and CT in HL

739 patients /HD15 with CT residue  $\geq 2.5$ cm at end treatment



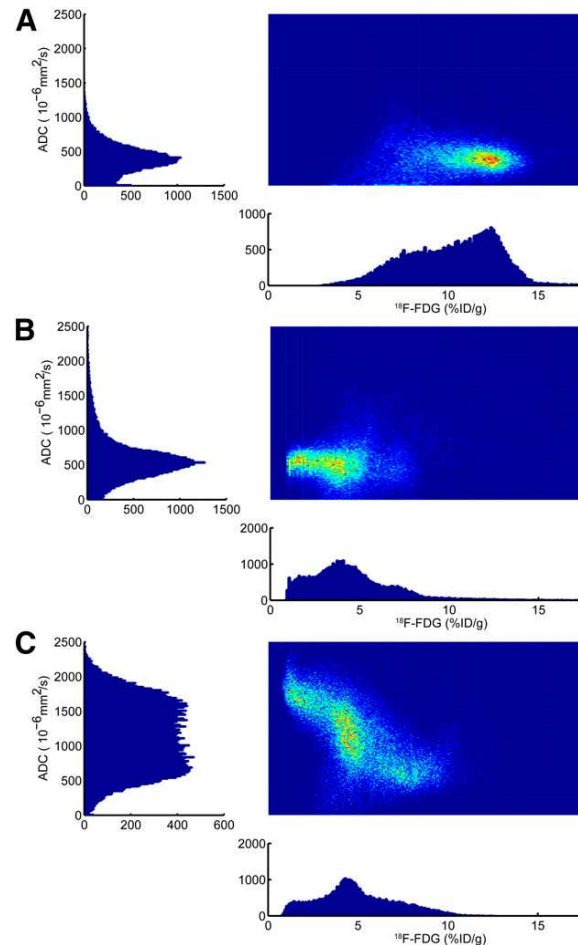
No. at risk	0	12	24	36	48	60	72
PET-, > 40%	397	370	319	244	178	91	36
PET-, ≤ 40%	151	135	118	86	53	27	10
PET+, > 40%	135	124	113	85	51	27	10
PET+, ≤ 40%	54	38	29	19	15	11	1

Poor prognosis of patient PET+ and with a  $\leq 40\%$  tumour shrinkage

# Combining FDG/PET and MRI

Xenograft tumour model of a non-small cell lung cancer

Density scatter plots  
FDG intensity on x  
ADC on y



Initiation of therapy

Decrease of FDG  
Stable cellular density

Several components  
in the tumor



# Conclusions

- Holistic approach using PET and other parameters
- Could produce new prognostic index
- Improve understanding
- Validation needed ( limited number of patients in these studies)
- Open field for research