Machine Learning Model Developed to Aid in Patient Selection for Outpatient Total Hip Arthroplasty

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Research Question: Are machine learning models able to assist with preoperative patient selection for outpatient total hip arthroplasty by using patient comorbidities and demographic factors?

BACKGROUND

Total hip arthroplasty (THA), or total hip replacement, is a common elective surgical procedure that greatly restores quality of life. THA demand is increasing, but it has high costs mainly driven by hospital length of stay (LOS). More THA procedures are performed on an outpatient basis, in which the patient has same-day discharge (LOS = 0 days). Outpatient THA is as safe as inpatient THA for appropriately selected patients. Selecting patients for outpatient THA by length of stay may help maintain cost effectiveness and good outcomes. Machine learning (ML) is a form of artificial intelligence (AI) that learns from large datasets to build complex statistical models, which can be used to identify patterns and predict outcomes. In orthopedic surgery, ML has been studied for classifying patients and optimizing for surgical procedures,[20] outcome predictions,[21, 22] and patient-specific payment models.[23]

The purpose of this study is to develop ML models that may aid in patient selection for outpatient THA by predicting which patients, based on medical comorbidities and demographic information, may have long LOS or same-day discharge.

DESCRIPTION OF ORGANIZATION

The Department of Orthopedic Surgery at New York Presbyterian University Irving Medical Center was formerly the New York Orthopedic Hospital, which was founded for “the purpose of furnishing treatment to the poor, with especial reference to diseases and deformities of the bones and joints requiring surgical and mechanical treatment, and for giving instruction in the same.” Today, the Department of Orthopedic Surgery’s missions continue through focus on patient care, research, and education.[17]

The International Collaboration and Exchange Program was started at Columbia University to provide opportunities for students to network and collaborate with medical students from other countries around the world. Although COVID-19 disrupted travel plans, students planned on participating in summer basic science research rotations in partner countries while adhering to COVID-19 guidelines, travel plans, students planned on participating in summer basic science research rotations in partner countries while adhering to COVID-19 guidelines.

RESULTS

Table 1: Outcomes of cases when categorized by long LOS

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Non-LOS</th>
<th>LOS</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient (%)</td>
<td>90.5%</td>
<td>91.6%</td>
<td>0.01</td>
</tr>
<tr>
<td>Prolonged operative time (%)</td>
<td>16.9%</td>
<td>20.2%</td>
<td>17.1%</td>
</tr>
<tr>
<td>Delayed CH (days)</td>
<td>1.8%</td>
<td>2.8%</td>
<td></td>
</tr>
<tr>
<td>Non-normal discharge (%)</td>
<td>6.8%</td>
<td>12.4%</td>
<td>26.4%</td>
</tr>
<tr>
<td>No complications (%)</td>
<td>9.3%</td>
<td>3.3%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Post-op (%)</td>
<td>1.7%</td>
<td>2.8%</td>
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Table 2: Outcomes of cases when categorized by same-day discharge

<table>
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<tr>
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DISCUSSION

The ML models predicting long LOS and same-day discharge were considered good predictive and discriminative ability (AUC > 0.80). The model for short LOS had fair discriminative ability (AUC > 0.70). Greater numbers of comorbidities are associated with longer LOS. Non-White race was the main demographic factor found to increase odds of long LOS. These racial disparities likely reflect existing systemic inequalities in the data.[17] Predictive models may inadvertently perpetuate disparities; patients designated as higher risk may have more difficulty in being referred for THA and outpatient THA. Limitations include lack of external validity, lack of adjustments for surgery chronology between 2010-2018, and database coding errors.

REFERENCES