Performance validation of the ALPPS risk Model

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ALPPS

Associating Liver Partition Portal Vein Occlusion for Staged Hepatectomy

Stage 1

Portal vein ligation + parenchymal transection

Stage 2

1-2 weeks

Schnitzbauer, Schlitt et al, Ann Surg 2012
De Santibañes, Clavien, Ann Surg 2012
The ALPPS Risk Score

Avoiding Futile Use of ALPPS

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Study Aim

Validation of the ALPPS Risk Model (90d mortality) using a temporal and an external ALPPS cohort
Study Population

Inclusion criteria:
• ALPPS centers ≥5 cases

Exclusion criteria:
• Other transection variants than ALPPS and partial ALPPS
• Not proceeding to stage-2 surgery (invalid risk prediction for both stages)

Development cohort (DC)
528 patients
38 centers

Validation cohort (VC)
204 patients
32 centers

Temporal cohort
134 patients
28 centers
47 (9%) mortality

External cohort
70 patients
4 centers
28 (19%) mortality
### Pre-stage 1 Variables

#### Univariate analysis

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Development cohort (n = 528)</th>
<th>Validation cohort (n = 204)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>62 (53-69)</td>
<td>60 (51-67)</td>
<td>0.019</td>
</tr>
<tr>
<td>CRLM</td>
<td>69%</td>
<td>54%</td>
<td>0.001</td>
</tr>
<tr>
<td>Biliary tumors</td>
<td>15%</td>
<td>24%</td>
<td>0.015</td>
</tr>
<tr>
<td>Non-CRLM/non-biliary</td>
<td>16%</td>
<td>11%</td>
<td>0.134</td>
</tr>
</tbody>
</table>
## Pre-stage 1 Variables

### Univariate analysis

<table>
<thead>
<tr>
<th>Liver performance</th>
<th>Development cohort (n = 528)</th>
<th>Validation cohort (n = 204)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>sFLR pre-stage 1</td>
<td>0.21 (0.16-0.27)</td>
<td>0.22 (0.16-0.27)</td>
<td>0.732</td>
</tr>
<tr>
<td>Bilirubin (mg/dl)</td>
<td>0.59 (0.40-0.90)</td>
<td>0.63 (0.44-1.06)</td>
<td>0.014</td>
</tr>
<tr>
<td>INR</td>
<td>1.0 (1.0-1.1)</td>
<td>1.0 (1.0-1.1)</td>
<td>0.004</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>0.81 (0.70-0.96)</td>
<td>0.80 (0.67-0.94)</td>
<td>0.272</td>
</tr>
</tbody>
</table>
Pre-stage 1 Model

ROC Pre-stage 1 = 0.772

Pre-stage 1 Model

ROC Pre-stage 1: c-statistic = 0.772

Risk point allocation

- CRLM: 0
- Non-colorectal/non-biliary: 1
- Biliary tumor: 2
- Age ≥67 years: 3

Pre-stage 1 Model Validation

ROC curve analysis

**Development cohort**
- n=528
  - c-statistic: 0.772; P<0.000

**Validation cohort**
- n=204
  - c-statistic: 0.625; P=0.040
Pre-stage 1 Model Validation

Outcome per risk category

Development cohort
n=528

Validation cohort
n=204
Pre-stage 2 Variables

Univariate analysis

<table>
<thead>
<tr>
<th>Inter-stage course</th>
<th>Development cohort (n = 528)</th>
<th>Validation cohort (n = 204)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major complications (grade ≥ 3b)</td>
<td>10%</td>
<td>7%</td>
<td>0.239</td>
</tr>
<tr>
<td>ISGLS criteria</td>
<td>9%</td>
<td>14%</td>
<td>0.136</td>
</tr>
</tbody>
</table>

Vina del Mar - Chile September 24-27, 2017
## Pre-stage 2 Variables

### Univariate analysis

<table>
<thead>
<tr>
<th>Liver performance</th>
<th>Development cohort (n = 528)</th>
<th>Validation cohort (n = 204)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>sFLR pre-stage 2</td>
<td>0.37 (0.30-0.45)</td>
<td>0.39 (0.32-0.47)</td>
<td>0.179</td>
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<tr>
<td>Bilirubin (mg/dl)</td>
<td>0.76 (0.47-1.29)</td>
<td>0.69 (0.40-1.25)</td>
<td>0.637</td>
</tr>
<tr>
<td>INR</td>
<td>1.1 (1.0-1.2)</td>
<td>1.1 (1.0-1.2)</td>
<td>0.610</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>0.71 (0.60-0.91)</td>
<td>0.71 (0.59-0.90)</td>
<td>0.318</td>
</tr>
</tbody>
</table>
Pre-stage 2 Model

ROC Pre-Stage 2: c-statistic= 0.850

Pre-stage 2 Model

ROC Pre-Stage 2: c-statistic = 0.850

Risk point allocation (range: 0-12)

0.66 × [pre-stage 1 score]
+ 1.2 × [complications ≥ 3b; no=0; yes=1]
+ 1.5 × log_{10} [10 × bilirubin pre-stage 2 in mg/dL]
+ 1.7 × log_{10} [10 × creatinine pre-stage 2 in mg/dL]
Pre-stage 2 Model Validation

ROC curve analysis

Development cohort
n=528

c-statistic: 0.850; P<0.000

Validation cohort
n=204

c-statistic: 0.785; P=0.058
Pre-stage 2 Model Validation

Outcome per risk category

Development cohort  
n=528

Pre-stage 2 Risk score

Validation cohort  
n=204

Pre-stage 2 Risk score
Clinical Sample Vignette

77y female, gallbladder cancer

Pre-stage 1 futility risk  37%
Complication ≥3b
Bilirubin 3.33mg/dl
Creatinine 0.69mg/dl

Pre-stage 2 futility risk  79%
Summary

1. ALPPS Risk Score: Prospective validated decision guide to avoid 90-day mortality

1. Easy applicable risk calculation for individual patients before stage-1 and stage-2 surgery

2. Proper patient selection

3. Determination to proceed safely with stage 2 surgery
Patient Registration

Please register your ALPPS patients

www.alpps.net
ALPPS@usz.ch
São Luís

Gracias!