Semiquantitative Measurements of Standard-Uptake-Value (ΔSUV) in Assessment of Patients Response and Outcomes in Aggressive Lymphomas

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INTRODUCTION

Context: Positron emission tomography (PET) with 18-fluoro-2-deoxy-D-glucose ([18 F] FDG) is an essential tool for accurate staging, early, and late therapy response assessment in all FDG-avid lymphomas. Given the potential for interobserver variability in interpretation of this visual assessment, a more quantitative measure of tracer uptake, such as ΔSUV_{max}, may offer a more reproducible assessment.

PATIENTS &METHODS

study included patients histopathological diagnosed as (DLBCL) or (HD) .Patients' follow-up was maintained for at least 24 months from time of diagnosis. Patients were assessed every cycle by clinical examination. Base line PET-CT was performed, (PET 0) before initiation of therapy, 21 days post cycle 2 (PET 2) and cycle 4. (PET 4)

A whole-body acquisition was started 60 _ 10 minutes after a 5-MBq/Kg injection of 18F-FDG, working from groin up to the head. The administered activity of FDG, time of injection, and time of the scan beginning were recorded.

To assess ΔSUV max, the hottest tumor in any region or organ on PET2 or PET4 was used for comparison, even if its location differed from the initial hottest tumor in PET0. patients should be imaged on the same PET scanner to control for inherent differences in scanner characteristics. The percent change in FDG uptake from baseline to follow-up was defined as the difference between the highest SUV in any disease site at baseline and the highest SUV in any site of residual FDG uptake on follow-up, as a fraction of the former: ΔSUV= 100% × (baseline SUV max - follow-up SUVmax)/baseline SUVmax. According to SUV based assessment, PET2 and PET4 were considered negative when ΔSUVmaxPET0-2 > 66% and ΔSUV max PET0-4 > 70%, respectively .

For both PET2 scans and PET4 scans, the films are visualized, and the 5-PS was applied, with Scores of 4 or 5 are considered visually positive for metabolically active disease and scores of 1, 2 or 3(less than or equal to liver) are considered visually negative for metabolically active disease. Biopsy was considered for when PET4 is visually positive, but Δ SUV max is negative.

PFS &OS were calculated for all patients .

RESULTS

The current study included 73 patients diagnosed with lymphoma, 30 patients diagnosed with HD and 43 patients with DLBCL. The SUV uptake values at baseline was Mean ± SD: 16.30 ± 9.36 in NHL versus 12.55 ± 6.78 in HL. After 2 cycles of scheduled chemotherapy, 57 patients (78.1%) had negative PET based on Δ SUV max raised to 63 patients (86.3%) by the end of 4th cycle and this was different from 5PS where only 26 patients (60.5%) raised to 32 raised to (74.4%) after the 4th cycle. The agreement between Δ SUV max values and 5PS was moderate agreement .

After 4 cycles 22 patients needed to undergo biopsy because inconclusive results of PET. Comparison between Δ SUV max values and 5PS and biopsy reveled that semiquantitative analysis using ΔSUV max demonstrated that PET2 ΔSUV has higher specificity, very high positive predictive value, and accuracy 90.91% compared to the visual analysis also, PET4 ΔSUV has more specificity and positive predictive value and more accuracy, 95.45 % versus 54.55% for visual score. And the significant relation of ΔSUV_{max} results with biopsy (P value: 0.003) results as all the 17 patients with negative ΔSUV_{max} results confirmed to be negative by biopsy. Regarding response, there significant relation between the 2 groups regarding CR and refractory disease (P values were: <0.0001). (Table 5)

By the end of the study mean overall survival 23.175 months and the median time to progression was 16.6 months. Both time to progression and overall survival was shorter in patients with positive PET2 scans compared to patients with negative scans however these differences were not significant.



figure 1

: figures (a)(B)(c) from Lt to Rt showing mediastinal mass PET 0, PET 2 & PET 4 respectively . PET 0 (SUV max 34) , PET 2 (SUV max 5.2) & PET 4 (SUV max) coreesponind to complete CR

Table (1): Agreement (sensitivity, specificity, and accuracy) on different parameters compared to biopsy after four cycles

	Biopsy				Sensitivity	Specificity	PPV	NPV	Accuracy	AUC
	Negative (n =17)		Positive (n = 5)							
	No.	%	No.	%						
ΔSUVmax										
Negative more than 70%	17	100	1	20.0	80.0	100.0	100.0	94.44	95.45	0.900
Positive less than 70%	0	0.0	4	80.0						
k(p)	0.861* (<0.001*)									
PET.5PS										
1.2.3 Negative	7	41.2	0	0.0	100.0	41.18	33.33	100.0	54.55	0.706
4.5 Positive	10	58.8	5	100						
k(p)	0.241 (0.082)									

AUC: Area under the curve; PPV: positive predictive value; NPV: negative predictive value

Value of K	Strength of agreement
0.81 - 1.00	Very good

CONCLUSIONS

PET2 interpretation according to semiquantitative approach appears to discriminate lymphoma patients better than the visual Deauville 5-PS analysis: it could allow better detection of persistent or early relapsed disease, which could otherwise go unnoticed, while a negative PET2 result could support de-escalating therapy intensity, limiting related toxicities.

In conclusion, these encouraging results suggest the use of SUV max in addition to visual analysis to interpret interim PET for patients with DLBCL, specifically when a therapeutic decision is to be guided by interim PET results. Nevertheless, more studies are needed to address these questions and confirm these results.

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