

Tumor Response Assessment for Precision Cancer Therapy (RECIST/RANO)

**부산대병원
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Contents

- Background and Basic Principles
- Immune Response Patterns
- RANO-BM

Background & Basic Principles

History of Criteria

Criteria, years	Measurement	Target Lesions	Key Features
WHO, 1979	Bidimensional measurement (2D) = Longest diameter × Longest perpendicular diameter	No strict limit	Detailed but complex
RECIST 1.0, 2000	Unidimensional measurement (1D) = Only the longest diameter	10 lesions (max 5 per organ)	Simplified
RECIST 1.1, 2009	Unidimensional measurement (1D) = Only the longest diameter	5 lesions (max 2 per organ)	Improved reproducibility
iRECIST, 2017	Unidimensional measurement (1D) = Only the longest diameter	Same as RECIST 1.1	Accounts for pseudoprogression

Cancer. 1981 Jan 1;47(1):207-14.
J Natl Cancer Inst. 2000 Feb 2;92(3):205-16.
Eur J Cancer. 2009 Jan;45(2):228-47.
Lancet Oncol. 2017 Mar;18(3):e143-e152.

RECIST 1.1 – Measurable Lesions

Lesions	Measurable lesions	Non-measurable lesions
Tumor	• <u>Longest diameter</u> with a minimum size of <u>10mm</u> by CT scan* • 20mm by chest X-ray • 10mm caliper measurement by clinical exam 	• <10mm by CT scan* • Lesions which cannot be accurately measured with calipers • Ascites, pleural or pericardial effusion • Leptomeningeal disease, lymphangitic involvement of skin or lung • Abdominal masses or organomegaly identified by physical exam
LN	• LN must be $\geq$ <u>15mm</u> in <u>short axis</u> when assessed by CT scan*	• LN with ≥ 10 to <15mm short axis

*CT scan slice thickness no greater than 5 mm

RECIST 1.1 – Lymph nodes

■ Measurable/Target Lesions

- : Only the **short axis of LNs** is measured and Included in the baseline sum.
- : Measurable lesions: **Short axis $\geq$ 15 mm** by CT scan.

■ Non-Target Lesions

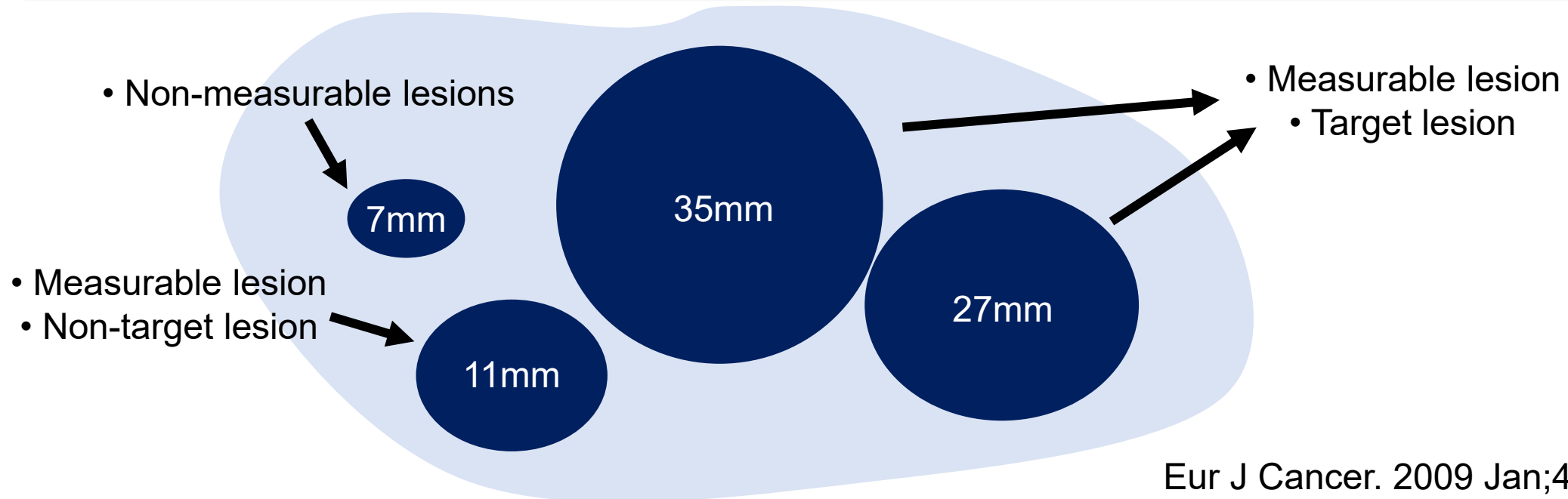
- : Pathological nodes with **short axis $\geq$ 10 mm but $<$ 15 mm**.
- : Do not require measurements and should be recorded as: '**Present**', '**Absent**', or in rare cases '**Unequivocal Progression**'.

■ Non-Pathological Nodes

- : Nodes with a short axis $<$ 10 mm.
- : Considered non-pathological and **do not record or follow these nodes**.

Measurable Lesions vs. Target Lesions

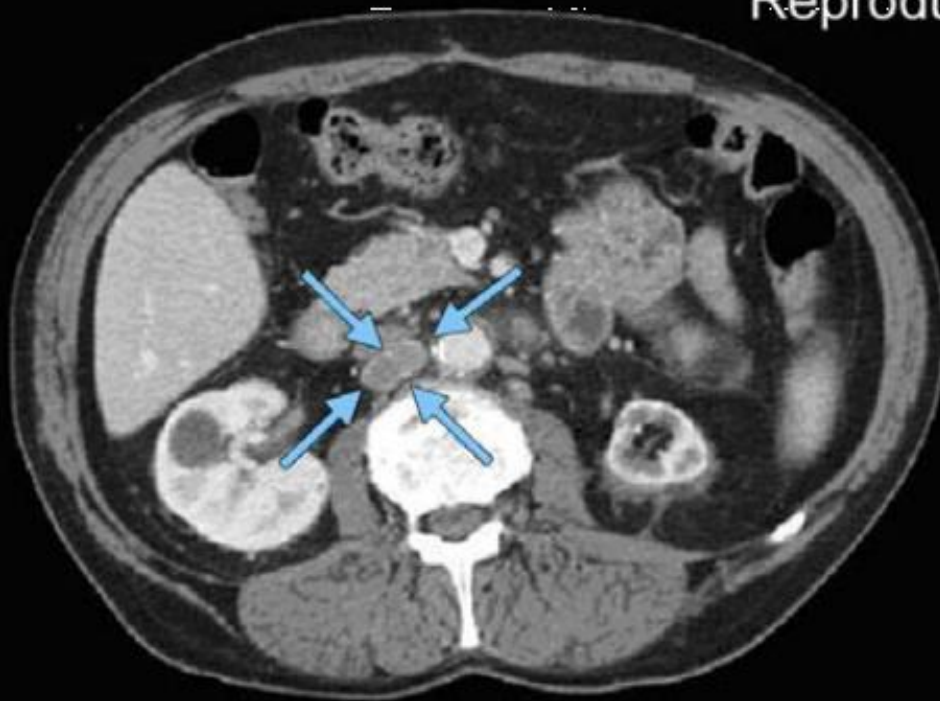
Measurable lesions	Target lesions
• All lesions that meets RECIST criteria • All may NOT become target lesions	• Selected from measurable lesion • Up to 2 lesions per organ, 5 in total • Used for response assessment • <u>Reproducible</u> repeated measurements

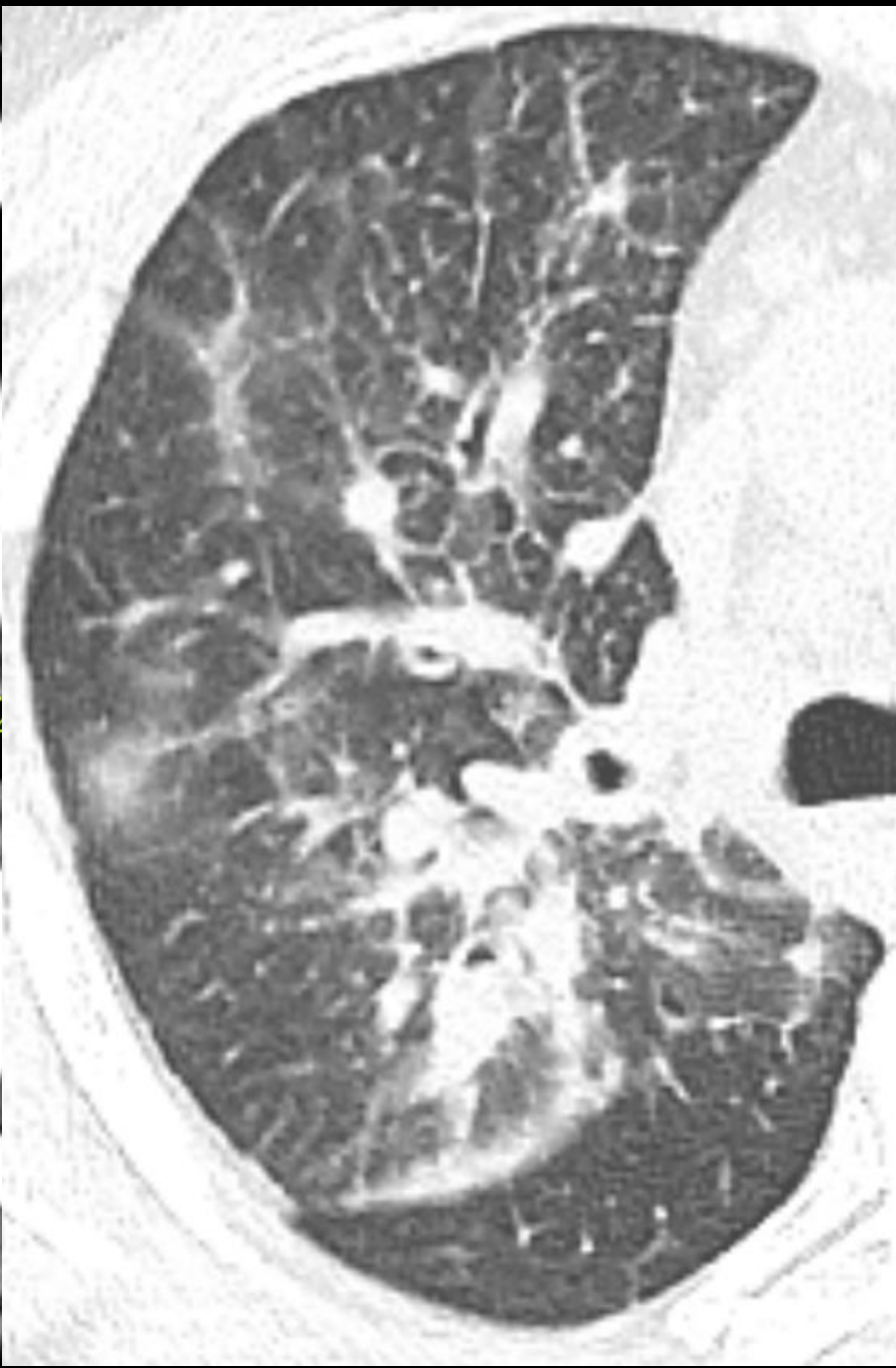
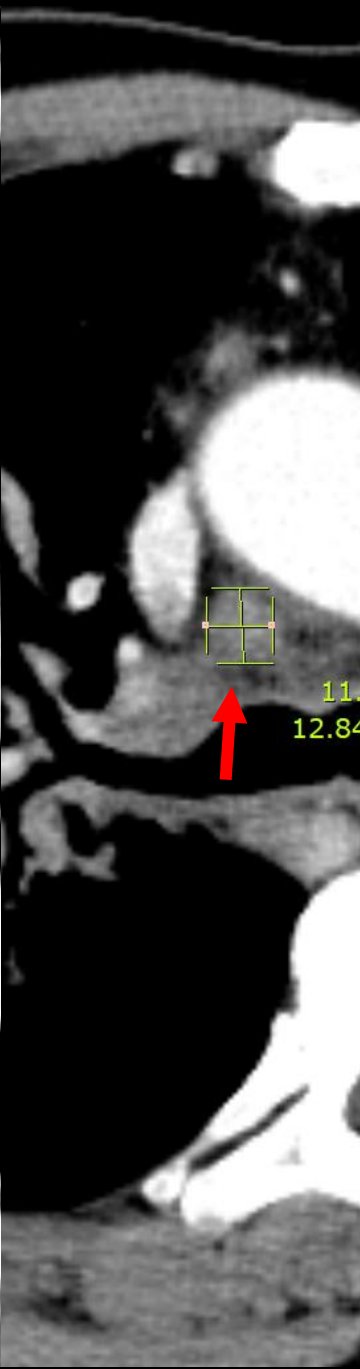
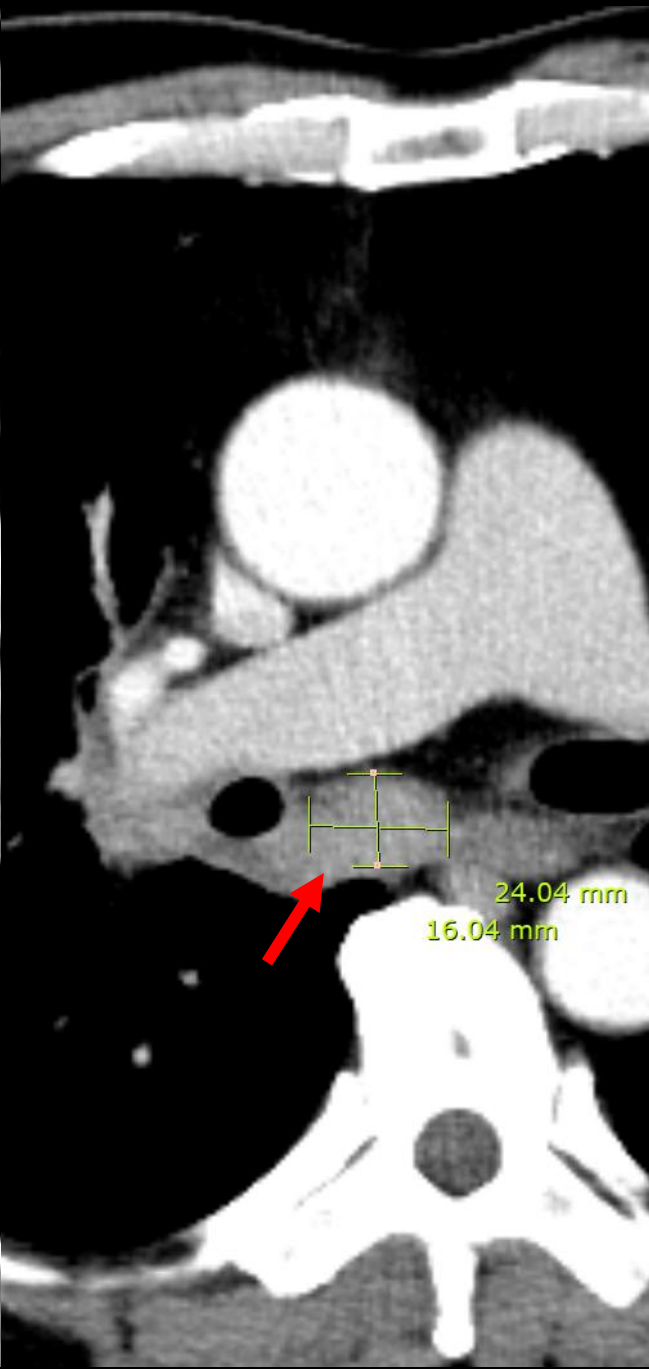
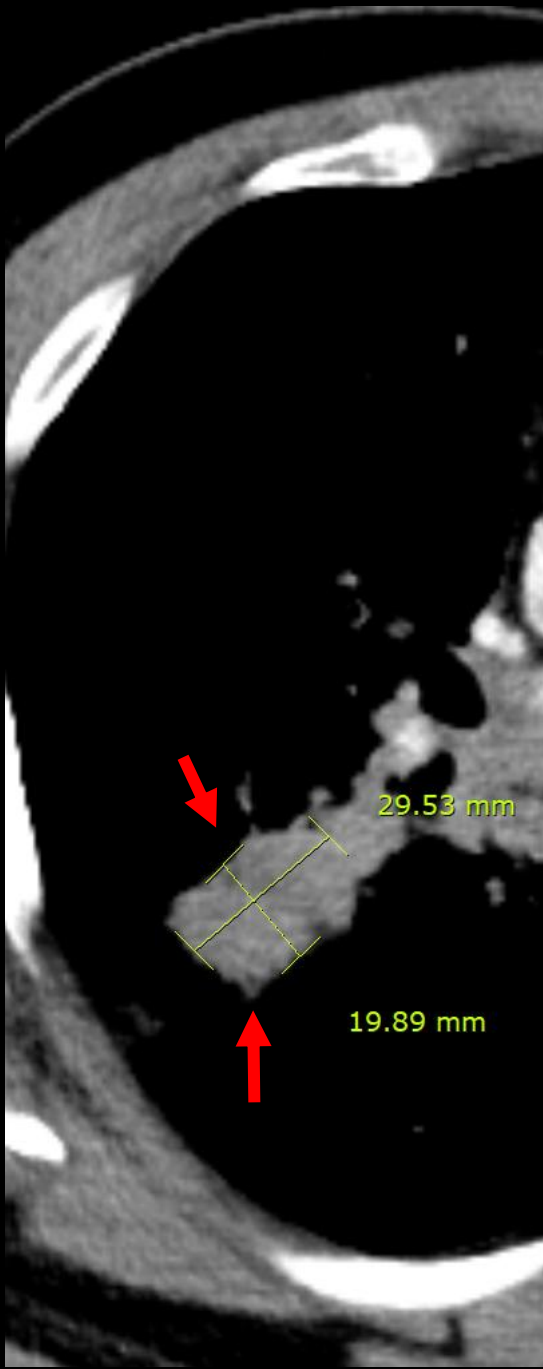


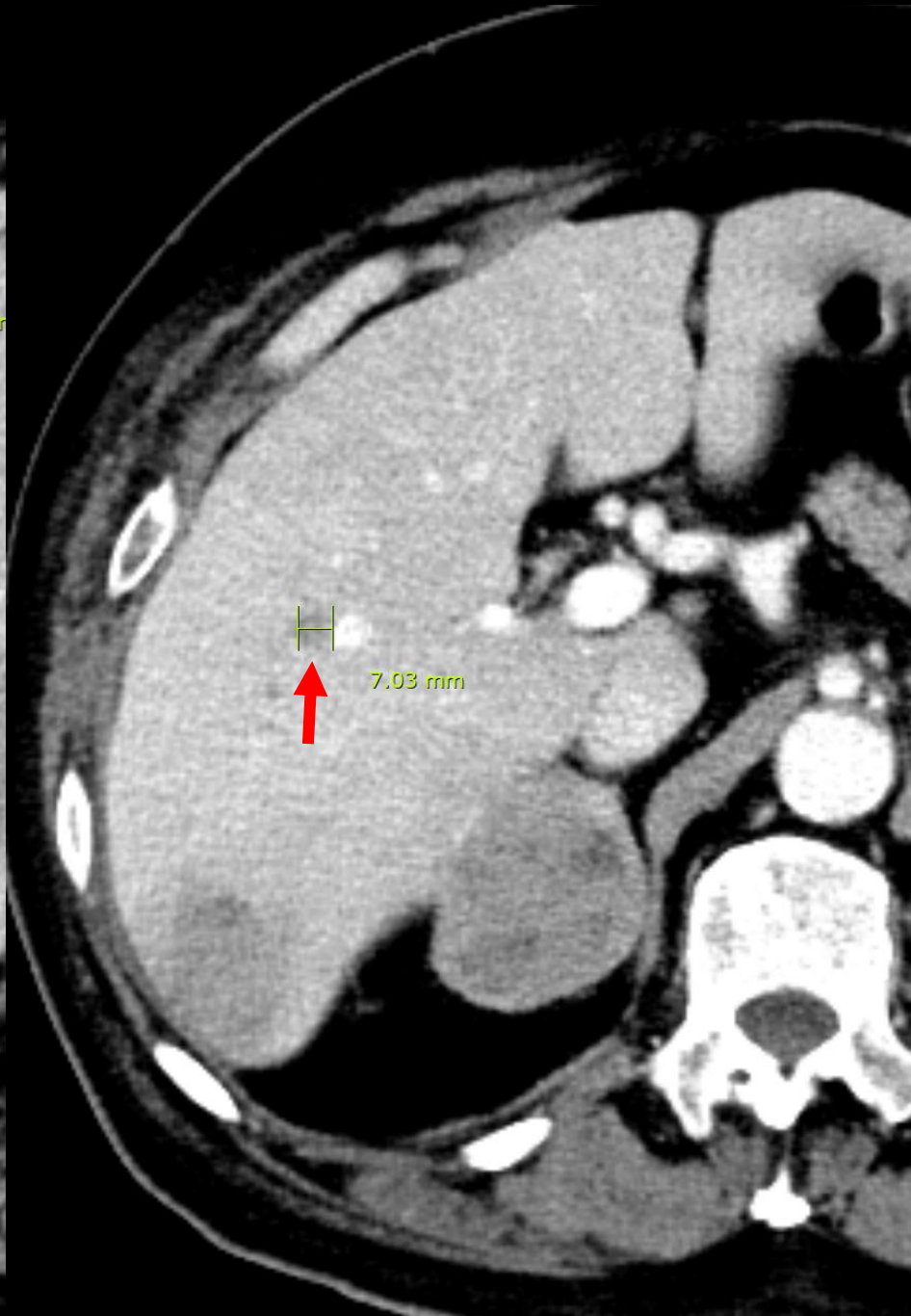
Largest lesion



Reproducible lesion







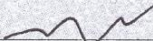
Tumor Assesment Worksheet

Study:

Investigator: Eom Jung Seop

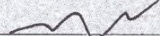
Site No.

Subject No.

RECIST 1.1	Week	Screening		6 Week		12 Week		18 Week		24 Week	
	Date of scan:	27 JUN 2026									
Description of Target Lesions	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)	
1 Right lower lobe	305-74	75									
2 7 LN	305-65	18									
3 4R LN	305-54	11									
4											
5											
Sum	104										
Response:	N/A										
Non-Target lesions	Image No	Response	Image No	Response	Image No	Response	Image No	Response	Image No	Response	
1 Right pleura	1. Absent 2. Present 3. Unequivocal Progression 4. N/E: Not Evaluated										
2											
3											
4											
Response:	N/A										
Presence of New Lesions?	Image No		Image No		Image No		Image No		Image No		
	NA										
Overall Response	N/A										
Date of Evaluation by Investigator	27-Jun-2026										
Investigator signature											

Tumor Assesment Worksheet

Study: [REDACTED]	Investigator: Eom Jung Seop	Site No.: [REDACTED]	Subject No. : [REDACTED]
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RECIST 1.1	Week	Screening		6 Week		12 Week		18 Week		24 Week	
	Date of scan:	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)
1 Right lower lobe		305-74	75								
2 7 LN		305-65	18								
3 4R LN		305-54	11								
4											
5											
Sum		104									
Response:		N/A									
Non-Target lesions		Image No	Response					Image No	Response	Image No	Response
1 Right pleura											
2											
3											
4											
Response:		N/A									
Presence of New Lesions?		Image No						Image No		Image No	
		NA									
Overall Response		N/A									
Date of Evaluation by Investigator		24-Jun-2026									
Investigator signature											

교수님, [REDACTED] 연구 대조군
[REDACTED] 의 4R LN 경우
11mm로 non-target lesion으로
변경하여 작성 혹은 제외 가능 연락받아
확인 위해 RECIST 전달드립니다.
오기 정정 / 재작성(혹시 몰라 새 종이 함께
넣어두겠습니다!!)

RECIST 1.1 – CR, PR

- **Complete Response (CR)**

- : Disappearance of all target lesions.

- : Any pathological LNs (whether target or non-target) must have reduction in short axis to <10 mm.

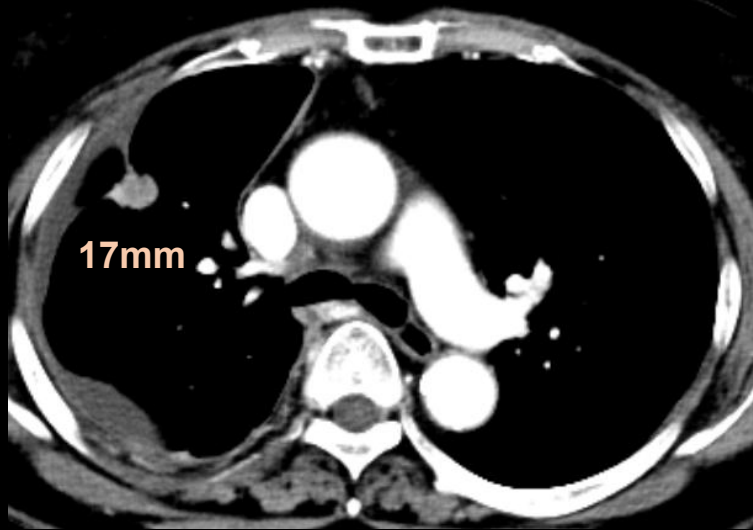
- **Partial Response (PR)**

- : At least a 30% decrease in the sum of diameters of target lesions, taking as reference the baseline sum diameters.

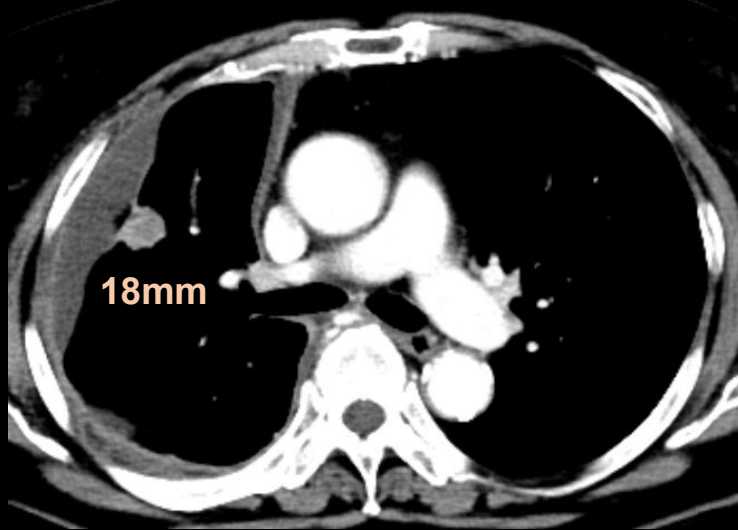
RECIST 1.1 – PD: Principles

- **Progressive Disease (PD)**

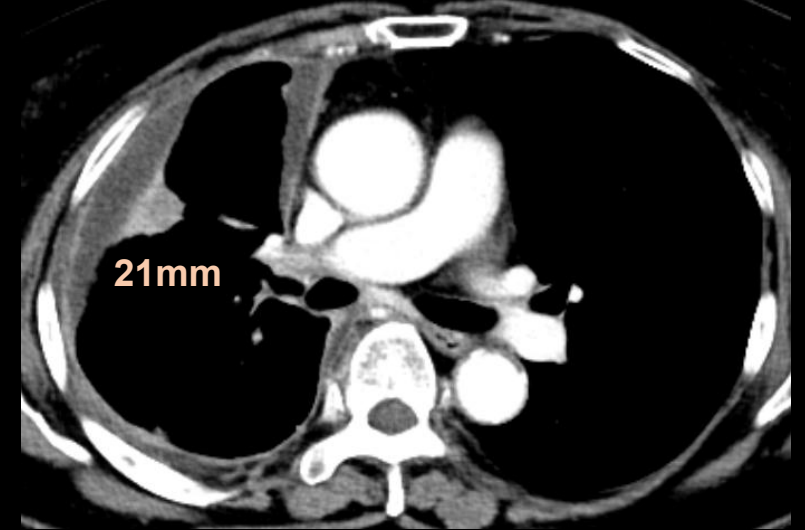
- : At least a 20% increase in the sum of diameters of target lesions, taking as reference the smallest sum on study.
- : In addition to the relative increase of 20%, the sum must also demonstrate an absolute increase of at least 5 mm.
- : The appearance of one or more new lesions is also considered progression.



Initial CT scan



After C2



After C4

RECIST 1.1 – PD: New Lesions

■ Key Principles

- : Appearance of new malignant lesions → **Progressive Disease (PD)**
- : Not due to imaging technique differences
- : Not a flare or healing of pre-existing lesions

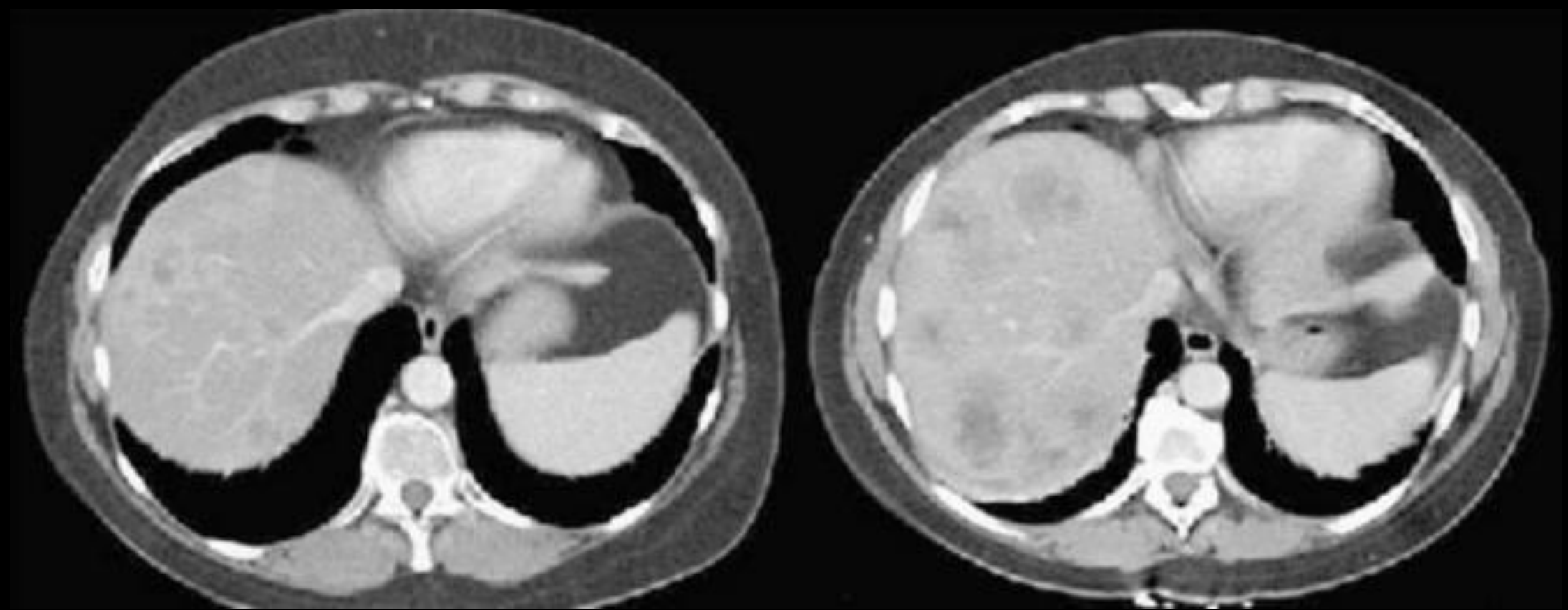
■ Special Considerations

- : **Lesions found in previously unscanned areas → New lesions**
(*Example:* Brain metastases found on follow-up MRI without baseline brain imaging → **PD**)
- : If a new lesion is **equivocal** (small or unclear)
 - Continue therapy and follow-up.
 - If confirmed as new → Use the **initial scan date for PD**

RECIST 1.1 – PD: Non-Target Lesions

- **Definition of Unequivocal Progression**

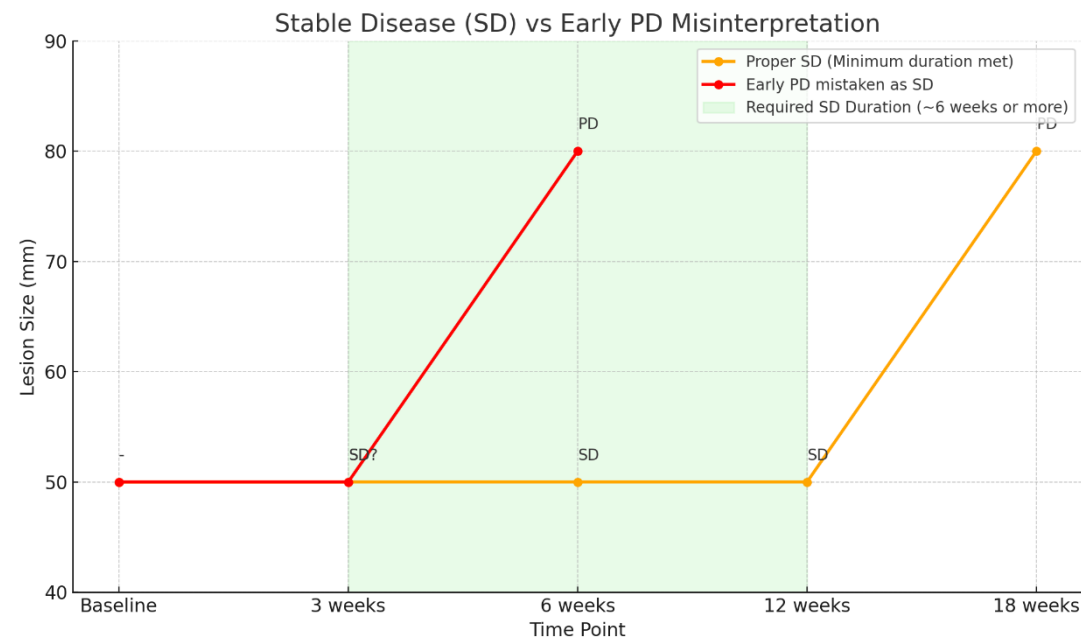
- : Unequivocal progression refers to a clear and substantial worsening of non-target lesions.
- : This progression must be clinically significant enough to warrant a change in therapy, even if target lesions are SD or PR.



RECIST 1.1 – SD

- **Stable Disease (SD)**

: Neither sufficient shrinkage to qualify for PR nor sufficient increase to qualify for PD, taking as reference the smallest sum diameters while on study.



Time point response

Table 1 – Time point response: patients with target (+/- non-target) disease.

Target lesions	Non-target lesions	New lesions	Overall response
CR	CR	No	CR
CR	Non-CR/non-PD	No	PR
CR	Not evaluated	No	PR
PR	Non-PD or not all evaluated	No	PR
SD	Non-PD or not all evaluated	No	SD
Not all evaluated	Non-PD	No	NE
PD	Any	Yes or No	PD
Any	PD	Yes or No	PD
Any	Any	Yes	PD

CR = complete response, PR = partial response, SD = stable disease, PD = progressive disease, and NE = inevaluable.

Time point response

Table 1 – Time point response: patients with target (+/- non-target) disease.

Target lesions	Non-target lesions	New lesions	Overall response
CR	CR	No	CR
CR	Non-CR/non-PD	No	PR
CR	Not evaluated	No	PR
PR	Non-PD or not all evaluated	No	PR
SD	Non-PD or all evaluated	No	SD
Not evaluable		No	NE
<u>PD</u>	Any	Yes or No	PD
Any	<u>PD</u>	Yes or No	PD
Any	Any	<u>Yes</u>	PD

CR = complete response, PR = partial response, SD = stable disease, PD = progressive disease, and NE = inevaluable.

Unequivocal Progression

Date of Assessment (yyyy/mm/dd)	Method	Screening 2026, 04, 01	2026, 05, 20	2026, 06, 29	1 / 1	1 / 1	
Location / Site	1:CT scan 2:MRI 3:PET/CT 4:Physical Exam 5:Others(specify)	Size (in mm)	Was the Target Lesion Previously Irradiated?	Size (in mm)	Size (in mm)	Size (in mm)	Size (in mm)
1. Lung, left upper lobe	CT	65	☒ No ☒ Yes	60	47		
2. Lymph node 4L	CT	30	☒ No ☒ Yes	8	5		
3. /			☐ No ☐ Yes				
4. /			☐ No ☐ Yes				
5. /			☐ No ☐ Yes				
Longest diameter for non-lymphoid lesion and short axis for lymphoid lesion							
Sum of the diameters (SoD)*	NA	95	NA	68	52		
Response	NA		NA	☐ CR ☐ PR ☐ SD ☐ PD ☐ NE ☐ NA	☐ CR ☐ PR ☐ SD ☐ PD ☐ NE ☐ NA	☐ CR ☐ PR ☐ SD ☐ PD ☐ NE ☐ NA	☐ CR ☐ PR ☐ SD ☐ PD ☐ NE ☐ NA
Non-Target Lesions							
Date of Assessment (yyyy/mm/dd)	Method	2026, 04, 01	2026, 05, 20	2026, 06, 29	1 / 1	1 / 1	
Location / Site	1:CT scan 2:MRI 3:PET/CT 4:Physical Exam 5:Others(specify)	Response 1. Present 2. Absent 3. Worsening	Response 1. Present 2. Absent 3. Worsening	Response 1. Present 2. Absent 3. Worsening	Response 1. Present 2. Absent 3. Worsening	Response 1. Present 2. Absent 3. Worsening	
1. Lymph node 7	CT	1	1	1			
2. Pleura, left pleural nodule	CT	1	1	1			
3. /							
4. /							
5. /							
Response	NA	NA	☐ CR ☒ Non-CR/Non-PD ☐ PD ☐ NE ☐ NA	☐ CR ☒ Non-CR/Non-PD ☐ PD ☐ NE ☐ NA	☐ CR ☐ Non-CR/Non-PD ☐ PD ☐ NE ☐ NA	☐ CR ☐ Non-CR/Non-PD ☐ PD ☐ NE ☐ NA	
Any New Lesions? If so, describe							
Date of Assessment (yyyy/mm/dd)	Method	1 / 1	1 / 1	1 / 1	1 / 1		
Location / Site	1:CT scan 2:MRI 3:PET/CT 4:Physical Exam 5:Others(specify)	Response 1. Present 2. Absent 3. Worsening	Response 1. Present 2. Absent 3. Worsening	Response 1. Present 2. Absent 3. Worsening	Response 1. Present 2. Absent 3. Worsening		
1. /							
2. /							
Overall Response Evaluation at each timepoint			☐ CR ☐ PR ☒ SD ☐ PD ☐ NE ☐ NA	☐ CR ☐ PR ☒ SD ☐ PD ☐ NE ☐ NA	☐ CR ☐ PR ☐ SD ☐ PD ☐ NE ☐ NA	☐ CR ☐ PR ☐ SD ☐ PD ☐ NE ☐ NA	
Investigator Signature and Date(Completed by)		[Signature] 06 APR 2026		[Signature] 21 May 2026		[Signature] 06 Jul 2026	
Investigator Signature and Date(Confirmed by)		[Signature] 06 APR 2026		[Signature] 21 May 2026		[Signature] 06 Jul 2026	

Tumor Assessment Worksheet

Study: C5751003

Investigator: [REDACTED]

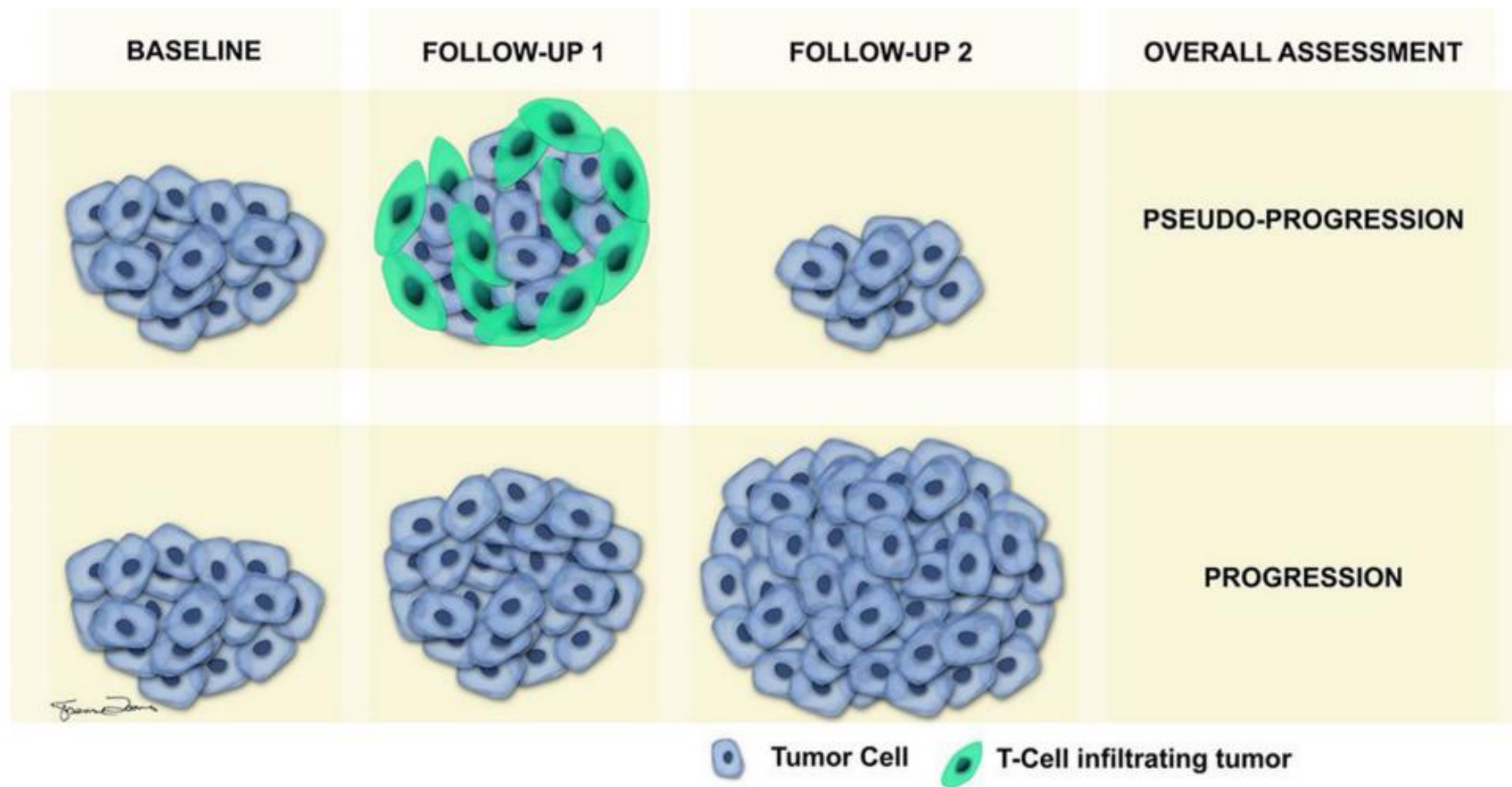
Site No.: [REDACTED]

Subject No. : [REDACTED]

RECIST 1.1		Week	Screening	6-Week	12 Week	18 Week	24 Week				
		Date of scan:	08-JUN-2026	27-JUN-2026							
	Description of Target Lesions	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)	Image No	직경(mm)
1	Right upper lobe	305-42	80	3-77	91						
2	7 LN	305-62	19	3-98	20						
3	10R LN	305-54	18	3-109	18						
4											
5											
Sum		117									
Response:		N/A									
	Non-Target lesions	Image No	Response	Image No	Response	Image No	Response	Image No	Response	Image No	Response
1	Left lung metastasis	1. Absent 2. Present 3. Unequivocal Progression 4. N/E: Not Evaluated		3-62, 72, 84	3						
2	Right pleura			3-141	2						
3	Left frontal lobe										
4	Left occipital lobe										
Response:		N/A									
Presence of New Lesions?		Image No		Image No		Image No		Image No		Image No	
		NA		Left pleura							
Overall Response		N/A		PD							
Date of Evaluation by Investigator		10-Jan-2026		27-Jun-2026							
Investigator signature		[Signature]		[Signature]							

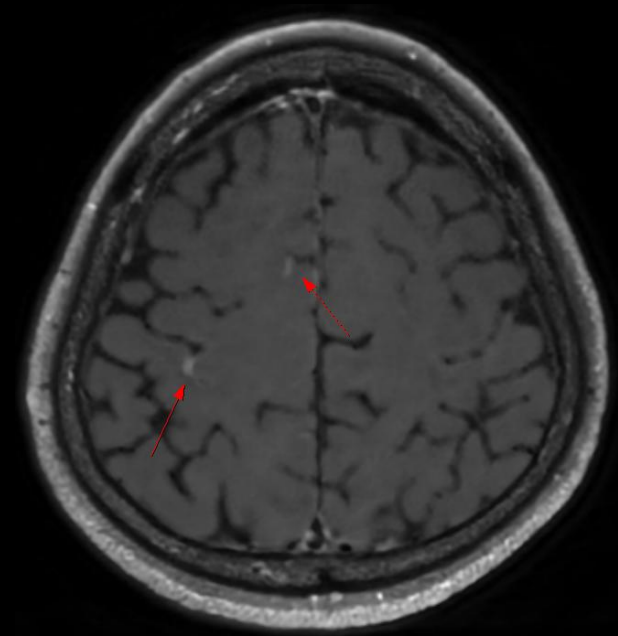
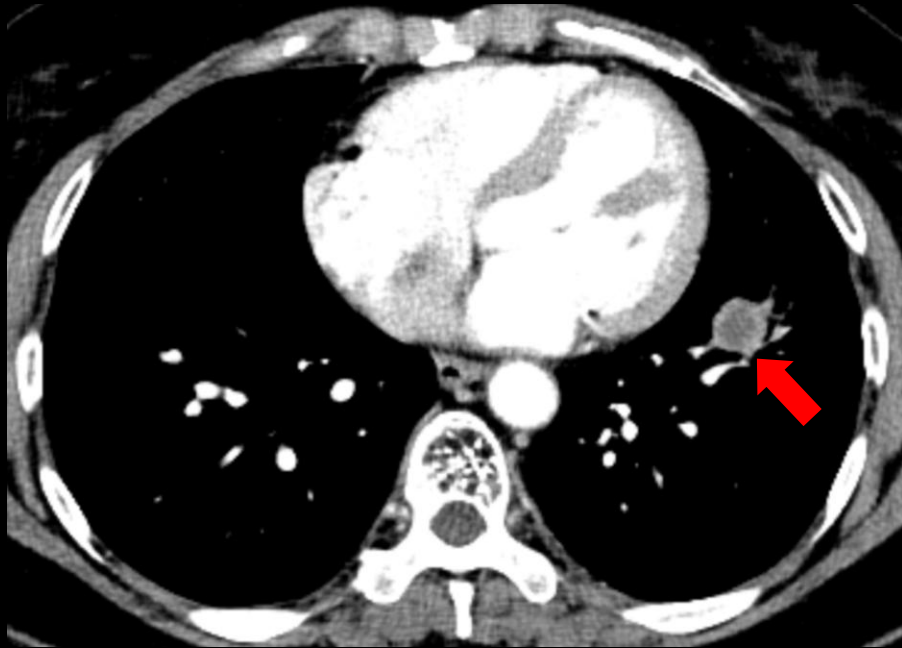
Immune Response Patterns

True vs Pseudo-progression

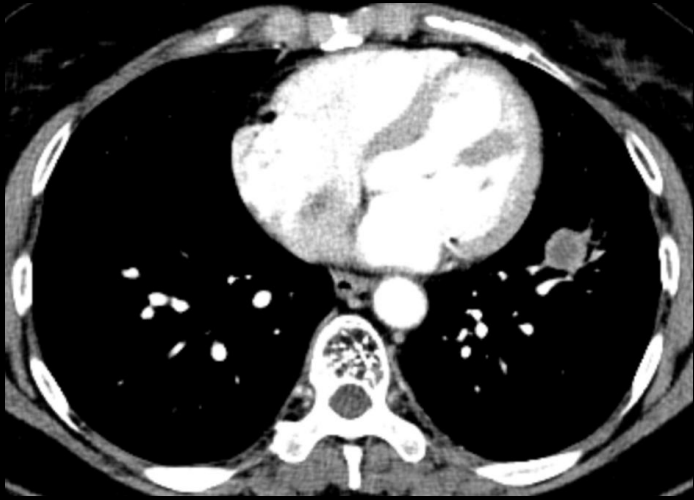


Case 1

- Female/64
- Lung mass in left lower lobe with multiple brain metastases



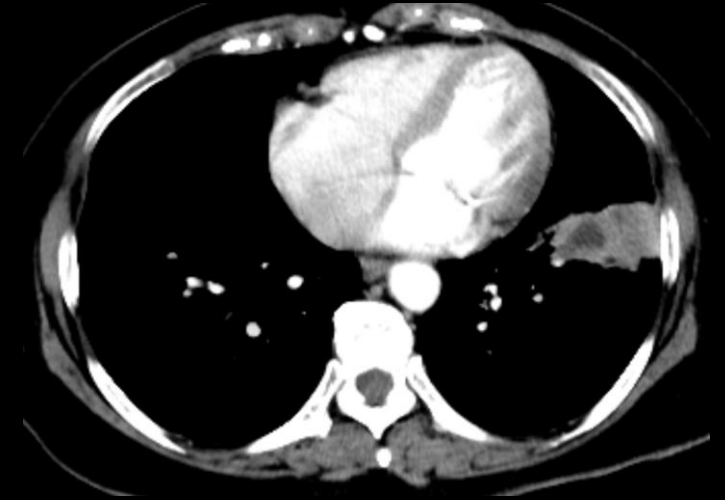
▪ **Adenocarcinoma, No driver mutation, PD-L1 SP263: 10%**



Initial CT scan



**Pembrolizumab +
Chemotherapy
(After C2)**



**Pembrolizumab +
Chemotherapy
(After C4)**

CONCLUSION

compared with previous MR, interval decreased and faint visualization state of previous multifocal small enhancement at both F,P,O lobe
- improving process of brain metastasis, more likely
rec) clinical correalation, F/U

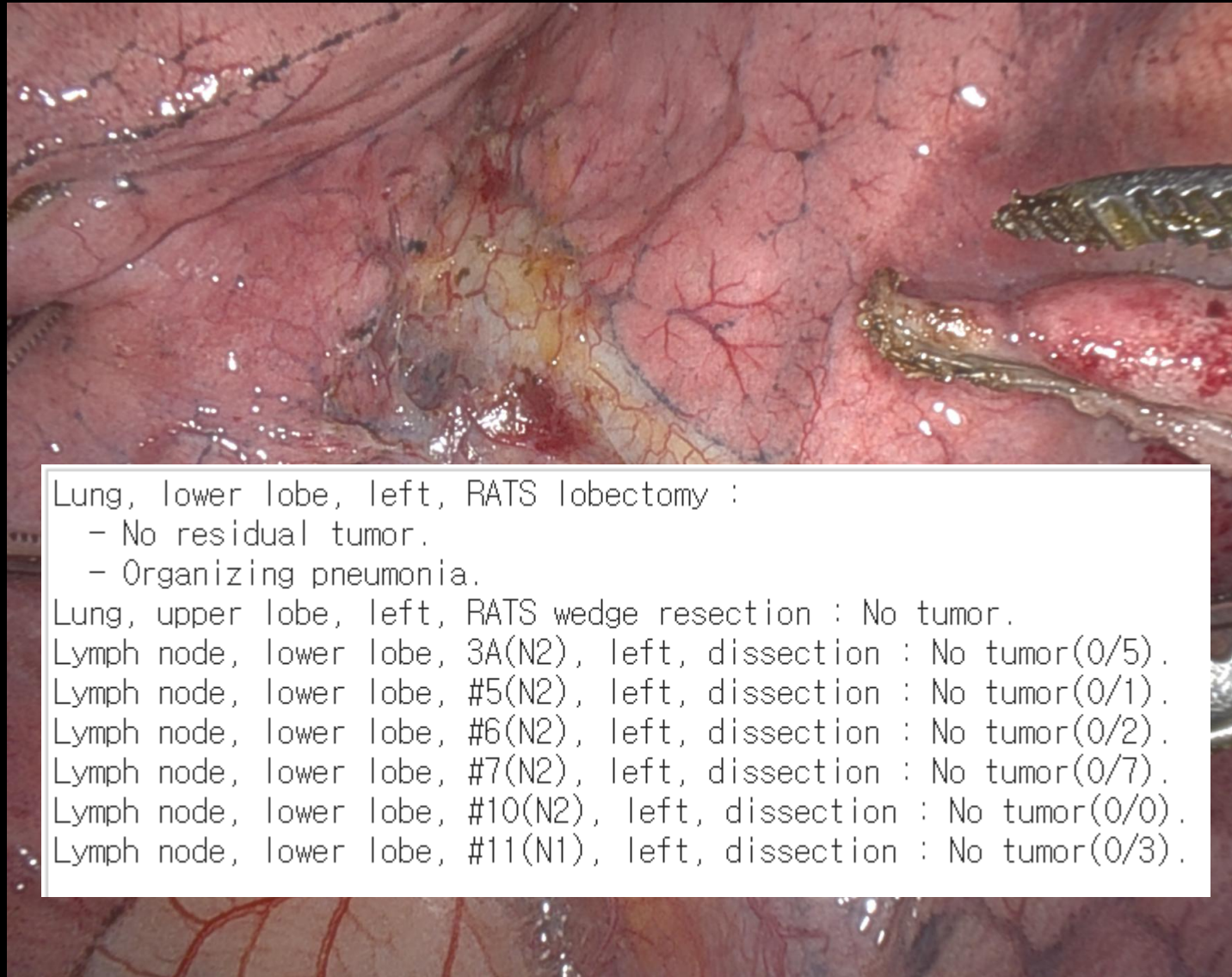
CONCLUSION

Compared to previous MRI taken 2025-02-07,

No more visible multifocal small enhancement at both F,P,O lobe.
- improving process of brain metastasis, more likely.

No newly appearing enhancing lesion.

Microangiopathy.



Lung, lower lobe, left, RATS lobectomy :

- No residual tumor.
- Organizing pneumonia.

Lung, upper lobe, left, RATS wedge resection : No tumor.

Lymph node, lower lobe, 3A(N2), left, dissection : No tumor(0/5).

Lymph node, lower lobe, #5(N2), left, dissection : No tumor(0/1).

Lymph node, lower lobe, #6(N2), left, dissection : No tumor(0/2).

Lymph node, lower lobe, #7(N2), left, dissection : No tumor(0/7).

Lymph node, lower lobe, #10(N2), left, dissection : No tumor(0/0).

Lymph node, lower lobe, #11(N1), left, dissection : No tumor(0/3).

▪ RATS LLLobectomy with MLND

Definition of PD in iRECIST

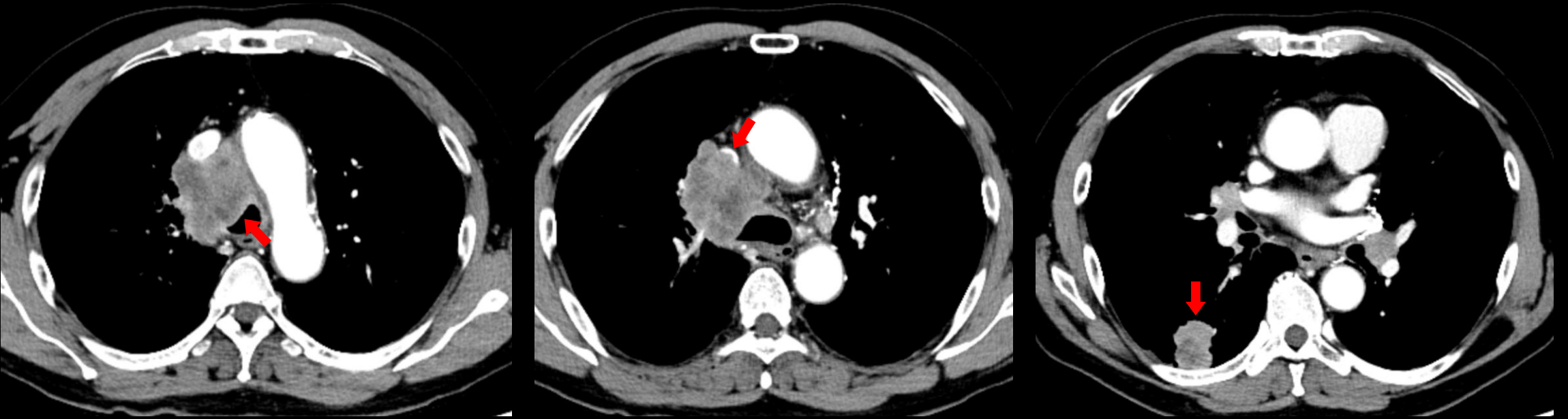
Feature	Description
New Lesion Handling	• Not immediately considered PD • Recorded separately
Initial PD Term	iUPD – Unconfirmed Progressive Disease
Confirmation Required	PD must be confirmed at ≥ 4 weeks with FU scan
Confirmed PD Term	iCPD – Confirmed Progressive Disease

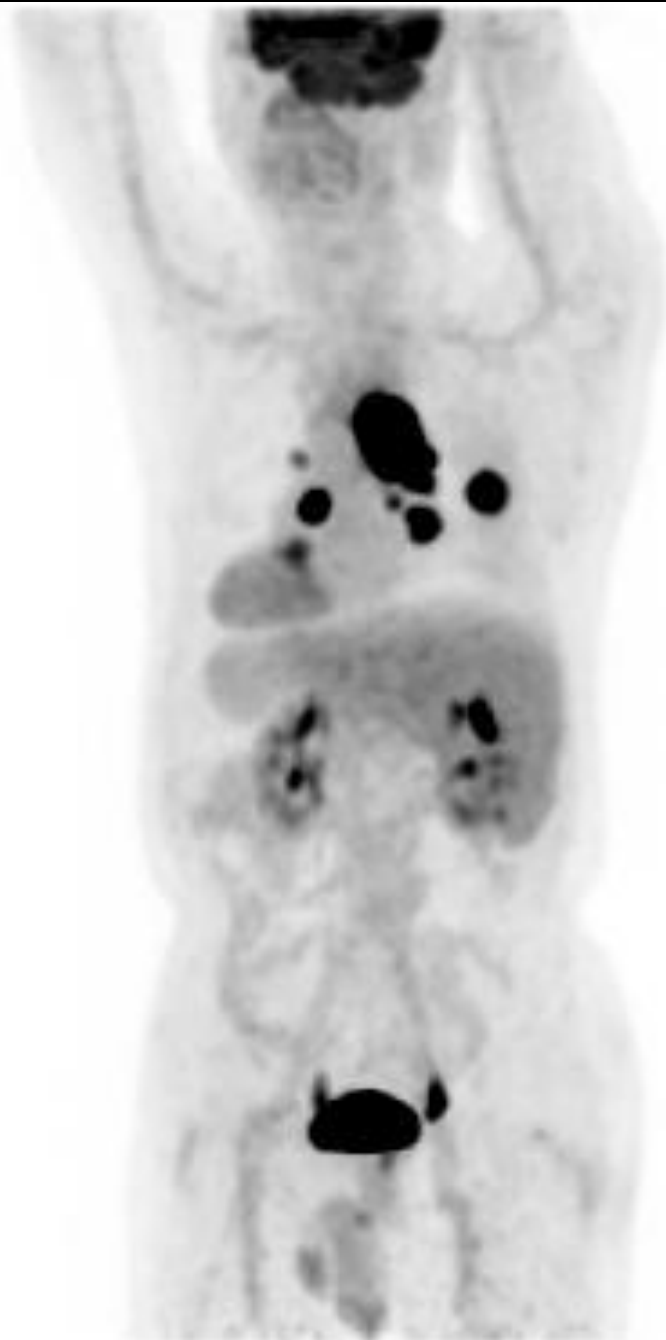
Case Summary

- Female/64, ECOG 0
- Stage IV ADC without driver mutation, PD-L1 SP263 10%
- 2025.01.10 Pembrolizumab/Pemetrexed/Carboplatin C1
- 2025.01.31 Pembrolizumab/Pemetrexed/Carboplatin C2
RECIST – SD, iRECIST – iSD
- 2025.02.24 Pembrolizumab/Pemetrexed/Carboplatin C3
- 2025.03.18 Pembrolizumab/Pemetrexed/Carboplatin C4
RECIST – PD, iRECIST – iUPD
- 2025.04.16 Salvage surgery: pCR

Case 2

- Male/69
- Stage IV squamous cell carcinoma, PD-L1 SP263 1%







Types of Atypical Immune Responses

Response Type	Definition	Incidence
Pseudoprogression	Initial progression → Tumor shrinkage or stabilization	5%
Dissociated Response	Some lesions shrink while others grow	7–8%

Eur J Cancer. 2018 Jan;88:38-47.
Clin Cancer Res. 2009 Dec 1;15(23):7412-20.
Lancet Oncol. 2017 Mar;18(3):e143-e152.

Response Assessment in Neuro-Oncology Brain Metastases (RANO-BM)

Why do we need RANO-BM?

RECIST 1.1	Brain Metastases
Developed for systemic solid tumors	→ Often small and multiple
Imaging-based assessment	→ Neurologic symptoms matter
Steroid use not considered	→ Steroids can improve symptoms & imaging
Limited consideration of local therapy	→ SRS can cause treatment-related changes

What is a measurable brain metastasis?

MRI slice thickness	Minimum measurable lesion
≤5 mm	≥10 mm
6 mm	≥12 mm
7 mm	≥14 mm

■ Measurable Brain Metastasis

- Contrast-enhancing
- ≥10 mm in longest diameter*
- Visible on ≥ 2 consecutive slices
- Lesion size ≥ 2× slice thickness

*The diameter perpendicular to the longest diameter in the plane of measurement should be **at least 5 mm** for the lesion to be considered measurable.

RECIST 1.1 vs RANO-BM

Feature	RECIST 1.1	RANO-BM
Primary scope	Systemic solid tumors	Brain metastases
Measurement	Unidimensional	
Measurable lesion	≥10 mm	≥10 mm
Target lesions	≤5 total, ≤2 per organ	≤5 CNS lesions
PR	≥30% decrease	
PD	≥20% increase and ≥5 mm absolute increase	
New lesion	Progressive disease	
Corticosteroid use	Not considered	Considered
Clinical status	Not considered	Considered

CR / PR / SD / PD

	CR	PR	SD	PD
Target lesions	Disappearance	$\geq 30\%$ ↓	Neither PR nor PD	$\geq 20\%$ ↑*
Non-target lesions	None	Stable/improved	Stable/improved	Unequivocal progression
New lesions	None	None	None	Present
Corticosteroids	None	Stable/decreased	Stable/decreased	N/A
Clinical status	Stable/improved	Stable/improved	Stable/improved	Deterioration

* $\geq 20\%$ increase in the sum of longest diameters, with an absolute increase of ≥ 5 mm

Lancet Oncol. 2015 Jun;16(6):e270-8.

Take-Home Messages

- RECIST 1.1 remains the foundation of tumor response assessment, but accurate application requires careful attention to lesion selection, measurement, and patterns of progression.
- Response assessment should be adapted to the clinical context: iRECIST for atypical immune responses and RANO-BM for brain metastases.

경청해 주셔서 감사합니다.