Is Body Mass Index a Risk Factor for Complications following Arthroscopy of the Knee, Hip and Shoulder?

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Published in *Arthroscopy* since Submission

PMID: 30733034
Disclosures

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Vehniah K. Tjong, MD – Paid consultant for Smith & Nephew.
Aim: Utilize the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database to determine if body mass index (BMI) is associated with 30-day postoperative complications following arthroscopic surgery.

Hypothesis: Elevated BMI is an independent risk factor for postoperative morbidity, mortality, readmission, reoperation and venothromboembolism (VTE) following arthroscopic surgery of the knee, hip and shoulder.

Level of Evidence: Level III
Methods

**Data source:** NSQIP Participant Use File (PUF) was queried between 2006 and 2016

**Case identification:** CPT and ICD-10 codes were used to isolate cases of elective arthroscopy of the knee, hip and shoulder

**Design:** A retrospective comparative analysis was conducted

**Statistics:** Univariate analyses and binary logistic regressions were used to ascertain the adjusted effect of BMI on:

- Morbidity
- Mortality
- Readmission
- Reoperation
- VTE
Results

141,335 patients met criteria

Most common complications
- Deep vein thrombosis (0.27%)
- Superficial surgical site infection (SSI) (0.17%)
- Urinary tract infection (0.13%)
- Pulmonary embolism (PE) (0.11%)

All morbidity
- Superficial SSI
- Deep SSI
- Organ/space SSI (septic arthritis)
- Wound disruption
- Pneumonia
- Unplanned reintubation
- PE
- Prolonged ventilation
- Progressive renal failure
- Acute renal failure
- Urinary tract infection
- Cerebrovascular accident
- Cardiac arrest
- Myocardial infarction
- Bleeding requiring transfusion
- Deep vein thrombosis (DVT)
- Sepsis
- VTE
Multivariate analysis: Binary logistic regression of predictors of All Morbidity

<table>
<thead>
<tr>
<th></th>
<th>SHOULDER (n=56449)</th>
<th>(^\text{HIP} (n=2023))</th>
<th>KNEE (n=82817)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Morbidity (%)</td>
<td>P-value</td>
<td>Morbidity (%)</td>
</tr>
<tr>
<td>Mean age (years) [SD]</td>
<td>58 (13.8)</td>
<td>&lt;0.001</td>
<td>41.83 (16.67)</td>
</tr>
<tr>
<td>Sex</td>
<td>0.340</td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>Male</td>
<td>233 (0.7)</td>
<td></td>
<td>10 (1.2)</td>
</tr>
<tr>
<td>Female</td>
<td>168 (0.8)</td>
<td></td>
<td>14 (1.2)</td>
</tr>
<tr>
<td>BMI</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Weight</td>
<td>55 (0.5)</td>
<td></td>
<td>7 (1.0)</td>
</tr>
<tr>
<td>Underweight</td>
<td>6 (2.0)</td>
<td>0.001</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Overweight</td>
<td>122 (0.6)</td>
<td>0.299</td>
<td>11 (1.5)</td>
</tr>
<tr>
<td>Obesity I</td>
<td>88 (0.8)</td>
<td>0.015</td>
<td>4 (1.1)</td>
</tr>
<tr>
<td>Obesity I w/ DM</td>
<td>26 (1.1)</td>
<td>0.001</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Obesity II</td>
<td>46 (1.0)</td>
<td>0.001</td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>Obesity II w/ DM</td>
<td>18 (1.2)</td>
<td>0.002</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Obesity III</td>
<td>21 (0.7)</td>
<td>0.138</td>
<td>1 (1.7)</td>
</tr>
<tr>
<td>Obesity III w/ DM</td>
<td>19 (1.6)</td>
<td>&lt;0.001</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Comorbidities</td>
<td>&lt;0.001</td>
<td></td>
<td>0.055</td>
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<tr>
<td>0 (*reference)</td>
<td>124 (0.5)</td>
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<td>11 (0.8)</td>
</tr>
<tr>
<td>1</td>
<td>135 (0.7)</td>
<td>0.002</td>
<td>11 (2.2)</td>
</tr>
<tr>
<td>&gt;=2</td>
<td>142 (1.4)</td>
<td>&lt;0.001</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>ASA</td>
<td>&lt;0.001</td>
<td></td>
<td>0.695</td>
</tr>
<tr>
<td>1-2</td>
<td>229 (0.5)</td>
<td></td>
<td>21 (1.2)</td>
</tr>
<tr>
<td>3-5</td>
<td>172 (1.2)</td>
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<td>3 (1.5)</td>
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</tbody>
</table>

*Reference = the reference group to which all other groups were compared in order to generate the adjusted OR and p-value.
All Morbidity versus BMI Class

Relative frequency of complication (%)

BMI Class

Underweight  Normal  Overweight  Obesity I  Obesity II  Obesity III

Hip  Knee  Shoulder

Northwestern Medicine
Multivariate analysis: Binary logistic regression of predictors of Readmission, Reoperation and VTE

<table>
<thead>
<tr>
<th></th>
<th>Readmission</th>
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<tbody>
<tr>
<td></td>
<td>Adjusted OR (95%CI)</td>
<td>P-value</td>
<td>Adjusted OR (95%CI)</td>
<td>P-value</td>
<td>Adjusted OR (95%CI)</td>
</tr>
<tr>
<td>Age</td>
<td>1.020 (1.014-1.025)</td>
<td>&lt;0.001</td>
<td>0.997 (0.989-1.004)</td>
<td>0.400</td>
<td>1.009 (1.002-1.015)</td>
</tr>
<tr>
<td>Female Sex</td>
<td>0.915 (0.796-1.052)</td>
<td>0.212</td>
<td>0.879 (0.713-1.085)</td>
<td>0.230</td>
<td>0.918 (0.764-1.104)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Normal Weight (*reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Underweight</td>
<td>2.041 (0.946-4.401)</td>
<td>0.069</td>
<td>1.828 (0.572-5.846)</td>
<td>0.309</td>
<td>1.312 (0.983-1.752)</td>
</tr>
<tr>
<td>Overweight</td>
<td>0.849 (0.687-1.050)</td>
<td>0.131</td>
<td>0.833 (0.614-1.131)</td>
<td>0.241</td>
<td>1.474 (1.088-1.996)</td>
</tr>
<tr>
<td>Obesity I</td>
<td>0.905 (0.721-1.136)</td>
<td>0.391</td>
<td>0.687 (0.485-0.973)</td>
<td><strong>0.034</strong></td>
<td>1.048 (0.571-1.923)</td>
</tr>
<tr>
<td>Obesity I w/ DM</td>
<td>0.750 (0.514-1.094)</td>
<td>0.136</td>
<td>1.039 (0.605-1.783)</td>
<td>0.889</td>
<td>1.469 (1.027-2.101)</td>
</tr>
<tr>
<td>Obesity II</td>
<td>0.888 (0.676-1.167)</td>
<td>0.395</td>
<td>1.010 (0.692-1.474)</td>
<td>0.959</td>
<td>1.264 (0.658-2.428)</td>
</tr>
<tr>
<td>Obesity II w/ DM</td>
<td>1.262 (0.884-1.801)</td>
<td>0.199</td>
<td>1.220 (0.692-2.149)</td>
<td>0.492</td>
<td>1.264 (0.658-2.428)</td>
</tr>
<tr>
<td>Obesity III</td>
<td>1.436 (1.018-2.028)</td>
<td>0.128</td>
<td>0.757 (0.486-1.180)</td>
<td>0.219</td>
<td>1.182 (0.766-1.822)</td>
</tr>
<tr>
<td>Obesity III w/ DM</td>
<td>2.342 (1.998-2.745)</td>
<td><strong>0.040</strong></td>
<td>0.960 (0.525-1.754)</td>
<td>0.894</td>
<td>1.544 (0.831-2.867)</td>
</tr>
<tr>
<td>ASA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASA 1-2 (*reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ASA 3-5</td>
<td>2.342 (1.998-2.745)</td>
<td><strong>&lt;0.001</strong></td>
<td>2.034 (1.585-2.610)</td>
<td><strong>&lt;0.001</strong></td>
<td>0.928 (0.729-1.180)</td>
</tr>
<tr>
<td>Principle arthroscopic procedure</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Shoulder (*reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Hip</td>
<td>2.018 (1.211-3.360)</td>
<td><strong>0.007</strong></td>
<td>1.202 (0.440-3.283)</td>
<td>0.720</td>
<td>1.173 (0.430-3.198)</td>
</tr>
<tr>
<td>Knee</td>
<td>0.985 (0.857-1.132)</td>
<td>0.829</td>
<td>1.719 (1.372-2.153)</td>
<td><strong>&lt;0.001</strong></td>
<td>2.288 (1.849-2.832)</td>
</tr>
</tbody>
</table>

*Reference = the reference group to which all other groups were compared in order to generate the adjusted OR and p-value.
Results

All Procedures (Knee, Hip & Shoulder)

• **Obesity class III with diabetes** was an independent risk factor
  – Morbidity (OR 1.522, 95% CI, 1.101-2.103)
  – Readmission (OR 2.342, 95% CI, 1.998-2.745)

• **Obesity class I** was independently protective
  – Reoperation (OR 0.687, 95% CI, 0.485-0.973)

• **VTE** risk factors included
  – **Overweight** (OR 1.474, 95% CI, 1.088-1.996)
  – **Obesity class 1 with diabetes** (OR 1.469, 95% CI, 1.027-2.101)
Results

- **Shoulder Arthroscopy** risk factors for all morbidity:
  - Underweight patients (OR 3.776, 95% CI, 1.605-8.883)
  - Class I obese (OR 1.421, 95% CI, 1.010-1.998)
  - Class II obese (OR 1.726, 95% CI, 1.159-2.569)

- **Knee Arthroscopy**
  - BMI did not significantly affect morbidity

- **Hip Arthroscopy**
  - Subgroup had a low event rate of morbidity, the analysis could not be performed
Conclusion

Arthroscopic procedures are safe with very low complication rates

However, certain patients are at higher risk:

Higher morbidity following shoulder arthroscopy
• Underweight
• Class I obese
• Class II obese

Higher morbidity and readmission following all arthroscopy
• Class III obesity with diabetes

Because BMI is a modifiable risk factor, these patients should be evaluated carefully before being considered for outpatient arthroscopic surgery


