Minimally-Invasive Robotic treatment of Benign and Malignant Liver Diseases

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Liver anatomy

- Classic lobes – right and left
  - Cantlie’s line: gallbladder bed and the vena cava – imaginary line...Cantlie in 1898
- Falciform ligament
  - Further divide the left lobe into medial segment and lateral segment
- Couinaud
  - divide the liver into 8 functional segments base on their blood supply and biliary drainage
- Glisson’s sheath
  - surround the portal pedicles
Falciform Ligament

Cantlie's line
Notice the surface anatomy of liver, lying high up in the rib cage therefore risk of injury during chest trauma / pleural tapping etc....
Surface Anatomy

Even higher when patient lies down....
Liver surgery-anatomy

- **Trisegmentectomy**
  - Right lobe + medial segment of Left lobe
  - Left lobe + either anterior or posterior segment of Right lobe
- **Lobectomy**
  - Either entire Right or Left lobe
- **Segmentectomy**
  - Removal of an anatomical Couinaud’s segment
- **Non anatomical resection**
  - Wide local excision
A patient is referred to your office with liver lesion

Benign lesion?

Secondary malignant lesion?

Primary malignant lesion?
Classification

Benign
- Cysts
- Hemangioma
- Focal nodular hyperplasia
- Adenoma

Malignant

1. Primary liver cancers
   - Hepatocellular carcinoma
   - Cholangiocarcinoma
   - Hepatoblastoma

2. Metastases
Liver
Cysts

• Simple cysts
  – Asymptomatic
  – Large size – pain
  – Complications... haemorrhage / abscess
  – Drainage / Marsupialization of the cyst (lap / open)

• Hydatid Cyst

• Polycystic Liver Disease
  – Other organs – spleen / kidneys
  – Auto Dominant (when associate with kidneys chromosome 16)
  – Asymptomatic
  – Complications:
    • Haemorrhage into cyst
    • Secondary infection – abscess
    • Liver dysfunction – totally replaced by cysts... liver transplant
Liver Hemangioma

- Female (puberty, pregnancy, oral contraceptive use, androgen therapy)
- Symptoms relate to size
  - Size: pain, rupture
  - Local pressure: bile duct obstruction / gastric outlet obstruction (very rare)

- Surgery only for very large size with symptom
  - Since risk of rupture
  - Severe symptoms
  - Inability to exclude malignancy
CT/Hemangioma
Focal Nodular Hyperplasia (FNH)  
Clinical Features

• Benign nodule formation of normal liver tissue
• Central stellate scar
• More common in young and middle age women
• No relation with sex hormones
• Usually asymptomatic
• May cause minimal pain
Focal Nodular Hyperplasia (FNH) Diagnosis and management

**Diagnosis:**
- US: Nodule with varying echogenicity
- CT: Hypervascular mass with central scar
- MRI: iso or hypo intense
- FNA: Normal hepatocytes and Kupffer cells with central core.

**Treatment:**
- No treatment necessary
- Pregnancy and hormones OK
CT/FNH
Hepatic Adenoma

Clinical features

• Benign neoplasm composed of normal hepatocytes no portal tract, central veins, or bile ducts
• More common in women
• Associated with contraceptive hormones (dose and duration dependent)
• Usually asymptomatic but may have RUQ pain
• Mat presents with rupture, hemorrhage, or malignant transformation (very rare)
Hepatic Adenoma
Diagnosis and Management

**DX**
- US: filling defect
- CT: Diffuse arterial enhancement
- MRI: hypo or hyper intense lesion
- FNA: may be needed

**Tx**
- Stop hormones
- Observe every 6m for 2 y
- If no regression then surgical excision (>5cm)
- If bleeding >> selective hepatic artery embolization
Adenoma
Malignant Liver Tumors
Malignant Liver Tumors

- **Primary**
  - **Hepatocellular Carcinoma**
    - 85-90% of all primary liver malignant tumour
  - Cholangiocarcinoma
  - Angiosarcoma
  - Hepatoblastoma

- **Metastases**
  - Colon
  - Breast
  - Lung
  - etc....
HCC: Incidence

- The most common primary liver cancer
- The most common tumor in Saudi men
- Increasing in US and all the world
HCC: Risk Factors

The most important risk factor is **cirrhosis** from any cause:

- Hepatitis B (integrates in DNA)
- Hepatitis C
- Alcohol
- Aflatoxin
- Other
US: HCC
CT: Arterial Phase
HCC Management

- Curative Vs Palliative intent
  - Assess the clinical stage of the disease
  - Assess the patient liver status / function
  - Assess the tumor anatomical resectability
HCC
Treatment / Therapy

- Surgical Resection
- Local Ablative Therapies
  - Ethanol injection
  - RFA radiofrequency ablation
  - Cryosurgery
  - Laser ablation
- Chemotherapy
  - Local Chemotherapy
    - TACE
      - transarterial chemo-embolization
    - TOCE
      - transarterial oily chemo-embolization
  - Intraarterial infusion
    - surgically placed arterial catheter, need to ligate other branches... right gastric, cholecystectomy & cystic artery ligation... before starting the infusion
- Systemic Chemotherapy
- Multimodality Therapy
  - Chemoirradiation
RFA
Percutaneous Ethanol Injection
Chemoembolization
Liver metastasis
Secondaries

- Aggressive approach
- **Exclude extrahepatic disease** before consider surgery
- Single met lesion
  - 5 years survival 35%
  - 5 years disease free survival 25%
- Multiple met lesions
  - 5 years survival 25-37%
  - 5 years disease free survival 20-30%
- Repeated resection for recurrent liver met
  - 5 years survival
    - After first resection 43%
    - After second resection 22%
Liver metastasis
(Colon carcinoma)

Imaging modalities

- Triple phase enhanced CT
- MRI with hepatocyte specific agent
Liver metastasis
(Colon carcinoma)

Treatment modalities

- Liver resection (Future liver remnant)
- Ablation
- Liver directed therapy
- Chemotherapy
Liver metastasis
(Colon carcinoma)

Scenario 1:
• Synchronous liver metastases diagnosed at time of workup
  - Status of primary (perforation, bleeding, obstruction) -
  > no
  - Assessment of liver disease, resectable? -> yes
  - Presence of extrahepatic disease -> no

Surgical approach
✓ Conventional approach; primary+chemotherapy then liver
  ✓ Simultaneous resection + chemotherapy
✓ Liver first approach: liver then primary + chemotherapy
Liver metastasis
(Colon carcinoma)

Scenario 2:
- Synchronous liver metastases diagnosed at time of colon resection
  - confirm diagnosis with wedge biopsy
  - proceed with colon resection
  - postoperative workup for liver metastasis

Scenario 3:
- Liver metastases present after colon resection
  - Assessment of liver disease, resectable? -> yes
  - Presence of extrahepatic disease -> no
Liver Surgery
Minimally invasive approach

Br j surg 2006
Laparoscopic liver resection
E. Vibert, T. Perniceni, H. Levard, C. Denet, N. K. Shahri, B. Gayet

• Better venous collateral drainage less ascitis
• Abdominal wall preserved diafragmatic kinetic
• Less adhesions (further surgery)
• Better vision of deep vascular structures
• Less blood loss
• Decreased hospital stay
• Similar survival rate
Liver Surgery
Minimally invasive approach

Ann Surg 2006
Laparoscopic liver resection for peripheral hepatocellular carcinoma in patients with chronic liver disease

- Conversion rate 26%
- 18% due to mild bleedings
- Time consuming
- Surgeon experience
- Laparoscopic hepatic transection
- Resection margin
Liver Surgery
Minimally invasive approach

ANZ J. Surg. 2007; 77: 948–953
LAPAROSCOPIC HEPATECTOMY, A SYSTEMATIC REVIEW
Laurence JM, Lam VW, Langcake ME, Hollands MJ, Crawford MD, Pless HC.

1996 - 2006
Pub med + Embase

321 Abstracts (239 excluded as non-English or animal or non-relevant)

82 Full articles (54 excluded as case reports, hand assisted, sequential/duplicate, reviews)

28 Final Study - 703 Pts
LAPAROSCOPIC LIVER SURGERY

Background

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Liver Surgery
Minimally invasive approach

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Conversion rate 8.1% (28 - 0)

Complications 17.6% (40 - 0)

Bile leaks 1.1%

Patient transfused 11.7%

Portal triad clamping time increased (p<0.050)
ROBOTIC Liver Surgery
Minimally invasive approach: WHERE AND WHY

• Hylum dissection

• Selective control of hepatic pedicle (no Pringle)

• Caval axis dissection
  With hepatic vein section

• Parenchimal transection

• Bleeding and biliary leakage control
Liver Surgery
Minimally invasive approach

“Robotic liver Surgery. Results for 70 resections”
Giulianotti PC, Coratti A, Sbrana F.
Surgery Jan 2011

Totally robotic right hepatectomy: surgical technique and outcomes

Robot assisted laparoscopic extended right hepatectomy
With biliary reconstruction
Giulianotti PC, Sbrana F et al., J laparoendosc Surg Tech, March 2010
ROBOTIC Liver Surgery
Minimally invasive approach

Hepatic Surgery: treatment of choice in colorectal metastasis

“Hepatic resection is the treatment of choice for colorectal liver metastases. RFA alone or in combination with resection for unresectable patients does not provide survival comparable to resection, and provides survival only slightly superior to nonsurgical treatment.”

“As the advancing of the management of liver metastases of colorectal cancer, more patients will become candidates for and benefit from potentially curative surgical resections. Optimal effect could only be achieved when used in a manner tailored to the individual patient.”

“Surgery is currently the only potentially curative treatment with a five year survival rate after hepatectomy from 26% to 49%.”
Biasco G et al., Cancer Treat Rev. 2006 May;32(3):214-28
ROBOTIC Surgery

- FEASIBILITY STUDIES COMPLETED !!

- IT’S TIME TO PLAN:
  - RANDOMIZED
  - PROSPECTIVE
  - MULTICENTRIC
  - CLINICAL TRIALS

Learning curve
Time consuming
High volume Institution
Now, this is not the end.  
It is not even the beginning of the end.  
But it is, perhaps,  
the end of the beginning.