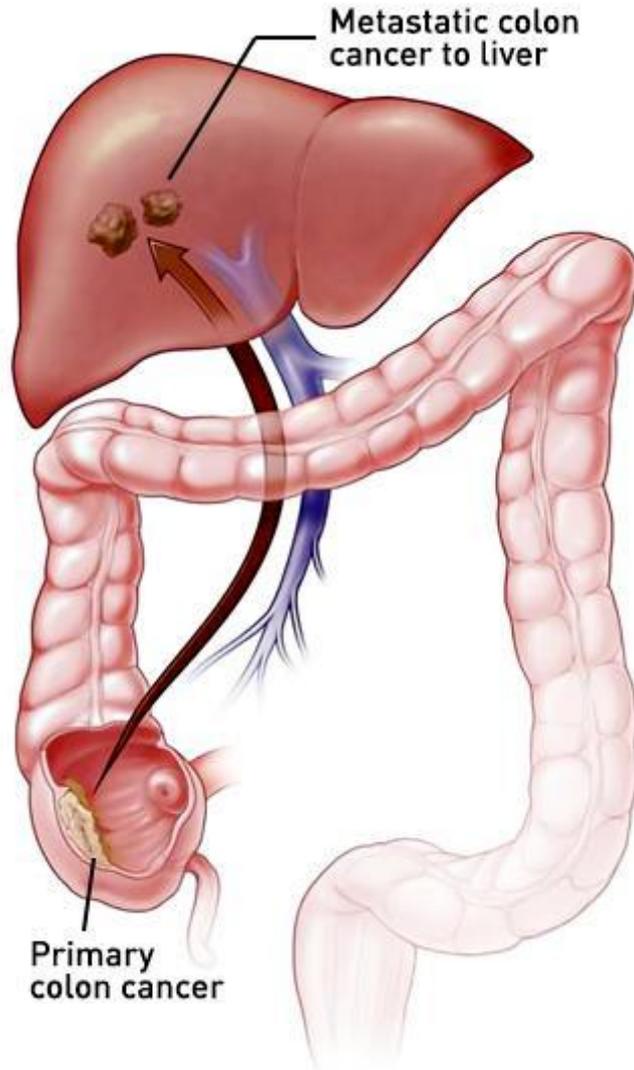
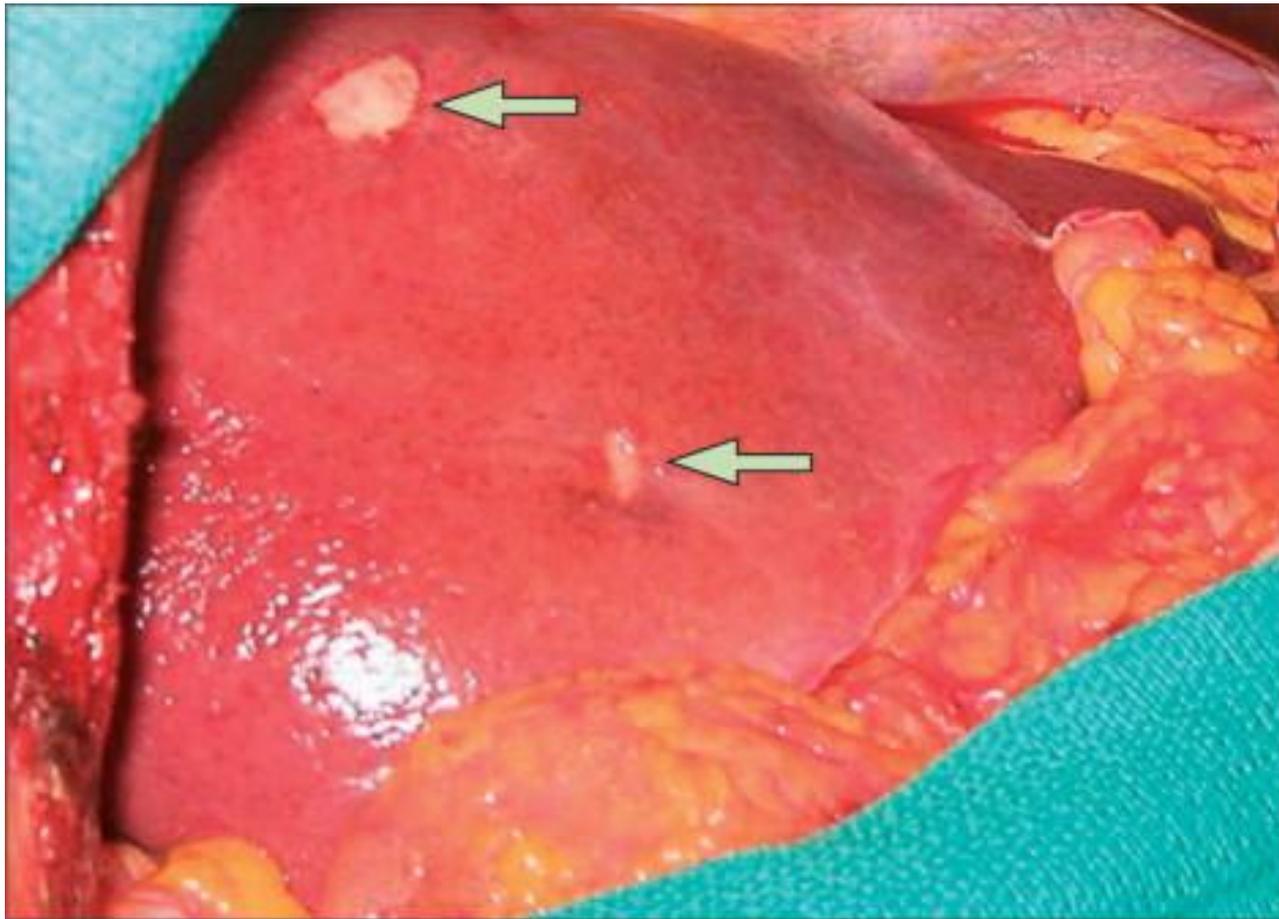


Advancements in Liver Surgery for Metastatic Colorectal Cancer (mCRC)

Clancy J. Clark, MD, FACS, FSSO
Director, Hepato-Pancreato-Biliary Surgery
Virginia Mason Medical Center, Seattle

Dec 5, 2025





Metastatic Colorectal Cancer to the Liver

- ~50% of CRC patients develop liver metastases
- Curative-intent surgery improves survival (5-year survival near 50%)
- **Considerations for Resection:**
 1. Resectability (inflow / outflow)
 2. Oncologic control (extrahepatic disease)
 3. Future Liver remnant (FLR) volume
 4. R0, negative margin

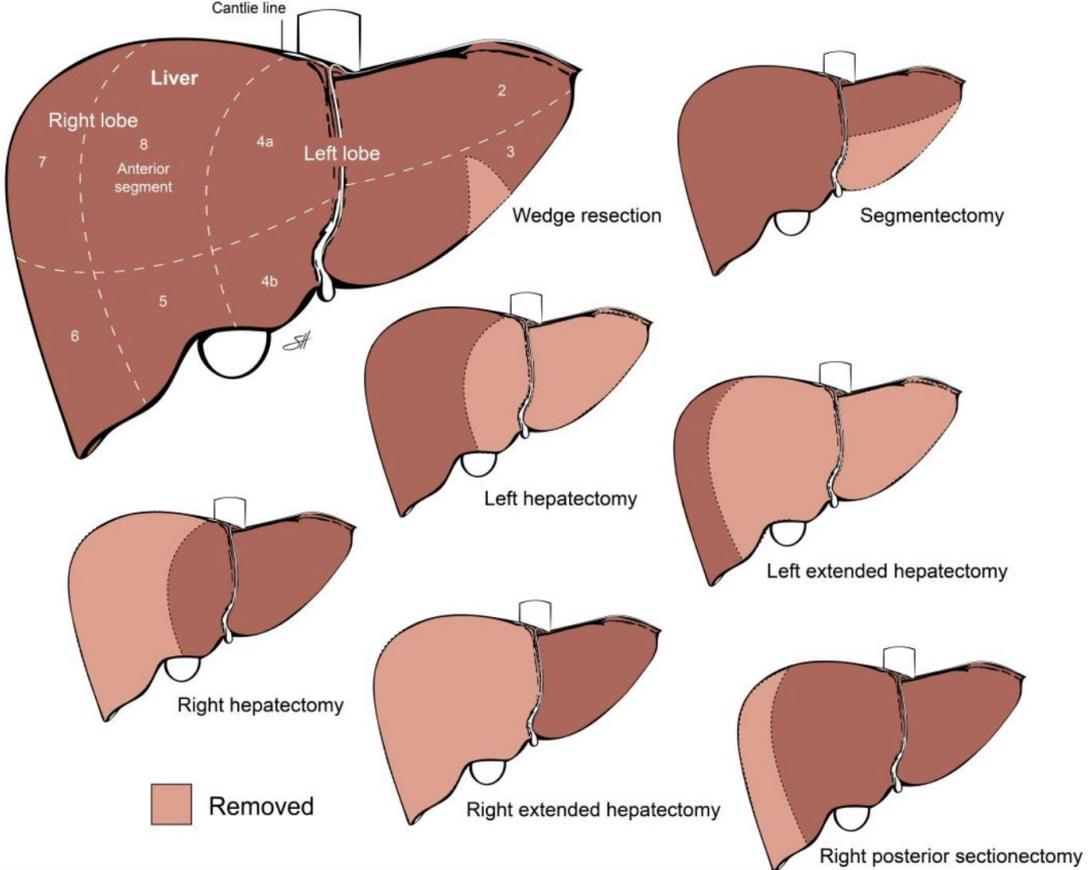
Metastatic Colorectal Cancer to the Liver

- ~50% of CRC patients develop liver metastases
- Curative-intent surgery improves survival (5-year survival near 50%)
- **Considerations for Resection:**
 1. Type of Resection
 2. Oncologic control (extrahepatic control)
 3. Future Liver remnant (FLR) volume
 4. R0, negative margin

Fong Prognostic Factors

- Positive lymph nodes
- Multiple tumors
- Disease free interval < 12m
- CEA > 200
- Tumor > 5cm

Types of Liver Resection



Extrahepatic mCRC

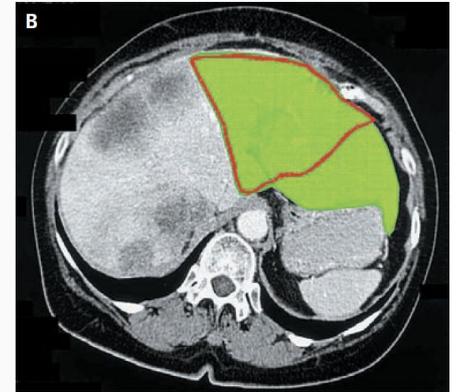
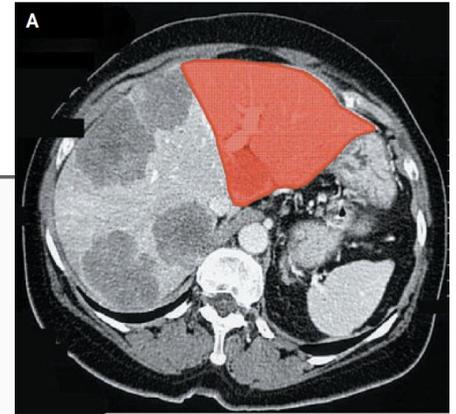
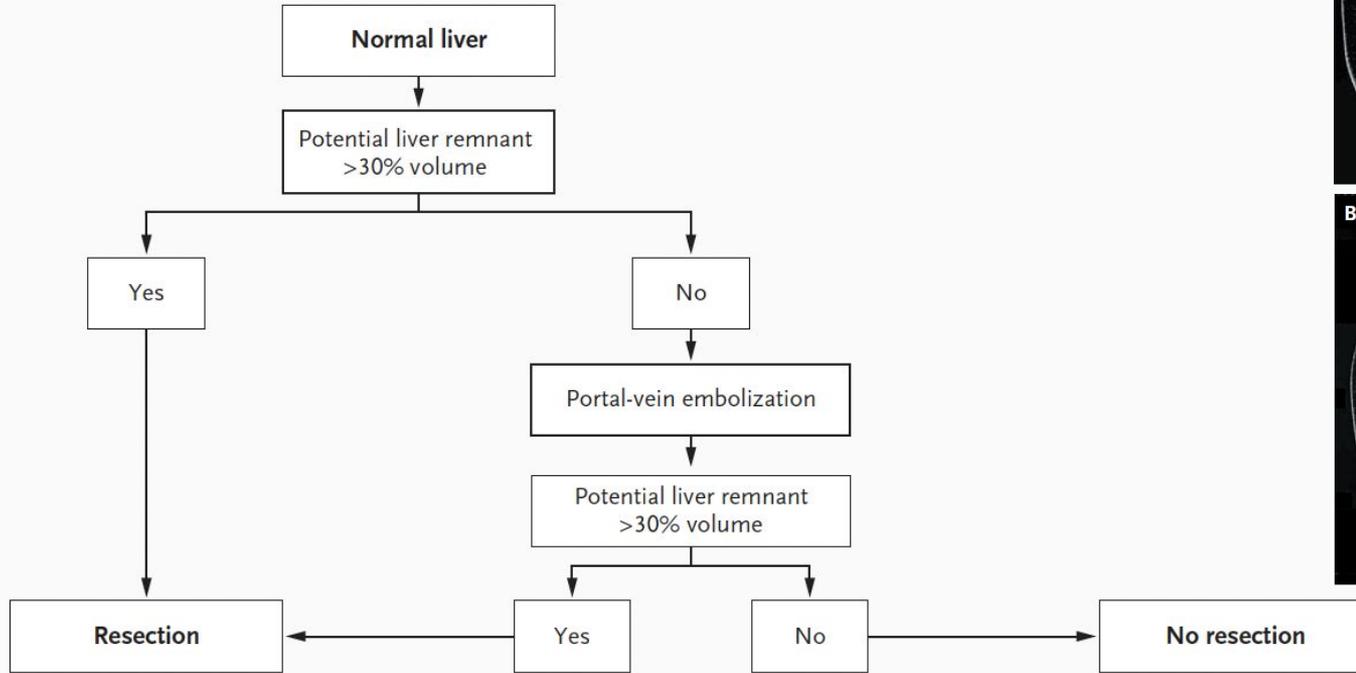
- Lung
- Peritoneum
- Hilar Lymph Nodes
- Aorto-Caval Lymph Nodes

Liver resection is if R0 resection can be achieved from all sites.



Future Remnant Volume (FLR)

A Patients with a Normal Liver



Negative Margin, R0

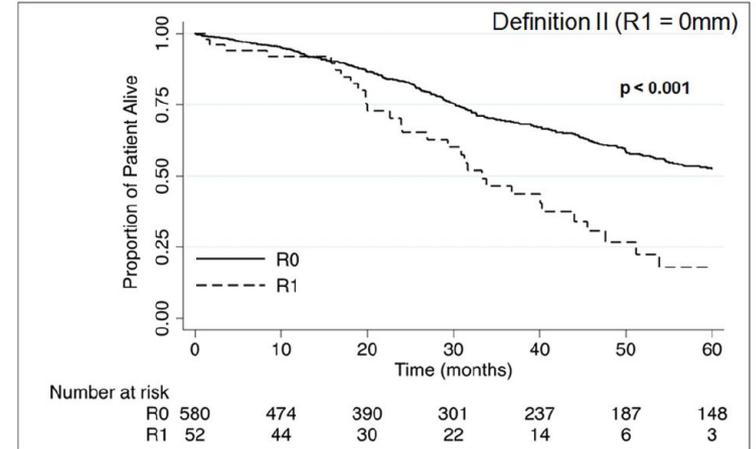
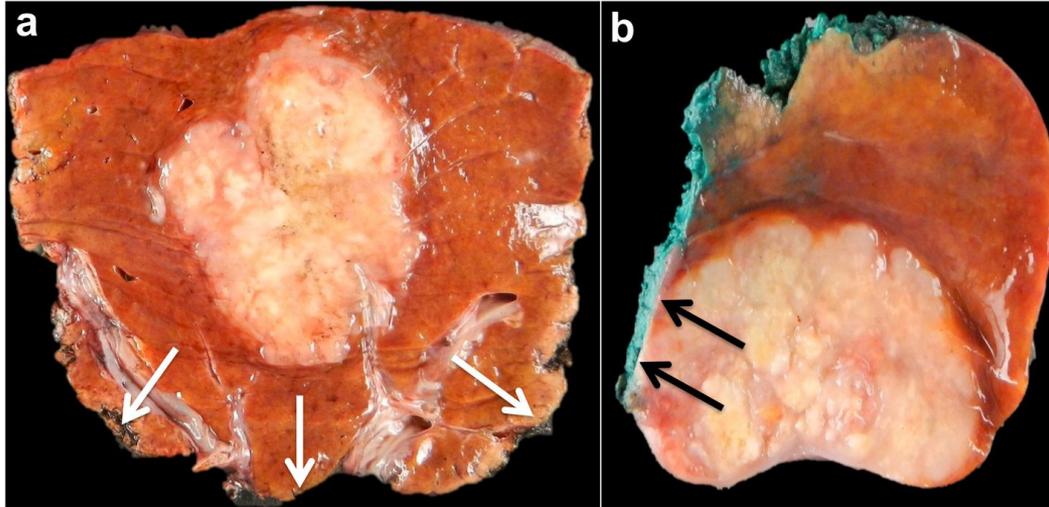


Fig. 3 The Kaplan-Meier (KM) survival analysis between the R0 and R1 groups (R1 defined as involved margin)

Multidisciplinary Team (MDT) for mCRC

- Burden of disease (e.g. extrahepatic disease)
- Timing of surgery
 - Synchronous mets (15-20%)
 - Metachronous mets (50-60%)
- Management of primary tumor
 - Symptomatic vs Asymptomatic
 - Location (right colon vs low rectal)
- Personalized chemotherapy therapy (e.g. RAS, BRAF, MSI)

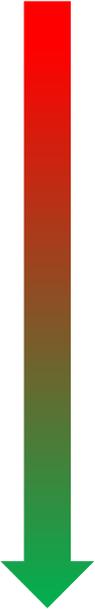
Multidisciplinary Team (MDT) for mCRC

- Burden of disease (e.g. extrahepatic disease)
- Timing of surgery
 - Synchronous mets (15-20%)
 - Metachronous mets (50-60%)
- Management of primary tumor
 - Symptomatic vs Asymptomatic
 - Location (right colon vs low rectal)
- Personalized chemotherapy therapy (e.g. RAS, BRAF, MSI)

MDT is critically important.

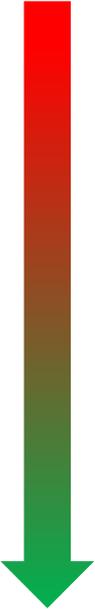
- ~40% of cases have a change in management
- 70% of changes are MAJOR

Surgical Intervention for mCRC

- 
- Open resection
 - Laparoscopic resection
 - Robotic resection
 - Hepatic artery infusion pump
 - Microwave ablation
 - Irreversible electroporation
 - Histotripsy



Surgical Intervention for mCRC

- 
- Open resection
 - Laparoscopic resection
 - Robotic resection
 - Hepatic artery infusion pump
 - Microwave ablation
 - Irreversible electroporation
 - Histotripsy



Robotic Liver Surgery: Why and When?

- **Advantages over open and laparoscopic surgery:**
 1. Better visualization (3D magnification, articulation)
 2. Enhanced precision (wristed instruments, tremor filtering)
 3. Minimized blood loss and shorter hospital stay
- **Ideal Locations:** Segments II, III, IVb, and VI resections

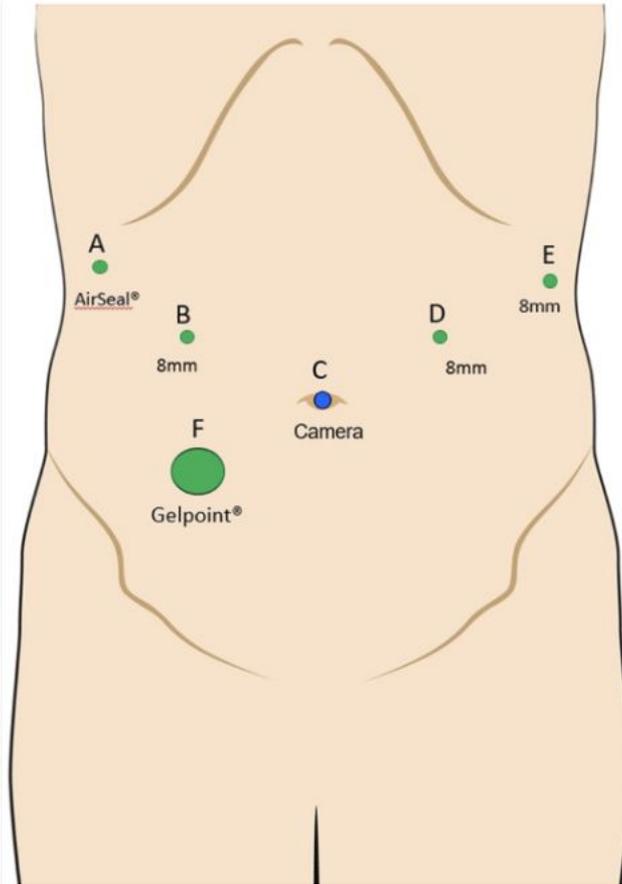


Technical Considerations in Robotic Liver Resection

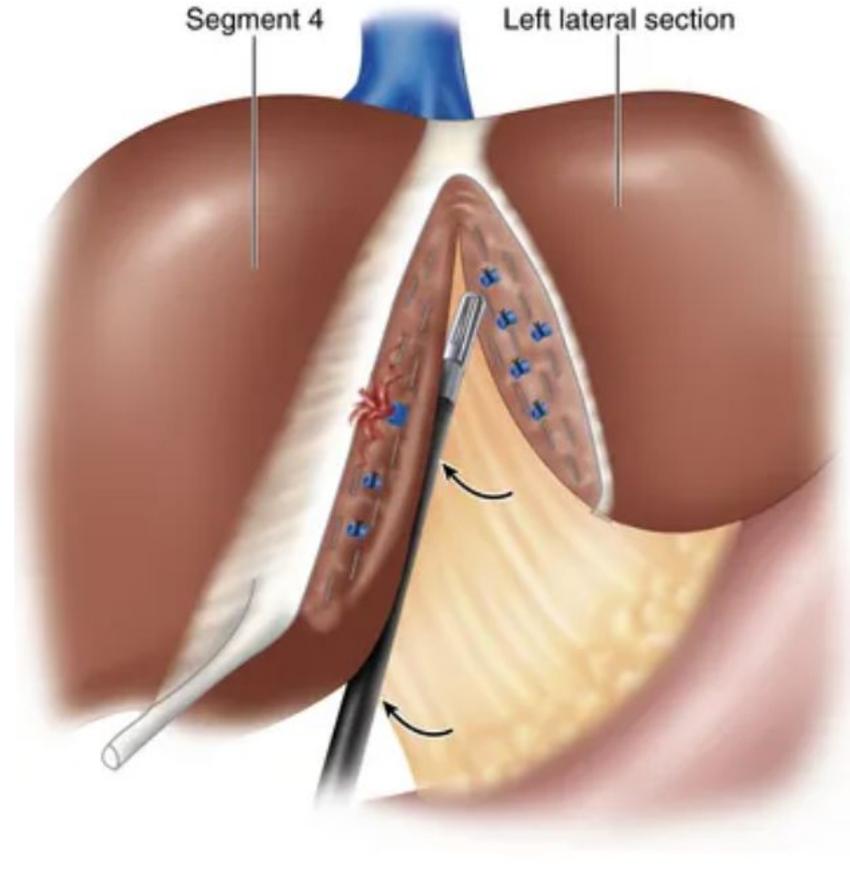
- Patient selection & positioning
- Port placement strategy for liver resections
- Vascular control techniques (Pringle maneuver, selective clamping)
- Parenchymal transection using robotic energy devices

Case Example: Robotic Right Hepatectomy

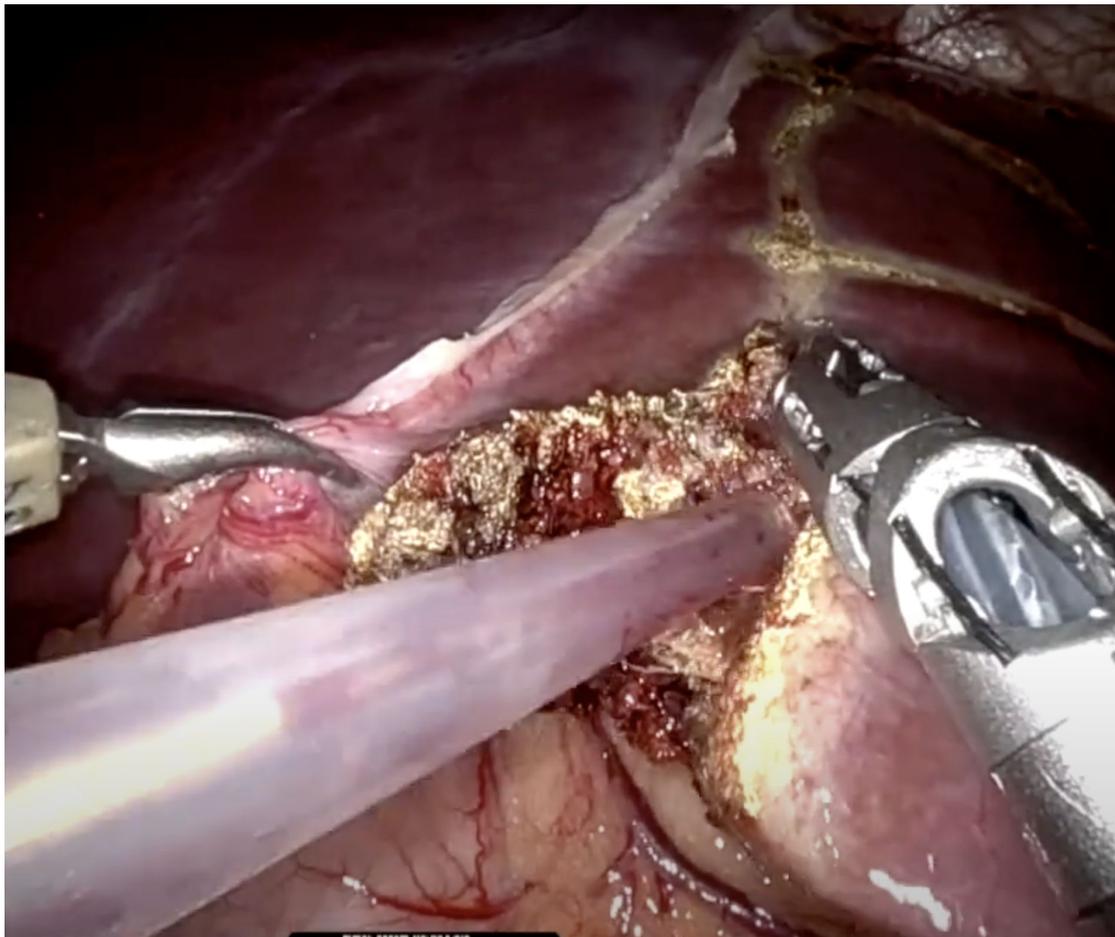
- 55-year-old patient with a **solitary CRLM in segment III**
- Pre-op imaging: Well-defined lesion, no extrahepatic disease
- Surgical steps:
 1. Trocar placement and liver mobilization
 2. Vascular Control
 3. Parenchymal transection
 4. Specimen retrieval via suprapubic extraction

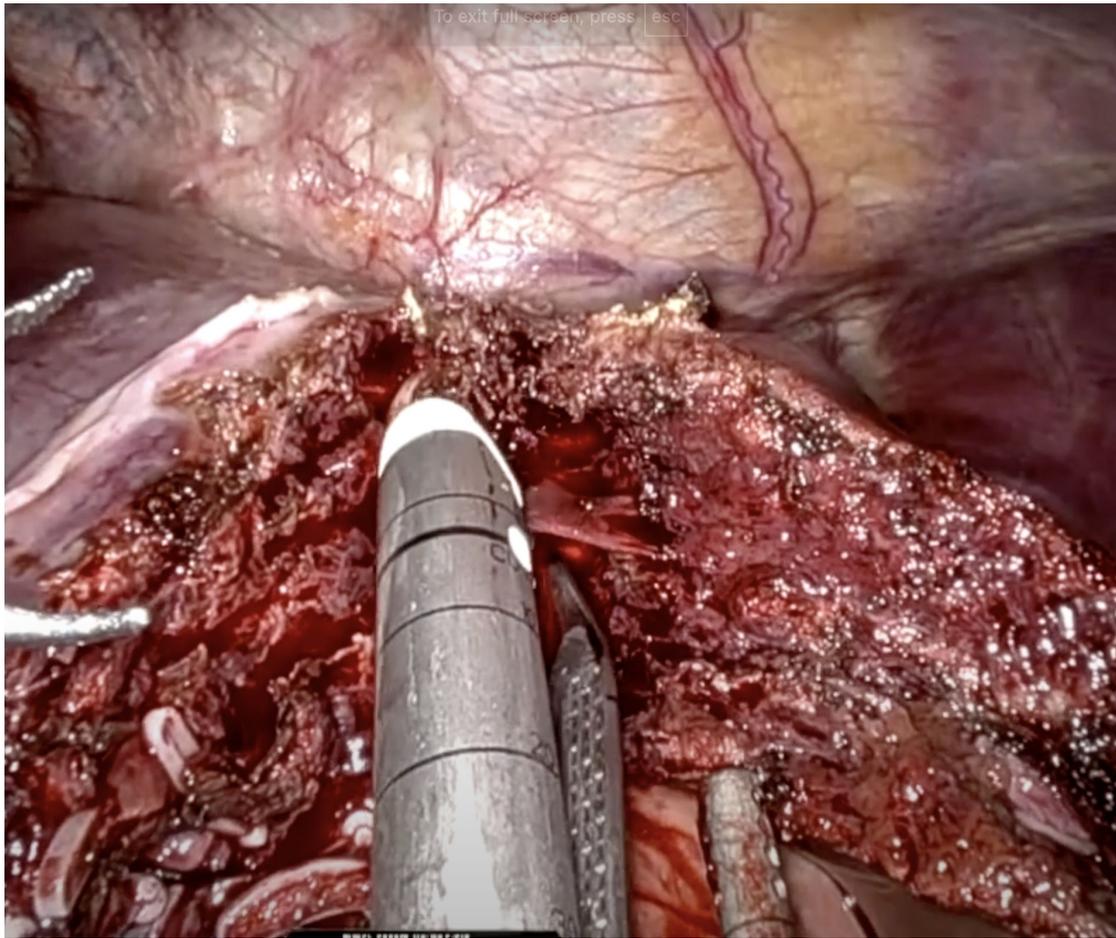


- A. AirSeal® trocar for insufflation and placement of liver retractor
- B. Arm # 1
- C. Arm # 2
- D. Arm # 3
- E. Arm # 4
- F. Gelpoint® assistant port





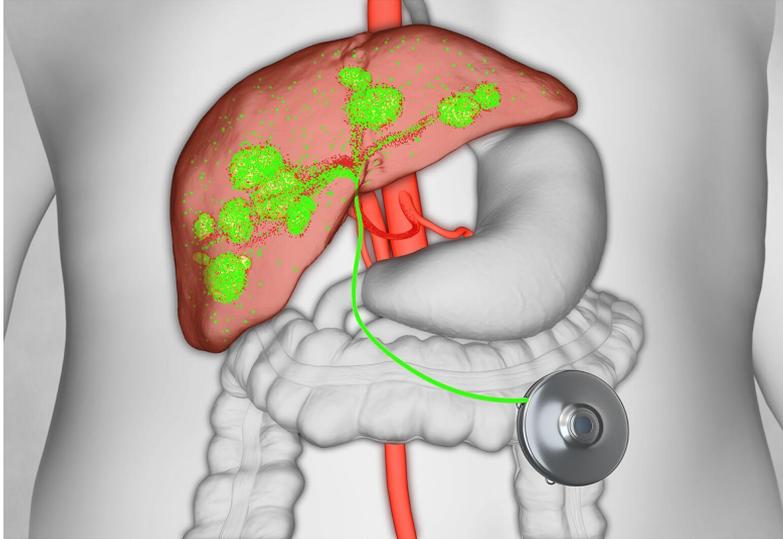




Alternative Therapies in Liver Metastases

- Used when **resection is not feasible** due to lesion location or patient comorbidities
- Options:
 1. Hepatic Artery Infusion (HAI) Pump
 2. Microwave Ablation (MWA)
 3. Irreversible Electroporation (IRE)
 4. Histotripsy

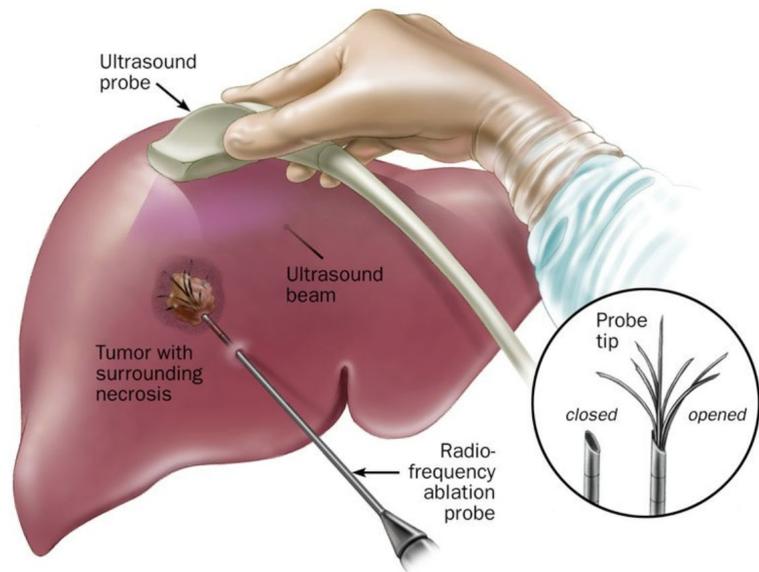
Hepatic Artery Infusion Pump



- Subcutaneous pump with catheter inserted into gastroduodenal artery
- Liver-directed therapy with 400x the systemic dose of chemotherapy

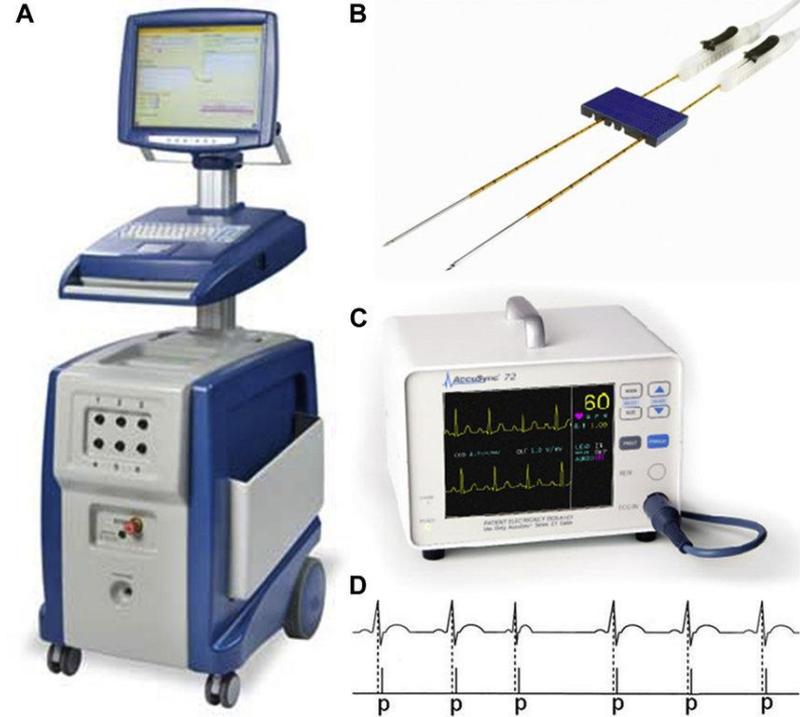
Microwave Ablation (MWA)

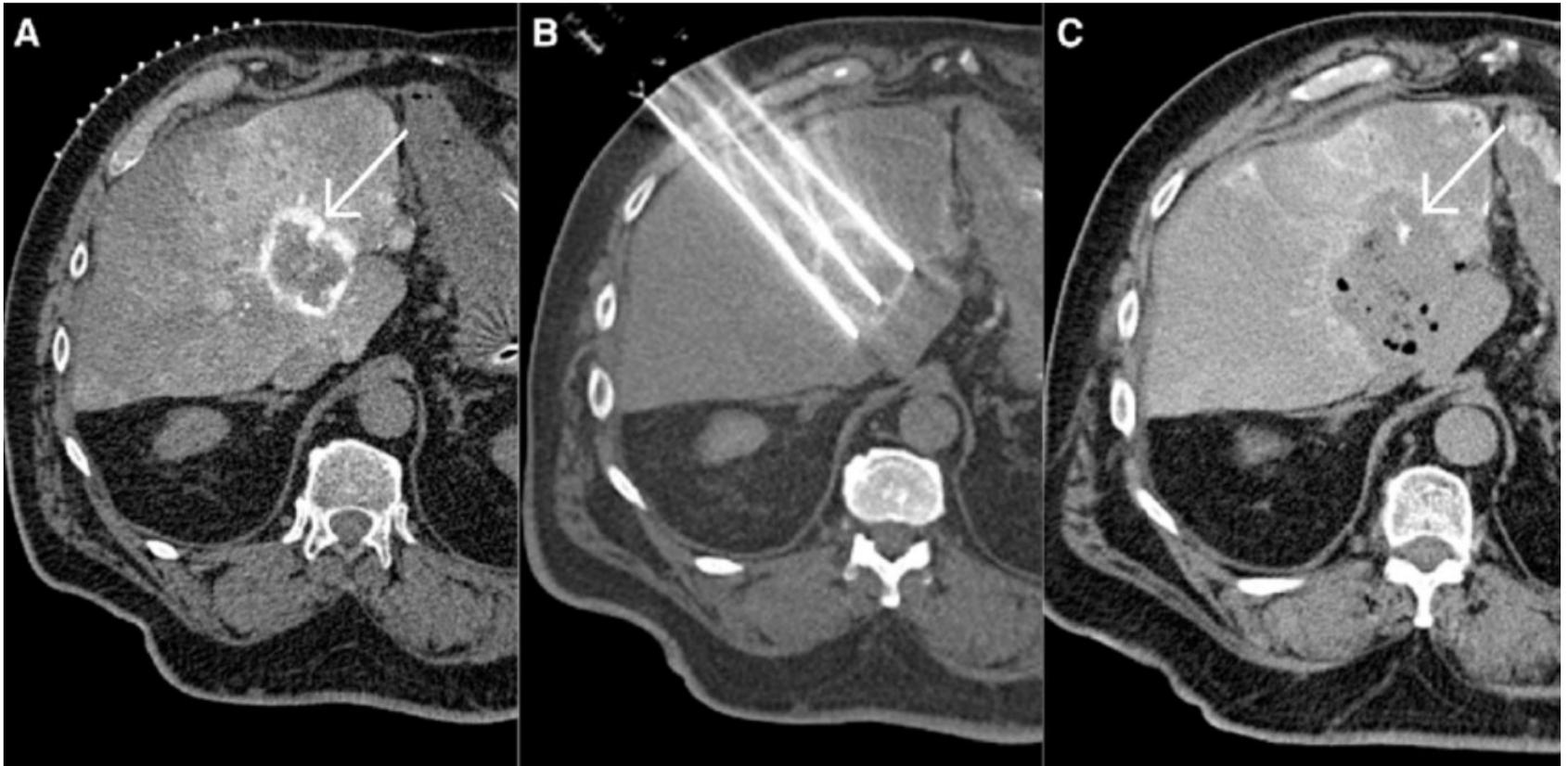
- Thermal ablation technique using electromagnetic waves
- Benefits:
 - Faster treatment
 - Larger ablation zones
 - Less heat sink effect
- Ideal for tumors ≤ 3 cm



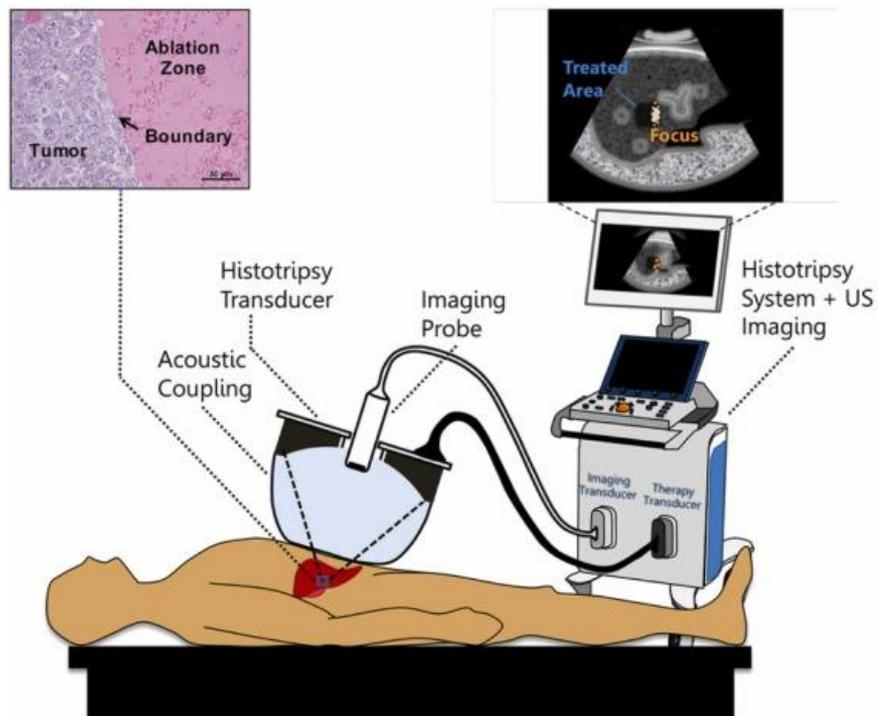
Irreversible Electroporation (IRE)

- Non-thermal technique using high-voltage pulses
- Preserves vessels and bile ducts → Suitable for perivascular tumors
- Growing evidence supports use in borderline-resectable CRLM





Histotripsy: A Disruptive Technology

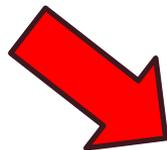


- Noninvasive ultrasound-based tumor destruction (acoustic cavitation)
- No heat, no needles – completely extracorporeal
- Clinical trials ongoing for solid liver tumors

Summary & Future Directions

1. Surgical evaluation is key component of colorectal cancer care
2. Robotic liver surgery is safe and effective for well-selected cases
3. Novel techniques have expanded treatment options for non-resectable lesions
4. Histotripsy represents a potential paradigm shift in liver tumor management

Learn more here!



Virginia Mason HPB Program
<https://www.vmfh.org/our-services/digestive-health/liver-pancreas-and-biliary-center-of-excellence>

Thank you.

Clancy J. Clark, MD
Cell: 336-480-8064
clancy.clark@commonspirit.org



My vCard

