Hepatic parenchymal transection techniques

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Requirements for laparoscopic vs open liver resection

1. Laparoscopic liver resection should not be more dangerous (morbidity&mortality)

2. The procedure should not be much more expensive

3. At least no difference in oncological outcomes

4. All the advantages of laparoscopic approach should be preserved (rapid recovery of physical activity, cosmeticity, etc.)
The differences in liver parenchyma transection between laparoscopic and open liver resection

Disadvantaged

1. Restriction of manipulation

2. Lack of option to control bleeding manually (compress by hand if HALS is not applied)

3. Long time hemostasis if large bleeding occurred

4. Need to have experienced cameraman (cleanness of optics maintenance during bleeding, optimal visualization of the source of bleeding, etc)
The differences in liver parenchyma transection between laparoscopic and open liver resection

Advantages

1. Caudal approach versus ventral approach (better view of IVC and posterior aspect of Glissonean hilum)

2. Magnification of small and large tubular structures

3. Option to use elevation of intra-abdominal pressure during bleeding from hepatic vein and IVC
Type of parenchyma destructions:

1. Crash technique (including by dissectors, any energy devise etc)
2. CUSA
3. Water-jet dissection
4. LigaSure
5. Stapler technique
Conclusions: The clamp–crush technique is more rapid and is associated with lower rates of blood loss and otherwise similar outcomes when compared with other methods of parenchymal transection (Cavitron ultrasonic surgical aspirator [CUSA], the hydrojet and the radiofrequency dissection sealer).
This meta-analysis does not indicate a benefit of any alternative transection technique on patients’ perioperative outcome compared with the clamp-crushing technique. The clamp-crushing technique remains the reference technique for transection of the parenchyma in elective hepatic resection.
8 randomized controlled trials and 7 nonrandomized studies evaluating 1539 patients

Conclusion. Of the 3 modalities used in liver resection (VSS, CUSA, and RFDS), only VSS appeared to offer significant benefit over standard CC. However, the generalization of our findings is limited by the scarcity and clinical heterogeneity of the published studies.
Liver parenchyma transection techniques in laparoscopic surgery

No meta-analysis or completed prospective randomized trial exist on liver parenchyma transection in laparoscopic surgery
Conclusion The two devices were safe and effective for LH in patients with cirrhosis. The LigaSure method may be a simple, feasible, and cost-effective surgical technique for LH in selected HCC patients with cirrhosis.
Principles of liver parenchyma transection

1. Inflow with/without outflow control
2. Low CVP
3. Application of cutting energy devices for superficial layers of parenchyma
4. Deep layers of parenchyma needed to be dissected by any type of crushing technique in order to expose large tubular structures for their safe encircling and dividing.
5. Equipment for parenchyma destruction is usually combines with bipolar device for bleeding control from small hepatic veins and temporary hemostasis by compression if large vessel is damaged
Bipolar forceps and energy work station

Erbe VIO 300D
Electrosurgical Unit

Erbe BiClamp forceps for coagulation
FDA approved vessel sealing up to 7 mm
Laparoscopic crush technique with bipolar forceps
Combination of CUSA with bipolar forceps
Parenchyma transection with WaterJat (ERBEJET 2)

- ERBEJET 2
- Applicator (with canal for aspiration)
- Aspiration module
- Cart
- Pedal
- Piston pump for applicator
- Saline
- Container for aspirated liquid
Display for Setting (ERBEJET 2)

- Water Jet pressure setting (up to 80 Bar)
- Power setting for aspirator
Selective effect of water jet
Selective dissection
Blood vessels and nerves are preserving

Selective effect of water jet
Histology: comparing

Electrosurgery  Laser  Water jet

Selectivity of Water Jet

Rate of vessels preserved

Applicator outlet: Ø 120 µm

Vessels diameter

- 0.1 - 0.3 mm
- 0.3 - 0.7 mm
- 0.7 - 1.5 mm
- > 1.5 mm

80 bar
60 bar
40 bar
20 bar
Water Jet Applicators

For open surgery

With integral canal for aspiration

With integral canal for aspiration and monopolar coagulation

Laparoscopic

With integral canal for aspiration. Diameter 6 mm, length 306 mm

Without canal for aspiration, diameter 5 mm, length 336 mm, with curved tip
Water Jet Advantages

**Advantages**

- Blood loss decrease
- Better operation field visual control
- Lack of necrotic tissue, better wound healing
- No thermal and unintentional mechanical damage
- Shorter procedure time
Comparison with ultrasound destruction

image courtesy of Minoru Tanabe, MD, PhD, Department of Hepatobiliary & Pancreatic Surgery, Tokyo Medical and Dental University
The blood loss volume relative to dissection surface area

In open surgery

<table>
<thead>
<tr>
<th>Method</th>
<th>Blood loss versus dissection surface (ml/cm²)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt dissection</td>
<td>72.72 ± 49.7</td>
<td>279</td>
</tr>
<tr>
<td>CUSA</td>
<td>18.26 ± 30.13</td>
<td>175</td>
</tr>
<tr>
<td>Waterjet</td>
<td>10.75 ± 15.35</td>
<td>350</td>
</tr>
</tbody>
</table>

Source: Rau et al., 2008
## The resection time relative to dissection surface area

### In open surgery

<table>
<thead>
<tr>
<th>Method</th>
<th>Rejection time versus resection surface (min/cm²)</th>
<th>n</th>
<th>Pringle time (min/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt dissection</td>
<td>0.77±1.75</td>
<td>279</td>
<td>0.23±0.56</td>
</tr>
<tr>
<td>CUSA</td>
<td>0.48±0.85</td>
<td>175</td>
<td>0.29±0.47</td>
</tr>
<tr>
<td>Waterjet</td>
<td>0.29±0.67</td>
<td>350</td>
<td>0.13±0.18</td>
</tr>
</tbody>
</table>

Source: Rau et al., 2008
Combination of WaterJet with bipolar forceps
Prospective randomized study (ClinicalTrials.Gov)

Comparison of Hydro-dissection Versus Ultrasonic Aspirator in Division of Liver Parenchyma in Laparoscopic Resection (LLS)

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. Know the risks and potential benefits of clinical studies and talk to your health care provider before participating. Read our disclaimer for details.

Sponsor:
Moscow Clinical Scientific Center

Information provided by (Responsible Party):
Ivan Kazakov, Moscow Clinical Scientific Center
1. At present there are no proven data in favor of any available method of liver parenchyma transection in laparoscopic surgery

2. The choice of any technique in parenchyma destruction depends on surgeon preference and his own experience

3. Randomized prospective trials are needed to clarify the situation
Thank you for your attention!