5th International Workshop on PET in Lymphoma
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Poster Session

Poster discussion
PET in lymphoma - clinical

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Poster discussion – PET in lymphoma

Philosophy of the abstract volume

Section	No. abstracts	Diseases
A	**13**	**Hodgkin lymphoma**
B	**17**	**Non-Hodgkin lymphoma**
C	**6**	**Metabolic tumor volume**
D	**8**	**Other technical studies**
LBA	**1**	**Hodgkin lymphoma**

Poster discussion – PET in lymphoma

Clinically versus technically oriented studies

45 abstracts on ‚PET in lymphoma‘

29 clinically oriented studies

A1-A9, A13, B1, B3-B7, B10, B12-B17, C1, C3, C4, C6, D6, LBA

16 technically oriented studies

A10-A12, B2, B8, B9, B11, C2, C5, D1-D5, D7, D8

12 brief presentations

8 clinically oriented studies

A4, A13, B5, B12, B13, C4, D6, LBA

6 technically oriented studies

A12, C2/C5, D2, D7/D8

Poster discussion – PET in lymphoma

29 clinically oriented studies

	HL	DLBCL	PMBCL	BL	PCNSL	PTCL	FL	MZL
Pre	A2, A5, ~~A8~~, A13, C1, C3, D6	B5, D6				C4	D6	B14
Interim	A1, A3, A4, A6, A9, B17	B4, B6, B7, B15	B17	C6				
Post	~~A7~~	~~B3~~	~~B1~~		B16		B10, B12, B13	
Follow-up	LBA							

Poster discussion – PET in lymphoma

25 clinically oriented studies

Baseline PET/CT

Diagnostic accuracy

Baseline PET/CT - NLPHL

A5: Grellier et al, Paris, France

Entity / study goal:	NLPHL / performance of pre-therapeutic PET/CT
No. of patients:	35 (27 untreated, 8 relapsed), retrospective
Gold standard:	CT

Results:

Per site analysis:

Sensitivity	100 %	→ Bone (marrow) lesions 20 %
Specificity	99 %	
Positive predictive value	97 %	
Negative predictive value	100 %	
Accuracy	99 %	→ Stage modification 34 %

Conclusions: FDG-PET/CT is useful to define stage in NLPHL

Baseline PET/CT – MALT lymphomas

B14: Treglia et al, Bellinzona, Switzerland

Entity / study goal:	Marginal zone lymphoma MALT / detection rate
Studies:	20 (published until February 2014)
No. of patients:	376, meta-analysis
Gold standard:	?

Results:

	PET	PET/CT
Overall detection rate	73 %	69 %
Bronchial MALT	94 %	
Head & Neck MALT	90 %	
Gastric MALT	62 %	
Ocular MALT	49 %	

Conclusions: MALT lymphomas are variably FDG-avid
Potential clinical role (radiotherapy in localized stages?)

Poster discussion – PET in lymphoma

25 clinically oriented studies

Baseline PET/CT

Bone marrow involvement

Baseline PET/CT – Hodgkin lymphoma

A2: Zwarthoed et al, Nice, France

Entity / study goal:	Hodgkin lymphoma / bone (marrow) involvement
No. of patients:	152, advanced stage, retrospective
Gold standard:	? (bone marrow biopsy)
Treatment:	ABVD

Results:

	PET/CT	Biopsy	3-yr PFS
Focal uptake	23 (15 %)	6 (of 11)	60 % vs. 79 %
Diffuse uptake (≤ or > liver)	42 (28 %), correlated with spleen uptake, leukocytosis, anemia, hypalbuminemia, B symptoms		

Conclusions:

- Focal uptake – stage IV disease
- Diffuse uptake – reactive changes
- Biopsy rarely changes stage, never changes treatment
- Excellent reviewer concordance (kappa coefficient 0,86)

Baseline PET/CT – BM involvement

D6: Ujjani et al, Washington, D.C., USA

The utility of 18F-FDG PET/CT in assessing bone marrow involvement in lymphoma (HL, DLBCL, FL)

Poster discussion – PET in lymphoma

25 clinically oriented studies

Baseline PET/CT

Prognostic impact

Baseline PET/CT – Hodgkin lymphoma

C1: Touati et al, Limoges, France

Entity / study goal:	Hodgkin lymphoma / metabolic tumor volume
No. of patients:	46, stage I – IV, retrospective
Threshold for MTV:	≥ liver SUV + 3 SD (50 cm^3 of normal liver)
Treatment:	?

Results:

Median MTV 194 cm^3

ROC analysis	No. pts. (%)	2-yr EFS	
MTV ≤ 310 cm^3	27 (59 %)	89 %	
MTV > 310 cm^3	19 (41 %)	28 %	no correlation with CD68

Conclusions: Initial MTV predicts EFS in HL (independently of other factors)

Baseline PET/CT – Hodgkin lymphoma

C3: Patel et al, Leeds, United Kingdom

Entity / study goal:	Hodgkin lymphoma / metabolic tumor volume
No. of patients:	77, stage II – III (BM biopsy normal), retrospective
Threshold for MTV:	30 % or 40 % of SUVmax
	Bone marrow uptake: normal vs. reactive
Treatment:	?

Results:

No correlation between PFS and SUVmax, MTV or TLG

Correlation between PFS and BM uptake pattern (reactive: HR 2,78)

Conclusions: Initial SUVmax, MTV or TLG do not predict PFS in HL
BM uptake pattern correlates with PFS
(cytokines released by HRS cells or monocytes?)

Baseline PET/CT – prognostic impact

B5: Hüttmann et al, Essen, Germany

Outcome of aggressive non-Hodgkin‘s lymphoma patients with a negative pre-treatment PET scan

A13: Kurch et al, Leipzig, Germany

Relevance of non-FDG-avid areas inside a tumour mass in paediatric Hodgkin lymphoma patients

C4: Cottereau et al, Rouen, France

Prognostic value of metabolic tumor volume measured on 18F-FDG PET/CT in patients with nodal presentation T cell lymphoma

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25 clinically oriented studies

Interim PET/CT

Prognostic impact in HL

Interim PET/CT – Hodgkin lymphoma

A1: Miltényi et al, Debrecen, Hungary

Entity / study goal:	Hodgkin lymphoma / interim PET/CT
No. of patients:	113 (62 early + 51 advanced), retrospective
Time point:	After 2nd cycle
Evaluation:	Deauville criteria
Treatment:	ABVD

Results:

	NPV	PPV	5-yr RFS	5-yr OS
All patients	93 %	57 %	93 % vs. 41 %	93 % vs. 58 %
Early	100 %	54 %		
Advanced	82 %	59 %		

Conclusions: Interim PET/CT is predictive of RFS and OS in HL
NPV better than PPV

Interim PET/CT – Hodgkin lymphoma

A3: Zaucha et al, Gdynia, Poland

Entity / study goal:	Hodgkin lymphoma / interim PET/CT
No. of patients:	238 (71 early + 167 advanced), retrospective
Time point:	After 1st (± 2nd) cycle
Evaluation:	Deauville criteria (positive: 4+5)
Treatment:	ABVD

Results:

	iPET1+	iPET2+	NPV	2-yr PFS (- vs. +)
Early	15 %	3 %	100 %	100 % vs. 80 %
Advanced	31 %	13 %	88 %	91 % vs. 47 %

iPET1- / iPET2-: 7 % / 14 % relapses in advanced stages

Conclusions: Interim PET/CT is predictive of PFS in HL
NPV of iPET better in early stages than in advanced stages

Interim PET/CT – Hodgkin lymphoma

A6: Dann et al, Haifa, Israel

Entity / study goal:	Hodgkin lymphoma / interim PET/CT
No. of patients:	308, prospective
Time point:	After 2nd cycle
Evaluation:	Dynamic visual score, Deauville score
Treatment:	ABVD (A), BEACOPPesc (B), radiotherapy (RT)

Stages	iPET negative	iPET positive
Early favorable	2 x A + RT	2 x A + 2 x A + RT
Early unfavorable	2 x A + 2 x A + RT	2 x A + 4 x A + RT
Advanced IPS 0-2	2 x A + 4 x A	2 x A + 2 x B + RT
Advanced IPS 3-7	2 x B + 4 x A	2 x A + 2 x B + RT

Results:

	NPV	PPV	Accuracy
Dynamic visual score	88 %	29 %	81 %
Deauville	89 %	38 %	83 %

Conclusions: Both scores are predictive of PFS
Deauville slightly superior to dynamic visual score

Interim PET/CT – HL and PMBCL

B17: Algrin et al, Nice, France

Entity / study goal:	Mediastinal lymphomas / interim PET/CT
No. of patients:	112 (68 HL + 44 PMBCL), retrospective
Time point:	After 2nd or 4th cycle (PET2, PET4)
Evaluation:	Deauville, Cheson, Gallamini, Dann / ΔSUV
Treatment:	?

Results:

	5-yr-PFS
HL	68 %
PMBCL	93 %

5-yr-PFS	PET2	PET4
ΔSUV >66 %	77 %	86 %
ΔSUV <66 %	67 %	47 %

PET4 predicts PFS by Deauville score (only score 5) and ΔSUV

Conclusions: Interim PET/CT is predictive of PFS in mediastinal lymphomas

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25 clinically oriented studies

Interim PET/CT

Prognostic impact in DLBCL and BL

Interim PET/CT – DLBCL

B6: Hutchings et al, Copenhagen, Denmark

Entity / study goal:	DLBCL / interim PET/CT
No. of patients:	70 (37 PET1 + 33 PET2), prospective
Time point:	Before therapy, after 1st and 2nd cycle and at end of treatment (PET0, PET1, PET2, EOT)
Evaluation:	iPET: Deauville (pos.: 4+5), ΔSUV; EOT: IHP
Treatment:	GA101 + CHOP (response: CR + PR)

Results:

	PET1-	PET1+	PET2-	PET2+	Correlation EOT
Deauville PET1	49 %	51 %			None
Deauville PET2			67 %	33 %	None
ΔSUV PET1/PET0					Weak
ΔSUV PET2/PET0					None

Conclusions: Interim PET/CT is not predictive of EOT response in DLBCL
But: PET+ PR rated as EOT response, no PFS data

Interim PET/CT – DLBCL

B4: Mylam et al, Odense, Denmark

Entity / study goal:	DLBCL / interim PET/CT
No. of patients:	112, prospective
Time point:	Before therapy and after 1st cycle (PET0, PET1)
Evaluation:	IHP, Deauville criteria (positive: 4+5 or 5)
Treatment:	?

Results:

2-yr-PFS:	iPET-	iPET+	
IHP	n.s.		
Deauville 4+5	n.s.		
Deauville 5	85 %	51 %	p=0,002
Tumor/liver SUVmax </> 3.1	90 %	57 %	

Conclusions: Interim PET/CT is not predictive of PFS in DLBCL
Deauville 4+5 vs. 5 may be improved by use of T/L-SUV

Interim PET/CT

Deauville 5-point scale: Cut-of between 4 and 5 ?

Five-point Deauville Criteria.

Score 1	No uptake
Score 2	Uptake ≤ mediastinum
Score 3	Uptake > mediastinum < liver
Score 4	Uptake moderately increased above liver at any site
Score 5	Markedly increased uptake at any site including new sites of disease

Interim PET/CT – AIDS-related lymphoma

B15: Viau et al, Nice, France

Entity / study goal:	AIDS-related lymphoma / interim PET/CT
No. of patients:	19 (8 HL + 6 DLBCL + 5 BL), retrospective
Time point:	Before therapy and after 2nd or 3rd cycle
Evaluation:	ΔSUVmax, ΔSULmax, ΔMTV (> vs. < 66 %) ; Deauville (positive: 4+5), tumor/liver activity
Treatment:	? (tumorSULmax/liverSULmean)

Results:

3-yr-OS:	Good response	Poor response	
ΔSUVmax / ΔSULmax	87 %	33 %	p<0,0001
ΔMTV			n.s.
Deauville	81 %	44 %	n.s.
Tumor/liver activity </> 5	84 %	33 %	p<0,0001

Conclusions: ΔSUVmax is predictive of OS in AIDS-related lymphoma
Ratio tumorSULmax/liverSULmean is promising

Interim PET/CT – Burkitt lymphoma

C6: Shah et al, Mumbai, India

Entity / study goal:	Burkitt lymphoma / interim PET/CT
No. of patients:	21 (14 children + 7 adults), retrospective
Time point:	Before therapy and after 2nd or 3rd cycle
Evaluation:	ΔSUVmax, ΔTLG
Treatment:	?

Results:

	No. pts.	2-yr-DFS
100 % reduction SUVmax and TLG	13	100 %
> 90 % reduction SUVmax and TLG	3	100 %
< 90 % reduction SUVmax and TLG	5	40 %

Conclusions: Both ΔSUVmax and ΔTLG are predictive of DFS in BL
High NPV (reliable identification of long-term responders)

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25 clinically oriented studies

Interim PET/CT

Additional prognostic factors

Interim PET/CT – HL: tumor shrinkage

A9: Kobe et al, Cologne, Germany

Entity / study goal:	Hodgkin lymphoma / interim PET/CT + tumor size
No. of patients:	739 (residual tumor ≥ 2,5 cm), prospective (HD15)
Time point:	After chemotherapy, decision to deliver radiotherapy
Evaluation:	Visual (central review)
Treatment:	BEACOPP variants ± radiotherapy

Results:

	No. pts.	4-yr-PFS
PET negative (no radiotherapy)	548 (74 %)	92 %
PET positive (radiotherapy)	191 (26 %)	86 %
PET positive + ≥ 40 % shrinkage	137 (19 %)	93 %
PET positive + < 40 % shrinkage	54 (7 %)	72 %

Conclusions: Tumor shrinkage (as determined by CT) is predictive of PFS in HL pts. receiving RT for residual PET+ lesions

Interim PET/CT – DLBCL: molecular feat.

B7: Scherman et al, Creteil, France

Entity / study goal:	DLBCL / interim PET/CT + molecular features
No. of patients:	91 (IHC + FISH: BCL2, BCL6, MYC), retrospective
Time point:	After 2nd cycle
Evaluation:	Visual, ΔSUVmax
Treatment:	?

Results:

Slow metabolic response + BCL2 overexpression or BCL2 gene alteration
→ poor prognosis

Conclusions: BCL2 abnormalities improve prediction by iPET

Interim PET/CT – HL: lympho/mono ratio

A4: Simon et al, Debrecen, Hungary

Prognostic role of peripheral lymphocyte/monocyte ratio and interim PET/CT in Hodgkin lymphoma patients

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Post-treatment PET/CT

Prognostic impact

Post-treatment PET/CT – PCNSL

B16: Edeline et al, Saint-Cloud, France

Entity / study goal:	PCNSL / post-treatment PET/CT
No. of patients:	10 (post-treatment: 9), retrospective
Time point:	Pre- and post-treatment, comparison MRI
Evaluation:	Visual and SUVmax (activity > surrounding brain)
Treatment:	Chemotherapy (± radiotherapy)

Results:

	Pre PET+	PET-	Post PET+	PET-	Post-MRI+	MRI-
No. pts.	8	2	0	9	4	5
Relapse				6	4	2

Conclusions: Poor NPV of post-treatment PET/CT
MRI superior

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Post-treatment PET/CT

Additional prognostic factors

Post-treatment PET/CT – FL: MRD

B10: Luminari et al, Modena, Italy

Entity / study goal:	Follicular lymphoma / post-treatment PET/CT + MRD
No. of patients:	41 (BCL2/IGH positive in bone marrow), prospective
Time point:	End of treatment
Evaluation:	Deauville (positive: 4+5)
Treatment:	?

Results:

	No. pts. (%)
PET- / MRD -	28 (68 %)
PET- / MRD+	8 (20 %)
PET+ / MRD-	2 (5 %)
PET+ / MRD+	3 (7 %)

	PFS (HR)	
PET- vs. PET+	3.61	p=0,028
MRD- vs. MRD+	2.54	p=0,060
PET-/MRD- vs. PET+ ± MRD+	3.42	p=0,012

Conclusions: PET/CT and MRD provide independent information
Combining post-treatment PET/CT with post-treatment MRD improves prediction of PFS

Post-treatment PET/CT – follicular lymph.

B12: Kostakoglu et al, New York, USA

Post-induction therapy FDG-PET is prognostic for PFS in relapsed follicular lymphoma:
a preliminary analysis of the GAUSS study

B13: Trotman et al, Sydney, Australia

Prognostic value of PET/CT after frontline therapy in follicular lymphoma:
applying the 5PS in three multicenter studies

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Follow-up PET/CT

Detection of relapse

Follow-up PET/CT – Hodgkin lymphoma

LBA: Pugliese et al, Naples, Italy

A randomized trial of routine surveillance imaging procedures:

ultrasonography / chest radiography vs. FDG PET/CT

for detecting relapse

in patients with advanced stage Hodgkin lymphoma