

Original Article

Transradial approach to treating endovascular cerebral aneurysms: Case series and technical note

Javier Goland^{1,2}, Gustavo Fabián Doroszuk¹, Silvia Lina Garbugino², María Paula Ypa²¹Hospital El Cruce Néstor Kirchner, Florencio Varela, Buenos Aires, ²Hospital de Clínicas José de San Martín, CABA, Argentina

E-mail: *Javier Goland - javiergoland@gmail.com; Gustavo Fabián Doroszuk - gusdoro@yahoo.com.ar; Silvia Lina Garbugino - silviagarbu@gmail.com; María Paula Ypa - paulaypa@gmail.com

*Corresponding author

Received: 08 October 16 Accepted: 09 February 17 Published: 10 May 17

Abstract

Background: Several benefits have been described over the years of the transradial versus femoral endovascular approach to cardiac interventions. Consequently, its use has become habitual at most centers that perform cardiac catheterizations. This paper details a right transradial approach, incorporating a variety of coils or flow diverters, which can be utilized for the endovascular treatment of different cerebral aneurysms.

Methods: From 2014 to 2016, we performed 40 endovascular procedures to treat cerebral aneurysms adopting the same right transradial approach. Five aneurysms were treated with flow diverters and 35 were treated with coils. Seven of these aneurysms were asymptomatic, whereas 33 had already ruptured.

Results: Satisfactory treatment was achieved in all cases through the same approach in the absence of any complications.

Conclusions: A right transradial approach may be satisfactory for the endovascular treatment of different cerebral aneurysms, including aneurysms in either hemisphere. This is the largest series of cerebral aneurysms treated through a transradial approach.

Key Words: Cerebral aneurysms, embolization, transradial approach

Access this article online

Website:www.surgicalneurologyint.com**DOI:**

10.4103/sni.sni_393_16

Quick Response Code:

INTRODUCTION

Endovascular treatment of cerebral aneurysms with coils constitute a recommendation type I class B in high volume centers for ruptured and unruptured aneurysms. The approach used in most medical centers for endovascular diagnosis and treatment of aneurysms is femoral puncture due to familiarity with this route.^[5,27]

A retrospective study comparing cardiac catheterization through femoral artery vs radial artery found significant differences in the incidence of pseudoaneurysms in those performed via femoral artery vs radial artery punctured. Complications associated to femoral approach, both

in diagnosis and therapy, are described in several articles, including bruising at the puncture site (1.3%), retroperitoneal hematomas (0.4%), pseudoaneurysm at

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How to cite this article: Goland J, Doroszuk GF, Garbugino SL, Ypa MP. Transradial approach to treating endovascular cerebral aneurysms: Case series and technical note. *Surg Neurol Int* 2017;8:73.

<http://surgicalneurologyint.com/Transradial-approach-to-treating-endovascular-cerebral-aneurysms:-Case-series-and-technical-note/>

the puncture site (0.1%), and arterial dissections (0.3%). A higher rate of complications were described in patients with anticoagulant and antiplatelet therapy. Furthermore, the presence of stenosis or atheromatosis aneurysms at iliac or aorta arteries hinder its catheterization through them. Once the procedure is completed, the manual compression of the groin is required in femoral approached patients for at least 10–20 minutes with subsequent pressure bandage, complete rest for 4 hours, and relative rest for 24 hours with the bandage. Despite these measures, other complications associated with this approach include, in addition to those previously mentioned, back pain, arteriovenous fistulas at the puncture site, femoral nerve injuries, chronic lower limb ischemia, and thromboembolism.^[2,7,16,24]

Transradial approach for coronary angiography was described in 1989. Many benefits of this approach have been described against the femoral over the years, which generated the habitual use of it in most centers for cardiac angiography.^[1,4,10,12,18-20]

There are several reports of series of cases of this approach for cerebral angiography and some reports of cases of acute ischemic stroke and aneurysms approached transradial because of impossibility of the femoral approach; however, there is no series of transradial approach for endovascular aneurysms treatment.^[13-15,17,22,23,26]

We describe the technique utilized in a series of 40 cerebral aneurysms of diverse topographies through a right radial approach treated with coils or flow diverters at two medical centers. This is the largest series of endovascular aneurysms treatment done through a transradial approach described in neurosurgical literature.

MATERIALS AND METHODS

Under general anesthesia, 35 cerebral aneurysms were treated with coils and 5 aneurysms with flow diverters. The procedures were performed between 2014 and 2016 in two public hospitals situated in Buenos Aires. Patients with aneurysms amenable to be treated only with coiling or flow diverter device through a 6fr guide catheter or smaller were included in the study. Thirty-eight treatments were performed by two of the authors (JG and GD) in center 1 and the other two were performed by the authors (JG, SG and PY) in center 2. All patients were approached through a right radial artery puncture. 8 aneurysms had been diagnosed on a previously study and an angiography and embolization were performed at the same study on the others 32. There were 33 symptomatic aneurysms and seven unruptured aneurysms [Table 1].

All patients signed informed consent or responsible family if they were unable to do so before the study.

We performed Allen Test in half of the cases of our serie to evaluate collateral circulation. From June 2015,

Table 1: Cerebral aneurysms cases treated through transradial approach

Case	Gender	Age	Type	Localization	Side	Implants
#1	F	52	U	PERICALLOSAL	Ri	COILS
#2	F	27	U	VERTEBRAL	Ri	FLOW DIVERTER
#3	M	40	R	POST COM	Ri	COILS
#4	M	61	R	POST COM	Ri	COILS
#5	M	52	R	POST COM	L	COILS
#6	M	53	R	Ant COM	Ri	COILS
#7	F	59	R	ANT COM	L	COILS
#8	F	43	R	POST COM	L	COILS
#9	F	15	R	ANT CEREBRAL	L	COILS
#10	F	57	R	OPHTALMIC	Ri	COILS
#11	F	43	R	POST COM	L	COILS
#12	M	60	R	ANT COM	Ri	COILS
#13	F	73	U	CAVERNOUS	Ri	FLOW DIVERTER
#14	M	50	R	CAROT BIFURC	L	COILS
#15	M	25	R	ANT COM	L	COILS
#16	M	56	R	ANT COM	Ri	COILS
#17	F	56	R	ANT COM	L	COILS
#18	F	62	R	MEDIAL CER	L	COILS
#19	M	53	R	ANT COM	Ri	COILS
#20	F	61	R	MEDIAL CER	Ri	COILS
#21	F	38	R	MEDIAL CER	L	COILS
#22	F	57	U	ANT COM	Ri	COILS
#23	M	38	R	CAROTID	Ri	COILS
#24	F	59	R	MEDIAL CER	Ri	COILS
#25	M	47	R	CAROTID	Ri	COILS
#26	F	38	R	POST COM	Ri	COILS
#27	F	46	R	MEDIAL CER	L	COILS
#28	F	43	R	MEDIAL CER	L	COILS
#29	M	27	R	CAROTID BIFURC	L	COILS
#30	F	60	U	CAVERNOUS	L	FLOW DIVERTER
#31	F	74	U	CAVERNOUS	Ri	FLOW DIVERTER
#32	F	50	R	POST COM	Ri	COILS
#33	M	60	R	POST COM	Ri	COILS
#34	M	35	R	ANT COM	L	COILS
#35	F	45	R	MEDIAL CER	Ri	COILS
#36	M	28	R	ANT COM	L	COILS
#37	F	57	U	POST COM	Ri	FLOW DIVERTER
#38	F	48	R	MEDIAL CER	Ri	COILS
#39	M	35	R	POST COM	Ri	COILS
#40	F	57	R	POST COM	L	COILS

M: Male, F: Female, R: Ruptured, U: Unruptured, POST COM: Posterior communication artery, ANT COM: Anterior communication artery, ANT CER: Anterior cerebral artery, CAVERNOUS: Intracavernous carotid artery, MEDIAL CER: Medial cerebral artery, CAROTID BIFURC: carotid bifurcation artery, OPHTALMIC: Ophthalmic artery, Ri: Right, L: Left

we discontinued the test because studies revealed no significant differences in safety regardless of the Allen's Test result.^[3,21,25]

Under general anesthesia, we performed a Seldinger double-wall technique at a point located 3 cm

proximal to the wrist, using a 21-gauge micropuncture needle [Figure 1]. Using blood return, we introduced a 0.021 inch microwire advancing it to the level of the brachial artery under fluoroscopic guidance to confirm a straight course [Figure 2]. The needle was removed and then a 6Fr hydrophilic radial sheath was placed advancing the total length of it into the artery (Merit Medical Systems, Utah, USA). A total of 10 cc of Nitroglycerin (200 µg/mL) followed by 70 IU/kg of heparin sulfate were instilled through the sheath.

A Simmons II catheter (Merit Medical Systems, Utah, USA) was used to perform three vessel studies previous to treatments. Some arteries approached directly with the guide without forming Simmons catheter [Figure 3], if not Simmons catheter was formed in the aortic valve [Figure 4]. Three vessels were always studied through radial access.

After diagnosis, an exchange on a 260 cm hydrophilic guide were done in the corresponding external carotid artery for aneurysm to treat. For addressing aneurysms through the right vertebral artery we entered directly with the guide catheter to the right vertebral artery. No aneurysms addressed by left vertebral artery in our series. We utilized three trademarks of guide catheters for these serie: DAC 5F (Concentric Medical, Mountain View, CA, USA), Fargomax 6F (Balt Extrusion, Montmorency, France) and Guider Softip XF 6F (Stryker, Neurovascular Fremont, Ca).

Using fluoroscopic and roadmap guidance, a 6Fr guide catheter was advanced over an angled glidewire into the proper artery and then the microcatheter was advanced up to the aneurysm. Four different microcatheters were used depending on the type of coil or flow diverter used: Headway 17 and 27 (MicroVention Inc., Tustin, CA), Excelsior SL10, (Stryker, Neurovascular Fremont, Ca), Vasco 27 (Balt Extrusion, Montmorency,

France). Coils used were: GDC (Stryker, Neurovascular Fremont, Ca), Barricade coil system (Blockade, Irvine CA). Flow diverters used were Fred (MicroVention Inc., Tustin, CA), Surpass (Stryker, Neurovascular Fremont, Ca), Silk (Balt Extrusion, Montmorency, France), and Derivo (Acandis GmbH & Co KG Pforzheim, Germany).

Once the procedure was concluded, radial sheath was removed without reversing heparin, leaving a direct compression over the puncture site after irrigation through the side via the same with 5cc of Nitroglycerin (200 µg/mL).^[14,28] Compression with a band of gauze was put over the puncture site for 24 hours [Figure 5].

RESULTS

Thirty-nine anterior circulation aneurysms and one vertebral aneurysms were treated through this approach; 23 right and 17 left aneurysms. Twenty-four of the patients undergoing transradial approach were women. The average age was 48.5 years [Table 1]. During the studies, no occlusion nor spasm artery were observed. Radial pulse was permeable at the end of 100% of the cases.

DISCUSSION

Radial approach for coronary procedures is widespread worldwide. There are large series of transradial cerebral angiographies and some case reports of endovascular treatments of posterior circuit aneurysms. The systematic use of this approach for endovascular treatment of anterior circuit intracranial aneurysms has not yet achieved the same acceptance than coronary studies. There are many advantages of transradial access with respect to the transfemoral approach; radial artery is

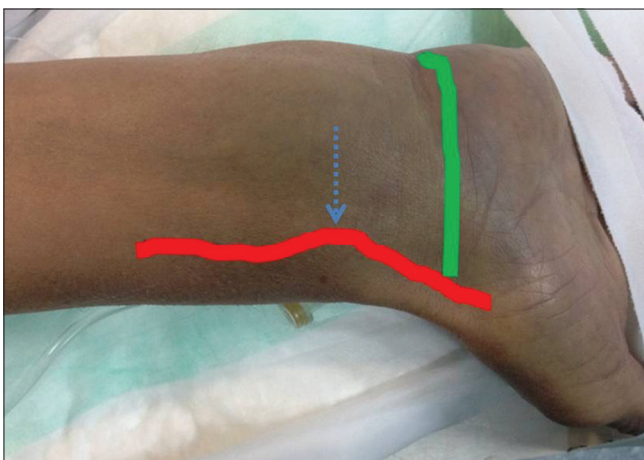


Figure 1: Puncture point. The red line marks the radial artery trajectory; the green line is over the wrist; the blue arrow indicates the puncture point located 3 cm proximal to the wrist line



Figure 2: Radiological control of the guide direction up to the brachial artery. Black arrows indicate the straight path of the radial artery in the forearm



Figure 3: Right vertebral and carotid arteries approached directly with guidance. (a) the guide wire inside the right vertebral artery; (b) contrast injection indicates the right vertebral artery; (c) the guide wire inside the right external carotid artery; (d) contrast injection inside the right common carotid artery

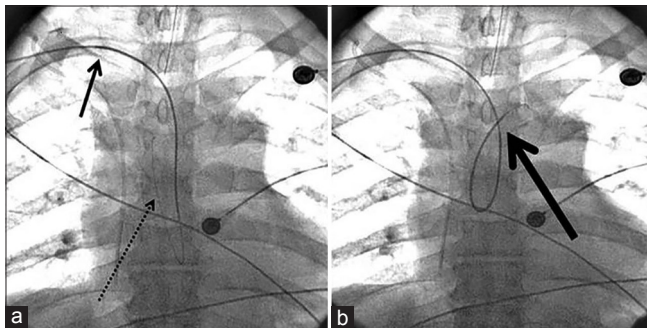


Figure 4: Simmons catheter within the aortic valve. (a) Continuous arrow indicates the subclavian approach of the catheter; the discontinuous arrow indicates the guide wire turning over in the aortic valve. (b) Continuous arrow shows the Simmons catheter already in place



Figure 5: Puncture point. (a) A gauze bandage compressed the puncture site post intervention. (b) The red circle identifies the puncture site one day post intervention

more superficial than femoral and liable location of it and its adjacent structures has no risk of injury. Radial artery is easily compressible, with less risk of bleeding post-procedure, and this approach was associated with fewer complications.^[1,9,25,28]

There are reports of hand ischemia occurring following cannulation of the radial artery for hemodynamic

monitoring in critically ill patients for more than 20 hours; however, this complication has not been reported thus far after transradial coronary procedures. Documentation of patent ulnar artery and palmar arch has been tested performing Allen Test. Maniotis *et al.* presented a prospective data collection of 1035 consecutive patients who had underwent transradial approach procedures performed irrespective of the results of Allen's test, and no significant differences in clinical evolution with or without radial thrombosis were observed.^[21]

Radial approach allows early ambulation and diminished costs in cardiac catheterized patients.^[8,11] In addition, patients preferred puncture radial to femoral questionnaires quality of life catheterizations performed after percutaneous coronary intervention series.^[6]

In our study, we were able to treat different aneurysms from diverse topographies and both sides with a high rate of efficiency and without complications [Figure 6].

Moreover, as remarkable features of this study, procedures were performed with different trademarks materials showing the versatility of this approach.

CONCLUSIONS

Transradial approach was utilized for endovascular treatment of multiple cerebral aneurysms with a satisfactory result. These treatments were performed with several trademarks catheter systems for both flow diverter and coils treatment. We did not observe arterial injuries nor technical limitations for this approach.

Financial support and sponsorship

Nil.

Conflicts of interest

All authors certify that they have no affiliations with or involvement in any organization or entity with financial interest (such as honoraria, educational grants, participation in speakers bureaus, membership, employment, consultancies, stock ownership, or other



Figure 6: Final control angiography in two cases. Large arrows indicate the brachial approach of the catheter guide in both cases. (a) (case #16): The thin arrow indicates a right anterior aneurysm treated with coils. (b) (case #18) The thin arrow indicates a left medial cerebral artery aneurysm treated with coils

equity interest, or expert testimony or patent-licensing arrangements), and no financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in subject matter or materials discussed in this manuscript.

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