Spine
By Design

Objective data to support spinal surgery choices.
Herniated discs & Back pain
• In the US alone, more than 1.2 million spinal surgeries are performed each year, including spinal fusion and decompression, or discectomy surgery, according to the National Center for Health Statistics.¹

• Roughly 25% of these are microdiscectomies (~300,000), costing between 4.5 and 15 billion a year.²

• 5-10% of microdiscectomies re herniate leading to additional surgery costs, longer recovery times and lost productivity.³
Spinal Surgical Decision Support Software
Methods: Predictive Software

A nonlinear, multivariate, **logistic regression** model:

- **Machine learning** software for spinal image processing
- **Neural networking algorithm** for prediction of surgical complications

\[
p = \frac{\exp (\beta_0 + \sum_{j=1}^{N} \beta_j x_j)}{\exp (\beta_0 + \sum_{j=1}^{N} \beta_j x_j) + 1}
\]

**Probability Calculator for Lumbar Disc Herniation Recurrence After Microdiscectomy**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHI</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m(^2))</td>
<td></td>
</tr>
<tr>
<td>sROM (degrees)</td>
<td></td>
</tr>
<tr>
<td>Lumbar lordosis angle (degrees)</td>
<td></td>
</tr>
<tr>
<td>Phirrmann grade (1-5)</td>
<td></td>
</tr>
<tr>
<td>Herniation type (protrusion = p, extrusion = e)</td>
<td></td>
</tr>
<tr>
<td>Smoking (no = 0, yes = 1)</td>
<td></td>
</tr>
<tr>
<td>Recurrence probability (highest = 1, lowest = 0)</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Correct Classifications

- Atlanta Emory
- Novosibirsk Cohort 1
- Novosibirsk Cohort 2
- Railway Irkutsk
- Sydney St. George
- All Institutions

- Reherniations
- No-Reherniation
Methods: Automated Image Processing
Current competition for this software is the surgeon’s “best guess” as to which surgery will be most successful based on risk factors for reherniation.  

Market is embracing the use of surgical planning software – most major spine device companies are currently pursuing addition of software to their product portfolio. 

Annular Closure Devices are sometimes used if reherniations are suspected.
Patients
Better weigh risks & reduce likelihood of costly (and painful) complications.

Hospitals
Reduce risk of surgical re-admittance & associated costs.

Insurance Companies
Provide additional validation of patient treatment plan efficacy.

Surgeons
Increase likelihood of successful outcomes for their patients.

Informed Surgical Choice
The Team - Biomedical Engineers

Morgan Giers
CTO

Charla Triplett
CEO

Sonia Ahrens
Lead Software Developer
Additional Team - Interdisciplinary Contributors

Business Advisors:

Greg Cogswell - Healthcare Economics Consultant
Angela Kiser – Medical Device Software QA Consultant
Reggie Dobson - Spine/Ortho Sales Advisor

Clinical Advisors:

Novosibirsk Research Institute of Traumatology and Orthopedics
Aleksandr V Krutko, MD PhD

Irkutsk Railway Clinical Hospital
Vadim Byvaltsev, MD PhD

Emory University
Tim Yoon, MD PhD

St. George Hospital
Ashish Diwan, MD PhD
Sources Cited


