Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

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University Hospital Reina Sofía.
Córdoba. Spain
ERAS (Enhanced Recovery After Surgery)

- Multidisciplinary protocols developed in colorectal surgery (early 90s)
- **Benefits:**
  - Reduction postoperative complications
  - Reduction surgical stress
  - Reduction postoperative stay
  - Early recovery
  - Early access to postoperative chemotherapy
  - Cost reduction

- Needs education of: surgeons / anesthetists / nurses / patients
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

- NG tube: useless
- Routine drains: useless
- Reduction fluid: low CVP
- Patient mobilization: early
- Oral intake: early
- Minimally invasive surgery: beneficial
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

AIMS:

• **Primary**: To analyze the implantation of ERAS protocols in a newly created laparoscopic liver surgery program

• **Secondary**: To analyze the correlation between ERAS applicability and the Iwate difficulty scoring system of laparoscopic liver resections
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• **Primary**: To analyze the *implantation of ERAS protocols* in a newly created laparoscopic liver surgery program

• **Secondary**: To analyze the *correlation between ERAS applicability and the Iwate difficulty scoring system* of laparoscopic liver resections
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

IWATE Criteria

<table>
<thead>
<tr>
<th>Difficulty index</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty level</td>
<td>Low</td>
<td>Intermediate</td>
<td>Advanced</td>
<td>Expert</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index surgery</td>
<td>Left lateral sectionectomy</td>
<td>Right or left hepatectomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Simple and small partial hepatectomy in segment III</td>
<td>Posterior sectionectomy for segment VII tumor ≥ 3 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Scoring system

Tumor location (Couinaud segment)

<table>
<thead>
<tr>
<th>Segment</th>
<th>Score</th>
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<tbody>
<tr>
<td>S1</td>
<td>4</td>
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<tr>
<td>S2</td>
<td>2</td>
</tr>
<tr>
<td>S3</td>
<td>1</td>
</tr>
<tr>
<td>S4a</td>
<td>4</td>
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<tr>
<td>S4b</td>
<td>3</td>
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<tr>
<td>S5</td>
<td>3</td>
</tr>
<tr>
<td>S6</td>
<td>2</td>
</tr>
<tr>
<td>S7</td>
<td>5</td>
</tr>
<tr>
<td>S8</td>
<td>5</td>
</tr>
</tbody>
</table>

Tumor size

<table>
<thead>
<tr>
<th>Score</th>
<th>&lt;3 cm</th>
<th>≥3 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Proximity to major vessel

<table>
<thead>
<tr>
<th>Score</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Main or second branch of Glisson’s tree, major hepatic vein, or inferior vena cava

Extent of liver resection

<table>
<thead>
<tr>
<th>Score</th>
<th>HALS/Hybrid</th>
<th>Liver function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial resection</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>Left lateral sectionectomy</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Segmentectomy</td>
<td>3</td>
<td>Yes</td>
</tr>
<tr>
<td>Sectionectomy and more</td>
<td>4</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Wakabayashi.
Hepatobiliary Surg Nutr 2016
PATIENTS AND METHODS

• January 2014 – October 2016
• From start of LLR program
PATIENTS AND METHODS

- January 2014 – October 2016
- From start of LLR program
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2 PROTOCOLS

• **SFT (SUPER-FAST-TRACK):**
  • Less than 24 hours postoperative stay Low/Intermediate
  • Less than 48 hours postoperative stay Advanced

• **FT (FAST TRACK):**
  • Less than 48 hours postoperative stay Low/Intermediate
  • Less than 72 hours postoperative stay Advanced
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-9 am</td>
<td>Furosemide 20mg</td>
</tr>
<tr>
<td>9-10 am</td>
<td>Urinary catheter</td>
</tr>
<tr>
<td>10 am - 1 pm</td>
<td>Stop oral intake 500 cc Saline iv</td>
</tr>
<tr>
<td>1-3 pm</td>
<td></td>
</tr>
<tr>
<td>3-6 pm</td>
<td></td>
</tr>
<tr>
<td>6-10 pm</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>12 pm</td>
<td></td>
</tr>
</tbody>
</table>
**Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery**

<table>
<thead>
<tr>
<th>8-9 am</th>
<th>9-10 am</th>
<th>10 am – 1 pm</th>
<th>1-3 pm</th>
<th>3-6 pm</th>
<th>6-10 pm</th>
<th>10-12 pm</th>
<th>12 pm →</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADMISSION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Furosemide 20mg</td>
<td>Stop oral intake</td>
<td>500 cc Saline iv</td>
</tr>
<tr>
<td>Furosemide 40mg</td>
<td>Epidural catheter</td>
<td>Central vein line</td>
<td>Arterial line</td>
<td>Blood and gas analysis</td>
<td>Lactate and monitoring</td>
<td>Water intake</td>
<td>Remove epidural cath</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DISCHARGE TO WARD</td>
<td>Clear fluid/ progression to solid diet</td>
<td>Stand up/ walk</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

**DAY - 1**

**DAY 0**
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

<table>
<thead>
<tr>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-9 am</td>
<td>Furosemide 40mg, Epidural catheter, Central vein line, Arterial line</td>
</tr>
<tr>
<td>9-10 am</td>
<td>Blood and gas analysis, Lactate and monitoring</td>
</tr>
<tr>
<td>10 am - 1 pm</td>
<td>DISCHARGE TO WARD</td>
</tr>
<tr>
<td>6-10 pm</td>
<td>DISCHARGE TO WARD</td>
</tr>
<tr>
<td>10-12 pm</td>
<td>Furosemide 20mg, Urinary catheter, Stop oral intake 500 cc Saline iv</td>
</tr>
<tr>
<td>12 pm</td>
<td></td>
</tr>
</tbody>
</table>

**DAY - 1**

- **ADMISSION**
  - Furosemide 20mg
  - Urinary catheter
  - Stop oral intake 500 cc Saline iv

**DAY 0**

- Blood and gas analysis
- Lactate and monitoring
- Abdominal palpation +/- ultrasound

**DAY +1**

- Clear fluid/ progression to solid diet
- Stand up/walk
- Respiratory exercises
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

### DAY - 1
- **Furosemide 40mg**
- Epidural catheter
  - Central vein line
  - Arterial line
- **SURGERY**
  - Blood and gas analysis
  - Lactate and monitoring
- **DISCHARGE TO WARD**
  - Water intake
  - Remove epidural cath
  - Clear fluid
  - Stand up
  - Respiratory exercises

### DAY 0
- Blood and gas analysis
  - Lactate and monitoring
- Abdominal palpation
  - +/- ultrasound
- Solid intake
  - Stand up
  - Respiratory exercises
- Blood and gas analysis
  - Lactate and monitoring

### DAY +1
- Blood and gas analysis
  - Lactate and monitoring
- Abdominal palpation
  - +/- ultrasound
- **DISCHARGE**

### DAY +2
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

46 CASES

2 Low
SFT (<24h) 100%

Failed

Intermediate
SFT (<24h) (11) 39.3%
FT (<48h) (18) 64.3%
Failed (10) 35.7%

Advanced
SFT (<48h) (6) 37.5%
FT (<72h) (9) 56.3%
Failed (7) 43.8%
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>SFT (&lt;24h)</th>
<th>FT (&lt;48h)</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>(11) 39.3%</td>
<td>(18) 64.3%</td>
<td>(10) 35.7%</td>
</tr>
</tbody>
</table>
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

46 CASES

2 Low
- SFT (<24h) 100%
- FAILED (10) 35.7%

28 Intermediate
- SFT (<24h) (11) 39.3%
- FT (<48h) (18) 64.3%
- FAILED (10) 35.7%

16 Advanced
- SFT (<48h) (6) 37.5%
- FT (<72h) (9) 56.3%
- FAILED (7) 43.8%
### Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

<table>
<thead>
<tr>
<th>COMPLICATIONS</th>
<th>ALL SERIES (95 cases)</th>
<th>ERAS (46 cases)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCI</td>
<td>3,0042 +/- 11,86</td>
<td>2,08 +/- 5,8</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>No complications</td>
<td>87,39 %</td>
<td>84,8%</td>
<td>NS</td>
</tr>
<tr>
<td>Minor complications (I-II)</td>
<td>7,36 %</td>
<td>10,9% (x5)</td>
<td>NS</td>
</tr>
<tr>
<td>Major complications (IIIa, IIIb, IV)</td>
<td>4,2 %</td>
<td>4,3% (x2)</td>
<td>NS</td>
</tr>
<tr>
<td>Mortality (V)</td>
<td>1,05%</td>
<td>0%</td>
<td>NS</td>
</tr>
</tbody>
</table>
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

<table>
<thead>
<tr>
<th>Dindo-Clavien</th>
<th>Age</th>
<th>Iwate Score</th>
<th>Resection</th>
<th>Complication</th>
<th>Postop. stay</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>46</td>
<td>8</td>
<td>Segment 8</td>
<td>Wound Hematoma</td>
<td>4</td>
<td>Conservative</td>
</tr>
<tr>
<td>I</td>
<td>72</td>
<td>6</td>
<td>Segment 6</td>
<td>Wound Hematoma</td>
<td>4</td>
<td>Conservative</td>
</tr>
<tr>
<td>II</td>
<td>75</td>
<td>9</td>
<td>Segment 8</td>
<td>Acute Kidney Injury (Cr 3)</td>
<td>4</td>
<td>Fluids</td>
</tr>
<tr>
<td>II</td>
<td>62</td>
<td>7</td>
<td>Section 2-3</td>
<td>Ascites</td>
<td>6</td>
<td>Diuretics</td>
</tr>
<tr>
<td>II</td>
<td>72</td>
<td>7</td>
<td>Segment 6</td>
<td>Respiratory insufficiency</td>
<td>7</td>
<td>Medical</td>
</tr>
<tr>
<td>IIIa</td>
<td>55</td>
<td>9</td>
<td>2-3+ segment 7</td>
<td>Bile leak</td>
<td>13</td>
<td>ERCP</td>
</tr>
<tr>
<td>IIIa</td>
<td>66</td>
<td>7</td>
<td>Left hepatectomy</td>
<td>Collection</td>
<td>Readmitted</td>
<td>Percutaneous drain</td>
</tr>
</tbody>
</table>
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Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

![Graph showing operative time vs difficulty score]

- Low
- Intermediate
- Advanced
- Expert
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### Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Furosemide 20mg</td>
<td>Stop oral intake 500 cc Saline iv</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Urethral catheter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### DAY - 1

- **SURGERY**
  - Furosemide 40mg
  - Epidural catheter
  - Central venous line

- **DISCHARGE TO WARD**
  - Clear fluid/ progression to solid diet
  - Stand up/ walk
  - Respiratory exercises

- **Blood and gas analysis**
- **Lactate and monitoring**

- **Water intake**
- **Remove epidural cath**

#### DAY 0

- **Blood and gas analysis**
- **Lactate and monitoring**

- **Abdominal palpation +/- ultrasound**

#### DAY +1
Application of ERAS Protocols (Enhanced Recovery After Surgery) and correlation with Iwate difficulty scoring system in laparoscopic liver surgery

CONCLUSIONS:

• After excluding high-risk patients, conversions and expert resections:
  • Postop. stay can be ≤24 hours in 50% of Low and Interm resections
  • Postop. stay can be ≤ 48 hours in 75% of Low and Interm resections
  • Up to 60% of Advanced resections may have Postop. stay ≤ 72 hours

• The ERAS protocols for laparoscopic liver resections are safe

• It is mandatory that patients feel themselves involved in the ERAS

• The failure of ERAS application is not related with increased complications
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