Transradial approach for neuroendovascular surgery of intracranial vascular lesions

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Object. The authors present their experience in performing a transradial approach for neuroendovascular surgery of intracranial vascular lesions when a transfemoral approach was unfavorable.

Methods. Eight patients ranging in age from 52 to 88 years underwent a total of nine neuroendovascular procedures for intracranial vascular lesions. A transradial approach was used in all patients. The patients had previously undergone a transfemoral approach for the endovascular intervention, but that procedure was unsuccessful. Five patients had intracranial basilar artery (BA) aneurysms, one patient had symptomatic BA stenosis, one patient had a dural arteriovenous fistula in the posterior fossa, and one patient had a high-flow arteriovenous malformation in the frontal lobe.

In each case, a transradial approach achieved a stable platform that allowed intracranial microcatheterization for neuroendovascular intervention. None of the patients experienced complications attributed to the transradial artery approach.

Conclusions. During neuroendovascular surgery for the treatment of intracranial lesions, the transradial approach is a viable alternative if the transfemoral approach is unfavorable. This series represents the first known description of neuroendovascular surgery for intracranial lesions via a transradial approach.

KEY WORDS • transradial approach • neuroendovascular surgery • intracranial aneurysm • intracranial stenosis • arteriovenous malformation

The RA is described as an intraarterial access site that has documented advantages for coronary angiography, coronary angioplasty and stenting, and renal artery stenting. The literature also contains references to the transradial approach for diagnostic cerebral angiography, angioplasty and stenting of extracranial VA stenosis at the origin of the VA off the subclavian artery, and cervical ICA stenting. To the best of our knowledge, there is no published case in which the transradial approach was used for interventional treatment of intracranial lesions. We describe nine operations (eight patients) in which the transradial approach was used for neuroendovascular surgery for the treatment of an intracranial vascular lesion.

Clinical Material and Methods

Patient Population

After we obtained an exempt status from our Institutional Review Board, we retrospectively studied the medical records of eight patients (age range 52–88 years, two men and six women) who underwent a total of nine neuroendovascular procedures at Shands Hospital at the University of Florida. Every patient presented with an intracranial vascular lesion that could not be treated when a transfemoral approach was attempted because of excessive aorta–iliac and cervicocerebral arch tortuosity and ectasia. We performed a transradial approach in all nine procedures to bypass the vessel tortuosity and ectasia. Four patients in this series presented with ruptured aneurysms—the first three (Cases 1–3) with basilar apex lesions and the fourth (Case 4) with a right superior cerebellar artery–posterior cerebral artery aneurysm. One patient (Case 3) had a Hunt and Hess Grade I SAH, two patients (Cases 1 and 4) a Hunt and Hess Grade III SAH, and one patient (Case 2) a Hunt and Hess Grade IV SAH for severe comorbidities. Another patient (Case 5) presented with a symptomatic unruptured giant fusiform basilar trunk aneurysm. In Case 6 the patient presented with an SAH due to a ruptured DAVF in the posterior fossa, which was assigned a Hunt and Hess Grade III. In Case 7 the patient had symptomatic high-grade mid-BA stenosis with brainstem ischemia, and in Case 8 the patient had a posterior frontal AVM, which was fed primarily from the vertebrobasilar system through an extremely dilated PCoA owing to an ipsilateral CA occlusion. (Table 1).

Surgical Procedure

In each case, the patients were brought to the neuroendovascular suite and placed supine. Before we accessed the RA, an Allen Test was performed. The results of this test demonstrated adequate collateral blood flow in all eight patients. The site superficial to the RA was infiltrated with 2% lidocaine to induce local anesthesia. Access to the RA

Abbreviations used in this paper: AVM = arteriovenous malformation; BA = basilar artery; BrA = brachial artery; CA = carotid artery; DAVF = dural arteriovenous fistula; FA = femoral artery; ICA = internal CA; PCoA = posterior communicating artery; RA = radial artery; SAH = subarachnoid hemorrhage; UA = ulnar artery; VA = vertebral artery.
was obtained using a micropuncture kit (Neff Percutaneous Access Set; Cook, Inc., Bloomington, IN); trauma to the RA was minimized by using a 21-gauge needle and a 0.018-in guidewire. The micropuncture system is composed of a 10-cm-long No. 4 French outer catheter with an interlocking No. 3 French inner catheter. Once the inner catheter had been removed, we injected an “RA cocktail,” a mixture of heparin (5000 IU/ml), verapamil (2.5 mg), nitroglycerin (400 μg/ml, 0.25 ml administered), and lidocaine (2%, 1 ml administered) through the No. 4 French catheter during a 2-minute period to allay vasospasm in the RA and BrA.3,4 Figure 1 demonstrates the usefulness of the RA cocktail. Before infusion of the cocktail, a No. 5 French diagnostic catheter could occlude antegrade blood flow (Fig. 1 left); however, several minutes after the cocktail had been infused, the No. 5 French diagnostic catheter was replaced with a No. 6 French femoral sheath (7.5 French outer diameter) and a No. 6 French guiding catheter, with resumption of excellent antegrade flow through the arteries (Fig. 1 right). The guiding catheter was finally placed into the dominant VA through a brachial-axillary-subclavian approach (Fig. 2).

Results

In all eight patients, we achieved a direct, stable platform through the transradial approach, which eliminated the difficult aorta–iliac and cervicocerebral aortic arch tortuosity and ectasia. There were no complications associated with the transradial approach; however, there was one complication in this series (Case 7) unrelated to the operative approach. In that case the patient presented with symptomatic high-grade BA stenosis and brainstem ischemia, and he underwent intracranial stent placement (Bx Velocity coronary artery stent; Cordis Corp., Miami Lakes, FL). Unfortunately, the patient suffered an SAH due to a BA dissection shortly after he was returned to the intensive care unit. Several hours later he suffered another SAH and eventually died.

Case 8 was unusual because the patient underwent two transradial neuroendovascular procedures. She had presented to our institution with progressive left hemiparesis, which may have been caused by ischemia or a steal phenomenon from a high-flow AVM in the right posterior frontal lobe. This AVM was fed predominantly by the verteobasilar PCoA to the right middle cerebral artery branches. Access to the right ICA was unavailable because of a ligation performed 40 years earlier. The transfemoral approach was attempted to reach the verteobasilar artery–PCoA region as well as the left CA-anterior cerebral artery-anterior communicating artery region. Both transfemoral attempts were unsuccessful because of severe vessel tortuosity and an excessively long vessel,
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which exceeded the lengths of all commercially available microcatheters. This patient subsequently underwent two successful embolizations of the frontal AVM. These were performed using Truefill n-BCA glue (Cordis Corp.) through a transradial approach that shortened the microcatheter distance needed to reach the AVM.

Discussion

By-passing the aorta-iliac system by using a transradial approach offers many benefits. Because there is usually excellent collateral blood flow through the UA and the palmar arch, RA occlusion is well tolerated. In addition, no major nerves or veins are located near the RA and, therefore, this approach can lower access site–related complications including neuropathies and AVFs. Uncomfortable inguinal FA compression and expensive vascular closure devices are not necessary. Using the transradial approach, hemostasis is achieved easily by local compression because the RA is superficially located. In contrast to FA access, patients can begin walking immediately after the procedure.

In cardiac procedures, the risks of the transradial approach have been shown to be lower than those associated with the transfemoral or transbrachial approach. These risks include RA, BrA, and subclavian artery dissections, pseudoaneurysms, and occlusions. In a report of 1000 patients who underwent transradial angiography, an 8.6% rate of asymptomatic occlusion was reported, as well as an RA pseudoaneurysm and one forearm hematoma. It has been noted that RA occlusion is well tolerated if a patient has good collateral UA flow, as demonstrated by the Allen Test. A randomized comparison of 900 patients demonstrated that a significantly lower complication rate is associated with RA access (0%) compared with that associated with BrA access (2.3%) or FA access (2%). The RA approach has several advantages over the BrA approach. The RA has abundant collateral flow due to both the deep and superficial palmar arches from the UA. In contrast, the BrA has very poor collateral flow and damage to this artery affects both the RA and UA. Moreover, the RA is located more superficial than the BrA, resulting in simpler intraarterial access and direct postprocedure compression resulting in fewer hematomas. Therefore, it is our preference to use the transradial approach in patients in whom the vascular anatomy complicates a transfemoral approach.

Conclusions

In each case, a transradial approach achieved a stable platform, which had not been possible using a transfemoral approach. None of the patients experienced complications resulting from the RA approach. The transradial approach for endovascular treatment of intracranial vascular lesions offers a viable alternative for patients in whom FA access is unfavorable. To the best of our knowledge, this series represents the first description of the use of the transradial approach to access the intracranial vasculature for neuroendovascular surgery of various intracranial lesions.

Disclaimer

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