

Advances in Liver Surgery Guided by Improved Imaging

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Disclosures

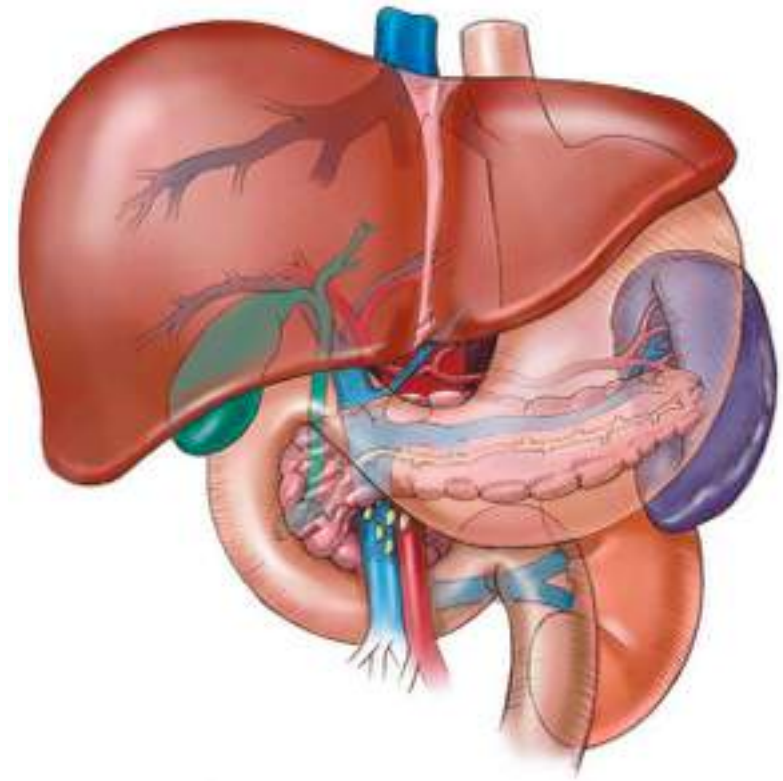
- I have no industry relationships relevant to Liver Transplantation or Liver Surgery

Objectives

- **Trends in Liver Transplantation**
- **Trends in Liver Disease**
- **Trends in Liver Surgery**
- **Technology in Liver Surgery/Imaging**

The Liver is Central to Digestion and Detoxification

- Largest gland in the body
- 3-4 lb
- Two lobes
- Only internal organ that can regenerate
- The liver helps the body digest food, store energy, makes proteins, protects against foreign invaders and remove toxins



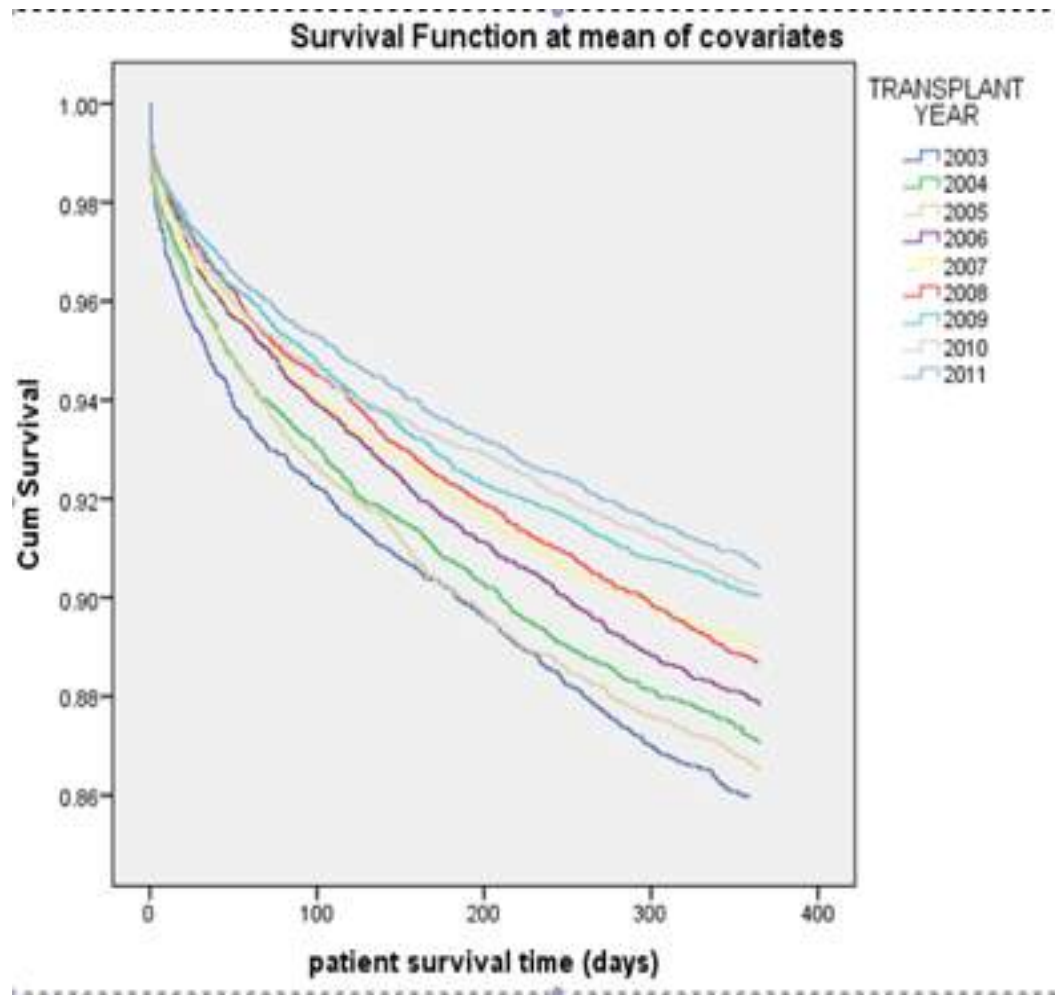
Liver Disease: A Growing Epidemic

- Liver disease is a leading cause of mortality in the US
 - More than 36,000 deaths annually – and rates are increasing
- Cancers of the liver have low survival without transplantation or surgery
 - One of few cancers increasing in frequency in US and worldwide
- Obesity leading to liver disease will become a major problem in the future

Liver Transplantation Indications

- Decompensated liver disease
- HCC
- Fulminant liver failure

Transplant is Getting Better: 1 year survival exceeds 90%



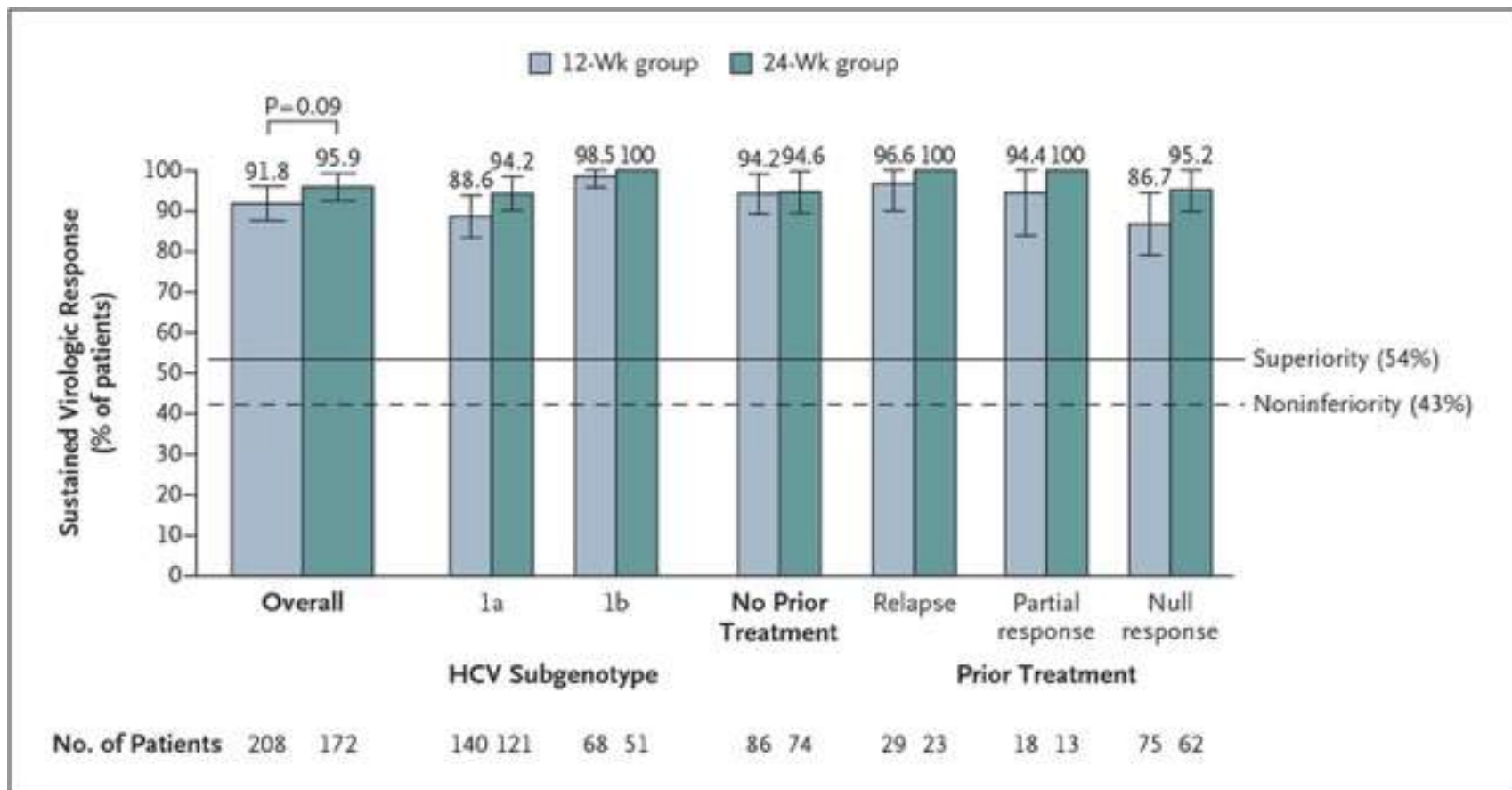
Trends in Decompensated liver disease

- HCV treatment
- NASH/NAFLD

HCV

- Largest cause of end-stage liver disease in the United States
- 3-4 million people
- Novel therapies in past 2 years

Sustained Virologic Response at Post-Treatment Week 12 in Each Treatment Group, Overall and According to Subgroups.



Poordad F et al. N Engl J Med 2014;370:1973-1982.

Sofosbuvir and Velpatasvir for HCV Genotype 1, 2, 4, 5, and 6 Infection

J.J. Feld, I.M. Jacobson, C. Hézode, T. Asselah, P.J. Ruane, N. Gruener, A. Abergel, A. Mangia, C.-L. Lai, H.L.Y. Chan, F. Mazzotta, C. Moreno, E. Yoshida, S.D. Shafran, W.J. Towner, T.T. Tran, J. McNally, A. Osinusi, E. Svarovskaia, Y. Zhu, D.M. Brainard, J.G. McHutchison, K. Agarwal, and S. Zeuzem, for the ASTRAL-1 Investigators*

Table 2. Response during and after Treatment.^a

Response	Sofosbuvir–Velpatasvir (N = 624)
HCV RNA <15 IU/ml	
During treatment period — no. (%)	
At wk 2	355 (57)
At wk 4	564 (90)
At 12 wk after treatment period — no./total no. (%)	
Any genotype	618/624 (99)
1a	206/210 (98)
1b	117/118 (99)
2	104/104 (100)
4	116/116 (100)
5	34/35 (97)
6	41/41 (100)
Virologic failure — no. (%)	
During treatment	0
After treatment	2 (<1)
Other reason for classification as failure — no. (%)	
Loss to follow-up	2 (<1)
Withdrawal of consent	1 (<1)
Death	1 (<1)

* None of the patients receiving placebo had an HCV RNA level of less than 15 IU per milliliter at any time point. Additional data about response according to subgroup are provided in Tables S2 and S3 in the Supplementary Appendix.





The NEW ENGLAND JOURNAL of MEDICINE

THE NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

An Interferon-free Antiviral Regimen for HCV after Liver Transplantation

Paul Y. Kwo, M.D., Parvez S. Mantry, M.D., Eoin Coakley, M.D., Helen S. Te, M.D.,
Hugo E. Vargas, M.D., Robert Brown, Jr., M.D., M.P.H., Fredric Gordon, M.D.,
Josh Levitsky, M.D., Norah A. Terrault, M.D., M.P.H., James R. Burton, Jr., M.D.,
Wangang Xie, Ph.D., Carolyn Setze, M.S., Prajakta Badri, Ph.D.,
Tami Pilot-Matias, Ph.D., Regis A. Vilchez, M.D., Ph.D., and Xavier Forns, M.D.

ABSTRACT

BACKGROUND

Hepatitis C virus (HCV) infection is the leading indication for liver transplantation worldwide, and interferon-containing regimens are associated with low response rates owing to treatment-limiting toxic effects in immunosuppressed liver-transplant recipients. We evaluated the interferon-free regimen of the NS5A inhibitor ombitasvir coformulated with the ritonavir-boosted protease inhibitor AET-450 (AET-450)r, the nonnucleoside NS5B polymerase inhibitor dasabuvir, and ribavirin in liver-transplant recipients with recurrent HCV genotype 1 infection.

METHODS

We enrolled 34 liver-transplant recipients with no fibrosis or mild fibrosis, who received ombitasvir-AET-450/r (at a once-daily dose of 25 mg of ombitasvir, 150 mg of AET-450, and 100 mg of ritonavir), dasabuvir (250 mg twice daily), and ribavirin for 24 weeks. Selection of the initial ribavirin dose and subsequent dose modifications for anemia were at the investigator's discretion. The primary efficacy end point

From Indiana University, Indianapolis (P.Y.K.); the Liver Institute at Methodist Dallas, Dallas (P.S.M.); AbbVie, North Chicago, IL (E.C., W.X., C.S., P.B., T.P.-M., R.A.V.); University of Chicago Medical Center (H.S.T.) and Northwestern University Comprehensive Transplant Center (J.L.) — both in Chicago; Mayo Clinic, Phoenix, AZ (H.E.V.); Columbia University Medical Center, Center for Liver Disease and Transplantation, New York (R.B.); Lahey Hospital and Medical Center, Burlington, MA (F.G.); University of California, San Francisco, San Francisco (N.A.T.); University of Colorado Denver, Aurora (J.R.B.); and the Liver Unit, Hospital Clinic, Institut d'Investigacions Biomèdiques August Pi i Sunyer and Centre de Recerca Biomèdica en Hepatitis

NASH/NAFLD

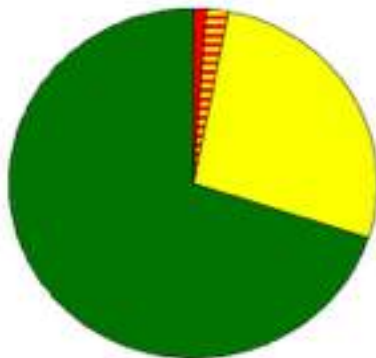
- **Most common chronic liver disease in USA**
- **4th most common reason for liver transplant**
 - Projected to be the most common in 10-20yrs
- **Up to 20-40% adults**
- **6 million children**

By 2020

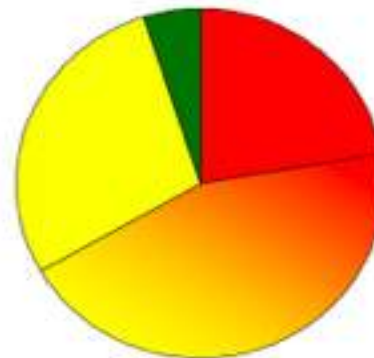
Prevalence of NAFLD and NASH

- Too much fat in the liver (NAFLD)
 - > 30% of adults
 - 13% of children
- Fat plus significant injury (NASH)
 - 3-4% of all adults
 - 15-20% of obese adults
 - 25-70% of people having bariatric surgery

General population



Severely obese



- NASH with fibrosis
- NASH
- Simple steatosis
- Normal

NAFLD

- Associated with HCC even in absence of cirrhosis
- More common at lower BMI in Asians-even with BMI < 28

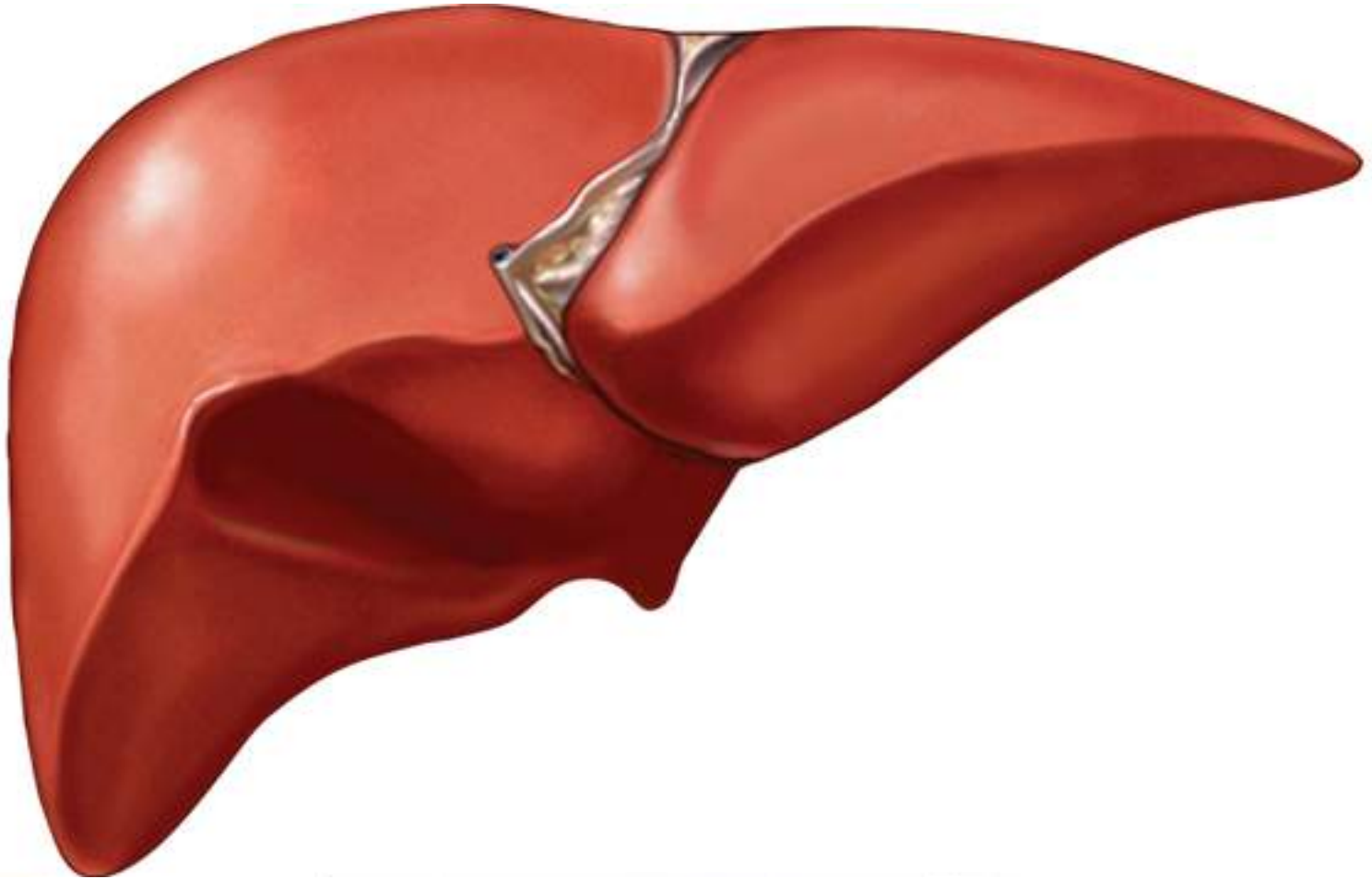
Trends in Liver Surgery Care

- **Improved outcomes**
 - **Liver Transplantation**
 - **Hepatic resection**
- **More minimally invasive surgery**
 - **Laparoscopy**
 - **Robotic surgery**
- **Increased technology**
 - **Operative planning**
 - **3-D imaging**
 - **Real-time localization**

Liver Surgery

- **Increased use of parenchymal sparing resections**
- **Low intra-operative CVP**
- **Use of 2-stage resections**

Liver has few external landmarks



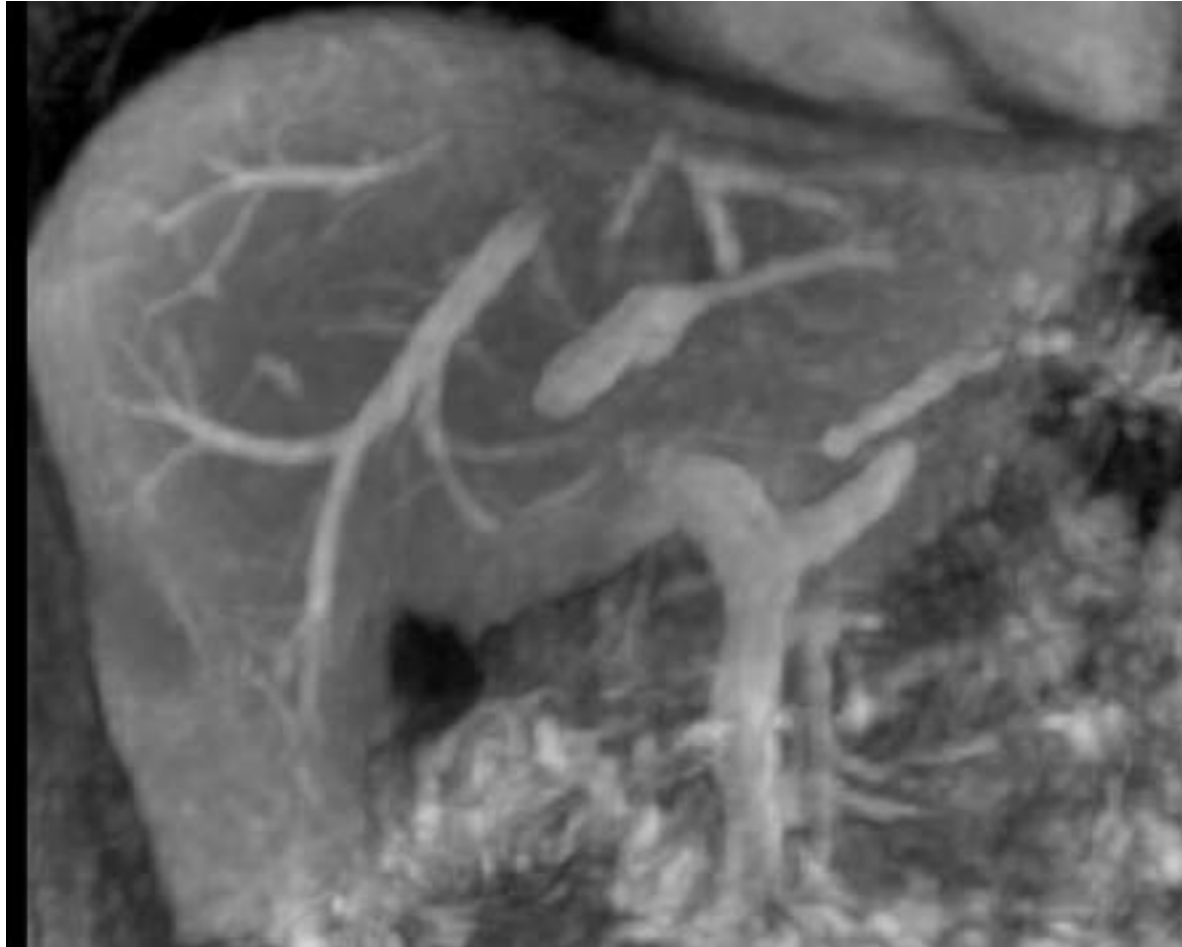
Technology can do some amazing things but

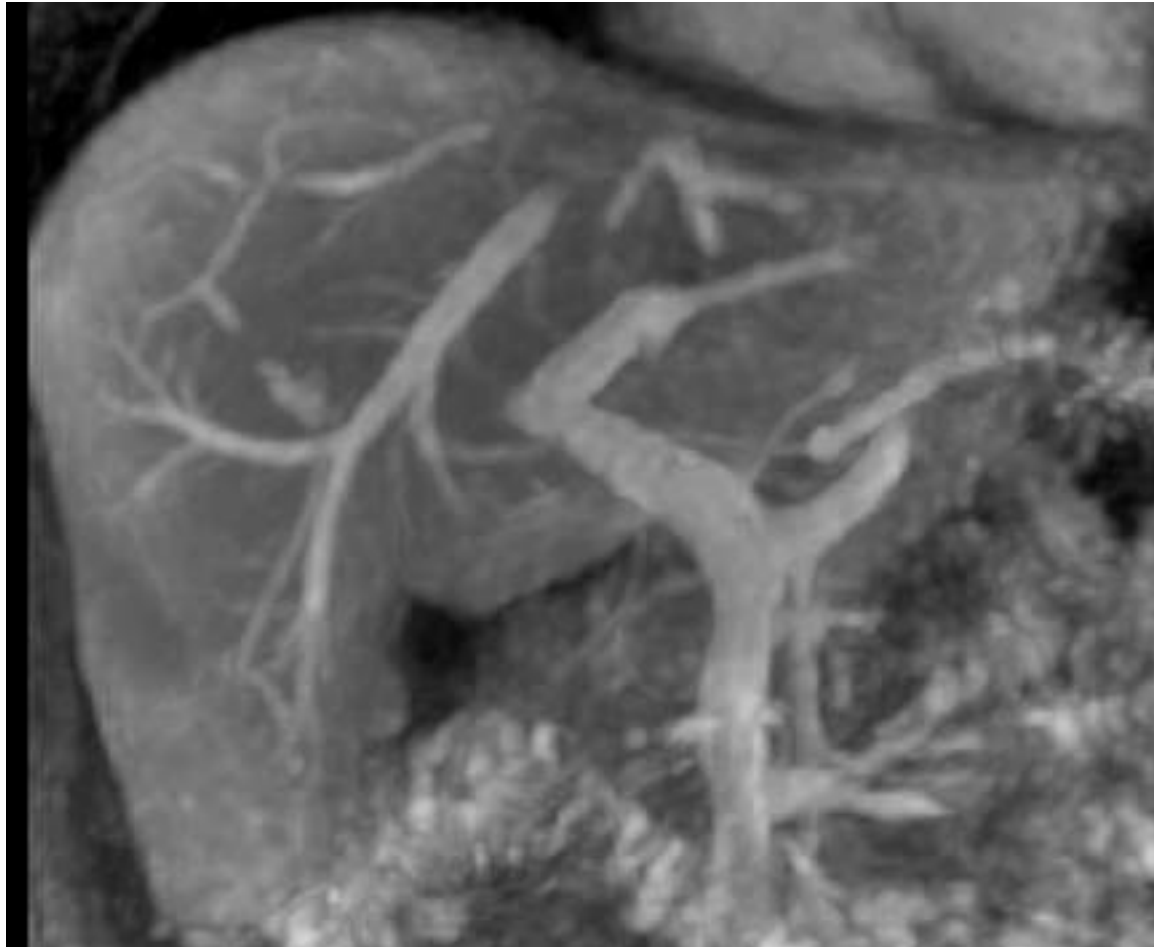


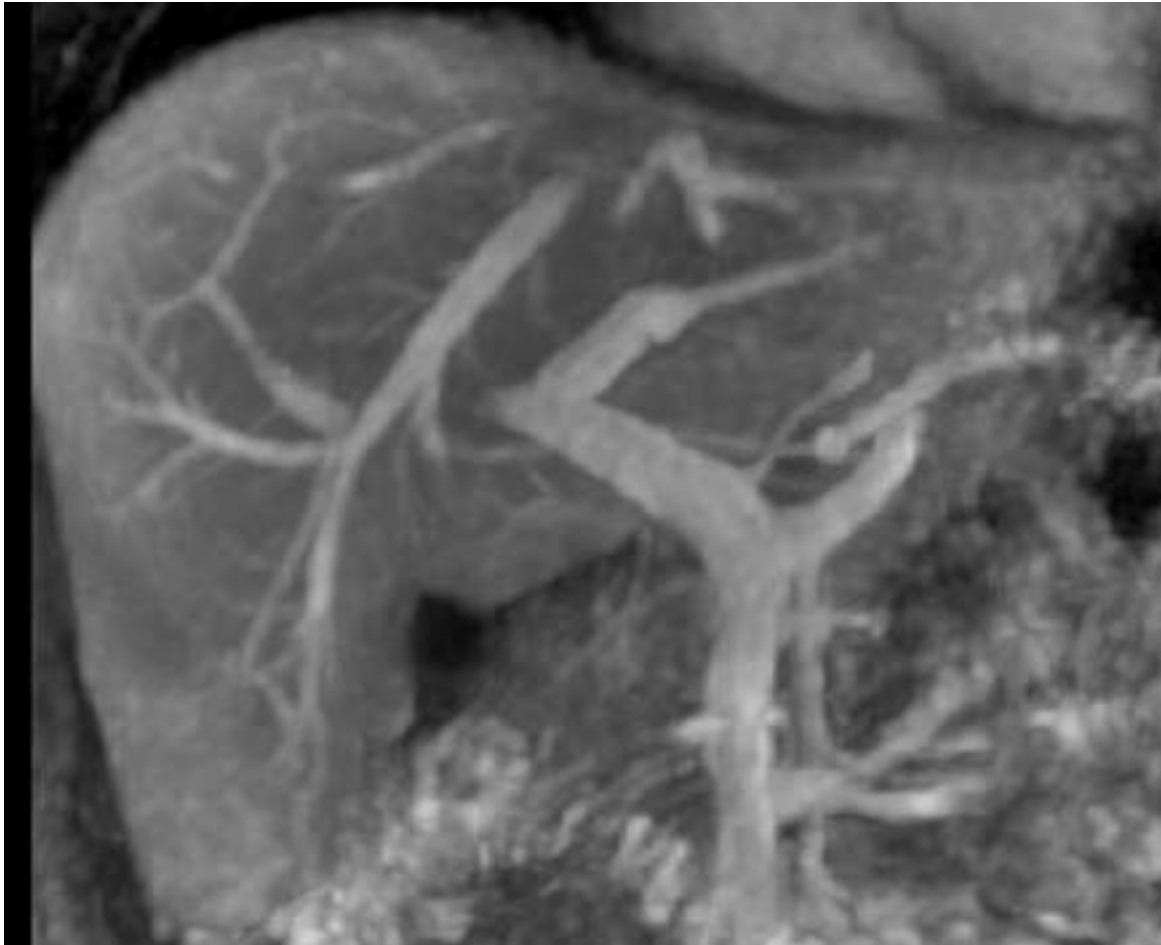
But you need a really detailed roadmap

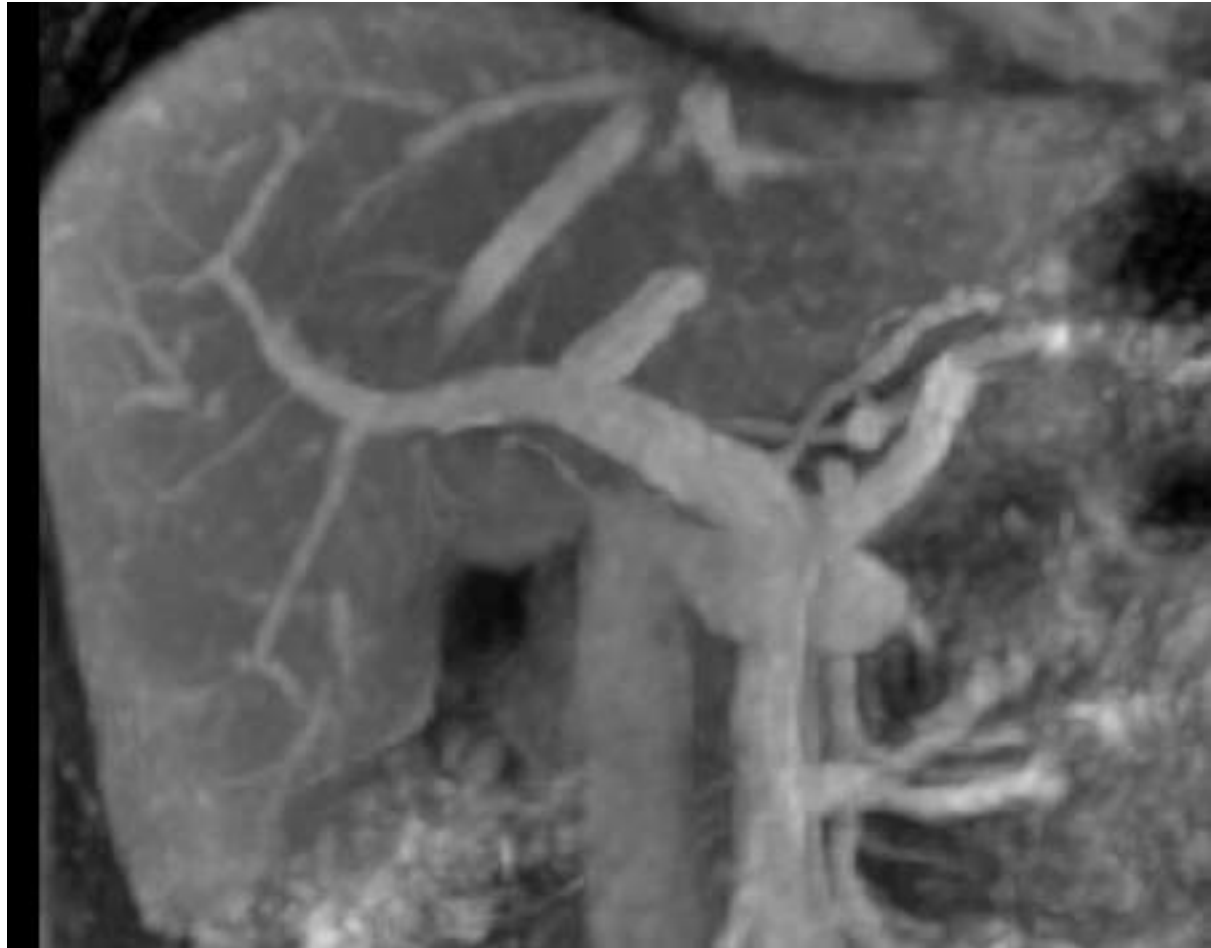


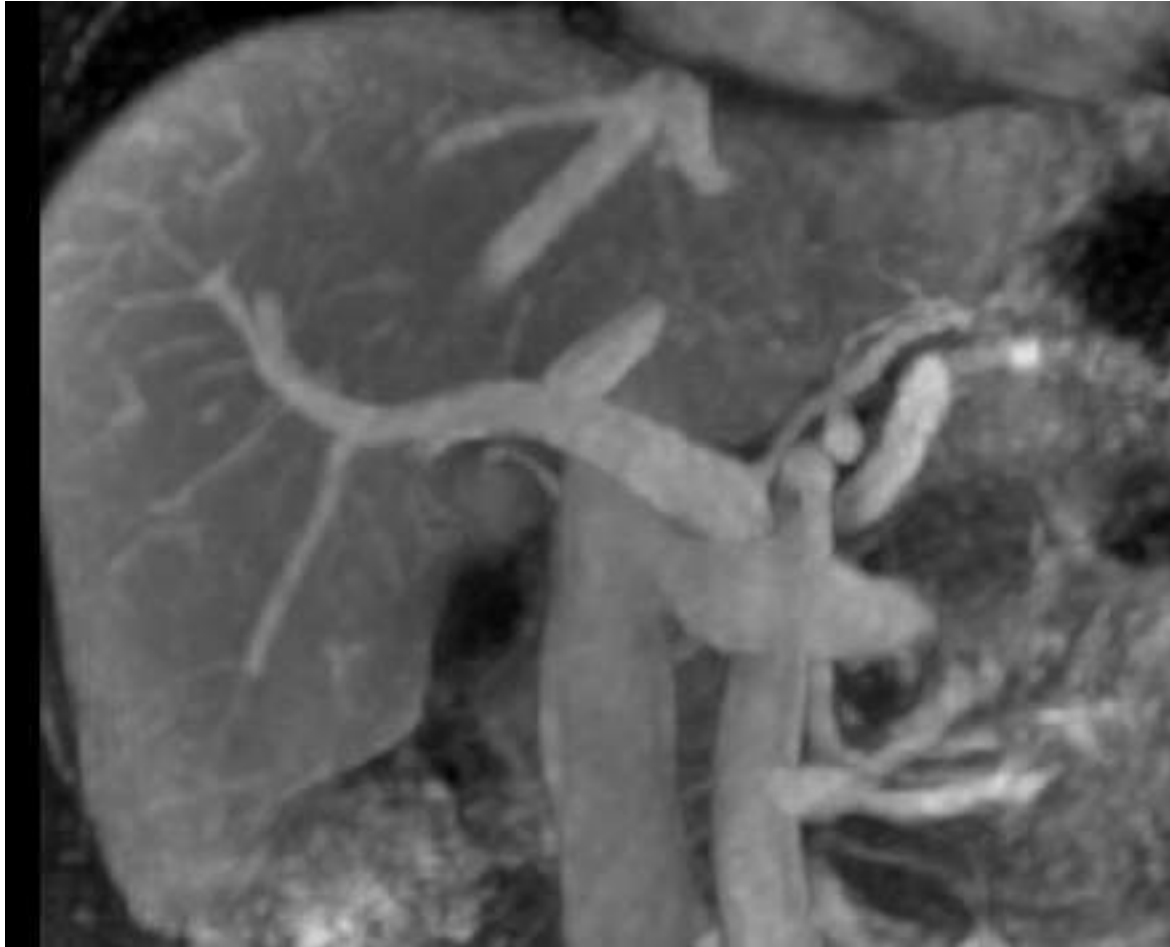
Liver Vasculature

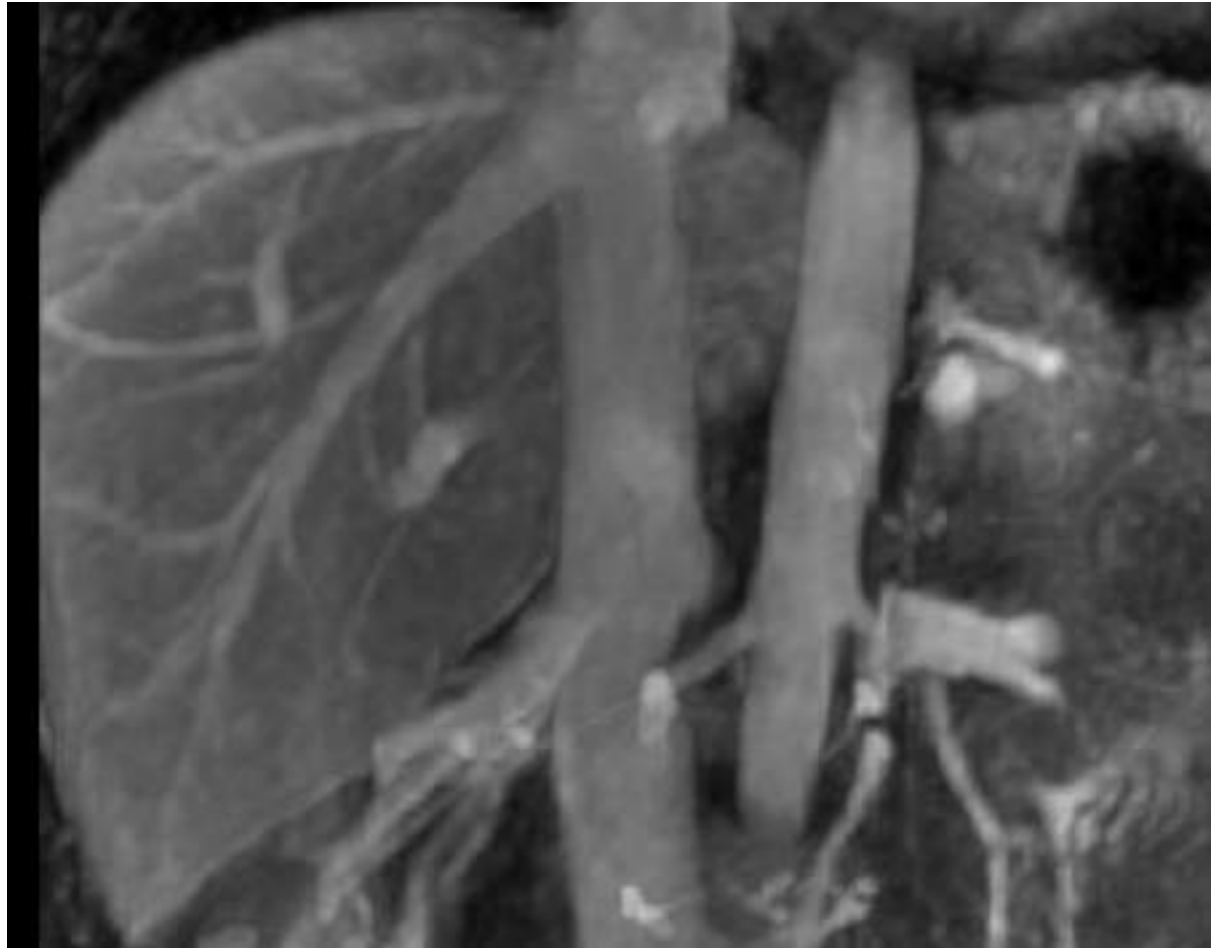








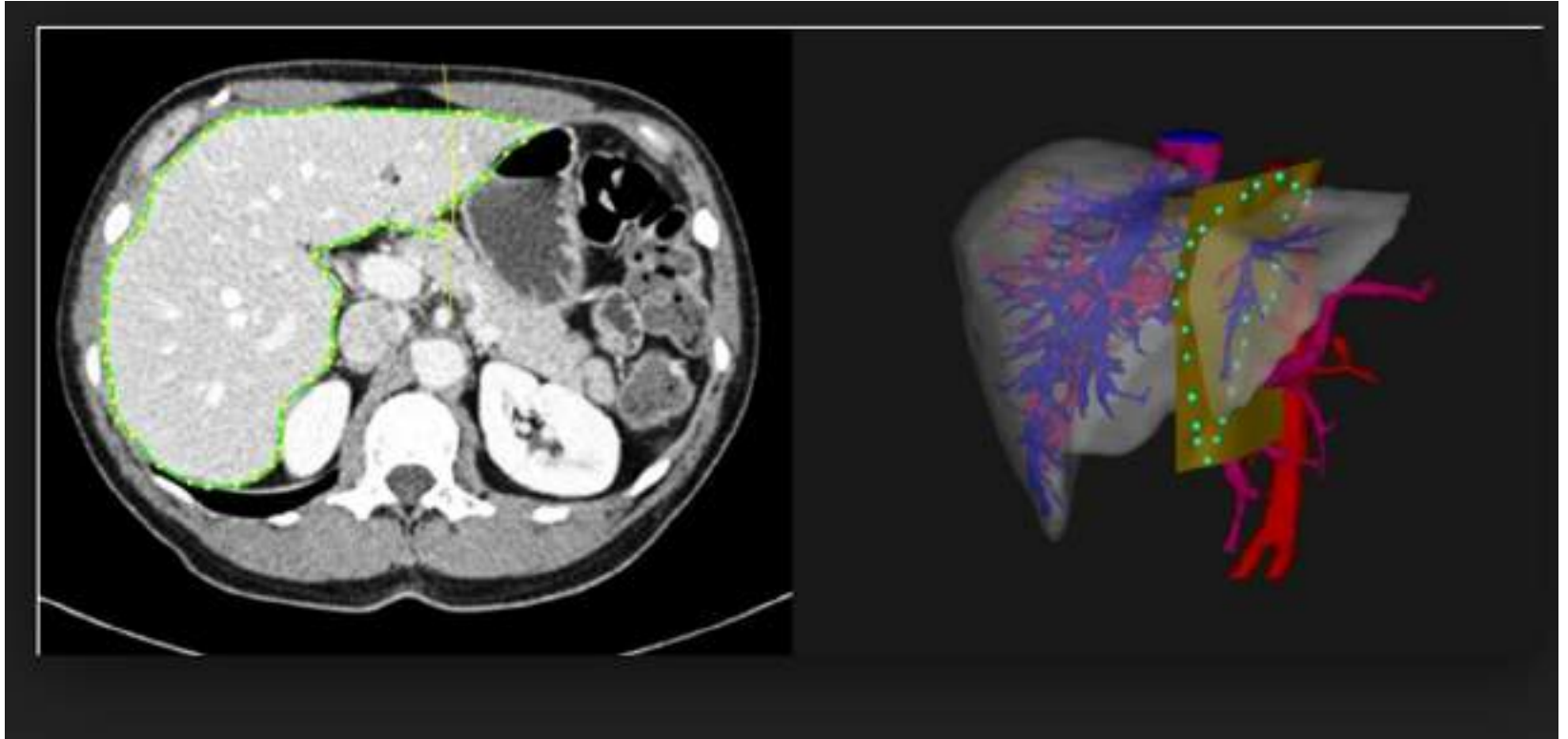




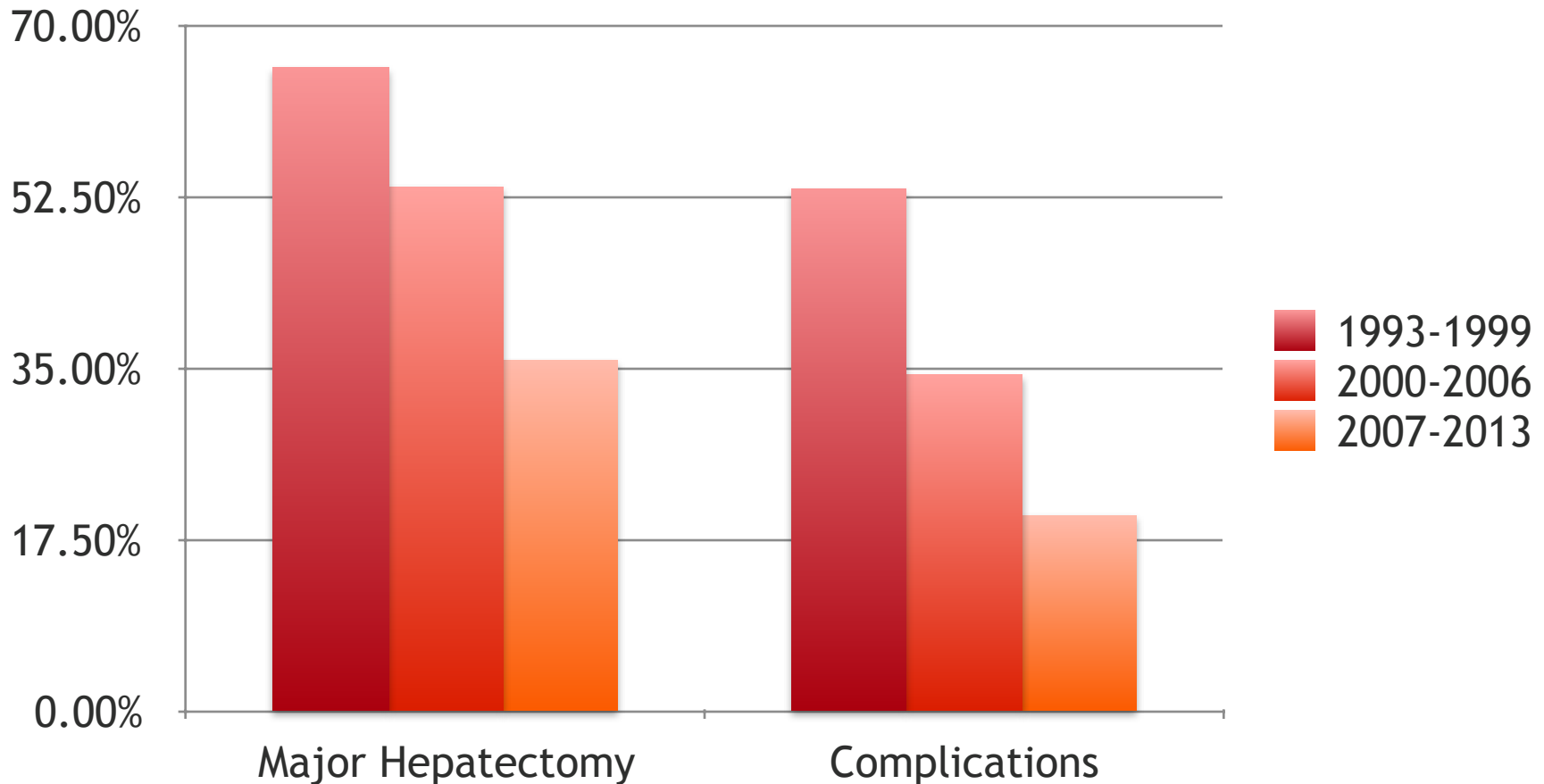
3-D reconstruction



Pre-operative Planning



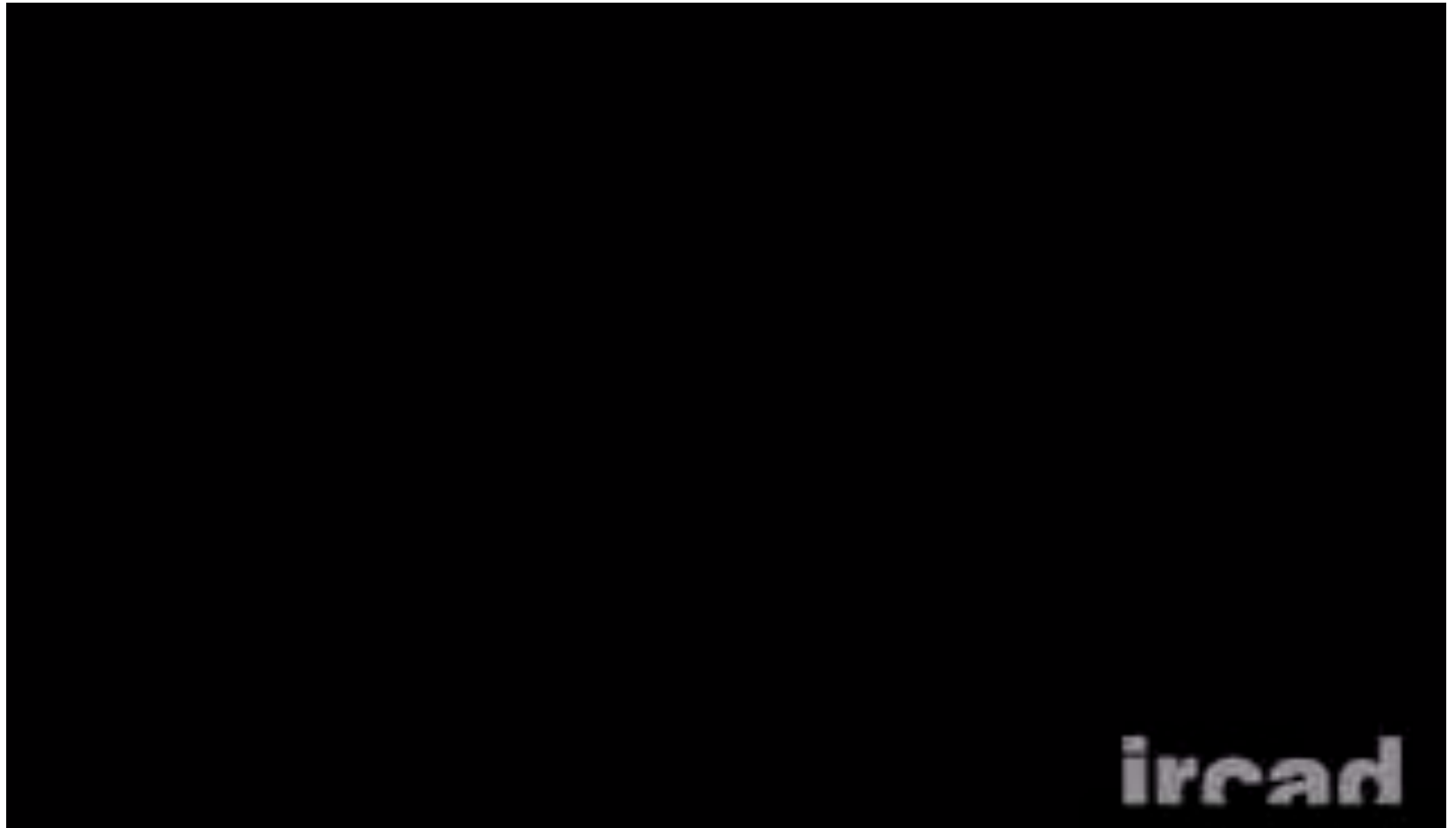
Parenchymal sparing-less liver removed fewer complications



**Hepatic Parenchymal Preservation Surgery:
Decreasing Morbidity and Mortality Rates
in 4,152 Resections for Malignancy**

T Peter Kingham, MD, FACS, Camilo Correa-Gallego, MD, Michael I D'Angelica, MD, FACS,
Mihai Gones, PhD, Ronald P DeMatteo, MD, FACS, Yuman Fong, MD, FACS, Peter J Allen, MD, FACS,
Leslie H Blumgart, MD, FACS, William R Jarnagin, MD, FACS

Augmented Reality



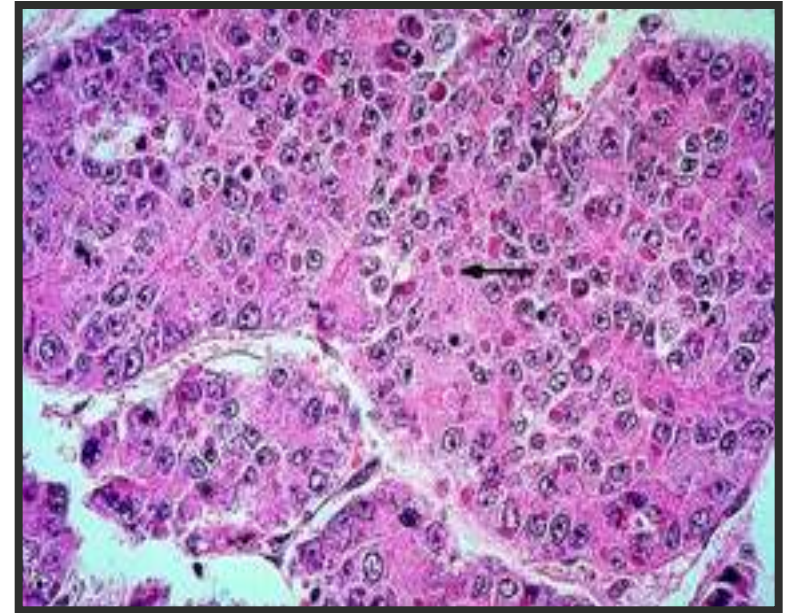
Hepatocellular Carcinoma Epidemiology

- **3rd most common cancer worldwide**
600,000 deaths worldwide
- **80% to 90% increase in incidence**
over the last 2 decades in USA

Hepatocellular Carcinoma

- Associated with cirrhosis greater than 80% of cases
- Up to 20% of patients with cirrhosis will develop HCC over 10 years
- 12-14,000 new cases per year in U.S. and rising steadily

Hepatocellular Carcinoma

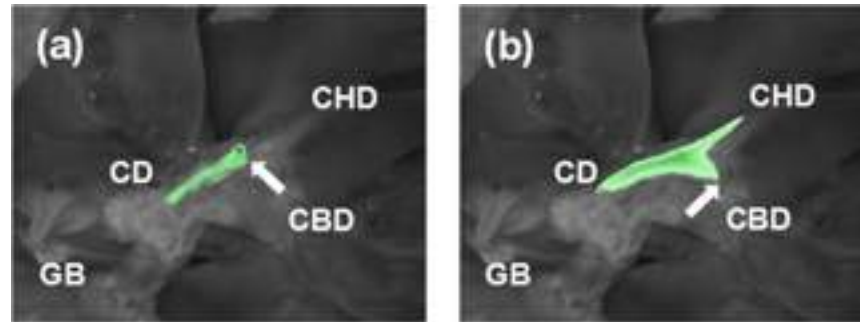




Fully Laparoscopic Left-Sided Donor Hepatectomy Is Safe and Associated With Shorter Hospital Stay and Earlier Return To Work: A Comparative Study

Benjamin Samstein,¹ Adam Griesemer,¹ Daniel Cherqui,³ Tarek Mansour,¹ Joseph Pisa,¹ Anna Yegiants,¹ Alyson N. Fox,² James V. Guarrera,¹ Tomoaki Kato,¹ Karim J. Halazun,⁴ and Jean Emond¹





Legend:

Ex vivo fluorescence images simulating the detection of different surgical scenarios: (a) the correct scenario, where the cystic duct is clamped; (b) an incorrect scenario where the common bile duct is accidentally clamped. GB: gall bladder. CBD: common bile duct. CHD: common hepatic duct. CD: cystic duct. Arrows indicate the clamping locations.

Conclusions

- **Liver Transplantation associated with excellent survival**
- **HCV therapies are changing liver disease in this country**
- **Liver surgery associated with lower complications and technologic advances**

Acknowledgement

- **Main Street Radiology**
- **Dr. David Rogers**
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- **Dr. Pierre Saldinger**

- **Ann Marie Prendergast**