Laparoscopic redo liver resection

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Introduction

• Surgery can be the only curative option for operable malignant liver disease.
• Recurrence after surgery:
  – CRLM & HCC: up to 70%\textsuperscript{1,2}
• Repeat resection can be curative especially in patients with liver only recurrence


Potential challenges!!

- Surgically altered liver anatomy
- Adhesions after previous resection
- Difficult achievement of Pringle’s control
- Less liver volume!

→ Laparoscopically, those challenges can be magnified!!!
Potential advantages !!

- All the inherent benefits of laparoscopic approach (less blood loss, shorter hospital stay, less complications)
- Less adhesions and distortions for future re-re resections
Feasibility and clinical scenarios
Segment IVA resection after Laparoscopic Right hemihepatectomy
Posterior segment, lesion near major vessel
Metastasectomy seg 2/3 after open extended Right
Lesion adjacent to vascular pedicle
Limited liver volume
challenging inflow control
After LLS in a 2 stage hepatectomy
The First European Guidelines Meeting on Laparoscopic Liver Surgery
10th-11th February 2017

9th February Pre-Congress Technical Course

Southampton, UK
Hilton at the Ageas Bowl, Southampton
The Ageas Bowl Stadium, Botley Road, Southampton, SO30 3XH, United Kingdom

Witness the establishment of the first European guidelines for laparoscopic liver surgery, with updates of the latest techniques and evidence.

Attend the pre-congress course with lectures from the most renowned laparoscopic liver surgeons.

Five oral presentations will be selected from the best submitted abstracts.

Endorsed by
Redo LLS: literature search

Strategy
• Pubmed: September 2016 and January 2017
  - liver resect* [tiab] OR hepatectomy* [tiab]
  - AND laparoscopic* [tiab])
  - AND (redo [tiab] OR repeat [tiab] OR recurrent [tiab] OR previous liver surgery [tiab] or previous liver resection [tiab])

Inclusion criteria
• Patients: adult patients with previous liver surgery (open or laparoscopic)
• Intervention: laparoscopic liver surgery
• >10 patients
Results

**Excluded:** 42
- <10 patients: 8
- not English: 6
- different patients: 26
- Editorials/letters: 2

**Included:** 8
- Kanazawa et al. 2013 *J Hepatobiliary Pancreat Sci*
- Belli et al. 2009 *Surg Endosc*
- Shafee et al. 2010 *JACS*
- Shelat et al. 2014 *World J Surg*
- Isetani et al. 2015 *World J Gastroenterol*
- Chan et al. 2014 *World J Surg*
- Cioffi et al. 2015 *Hepatoma Res*
- Nomi et al. 2016 *Ann Surg*
- Goh et al. 2016 *J Laparoendosc Adv Sur Tech*
Feasibility

Brian Goh et al. 2016
Level of evidence: 2++

- Systematic literature review including 10 studies reporting on 103 patients undergoing laparoscopic repeat resection for recurrent HCC (no meta-analysis)

- **Conclusion:** laparoscopic repeat resection is feasible and safe in many different settings
Redo after open vs. redo after lap

Zahra Shafee et al. 2010
Is Laparoscopic Repeat Hepatectomy Feasible? A Tri-institutional Analysis. JACS
Level of evidence: 2-

- Retrospective, multicenter analysis of 45 laparoscopic repeat resections after previous LLR vs 31 laparoscopic repeat resections after previous OLR

- Previous OLR resulted in increased blood loss, but this did not influence post-op complication rate
Lap vs. open redo

Akishige Kanazawa et al. 2013
Laparoscopic liver resection for treating recurrent hepatocellular carcinoma. *Journal of Hepatobiliary Pancreatic Sciences*

Level of evidence: 2-

- Retrospective analysis of 20 laparoscopic vs 20 open repeat liver resections

- Significantly less blood loss and complications in the laparoscopic group and shorter hospital stay
Primary vs. redo resection

Vishal Shelat et al. 2014

Outcomes of Repeat Laparoscopic Liver Resection Compared to the Primary Resection. *World J Surg* **Level of evidence: 2**-

- Retrospective analysis of 20 laparoscopic repeat resection vs 19 laparoscopic primary resections

- Repeat resection increased blood loss, operating time and conversion but this did not impact hospital stay or post-op complications
The Southampton Guidelines for Laparoscopic Liver Surgery:

From Indication to Implementation

Mohammad Abu Hilal\textsuperscript{c, 1}, Luca Aldrighetti\textsuperscript{s, 2}, Ibrahim Dagher\textsuperscript{s, 3}, Bjorn Edwin\textsuperscript{s, 4}, Roberto Ivan Troisi\textsuperscript{s, 5}, Ruslan Alikhanov\textsuperscript{e, 6}, Somaiah Aroori\textsuperscript{e, 7}, Giulio Belli\textsuperscript{e, 8}, Marc Besselink\textsuperscript{e, 9}, Javier Briceno\textsuperscript{e, 10}, Brice Gayet\textsuperscript{e, 11}, Mathieu D'Hondt\textsuperscript{e, 12}, Mickael Lesurtel\textsuperscript{e, 13}, Krishna Menon\textsuperscript{e, 14}, Peter Lodge\textsuperscript{e, 15}, Fernando Rotellar\textsuperscript{e, 16}, Julio Santoyo\textsuperscript{e, 17}, Olivier Scatton\textsuperscript{e, 18}, Olivier Soubrane\textsuperscript{e, 19}, Robert Sutcliffe\textsuperscript{e, 20}, Ronald Van Dam\textsuperscript{e, 21}, Steve White\textsuperscript{e, 22}, Mark Halls\textsuperscript{1}, Federica Cipriani\textsuperscript{2}, Marcel Van der Poel\textsuperscript{e, 9}, Ruben Ciria\textsuperscript{2}, Leonid Barkhatov\textsuperscript{4}, Yrene Gomez-Luque\textsuperscript{9}, Sira Ocana-Garcia\textsuperscript{2}, Andrew Cook\textsuperscript{M, 23}, Joseph Buell\textsuperscript{v, 24}, Pierre Alain Clavien\textsuperscript{v, 25}, Christos Dervenis\textsuperscript{v, 26}, Giuseppe Fusa\textsuperscript{i, 27}, David Geller\textsuperscript{v, 28}, Hauke Lang\textsuperscript{v, 29}, John Primrose\textsuperscript{v, 1}, Mark Taylor\textsuperscript{v, 30}, Thomas Van Gulik\textsuperscript{v, 9}, Go Wakabayashi\textsuperscript{v, 31}, Horacio Asbun\textsuperscript{v, 32}, Daniel Cherqui\textsuperscript{v, 33}
# Recommendations

## Session 2 - PATIENTS and COMPLEX DISEASES

### Topic 5: HIGH RISK PATIENTS

<table>
<thead>
<tr>
<th>CQ7: Are there contraindications for LLR in elderly and high BMI patients (fragile patients)?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R7.1</strong> - In Elderly patients a laparoscopic approach appears to offer advantages in terms of shorter hospital stay and lower complication rates.</td>
</tr>
</tbody>
</table>

| **R7.2** - Increasing age is not in itself a contraindication to laparoscopic liver resection. Surgeons should be aware of the potential decrease in physiologic reserve of these patients and should have a low threshold for conversion. | 2++ | Strong |

| **R7.3** - Obesity is not a contraindication to laparoscopic liver resection. | 2+ | Strong (Upgraded from conditional) |

## Topic 6: REDO LIVER RESECTIONS

<table>
<thead>
<tr>
<th>CQ8: Are LLR feasible in patients with previous liver resections?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R8</strong> - In experienced hands and with strict patient selection, laparoscopy is an appropriate option in patients requiring repeat liver resection.</td>
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</table>
Conversion for Unfavorable Intraoperative Events Results in Significantly Worst Outcomes During Laparoscopic Liver Resection

Lessons Learned From a Multicenter Review of 2861 Cases

Mark C. Halls, MBBS, † Federica Cipriani, MD, † Giampaolo Berardi, MD, ‡ Leonid Barkhatov, MD, § Panagiotis Lainas, MD, ‡ Mohammed Alzoubi, MD, † Mathieu D’Hondt, PhD, †|| Fernando Rotellar, PhD, # Ibrahim Daghr, PhD, ‡ Luca Aldighetti, PhD, ‡ Roberto I. Troisi, PhD, ‡ Bjorn Edwin, PhD, §
and Mohammed Abu Hilal, MD, PhD*

Objective: To investigate the risk factors for conversion during laparoscopic liver resection and its effect on patient outcome in a large cohort of patients. Additional analysis of outcomes in patients who required conversion for unfavorable intraoperative events will be performed to establish if the cause of conversion affects outcome.

Summary Background Data: Multiple previous studies demonstrate that laparoscopic liver surgery reduces intraoperative blood loss, hospital stay, and morbidity while maintaining comparable oncological and survival outcomes when compared with open liver resections. However, limited information is available regarding the possible sequelae of conversion to open surgery, especially with regards to cause of conversion.

Methods: A retrospective analysis of 2861 cases from prospectively maintained databases of 7 tertiary liver centers across Europe was performed.

Results: Neo-adjuvant chemotherapy, previous liver resection(s), resections for malignant lesions, postero-superior location, and the extent of the resection are associated with an increased risk of conversion. Patients who require conversion have longer operations with higher blood loss; a longer HDU and total hospital stay; increased frequency and severity of complications; and higher 30- and 90-day mortality. Patients who had an elective conversion for an unfavorable intraoperative finding had better outcomes than patients who had an emergency conversion secondary to an unfavorable intraoperative event in terms of HDU and total hospital stay; severity of complication; and 90-day mortality.

Conclusions: Our study highlights the risk factors for conversion and suggests that conversion for unfavorable intraoperative events is associated with worse outcomes.

liver resection to be performed. In 1992, Gagner et al described the first laparoscopic nonanatomical wedge resection of focal nodular hyperplasia and 4 years later Azagra et al reported the first anatomical liver resection.

At present no data from randomized control trials is available, however a significant body of work already exists that demonstrates that laparoscopic liver surgery (LLS) reduces intraoperative blood loss, hospital stay, and morbidity while maintaining comparable oncological and survival outcomes with similar financial cost to its open counterpart.

As with open liver surgery, bleeding still remains a concern for surgeons performing LLS and it represents the most common cause of conversion to open surgery. The largest case series to date suggests that the average conversion rate is 10%, based on retrospective analysis of 1184 major resections between 1996 and 2014. Other studies have reported increased conversion rates in the following: patients aged over 75, patients having received neo-adjuvant chemotherapy, patients with a high BMI, increasing lesion size, lesions within the postero-superior segments, the presence of cirrhosis, the need for Pringle manoeuvre, higher intraoperative blood loss and surgeons in the early phases of the learning curve. However, these studies are all limited by their relatively small patient cohorts. A few of these studies raise the point that conversion does not increase operative time; however, it results in the loss of the beneficial aspects of laparoscopic surgery, in terms of reduced morbidity, blood loss, hospital stay, and mortality.

2861 cases from 7 tertiary liver centers across Europe was performed.
### TABLE 2. Patient Demographics

<table>
<thead>
<tr>
<th>Previous Liver Resection (n)</th>
<th>Conversion Rate (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No previous resections (2606)</td>
<td>7.0% (182)</td>
</tr>
<tr>
<td>1 previous liver resection (241)</td>
<td>13.7% (33)</td>
</tr>
<tr>
<td>2 previous liver resections (26)</td>
<td>23.1% (6)</td>
</tr>
<tr>
<td>3 previous liver resections (4)</td>
<td>25.0% (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesion Size (n)</th>
<th>Conversion Rate (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3 cm (1518)</td>
<td>6.0% (92)</td>
</tr>
<tr>
<td>3–5cm (755)</td>
<td>8.5% (64)</td>
</tr>
<tr>
<td>&gt;5 cm (588)</td>
<td>11.2% (66)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resection Extent/Volume (n)</th>
<th>Conversion Rate (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wedge/atypical segmentectomy (1283)</td>
<td>5.6% (71)</td>
</tr>
<tr>
<td>Anatomical segmentectomy (435)</td>
<td>9.5% (41)</td>
</tr>
<tr>
<td>Bisegmentectomy/sectionectomy (713)</td>
<td>5.5% (39)</td>
</tr>
<tr>
<td>Trisegmentectomy/hemi-hepatectomy (410)</td>
<td>16.6% (68)</td>
</tr>
<tr>
<td>Extended hepatectomy (19)</td>
<td>15.8% (3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resection Classification (n)</th>
<th>Conversion Rate (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor (1720)</td>
<td>4.4% (76)</td>
</tr>
<tr>
<td>Technical major (anatomically minor resections involving segments 1, 4a, 7 or 8) (712)</td>
<td>10.7% (76)</td>
</tr>
<tr>
<td>Anatomical major (429)</td>
<td>16.3% (70)</td>
</tr>
</tbody>
</table>
Conversion for Unfavorable Intraoperative Events Results in Significantly Worst Outcomes During Laparoscopic Liver Resection  
Lessons Learned From a Multicenter Review of 2861 Cases

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**Table 3. Conversion Rates With Respect to Previous Liver Resection, Lesion Size, Resection Extent and Resection Classification**

<table>
<thead>
<tr>
<th>Variables</th>
<th>P Value (Entire Cohort)</th>
<th>Odds Ratio (95% CI) for Entire Cohort</th>
<th>P Value (After 100 Cases)</th>
<th>Odds Ratio (95% C.I.) after 100 Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Gender</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>BMI</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Previous laparoscopic surgery</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Previous open upper abdominal surgery</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Deep lesions (&gt;1 cm from capsule)</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Close proximity to IVC/Hilar structures</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Concurrent procedure (secondary smaller volume liver resections, bowel resections,)</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Lesion size</td>
<td>0.001</td>
<td>1.423 (1.163–1.741)</td>
<td>n/s</td>
<td>0.569 (0.371–0.871)</td>
</tr>
<tr>
<td>Presence of cirrhosis</td>
<td>0.013</td>
<td>1.750 (1.127–2.717)</td>
<td>n/s</td>
<td>1.291 (1.101–1.514)</td>
</tr>
<tr>
<td>ASA (low/high)</td>
<td>0.032</td>
<td>0.680 (0.478–0.967)</td>
<td>0.009</td>
<td>0.569 (0.371–0.871)</td>
</tr>
<tr>
<td>Resection extent</td>
<td>0.003</td>
<td>1.236 (1.072–1.424)</td>
<td>0.002</td>
<td>1.291 (1.101–1.514)</td>
</tr>
<tr>
<td>Neoadjuvant chemotherapy</td>
<td>0.038</td>
<td>1.460 (1.021–2.088)</td>
<td>0.016</td>
<td>1.628 (1.097–2.417)</td>
</tr>
<tr>
<td>Classification of resection</td>
<td>&lt;0.001</td>
<td>1.712 (1.430–2.049)</td>
<td>&lt;0.001</td>
<td>1.870 (1.494–2.340)</td>
</tr>
<tr>
<td>Malignant lesions</td>
<td>0.033</td>
<td>1.721 (1.045–2.835)</td>
<td>0.047</td>
<td>1.922 (1.008–3.662)</td>
</tr>
<tr>
<td>Previous liver resection</td>
<td>&lt;0.001</td>
<td>2.266 (1.626–3.157)</td>
<td>&lt;0.001</td>
<td>2.345 (1.598–3.441)</td>
</tr>
</tbody>
</table>
Conclusions

• Redo LLR are feasible and safe

• They may offer better results than OLR

• Better results after a previous LLR

• They are more complex than primary resections

• Associated with higher conversion rates, blood loss and operative time

• Patients selection and respect of the surgical learning curve is essential
Merci Paris
Pour les emotions,
le partage scientifique et l'amitie