Hospital Tax Status and Carotid Artery Stent Utilization in US Hospitals

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Background
- Carotid Artery Disease is a major cause of Stroke in the United States and is associated with significant morbidity and mortality.
- Carotid Endarterectomy (CEA) and Carotid Artery Stenting (CAS) are performed to prevent Stroke.
- The National Institute of Neurological Disorders and Stroke (NINDS) identified specific individuals for whom the surgery is beneficial:
  - Highly beneficial for persons who have already had a stroke or experienced the symptoms of a stroke with severe stenosis of 70-99 percent.
  - Beneficial in persons who have had transient or mild stroke symptoms due to moderate carotid Stenosis 50-69 percent.
- The Asymptomatic Carotid Atherosclerosis Study (ACAS) found the procedure highly beneficial for persons who are symptom-free but have a carotid stenosis of 60-99 percent.
- The Carotid Revascularization Endarterectomy vs. Stenting Trial (CREST) found no significant difference between the procedures regarding the 4-year rate of stroke or death in patients with or without a prior stroke.
- The Faculty Advocating Collaborative and Thoughtful Carotid Artery Treatments (FACTCATs) have suggested CAS is less effective (see subgroup analysis of CREST) and more expensive than CEA.

Objective
- We sought to identify the association of hospital tax status (non-profit vs. for-profit) on CAS vs. CEA utilization for patients admitted to US hospitals for carotid revascularization.

Methods
- Using the Nationwide Inpatient Sample Data, admissions for carotid artery occlusive disease from 2006-2011, we identified all private, non-federated US hospitals that performed carotid revascularization procedures including CAS (ICD-9 00.63) or CEA (ICD-9 38.12) as defined by the International Classification of Disease codes.
- Only hospitals that performed a minimum of 20 revascularization procedures were selected to minimize variability.
- Only hospitals performing at least one CAS were included in the analysis (Medicare certified hospitals).
- A multilevel multivariable logistic regression was then used controlling for patient demographics, comorbidities, and other hospital characteristics to assess the effect of hospital tax status on CAS use.

Results
- Across 723 hospitals (600 non-profit, 123 for-profit), 66,731 carotid revascularization admission were identified.
- Approximately one of five (18.7%) revascularization admissions included received a carotid artery stent.
- Hospital charge (adjusted in 2014 US dollars) per hospitalization for CAS was $52,177 vs. $29,078 for CEA (p<0.01).
- The average annual rate of stenting among all hospitals performing revascularization was 17.7 per 100 procedures.
- Median was 12.5, Interquartile Range 5.4-26.7 per 100 procedures.
- The average CAS rate among non-profit hospitals was 17.5 per 100 procedures (95% CI 16.2-18.9).
- The average CAS rate among for-profit hospitals was 24.2 per 100 procedures (95% CI 29.2-28.2).
- For-profit hospital designation was associated with a greater odds of carotid artery stenosis for patients undergoing carotid revascularization.

<table>
<thead>
<tr>
<th>COST per revascularization admission:</th>
<th>Hospitals</th>
<th>Stenting Rate</th>
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</thead>
<tbody>
<tr>
<td>CAS - $52,177</td>
<td>600</td>
<td>17.5</td>
</tr>
<tr>
<td>CEA - $29,078</td>
<td>123</td>
<td>24.2</td>
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</tbody>
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Conclusions
- For-profit hospital tax status is associated with a higher rate of CAS compared to non-profit hospitals in those receiving carotid revascularization.
- Further research is needed to understand the individual and system level factors driving this difference.