1298 RADIOMICS FEATURES TO PREDICT IMMUNE CHECKPOINT INHIBITOR-RELATED PNEUMONITIS (CIP) IN NSCLC PATIENTS TREATED WITH IMMUNOTHERAPY

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Background As immunotherapy is more widely used for advanced non-small cell lung cancer (NSCLC), important challenges remain with adverse events including checkpoint inhibitor-associated pneumonitis (CIP). CIP usually requires discontinuation of immunotherapy even if the tumor responds, and effective models for predicting CIP are still limited. This study aims to investigate radiomic features using artificial intelligence (AI) algorithms to predict CIP in patients with NSCLC.

Methods Data from 132 patients with stage III-IV NSCLC treated with immunotherapy were analyzed. Tumor response was evaluated based on immune-related RECIST (irRECIST) (tables 1 and 2). Patients were categorized into two groups: durable responders (including complete response [CR], partial response [PR], or stable disease [SD]) and non-responders (progressive disease [PD]). Segmentation was performed by three physicians using LIFEx software (IMIV/CEA, Orsay, France). 3D-radiomic features were collected from the tumor and peritumoral regions on contrast enhanced CT imaging. The lesion size was measured as a volume-of-Interest (VOI). Linear mixed-effects (LME) regression model was used to evaluate the association between radiomic features and the size of the VOI, with CIP and radiation-related pneumonitis status specific variables for slope and intercept. The chemotherapy containing regimen was considered as a random factor. The corresponding p-values were used to assess differences in LME regression slope and/or intercept between all groups.

Results CIP was more common in the non-responder group [durable responder: 8/91 (8.8%) vs non-responder: 6/41 (14.6%) (p=0.049)] (table 2). Higher platelet counts at baseline (≥400K) was more prevalent in the non-responder group (p<0.001) and patients who received chemotherapy containing regimen were more likely to be durable responders (p<0.001) (table 1).

Association between some CT-based radiomic features and the tumor size demonstrates statistically significant difference between radiation-related and CIP. Significant difference in the intercept (0.05, 95%CI[0.04, 0.05] p<0.001) and the slope (-0.01, 95%CI[-0.007, 0.012], p<0.001) of Neighboring Gray Tone Difference Matrix (NGTDM) coarseness computed for primary tumors was found with CIP (intercept difference -0.07, 95%CI[-0.1, -0.4], p<0.001 and slope difference 0.02, 95%CI[0.01, 0.02], p<0.001). For the peritumoral space, Intensity Histogram Maximum Histogram Gradient Grey Level, also showed significant difference in the intercept (30, 95%CI [19.7–40.3], p<0.001) and the slope (-2.96, 95%CI[-5.3, -0.6], p<0.015) and CIP associated difference in the intercept equal 42.7 (95%CI[12.76, -70.4], p<0.03) and slope difference -10.5 (95%CI[-15.3, -4.76], p<0.002).

Conclusions Non-responders among NSCLC patients treated with immunotherapy had a higher incidence of CIP, and CT-based radiomic features may assist in the prediction of CIP.

Ethics Approval Northwestern IRB approved: STU00207117EnterWrite to Liam Il-Young Chung

Abstract 1298 Table 1 Clinicopathologic characteristic of 132 patient with non-small cell lung cancer (NSCLC) who recevied immunotherapy, categorized by responder and non-responder based on the immune-related RECIST (irRECIST)

		Total (n=132)	Durable responder (n=91)	Non-responder (n=41)	p-value
Age (n, %)	Median (range, years)	66.5 (29-89)	67.0 (31-89)	65.0 (29-81)	0.162
	<66	66 (50.0)	44 (48.4)	22 (53.7)	
	≥66	66 (50.0)	47 (51.6)	19 (46.3)	
Sex (n, %)	Male	61 (46.2)	44 (48.4)	27 (65.9)	0.152
	Female	71 (53.8)	47 (51.6)	14 (34.1)	
Smoking status (n, %)	Never	25 (18.9)	19 (20.9)	6 (14.6)	0.117
	Former	93 (70.5)	60 (65.9)	33 (80.5)	
	Current	14 (10.6)	12 (13.2)	2 (4.9)	
Performance status (n, %)	0-1	115 (87.1)	81 (89.0)	34 (82.9)	0.267
	2-4	17 (12.9)	10 (11.0)	7 (17.1)	
Body mass index (n, %)	Median (range, kg/m²)	25.5 (15.4-58.7)	25.5 (15.4-40.8)	25.7 (15.4-58.7)	0.936
	<25.5	66 (50.0)	46 (50.5)	20 (48.8)	
	≥25.5	66 (50.0)	45 (49.5)	21 (51.2)	
Histologic type of tumor (n, %)	Adenocarcinoma	98 (74.2)	67 (73.6)	31 (75.6)	0.623
	Squamous cell carcinoma	17 (12.9)	12 (13.2)	5 (12.2)	
	Adenosquamous carcinoma	2 (1.5)	1 (1.1)	1 (2.4)	
	Poorly differentiated carcinoma	15 (11.4)	11 (12.1)	4 (9.8)	
PD-L1 IHC on tumor cells (n, %)	<1%	45 (34.1)	29 (31.9)	16 (39.0)	0.107
	1-49%	35 (26.5)	25 (27.5)	10 (24.4)	
	≥50%	25 (18.9)	25 (23.5)	4 (9.8)	
Tumor stage (n, %)	III	10 (7.6)	6 (6.6)	4 (9.8)	0.219
	IV	122 (92.4)	85 (93.4)	37 (90.2)	
TMB (n, %)	Median (range)	1.8 (0.5-61.5)	5.8 (0.5-61.5)	4.2 (0.8-12.1)	0.052
	<5.7 Mbp	21 (35.9)	14 (35.4)	7 (17.1)	
	≥5.7 Mbp	21 (35.9)	14 (35.4)	7 (17.1)	
Serum proteomic signature	Good	20 (35.2)	14 (35.6)	6 (14.6)	0.684
	Intermediate	1 (0.0)	0 (0.0)	0 (0.0)	
	Poor	19 (34.6)	16 (37.6)	3 (7.3)	
Microsatellite instability (MSI)	Low	42 (31.8)	30 (33)	12 (29.3)	0.471
	High	7 (5.3)	6 (6.6)	1 (2.4)	
NLR (n, %)	Median (range)	4.9 (0.2-100.0)	4.4 (0.2-93.3)	5.1 (0.7-97.5)	0.676
	<4.9	66 (50.0)	44 (48.4)	22 (53.7)	
	≥4.9	66 (50.0)	47 (51.6)	19 (46.3)	
Platelet (n, %)	Median (range, K)	289 (30-759)	291 (82-759)	278 (30-752)	<0.001
	<400K	109 (82.6)	86 (94.5)	23 (56.1)	
	≥400K	23 (17.4)	5 (5.5)	18 (43.9)	
Type of treatment (n, %)	Not containing chemotherapy	79 (59.8)	47 (51.6)	32 (78.0)	<0.001
	Containing chemotherapy	53 (40.2)	44 (48.4)	9 (22.0)	

IHC, immunohistochemistry; NLR, neutrophil/lymphocyte ratio; TMB, tumor mutational burden.

Abstract 1298 Table 2 Outcomes after immunotherapy Outcomes after immunotherapy of 132 patients with non-small cell lung cancer (NSCLC) who received immunotherapy, categorized by responder and non-responder based on the immune-related RECIST (irRECIST)

		Total (n=132)	Durable responder (n=91)	Non-responder (n=41)	p-value
Treatment-related pneumonitis	Total	23 (17.4)	13 (14.3)	10 (24.4)	0.078
	Immunotherapy-related	14 (10.6)	8 (8.8)	6 (14.6)	0.049
	Radiation-related	8 (6.1)	4 (4.4)	4 (9.8)	0.424
	Obstructive	2 (1.5)	1 (1.1)	1 (2.4)	0.790
Grade of pneumonitis	0	109 (82.6)	78 (85.7)	31 (75.6)	0.151
	1	11 (8.3)	6 (6.6)	5 (12.2)	
	2	10 (7.6)	7 (7.7)	3 (7.3)	
	3	2 (1.5)	0 (0.0)	2 (4.9)	
Time to pneumonitis [median (range; months)]		4.9 (0.5–47.6)	3.9 (0.5–47.6)	4.9 (0.5–8.8)	0.061
Brain metastasis at diagnosis	Yes	47 (35.6)	31 (34.1)	16 (39.0)	0.633
	No	85 (64.4)	60 (65.9)	25 (61.0)	
Bone metastasis at diagnosis	Yes	35 (26.5)	25 (27.5)	10 (24.4)	0.451
	No	97 (73.5)	66 (72.5)	31 (75.6)	
Liver metastasis at diagnosis	Yes	20 (15.2)	14 (15.4)	6 (14.6)	0.625
	No	112 (84.8)	77 (84.6)	35 (85.4)	
Response evaluation by irRECIST at least 24 weeks	Complete response (CR)	5 (3.8)	5 (5.5)	0 (0.0)	*
	Partial response (PR)	34 (25.8)	34 (37.4)	0 (0.0)	
	Stable disease (SD)	54 (40.9)	54 (59.3)	0 (0.0)	
	Progressive disease (PD)	41 (31.1)	0 (0.0)	41 (100.0)	
Death	Yes	86 (65.2)	54 (59.3)	32 (78.0)	<0.001
	No	46 (34.8)	37 (40.7)	9 (22.0)	
Duration of treatment [median (range; months)]		6.6 (0.2–72.1)	9.6 (0.2–72.1)	3.0 (0.2–55.3)	0.007
Progression-free survival [median (range; months)]		8.8 (0.2–97.2)	10.7 (0.2–97.2)	2.6 (0.5–45.2)	0.006
Overall survival [median (range; months)]		14.7 (0.7–97.2)	21.3 (1.3–97.2)	4.7 (0.7–55.3)	<0.001

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