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Original Article

Prognostic Value of the Metabolic Response on Serial ^{18}F-FDG PET/CT in Pancreatic Cancer

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Background/Aims: The prognostic value of serial ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F-FDG PET/CT) for patients with borderline resectable or locally advanced pancreatic cancer who undergo conversion surgery or continue chemotherapy without surgery has not been well-established.

Methods: A retrospective analysis of patients with pancreatic ductal adenocarcinoma was conducted at Seoul National University Bundang Hospital between March 2013 and February 2022. Patients underwent PET/CT at baseline and subsequent radiologic evaluations following chemotherapy. Changes in the maximum standardized uptake value (SUVmax), mean standardized uptake value (SUVmean), metabolic tumor volume, and total lesion glycolysis were analyzed. Based on their treatment regimens, patients were stratified into the conversion surgery group or nonconversion surgery group. Survival outcomes and various clinical factors were assessed.

Results: Among 121 patients, 52 underwent conversion surgery, and 69 continued to receive chemotherapy without surgery. A significant reduction in the SUVmax was correlated with prolonged recurrence-free survival and overall survival in the conversion surgery group. Confirmation of a pathologic response indicated a significant association between reductions in the SUVmax and positive outcomes. Reductions in the metabolic tumor volume and total lesion glycolysis were associated with improved progression-free survival and overall survival in the nonconversion surgery group.

Conclusions: Serial PET/CT scans demonstrated prognostic value in pancreatic ductal adenocarcinoma patients, revealing distinct correlations in the conversion surgery group and nonconversion surgery group. **(Gut Liver, 2025;19:462-472)**

Key Words: Positron emission tomography computed tomography; Pancreatic neoplasms; Prognosis

INTRODUCTION

Pancreatic ductal adenocarcinoma (PDAC) is challenging because of its poor prognosis, which is characterized by a 5-year survival rate of only 10%. Moreover, surgical intervention is the only curative option for PDAC.[1] However, only 20% of patients present with resectable disease at the time of diagnosis.[2] Neoadjuvant chemotherapy (NACT) has allowed for new possibilities for patients with locally advanced or borderline resectable PDAC and has enabled conversion surgery. Accurate assessments of the response to NACT are important for predicting outcomes after treatment. Additionally, the restricted array of available chemotherapy treatments as well as suboptimal outcomes, highlights the importance of efficiently utilizing limited chemotherapy regimens. Early determination of the prognosis is critical to optimizing the effectiveness of such regimens.

Various studies have evaluated the response to NACT using modalities such as computed tomography (CT)

based on the Response Evaluation Criteria in Solid Tumors (RECIST) version 1.1 guidelines.[3,4] However, these widely adopted criteria are associated with challenges when differentiating peritumoral fibrotic changes from viable tumor tissue after NACT.[5] Despite acknowledgment of the role of tumor heterogeneity in treatment resistance, the lack of sensitive biomarkers is problematic. Current methods, including CT, struggle to capture the complexity of tumor heterogeneity. Furthermore, the advent of novel biological therapies has complicated the response evaluation because of their tendency to infrequently induce tumor shrinkage.[6,7] Alternatively, the tumor marker carbohydrate antigen 19-9 has potential as a prognostic indicator; however, caution is necessary because it may reflect systemic, rather than local responses.[8]

Metabolic imaging provides a comprehensive and quantitative, whole-body evaluation of treatment-induced alterations in tumor glycolysis soon after treatment initiation before any observable morphological changes occur.[9] Consequently, it has the potential to reveal tumor heterogeneity by elucidating the diverse behaviors of distinct tumor sites in response to treatment. ^{18}F-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography/CT (PET/CT) is an essential tool that can assess the treatment response by relying on alterations in tumor glucose metabolism.[10] Numerous studies of various cancer types have demonstrated the utility of PET/CT metabolic parameters for predicting prognoses.[9,11-15] Additionally, several studies have explored the relevance of these parameters to pancreatic cancer. However, investigations of pancreatic cancer have predominantly focused on analyzing prognoses based on parameter values obtained at isolated time points, such as before or after treatment initiation. Notably, few studies have examined the changes in individual parameters and their associated outcomes. Moreover, most existing studies have included heterogeneous patient cohorts and predominantly focused on patients who have undergone surgery.[16-19]

This study aimed to investigate correlations between alterations in metabolic parameters and the prognosis of patients with borderline resectable pancreatic cancer (BRPC) and those with locally advanced pancreatic cancer (LAPC). We sought to determine whether obtaining information from serial PET/CT evaluations could provide more useful insights than traditional radiologic responses. Furthermore, we aimed to explore the benefits of serial PET/CT not only for patients who underwent conversion surgery but also for patients who continued to receive chemotherapy and did not undergo surgery.

MATERIALS AND METHODS

1. Study participants

This retrospective study included patients with histopathologically confirmed PDAC treated at Seoul National University Bundang Hospital between March 2013 and February 2022. The primary objective of this study was to investigate the ability to predict the prognosis using serial PET/CT for patients with either BRPC or LAPC. The definitions of BRPC and LAPC were based on the National Comprehensive Cancer Network guidelines.[20]

2. PET/CT imaging and analysis

All ^{18}F-FDG PET/CT evaluations were performed using dedicated PET/CT scanners (Biograph mCT Flow [Siemens Healthineers, Cary, NC, USA] or Discovery VCT [GE Medical Systems, Chicago, IL, USA]) at our hospital. Patients with concurrent malignancies and those who underwent PET/CT imaging at other institutions were excluded. The inclusion criteria were available baseline PET/CT imaging results and subsequent imaging results after treatment initiation. All ^{18}F-FDG PET/CT images were assessed by two nuclear medicine physicians (Yoo Sung Song and Hyun Gee Ryoo), and any discrepancies between the readers were resolved through a consensus. Assessment of the metabolic tumor response involved a meticulous examination of the following four parameters: maximum standardized uptake value (SUVmax), mean standardized uptake value (SUVmean), metabolic tumor volume (MTV), and total lesion glycolysis (TLG). SUVmax of the volume of interest was measured as follows: [decay-corrected activity (kBq) per tissue volume (mL)]/[injected 18F-FDG activity (kBq) per body mass (g)]. MTV was defined as total tumor volume with an SUV ≥2.5, and the MTV and SUVmean of the volume of interest were automatically calculated. TLG was calculated as SUVmean×MTV. ΔSUVmax or percent reduction of SUVmax was calculated using the following formula: [(SUVmax after treatment–SUVmax before treatment)/SUVmax before treatment]×100; the other metabolic parameters were similarly calculated.[12] The cohort was stratified into two groups based on the median change in each parameter for subsequent analysis.

3. Study design

Patients were categorized into the conversion surgery group (those who underwent conversion surgery; n=52) and nonconversion surgery group (those who continued to receive chemotherapy and did not undergo surgery; n=60). Because of the substantial impact of surgical intervention on the prognosis, separate analyses were performed for each group. Survival outcomes were verified using national

insurance records and detailed medical records.

Data from the patient records, including age, sex, diabetes mellitus, Eastern Cooperative Oncology Group status, tumor size, tumor location, chemotherapy details, second-line chemotherapy utilization, College of American Pathologists (CAP) tumor regression grade (grade 0, complete response with no residual tumor; grade 1, marked response with minimal residual tumor [single or rare groups of cancer cells]; grade 2, moderate response with some residual tumor; and grade 3, poor or no response), and carbohydrate antigen 19-9 serum levels (measured using a radioimmunoassay; reference 37 U/mL), were meticulously reviewed.

4. Ethics statement

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board (IRB number: B-2401-877-102) of Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seongnam, Korea. The requirement for written informed consent was waived because of the retrospective nature of this study.

5. Statistical analysis

Statistical analysis was conducted using R software (version 4.2.1; R Foundation for Statistical Computing, Vienna, Austria). The survival analysis used the Kaplan-Meier curves to assess overall survival (OS) rates of the studied cohort. This approach allowed for a comprehensive examination of time-to-event outcomes because the Kaplan-Meier curves enabled visual comparisons of survival probabilities over time. Moreover, a Cox regression model including various factors that might influence the prognosis was used for multivariate analysis. Univariate analysis was conducted for each parameter, and parameters showing significant differences were further analyzed using multivariate analysis, adjusted for other factors. MTV and TLG are correlated variables, not independent ones; therefore, they were not included together in the multivariate analysis. Rigorous statistical modeling was performed to identify and quantify the impact of different variables on the observed outcomes, thus providing valuable insights regarding the complex interplay of prognostic factors. Furthermore, the Wilcoxon test was performed to investigate variations in the metabolic tumor response parameters based on different variables. This non-parametric test provided a reliable method for investigating potential differences associated with various factors, thereby contributing to a more detailed understanding of the metabolic responses of the study population.

These statistical methodologies, particularly the application of Kaplan-Meier curves, enriched the analysis by offering dynamic visualization of survival outcomes and enhancing the exploration of relationships between prognostic factors and metabolic tumor responses of patients diagnosed with BRPC or LAPC.

RESULTS

1. Baseline characteristics and overall outcomes

From March 2013 to February 2022, a total of 3,432 patients received treatment for pancreatic cancer at Seoul National University Bundang Hospital. Among these patients, 1,153 were diagnosed with BRPC or LAPC. Of these, 121 patients who underwent both initial and subsequent PET/

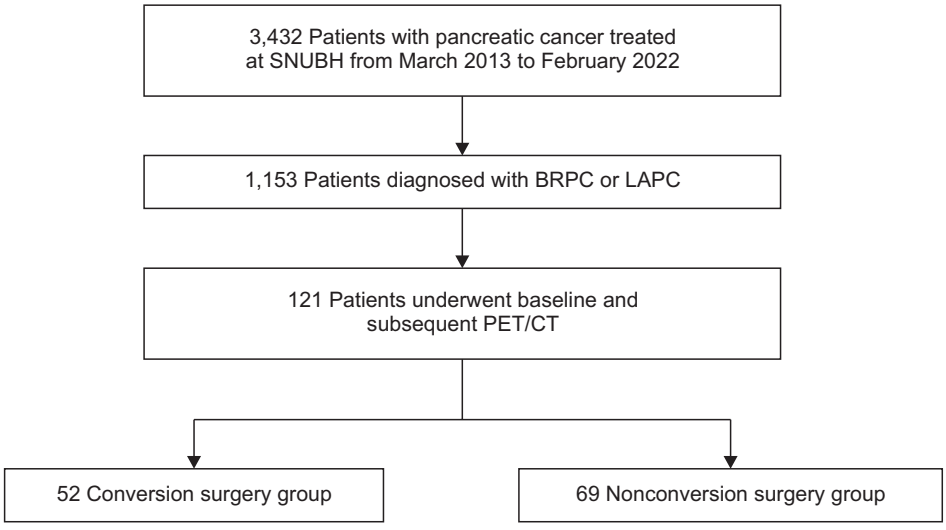


Fig. 1. Flowchart of the study. SNUBH, Seoul National University Bundang Hospital; BRPC, borderline resectable pancreatic cancer; LAPC, locally advanced pancreatic cancer; PET/CT, positron emission tomography/computed tomography.

Table 1. Baseline Characteristics

Characteristics	Conversion surgery group (n=52)	Nonconversion surgery group (n=69)	Total (n=121)	p-value
Age, median (range), yr	68.2 (35.3–82.3)	66.9 (37.5–79.5)	67.5 (35.3–82.3)	0.504
Sex, No. (%)				0.960
Male	23 (44.2)	32 (46.4)	55 (45.5)	
Female	29 (55.8)	37 (53.6)	66 (54.5)	
BMI, mean±SD, kg/m^2	23.6±3.3	22.7±2.5	23.1±2.9	0.093
ECOG, No. (%)				0.679
0	11 (21.2)	18 (26.1)	29 (24.0)	
1	41 (78.8)	51 (73.9)	92 (76.0)	
Tumor location, No. (%)				0.268
Head	30 (57.7)	35 (50.7)	65 (53.7)	
Body	17 (32.7)	31 (44.9)	48 (39.7)	
Tail	5 (9.6)	3 (4.3)	8 (6.6)	
Stage, No. (%)				0.093
BRPC	33 (63.5)	32 (46.4)	65 (53.7)	
LAPC	19 (36.5)	37 (53.6)	56 (46.3)	
First line chemotherapy, No. (%)				0.267
FOLFIRINOX	51 (98.1)	65 (94.2)	116 (95.9)	
GNP	1 (1.9)	1 (1.4)	2 (1.7)	
Gemcitabine	0	3 (4.3)	3 (2.5)	
Baseline SUVmax, median±SD	5.3±2.4	6.0±2.8	5.7±2.6	0.180
Baseline SUVmean, median±SD	3.2±0.7	4.4±6.0	3.9±4.6	0.080
Baseline MTV, median±SD	14.9±15.7	18.5±24.1	16.9±20.9	0.328
Baseline TLG, median±SD	53.4±62.2	77.1±118.4	66.9±98.6	0.157

BMI, body mass index; ECOG, Eastern Cooperative Oncology Group; BRPC, borderline resectable pancreatic cancer; LAPC, locally advanced pancreatic cancer; FOLFIRINOX, combination of 5-fluorouracil, leucovorin, irinotecan, and oxaliplatin; GNP, gemcitabine plus nab-paclitaxel; SUVmax, maximum standardized uptake value; SUVmean, mean standardized uptake value; MTV, metabolic tumor volume; TLG, total lesion glycolysis.

CT evaluations at Seoul National University Bundang Hospital were enrolled in this study (Fig. 1). The demographic and clinical characteristics of these patients are summarized in Table 1. After chemotherapy, 52 patients underwent conversion surgery; however, 69 patients continued to receive chemotherapy and did not undergo surgery. Among these patients, 55 (45.5%) were male, the median age was 67.5 years, and 65 (53.7%) had BRPC. Most patients (95.9%) received FOLFIRINOX (combination of 5-fluorouracil, leucovorin, irinotecan, and oxaliplatin) as first-line chemotherapy. The median interval between the baseline PET/CT evaluation and subsequent PET/CT evaluation was 4.2 months (range, 2.0 to 8.0 months). The median ΔSUVmax, ΔMTV, ΔTLG, and ΔSUVmean values were −40.5%, −96.5%, −97.2%, and −24.3%, respectively. When stratifying patients into two groups based on the median values of changes in each parameter, patients with significant decreases in all parameters experienced prolonged OS compared to those who did not (ΔSUVmax, 31.8 months vs 19.3 months; ΔMTV, 31.8 months vs 18.3 months; ΔTLG, 30.2 months vs 18.8 months; ΔSUVmean, 30.0 months vs 19.3 months) (Fig. 2).

2. Conversion surgery group

We investigated the influence of changes in the SUVmax, SUVmean, MTV, and TLG on recurrence-free survival (RFS) and OS of the conversion surgery group. The median ΔSUVmax, ΔMTV, ΔTLG, and ΔSUVmean values were −41.3%, −99.8%, −99.9%, and −44.1%, respectively. When dividing patients into two groups based on the median value of changes in each parameter, patients with significant decreases in SUVmax experienced prolonged RFS (not reached vs 20.8 months) and OS (51.7 months vs 30.2 months) compared with those who did not (Fig. 3). This association remained significant after adjusting for age, sex, Eastern Cooperative Oncology Group performance status, stage, and adjuvant chemotherapy during the multivariate analysis. Specifically, patients with less reductions in the SUVmax experienced shorter RFS (hazard ratio, 2.56; 95% confidence interval, 1.16 to 5.61; p=0.019) and OS (hazard ratio, 2.55; 95% confidence interval, 1.10 to 5.89; p=0.029) (Table 2). However, changes in the SUVmean, MTV, and TLG did not result in significant differences in the prognosis after treatment (Supplementary Fig. 1). When dividing patients into two groups based on the median values of metabolic parameters from baseline and posttreatment PET/CT, no significant differences in OS were observed (Supplementary Figs 2 and 3).

According to RECIST version 1.1 guidelines, 26 patients had a partial response (PR) and 26 patients had stable dis-

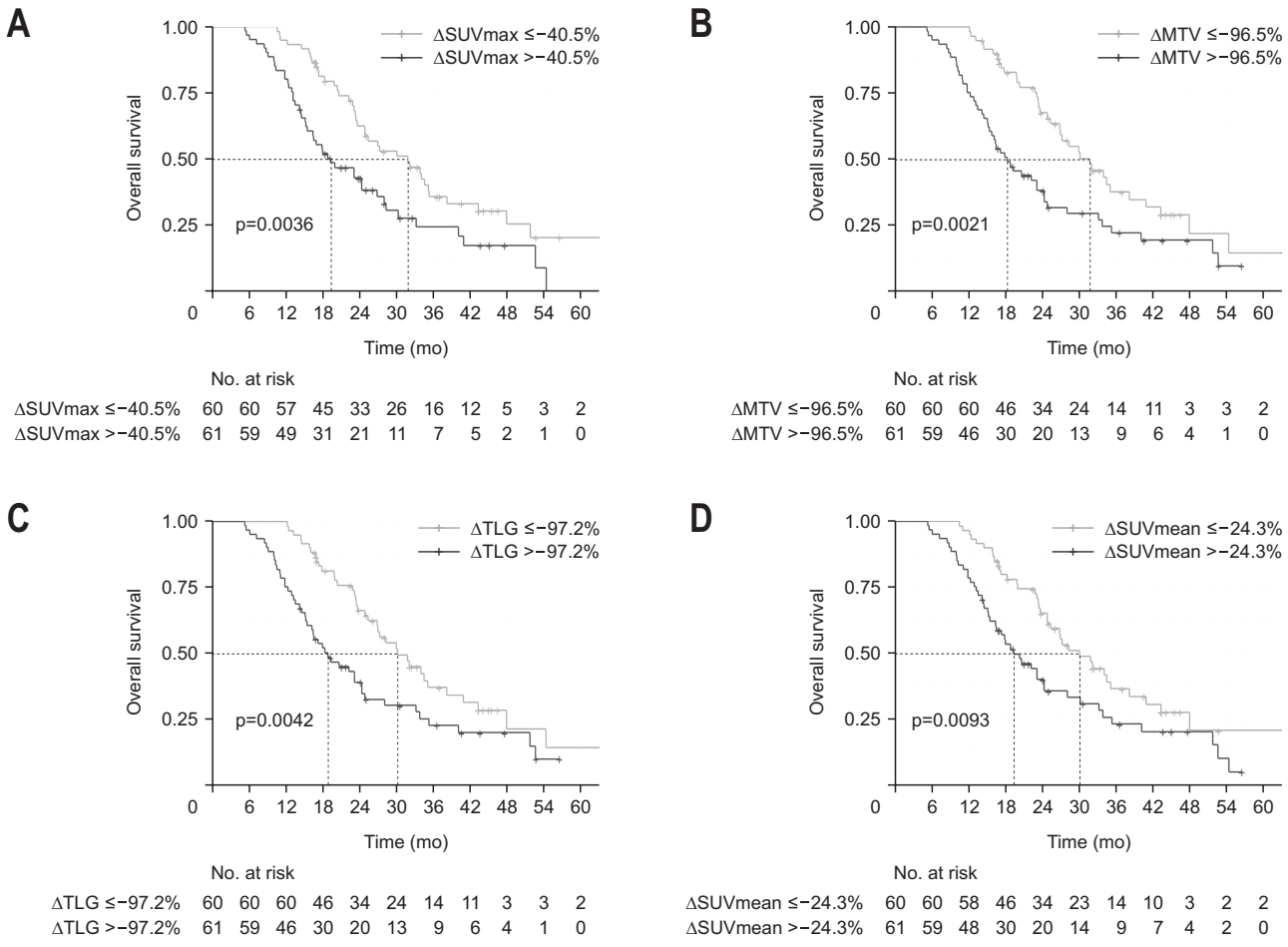


Fig. 2. Overall prognostic outcomes. (A) SUVmax, (B) MTV, (C) TLG, and (D) SUVmean. SUVmax, maximum standardized uptake value; MTV, metabolic tumor volume; TLG, total lesion glycolysis; SUVmean, mean standardized uptake value.

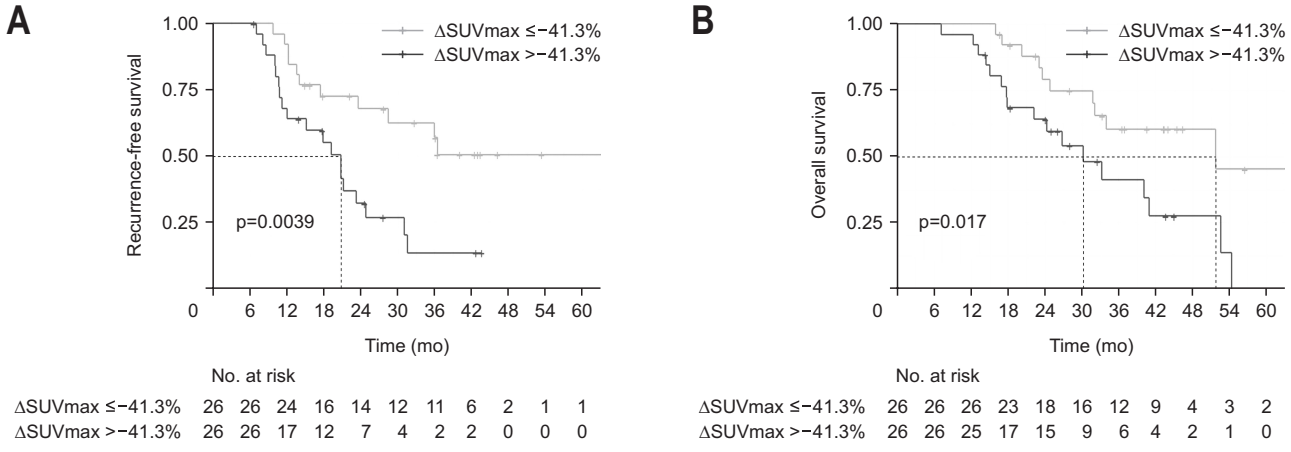


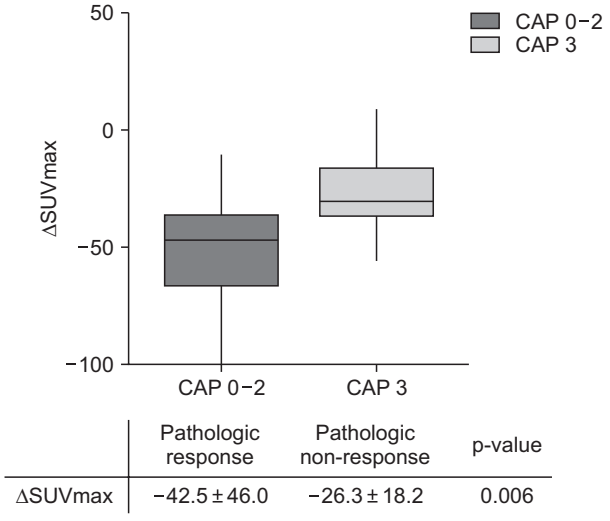
Fig. 3. Prognosis with ΔSUVmax in the conversion surgery group. (A) Recurrence-survival and (B) overall survival. SUVmax, maximum standardized uptake value.

ease (SD) at the time of the subsequent PET/CT evaluation. There were no significant differences in the RFS and OS of the PR and SD groups (Supplementary Fig. 4). A comparison of ΔSUVmax with a radiologic response revealed no significant differences between the PR and SD groups (−46.2% vs −34.1%, p=0.179) (Supplementary Fig. 5). However, a comparison of the CAP grade determined using surgical specimens showed a greater reduction in the SUVmax was

Table 2. Multivariate Analysis for Recurrence-Free Survival and Overall Survival in the Conversion Surgery Group

Prognostic factor	Recurrence-free survival		Overall survival	
	HR (95% CI)	p-value	HR (95% CI)	p-value
ΔSUVmax				
≤−41.3%	1.00		1.00	
>−41.3%	2.56 (1.16–5.61)	0.019	2.55 (1.10–5.89)	0.029
Age				
≤68 yr	1.00		1.00	
>68 yr	1.37 (0.64–2.94)	0.412	2.04 (0.85–4.89)	0.109
Sex				
Male	1.00		1.00	
Female	0.86 (0.41–1.83)	0.696	0.64 (0.29–1.42)	0.276
ECOG				
0	1.00		1.00	
1	1.33 (0.49–3.60)	0.412	0.77 (0.28–2.16)	0.621
Stage				
BRPC	1.00		1.00	
LAPC	1.37 (0.65–2.91)	0.405	1.12 (0.51–2.48)	0.779
Adjuvant chemotherapy				
No	1.00		1.00	
Yes	1.49 (0.70–3.15)	0.301	0.97 (0.43–2.19)	0.945

HR, hazard ratio; CI, confidence interval; SUVmax, maximum standardized uptake value; ECOG, Eastern Cooperative Oncology Group; BRPC, borderline resectable pancreatic cancer; LAPC, locally advanced pancreatic cancer.



	Pathologic response	Pathologic non-response	p-value
ΔSUVmax	−42.5 ± 46.0	−26.3 ± 18.2	0.006

Fig. 4. Correlation between ΔSUVmax and pathologic response. SUVmax, maximum standardized uptake value; CAP, College of American Pathologists.

noted in the pathologic response group (CAP grade 0–2 vs CAP grade 3: −42.5% vs −26.3%, p=0.006) (Fig. 4). These findings suggest that the degree of reduction in SUVmax may predict the pathologic response of pancreatic cancer to NACT. Furthermore, an examination of the correlation between ΔSUVmax and R0 resection showed that patients who experienced a significant reduction in SUVmax had a notably higher proportion of R0 resections compared to those who did not (100.0% vs 73.1%, p=0.015).

3. Nonconversion surgery group

In contrast to the conversion surgery group, patients receiving continuous chemotherapy exhibited a different trend, where greater reductions in MTV and TLG were associated with improved progression-free survival (PFS) and OS (Fig. 5), not in SUVmax and SUVmean (Supplementary Fig. 6). Notably, patients with significant reductions in the MTV experienced prolonged PFS (13.7 months vs 7.4 months, p<0.001) and OS (25.3 months vs 15.4 months, p=0.003). Similarly, patients with substantial reductions in the TLG experienced extended PFS (13.7 months vs 6.9 months, p<0.001) and OS (25.3 months vs 14.5 months, p<0.001). These associations remained consistent after adjusting for other factors in the multivariate analysis (Tables 3 and 4). The median ΔSUVmax, ΔMTV, ΔTLG, and ΔSUVmean values were −40.4%, −84.3%, −87.3%, and −15.2%, respectively. When dividing patients into two groups based on the median values of metabolic parameters from baseline PET/CT, no significant difference in OS was observed (Supplementary Fig. 7).

According to RECIST version 1.1 guidelines, 14 patients had PR, 49 had SD, and six had progressive disease at the time of the subsequent PET/CT evaluation. No significant differences in the prognoses of patients with PR and those with SD were observed (Supplementary Fig. 8). However, when we focused on the patients with SD, significant reductions in MTV and TLG were associated with better survival (ΔMTV OS, 30.0 months vs 15.8, p<0.001; ΔMTV PFS, 16.2 months vs 6.5 months, p<0.001; ΔTLG OS, 28.3

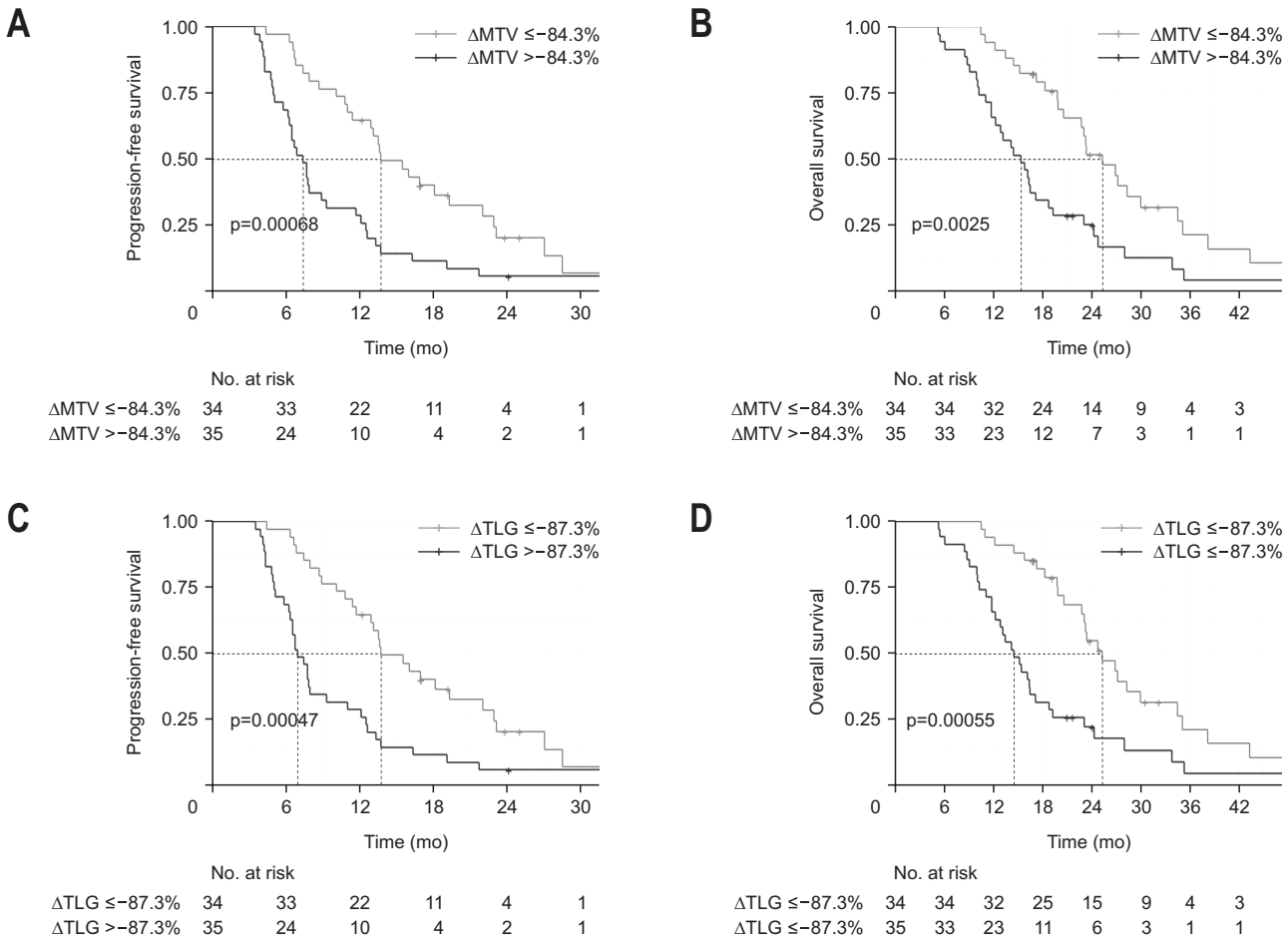


Fig. 5. Prognosis with ΔMTV, ΔTLG in the nonconversion surgery group. (A) Progression-free survival and (B) overall survival with ΔMTV. (C) Progression-free survival with and (D) overall survival with ΔTLG. MTV, metabolic tumor volume; TLG, total lesion glycolysis.

Table 3. Multivariate Analysis for Progression-Free Survival and Overall Survival in the Nonconversion Surgery Group (MTV)

Prognostic factor	Progression-free survival		Overall survival	
	HR (95% CI)	p-value	HR (95% CI)	p-value
ΔMTV				
≤−84.3%	1.00		1.00	
>−84.3%	2.42 (1.43–4.10)	<0.001	2.21 (1.29–3.79)	0.004
Age				
≤67 yr	1.00			
>67 yr	1.01 (0.60–1.69)	0.979	1.09 (0.64–1.89)	0.744
Sex				
Male	1.00		1.00	
Female	0.79 (0.46–1.36)	0.397	1.00 (0.58–1.73)	0.999
ECOG				
0	1.00		1.00	
1	1.04 (0.56–1.92)	0.909	1.08 (0.58–2.04)	0.802
Stage				
BRPC	1.00		1.00	
LAPC	0.70 (0.42–1.18)	0.183	0.81 (0.47–1.40)	0.452

MTV, metabolic tumor volume; HR, hazard ratio; CI, confidence interval; ECOG, Eastern Cooperative Oncology Group; BRPC, borderline resectable pancreatic cancer; LAPC, locally advanced pancreatic cancer.

Table 4. Multivariate Analysis for Progression-Free Survival and Overall Survival in the Nonconversion Surgery (TLG)

Prognostic factor	Progression-free survival		Overall survival	
	HR (95% CI)	p-value	HR (95% CI)	p-value
ΔTLG				
≤−87.3%	1.00		1.00	
>−87.3%	2.42 (1.41–4.17)	0.001	2.50 (1.42–4.40)	0.002
Age				
≤67 yr	1.00			
>67 yr	0.86 (0.51–1.46)	0.585	0.97 (0.56–1.67)	0.914
Sex				
Male	1.00		1.00	
Female	0.85 (0.50–1.46)	0.567	1.07 (0.62–1.85)	0.806
ECOG				
0	1.00		1.00	
1	1.05 (0.57–1.94)	0.882	0.97 (0.56–1.67)	0.743
Stage				
BRPC	1.00		1.00	
LAPC	0.83 (0.49–1.40)	0.480	0.94 (0.54–1.65)	0.833

TLG, total lesion glycolysis; HR, hazard ratio; CI, confidence interval; ECOG, Eastern Cooperative Oncology Group; BRPC, borderline resectable pancreatic cancer; LAPC, locally advanced pancreatic cancer.

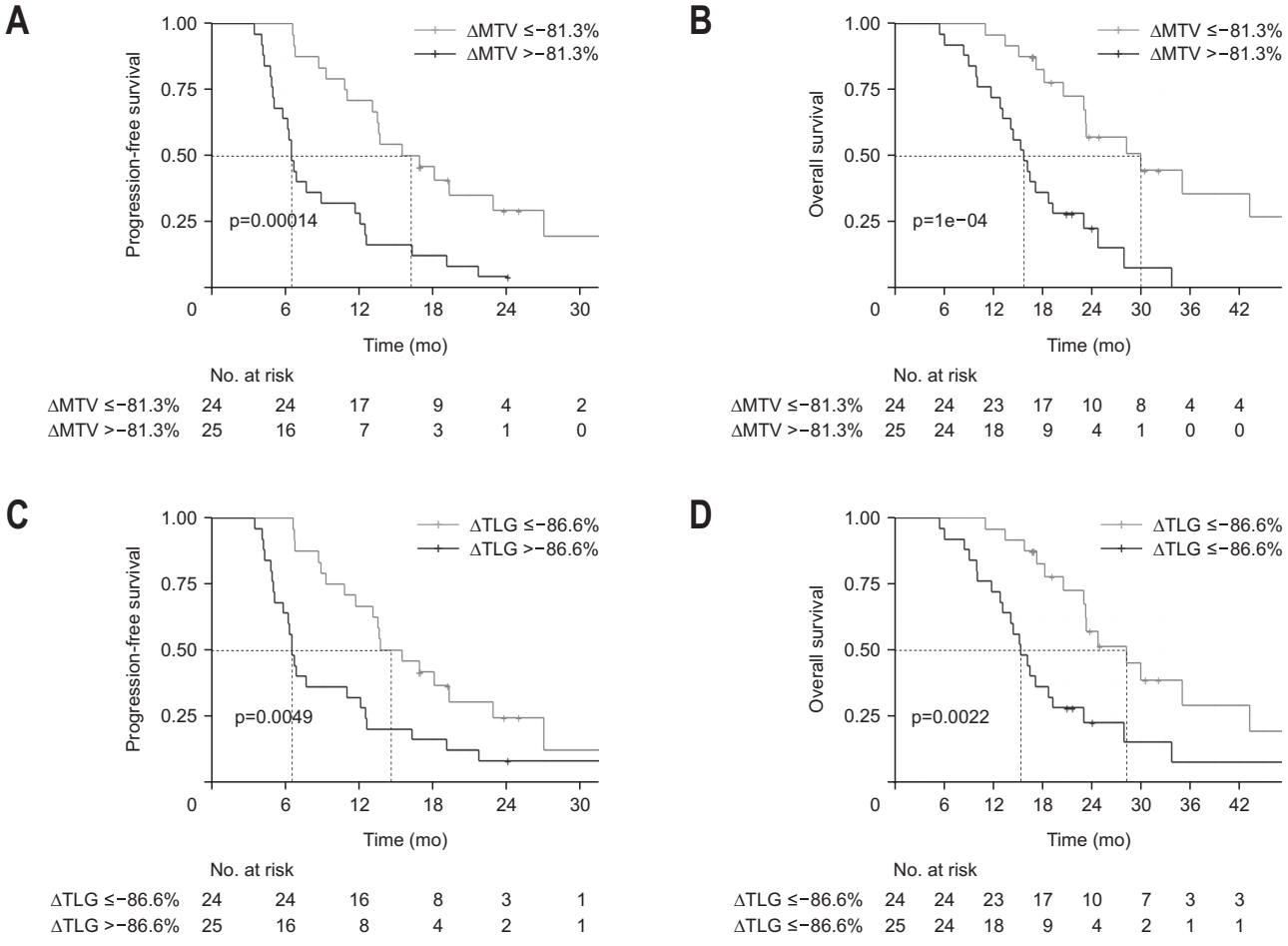


Fig. 6. Prognosis with ΔMTV, ΔTLG in the SD subgroup of the nonconversion surgery group. (A) Progression-free survival and (B) overall survival with ΔMTV. (C) Progression-free survival and (D) overall survival with ΔTLG. SD, stable disease; MTV, metabolic tumor volume; TLG, total lesion glycolysis.

months vs 15.4 months, p=0.002; ΔTLG PFS, 14.6 months vs 6.5 months, p=0.005) (Fig. 6).

DISCUSSION

This study demonstrated that changes in metabolic parameters assessed via serial ^{18}F-FDG PET/CT are valuable predictors of prognosis in patients with BRPC and LAPC. By stratifying patients into conversion surgery and nonconversion surgery groups, we identified distinct prognostic indicators in each cohort. In particular, reductions in SUVmax were significant predictors of prolonged RFS and OS in the conversion surgery group, while reductions in MTV and TLG were associated with improved PFS and OS in the nonconversion surgery group. These findings highlight the utility of PET/CT for evaluating treatment responses and guiding therapeutic decisions.

Anatomic imaging techniques may not reflect shrinkage of the viable tumor after chemotherapy.[21] Alterations in tumor glucose metabolism manifest earlier than changes in tumor size, and these observations are valuable for distinguishing persistent disease from scar tissue.[13,22,23] Moreover, when evaluating treatment response, it is deemed more relevant to assess changes in metabolic parameters than to rely on the absolute values of measurements before or after treatment. Following the approach of several previous studies, we examined the prognostic implications of changes in metabolic parameter values and observed statistically significant differences, thus supporting the notion that variations in parameter values are more indicative of outcomes.[13,24] Baseline PET/CT metabolic parameters and subsequent PET/CT metabolic parameters showed no difference in prognosis. Furthermore, unlike previous studies that primarily focused on the prognosis of patients who underwent surgery, our investigation also included patients with BRPC or LAPC who did not undergo surgery and continued to receive chemotherapy.

The observed differences in the predictive value of SUVmax and volume-based parameters (MTV and TLG) may be attributed to the biological characteristics of pancreatic tumors. SUVmax reflects the most metabolically active region within a tumor and is relatively simple to measure. Its reduction following NACT may indicate decreased tumor aggressiveness, which is crucial for patients undergoing surgery. Similar observations have been reported by studies of different cancer types in which changes in SUVmax after NACT were correlated with varying prognoses.[14,17,25,26] Conversely, MTV and TLG account for the total metabolic tumor burden, providing a more comprehensive assessment of tumor heterogeneity and resistance to therapy–a key consideration for patients receiving continued chemotherapy without surgery. Tumor heterogeneity, defined by the presence of diverse subclones within a tumor, contributes significantly to treatment resistance. Residual MTV and TLG after NACT likely represent chemo-resistant tumor components, offering a robust metric for evaluating therapeutic efficacy. These findings align with studies in other cancer types, where volume-based parameters have demonstrated prognostic significance.[24,27-30]

The optimal timing for subsequent PET/CT evaluations is important for accurate assessment of treatment response and prognosis. Although this study observed heterogeneity in the timing of subsequent PET/CTs (range, 2 to 8 months), current evidence suggests that imaging should ideally be conducted at least 6 weeks after the completion of treatment.[19] The average period from chemotherapy to surgery for LAPC patients is 6.4 months.[31] Moreover, the National Comprehensive Cancer Network guideline 2024 recommends induction chemotherapy for 4-6 months in LAPC patients. Therefore, it could be suggested that follow-up PET-CT would be appropriate around 4 months (around 2nd evaluation).

This study had several limitations. First, it was a retrospective, single center study, and there may have been selection bias for patients who underwent serial PET/CT. Second, the study was conducted on a relatively small sample size, which may limit the generalizability of the findings.

In conclusion, serial PET/CT provides valuable prognostic insights for pancreatic cancer patients, particularly those with BRPC or LAPC. Changes in SUVmax in the conversion surgery group and changes in MTV and TLG in the nonconversion surgery group were predictive of outcomes, respectively. Importantly, these findings suggest that assessing tumor heterogeneity using metabolic parameters provides valuable insights regarding the treatment response and prognosis, thus overcoming the limitations of traditional radiologic assessments. Further research is warranted to validate the utility of these metabolic parameters for guiding therapeutic decisions and improving outcomes of patients with pancreatic cancer.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

Study concept and design: J.A., J.H.H. Data acquisition: J.A., Y.S.S. Data analysis and interpretation: J.A., B.K., S.Y., Drafting of the manuscript: J.A., Y.S.S., J.H.H. Critical revision of the manuscript for important intellectual content: K.J., J.C.L., J.K. Statistical analysis: J.A., K.J. Study supervision: J.H.H.

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SUPPLEMENTARY MATERIALS

Supplementary materials can be accessed at https://doi.org/10.5009/gnl240458.

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