INNOVATIONS IN THE TREATMENT OF LIVER TUMORS

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Treatment options for liver tumors

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Benign Tumors

- Hepatocytes
- Adenoma
- Focal nodular hyperplasia
- Hepatocellular hyperplasia
- Focal nodular hyperplasia
- Partial nodular transformation
- Nodular regenerative nodules
- Adenomatous hyperplasia
- Macroregenerative nodules
- Other
  - Inflammatory pseudotumor
  - Myoma
  - Epidermoid cyst
  - Benign teratoma
  - Hepatic pregnancy

Mesenchymal

- Hemangioma
- Hamartoma
- Hemangioendothelioma
- Lymphangioma
- Lipoma
- Leiomyoma
- Fibroma
- Focal fatty change
- Polycystic liver disease
- Neurofibromatosis
- Schwannoma

Malignant

- Hepatoma
- Cholangiocarcinoma

Heterotopic Tissue

- Adrenal rests
- Pancreatic rests
- Biliary duct adenoma
- Biliary papillomatosis

LIVER RESECTION

Best for curative intent, less risk of recurrence with adequate resection margins

- Open surgery
- Laparoscopy

Major surgery with potential blood loss
Adequate liver reserve is necessary

STAPLED LIVER RESECTION

A BETTER TECHNIQUE

A novel technique using the laparoscopic stapler as an alternative to traditional hepatic parenchyma resection.
STAPLED LIVER RESECTION
A BETTER TECHNIQUE

Operative time reduced in stapled vs nonstapled with the greatest reduction in the right lobectomy group: 220 min vs 319 min.

Hospital LOS no different except in the laparoscopic patients in which case they were discharged same day or within 24 hours.

Less blood loss and less transfusion requirement.

52 year old man with metastatic colon cancer to the liver.

- 3 lesions: 2 in the right lobe and 1 in the medial segment of the left lobe
- Small left lateral lobe
- Right portal vein embolization
- Still small left lateral lobe
- 2 stage liver liver resection
TRANSARTERIAL CHEMOEMBOLIZATION

Useful for tumors with heavy arterial supply — such as HCC

Chemotherapy for HCC is more effective if the tumors are ischemic

Modality of choice is Adriamycin impregnated beads - Doxi beads

Transarterial Chemoembolization

Before TACE

After TACE

Slide courtesy of Eugene Schiff MD

TheraSphere®
Yttrium-90 Microspheres

Innovative Treatment For Hepatocellular Carcinoma
TheraSphere®

- Y-90 TheraSphere consists of insoluble 20-30 μm glass spheres with Y-90 as an integral constituent of the glass matrix.

Mechanism of Action

- Based upon hypervascularity of tumor compared with normal liver tissue
- TheraSphere® introduced via catheterization of hepatic artery
- Microspheres are trapped in the tumor capillary bed and are non-embolic
- Pure beta-emitter
- Average beta emission energy is 0.9367 MeV
- Average penetration range in tissue is 2.5 mm
- Physical half-life is 64.2 hours and decays to stable zirconium-90

Pre treatment CT
**THE CYBERKNIFE**

- Converging beams
- Frameless
- Real-time tracking

- Allows fractionation
- Robotically driven linear accelerator

**Cyberknife® Radiosurgery**

- **Definition**
  - Radiosurgery uses precisely targeted radiation to destroy lesions anywhere in the body in 1-5 fractions/stages
  - Alternative to surgery

- **Benefits**
  - No incisions
  - No general anesthesia
  - Lower risk of complications
  - Improved patient quality of life
CYBERKNIFE PRECISION

- Total error 1.1 ± 0.3 mm (range, 0.79 to 1.41) (Chang, Neurosurgery 2003)
- Comparable to frame-based

SYNCHRONY

- Computer controlled Tai Chi
- Respiratory motion is tracked in real time
- Fiducials are used to verify and track organ motion via an orthogonal pair of electronic x-ray devices to provide real time feedback correction to the robotic arm during delivery
- Beacons on the skin monitor respiratory motion as a second correction technique
JD
- 55 yo man with hemochromatosis and Hep B
- Feb 2005 was found to have a 1.5 cm HCC which by Nov 2005 had increased to 3 cm
- 12/08/05 attempted Lap RFTA
- Radiosurgery 12/28/05-12/30/05
- OLTX 4/22/06

Pre MRI
Dec 2005

Post MRI
Mar 2006

LAPAROSCOPIC HEPATIC RADIOFREQUENCY THERMAL ABLATION
LS
BREAST MET

• 40 year old woman
• Lumpectomy, radiation and chemo
• 8 months later small PET positive lesion in the left lateral lobe of the liver

BREAST MET
PRE-TREATMENT MRI

BREAST MET
METASTATIC CARCINOID

- 65 year old man
- Progressive symptoms over 6 months
- CT scan showed 2 dominant lesions in the liver

CARCINOID

CARCINOID
PRIMARY ADENOCARCINOMA

- 72 year old man
- 2.5 cm lesion with medical contraindications to surgery
- Lap RFTA with placement of fiducials “just in case”
- 3 year follow up no evidence of disease recurrence

ADENOCARCINOMA
POST RFTA YEAR 1

ADENOCARCINOMA
POST-RFTA YEAR 3
PATIENT I.W.
38 year-old man metastatic colon cancer
1999
10/99 left colectomy, no evidence of liver disease
2001
CT scan 01/01 right lobe lesion
FMRI, PET 03/01 right lobe extending into medial segment left lobe lesion
Laparoscopic thermal ablation 03/01
CT scan 06/01 interpreted as enlarging lesion consistent with met
GMRI 07/01 no evidence of residual disease
2011
MRI no evidence of recurrence at ablation site or new tumor

Pretreatment 3/2000

Post treatment 3/2000
82 year old man with Hep C, a 3 cm liver lesion biopsy negative for malignancy and a 40 year old wife
Repeat MRI after biopsy still consistent with HCC
Lap biopsy and frozen showed HCC
Lap RFTA 7/2004
G.S.

- Presented to the ER for abdominal pain and was found to have multiple liver lesions
- Referred for evaluation
- Lap resection of left lateral lobe and Lap RFTA of right lobe for adenomas

Adenoma
MRI pre treatment

FNH
MRI pre treatment
CG

- 35 yo with 2 hepatic adenomas
- Lap RFTA
- Discharged same day

Adenoma Pre treatment MRI

Adenoma Post treatment MRI
Hepatic adenoma

Hepatic adenoma

Adenoma
Position probe at base of lesion
Irreversible Electroporation

- Also known as the Nanoknife
- Uses electrical energy to destroy tumors at the cellular level
- Creates nanoscale defects in the cell membrane
- Pulses of up to 2500 volts are delivered in micro burst
The treatment of liver tumors has changed dramatically with many surgical and interventional radiology treatments now outpatient.

The lines between cure and palliation are blurring.

“Success” depends on a multimodality approach with physicians dedicated to this rapidly changing field.

The surgeon, interventional radiologist, medical oncologist and radiation oncologist must work closer than ever to provide state of the art care to our patients.

Baylor is one of the few programs in the country that provides liver transplantation to Cyberknife and anything in between.

The Baylor Liver and Pancreas Disease Center is part of the vision of BHCS to provide multimodality care to a growing oncology patient population.