P3.09. Stereotactic Mr-Guided Adaptive Radiotherapy (SMART) for Ultracentral Non-Small Cell Lung Cancer (NSCLC)

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INTRODUCTION

Stereotactic ablative body radiotherapy (SABR) is a standard of care for early-stage lung cancer and thoracic oligometastatic and oligoprogressive disease [1-3]. However, ultracentral lesions pose a challenge due to the safety concerns.

Stereotactic MR-guided Adaptive Radiotherapy (SMART) enables daily adaptation, real-time tracking, and automated gating, allowing for sparing of critical organs while potentially enhancing target coverage.

METHODS

Retrospective analysis included SMART-based SABR for ultracentrally located **primary or metastatic** lesions from histologically proven non-small cell lung cancer (NSCLC) *(Table 1)*

Ultracentral definition: planning target volume (PTV) overlapping the proximal bronchial tree (PBT), oesophagus, or pulmonary vessels.

Endpoints:

- Grade ≥3 SMART-related toxicity
- Freedom from local progression (FFLP)
- Progression-free survival (PFS)
- Overall survival (OS)
- Reduction in PTV volume and overlap with ultracentral OARs (SMART_PTV vs. simulated non-adaptive 4DCT SABR_PTV) [4] *Fig 3*

Table 1. Demographics and clinic characteristics

Age, median (range) years	68 (46-82)
Gender, n (%)	
Male	3 (25)
Female	9 (75)
Lesion Type, n (%)	
Primary lung	3 (15.8)
LN Mets	16 (84.2)
History of metastatic disease before, n (%)	
No	4 (33.3)
Yes	8 (66.7)
Thoracic mets	2 (16.7)
Extra-thoracic mets	6 (50.0)
Histology subgroup, n (%)	
Adenocarcinoma	8 (66.7)
Large Cell Neuroendocrine	3 (25)
Squamous carcinoma	1 (8.3)

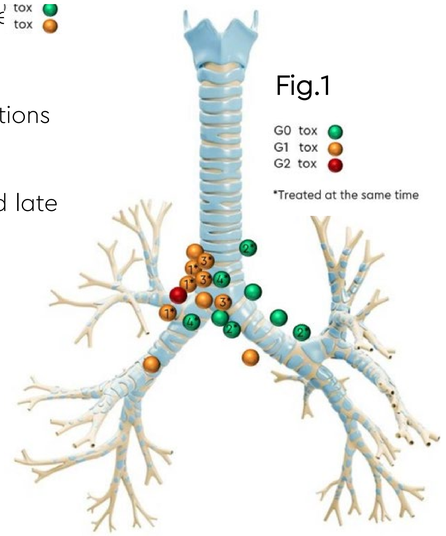
LN: lymph-nodes; PET-CT: Positron Emission Tomography

RESULTS

Between 2020 and 2023, twelve patients with 19 ultracentral NSCLC le tox tox

- The median dose was 40Gy (30-60Gy) in 5-8 fractions.
- Online plan adaptation was performed in 100% of delivered fractions (86 fractions).
- No severe toxicity (grade 3+) was observed, and G1-2 acute and late toxicity rates were 50% and 16.7%, respectively *(Table 2)* .
- Figure 1 shows the distribution of each lesion location concerning the PBT, graded by maximum reported toxicity and indicating those treated synchronously.

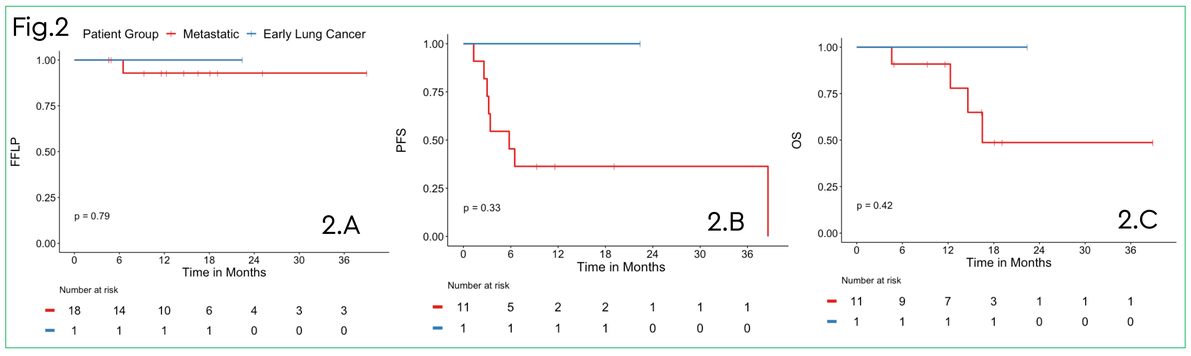
Fig.1



Over a median follow-up of 15 months (range 4-38 months):

- One lesion recurred within the SMART field.
- 1-year FFLP was 93%. (Fig. 2.A)
- Median-PFS was 6.15 months (1-38 months). (Fig 2.B)
- Median OS and 1-year OS were not reached (range 4-38 months) and 92%.) (Fig. 2C)
- 1-year OS was 92%.

Fig.2



Median simulated conventional-SABR PTV was significantly larger than the SMART PTV (31.2cc vs 9.3cc, p< 0.001), with a significant increase in the median overlap with ultracentral OARs (4.6cc vs 0.75cc p < 0.001).

Figure 3 is representative of a SABR treatment plan for an ultracentrally mediastinal nodes. The overlap with PBT (yellow), great vessels (pink) and oesophagus (purple) is shown.

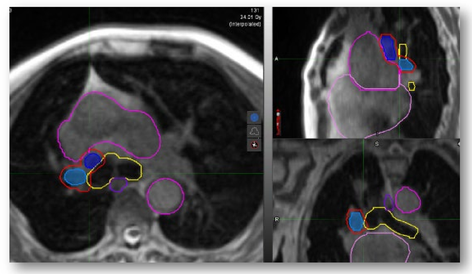


Fig.3

Table 2. Toxicity according CTCAE v5

Acute, n (%)	6 (50)
G0	6 (50)
G1	5 (41.7)
Fatigue	4 (33.3)
Cough	1 (8.3)
Dysphagia	1 (8.3)
Breathlessness on exertion	1 (8.3)
G2	1 (8.3%)
Nausea/Vomiting	1 (8.3%)
G3-5	0 (0)
Late, n (%)	2 (16.7)
G1	
Breathlessness on exertion	2 (16.7)
G3-5	0 (0)

CONCLUSION

Our analysis demonstrates that hypofractionated SMART with daily online adaptation for ultracentral NSCLC achieved comparable local control to conventional non-adaptive SABR, with a safer toxicity profile.

Our data showing reduced PTV overlap with ultracentral OARs compared to simulated conventional SABR PTVs is consistent with prior findings [5].

These findings support the consideration of SMART as a safer and effective treatment option for this challenging subgroup of thoracic tumours.

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