Efficacy of Transradial Cerebral Angiography in the Elderly

Jung-Hyun Park, M.D., Dae-Yong Kim, M.D., Jin-Wook Kim, M.D., Yong-Seok Park, M.D., Won-Bae Seung, M.D.
Department of Neurosurgery, Gospel Hospital, Kosin University College of Medicine, Busan, Korea

Objective: Transradial angiography has become popular among many cardiologists as a diagnostic and therapeutic tool. However, transradial cerebral angiography is not utilized to the same extent. The purpose of this study is to present our experience regarding the usefulness of transradial cerebral angiography, especially in elderly patients.

Methods: Between May 2011 and February 2012, a total of 126 cerebral angiographies were performed via a transradial approach in a single center. Of them, only 47 patients were over 60 years old. In our institution, we shifted the initial access from the right femoral artery to the right radial artery in all patients requiring cerebral angiography in 2011. We did not attempt radial access in 40 cases for variable reasons.

Results: The procedural success rate was 92.2%. We have four failures of transradial angiography; two because of loop formations of the radial and brachial artery and two due to multiple puncture failures. All supra-aortic vessels were successfully catheterized. However, the selective catheterization rates of the left side distal vessels were lower, as success rates were 89.7% for the right internal carotid artery and 75% for the left internal carotid artery. Procedure-related vascular complications, such as puncture site hematoma, hand ischemia, pseudoaneurysm, arteriovenous fistula and arterial dissection were not observed in our series. However, intraprocedural thrombosis developed in one patient, which was resolved completely by intraarterial thrombolytic agents.

Conclusion: With advancing patient’s age, we believe that transradial cerebral angiography is a useful tool to decrease patient’s discomfort and more effectively manage the vessel tortuosity.

Key Words: Angiography · Cerebral angiography · Radial artery · Transradial.

INTRODUCTION

Due to progress in cerebrovascular imaging methods, such as magnetic resonance (MR) angiography and three-dimensional CT angiography, there is increased interest in cerebrovascular disease in ageing society. Many cerebrovascular diseases are worked up through health screening, which prevent cerebrovascular events. However, cerebral catheter angiography remains the gold standard method for examining the vasculature of patients with cerebrovascular disease. In most institutions, the right femoral artery is usually selected as the main vascular access for performing cerebral angiography, because of the clinicians’ familiarity and its convenience. Transfemoral angiography has some limitations. Many patients suffer from hematomas or bruising in the groin. Additionally, pseudoaneurysms or arteriovenous fistulae of the puncture site are rare but do occur.

It cannot be used when patients have extensive atherosclerotic disease or atypical anatomy in their aortic arch or brachiocephalic vessel, femoral artery occlusion or abnormality. To avoid these problems and limitations, we performed transradial access for the preceding year.

The purpose of this study is to describe the efficacy of transradial angiography by a single operator's experience for one year, especially in elderly patients.

MATERIALS AND METHODS

Patient selection
Between March 2011 and February 2012, 244 patients underwent selective cerebral angiography with digital subtraction angiography in our institution. For 126 patients (51.64%), the procedure was performed via a transradial approach for the evaluation
of cerebrovascular disease. These patients ranged in age from 17 to 78 years (mean age, 56.2 years) and included 73 women and 53 men. There were 47 patients over the age of 60; 25 women and 22 men. Additionally, 91 of the total 244 patients receiving a cerebral angiography were over the sixty, 47 underwent transradial access and 44 underwent transfemoral access. Patients requiring interventional procedures were excluded. After a one-year neurointerventional learning period with 322 cerebral angiographic cases in another institution, we shifted the initial access from the right femoral artery to the right radial artery in all patients requiring cerebral angiography. The indications for cerebral angiography are listed in Table 1 for patients over the age of 60. We did not attempt radial access in 40 of these patients for various reasons (Table 2). Our institutional review board approved these informed consents.

**Instruments and techniques**

Patients were brought to the angiographic suite. All procedures were performed for diagnostic purposes. We performed all the transradial approaches via the right side. If the right side was not available, we did not proceed with the transradial approach because performing this procedure via the left radial artery was very inconvenient. In these cases, we performed a right transfemoral approach. All patients underwent a modified Allen’s test of the right wrist to evaluate satisfactory collateral perfusion. Under fluoroscopy monitoring, a 5-French Simmons 2 catheter was advanced over a 0.035-inch hydrophilic guidewire (Terumo Radifocus, Tokyo, Japan) through the radial artery to the brachial artery, then through the axillary artery into the subclavian artery in all cases. Guidewire was subsequently advanced to the ascending aorta and turned back at the aortic valve for the reconstitution of the natural Simmons configuration of the catheter. After the catheter was reconstituted, the catheter tip was controlled to select the orifice of the target artery [the innominate artery, left common carotid artery (CCA) or the left subclavian artery], and then advanced to the distal selection [the internal carotid artery (ICA) or vertebral artery]. After the procedure, the catheter and sheath were removed, and a superficial pressure dressing with a radial artery hemostatic device (Hangshou Alicon Pharm Co., LTD, Zhejian, China) was applied to the radial artery puncture site. Patients were observed for three hours before discharge. During this observation period, their activity was not limited to bed rest.

**RESULTS**

In patients over the age of 60, radial access was successful in 47 of 51 cases, a success rate of 92.2%. Transfemoral approach was performed in the four patients with failed radial artery access. This was attributed to failure of the radial puncture, loop formation or tortuosity at the proximal end of the radial artery in two patients, and severe vasospasm of the radial artery following multiple puncture trials in two patients (Fig. 1). All supra-aortic vessels were successfully catheterized. However, selective catheterization rates of the left-sided distal vessels were lower, with success rates of 89.7% (26/29) for the right ICA and 75% (27/36) for the left ICA. Patients were excluded when it was deemed impossible or dangerous to catheterize the ICA because of severe stenosis or atheromatous plaques. We did not attempt to select the vertebral artery routinely, if there was not found the lesions at previous CT angiography or MR angiography. Two procedures using the same radial artery were performed in two patients (4.3%). Among these patients, radial artery occlusion or stenosis was not demonstrated on follow-up cerebral angiography. In all patients in whom the transradial angiography was successful, the diagnostic adequacy and quality

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**Table 1. Indications for transradial cerebral angiography in patients with age >60 years**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Number of cases</th>
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<tbody>
<tr>
<td>Aneurysm</td>
<td>26</td>
</tr>
<tr>
<td>Transient ischemic attack</td>
<td>6</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>5</td>
</tr>
<tr>
<td>Brain tumor</td>
<td>2</td>
</tr>
<tr>
<td>Follow-up of coiling or clipping</td>
<td>8</td>
</tr>
</tbody>
</table>

**Table 2. The reasons for initial transfemoral access in patients with age >60 years**

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritability due to confused mentality</td>
<td>18</td>
</tr>
<tr>
<td>Inability to position patient’s right arm</td>
<td>4</td>
</tr>
<tr>
<td>Not palpable or too weak radial pulse</td>
<td>10</td>
</tr>
<tr>
<td>Abnormal Allen’s test</td>
<td>4</td>
</tr>
<tr>
<td>Absolute selection of left vertebral artery</td>
<td>4</td>
</tr>
</tbody>
</table>

There were four cases excluded due to failure of transradial access; two loop formations of radial artery and two multiple puncture failures.
of images were satisfactory.

Pain in the forearm or arm developed in three patients during the procedures, but it was usually mild and transient. Vasospasm of the radial artery was noted in two cases. Spasms were effectively resolved with the combined solution of nitroglycerin, verapamil, and heparin. Procedure-related vascular complications, such as puncture site hematoma, hand ischemia, pseudoaneurysm, arteriovenous fistula and arterial dissection, were not seen in our series. No patients had functional disability of the hand, and no complaints of discomfort were reported on the questionnaire. However, intraprocedural thrombosis developed in one patient and aggravation of a pre-existing neurologic deficit was noted (Fig. 2). Chemical thrombolysis was performed through the transradial route and the thrombus was removed completely. The patient's symptom was improved after one day without further sequelae.

DISCUSSION

The transradial approach was introduced for the first time in 1998 in coronary angiography. It was contributed to reduce puncture site complication and the discomfort of the patients. Transradial approach has become popular among a majority of interventional cardiologists as a diagnostic and therapeutic tool in a number of centers worldwide because of its low puncture site complication rate, as compared with the transfemoral approach, for patients undergoing anticoagulation therapy. The transradial approach in cerebral angiography and neurointervention was introduced in 2000. Some authors expected that the transradial approach could be a gold standard for cerebral angiography, although the transfemoral approach is usually favored in almost centers because of familiarity and convenience.

The femoral artery is the most common puncture site used for cerebral angiography, because most angiographers and neurorinterventionalists are comfortable using this access for the entire cerebral vascular system. However, there are some limitations. Transfemoral approach cannot be used when patients have extensive atherosclerotic disease in their aortic arch, atypical anatomy of their aortic or brachiocephalic vessels, dissection of the thoracic artery, iliofemoral occlusive disease, or groin infection. Additionally, this procedure can lead to several complications, such as retroperitoneal hematoma, pseudoaneurysm formation, arteriovenous fistula formation, femoral nerve injury, lower limb ischemia, and pulmonary embolism. One of the major limitations of the transfemoral approach is the requirement for 4 to 6 hours of leg immobilization and bed rest to prevent bleeding complications at the femoral access site. At times, duration of the leg immobilization was greatly reduced by application of percutaneous closure devices. However, these devices were expensive.

Transradial approach has the most important advantage of easy hemostasis. Compared with a groin hematoma formation rate with transradial approach reported as high as 10%, Transfemoral approach may cause more suffering for the patients, particularly for those with advanced age, degenerative spine or spinal lesions, or benign prostate hypertrophy, because these conditions require complete bed rest for at least several hours following femoral artery puncture. Furthermore, after the transfemoral approach, patients are usually kept in the hospital overnight for observation. In contrast, transradial approach does not require bed rest and allows the patient to be ambulatory immediately without the restriction of arm movement after procedure. In our institution, after transfemoral approach, we perform manual compression for 15 minutes without the use of additional percutaneous groin closure devices in the angiographic suite. However, transradial approach does not take the time for the compression. It is not necessary to compress the puncture site manually, as a simple compression device is sufficient to achieve hemostasis without special precautions. We generally observe patients for six hours with leg immobilization after transfemoral angiography. It is quite uncomfortable for patients and may lead to anxiety toward future angiographic trials. However, transradial angiography does not require prolonged observation. It takes 3 hours for observing patients and allows ce-
Transradial cerebral angiography is a useful routine or alternative method for patients in whom transfemoral cerebral angiography is less favorable. With advancing patient age, transradial angiography is helpful to overcome vessel tortuosity and patient discomfort.

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