

# Adaptive MRI-Guided Stereotactic Reirradiation for Liver Metastases: A Retrospective Analysis of Clinical and Dosimetric Outcomes

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## INTRODUCTION

SABR is a well-established non-invasive local treatment for liver metastases with high local control (LC). However, up to 50% of patients experience intra-hepatic disease progression (1). Limited data exist on repeated liver SABR re-irradiation

**MR-guided SABR (MRgSABR)** has been postulated as an optimal approach for delivering treatment in the upper abdomen (2,3)

We aim to evaluate the **clinical and dosimetric benefits of MRgSABR re-irradiation for liver metastases** in this retrospective analysis

## METHODS

Reirradiation criteria included:

- Up to 4 metastases
- No tumour size limit
- Uninvolved liver volume  $\geq 700\text{cc}$
- Child-Pugh score  $\leq \text{B7}$

Treatment aims were classified according to reirradiation and oligometastatic ESTRO-EORTC consensus (4,5). OAR tolerances were calculated per UK SABR Consortium reirradiation guidelines (6). Toxicities were recorded according to CTCAE v5.0

## RESULTS

October 2020 - April 2024: **12 patients with 18 liver lesions** (Fig 1) were re-irradiated:

- All patients underwent daily online adaptive **MRgSABR (MRidian Linac, ViewRay Systems Inc, OH)** and among them, 75% also were treated with MRgSABR for their initial course
- **Colorectal cancer** was the most common histology (**66,7%**)
- **58.3%** of patients received **prior additional liver-directed-treatment** such as surgery or RFA
- In **four cases, multiple liver metastases** were re-irradiated simultaneously

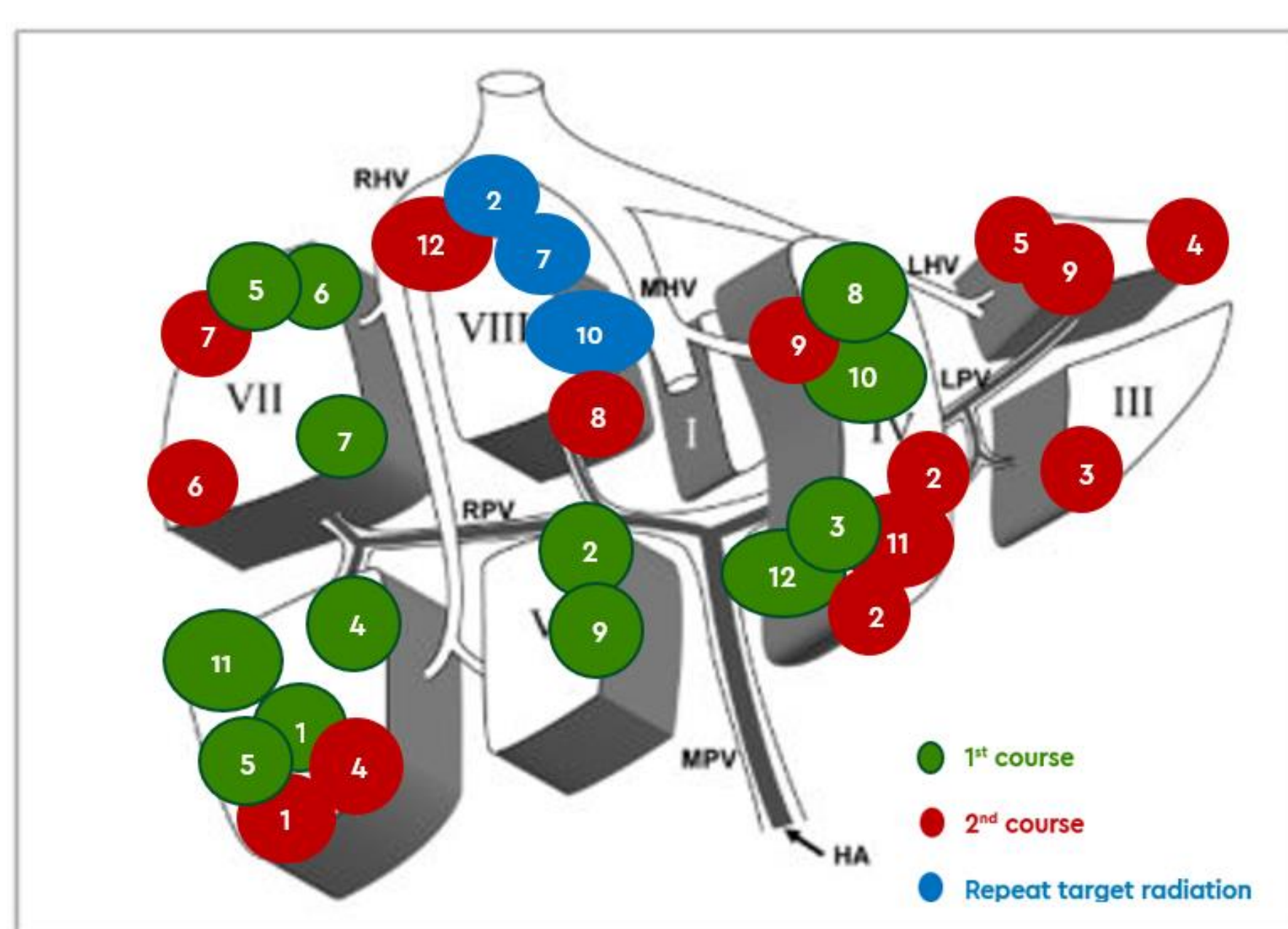


Figure 1: Diagram of the lesions' distribution across hepatic segments

### Dosimetric Parameters:

- All mandatory OAR-constraints met
- PTV V(100%) was 95% (SD 7.6) and PTV D(95%) was 40Gy (SD 11.4)

	Dose (Gy) m (range)	BED <sub>10</sub> m (range)	GTV vol (cc) m (range)	PTV vol (cc) m (range)	Met size(cm) m (range)	MLD (Gy) M; SD (range)	Liver D (700cc) M; SD (range)
<b>Primary</b>	50 (40-60) in 3-5#	100 (72-151)	8.12 (2.76-98.5)	40.9 (13.4-180.5)	3.4 (2-9)	6.21 4.0 (0.5-13.2)	6.21 4.0 (0.5-13.2)
<b>Secondary</b>	45 (30-60) in 3-5#	100 (48-132)	13.1 (1.87-71.8)	33.4 (9.8-141.1)	3.5 (1.7-9)	6.1 3.1 (2.8-13.5)	1.9 2.5 (0.2-8)

## References

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### Reirradiation toxicity profile:

- No patient experienced acute  $\geq \text{G2}$  toxicity.
- Acute G1 toxicity was 50% with fatigue being the commonest (41.7%).
- One patient developed late G4 colo-hepatic fistula, following liver resection and RFA.
- No liver decompensation was reported

### The median interval between courses was 16.5 months (6-37m):

- First SABR in-field-LC was 66.7%
- Median, 1-year, and 2-year-OS from primary-SABR course were 34 months (12-37m), 91.7% (95%CI54-99%) and 82.5% (95%CI46-95%), respectively.

Table 1. Demographic parameters

PRIMARY	N	12	
	Age, median (range)	62 (40-84)	
	<b>Gender, n (%)</b>		
	Male	6 (50%)	
	Female	6 (50%)	
	<b>Histology</b>		
	CRC	8 (66.7%)	
	Pancreas	1 (8.3%)	
	Breast	1 (8.3%)	
	Oesophagus-gastric	1 (8.3%)	
Ovary	1 (8.3%)		
<b>Prior ablative treatments (multimodality approach)</b>			
Liver Surgery	5 (3 of them more than one)		
RFA	2		
<b>Intercourses Time (months) median (range)</b>		<b>16.5 (6-37)</b>	
SECONDARY	<b>Progression characteristics</b>		
	Lesions (N)	18	
	Re-biopsy	3 (25%)	
	<b>Oligoprogression classification*</b>		
	<b>De-novo</b>		
		0 (0%)	
	<b>Repeat</b>	Oligorecurrence	4 (33.33%)
		Oligoprogression	1 (8.3%)
		Oligopersistence	1 (8.3%)
	<b>Induced</b>	Oligorecurrence	4 (33.33%)
Oligoprogression		1 (8.3%)	
Oligopersistence		1 (8.3%)	
<b>Reirradiation Classification†</b>			
Type 1	6 (50%)		
Type 2	6 (50%)		

N: number; CRC: colorectal cancer; Gy: gray; RFA: radiofrequency  
\*According ESTRO-EORTC consensus,

**Median-follow-up from reirradiation was 10 months (3-33m).** At analysis from reirradiation:

- 58% were alive and 41.7% died from disease progression.
- **Radiological response** was observed in **88.9%** (16/18 liver metastases)
- One patient relapsed in-field. Intrahepatic out-of-field recurrence was main pattern of failure (75%), while 58% had distant relapse (lung most common site, 41.7%).
- Median chemotherapy-free-interval was 5 months (3-11)
- **1-year and 18-month-OS** were 71.3% (95%CI34-90%) and 57% (95%CI20-82%), respectively.

## CONCLUSION

MRI-guided liver SABR re-irradiation is a non-invasive local treatment option delivering ablative doses with low toxicity and excellent in-field LC, even in a heavily pre-treated population. Intrahepatic out-of-field and distant relapse were main failure patterns highlighting the need for improved systemic therapy in repeat/induced oligometastatic cohort. Additional follow-up is needed to assess long-term efficacy and toxicity.

