

Quality Assurance of delineation and dosimetry of the RTEP7–IFCT-1402 multicentre randomised phase II trial

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Background & objective

- The RTEP7–IFCT-1402 phase II trial showed improved local control with an interim [18F]FDG-PET-guided adaptive boost up to 74 Gy in stage III NSCLC, without increased toxicity.
- Adaptive radiotherapy (repeat imaging, contouring, replanning) increases the risk of inter-centre variability and protocol deviations.
- In clinical trials, radiotherapy protocol deviations are associated with increased risks of treatment failure and overall mortality (Ohri et al., 2013).
- Objective: assess OAR delineation and dosimetric compliance, and the impact of protocol deviations on locoregional progression (LRP) and overall survival (OS).

Materials & methods

- 129 of 158 RTEP7–IFCT-1402 patients analysed (excluded: incomplete chemoradiotherapy n=17, metastases n=1, technical issues n=11); 41 received the boost.
- Heart, lungs, oesophagus and spinal cord contours generated with MVision (deep-learning software) as a standardised reference.
- Centre-reported OAR contours and dosimetric parameters compared with those derived from MVision (Wilcoxon paired test); dosimetric deviations graded by protocol thresholds.
- 3D Dice < 0.80 reviewed by a radiation oncologist; confirmed deviations: major (3D Dice < 0.60) or minor (0.60–0.80).
- Impact of protocol deviations on LRP and OS (Kaplan-Meier, log-rank test).

Contour agreement: centres vs MVision

Organ	Initial plan		Boost plan	
	n	Median 3D Dice [Q1;Q3]	n	Median 3D Dice [Q1;Q3]
Oesophagus	129	0.75 [0.71;0.79]	41	0.78 [0.70;0.81]
Heart	129	0.93 [0.91;0.94]	41	0.92 [0.90;0.94]
Lungs - CTV	129	0.97 [0.96;0.98]	27	0.97 [0.96;0.98]
Lungs - PTV	129	0.97 [0.96;0.98]	39	0.97 [0.96;0.98]
Spinal cord	66	0.67 [0.61;0.71]	23	0.67 [0.59;0.70]

Table 1. 3D Dice similarity coefficients between centre-reported and MVision contours
median values < 0.80 in red (threshold for expert review).

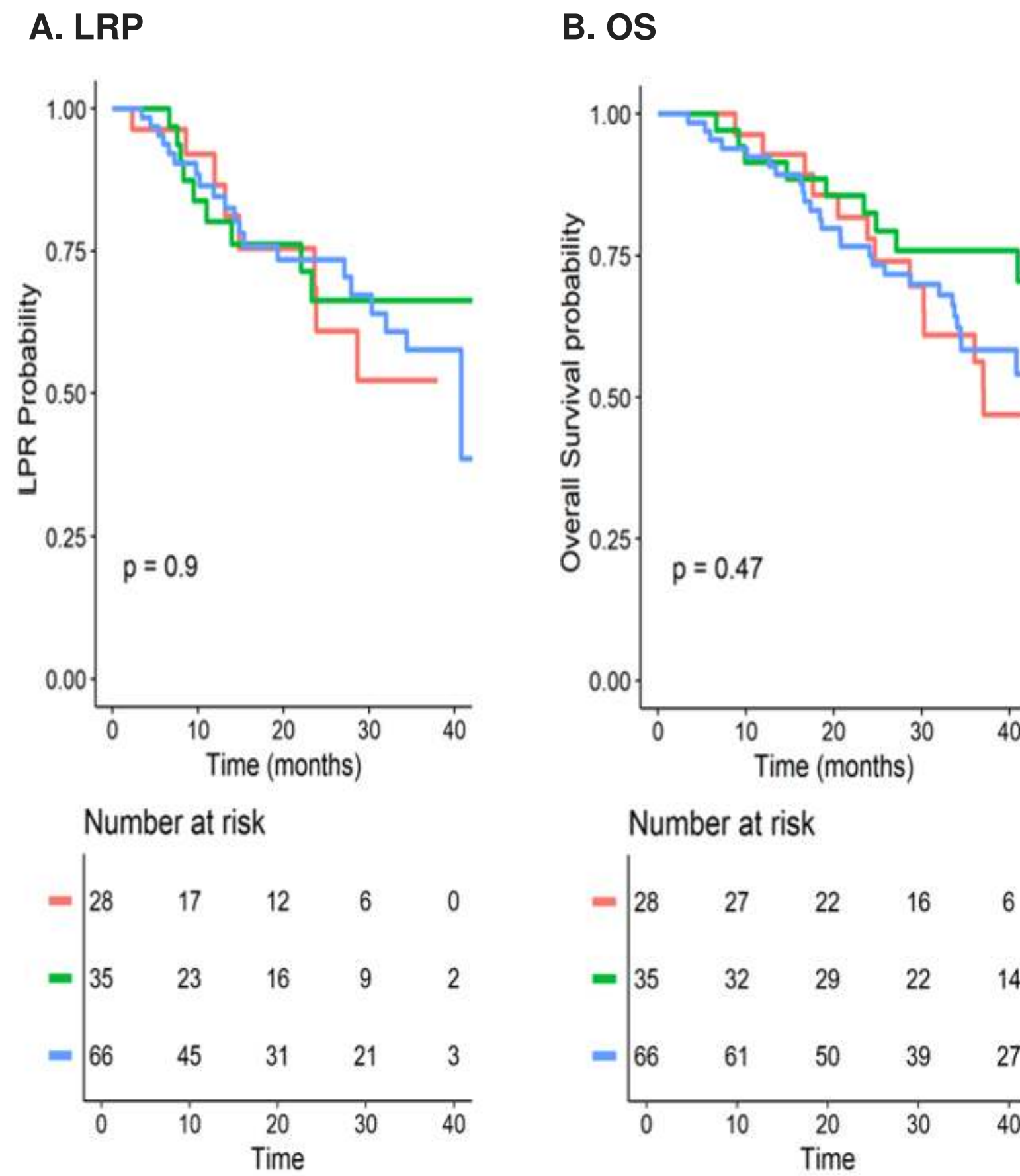
Dosimetric agreement: centres vs MVision

	Initial radiotherapy plan						Adaptive boost radiotherapy plan				
	n	Centre-reported median [IQR]	MVision median [IQR]	Median Δ% [IQR]	p-value		n	Centre-reported median [IQR]	MVision median [IQR]	Median Δ% [IQR]	p-value
Oesophagus V60 (%)	129	16.2 [7.4–25.2]	14.6 [6.0–22.9]	15.0 [7.2–27.8]	0.006		41	15.3 [4.7–25.3]	14.6 [4.1–23.8]	18.4 [9.8–29.9]	0.07
Oesophagus D0.03cc (Gy)	—	—	—	—	—		41	69.6 [67.4–71.9]	68.9 [67.8–73.3]	0.9 [0.5–2.9]	0.87
Heart Dmean (Gy)	129	9.9 [5.4–16.3]	9.5 [5.6–15.1]	10.4 [3.4–21.6]	0.29		41	9.7 [4.0–11.1]	8.8 [4.5–12.8]	14.4 [6.9–25.9]	0.69
Heart V40 (%)	129	6.2 [2.6–12.4]	5.8 [2.7–12.6]	20.7 [9.0–46.6]	0.56		41	4.8 [1.4–9.3]	4.8 [2.0–9.1]	33.3 [17.6–58.0]	0.80
Lungs - CTV Dmean (Gy)	129	15.0 [12.7–18.0]	15.0 [12.4–18.1]	0.7 [0.3–1.8]	0.09		28†	15.6 [13.0–18.0]‡	16.0 [13–19]	1.05 [0.4–2.5]	0.02
Lungs - CTV V20 (%)	129	26.8 [21.7–31.5]	26.9 [21.6–32.3]	0.8 [0.3–2.2]	0.16		28†	28.0 [22.3–31.6]‡	28.6 [22.4–33.0]	1.20 [0.5–2.8]	0.02
Lungs - PTV Dmean (Gy)	129	14.0 [11.6–16.5]	14.2 [11.6–16.5]	0.8 [0.3–1.9]	0.61		41	15.0 [12.5–18.6]	15.9 [12.6–18.8]	1.20 [0.5–2.6]	0.01
Lungs - PTV V20 (%)	129	25.0 [20.7–29.2]	25.1 [20.4–30.0]	0.8 [0.3–2.1]	0.61		41	27.1 [20.3–32.8]	27.6 [20.2–32.8]	1.30 [0.4–2.5]	0.03
Spinal cord D2 (Gy)	66†	32.1 [24.7–37.2]	32.0 [24.5–36.7]‡	1.10 [0.4–2.0]	0.0009		22†	31.3 [24.8–36.2]	31.5 [24.4–36.6]‡	1.05 [0.2–1.9]	0.03

Table 2. Comparison of centre-reported and MVision-generated dosimetric parameters during the initial and adaptive boost radiotherapy plans.
Wilcoxon paired test; significant p-values in red.
Δ%: absolute relative difference between MVision-generated and centre-reported values.
† Statistical comparisons were restricted to paired observations because of missing data (centre-reported for spinal cord, MVision-generated for Lungs – CTV).
‡ Values correspond to the paired subset. Oesophagus D0.03cc : 74 Gy protocol constraint only.

Protocol deviations and outcomes

— No deviation — ≥1 major deviation — ≥1 minor deviation



21.7 / 51.2 / 27.1 %

patients with no deviation / minor deviations only / ≥1 major deviation
(dosimetric and/or contouring)

14.7 % vs 14.0 %

patients with ≥1 major dosimetric vs contouring deviation

No association

between dosimetric, contouring or combined deviations and LRP or OS

Key results

- Dosimetric parameters agreed closely between centres and MVision, except for oesophageal V60 at initial planning (16.2 vs 14.6 %; p=0.006); other significant differences remained below 1 Gy or 1 %.
- Major dosimetric deviations mainly involved oesophageal V60 at initial planning (9.3 %) and lungs PTV V20 at boost planning (12.2 %).
- Expert review confirmed excellent heart and lung delineation; most contouring deviations involved the oesophagus. Some centres contoured the anatomical spinal cord instead of the bony spinal canal, as required by the protocol.
- Major contouring deviations were more frequent in low-volume centres (<6 patients) than in high-volume centres (30.4 % vs 10.4 %; p=0.02).
- No association between deviations and LRP or OS: dosimetric (p=0.78 / 0.57), contouring (p=0.31 / 0.81), combined (p=0.90 / 0.47), for LRP / OS respectively.

Conclusions

- Interim [18F]FDG-PET-guided adaptive radiotherapy can be implemented reproducibly across a large multicentre network when supported by a dedicated RTQA program.
- Despite a significant difference in oesophageal V60 at initial planning, protocol deviations did not impact clinical outcomes.
- The combination of automated contour comparison and expert review provides a robust framework to assess contouring consistency and dosimetric compliance.

RTEP7–IFCT-1402 trial — primary results

Vera P et al. Adaptive radiotherapy (up to 74 Gy) or standard radiotherapy (66 Gy) for patients with stage III NSCLC, according to [18F]FDG-PET tumour residual uptake at 42 Gy (RTEP7–IFCT-1402): a multicentre, randomised, controlled phase 2 trial. Lancet Oncol 2024;25(9):1176–1187.

doi: 10.1016/S1470-2045(24)00320-6 — scan to read



Figure 1. Kaplan-Meier estimates of LRP (A) and OS (B) according to combined dosimetric and contouring deviations.