Endovascular Treatment of Subclavian Artery CTOs

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Disclosure

Speaker name:

..............................................................

I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other(s)

☒ I do not have any potential conflict of interest
Pathophysiology

- Occlusion: proximal of the SCA
- the retrograde blood flows of the VA toward the upper arm, distal to subclavian artery
Clinical manifestation

- Most patients are *asymptomatic*
- Vertebro-basilar insufficiency: transient ischemic attacks, vertigo, dizziness, syncope and stroke
- Ischemia symptom of upper extremities: clumsiness, arm claudication, reduced BP or absent radial pulse
- Coronary Subclavian Steal Syndrome

Endovascular treatment

- PTA and stenting rather than bypass, is the widely favored approach.
- Similar clinical outcomes to open surgery
- Minimal risks under local anesthesia.

Initial and long-term results of endovascular therapy for chronic total occlusion of the subclavian artery.


Abstract

PURPOSE: To study the initial and long-term results of angioplasty and primary stenting for the treatment of chronic total occlusion (CTO) of the subclavian artery (SA).

MATERIALS AND METHODS: From January 1999 to February 2010, 56 patients (25 men with a mean age of 58 ± 8 years) underwent endovascular treatment for CTO of the SA. Duplex scans and arteriograms confirmed occlusion in all cases. Indications for recanalization were subclavian steal syndrome in 33 patients (58.1%), arm claudication in 13 patients (23.2%), and coronary ischemia in 7 patients (12.5%) who had a history of previous coronary artery bypass grafting that included left internal thoracic artery graft. Three patients (5.4%) were treated before the scheduled coronary artery bypass surgery, which included left internal thoracic artery graft. After successful recanalization, all arteries were stented, and all of the patients were followed-up at 1, 3, 6, and 12 months after surgery and annually thereafter.

RESULTS: Successful recanalization of the SA was achieved in 46 patients (82.1%), and the complication rate was 7.1%. During follow-up (mean 40 ± 26 months; range 2 to 125), the primary patency rates after 1 and 3 years were 97.9% and 82.7%, respectively. At the end of follow-up, 76% of the arteries showed no evidence of restenosis. Univariate analysis failed to identify any variable predictive of long-term patency of successfully recanalized SA.

CONCLUSION: Percutaneous transluminal angioplasty with stenting of the complete total occlusion of the SA is a safe and effective procedure associated with low risks and good long-term results.
Table 2 Procedural data with respect to primary success of recanalization

<table>
<thead>
<tr>
<th>Variable</th>
<th>All patients (N = 56)</th>
<th>Success (N = 46)</th>
<th>Failure (N = 10)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of occlusion (mm)</td>
<td>24.59 ± 7.38</td>
<td>24.04 ± 7.67</td>
<td>27.1 ± 5.52</td>
<td>0.24</td>
</tr>
<tr>
<td>Target artery calcification (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2 (3.6)</td>
<td>2 (4.3)</td>
<td>0 (0)</td>
<td>0.50</td>
</tr>
<tr>
<td>Mild</td>
<td>15 (26.8)</td>
<td>13 (28.3)</td>
<td>2 (20)</td>
<td>0.59</td>
</tr>
<tr>
<td>Moderate</td>
<td>21 (37.4)</td>
<td>18 (39.1)</td>
<td>3 (30)</td>
<td>0.58</td>
</tr>
<tr>
<td>Severe</td>
<td>18 (32.1)</td>
<td>13 (28.3)</td>
<td>5 (50)</td>
<td>0.18</td>
</tr>
<tr>
<td>Approach (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Femoral</td>
<td>9 (16.1)</td>
<td>8 (17.3)</td>
<td>1 (10)</td>
<td>0.09</td>
</tr>
<tr>
<td>Arm</td>
<td>6 (12.7)</td>
<td>3 (6.5)</td>
<td>3 (30)</td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>41 (73.2)</td>
<td>35 (76.2)</td>
<td>6 (60)</td>
<td></td>
</tr>
<tr>
<td>Side of occlusion (left) (%)</td>
<td>52 (92.9)</td>
<td>42 (85.7)</td>
<td>10 (100)</td>
<td>0.33</td>
</tr>
<tr>
<td>Stent type (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No stent</td>
<td>10 (17.9)</td>
<td>N/A</td>
<td>10 (100)</td>
<td></td>
</tr>
<tr>
<td>Self-expandable</td>
<td>17 (30.4)</td>
<td>17 (36.9)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Balloon-expandable</td>
<td>29 (51.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean stent diameter (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All stents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-expandable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balloon-expandable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stents per patient</td>
<td>0.93 ± 0.57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complications (%)</td>
<td>4 (7.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversion to surgery (%)</td>
<td>9 (16.7)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>In-hospital mortality (%)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Difference between patients with successful and failed SA recanalization.
CTO vs. stenosis

- Pass through
- Embolization
- Ostium of adjacent arteries
Recanalization strategy

• Antegrade first
• Telescope technique
• CTO guidewire
• Emboli protection technique
Our data

• January 2010 ~ January 2016, 19 pts with subclavian artery CTO
• Endo first strategy
<table>
<thead>
<tr>
<th>Demographics and Characteristics of the patients [num(%)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(y)</td>
</tr>
<tr>
<td>Gender(NO.of men)</td>
</tr>
<tr>
<td>Family history of atherosclerosis</td>
</tr>
<tr>
<td>Hypertension</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Coronary heart disease</td>
</tr>
<tr>
<td>History of stroke*</td>
</tr>
<tr>
<td>Smoking</td>
</tr>
</tbody>
</table>

*including lacunar infarction
<table>
<thead>
<tr>
<th>Symptoms and Signs of the patients</th>
<th>[num(%)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertigo</td>
<td>13(68.4)</td>
</tr>
<tr>
<td>Syncope</td>
<td>1(5.3)</td>
</tr>
<tr>
<td>Arm numbness</td>
<td>1(5.3)</td>
</tr>
<tr>
<td>Arm claudication</td>
<td>3(15.8)</td>
</tr>
<tr>
<td>Absent radial pulse*</td>
<td>2(10.5)</td>
</tr>
<tr>
<td>Weakness radial pulse**</td>
<td>16(84.2)</td>
</tr>
</tbody>
</table>

* **affected side
Result

• The technical success rate: 89.5% (17/19).
• 2 failure cases, by both antegrade and retrograde approach.
• Clinical symptom remission rate: 84.2% (16/19)
Result

- Antegrade approach in 11 cases.
  - successful recanalization rate 61.1% (11/18)

- Retrograde approach in 8 cases:
  - 7 cases as the second line choice after the fail of an antegrade approach
  - 1 case, broke through by retrograde approach directly (no femoral access)
  - successful recanalization rate 75.0% (6/8)
Result

- L side: 12 self-expandable stents, 1 cover stent and 2 balloon-expandable stents
- R side: 2 balloon-expandable stent, both EPD
Complication

- no perioperative mortality or any permanent neurological deficit.
- 1 case: arterial dissection
CASE 1

- Male, 70y
- Vertigo 1m
- BUS Lsca CTO （Grade 3）
- Smoking history
- BP L 100/80mmHg, R 200/140mmHg
- Femoral artery （-）
• Bilateral iliac artery total occlusion
• No claudication
• L Brachial Artery approach
• symptom relieved

• 4Y follow up no restenosis
CASE 2

- Male, 65y
- L arm claudication 4y
- BUS: LSCA occlusion?
- Hypertension, DM, smoking history
balloon 6 × 30mm
stent 8 × 40mm
• L arm no claudication
• 2+y follow up no stenosis
CASE 3

- Female, 84y
- Vertigo 1y
- BUS Rsc occlusion (Grade 3)
- Smoking history, DM, CABG, HP
- BP L 122/50mmHg, R 106/55mmHg
- symptom relieved
- BP L 120/55mmHg, R 115/55mmHg
- 1y follow up no restenosis
follow-up

• 12 to 66 m, median follow-up time 36 m.
• Restenosis occurred in 2 cases.
• One case: the ultrasound: restenosis in stent at the 24m. The patient received PTA
• The other case: restenosis at the 36-m follow up
• slight fatigue of left arm, refused the endovascular treatment.
The cumulative primary patency rate at 5 years was 77.8%. The cumulative secondary patency rate at 5 years was 88.9%.

**red line**: cumulative primary patency rate,
**green line**: cumulative secondary patency rate

The cumulative primary patency rate at 5 years was 77.8%. The cumulative secondary patency rate at 5 years was 88.9%.
Take home message

• Breakthrough CTO： Key Step.
• Support system： crucial（guiding catheter、long sheath、support catheter……）
• CTO guidewire
• Antegrade approach  first line choice
• Retrograde approach might have potential risk of dissection， can also be considered as secondary choice.

Conclusion

• Endovascular treatment has good technical success rate & long term patency
• should be used as the priority choice of subclavian artery chronic total occlusion.
Thanks
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