Doppler Ultrasound for Frequent Carotid Artery Stenosis Monitoring
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Need
- Carotid Artery Stenosis: Plaque buildup in the carotid artery bifurcation (Atherosclerosis)
- Responsible for 20-30% of all strokes
- Described as a "potentially preventable cause of stroke" but only monitored every 6 - 12 months
- Clinical relevance only begins at 50% stenosis

Rationale: More consistent monitoring will lead to more timely interventions resulting in less strokes.

Solution

Approach
- Measure Peak Systolic Velocity (PSV) using Doppler Ultrasound

<table>
<thead>
<tr>
<th>Percent Stenosis</th>
<th>PSV (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50%</td>
<td>&lt;125</td>
</tr>
<tr>
<td>50 - 69%</td>
<td>125 - 230</td>
</tr>
<tr>
<td>≥70%</td>
<td>&gt;230</td>
</tr>
</tbody>
</table>

\[ V = \frac{\Delta f \times c}{2f \times \cos \theta} \]
- \( V \) = velocity of mean blood flow vector
- \( \Delta f \times c \) = frequency of transmitted beam
- \( \theta \) = angle of insonation
- \( c \) = speed of sound in medium

Results & Impact

System Frequency Response
- System passes Doppler shifted components of flow between 125 to 600 cm/s and rejects all others