Transition to Radial Approach for Neurovascular Procedures is Safe and Convenient: Characterization of a Learning Experience

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Introduction

- Transradial diagnostic and therapeutic endovascular procedures are associated with lower complication rates and better patient comfort when compared to the traditional femoral approach.

- Since most cerebrovascular providers have been performing endovascular procedures via a transfemoral approach for the entirety of their clinical career, adopting a radial access approach is often seen as difficult, risky, or time-consuming.

- We aimed to describe our single-center experience of transitioning to a radial-first approach for neurovascular procedures, with a special focus in diagnostic angiographies.

- Our goal is to provide data on the expected learning curve for such transitions and the typical length of the procedures and radiation dosing within the first 5 months of the transition.
Methods

Study Design

- **Retrospective review** of a prospective maintained cerebrovascular registry at an academic institution within the United States.

- The **first five months** of experience (March–August 2019) were divided into **four quartiles** evenly distributed in time (Q1-Q4).

Exclusion criteria

- Patients who underwent endovascular procedures through the **femoral route**.

Inclusion criteria

- Patients who underwent diagnostic or therapeutic **transradial** endovascular procedures.

Primary outcome

- **Total length of procedure**
  - Time incurred between the time-out and the last fluoroscopic image acquired.
Results

- 121 patients underwent transradial procedures:
  - 113 (93%) diagnostic.
  - 8 (7%) therapeutic.
  - 81 women (67%).
  - Mean age: 56 (± 14) years.

- Successful transradial procedures: 115 (95%).
  - Failures in radial artery cannulation: 6 (5%).

- Complications: 1 (1%)
  - An anterior circulation stroke with transient neurological deficit.

Additional characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Patients (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intracranial aneurysm</td>
<td>77 (64)</td>
<td>-</td>
</tr>
<tr>
<td>Vascular malformations</td>
<td>20 (16)</td>
<td>0.010</td>
</tr>
<tr>
<td>Stroke</td>
<td>15 (12)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Other</td>
<td>9 (7)</td>
<td>0.626</td>
</tr>
<tr>
<td>Procedures per quartile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>16 (13)</td>
<td>-</td>
</tr>
<tr>
<td>Q2</td>
<td>29 (24)</td>
<td>0.039</td>
</tr>
<tr>
<td>Q3</td>
<td>30 (25)</td>
<td>0.001</td>
</tr>
<tr>
<td>Q4</td>
<td>46 (38)</td>
<td>0.001</td>
</tr>
<tr>
<td>Radiation exposure per-case, in mGy (median, IQR)</td>
<td>264 [158, 418]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Left vertebral artery selection</td>
<td>21 (18)</td>
<td>0.001</td>
</tr>
<tr>
<td>Number of cranial vessels assessed (median, IQR)</td>
<td>2 [1, 3]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ultrasound assistance for radial artery cannulation</td>
<td>62 (52)</td>
<td>0.020</td>
</tr>
</tbody>
</table>
Results

Length of 107 successful diagnostic transradial procedures

Multivariable analysis for the association with the total length of the procedure in 107 diagnostic procedures

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coef.</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartile group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>-9.81</td>
<td>-15.26 to -4.36</td>
<td>0.001</td>
</tr>
<tr>
<td>Q3</td>
<td>-9.03</td>
<td>-14.48 to -3.57</td>
<td>0.001</td>
</tr>
<tr>
<td>Q4</td>
<td>-11.33</td>
<td>-16.68 to -5.98</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Number of cranial vessels assessed</td>
<td>2.66</td>
<td>1.53 to 3.80</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Left vertebral artery cannulation</td>
<td>6.05</td>
<td>1.40 to 10.69</td>
<td>0.011</td>
</tr>
<tr>
<td>Ultrasound assistance</td>
<td>0.69</td>
<td>-2.74 to 4.13</td>
<td>0.688</td>
</tr>
</tbody>
</table>

Variable: Coef. 95% CI P value
Quartile group: Q2 -9.81 -15.26 to -4.36 0.001
Q3 -9.03 -14.48 to -3.57 0.001
Q4 -11.33 -16.68 to -5.98 < 0.001
Number of cranial vessels assessed 2.66 1.53 to 3.80 < 0.001
Left vertebral artery cannulation 6.05 1.40 to 10.69 0.011
Ultrasound assistance 0.69 -2.74 to 4.13 0.688
Results

Diagnostic Procedures in < 25 minutes

Q1  Q2  Q3  Q4
Our rate of procedure success (95%) is comparable to the success rates described in the literature (94.5-99.3%).

- 3 out of 6 patients with access failure harbored a past medical history of previous radial arterial lines and/or previous cardiology transradial procedures.

Our complication rate was 1%, which is low and comparable with previous studies (3.8-10%).

- Compared to femoral access, radial access has been associated with a reduction in the odds of having major bleeding, death, myocardial infarction, and stroke.

We did not find a significant variation in the radiation dose when comparing diagnostic procedures done at Q1 (348 mGy) and Q4 (326 mGy), \( p=0.692 \).

Over the duration of the study, the mean diagnostic procedure time was significantly reduced (33 min. in Q1 vs 22 min. in Q4), reflecting the learning curve process.

- This is comparable to the mean duration of transradial diagnostic cerebral procedures previously reported (28-40 min.).

The use of ultrasound was not a significant factor for variation in the length of the procedure.

- This result differs from previous reports showing an improvement in success rates and speed of radial artery cannulation.

- It is likely that selection bias plays a role here, with our providers using ultrasound for patients considered to have more challenging access.
Our 5-month experience suggests the transradial route is both a safe and convenient approach.

The total length of procedure decreases significantly as providers gain experience and become more confident with this route.

While the duration of procedures was significantly reduced over time, radiation exposure remained stable.

The transition to the transradial approach for the neuro-endovascular procedures is not abrupt. It should be introduced gradually and as a complement to transfemoral access.

- We suggest starting with diagnostic procedures, until the operator and institution becomes proficient with the technique, and then transitioning to therapeutic procedures.