




# Therapeutic Neurointervention through Transradial Approach: Preliminary Experience from a Tertiary Care Center

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Indian J Neurosurg 2023;12:223–228.

## Abstract

**Background** The aim of this study was to assess the safety and feasibility of radial access for therapeutic neurointervention procedures.

**Methods** The retrospective evaluation of 20 patients taken for therapeutic neurointervention through transradial access at our institute was done from July 2021 to April 2022.

**Results** Therapeutic neurointervention procedures were attempted in 20 patients (age, 24–74 years; mean age, 48.4 years; 13 (65%) females using a transradial approach. The radial artery's mean diameter was 2.135 mm. The right radial access was taken in 18 (90%) cases. Indications for treatment were ruptured aneurysm in 13 (65%), mechanical thrombectomy in 5 (25%), flow diversion for a recanalized aneurysm in 1 (5%), and balloon occlusion test in 1 (5%) case. The procedure was successful through the transradial approach in 18 (90%) procedures. Failure was seen in two cases that were completed after conversion to the transfemoral approach. The reason for access conversion was a severe spasm in both cases. No significant access site complications were seen in the study cohort.

## Keywords

- aneurysm
- coiling
- transradial

**Conclusion** A radial access route is a promising approach for therapeutic interventions with a high success rate and minimal access site complications. Interventionists should get accustomed to this approach as primary or alternative access for neurointervention.

## Introduction

The radial approach is gaining considerable popularity among the neurointervention community. For decades, the transfemoral approach (TFA) has been the standard approach

for diagnostic and therapeutic neurointervention due to its larger diameter, greater familiarity, easy accessibility, and relatively straight angle for catheterization of aortic arch vessels.<sup>1,2</sup>

article published online  
December 23, 2022

DOI <https://doi.org/10.1055/s-0042-1758778>.  
ISSN 2277-954X.

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The transradial approach (TRA) has already demonstrated its value in cardiology literature and is now considered the standard approach. The advantages of a radial approach are a superficial location of the vessel, minor access site complications, shorter hospital stay, and better patient acceptance.<sup>3,4</sup>

Recent literature has shown the safety and feasibility of the TRA for performing the therapeutic neurointervention procedure. A few significant challenges in shifting to the TRA are the small caliber of the radial artery, a learning curve for the new operators, and a lack of dedicated radial-specific hardware posing a challenge in assessing the aortic arch vessels in a few instances.<sup>4,5</sup>

This study presents our initial experience with the TRA to performing therapeutic neurointervention procedures.

## Methods

Retrospective analysis of our Diagnostic cerebral angiography (DSA) data was obtained from July 2021 to April 2022 after taking the ethical committee approval. In this period, 20 patients had an attempted TRA approach taken for therapeutic neurointervention procedures. Inclusion criteria were patients referred for therapeutic neurointervention to our department, aged more than 18 years, radial artery diameter more than 1.8 mm, and consenting to intervention via radial route. The demographic, procedural, and clinical data of the patients were analyzed. Exclusion criteria were any known history of right arm trauma or vascular malformation/stenosis, patients with peripheral artery disease, and patients requiring a future fistula for renal diseases.

TRA approach: Informed consent was taken from all the patients before TRA.

A single operator with experience of more than 100 diagnostic cerebral angiograms via radial approach ensured access through the radial artery.

## Procedural Details

We did not perform Allen's and Barbeau's tests on the study population. The right-sided radial artery was the leading access site in our study. A radial board and comfortable padding were used for the right radial approach to ensure patient comfort. The hand was positioned at 0 to 15 degrees to the patient's side. The hand was kept supinated with a cotton pad to ensure slight extension at the wrist. For the left radial approach, the hand was kept over the left thigh in a neutral position. An ultrasound assessment for the size and orientation of the radial artery was performed. The periarterial tissue was infiltrated with 1 to 2 mL of lignocaine. In all the cases, an ultrasound-guided puncture was performed. A short 6F radial sheath, preferably coated sheath such as Terumo Terumo Glidesheath Slender 6F (Terumo, Tokyo, Japan), was used in all the cases. After the sheath insertion, a radial cocktail combination of 200 µg of nitroglycerine, 2.5 mL diltiazem, and 5000 IU of heparin was given. A radial angiogram was taken to look for any radial artery variation/loops or injury.

After the initial sheath placement, depending on the pathology and vessel involved, an exchange with the 6F 90 cm long sheath (Ballast, Balt, California, United States) was done if required. In other cases, a 6F guiding catheter was directly placed into the vessel of interest through the short sheath. A 5F Simmons catheter was used to catheterize the aortic vessels and put the long sheath or guide catheter in the vessel of interest. The rest of the procedural hardware was used depending on the pathology and carried out similar to the TFA.

Post-procedure closure in all the cases was achieved by using a dedicated radial band while maintaining antegrade flow evaluated by plethysmography to maintain patent hemostasis. Gradual deflation of the radial band was achieved over 2 to 3 hours.

## Results

Therapeutic neurointervention procedures were attempted in 20 patients (age, 24–74 years; mean age, 48.4 years; 13 [65%] females) using a transradial approach. Demographic and clinical data of the study population are shown in ►Table 1. The radial artery's mean diameter was 2.135 mm. Right radial access was taken in 18 (90%) cases, and left radial access in 2 (10%) cases. Indications for treatment were ruptured aneurysm in 13 (65%), mechanical thrombectomy in 5 (25%), flow diversion for recanalized aneurysm 1 (5%), and balloon occlusion test in 1 (5%) case (►Table 2). The procedure was successful through the TRA in 18 (90%) procedures. The mean fluoroscopic time was 37.5 minutes. Representative cases are shown in ►Figs. 1 to 4. Failure was seen in two cases that were completed after conversion to the TFA. The reason for access conversion was severe spasm (►Fig. 5A) in both cases. No

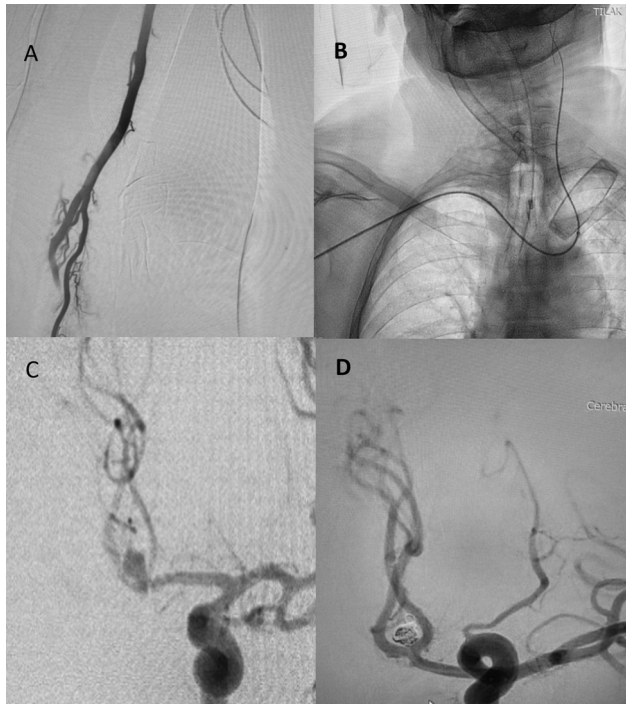
**Table 1** Demographic and clinical data of the study population

Characteristics	n = 20
Age (years), mean	48.4
Female, n (%)	13 (65)
Indications for therapeutic procedure, n (%)	
Ruptured aneurysm coiling	13(65)
Unruptured aneurysm Flow Diverter (FD)	1 (5)
Mechanical thrombectomy	5(25)
Balloon occlusion test	1 (5)
Patients on antiplatelet therapy, n (%)	
Aspirin + Prasugrel	1 (5)
Aspirin	3 (15)
Radial arterial diameter (mean)	2.135
Radial access, n (%)	
Right	18(90)
Left	2 (10)
Ultrasound guided puncture, n (%)	20(100)
Failure through transradial approach (TRA), n (%)	2(10)
Conversion to femoral	2 (10)

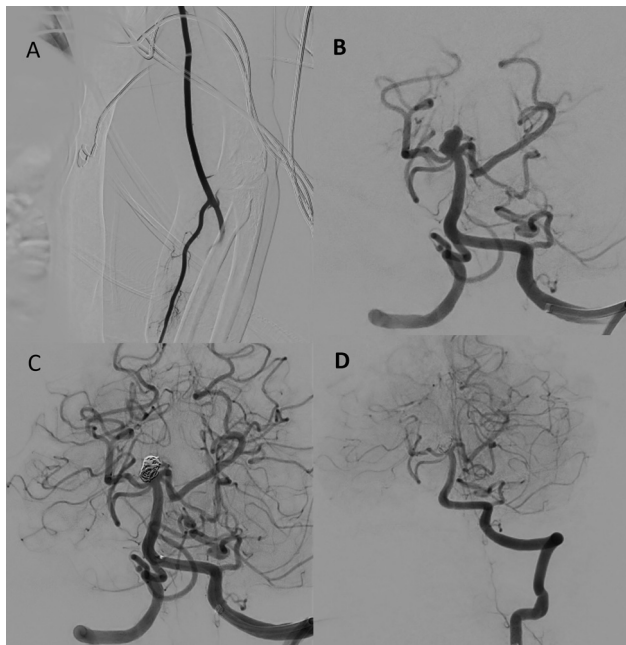
**Table 2** Summary of the study population with transradial attempt for the endovascular procedure

Case number	Age/sex	Diagnosis	Cocktail	Radial side	Access sheath	Guiding catheter	Vessel	Procedure	spasm	Access site complication	Access site conversion	Procedural success via radial
1	37/F	Ruptured Pcom	Yes	Right	Ballast 6F 088	Neuron 6F	RICA	Coiling	No	No	No	Yes
2	74/M	Right MCA M2 occlusion	Yes	Right	Ballast	Neuron 6F	RICA	Stentriever	No	No	No	Yes
3	50/F	Ruptured Acom	Yes	Right	Ballast	Neuron 6F	LICA	Coiling	No	No	No	Yes
4	60/M	Rupture Acom	Yes	Right	Ballast	Neuron 6F	RICA	Coiling	No	No	No	Yes
5	50/F	Right MCA M1 occlusion	Yes	Right	Ballast	Neuron 6F	RICA	Stentriever	No	No	No	Yes
6	35/M	Ruptured LICA communicating aneurysm	Yes	Right	Ballast	Neuron 6F	LICA	Coiling	No	No	No	Yes
7	54/F	Ruptured right paraophthalmic ICA aneurysm	Yes	Right	Ballast	Neuron 6F	RICA	Coiling	No	No	No	Yes
8	48/M	Ruptured Acom	Yes	Right	Ballast	–	–	Coiling	Yes	–	Yes, femoral	No
9	70/F	Ruptured Acom	Yes	Right	Ballast	Neuron 6F	RICA	Balloon assisted coiling	No	Delayed pseudoaneurysm	No	Yes
10	36/M	Left M1 MCA occlusion	Yes	Right	Ballast	–	–	Stentriever	Yes	–	Yes, femoral	No
11	32/F	Recanalised RICA aneurysm	Yes	Right	Ballast	Neuron 6F	RICA	FD	No	No	No	Yes
12	47/M	Ruptured left PICA	Yes	Left	6F Short radial sheath	Neuron 6F	LVA	Coiling	No	No	No	Yes
13	51/F	Ruptured RICA communicating aneurysm	Yes	Right	Ballast	Neuron 6F	RICA	Coiling	No	No	No	Yes
14	30/F	Ruptured right paraophthalmic aneurysm	Yes	Right	Ballast	Neuron 6F	RICA	Coiling	No	No	No	Yes
15	53/M	Basilar artery stroke	Yes	Right	6F short sheath	Benchmark 6F	RVA	Stentriever	No	No	No	Yes
16	48/F	Unruptured Giant RICA aneurysm	Yes	Right	6F short sheath	Neuron 6F	RICA	Balloon occlusion test	No	No	No	Yes
17	24/F	Basilar stroke	Yes	Right	6F short sheath	Sofia plus	RVA	Aspiration + stentriever	No	No	No	Yes
18	40/F	Ruptured basilar top	Yes	Left	6F short sheath	Neuron 6F	LVA	Coiling	No	No	No	Yes
19	64/F	Ruptured Acom	Yes	Right	Ballast	Neuron 6F	RICA	Coiling	No	No	No	Yes
20	65/F	Ruptured Acom	Yes	Right	Ballast	Neuron 6F	RICA	Coiling	No	No	No	Yes

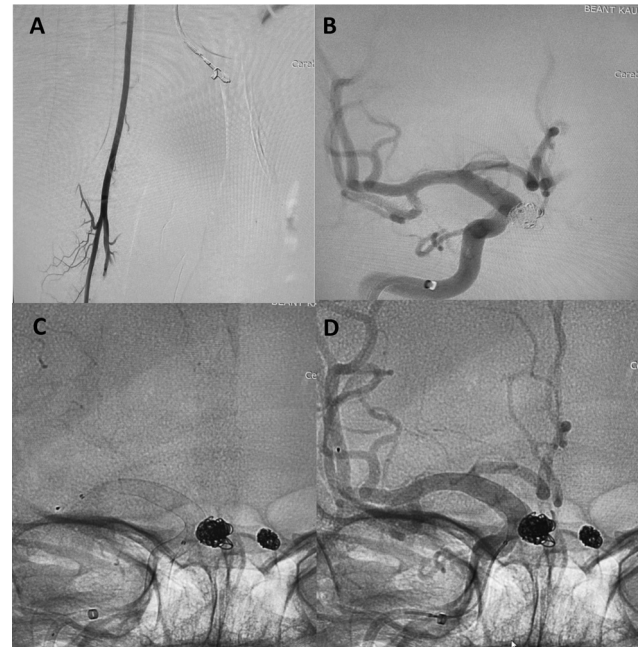
Abbreviations: LICA, left internal carotid artery; LVA, left vertebral artery; MCA, middle cerebral artery; PICA, posterior inferior cerebellar artery; RICA, ruptured internal carotid artery; RVA, right vertebral artery.



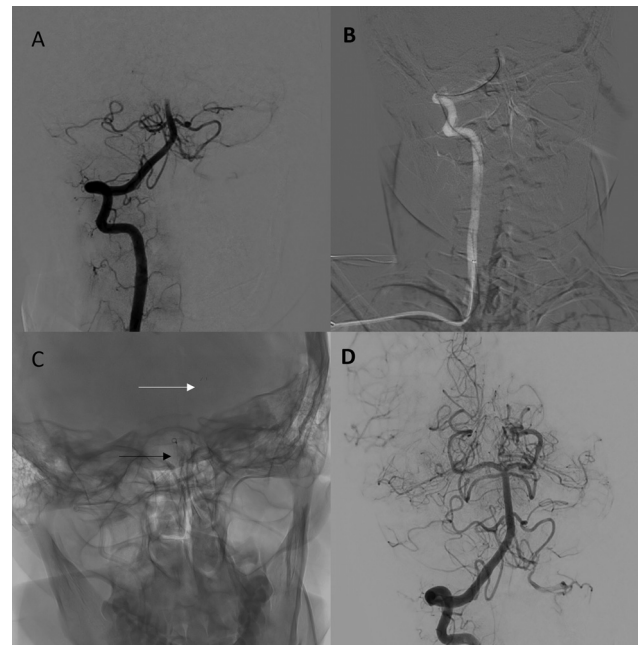
**Fig. 1** A 60-year-old male with rupture Acom aneurysm. (A) Angiogram showing right radial access. (B) Bovine arch was noted, permitting easier access for the long sheath and guiding catheter to reach left CCA. (C) Acom aneurysm with test filling through dominant left A1 Anterior cerebral artery (ACA). (D) Partial coiling of the aneurysm was performed with four coils.



**Fig. 2** A 40-year-old female with ruptured basilar top aneurysm. (A) Angiogram showing left radial access. (B) Left vertebral run shows the presence of basilar top aneurysm (C) Microcatheter in the aneurysm with coil placement. (D) Final angiogram shows near complete obliteration of the aneurysm.

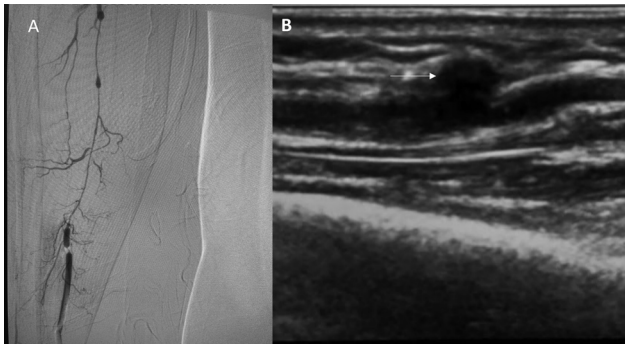


**Fig. 3** A 32-year-old female with previously coiled bilateral ophthalmic segment aneurysm with a residual neck on the right side. (A) Right radial access with angiographic run. (B) Ballast sheath was used, and 6F neuron guiding catheter was placed in right internal carotid artery. (C, D) Fluoroscopy image and angiographic run show a successful deployment of the flow diverter.



**Fig. 4** A 24-year-old female with a history of Antiphospholipid antibody syndrome (APLA) syndrome with basilar artery occlusion. (A) Right vertebral artery (RVA) run shows occlusion at mid basilar level. (B) Roadmap image shows right radial access with the direct passage of aspiration catheter into the RVA (C) Fluoroscopic images show Solumbra technique with aspiration catheter in the proximal basilar artery (black arrow) and Stentriever in the left P1 posterior cerebral artery (white arrow). (D) Post-procedure run shows Thrombolysis in cerebral infarction (TICI) 3 recanalization with the complete opening of the vessels.





**Fig. 5** (A) Severe vasospasm of the right radial artery. In this case, transfemoral conversion was done. (B) Ultrasound examination of the radial artery after 1 month of the procedure shows the presence of a small pseudoaneurysm formation (white arrow).

significant access site complications were seen in the study cohort. A follow-up ultrasound of the radial artery at 1 month was available in 10 cases and showed normal radial artery caliber with no evidence of radial artery occlusion. One patient revealed the presence of small pseudoaneurysm formation at the right radial artery (→ Fig. 5B).

## Discussion

This study aimed to demonstrate our early institutional experience with the TRA for performing therapeutic neurointervention cases. The TRA for diagnostic and therapeutic neurointervention has been gradually incorporated into our practice for more than a year. To the best of our knowledge, this is the first study from India demonstrating the feasibility of TRA for therapeutic neurointerventions.

TRA is gradually gaining acceptance in the neurointervention community, with recent literature demonstrating excellent safety and efficacy for performing endovascular procedures.<sup>4,6–10</sup>

A systemic review involving 21 studies and 1,342 patients undergoing various neurointervention procedures found 64 (4.77%) patients getting converted into a transfemoral route, out of which 7 (0.52%) were due to access-related issues and 57 (4.25%) were due to inability to cannulate the target vessel.<sup>5</sup>

Another systemic review involving TRA for flow diversion and 11 studies (290 patients) showed a completion rate of 90.7% via radial route. No access site complications were seen.<sup>11</sup>

Meta-analysis for stroke thrombectomy involving 10 studies (309 patients) showed a mean crossover to TFA in 7.2% of cases and access site complication in approximately 0.014% of cases. They found no significant difference between the TRA and TFA routes when comparing the data with contemporary trials.<sup>12</sup>

In our study, 20 patients were included who had undergone TRA for therapeutic neurointervention. We achieved technical success in 18 (90%) of the cases. Conversion to TFA was required in two patients (10%). In both these cases, Ballast sheath was used, and severe spasm

was noted after sheath insertion due to impeded movement of the sheath. The procedures were successfully completed via the TFA route. A previous study has also shown the utility and effectiveness of Ballast sheath for TRA.<sup>13</sup>

We also used this sheath in 15 (75%) cases as 6F outer diameter with 088 inner diameters provides a profitable triaxial system for better support and the ability to use varied hardware for further procedural completion.

No immediate access site complications were seen. A follow-up ultrasound of the radial artery was done at 1 month in 10 patients. No evidence of radial artery occlusion was seen. One patient showed the formation of a small pseudoaneurysm that was managed with further compression with a radial band for 4 hours. Previous studies involving 750 patients showed access site complications in 4 (0.5%) cases. These data indicate a high safety, efficacy, and feasibility of radial access for performing therapeutic neurointerventions.

The left radial approach is gaining momentum with literature showing its safety and feasibility for performing neurointervention.<sup>14</sup> In our study, two (10%) cases were done via the left radial approach. Inherent challenges with the left approach are the increased distance between the access site and the operator and the difficult catheterization of the left common carotid artery (CCA) due to the acute angle. We reserve this approach for a left vertebral artery pathology or when access to the right radial artery is unavailable.

Multiple studies have already shown the utility of the TRA for neurointervention. In the author's experience, there are a few initial challenges when shifting to transradial from the well-known TFA. As the diameter of the radial artery is smaller compared to the femoral, the chances of dissection and spasms are higher, limiting access. This is particularly important when placing a 6F long sheath or guiding sheath across the radial.

Another challenge is placing the guiding catheter or long sheath across the aortic vessels, particularly in left CCA, type II/III aortic arch, or subclavian tortuosity. Thus, getting accustomed to radial puncture and aortic arch morphology is essential by performing 40 to 50 diagnostic radial cerebral angiograms before performing therapeutic cases. We have recently published our experience with factors that may influence the radial access success for cerebral angiography.<sup>15</sup>

Once access to the vessel of interest is taken, the procedure is similar to the femoral route with less challenge. The advantages of the radial artery that we find helpful are fewer chances of puncture site hematoma, early discharge, and mobilization of the patient and better patient acceptance. However, appropriate case selection should be made during the initial phase before ultimately shifting to the transradial from the TFA.

Our study had a few limitations. It was a single-center study with a small study population. The small study may not represent the feasibility in all the cases that are referred for neurointervention. Long-term clinical follow-up of the patients was not included in this study as our primary aim was to see the technical feasibility of performing the procedure using TRA. The purpose of this study was to

highlight our initial experience with this emerging approach. Well-planned randomized studies comparing the TRA and TFA for neurointerventions are required to elaborate on the usefulness of one technique over another.

## Conclusion

TRA has the potential to become the primary access route for performing therapeutic neurointervention owing to its many advantages. Greater familiarity with the technique and development of radial-specific hardware will further enhance its application in the neurointervention community.

**Conflict of Interest**  
None declared.

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