LEARNING CURVE OF LUMBAR DECOMPRESSIVE LAMINECTOMY IN BIPORTAL ENDOSCOPIC SPINE SURGERY (BEss) USING LC-CUSUM

Sang-Min Park, Jinsuk Seo*, Ho-Joong Kim, Jin S. Yeom

Department of Orthopaedic Surgery
Seoul National University Bundang Hospital
*Department of Neurosurgery
Wooridul Spine Hospital Gangnam
Introduction

BIPORTAL ENDOSCOPIC SS

4mm, 30° Arthrocope

Midline

Rt side

Caudal

Lt approach

Midline

Lt approach

Contra-lateral (Rt)

Midline

Ipsilateral (Lt)
LEARNING CURVE

- **LC-CUSUM (Learning Curve-Cumulative Summation test)**
  - For monitoring of learning curve
  - Good statistical method to determine when adequate performance can be reached
  - Graphical presentation
    → Easy understanding of the result

**LC-CUSUM**

Learning curve point = Adequate performance level
Purpose

To determine how many surgeries are needed to achieve an adequate performance level in BESS for decompressive laminectomy in lumbar spinal stenosis.
PATIENT POPULATION

• From June 2017 to January 2018

Lumbar spinal stenosis
Underwent decompressive laminectomy
By a single orthopedic surgeon (SMP)
N = 109

Multi-level
Conventional
ULBD
Tubular
N = 49

Single-level decompressive laminectomy
Using BESS
N = 60
LC-CUSUM

• **Parameters**

  • **Score (S)**
    • Success $\rightarrow$ Downward
    • Failure $\rightarrow$ Upward

  • **Decision limit (h)**
    • Adequate level

### Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_0$, unacceptable failure rate</td>
<td>0.4</td>
</tr>
<tr>
<td>$p_1$, acceptable failure rate</td>
<td>0.2</td>
</tr>
<tr>
<td>$\alpha$, probability of the type I error</td>
<td>0.05</td>
</tr>
<tr>
<td>$\beta$, probability of the type II error</td>
<td>0.2</td>
</tr>
<tr>
<td>$P = \ln(p_1/p_0)$</td>
<td>-0.6932</td>
</tr>
<tr>
<td>$Q = \ln[(1-p_0)/(1-p_1)]$</td>
<td>-0.2877</td>
</tr>
<tr>
<td>$S = Q / (P+Q)$</td>
<td>0.2933</td>
</tr>
<tr>
<td>$1-S$</td>
<td>0.7067</td>
</tr>
<tr>
<td>$a = \ln[(1-\beta)/\alpha]$</td>
<td>2.77</td>
</tr>
<tr>
<td>$h = a/(P+Q)$, decision limit</td>
<td>-2.83</td>
</tr>
</tbody>
</table>
LC-CUSUM

• **Learning curve**
  • **Operating time**
    • From skin incision to closure of skin
    • Which recorded in anesthesia records
  • **Goal: 75 min**
    • Mean time of *microscopic decompressive laminectomy* at a single level
## DEMOGRAPHICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>60</td>
</tr>
<tr>
<td>Mean age, years (range)</td>
<td>67.6 (41 – 91)</td>
</tr>
<tr>
<td>Men / Women (No.)</td>
<td>31 / 29</td>
</tr>
<tr>
<td>Mean height, cm (range)</td>
<td>162.1 (143 – 186.5)</td>
</tr>
<tr>
<td>Mean weight, kg (range)</td>
<td>65.5 (38.1 – 109.6)</td>
</tr>
<tr>
<td>Body mass index, kg/m² (range)</td>
<td>24.8 (16.3 – 33.1)</td>
</tr>
<tr>
<td><strong>Approached side (No.)</strong></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>15</td>
</tr>
<tr>
<td><strong>Left</strong></td>
<td>45</td>
</tr>
<tr>
<td><strong>Operative level (No.)</strong></td>
<td></td>
</tr>
<tr>
<td>L2-3</td>
<td>5</td>
</tr>
<tr>
<td>L3-4</td>
<td>5</td>
</tr>
<tr>
<td><strong>L4-5</strong></td>
<td>44</td>
</tr>
<tr>
<td>L5-S1</td>
<td>6</td>
</tr>
</tbody>
</table>
LC-CUSUM

$S = Q / (P+Q)$

Success 0.2933

1-$S$

Failure 0.7067

Results

Downward

Upward

Adequate level of performance

$h = -2.83$
BESS

- Learning curve
  - Overall complications during the early learning period
  - But, these measures cannot define surgical competency
  - In our study
    - Reached adequate operative time at 58th operation when compared to ULBD

Discussion

Adequate level of performance

LC-CUSUM analysis

h = -2.83
CONCLUSION

- Learning curve for BESS

  - Demonstrated that a **substantial learning period (58 cases)** may be needed **before adequate performance is achieved** for lumbar decompressive laminectomy via BESS in **nonexpert spine surgeon**
DISCLOSURE

• No conflict of interest