

RADIATION SEGMENTECTOMY & LOBECTOMY



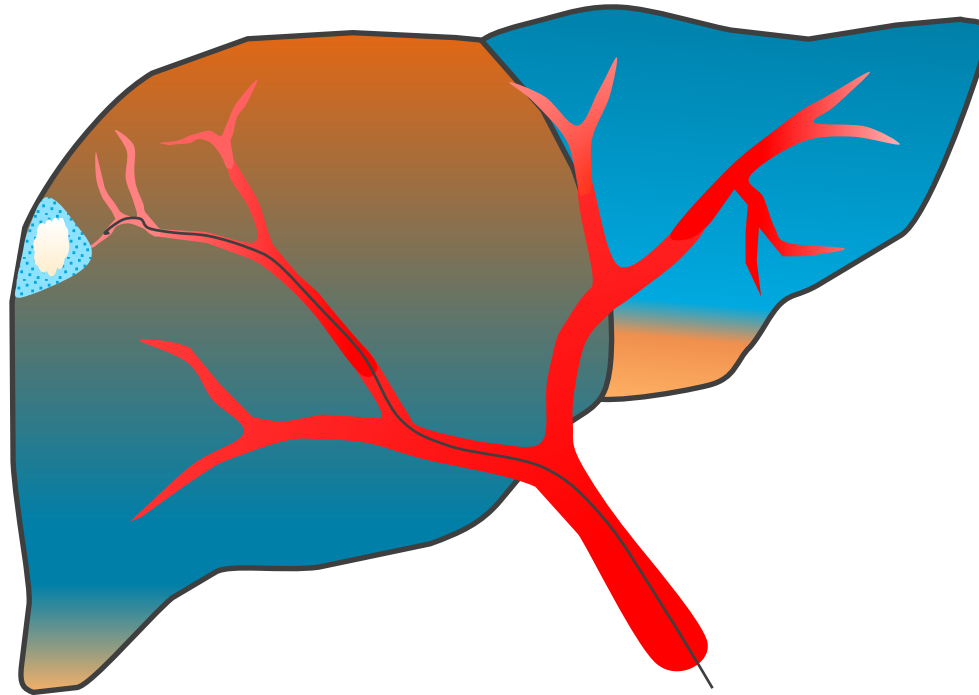
ROBERT J LEWANDOWSKI, MD FSIR
PROFESSOR OF RADIOLOGY, SURGERY, MEDICINE
DIRECTOR OF INTERVENTIONAL ONCOLOGY
NORTHWESTERN UNIVERSITY (CHICAGO)



DISCLOSURES

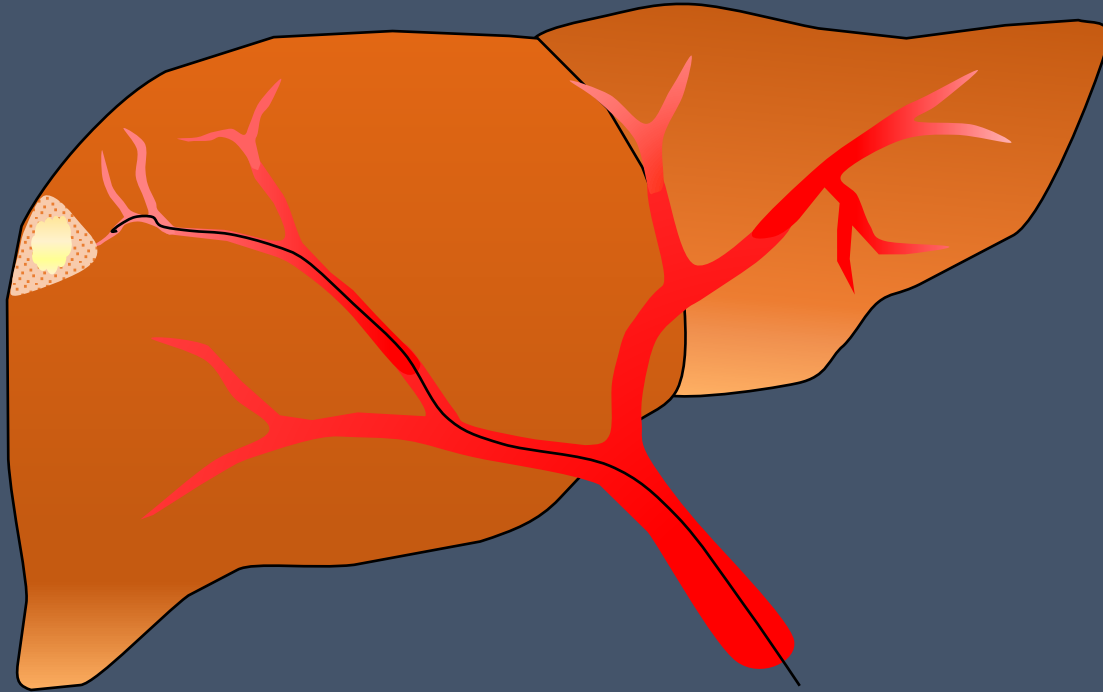
- Consultant: BSC, BD, Varian, ABK Medical, Alhambra Medical

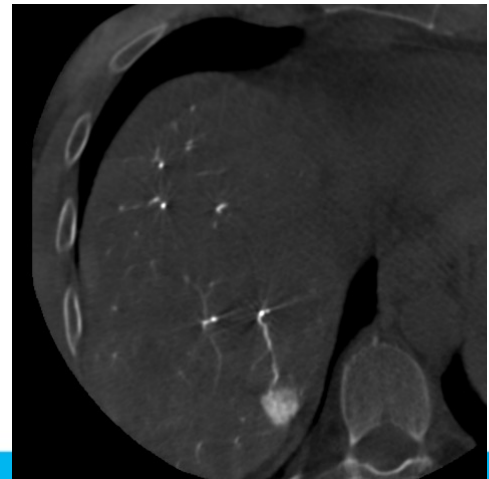
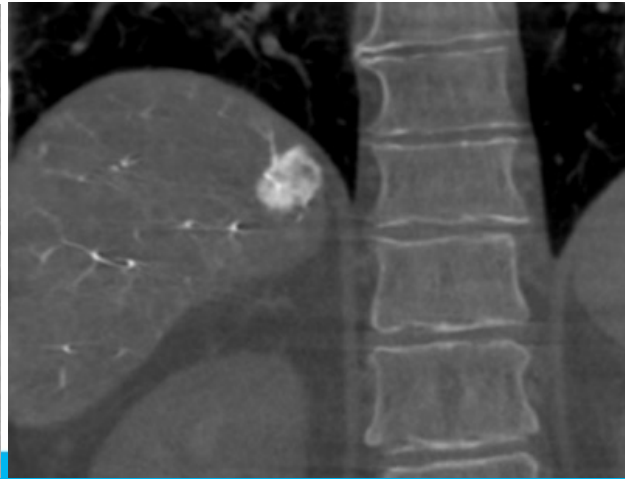
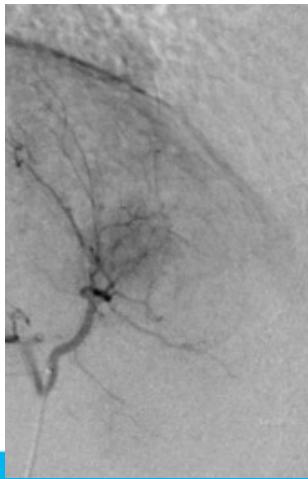
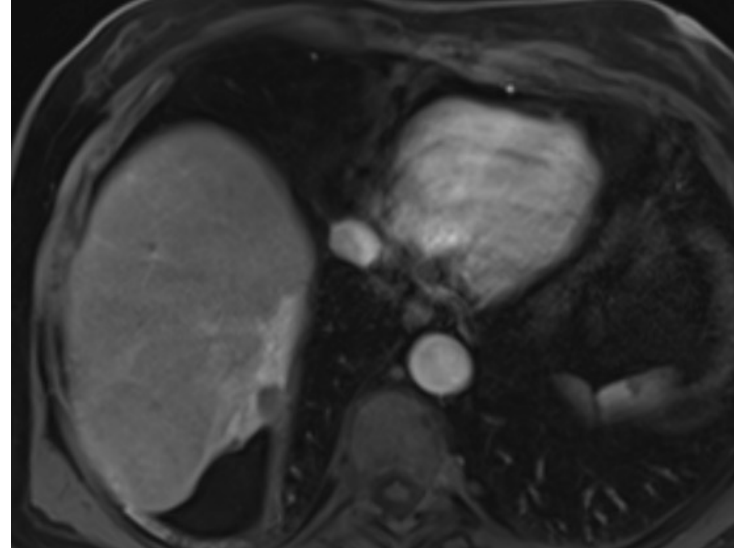
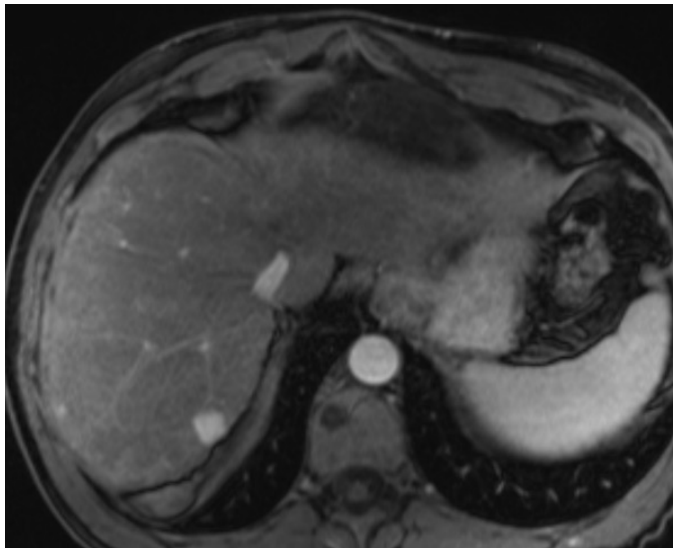
RADIATION SEGMENTECTOMY



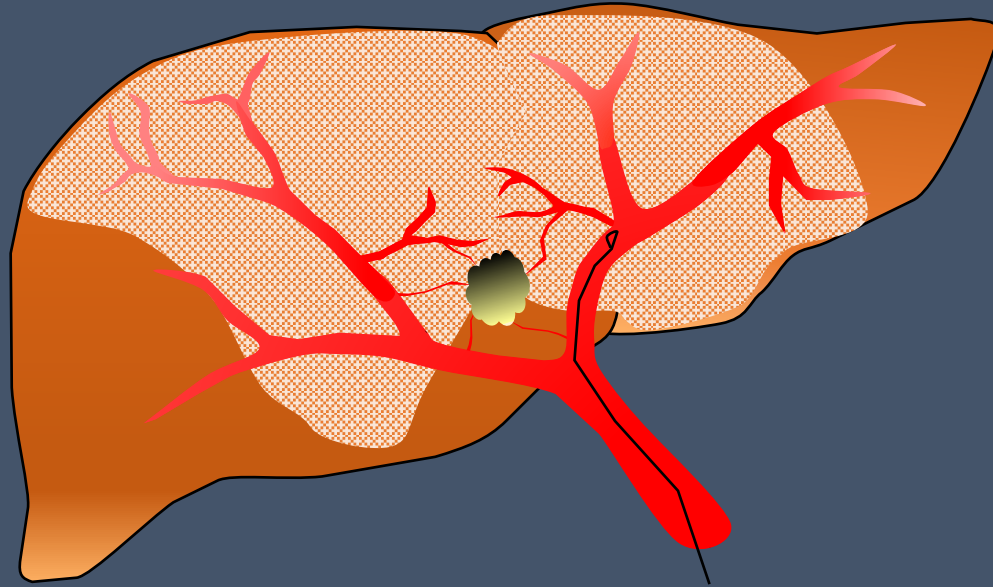
1. TUMOR LOCATION IS IMPORTANT

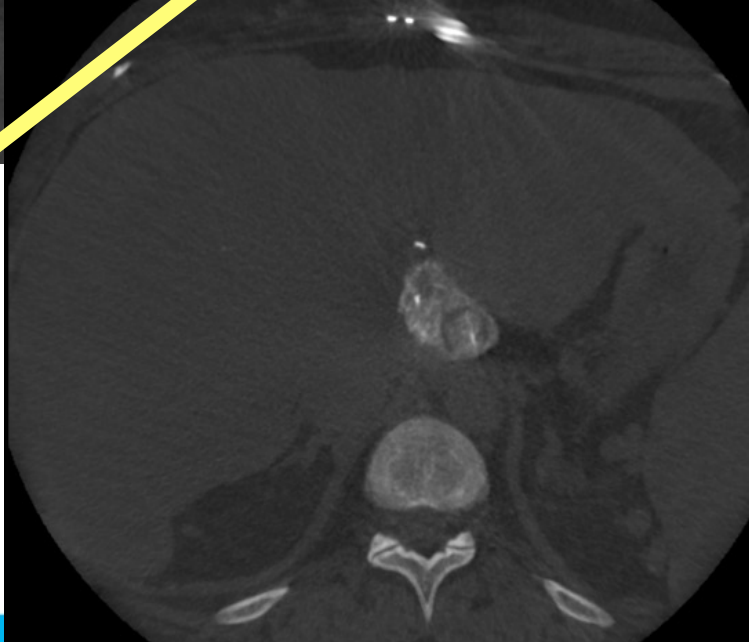
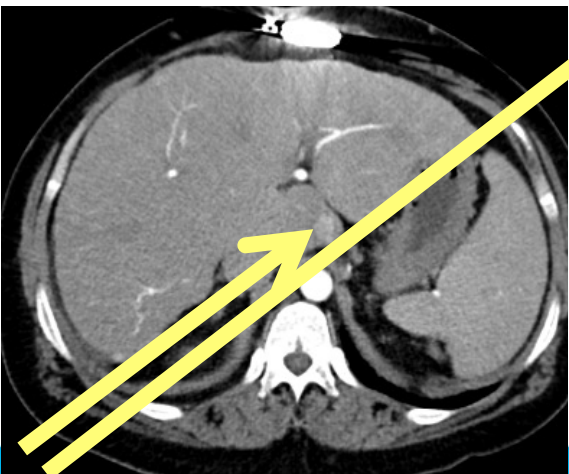
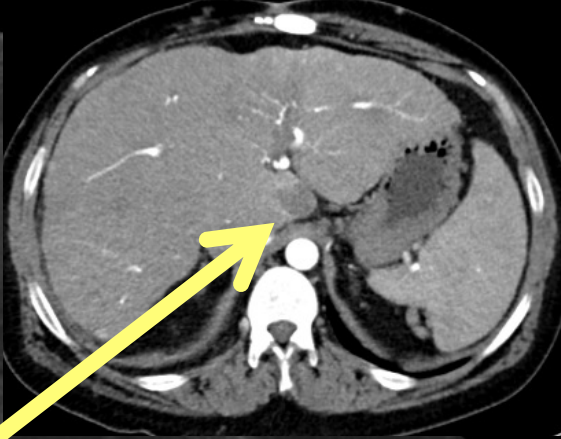
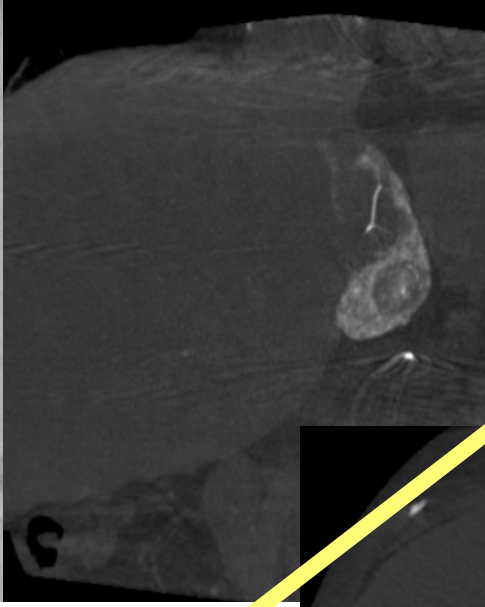
PERIPHERAL TUMOR



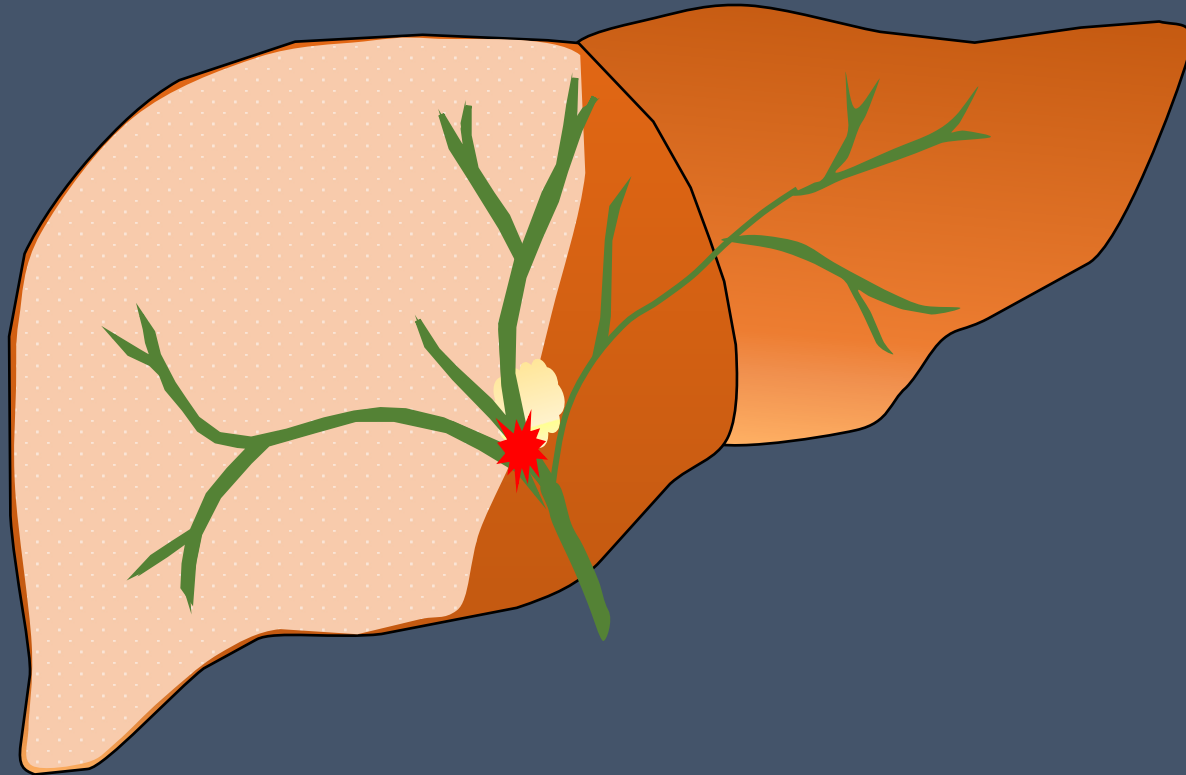


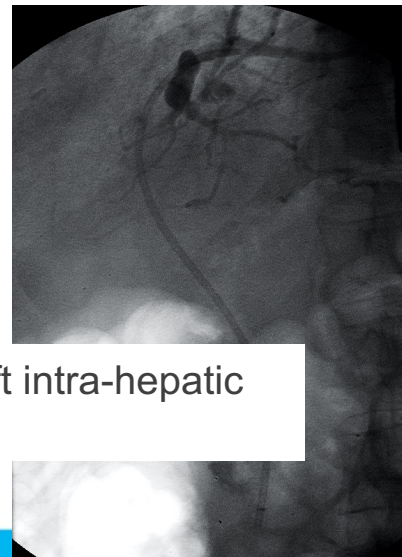
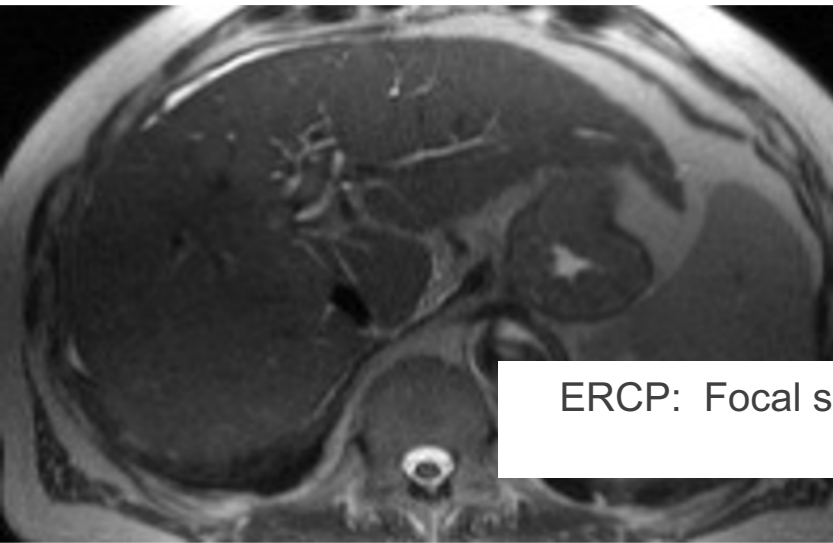
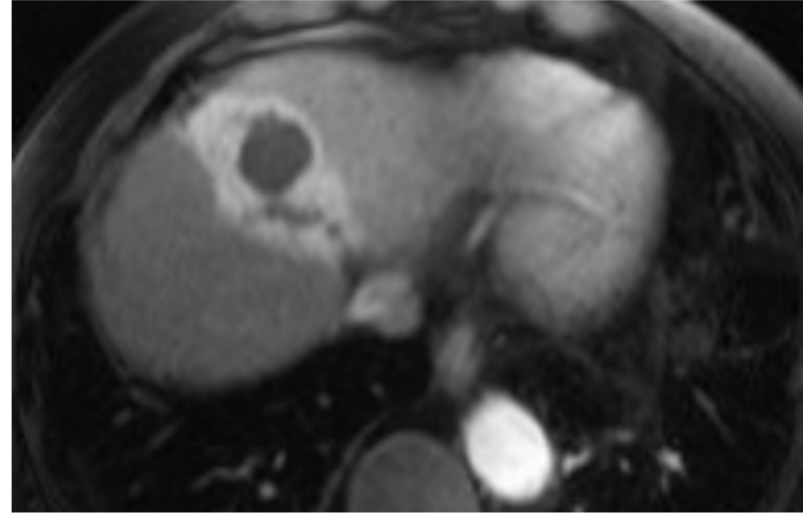
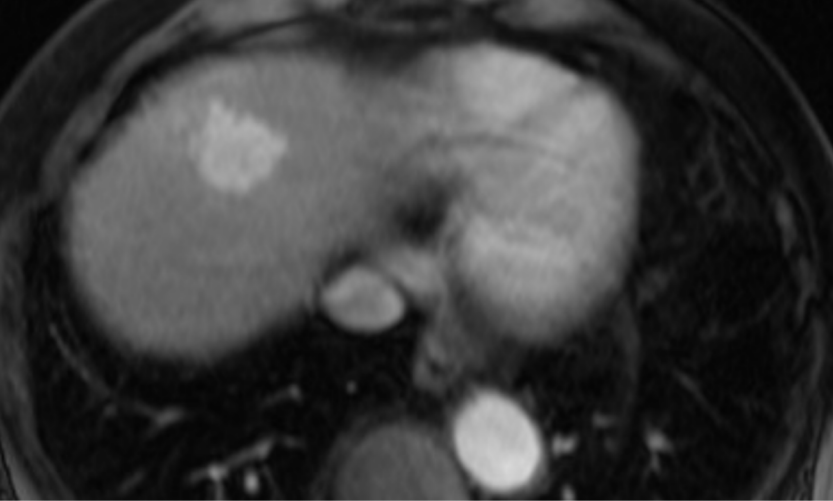
CENTRAL TUMOR





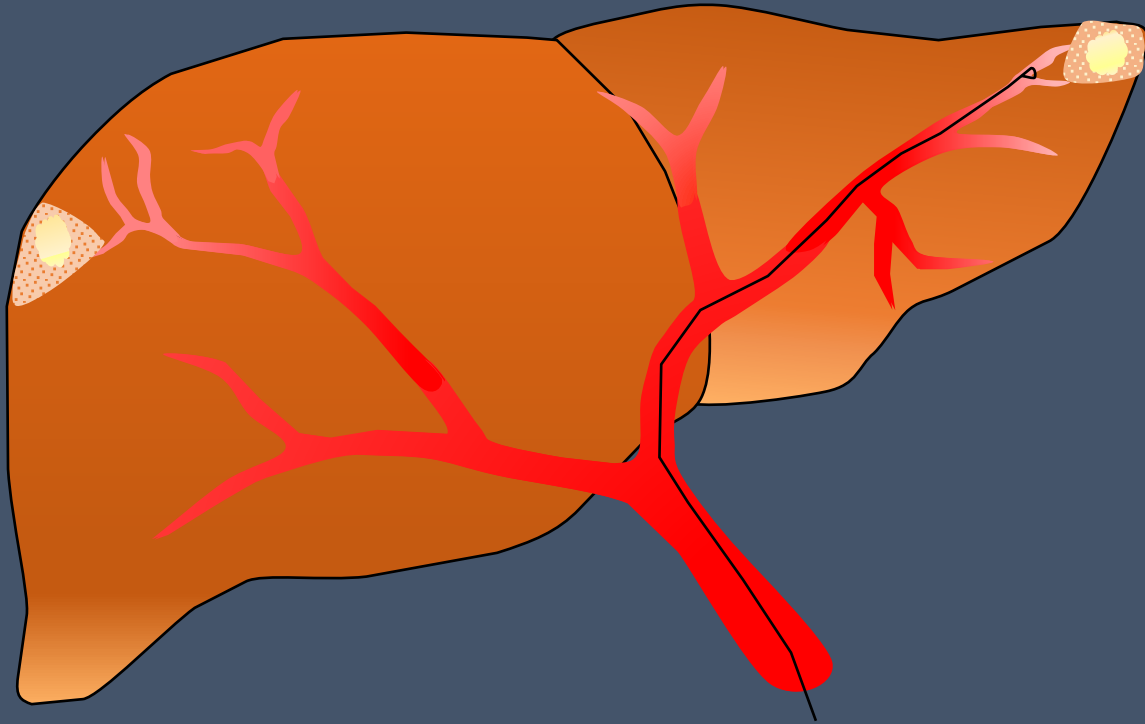
CENTRAL TUMOR



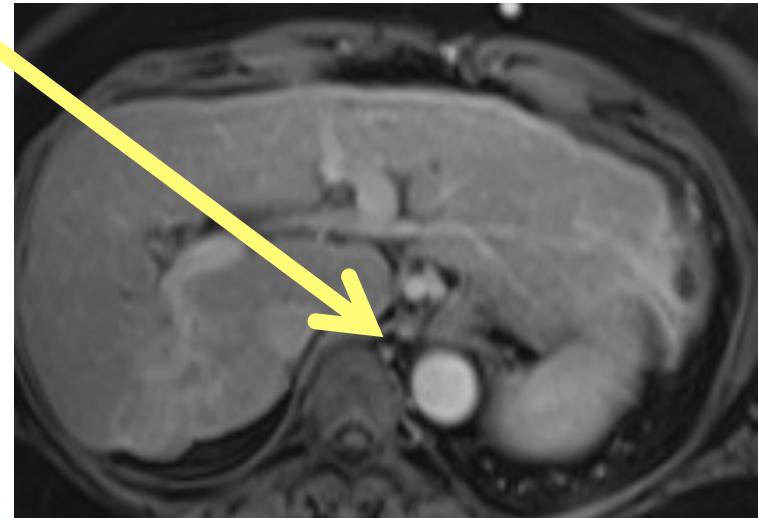
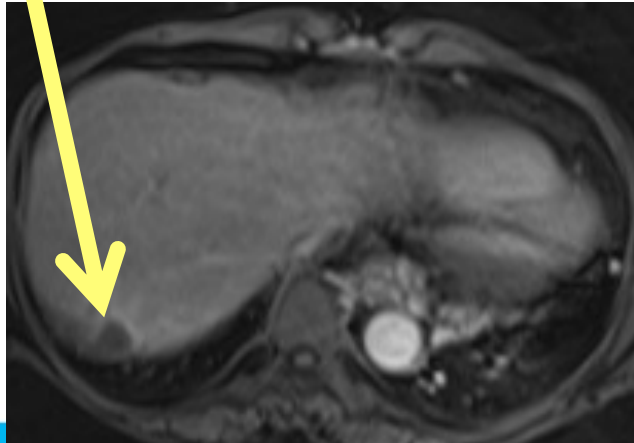
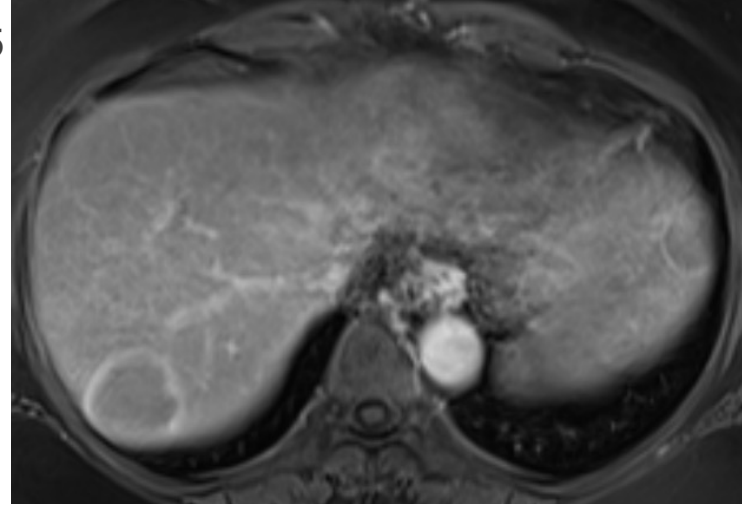
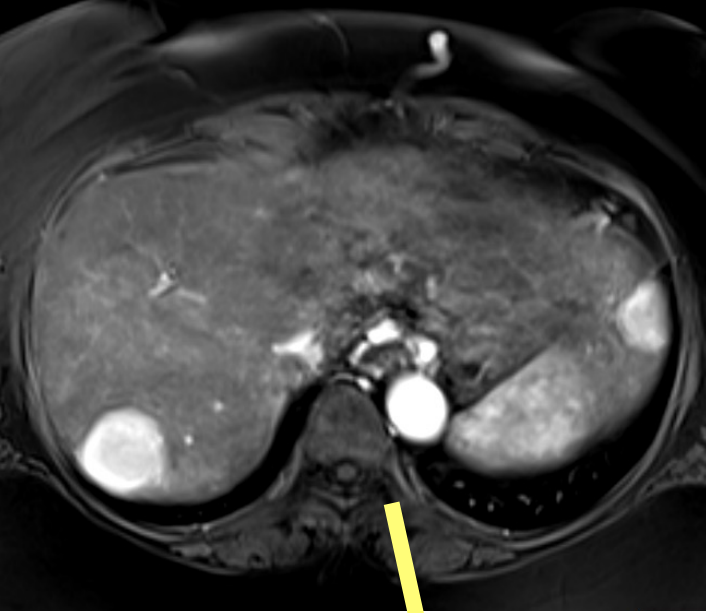


ERCP: Focal stricture origin left intra-hepatic duct

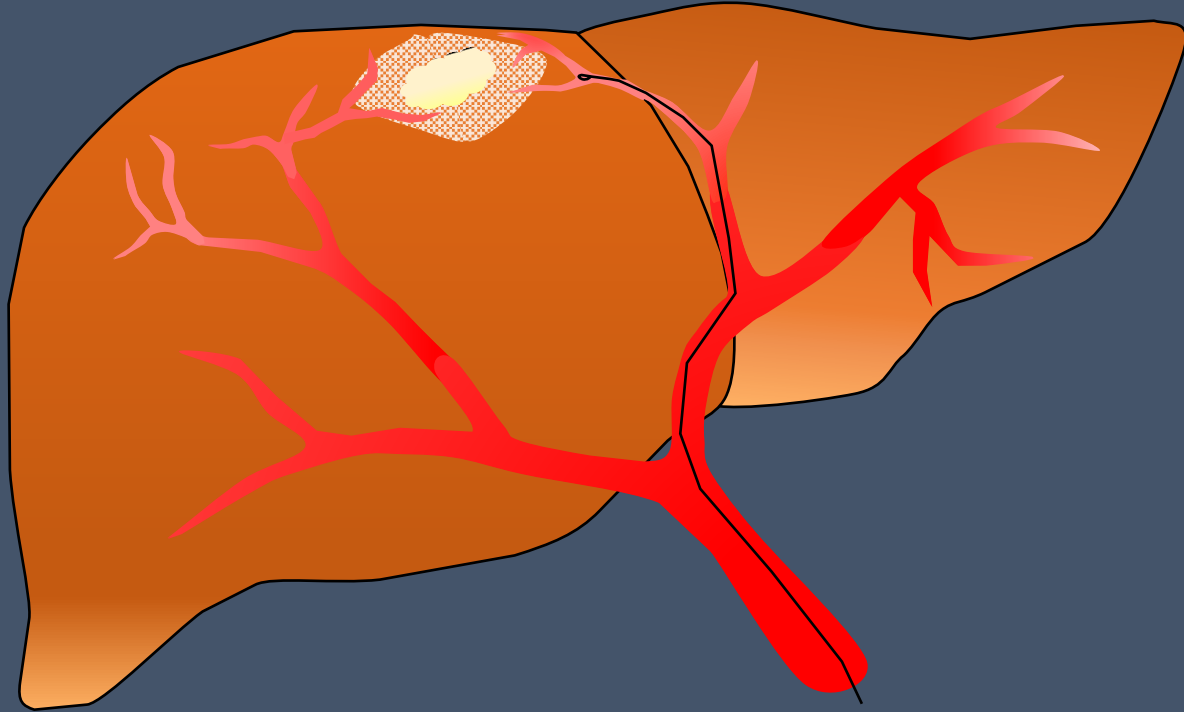
(MULTIPLE) PERIPHERAL TUMOR(S)

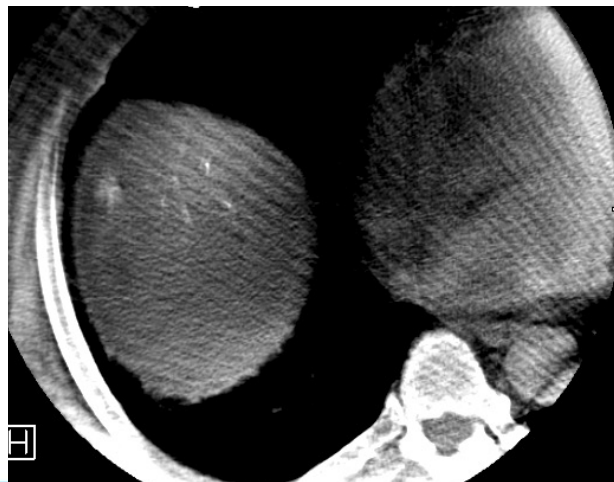
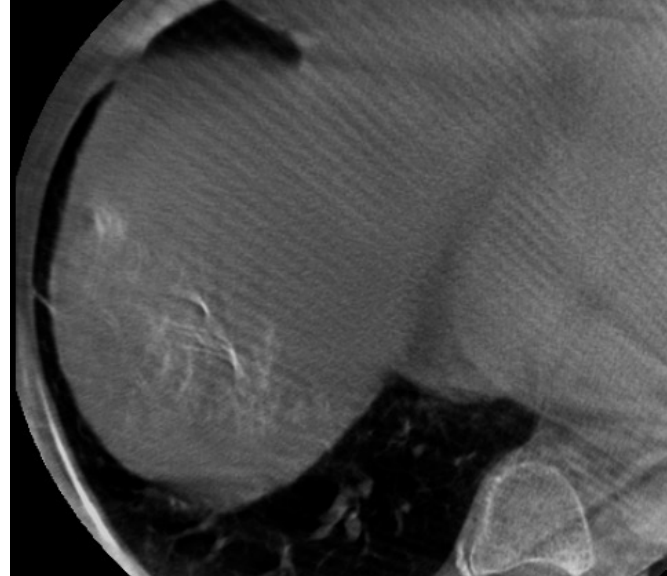
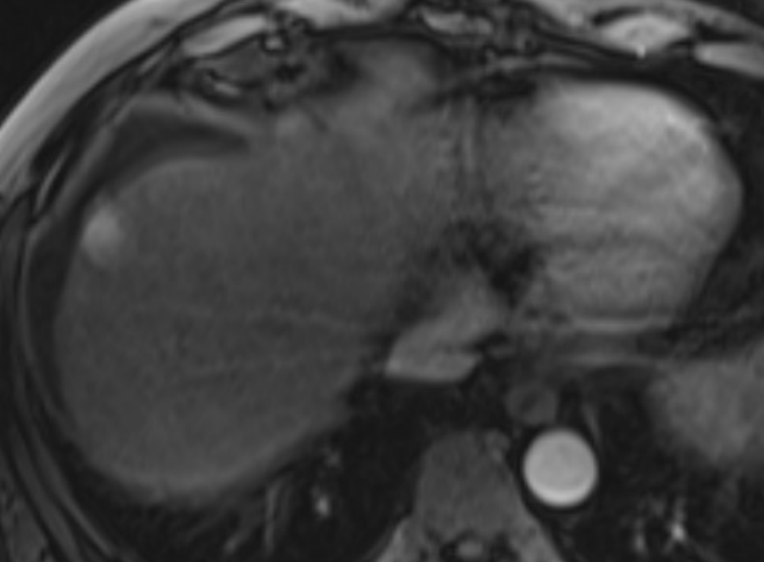


AFP 4,491.5

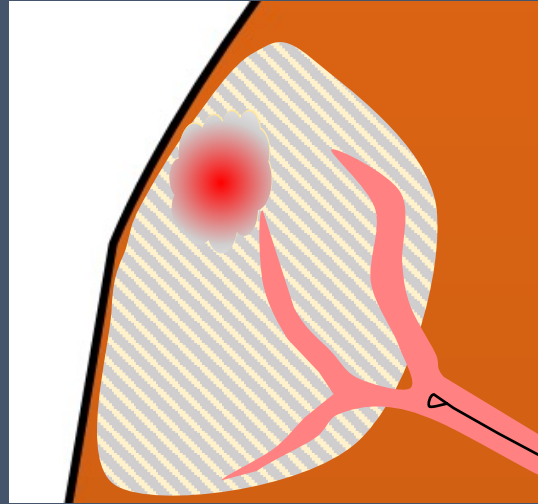
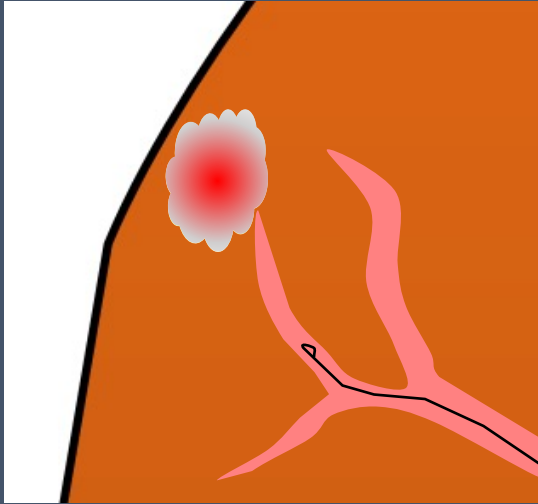


WATERSHED TUMOR

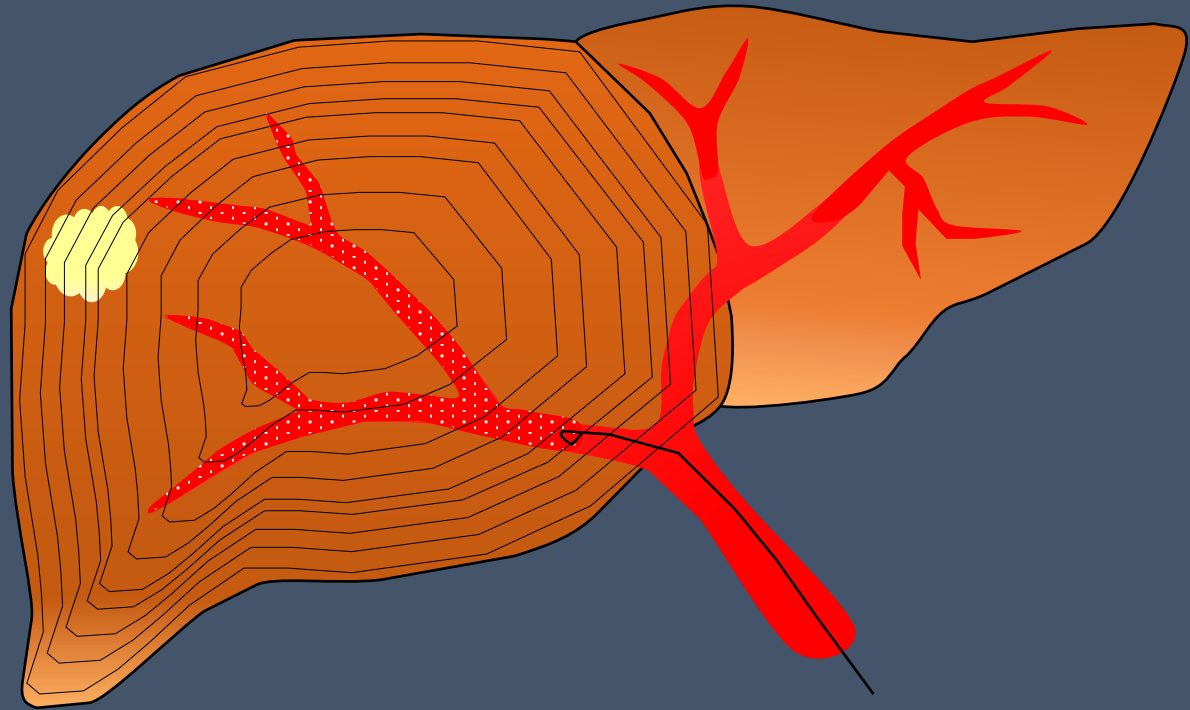


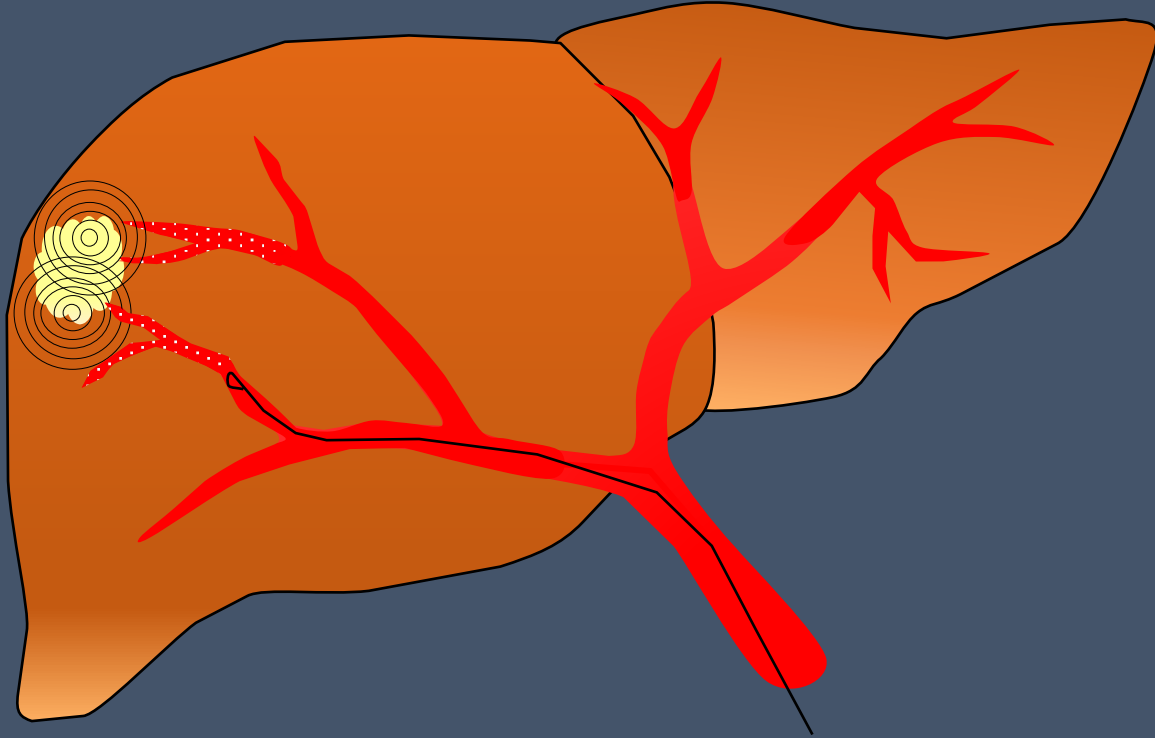


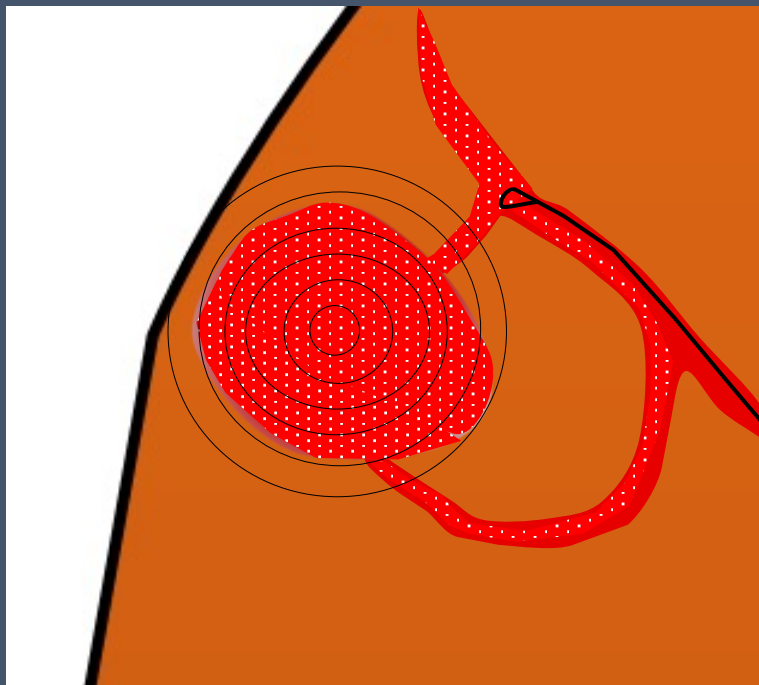
2. Margin Important



3. Cone-Beam CT





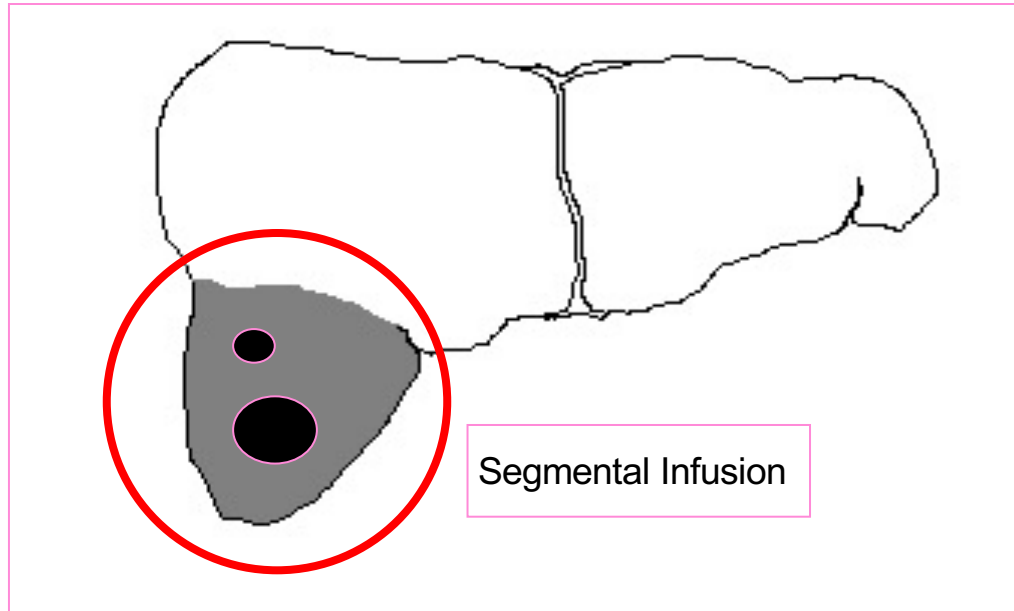


4. Dose Matters

RADIATION SEGMENTECTOMY: A NOVEL APPROACH TO INCREASE SAFETY AND EFFICACY OF RADIOEMBOLIZATION

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ROBERT J. LEWANDOWSKI, M.D.,* MARY F. MULCAHY, M.D.,† ROBERT K. RYU, M.D.,*
KENT T. SATO, M.D.,* TALIA BAKER, M.D.,‡ LAURA KULIK, M.D.,† RAMONA GUPTA, M.D.,*
MICHAEL ABECASSIS, M.D.,‡ AL B. BENSON, III, M.D.,† REED OMARY, M.D.,* LAURA MILLENDER, M.D.,§
ANDREW KENNEDY, M.D.,¶ AND RIAD SALEM, M.D.*‡

(ABLATIVE) RADIATION SEGMENTECTOMY



Unresectable Solitary Hepatocellular Carcinoma Not Amenable to Radiofrequency Ablation: Multicenter Radiology-Pathology Correlation and Survival of Radiation Segmentectomy

JHEP 2014

Michael Vouche,¹ Ali Habib,¹ Thomas J. Ward,² Edward Kim,² Laura Kulik,³ Daniel Ganger,³ Mary Mulcahy,⁴ Talia Baker,⁵ Michael Abecassis,⁵ Kent T. Sato,¹ Juan-Carlos Caicedo,⁵ Jonathan Fryer,⁵ Ryan Hickey,¹ Elias Hohlastos,¹ Robert J. Lewandowski,^{1,4} and Riad Salem^{1,4,5}

- All 33 Patients with > 90% pathologic necrosis
 - Threshold dose 190 Gray to achieve CPN

Angiosomal radiopathologic analysis of transarterial radioembolization for the treatment of hepatocellular carcinoma

Abdominal Radiol 2017

Altan F. Ahmed¹, Naziya Samreen,^{1,2} Joseph R. Grajo¹, Ivan Zendejas,³ Chris L. Siström,¹ Amy Collinsworth,⁴ Ashwini Esnakula,⁴ Jehan L. Shah¹, Roniel Cabrera,⁵ Brian S. Geller¹, Beau B. Toskich^{1,6}

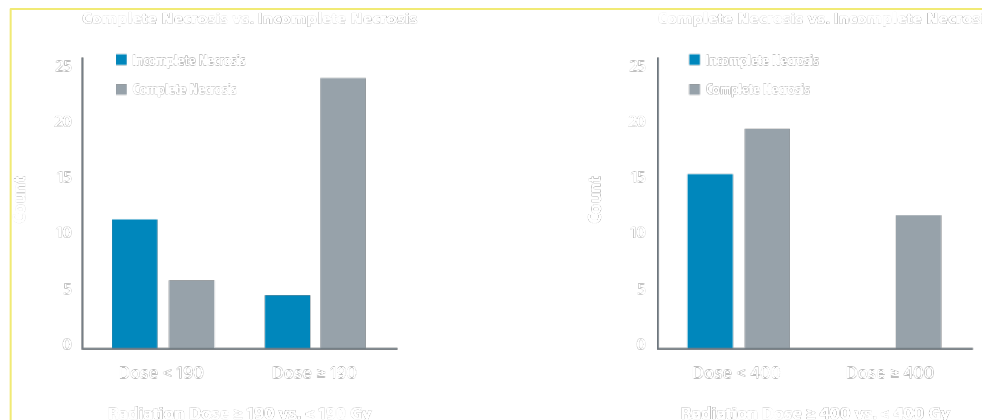
- Complete pathologic necrosis observed in 7/12 tumors
 - Ablative 5/6 (83%) vs. Non-ablative 2/6 (33%)



Correlation of Y90-absorbed radiation dose to pathological necrosis in hepatocellular carcinoma: confirmatory multicenter analysis in 45 explants

Ahmed Gabr¹ · Ahsun Riaz¹ · Guy E. Johnson² · Edward Kim³ · Siddharth Padia⁴ · Robert J. Lewandowski¹ · Riad Salem¹

- Retrospective, multicenter: 45 HCC patients (CPA)
- Radiation segmentectomy: Solitary HCC ≤ 8 cm
 - Dose > 190 Gray*: 86% had CPN
 - Dose > 400 Gray*: 100% had CPN



*Absorbed perfused liver doses were estimated using MIRD calculations

CORRELATING HISTOPATHOLOGY WITH OUTCOMES

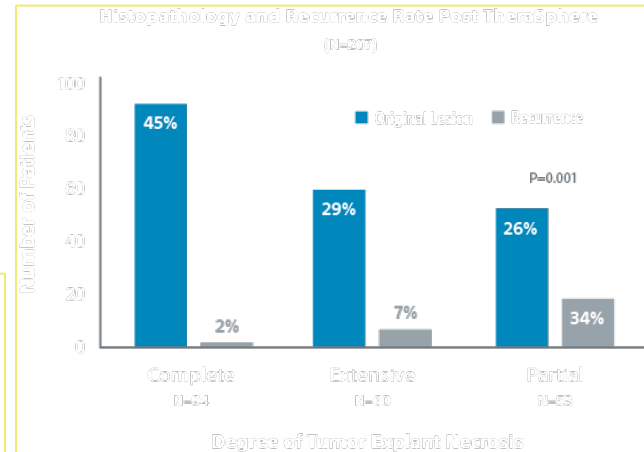
- Post-explant tumors examined from 207 patients who underwent liver transplant post Y90
- Tumors with CPN had lower HCC recurrence rate than tumors with incomplete necrosis
- Complete/extensive tumor necrosis was strongly associated with lower HCC-related mortality rate ($p=0.0009$); longer recurrence free survival ($p=0.0056$) and longer time to recurrence ($p<0.0001$)

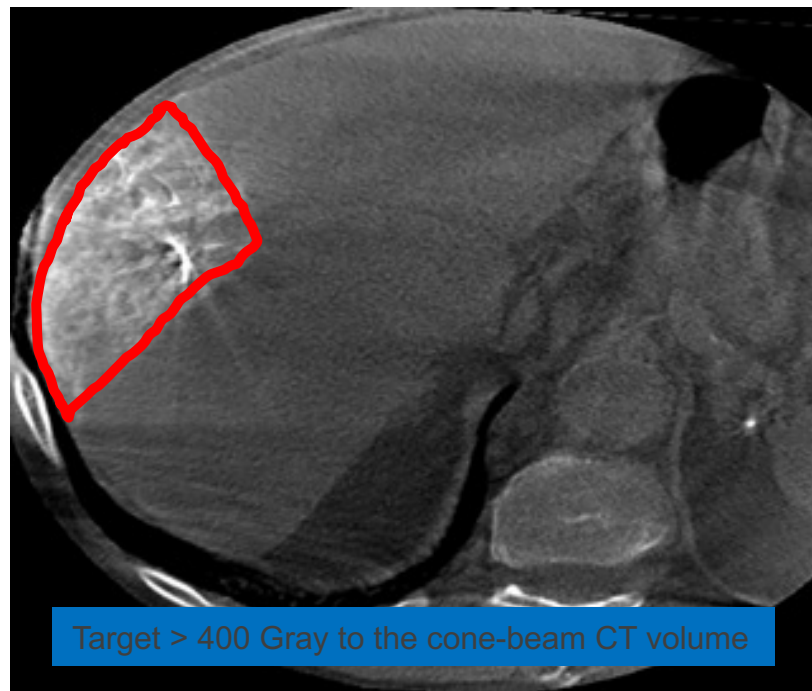
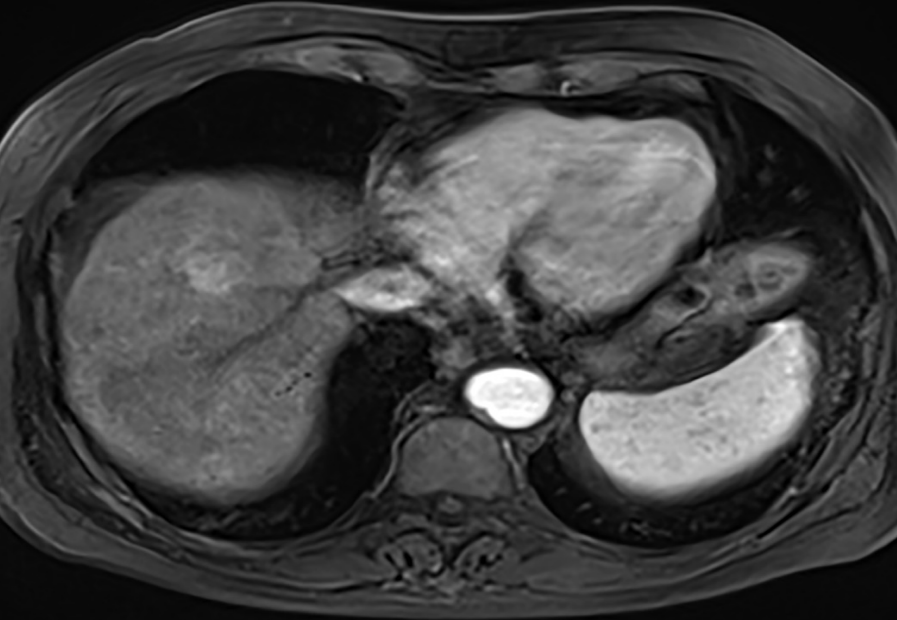
Necrosis defined as:

Complete: no viable HCC

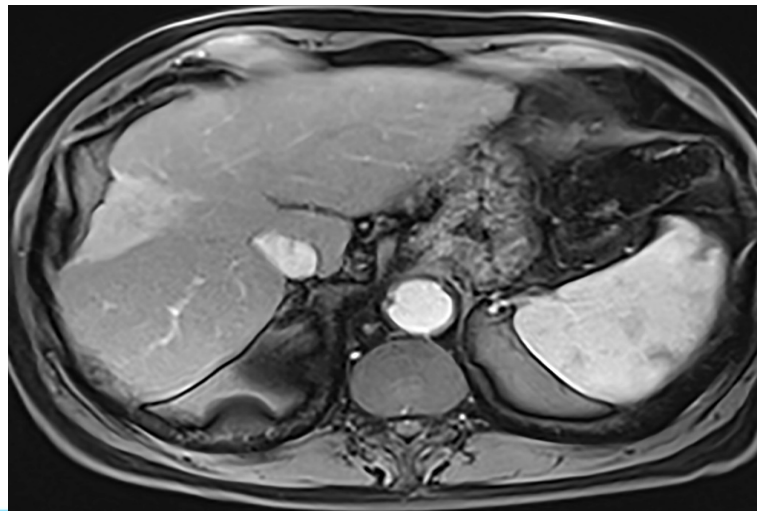
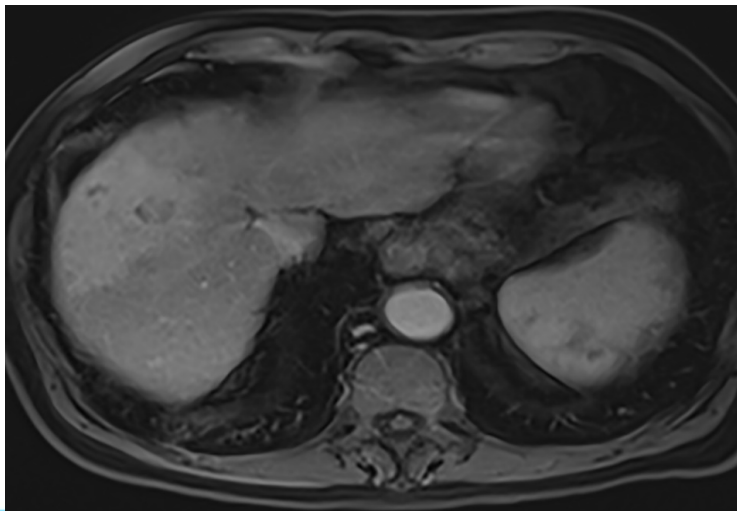
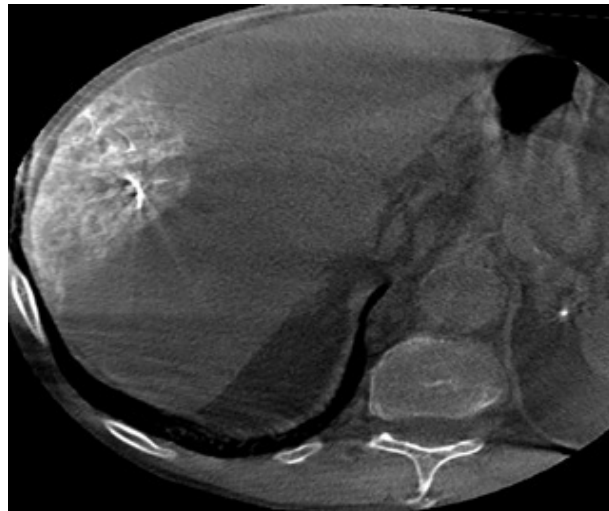
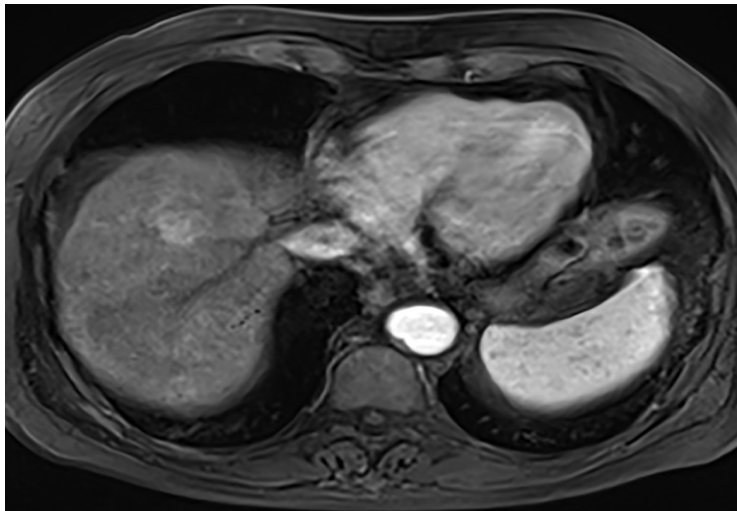
Extensive: 50-99% necrosis

Partial necrosis: <50% necrosis





Target > 400 Gray to the cone-beam CT volume



RADIATION SEGMENTECTOMY

1. Patient Selection

- a) Peripheral tumors, Solitary or Multi-Focal
- b) Bridging/Down-staging/Definitive

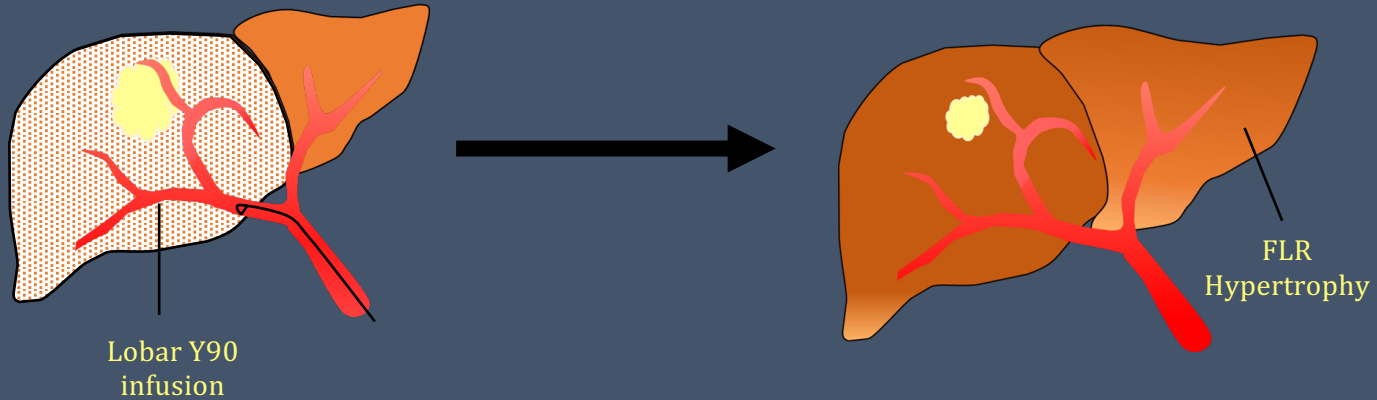
2. Technique

- a) Selective catheterization/Cone-beam CT
- b) Dosimetry based on volume of perfusion
- c) Glass: > 190 Gray (> 400 Gray)
- d) Resin: possibly > 150 Gray (multi-discipline panel 2021)

3. Results

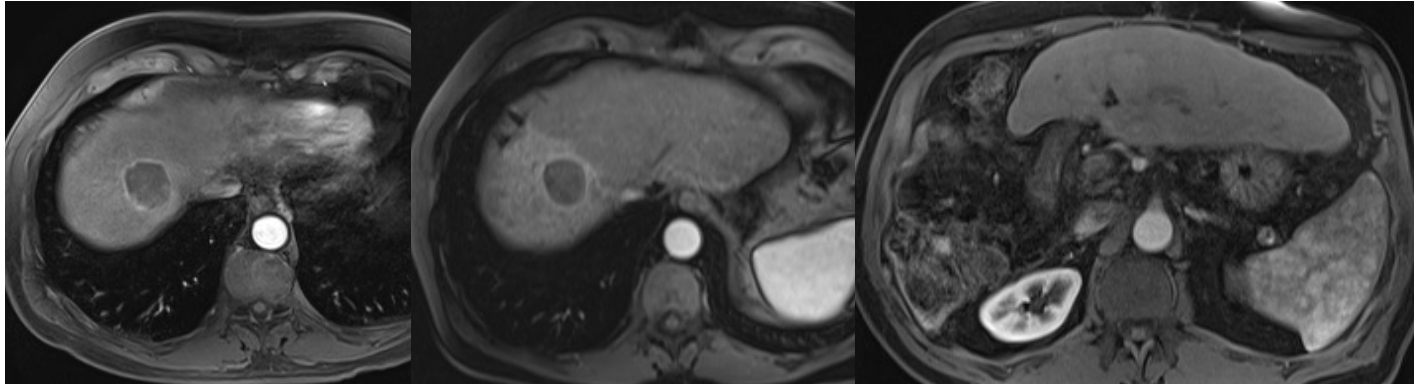
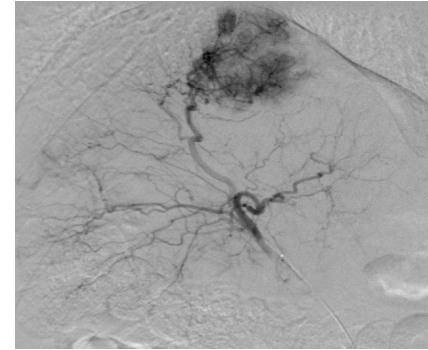
- a) Long TTP (and Duration of Response)
- b) High rates of CPN
- c) Curative Intent

RADIATION LOBECTOMY



(SAME DAY) RADIATION LOBECTOMY

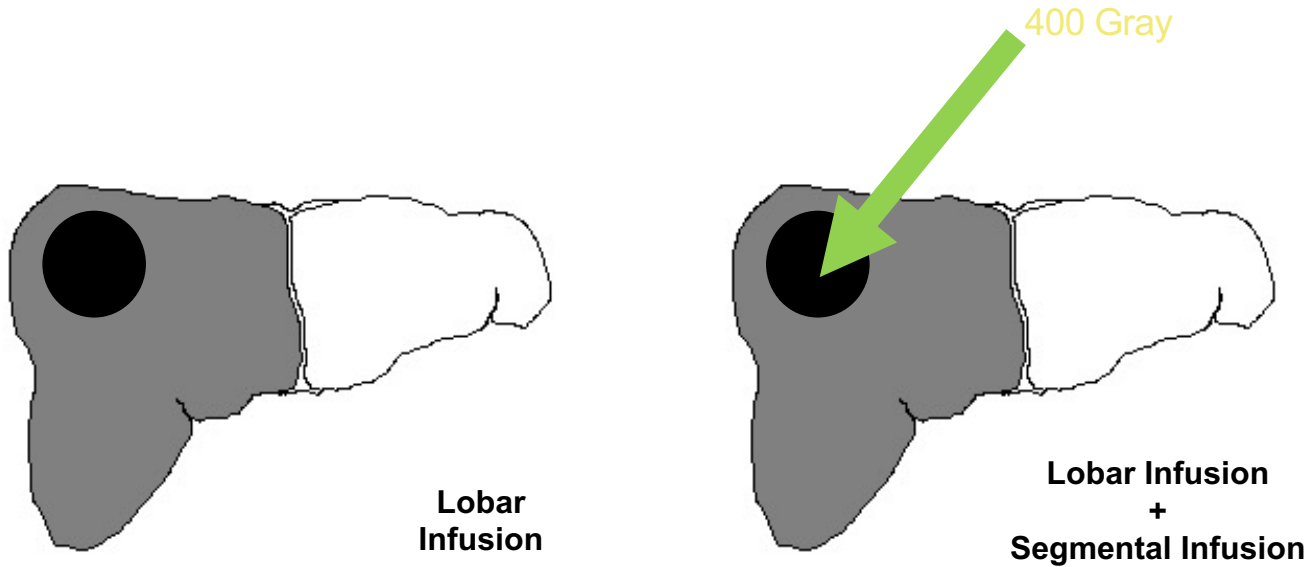
- Procedure Started at 9:15 AM
 - Planning angiography
 - Tc99m MAA scan → Nuclear Medicine Department
 - Radioembolization
- Patient left angiography suite at 11:30 AM



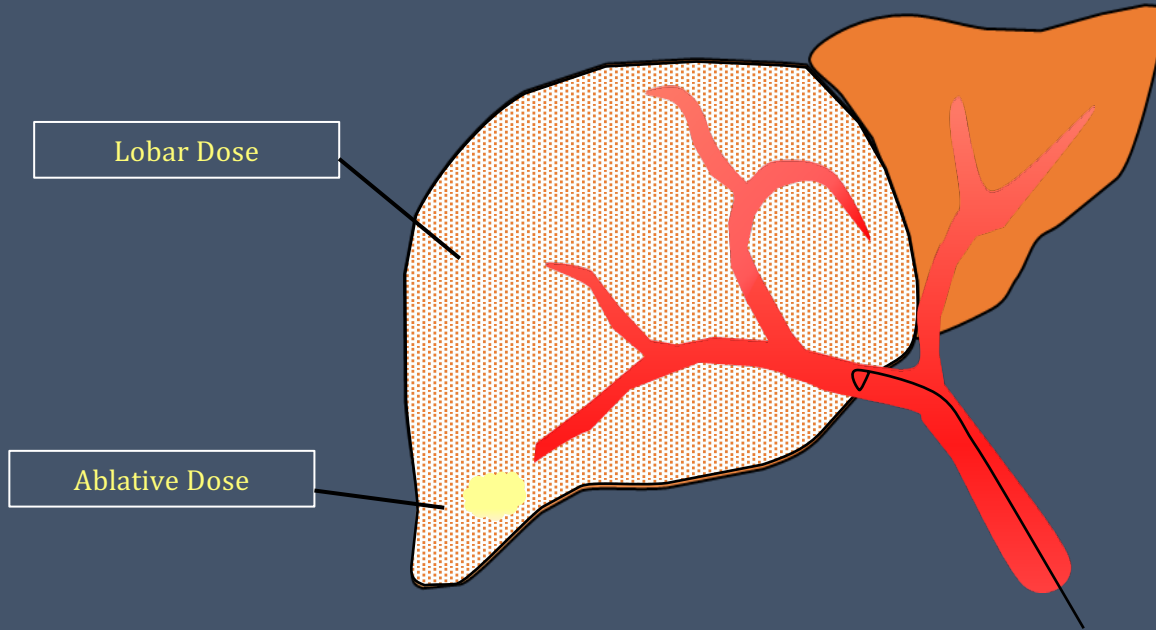
FLR increased 32-48%

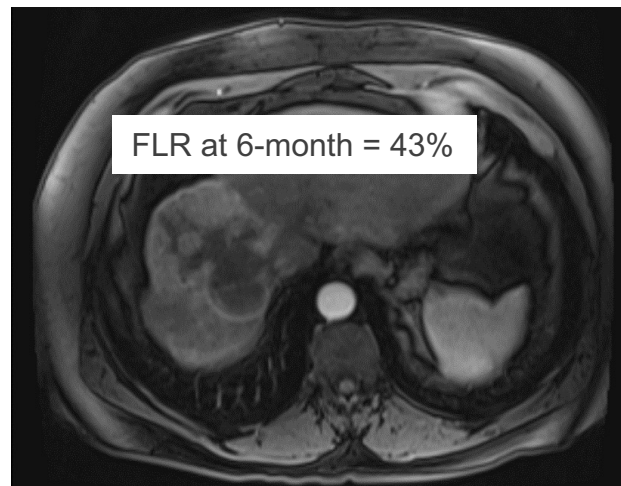
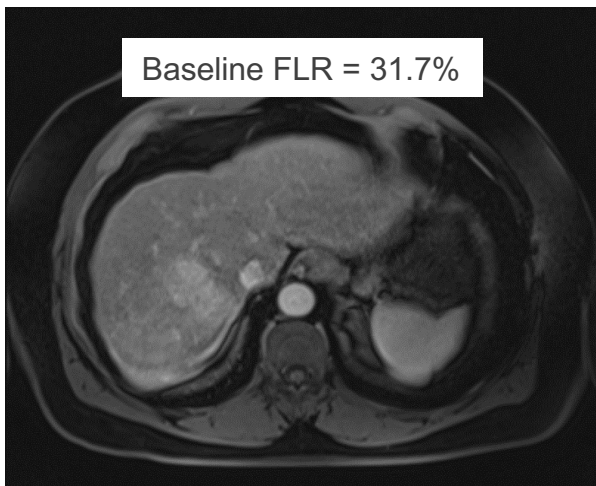
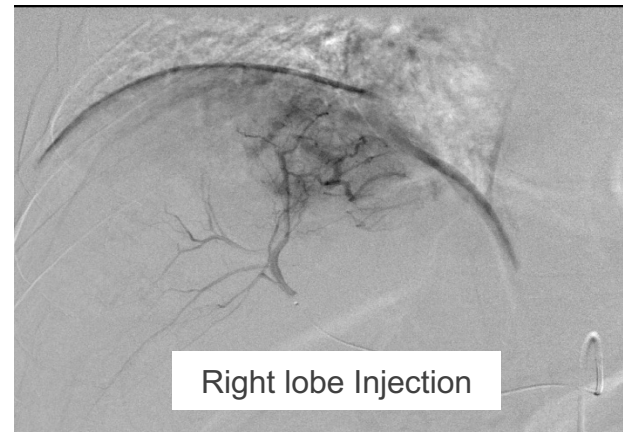
Trisegmentectomy 3-months post Y90

5. (MODIFIED) RADIATION LOBECTOMY



SEGMENTAL + LOBAR APPROACH

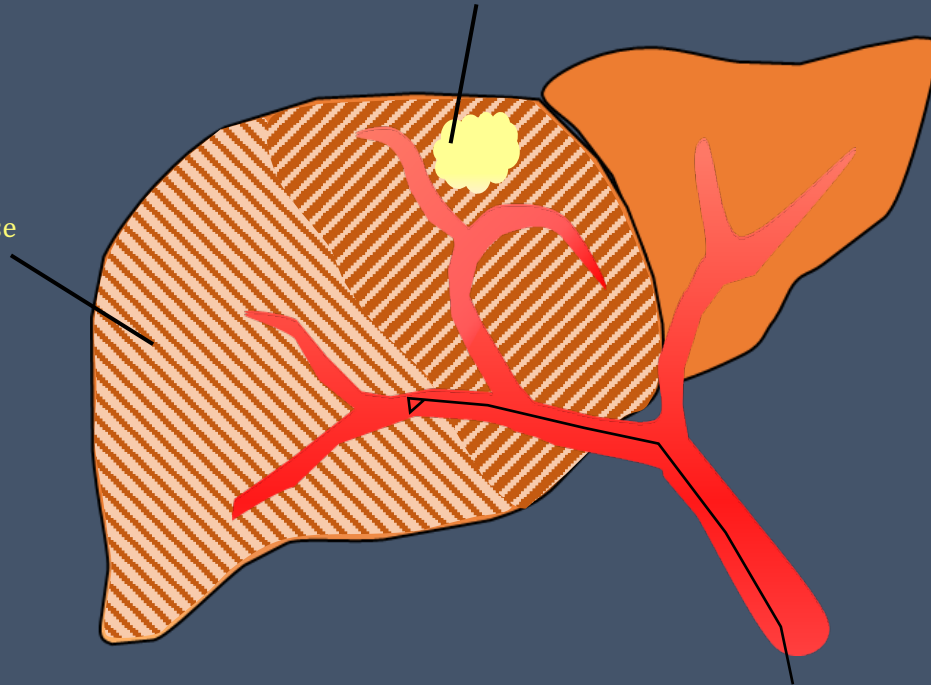




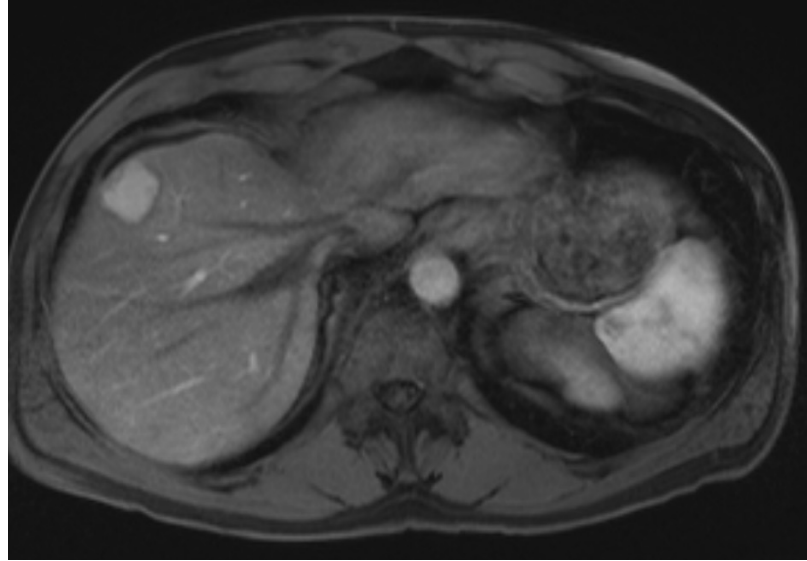
DOUBLE SEGMENTAL APPROACH

Ablative Dose

Non-ablative Dose

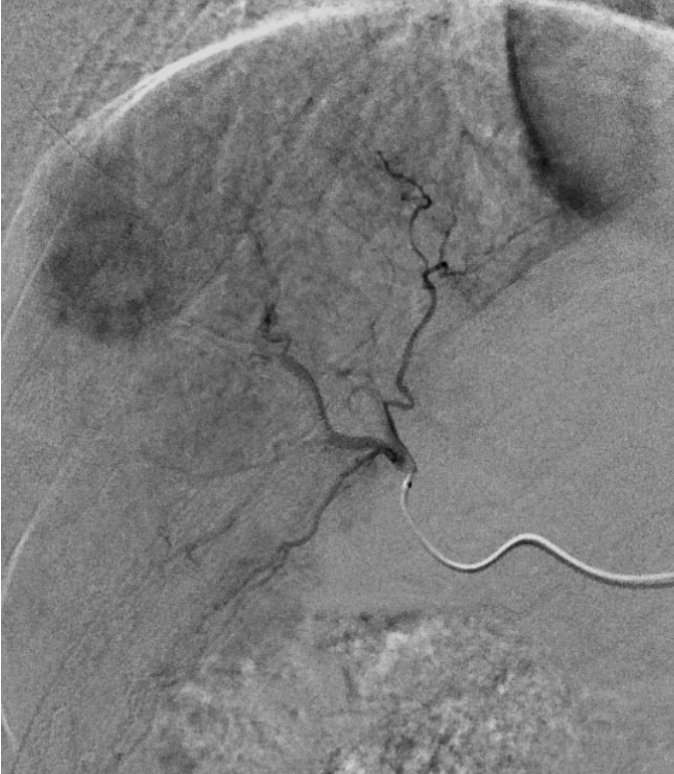


65 y/o Male with Hep C

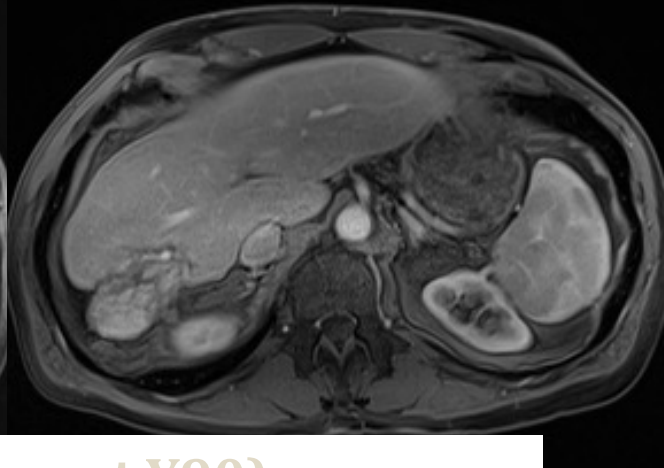
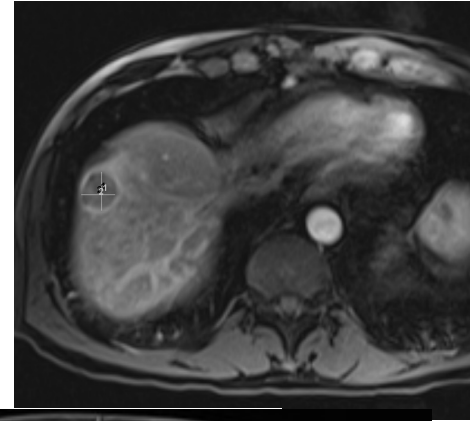
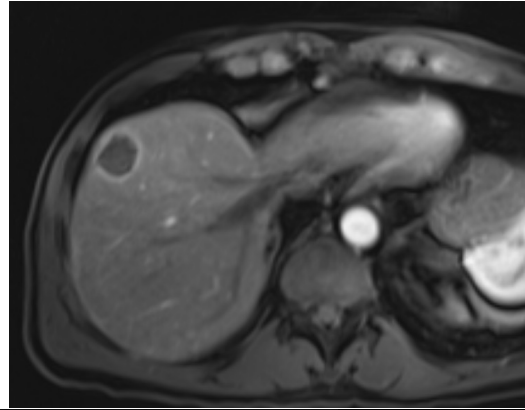
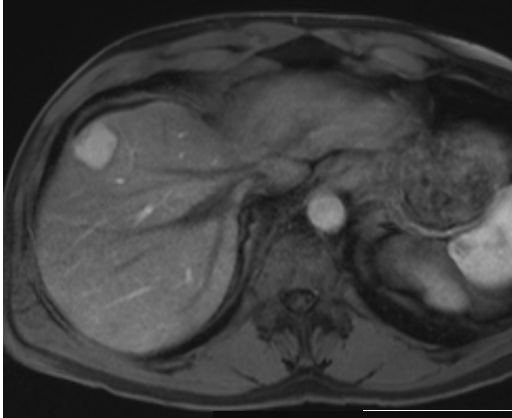


FLR 30%

Differential Dosing



Follow-Up



(3-years post Y90)



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