

INTRODUCTION

After lung SBRT, CT cannot confirm response — fibrosis and residual tumor look identical for years.

In our cohort, CT showed residual opacity in all 12 patients at every follow-up.

Adapting the diffusion-based complete-response concept from rectal cancer, we define the non-visible lesion (NVL): absence of diffusion restriction on the b=800 DWI image.

Aim: assess the reproducibility of visual NVL and its relationship to baseline tumor characteristics.

METHODS

Prospective, n = 12. Lung SBRT 40 Gy / 4 fx.

Same-day CT + MRI at baseline, 1, 3, 6 months.
DWI b = 0, 800 s/mm².

NVL scored on b=800 (primary image); ADC map + T1/T2 for reference only.

Two blinded observers: radiation oncologist (O.T.) + medical physicist (S.N.).

Endpoint: NVL at 6 months (NVL6M). Stats: Cohen's κ , Mann-Whitney U.

Table 1. Patient characteristics (by SUVmax)

Case	Histology	Stage	SUVmax	LD (mm)	Δ ADC% 1M	NVL6M	Outcome
1	Small cell	I	3.20	13.1	+88	NVL	Nodal relapse*
2	Small cell	I	3.80	16.5	+88	NVL	Nodal relapse*
3	CD	I	4.00	21.0	+100	NVL	No recurrence
4	CD	II	5.14	13.4	+71	NVL	No recurrence
5	SCC	II	7.00	25.0	+55	NVL	No recurrence
6	CD	I	7.22	20.9	+36	NVL	No recurrence
7	SCC	II	7.60	25.0	+58	NVL	No recurrence
8	Adeno	I	8.35	13.2	+30	near-NVL	No recurrence
9	SCC	II	8.60	34.9	-1	non-NVL	No recurrence
10	Adeno	I	9.00	35.0	+40	near-NVL	No recurrence
11	Small cell	I	9.73	21.0	+24	near-NVL	No recurrence
12	Adeno	I	12.67	14.4	+50	near-NVL	Brain mets

Read top-to-bottom: all 7 cases with SUVmax $\leq$ 7.6 reached NVL; all 5 with $\geq$ 8.35 did not. Two small cell cases reached NVL but relapsed in nodes — NVL is a local surrogate.

DISCUSSION AND CONCLUSION

Key results

Visual NVL is reproducible: $\kappa = 0.833$ (binary, almost perfect).

Lower SUVmax $\rightarrow$ NVL: all NVL $\leq$ 7.6, all non-NVL $\geq$ 8.35 (p = 0.0025).

Greater early ADC rise at 1 month also accompanied NVL (exploratory).

Interpreted with caution

No local recurrence occurred $\rightarrow$ NVL is not yet a validated surrogate for cure; SUVmax 8 is a descriptive trend, not a threshold.

Clinical value today

Even when a CT shadow persists, a disappeared diffusion signal lets us reassure the patient: this looks like scar, not tumor.

Future direction

Validation in a larger cohort with longer follow-up.

REFERENCES & ACKNOWLEDGEMENTS

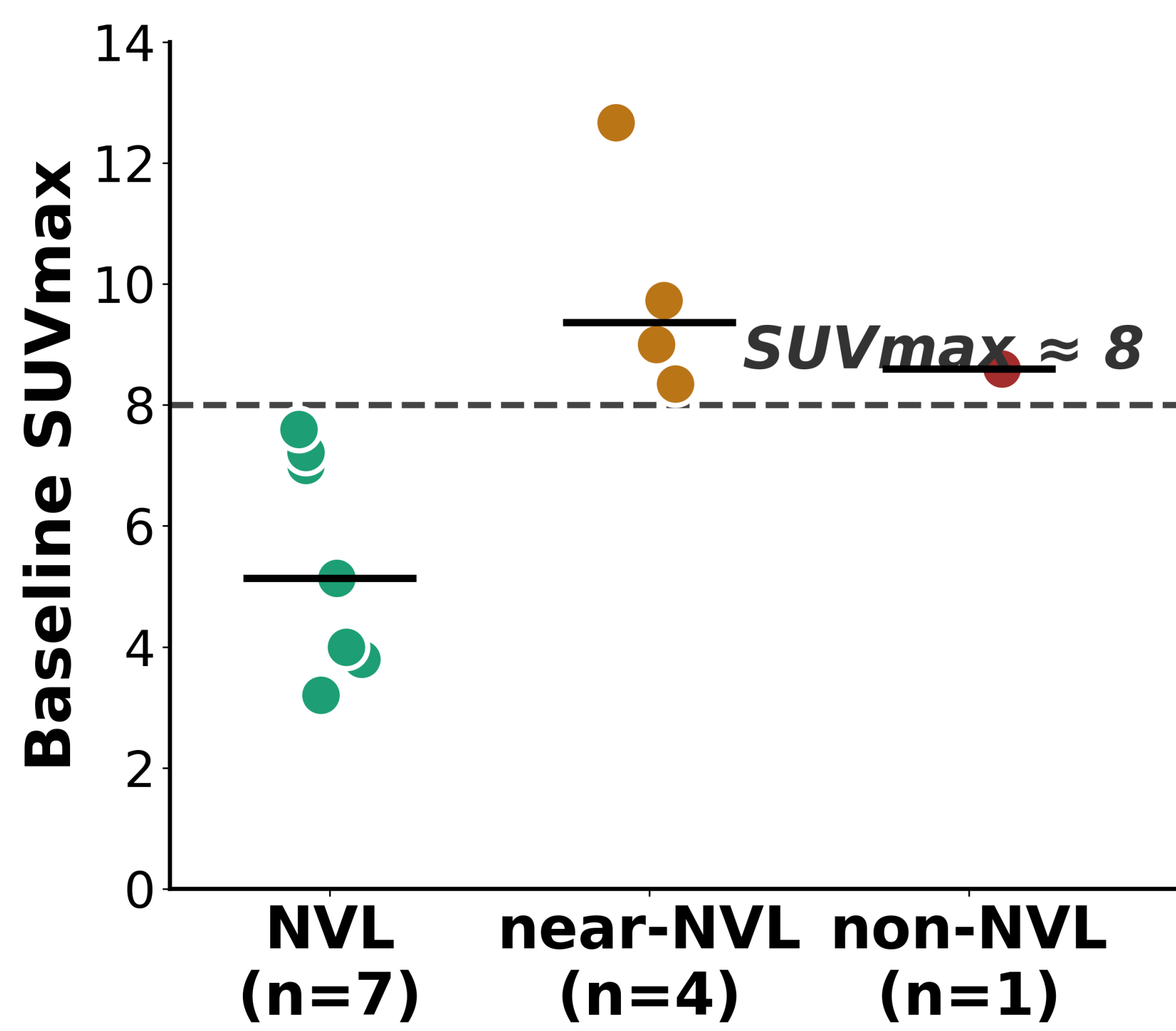
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RESULTS

7/12 (58%) achieved NVL at 6 months; no local recurrence.
SUVmax completely separated groups (U=0, p=0.0025); agreement $\kappa=0.833$.

Figure 1. Baseline SUVmax by DWI class



Left: complete group separation (dashed line $\approx$ 8). Right: green (NVL) appears earlier in low-SUVmax rows; leftmost column is SUVmax.

Figure 2. DWI class over time (by SUVmax)

	SUVmax	1 mo	3 mo	6 mo
Case 1	3.2	NVL	NVL	NVL
Case 2	3.8	—	NVL	NVL
Case 3	4.0	—	—	NVL
Case 4	5.1	—	near	NVL
Case 5	7.0	—	—	NVL
Case 6	7.2	—	—	NVL
Case 7	7.6	—	near	NVL
Case 8	8.3	—	near	near
Case 9	8.6	—	—	—
Case 10	9.0	—	near	near
Case 11	9.7	—	near	near
Case 12	12.7	—	near	near

$\kappa = 0.833$

Inter-observer
agreement

7 / 12

NVL at
6 months

p = 0.0025

SUVmax lower
in NVL

0

Local
recurrences

Early Δ ADC 1M: 64.5% (NVL) vs 30.0% (non-NVL), p = 0.017 exploratory

Table 2. Group comparison (Mann-Whitney U)

Variable	NVL6M (n=7)	non-NVL6M (n=5)	U	p
SUVmax	5.14 (3.90–7.11)	9.00 (8.60–9.73)	0	0.0025
ADC baseline	784 (701–1004)	860 (787–995)	12	0.371
LD (mm)	20.9 (14.0–23.0)	21.0 (14.4–34.9)	16	0.568
Δ ADC% 1M	64.5 (40.3–88.1)	30.0 (23.7–50.5)	28	0.017
Δ ADC% 3M	90.1 (34.8–101.5)	69.0 (22.5–96.4)	22	0.056
Δ LD% 1M	-33.3 (-44.9–-21.1)	-30.6 (-31.4–-26.1)	18	0.639
Δ LD% 3M	-52.4 (-84.0–-45.1)	-51.4 (-68.6–-38.7)	17	0.745

Table 3. Inter-observer agreement (κ)

Time	Assessment	Agreement κ (unwtd)	κ (wtd)	Interpretation
1 mo	3-tier	10/12 (83%)	0.294	Fair
3 mo	3-tier	9/12 (75%)	0.591	Moderate
6 mo	3-tier	10/12 (83%)	0.692	Substantial
6 mo	NVL6M binary	11/12 (92%)	0.833	Almost perfect

Figure 3. Confusion matrix (6-month)

	NVL	near-NVL	non-NVL
Observer A			
NVL	6	1	—
near-NVL	—	4	—
non-NVL	—	1	—

Diagonal = agreement (10/12). Both discordant cases fell in the near-NVL column — the gray zone. Binary NVL agreement was almost perfect ($\kappa=0.833$).

No conflict of interest