Surgical Management of Hepatocellular Carcinoma – Preoperative and Intraoperative strategies

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Hepatocellular carcinoma (HCC) is the fifth most common tumor worldwide. It is the tumor with the largest increase in incidence over the last 12 years and majority occur in cirrhotic liver. Furthermore, the overall survival of patients with HCC has not improved over the last 20 years, with the incidence rate almost equal to the death rate. It is projected that the increase in incidence of HCC will continue over the next 20 years.
Introduction

Traditionally Liver surgery for HCC IS associated with high mortality and morbidity

- Intraoperative bleeding
- Postoperative liver failure
- Postoperative biliary complications
- Infective complications
- Technology & Expertise – lack of it
Factors contributing to better outcome

- Better understanding of Anatomy - improved imaging and assessment
- Improved surgical skills, anaesthesia and technology
- Blood bank facilities
- Perioperative care
- Dedicated centers with expertise and infrastructure doing good volumes
- Advent of Liver Transplantation
Strategies contributing to better outcome

- Staging
- Stabilisation
- Structure
- Surgery
- Surgical Technique
Strategies contributing to better outcome

Staging
Staging of HCC

Four key factors that may affect the prognosis of patients with HCC have been identified:

1. Tumor stage at diagnosis
2. Overall health of the patient
3. Hepatic synthetic function
4. Efficacy of treatment

Several prognostic staging systems have been proposed for HCC.
There is lack of consensus on HCC staging system.

There is also a lack of standardization regarding the tests needed to determine tumor burden and extent of spread of HCC, which impede accurate staging.
Staging of HCC

- Performance status had been shown to be an independent predictor of survival

- MELD score was a better predictor of survival compared in patients waiting for a liver transplantation
**Staging of HCC**

- BCLC system has the best prognostic power for survival compared with the other systems.

- The superiority of the BCLC system over other tumor staging systems persists when separate analyses were performed for patients who did not undergo liver transplantation, indicating that it provided better stratification of HCC patients at both intermediate and advanced stages.
Strategies contributing to better outcome
Among the potentially curative treatment options for hepatocellular carcinoma (HCC), liver resection is widely considered the mainstay of curative therapy when compared with percutaneous ablation therapies or transarterial chemoembolization (TACE), surgery has a higher risk as a result of removal of functioning liver Parenchyma.

Careful assessment of the clinical severity of cirrhosis and the liver functional reserve is therefore pivotal to ensure suitable selection of appropriate candidates for resection.
Optimising the Outcome of Surgery

On the basis of preoperative imaging, hepatic resection is nowadays considered to be feasible

1) when all tumor nodules can be technically excised with negative margins while maintaining an adequately functioning hepatic remnant

2) when the clinical performance status is >50% to 60% and systemic comorbidity is compensated
Optimising the Outcome of Surgery

- **Contra indications**
  - Extrahepatic disease
  - Tumor thrombus in the inferior vena cava
  - Involvement of the common hepatic artery
  - Involvement of portal vein trunk

*AASLD Guidelines*
Optimising the Outcome of Surgery

Assessment

- Child Pugh Score

- ICG - an ICG retention rate at 15 minutes (ICG R15) of 10% to 20% is considered the upper limit for safe major hepatic resection

- OGTT

Another important factor in surgical risk assessment is the presence of underlying hepatitis, which can be inferred from preoperative liver function tests.

Serum aspartate transaminase more than twice normal values is predictive of liver failure in patients with cirrhosis after major hepatectomy.

Optimising the Outcome of Surgery

Remnant liver ratio (CT volumetry)

- > 35% : safe
- 30% ~ 35% : marginal
- 30% > : risky

Remnant liver ratio =
\[
\frac{\text{estimated whole liver volume} - \text{estimated residual volume}}{\text{estimated whole liver volume}}
\]
Portal Vein embolisation

- PVE can be used to preoperatively increase the volume and improve the function of the FLR and avoid the abrupt increase in the portal venous pressure after liver resection.

- Although normal livers have a better regenerative capacity than do fibrotic or cirrhotic ones, several studies have shown that PVE induces clinically important hypertrophy of the FLR in patients with chronic disease thereby reducing the risk for postoperative hepatic insufficiency.

Contraindications to PVE include:

* Tumor invasion of the portal vein to be resected because the portal flow is already diverted
* Tumor extension to the FLR
* Uncorrectable coagulopathy
* Portal hypertension
* Renal failure

In patients with biliary obstruction, PVE is contraindicated before drainage of FLR

Strategies contributing to better outcome
Better results in recent times

Better Operation theatre facilities & equipment

* State of art ICUs
* Improved Anaesthesia skills
* Improvement in Blood Transfusion
* Better Medications

Improved surgical skills
Dialysis

Prometheus

MARS

CRRT
Newer Hemostatic Modalities

- Harmonic Scalpel
- Argon Beam Coagulator
- Ligasure Tissue Sealing System
- Plasma Kinetic (PK) Bipolar System
Endoscopic Linear Staplers

- Tissue isatraumatically crushed before firing
- Deploy 3 parallel rows of staples
- Improved flexibility (angled)
- Entire target tissue with in active area of staple
Intraoperative USG

Essential tool
- Lesions < 1 cm missed on preoperative imaging
- Identify tumour margins
- Vascular Landmarks

Identifies tumour nodules not identified on laparoscopy in 33%

Change of Surgical Strategy in 38%

Strategies contributing to better outcome

Surgery
## Types of Resection

### First-order division

<table>
<thead>
<tr>
<th>Anatomical Term</th>
<th>Couinaud segments referred to</th>
<th>Term for surgical resection</th>
<th>Diagram (pertinent area is shaded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hemiliver</td>
<td>Sg 5-8 (+/-Sg1)</td>
<td>Right Hepatectomy OR Right Hemihepatectomy (stipulate +/segment 1)</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>OR Right Liver</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Left Hemiliver</td>
<td>Sg 2-4 (+/-Sg1)</td>
<td>Left Hepatectomy OR Left Hemihepatectomy (stipulate +/segment 1)</td>
</tr>
<tr>
<td>OR Left Liver</td>
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**Border or watershed:** The border or watershed of the first order division which separates the two hemilivers is a plane which intersects the gallbladder fossa and the fossa for the IVC and is called the midplane of the liver.

### Second-order division

(second-order division based on bile ducts and hepatic artery)

<table>
<thead>
<tr>
<th>Anatomical Term</th>
<th>Couinaud segments referred to</th>
<th>Term for surgical resection</th>
<th>Diagram (pertinent area is shaded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Anterior Section</td>
<td>Sg 5,8</td>
<td>Add (-ectomy) to any of the anatomical terms as in Right anterior sectionectomy</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Right Posterior Section</td>
<td>Sg 6,7</td>
<td>Right posterior sectionectomy</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Left Medial Section</td>
<td>Sg 4</td>
<td>Left medial sectionectomy OR Resection segment 4 (also see Third order) OR Segmenectomy 4 (also see Third order)</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Left Lateral Section</td>
<td>Sg 2,3</td>
<td>Left lateral sectionectomy OR Bisegmenectomy 2,3 (also see Third order)</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>
Parenchyma Sparing Surgery

- For a conservative approach, the extensive use of IOUS guidance is indispensable.

- It minimizes the tumor-free resection margins, without the need for a 1-cm safety margin, while achieving negative margin resection.

- This approach may also be associated with a lower expression of growth factors after surgery, which seems related to liver regeneration and tumor recurrence.

- This is useful in lesions close to caval confluence.

Surgical technique
Rt Hepatectomy

Mobilisation
Rt Hepatectomy

Pedicle Ligation
Rt Hepatectomy

Outflow Dissection
Parenchymal Dissection
Laparoscopic Liver resection

- Advanced laparoscopic procedure
- Only few centres worldwide
- Safe but demanding surgery
- Enabled by improved technology
- Careful patient selection important
Approaches

- Totally laparoscopic
- Hand assisted laparoscopic (HALS)

Advantages –
- Avoids large Chevron incision
- Reduced Operative blood loss
- Lower major post op morbidity
- Shorter hospital stay
- Patients with HCC awaiting liver transplantation – Less scarring /adhesions after laparoscopic resection
Ports Placement

- Five/Six Ports Technique
Hilar Dissection

- Normal liver tolerates up to 60 min clamping
- Cumulative clamping (15 min/5 min) up to 180 minutes well tolerated by Cirrhotics
- Longer Clamping time required for Cirrhotics/Fatty liver due to Coagulopathy and Fibrotic liver

Parenchymal transection

- Hemostasis important esp for large non anatomical resection / Cirrhotic liver

- Balance Hemostasis against damage to remaining tissue / Vital structures

- Tools – Bovie cautery
  - Harmonic Scalpel
  - CUSA with Clips
  - Tissue link devices
  - Staplers
Parenchymal transection

**Vascular Staplers**
- Anatomically limited space
- For major vascular structures
- Cost is a consideration

**Harmonic Scalpel**
- Higher incidence of biliary leaks
- Does not effectively seal biliary radicals
- Blades of insufficient length for large portal veins
- Combined with other methods by some

Parenchymal transection

ABC –
- For ooze from parenchyma or liver surface bleed
- Small risk of gas embolism; Vent should be kept open

Ligasure –
- Relies on collagen content of vessels
- Not suitable for thin walled veins

Oncologic Perspective

- **Initial reports** –
  - Concerns about port site recurrence and early local recurrence

- **Current reports** –
  - No increase in incidence of early local recurrence or positive margins


Conclusions

- Liver surgery for HCC is safe and effective

- Patient selection based on proper preoperative staging determines the surgical outcome

- Proper preoperative assessment of Liver function helps in guiding peroperative and intraoperative strategies to maximise the outcome

- Laparoscopic surgery though technically demanding can be adopted to HCC with out compromising on the oncological outcome

- OLT helps significant number patients who are otherwise unresectable to get cure for HCC
Thank you