Transradial Diagnosis and Intervention of Supraaortic Vessels

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ABSTRACT: Background. The transradial approach (TRA) is becoming widespread, mainly for coronary interventions, but it has rarely been used for diagnosis and even less for therapeutic treatment of supraaortic arterial vessel (SAAV) atherosclerotic disease. Objectives. We report our last year’s experience in both diagnostic and therapeutic endovascular procedures for SAAV atherosclerotic disease using the TRA. Methods. The TRA was used in 20 diagnostic and 18 therapeutic procedures for SAAV atherosclerotic disease performed on 26 males and 12 females with a mean age of 65 ± 7 years. Indications for diagnostic or therapeutic procedures were: clinical findings; and symptoms related to SAAV disease. Indications for the TRA were: no option of femoral approach (9/38); hostile arch anatomy (3/38); technical failure via femoral approach (4/38); ostial vertebral disease (6/38); or patient preference (16/38). All diagnostic procedures were undertaken using 5 Fr catheters. Treated vessels were: brachiocephalic; subclavian; carotid; vertebral; extracranial segments V1 and V2; and intracranial segment V4 and basilar arteries. Technical success was achieved in 17/18 therapeutic procedures (95%). We switched to the femoral approach in 1 patient with right-sided carotid disease where the distal protection device could not be propagated cranial to the narrowed segment. No vascular or neurological complications were recorded in any of the procedures. Patients were discharged the same day after diagnostic procedure and 1 day after therapeutic procedure. At a mean 7-month follow-up exam, neither neurological symptoms nor clinical restenosis were detected. Conclusions. Diagnostic and therapeutic procedures involving SAAV can be safely and successfully performed via the TRA by experienced interventional cardiologists.

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Coronary, lower-limb, and supraaortic arterial vessel (SAAV) disease are manifestations of the same systemic disorder — atherosclerosis — sharing the same pathogenesis and predisposing factors.1 Today’s leading textbooks and scientific papers in cardiology encourage the involvement of both clinical and interventional cardiologists in evaluating and treating these disorders.2,3 Paralleling this trend, the last decade has seen a gradual shift from the femoral to radial approach for diagnostic and therapeutic coronary interventions performed by interventional cardiologists.4 However, the use of this approach to evaluate and treat non-coronary vascular disorders is quite rare.

Since 2007, when the concept of atherosclerosis as a systemic disease was adopted, our load of patients investigated and evaluated for non-coronary atherosclerotic obstructive pathologies has increased and broadened. Herein we report our experiences in evaluating and treating SAAV atherosclerotic pathologies using the transradial approach (TRA). Rationale, patient characteristics, indications, contraindications, and basic principles of the technique including early results and mid-term follow-up are reported.

Methods

Background. There have been two cardinal changes at our institute since 2006-2007. We gradually shifted from the femoral to radial approach for assessing and treating coronary disease and began to evaluate and assess atherosclerosis as a systemic disease. Non-coronary vascular disease, including intracranial atherosclerotic disorders, was assessed and treated following the guidelines of the different societies, working groups, and associations involved in these fields.5,6

Our report focuses on retrospective non-randomized data collected throughout 2011. In that year, a total of 2448 endovascular procedures were undertaken in our catheterization laboratory — 2256 (92%) involving the coronary tree, 144 (6%) involving non-coronary extracardiac vessels, and 48 (2%) valvular interventions.

Among the non-coronary extracardiac vessel procedures, 87 (60%) were undertaken via the femoral approach and 57 (40%) via the radial approach: 19 of the 57 (33%) were directed to lower-limb procedures and 38/57 (67%) focused on SAAV. This retrospective analysis includes 26 males and 12 females with a mean age of 65 ± 7 years (range, 56-82 years). Patient clinical characteristics are shown in Table 1.

The indications for diagnostic procedures were clinical symptoms related to SAAV pathology or clinical findings such as asymmetry between upper-extremity pulses, cervical long systolic murmurs, or blood pressure differences between arms. The indications for therapeutic intervention were based on both American and European peripheral vascular disease-related guidelines.5,6

During 2011, intracranial interventions were directed toward posterior circulation pathologies only. All patients were assessed by a neurologist and subjected to intracranial vessel evaluation by carotid duplex, computed tomography (CT), or magnetic resonance (MR) angiography prior to the performance of interventional procedures. Main complaints related to posterior circulation vascular pathology were dizziness, vertigo, headache, recurrent syncope, or previous transient ischemic attacks. All patients with intracranial disease were symptomatic under comprehensive medical therapy. However, 2 patients with 80% internal carotid artery disease and 1 post-coronary artery bypass graft patient with 70% proximal left subclavian narrowing were asymptomatic.
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Mode of follow-up. Three to 6 months after intervention, clinical examination, and cervical carotid duplex and either CT or MR angiography for intracranial vessel evaluation were undertaken.

Techniques of SAAV Diagnosis and Intervention by the TRA

Diagnostic procedures

After performing an Allen test, all diagnostic procedures were performed via the right radial artery using 5 Fr diagnostic catheters and Terumo 0.035” guidewire. The radial sheath was flushed with 5000 units of unfractionated heparin and 200 µg of nitroglycerin before catheter insertion. We did not perform routine aortic arch angiography to facilitate cervical vessel cannulation. Anteroposterior and left anterior oblique projections were the most commonly used for cervical vessel engagement. Diagnostic catheters used for right-sided SAAV were: right coronary Judkins or internal mammary (IMA) catheters, and for left-sided SAAV: left coronary Judkins, IMA or Simmons catheters. Complete four-vessel cervical angiography including intracranial vascularity was mandatory before either carotid or intracranial interventions.

Therapeutic procedures

Radial angiography. Routine radial angiography was undertaken before every intervention, whereas 6 or 7 Fr guiding or long sheaths were intended to be used in order to assess radial diameter and course.

Approach. All SAAV diagnostic procedures were performed via the right radial artery. However, while right internal carotid system, brachiocephalic, right vertebral, and basilar therapeutic procedures were undertaken via the right radial artery, the left subclavian and left vertebral V1-V4 segments were treated via the left radial approach.
Pharmacotherapy. All interventional procedures were undertaken under dual-antiplatelet therapy (aspirin and clopidogrel) and activating clotting time (ACT) ≥250 seconds. All guiding catheters or long sheaths were immediately extracted from the radial artery at the end of the procedure with ACTs ≥250 seconds. Postprocedure aspirin (100 mg daily) was recommended for life and clopidogrel (75 mg daily) for 1 month.6

Twenty-two lesions were treated in 18 patients with SAAV disease. Two patients with unilateral vertebral disease had significant tandem lesions and another 2 showed bilateral V4 narrowing.

Vessel treated and equipment used for SAAV interventions (Table 2)

Guiding catheters/long sheaths. For carotid interventions, we used either 6 Fr multipurpose (J & J Cordis) or destination catheters (Terumo), and for vertebral interventions we used either 5 Fr right coronary Judkins (J & J Cordis) or 6 Fr Neuron catheters (Pneumbra).

Stents. Two drug-eluting stents and two bare-metal stents were used for 4/6 patients undergoing vertebral system interventions; self-expandable stents (Protégé Rx; ev3) were used for carotid disease and Genesis balloon-expandable stents (J & J Cordis) were used for subclavian or brachiocephalic interventions.

Wires. 0.014” wires were used for carotid and intracranial interventions and 0.018” wires for subclavian and brachiocephalic interventions.

Distal protection devices (Spider FX; ev3) were used only in carotid interventions. Pre- and postintervention angiographies performed via the radial approach related to subclavian, brachiocephalic, ostial vertebral, carotid, and basilar interventions are demonstrated in Figures 1-5, respectively.

Outcomes

Early outcome. Technical success was achieved in 17/18 (95%) of the therapeutic procedures. We switched to a femoral approach in 1 patient with right carotid artery disease where the distal protection device could not be propagated cranial to the narrowed segment. Neither vascular nor neurological complications were recorded in any of the procedures. The patients who underwent diagnostic procedures were discharged the same day, and those who underwent therapeutic procedures were discharged a day later.

Late outcome. At a mean follow-up of 7 ± 3 months, no neurological complications were detected among patients who underwent extra- or intracranial interventions. Intracranial CT or MR angiography detected 50% asymptomatic restenosis in 2/6 patients who underwent V4 segment interventions.

Discussion

Following 6 years of performing intensive coronary endovascular procedures via the radial approach, we demonstrate that SAAV diagnostic and interventional procedures can be safely and successfully performed via the same route.

Since first described in 1989, use of the radial approach for coronary diagnostic and therapeutic procedures has increased worldwide.9 The main advantages of this approach are: low
rate of access-site complications, early ambulation, same-day discharge, and increased patient comfort.\textsuperscript{9} Compared to groin access, initial and more recent reports indicate that the radial approach to diagnostic and therapeutic coronary procedures reduces hospital costs as well.\textsuperscript{10,11} Beyond coronary interventions, several studies and feasibility reports have shown successful application of transradial access for peripheral interventions.\textsuperscript{12,13}

More recently, radiologists, neurointerventionalists,\textsuperscript{14,15} as well as cardiologists have reported successful SAAV interventions via the radial route.\textsuperscript{16-18} Following the true need and new trend in which we, as cardiologists, are strongly encouraged to be involved in non-coronary endovascular procedures,\textsuperscript{3,5} we should get training in the radial approach for both coronary and non-coronary procedures. In our series, 16/38 patients could have been treated only by this approach whereas another 16/38 asked for this port of access. As we have shown by crossing the learning curve in coronary interventions, the same success and results are applicable in practice for SAAV interventions.

### Conclusion

In conclusion, for diagnostic and therapeutic procedures involving the SAAV, the radial approach seems to be a very promising technique and might be one of the best options for future routine use of transcatheter interventional techniques.

### References


### Table 2. Vessels involved and equipment used for supraaortic arterial vessel interventions.

<table>
<thead>
<tr>
<th>Vessel/No. of Patients</th>
<th>No. of Lesions</th>
<th>Guiding Size</th>
<th>Guidewire</th>
<th>Stent Type</th>
<th>Stent Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid/5</td>
<td>5-4 RICA</td>
<td>6 Fr</td>
<td>0.014”</td>
<td>Self-expandable</td>
<td>6-8</td>
</tr>
<tr>
<td>Vertebral segments/7</td>
<td>V1-4</td>
<td>5 Fr</td>
<td>0.014”</td>
<td>Coronary</td>
<td>2.5-4</td>
</tr>
<tr>
<td>Basilar/1</td>
<td>V2-3, V4-4</td>
<td></td>
<td>0.018”</td>
<td>Balloon-expandable</td>
<td>7</td>
</tr>
<tr>
<td>Subclavian/4</td>
<td>1</td>
<td>6 Fr</td>
<td>0.014-0.018”</td>
<td>Balloon-expandable</td>
<td>7-8</td>
</tr>
</tbody>
</table>

RICA = right internal carotid artery; LICA = left internal carotid artery.