Validation of the Oswestry Risk of Knee Arthroplasty Index (ORKA-1) for Patients Undergoing Autologous Chondrocyte Implantation

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Autologous Chondrocyte Implantation (ACI)

- Successful outcomes in 82% of patients after 11.4 years \(^1\)
- Survival rate of 63% after 20 years \(^2\)
- Multiple factors influence postoperative outcome
- Oswestry Risk of Knee Arthroplasty index (ORKA-1) \(^3\)
  1. Age
  2. Gender
  3. No. of defects
  4. Patellar defect
  5. Previous Surgeries
  6. Pre-OP Lyshom score

- Assesses the risk of conversion to arthroplasty at 10 years:
  - Group 1: 1%
  - Group 2: 11%
  - Group 3: 70%
  - Group 4/5: 100%
Purpose

1. Externally validate the ORKA-1 on overall failure rather than only conversion to arthroplasty
2. To identify predictors of failure and developing a score estimating the risk of failure after ACI

Hypothesis

• ORKA-1 will have limited predictive value in patients undergoing ACI in the US when used to predict overall failure
Patient Selection and Stratification

- ACI for focal cartilage defects in the knee
- Single surgeon
- March 2007 to August 2017

1. **Objective**
   - Based on ORKA-1, patients were stratified into Risk Groups 1-5
   - One patient had very high risk index and was assigned to Risk Group 6

2. **Failure was defined as:**
   1. Revision ACI
   2. Subsequent osteochondral autograft transfer (OAT) or osteochondral allograft transplantation (OCA)
   3. Arthroplasty
   4. Failure of more than 25% of the ACI (postoperative imaging or second look arthroscopy)
2. **Objective**

- Multivariable Cox proportional hazard model utilizing stepwise regression
- Following factors were considered:

<table>
<thead>
<tr>
<th>Pre-OP PROMs</th>
<th>Patient Factor</th>
<th>Lesion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-12 (PCS and MCS)</td>
<td>Age</td>
<td>Size</td>
</tr>
<tr>
<td>KOOS</td>
<td>BMI</td>
<td>Number</td>
</tr>
<tr>
<td>Lysholm</td>
<td>Sex</td>
<td>Subchondral bone involvement</td>
</tr>
<tr>
<td>Tegner</td>
<td>Smoking status</td>
<td>Patellar lesion</td>
</tr>
<tr>
<td>IKDC</td>
<td>WC status</td>
<td></td>
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<tr>
<td></td>
<td>Concomitant Surgeries</td>
<td></td>
</tr>
</tbody>
</table>
1. Objective

- ORKA-1 was calculated for 171 patients
- 27 patients (15.8%) failed

Risk Group 1 as baseline:

- **No difference** to Risk Group 2 and 4 ($p = 0.32$ and $p = 0.079$)
- **Sig. difference** to Risk Group 3, 5 and 6 ($p = 0.03; p = 0.017; p = 0.025$)
2. Objective

**Univariable Cox Model (p < 0.15)**
- Age
- Defect number and size
- WC
- KOOS, Lysholm, IKDC and SF-12 PCS

**Stepwise multivariable Cox Model (p < 0.05)**
- KOOS Sport/Recreation subscale

![Hazard ratio (HR)]
0.97; 95% CI, 0.95-0.99; p = 0.007

<table>
<thead>
<tr>
<th></th>
<th>Patients n = 154</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y, mean ± SD</td>
<td>31.8 ± 9</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>84 (54.9)</td>
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<tr>
<td>BMI, kg/m^2, mean ± SD</td>
<td>26.5 ± 4</td>
</tr>
<tr>
<td>WC, n (%)</td>
<td>10 (6.5)</td>
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<tr>
<td>Smoker, n (%)</td>
<td>11 (6.2)</td>
</tr>
<tr>
<td>Previous Surgery, n (%)</td>
<td>59 (38.6)</td>
</tr>
<tr>
<td>Concomitant MAT, n (%)</td>
<td>13 (8.4)</td>
</tr>
<tr>
<td>Concomitant HTO, n (%)</td>
<td>19 (12.3)</td>
</tr>
<tr>
<td>Concomitant TTO, n (%)</td>
<td>89 (57.8)</td>
</tr>
<tr>
<td>Concomitant DFO, n (%)</td>
<td>8 (5.2)</td>
</tr>
<tr>
<td>Subchondral bone involvement, n (%)</td>
<td>16 (10.4)</td>
</tr>
<tr>
<td>Patella Lesion, n (%)</td>
<td>99 (64.3)</td>
</tr>
<tr>
<td>Defect Number, mean ± SD</td>
<td>1.73 ± 0.88</td>
</tr>
<tr>
<td>Defect size, mm, mean ± SD</td>
<td>760 ± 528.4</td>
</tr>
</tbody>
</table>
Failure rate of ACI is 14.9% among 4,294 patients after an average follow up between 5 and 12.3 years.

Yet, there is no standard definition of failure – Surgical – Radiologic – Clinical – Combination of the above

Differing treatment protocols may lead to inaccurate estimates of ACI survival due to different thresholds for recommending revision with subsequent cartilage repair procedures versus arthroplasty.

A better understanding of preoperative risk factors allows the patient and physician to work together on deciding the best treatment strategy to address cartilage lesions.

Low preoperative KOOS Sport/Recreation subscale has mild negative effect on ACI survival.
Conclusion

- **ORKA-1 does show predictive character** for estimating patient’s risk of overall ACI failure

- However, caution must be exercised when using indices established in other countries with different treatment algorithms

- Comprehensive and **specific definition of failure for ACI is warranted** to help for better patient selection and counseling
Thank you for your attention!


