Multidisciplinary care of liver and pancreas cancers: Surgery

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Disclosures

• I have no conflicts of interest relevant to this talk
• I will discuss some applications under development and/or without FDA approval
Background: Pancreas Cancer

• About 56,770 people will be diagnosed in 2019 with pancreatic cancer (adenocarcinoma)
• About 45,750 people will die of pancreatic cancer annually
• Pancreatic cancer accounts for about 3% of all cancers in the US and about 7% of all cancer deaths.
• Pancreas neuroendocrine tumor (NET) accounts for 7% of pancreas malignancies
Pancreas cancer: “Resectable”

- Surgery + chemotherapy +/- XRT= possible cure?
- Only 15-20% of patients are surgical candidates
- No distant metastatic disease (e.g. liver, peritoneum)
- Limited nodal involvement to regional lymph nodes
- Limited involvement of peripancreatic blood vessels.
Pancreas Anatomy

Considerations:
- Location of tumor
- Blood vessels
- Margins
- Other organs
Distal pancreatectomy

Before surgery:
- Gall bladder
- Bile duct
- Stomach
- Spleen
- Tumor in body and tail of pancreas
- Duodenum
- Small intestine

After surgery:
- Gall bladder
- Bile duct
- Stomach
- Spleen
- Small intestine

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Pancreatoduodenectomy ("Whipple")
Minimally Invasive Surgery

- Smaller scars/incisions
- Less pain?
- Physiologic impact on body
- Oncologic outcomes need to be the same
Minimally Invasive Surgery: Laparoscopy

• Performing operations in a body cavity using light source +/- insufflation and long instruments through small incisions

• Established since late 1980’s
Da Vinci—Robotic gold standard (2000)

• Single operator can use multiple arms
• Computers stabilize movement
• Robotic arms can move with more degrees of freedom
• 3D visualization for surgeon
• Remote applications
Borderline resectable: vascular resection

- Utilization of neoadjuvant (preop) chemo +/- XRT
- Resection/reconstruction of portal vein/superior mesenteric vein
- Resection of celiac axis artery (Appleby)
Locally Advanced/Unresectable

• Palliative chemo/XRT--nonsurgical

• Irreversible electroporation (IRE) “Nanoknife”
  • Electrical impulses open gaps in cell membranes causing cell death
  • Can be used near blood vessels
  • STILL EXPERIMENTAL
  • **Preliminary data this year suggest IRE may release proteins which may make tumors more sensitive to immunotherapy
Cancers of the Liver

• Primary liver cancer (hepatocellular carcinoma/HCC)
  • 42,030 people in US will be diagnosed in 2019
  • About 31,780 people will die of liver cancer in 2019
  • Associated with cirrhosis, viral hepatitis

• Intrahepatic bile duct cancer (cholangiocarcinoma)
  • About 8000 people diagnosed annually in US

• Metastatic cancer to the liver
Types of liver resection

a) Right hemihepatectomy
b) Extended right hemihepatectomy

c) Left lateral liver resection
d) Left hemihepatectomy
How much liver can be removed?

- Location of tumor
- Underlying function of liver
- Liver regeneration (compensatory regrowth)
- Functional liver remnant
  - 20-30% of a normal liver
  - 30% of liver after chemotherapy
  - 40% of a cirrhotic liver
Enhancing Future Liver Remnant: Portal Vein Embolization

- Portal vein brings blood back to liver from intestinal system
- Blocking portal vein preoperatively on the side of the tumor shunts the blood to the future liver remnant, causing it to grow

Image courtesy of ISCAS
Liver Transplantation: Indication for HCC

• For patients with advanced cirrhosis and limited HCC
• Milan criteria (Mazzaferro, 1996)
  • Single tumor $\leq 5$cm
  • Maximum of 3 tumors $\leq 3$ cm
  • No vascular invasion
  ➔ Survival 70% at 5 years
• Expanded criteria
• Downstaging (Dr. Repic’s talk!)
Hepatic Artery (HA) Infusion Pump

- Liver metastasis (e.g. colon ca) preferentially receive blood supply from HA
- Systemic (IV) chemotherapy can be limited by toxicity
- Targeted HA delivery may decrease toxicity to other organs while increasing dose selectively to tumor.
- Can be limited by specific complications (infection, bile duct scarring, HA thrombosis, stomach/duodenal ulcers)
Tumor ablation

- Multifocal tumors or not enough functional liver for resection
- Radiofrequency ablation (RFA)
  - High frequency electrical currents delivered via a probe in the tumor to heat and destroy tissue around it
  - Limited by size and proximity to blood vessels
- Microwave
  - Probes inserted in tumor use electromagnetic field to heat and destroy tissue
  - Can treat slightly larger lesions or multiple lesions simultaneously in shorter time
- Depending on patient, may use percutaneous (IR), laparoscopic or open surgical placement
- Irreversible electroporation (IRE)?
Advances in intraoperative imaging

- Camera-based surgery takes away tactile sensation
  - 3D imaging for robotic console
- Structures may be obscured by inflammation, fat, scar
- Identification of cancer cells
- Routine use of intraoperative ultrasound
Near infrared fluorescence (NIR)

- Indocyanine green (ICG) used as fluorophore with NIR camera system (approx 740-840 nm)
- ICG distributes into blood, lymph, and bile
- NIR imaging capable of 5 mm + penetration into tissue
NIR: biliary surgery
NIR: tumor imaging
Summary

• Oncologic surgery balances biology of disease, anatomy, and maintenance of underlying organ function
• Current cancer care is carried out in multidisciplinary fashion
• Innovations include minimally invasive surgery, expanding surgical criteria, ablative technology, and improving intraoperative imaging
QUESTIONS?