Y90 Segmentectomy and Lobectomy: My Top-5 Tips

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Disclosures

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Top-5 Tips

1. All the work is in the mapping angiogram. The treatment is a breeze.

2. If you are not doing cone-beam CT routinely, you are below the standard of care.

3. Small microcatheters for segmental vessels; large microcatheters for lobar vessels

4. Don't be afraid of giving high doses.

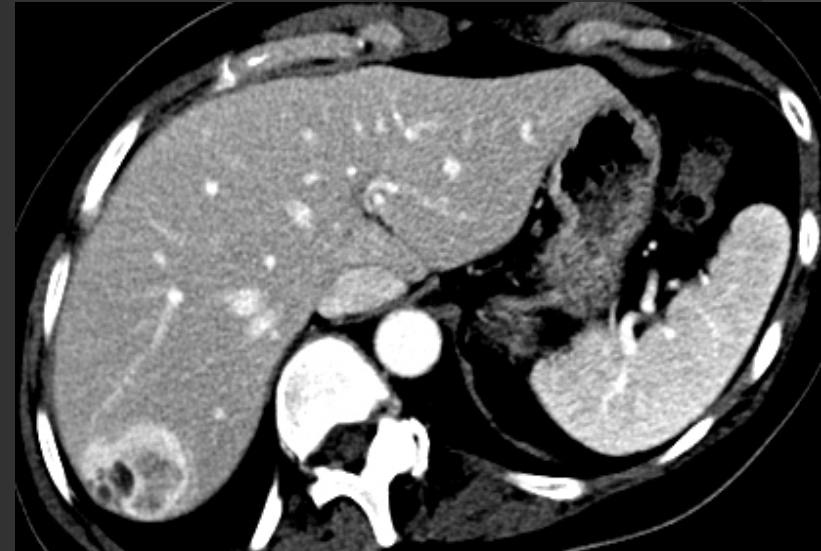5. Radiation lobectomy doesn't necessarily always have to get surgery.

1. All the work is in the mapping angiogram. The treatment is a breeze.
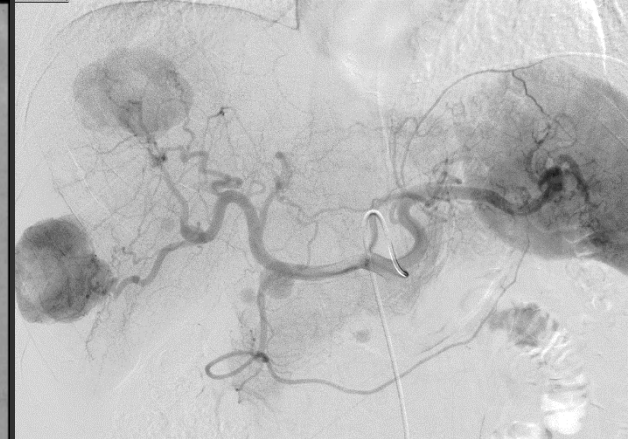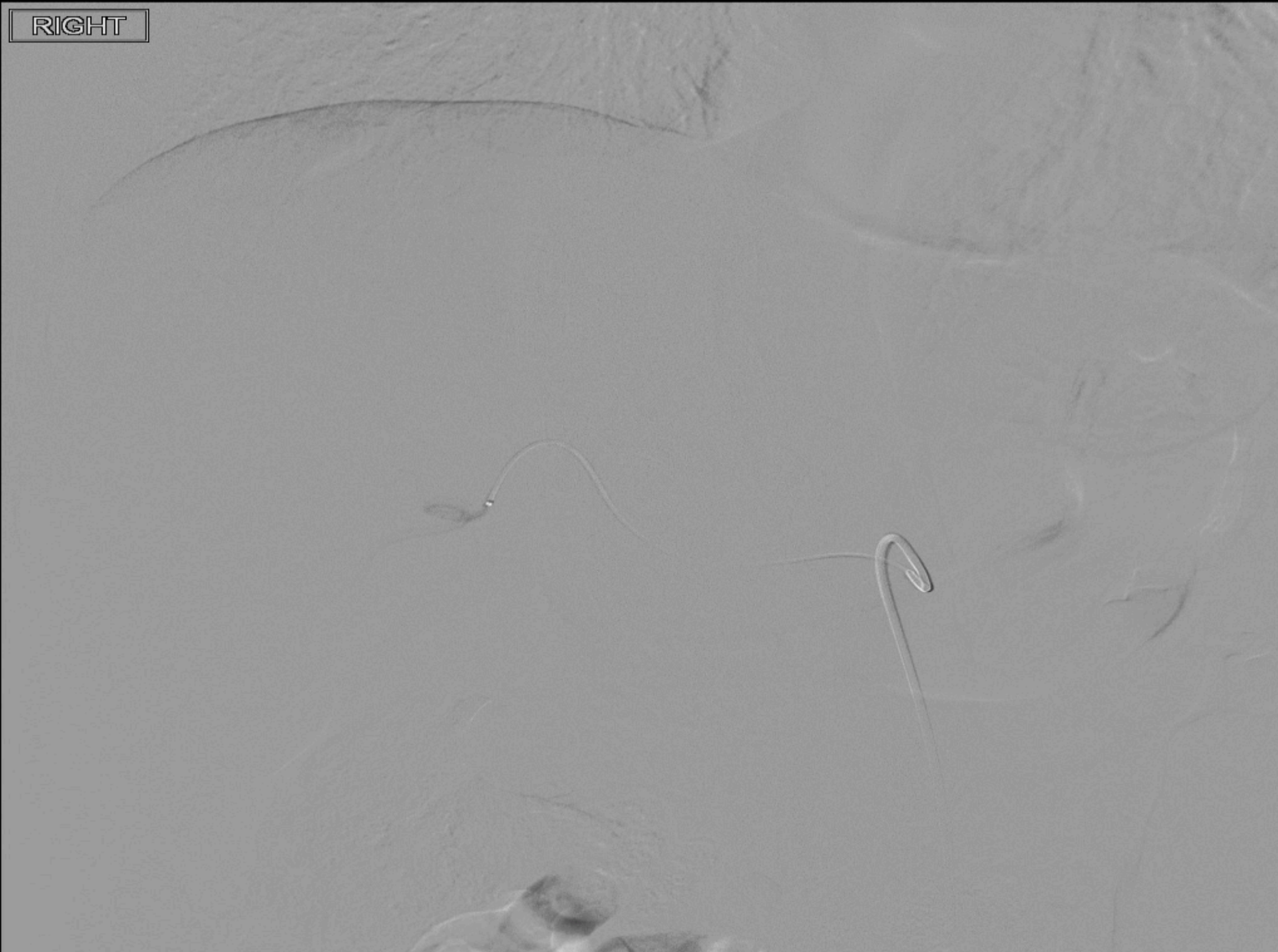
Mapping angiogram minimum:

- SMA
- Celiac
- Common/Proper hepatic artery
- Left hepatic artery
- Middle hepatic artery
- Right hepatic artery
- Cone-beam CT
- Segmental catheterization
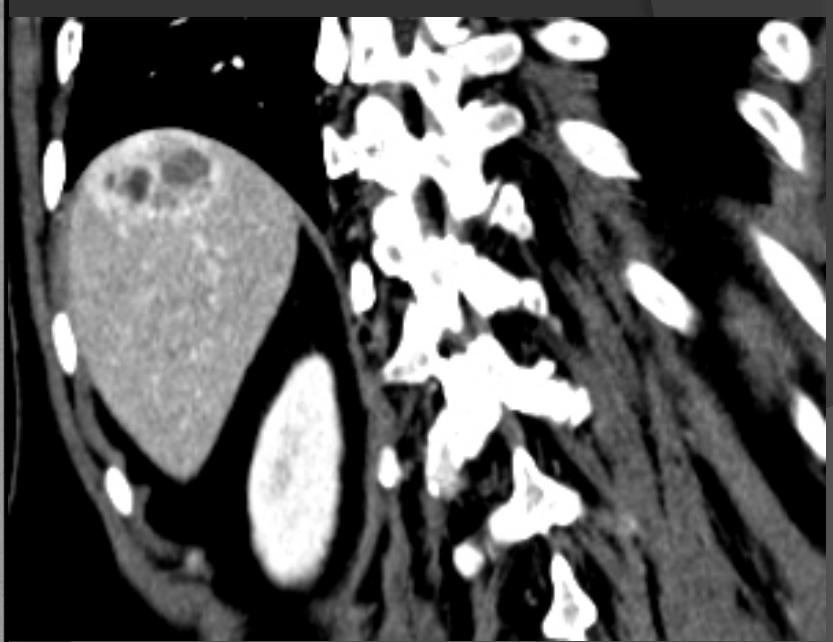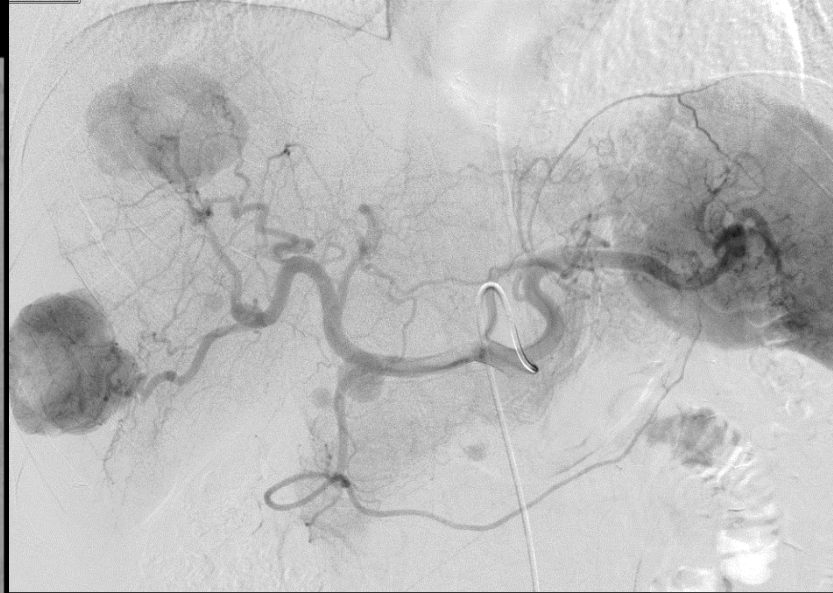
Two hypervascular tumors
Segment 7
Segment 6

RIGHT

RHA 2/12

RIGHT

Middle hepatic artery
1/6

2. If you are not doing cone-beam CT routinely, you are below the standard of care.

Goals of CBCT?

- Restage the patient
- Possibly better define indeterminate lesions
- Identify arterial feeders to tumors

Combined arterial and parenchymal phase in one scan

CBCT Variables

Every machine is different: You must be familiar with your settings.
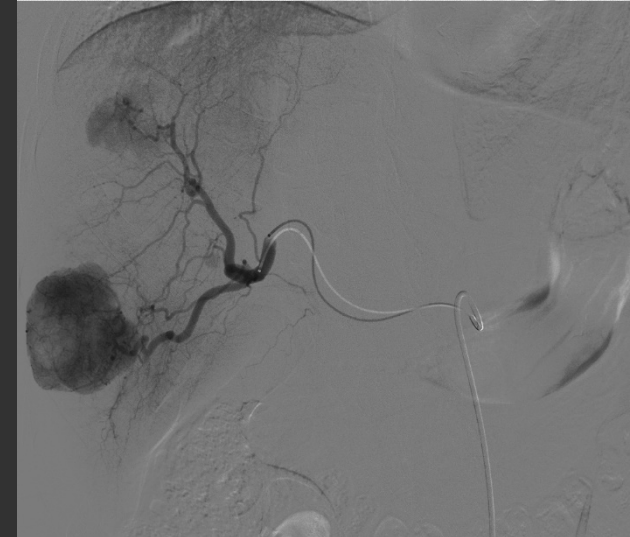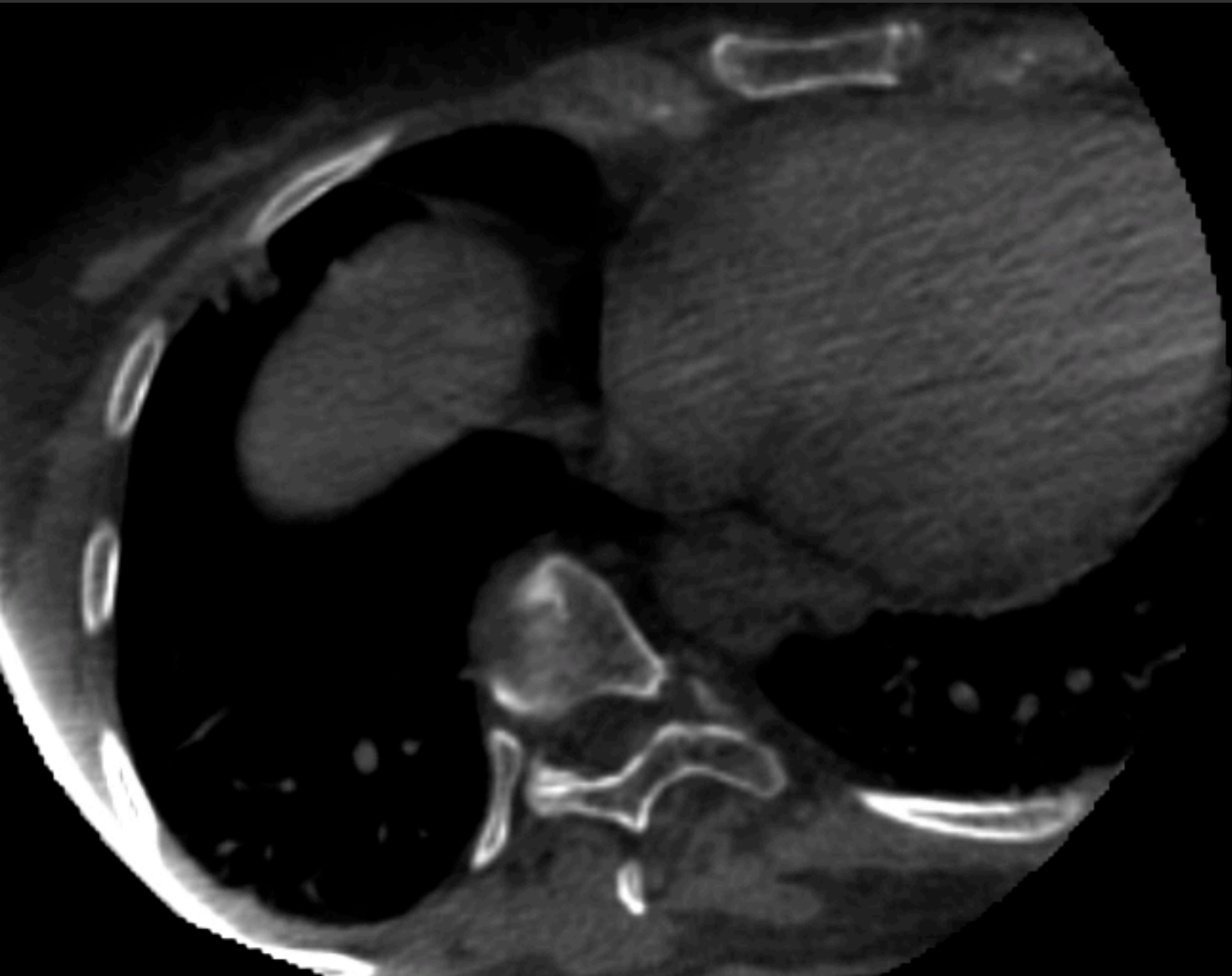
1. Acquisition time (4-10 seconds)
2. Contrast dilution
3. Contrast rate of injection
4. Acquisition delay time

CBCT Example

- Philips
- Acquisition time = 4 seconds (need to breath-hold for liver)
- Contrast:
  - 2/3 strength (average size pt.)
  - Rate of injection: antegrade flow without reflux based on prior DSA
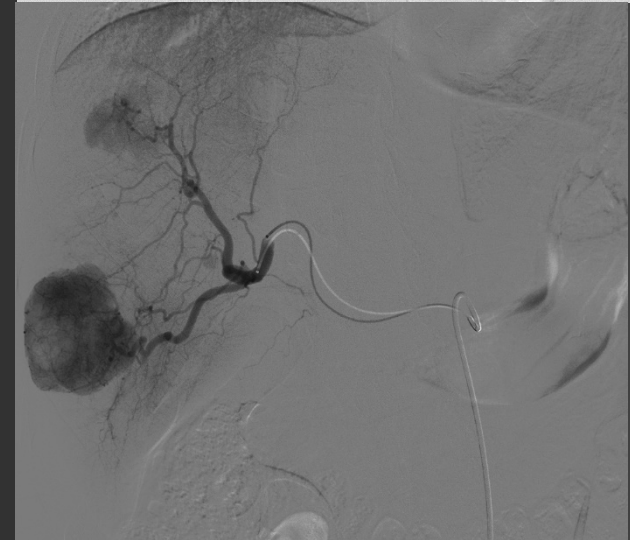 - Delay time: start of tumor blush based on prior DSA

CBCT Example

- Philips
- Acquisition time = 4 seconds (need to breath-hold for liver)
- Contrast:
  - 2/3 strength (average size pt)
  - Rate of injection: 2 cc/sec
  - Delay time: 3 seconds (start of tumor opacification)

- Acquire CT with contrast in the artery (arterial phase) and in the tumor (parenchymal phase)

- Total time = 7 seconds (3-sec. delay + 4-sec acq.) → 2/14 with 3-sec delay.

CBCT
Right hepatic artery
2/16
4-sec. delay
4-sec. acquisition

CBCT
Right hepatic artery
2/16
4-sec. delay
4-sec. acquisition

3. Small microcatheters for segmental vessels; large microcatheters for lobar vessels

Large = 2.8 French distal OD

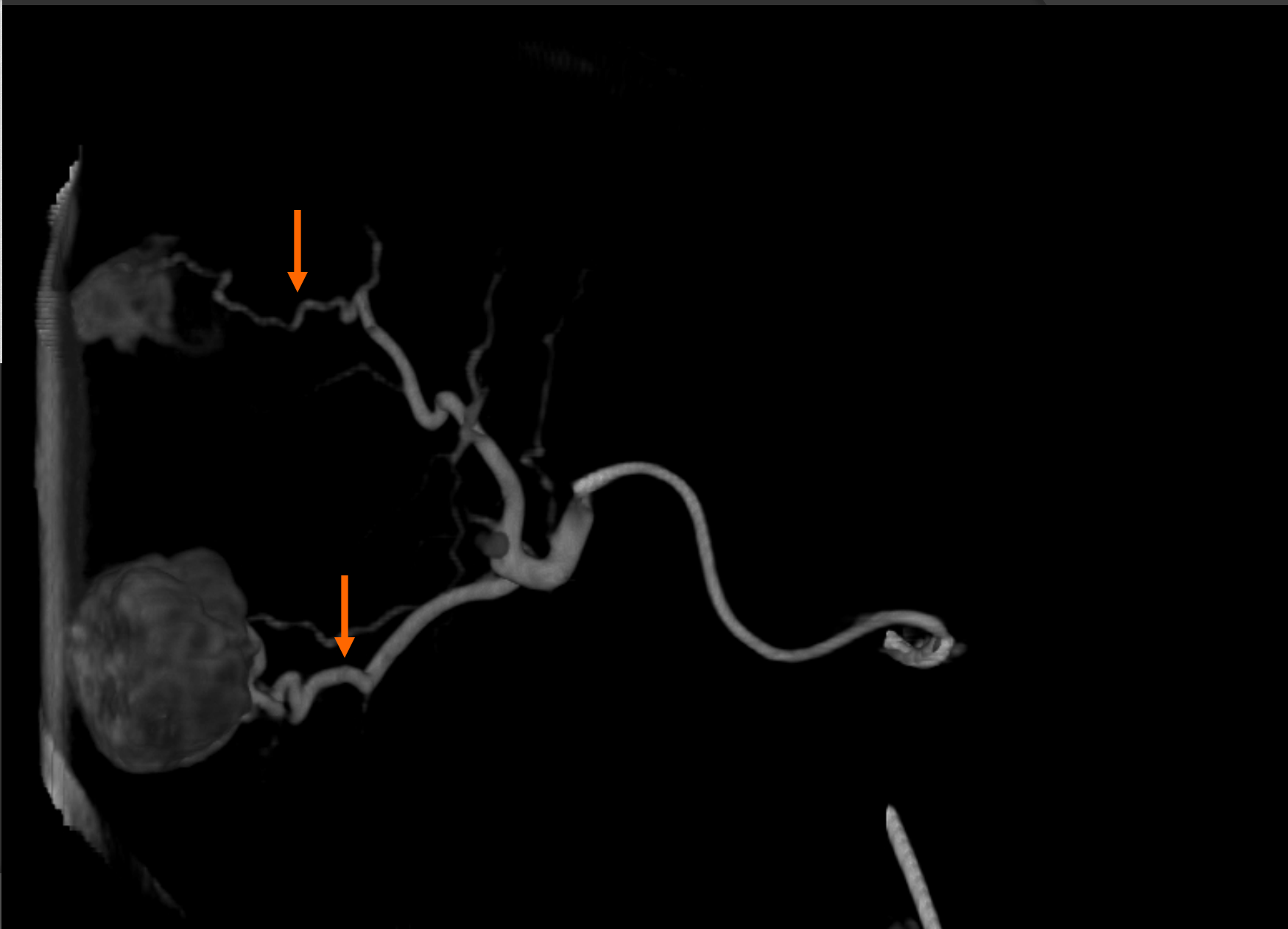PROGREAT
Renegade HI-FLOW
LANTERN

Medium = 2.4 Fr

PROGREAT 2.4
Direxion 021

Small = 2.0 Fr

PROGREAT alpha
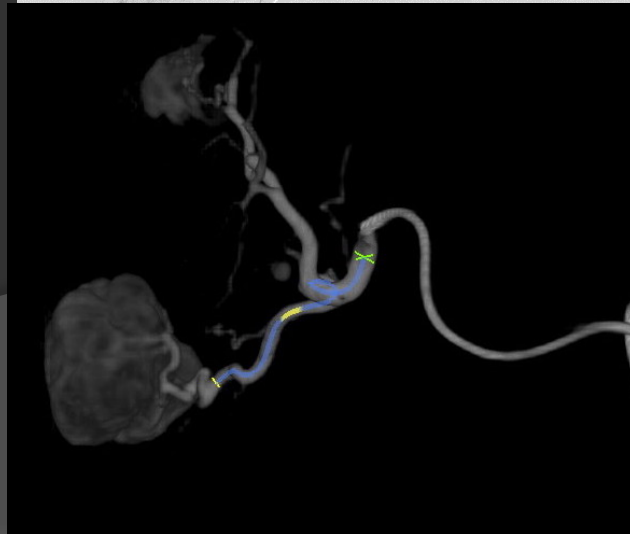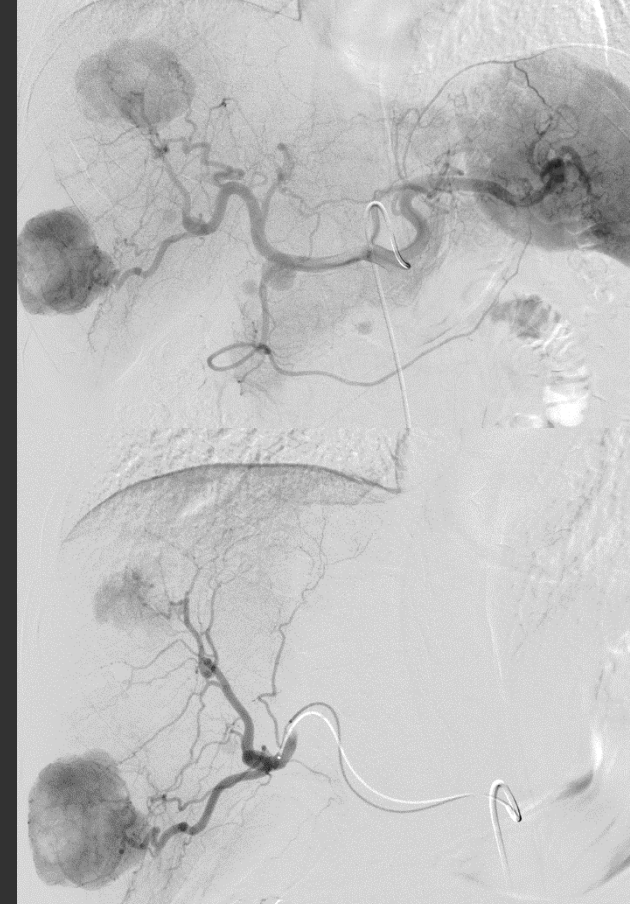TRUESELECT

Right hepatic artery

RIGHT

Y90   5 F Simmons-1
Segment 6   2.0 F TRUESELECT

RIGHT

Right lobar Y90
PROGREAT 2.8 Fr

4. Don't be afraid of giving high doses (in the right patient)

Package insert:

Glass: 120 gray

Resin: BSA formula

Segmentectomy: > 400 Gy

Lobectomy: > 120 Gy or partition dosing

LEGACY Trial

Patient Characteristics	Treated Population (N=162) N (%)
Median age (range), years	66 (21-90)
≥ 18 to < 65	69 (42.6)
≥ 65 to < 75	64 (39.5)
≥ 75	29 (17.9)
Gender, male	123 (75.9)
HCC Etiology	
HCV	112 (69.1)
Alcohol	48 (29.6)
NASH	23 (14.2)
HBV	15 (9.3)
Other/unknown	5 (3.1)
ECOG Status	
0	98 (60.5)
1	64 (39.5)
BCLC Status	
A	98 (60.5)
C	64 (39.5)
AFP ≥ 200 ng/mL	24 (14.8)

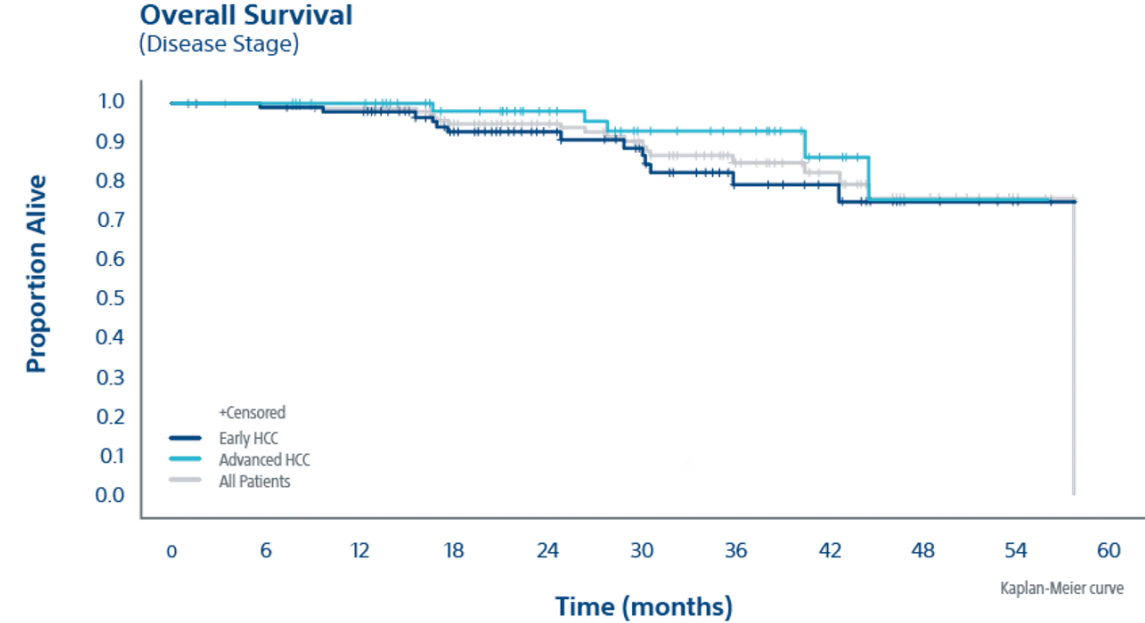| Treatment Characteristics	Treated Population (N=162) N (%)
Median Tumor Size (range), cm	2.6 (0.9-8.1)
Initial Y90 Treatment Goal	
Radiation segmentectomy	104 (64.2)
Radiation lobectomy	8 (5.0)
Bridge to liver transplantation	36 (22.2)
Other	1 (0.6)
Unknown	13 (8.0)
Type of Infusion	
Selective	155 (95.7)
Lobar	3 (1.9)
Mixed	4 (2.5)
Absorbed dose to perfused liver volume (Gy), median, (IQR)	410.1 (199.7, 797.7)
Number of TheraSphere Treatments	
1	130 (80.2)
≥2	32 (19.8)

HCC: hepatocellular carcinoma; BCLC: Barcelona Clinic Liver Cancer; Y90: Yttrium-90; Gy: Gray; IQR: Interquartile Range

Overall Survival: Disease Stage

Overall Survival
(Disease Stage)

	% Patients alive (95% CI)	
	24 M	**36 M**
Early HCC (BCLC A) (n=98)	92.8 (84.5, 96.7)	82.5 (69.9, 90.2)
Advanced HCC (BCLC C) (n=64)	98.0 (86.9, 99.7)	93.0 (79.7, 97.7)
All patients (n=162)	94.8 (89.5, 97.5)	86.6 (78.1, 92.0)

Factors Effecting Hypertrophy

Variables	Frequency of MHT $\geq 10\%$	Univariate analysis	Multivariate analysis
FLR <50% vs > 50%	92.4 vs 68.4%	$p = 0.0203$	$p = 0.0023$
HILD <88Gy vs $\geq$ 88Gy	65.7% vs 92.2	$p = 0.0081$	$p = 0.0029$
TD $_{\geq 205Gy}$ and TV $\geq 100cm^3$ vs TD $_{<205Gy}$ or TV < 100 cm^3	81.8 vs 75.8%	ns	–
HILD $\geq$ 88Gy or TD $_{\geq 205Gy}$ for TV $\geq 100cm^3$ vs HILD <88Gy and TD $_{<205Gy}$ or TV < 100 cm^3	83.9 vs 54.5%	$p = 0.0265$	not tested*
Child A5 vs A6 + B7	89.6 vs 40.0%	$p = 0.0001$	$p < 0.0001$
PVT present vs absent	81.8 vs 78.9%	ns	–
Hypersplenism present vs absent	71.4 vs 80.7%	ns	–
Response vs no response	81.4 vs 33.3%	ns	–
Liver toxicity vs no liver toxicity	75.0 vs 79.7%	ns	–
First line vs $\geq$ second line	72.9 vs 92.9%	ns, but trends ($p = 0.0706$)	–

- 73-patient study
- HCC
- Dose to tumor and liver calculated with MAA scan

Palard X. *Eur J Nucl Med Mol Imaging*. 2018;45(3):392-401.

Y90
Segment 7 HCC

3 GBq in seg 7
5 GBq in MHA

Single HCC with PVT

Potential candidate for right hepatectomy

Y90 or PVE?

175 Gray delivered to right hepatic lobe
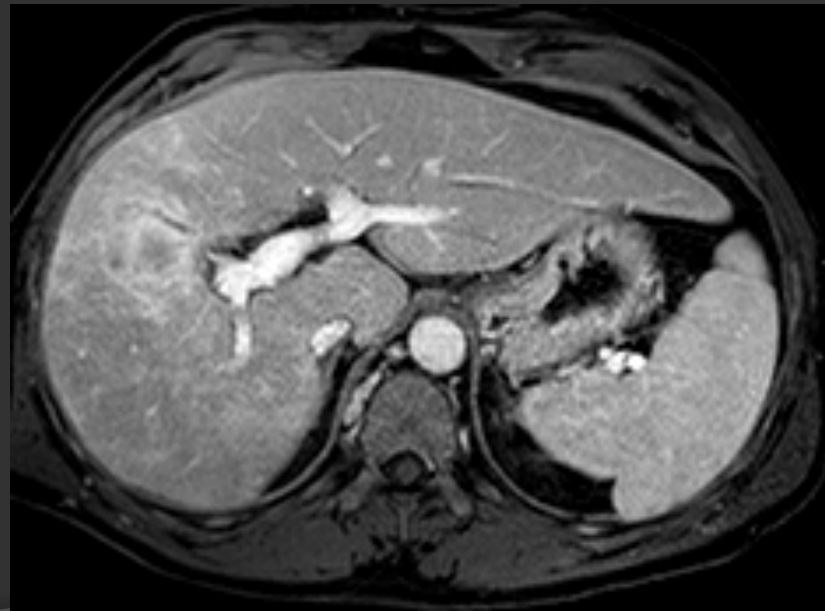
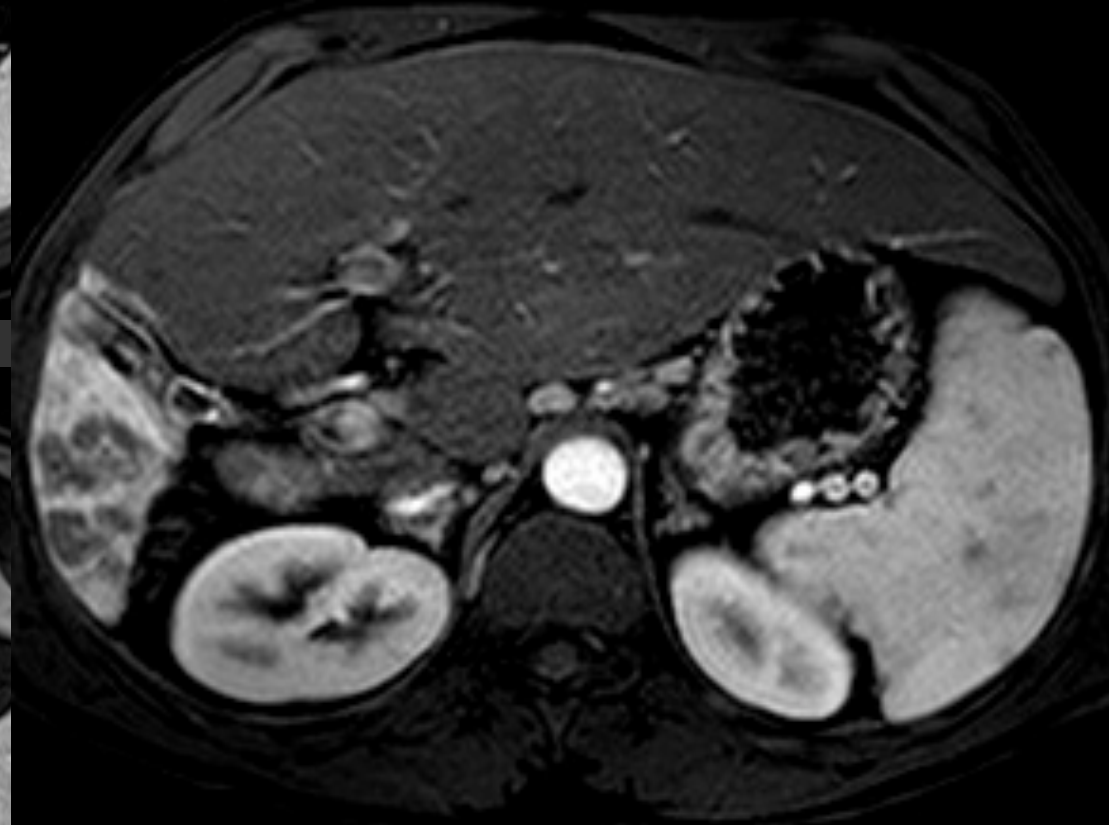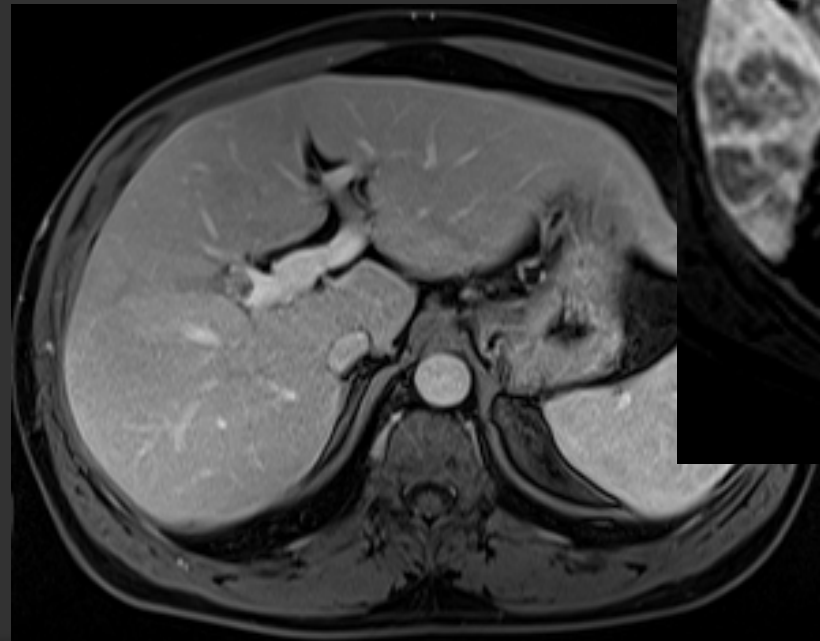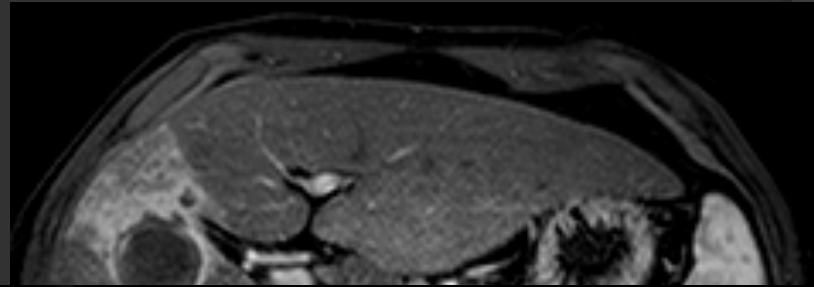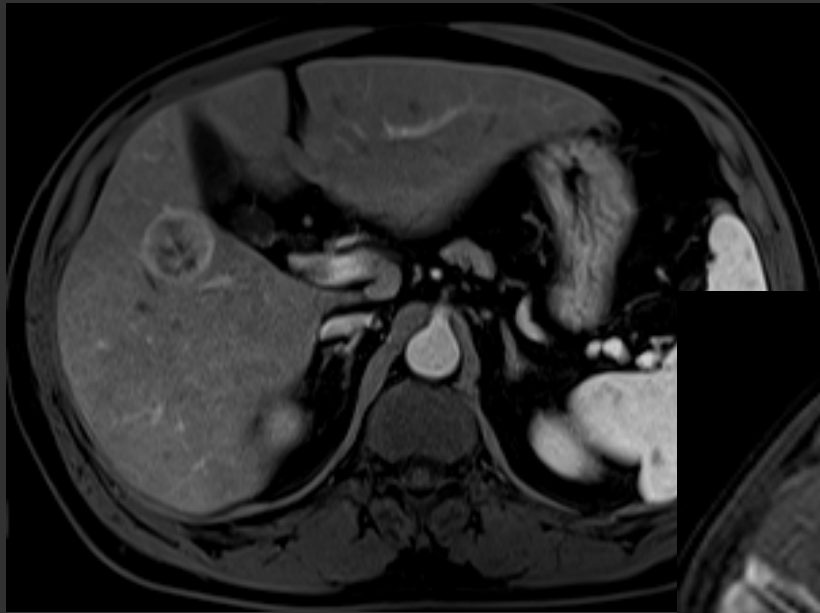Initial

Initial

4 months

Initial

24 months

5. Radiation lobectomy doesn't necessarily always have to get surgery

- Initially designed for patients to bridge or downstage to resection
- Many centers don't have experienced hepatic surgeons who want to do resection
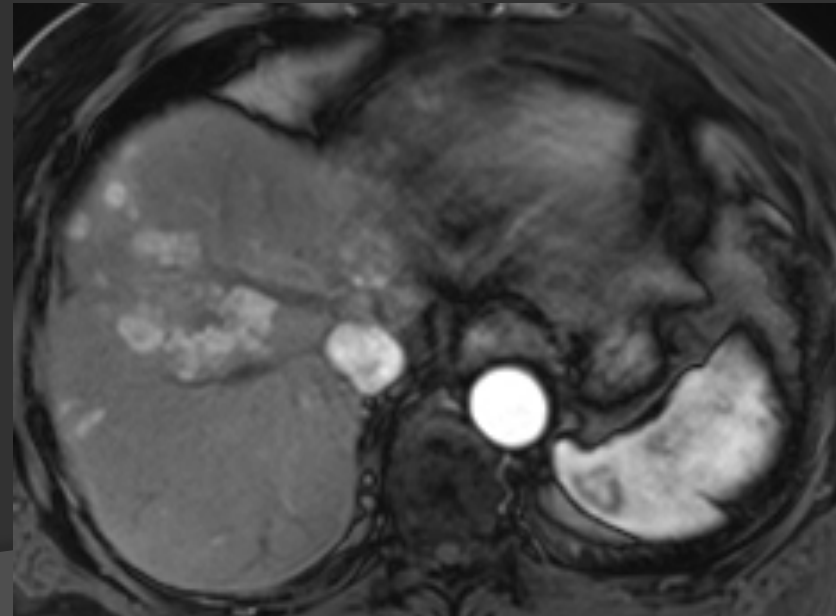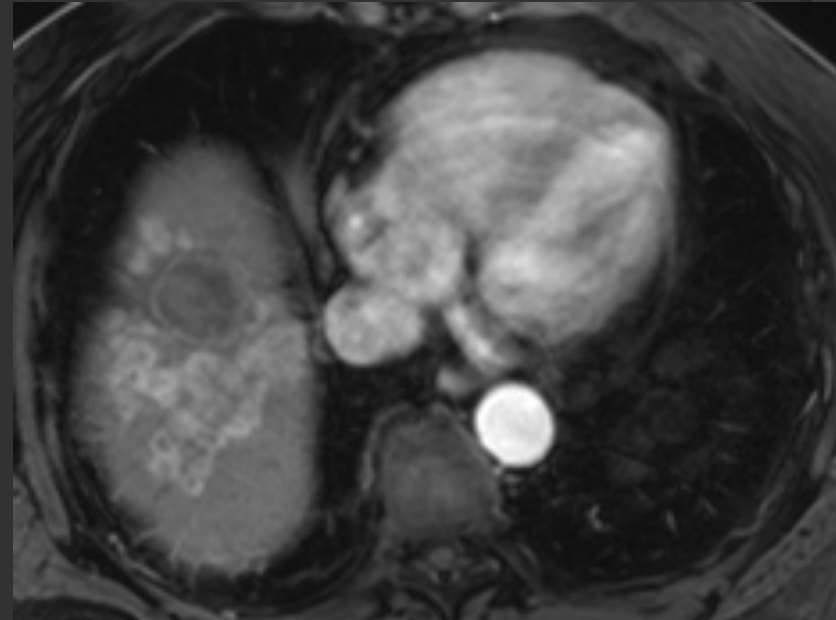- But what if they don't ever need surgery?

Include:
- Child Pugh A
- Unilobar disease
- Requires lobar treatment (not able to be segmental)

73-year-old male
HBV Cirrhosis

Child A
Portal HTN
ECOG 0

Initial segment 8 HCC (4.3 cm)
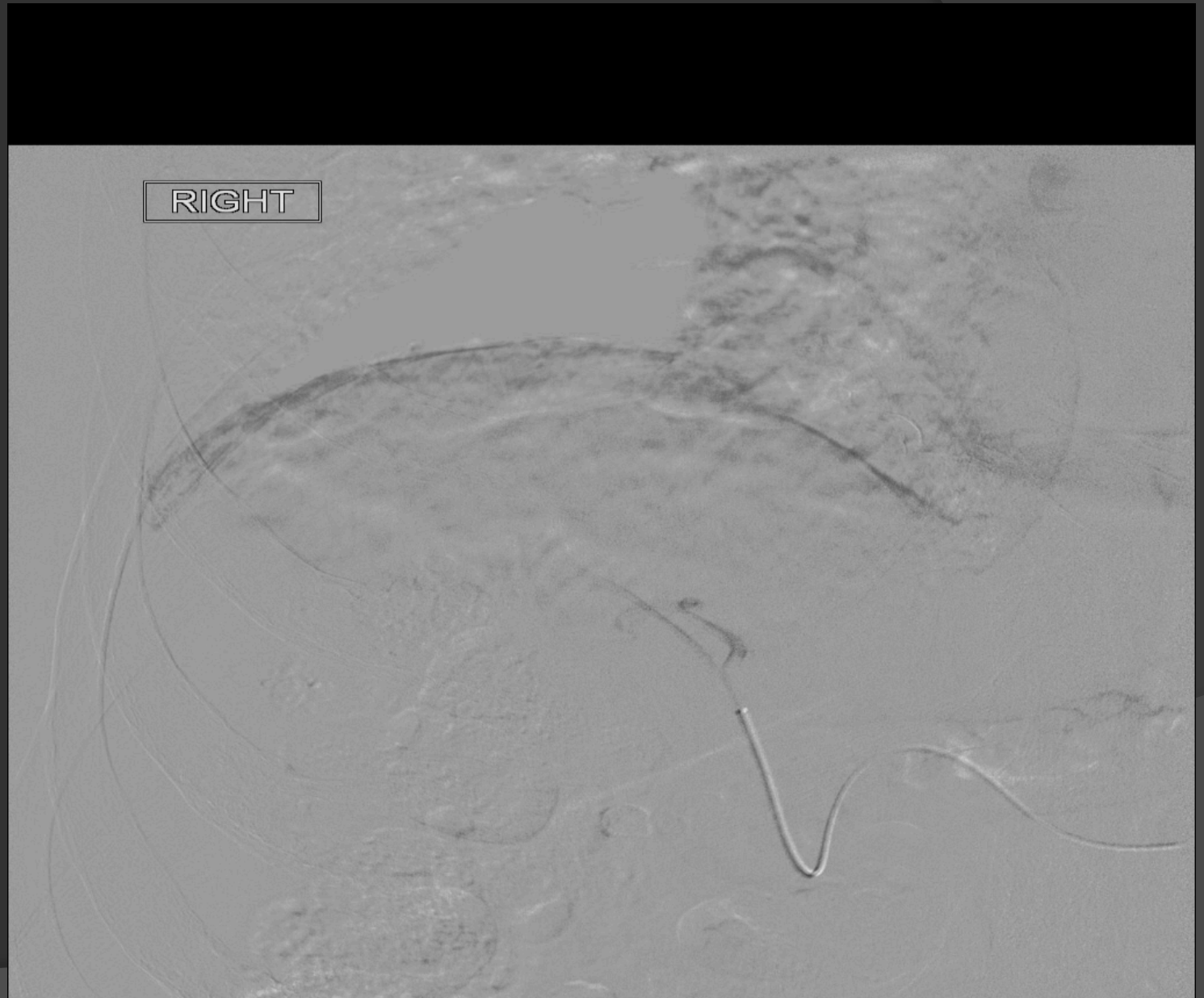MWA 1/2017
MWA for recurrence 3/17

Multifocal HCC, unilobar
No PVT
No mets
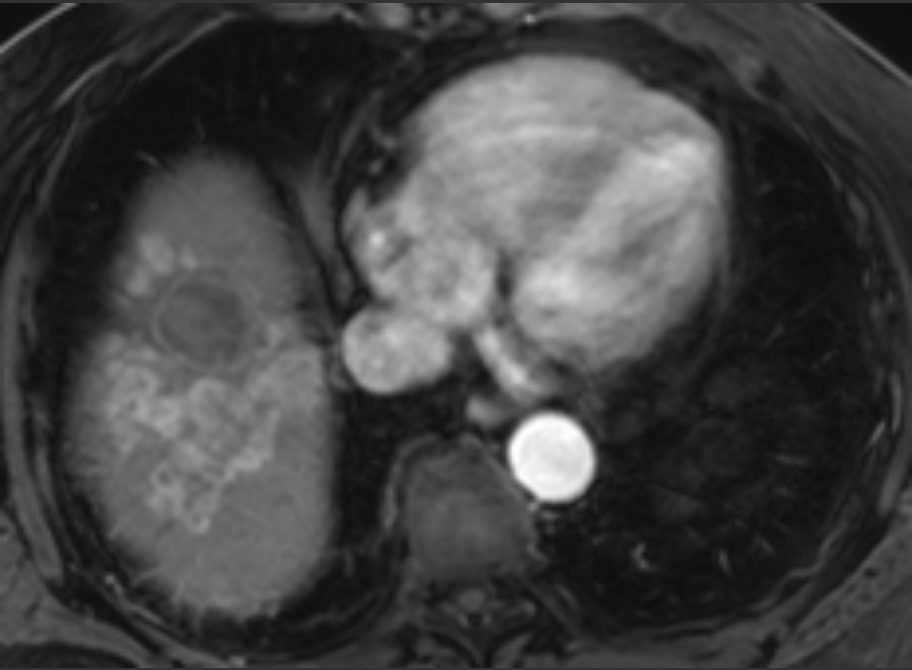**BCLC B**

180 Gray
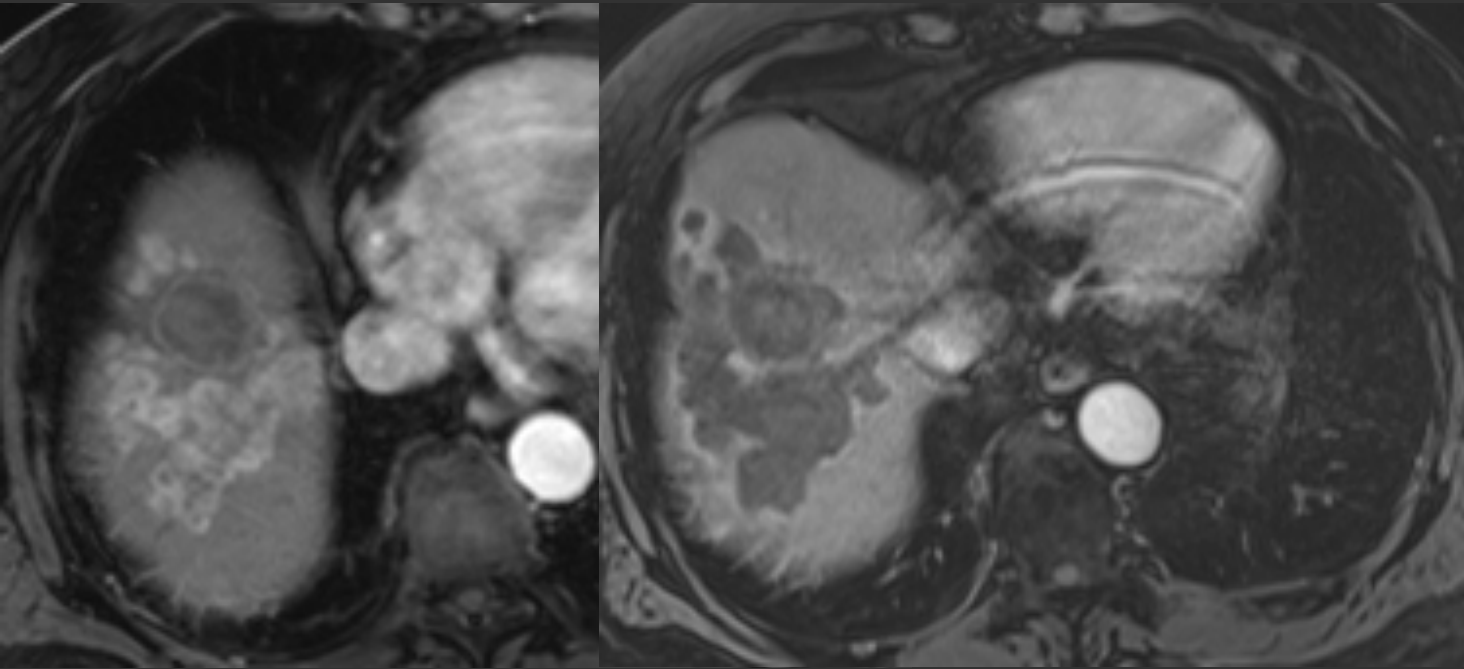Right hepatic lobe

S/p right radiation lobectomy
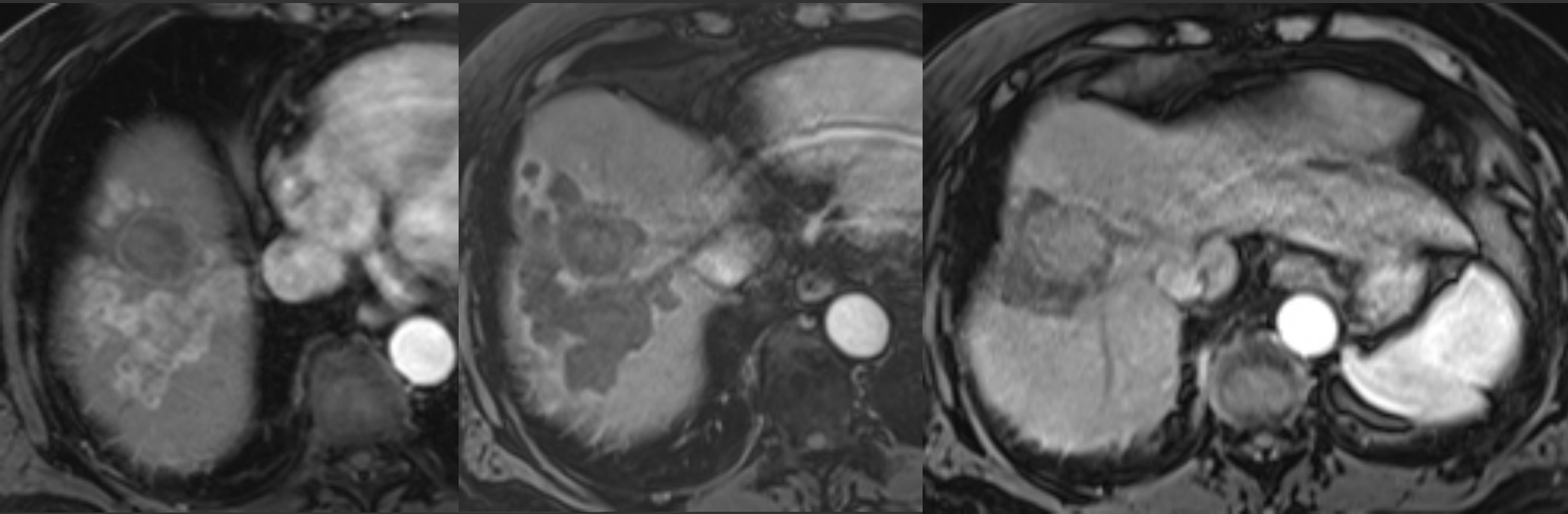

Baseline

S/p right radiation lobectomy

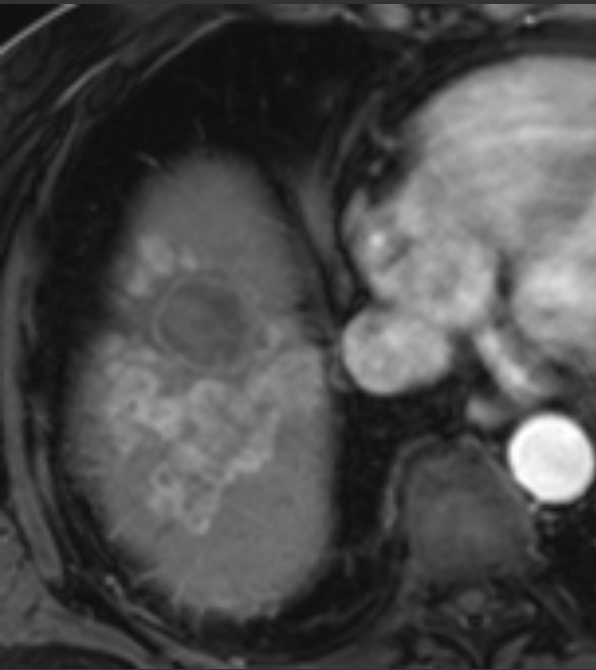Baseline   2 months

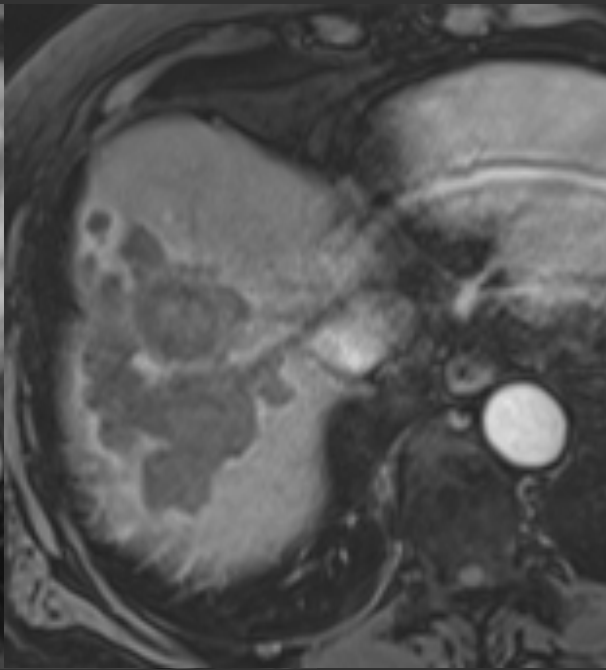S/p right radiation lobectomy
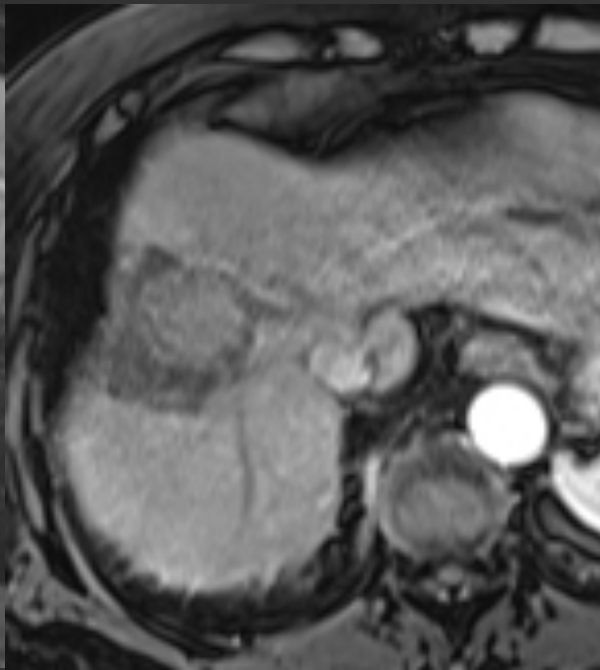
Baseline

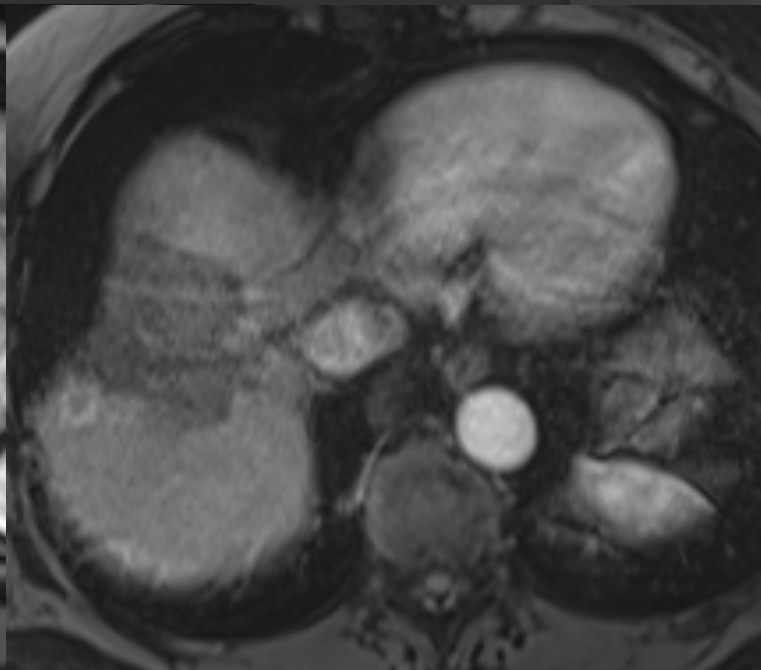2 months

12 months

S/p right radiation lobectomy

Baseline | 2 months | 12 months | 15 months

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Thank you!

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