Section: Radiology

Original Research Article

GROWING ROLE OF TRANS RADIAL ACCESS IN INTERVENTIONAL RADIOLOGY – OUR EXPERIENCE

Abhijit Markande[1], Nishanth Gopal[1], Kalpana S[2]

[1]DM Interventional Radiology Senior Resident - Postgraduate[1], Barnard Institute of Radiology, Madras Medical college, Park Town Chennai Tamil Nadu, India
[3]Director & Professor2, Barnard Institute of Radiology, Madras Medical College, Park Town Chennai Tamil Nadu, India

Received : *18/12/2023*
Received in revised form : *22/02/2024*
Accepted : *07/03/2024*

Keywords:
Trans Radial, Vascular and interventional radiology.

Corresponding Author:
Dr. Abhijit Markande,
Email: abhi.mn12@gmail.com

DOI: 10.47009/jamp.2024.6.2.176

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (2); 853-858

Abstract

Background: Trans radial access has been around in the percutaneous coronary intervention world for more than 30 years. However, the radial access appears to have slowly grown among the interventional radiology community in the past few years. Multiple studies have shown benefits of trans radial access for interventional procedures. The aim is to technical outcomes, advantages, and disadvantages of single centre approach to trans radial access in interventional radiology. **Materials and Methods:** A retrospective study of all patients who underwent trans radial access was conducted in the Barnard Institute of Radiology Intervention Division, Rajiv Gandhi Govt. General Hospital, MMC, Chennai between July 2022 to July 2023. Total of 312 patients underwent arterial diagnostic and interventional procedures of which 72 were trans radial access. **Result:** A total of 72 patients had radial artery access for diagnostic and interventional radiology procedure. Sixty-nine (95.84%) cases were completed via trans radial access. Three cases required cross over from the radial artery access to the femoral artery as the patient experienced pain in the forearm due to radial artery spasm. **Conclusion:** Trans-radial access is reliable and better alternative vascular access in Interventional Radiology and improves departmental efficiency as well as patient satisfaction.

INTRODUCTION

Campeau described one of the early case series of trans radial access for percutaneous coronary intervention in 1989. Trans radial access has been around in the percutaneous coronary intervention world for more than 30 years.[1,2]

However, the radial access has slowly grown among the interventional radiology community in the past few years.

Trans radial Access is associated with less vascular bleeding complication as compared to the trans femoral approach especially in patient with antiplatelet and anticoagulation.[1-5]

Despite having a long learning curve for trans radial access, benefits include an improved safety profile, less post procedural care, shorter hospital stays and better patient experience.[1-4]

Hurdles towards the shift from using the trans femoral access to trans radial access for interventional radiology procedures have multiple possible Reasons. The main factor could be the lack of familiarity with the trans radial access, mainly because most radiology training focuses on the trans femoral access, resulting in low confidence, and concern about complications and how to handle them. Another factor could be the mistaken belief that it is hard to reach the neurovascular and peripheral vascular arteries from the radial approach.[1-4]

This study represents our early experience in performing radial access in diagnostic and interventional radiology.

Aims

Technical outcomes, advantages, and disadvantages of single centre approach to trans radial access in interventional radiology.

MATERIALS AND METHODS

Study Design and Patient selection:

A retrospective study of all the patients who underwent trans radial access was conducted in the Barnard Institute of Radiology Intervention division Rajiv Gandhi Govt. General Hospital, MMC, Chennai between July 2022 to July 2023. Total of 312 patients underwent arterial diagnostic and interventional procedures of which 72 were trans radial access. All the trans radial access were done in adults more than 18yrs of age for diagnostic and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

interventional radiology procedures, of which 39 were male and 33 were female patients. This retrospective study was approved by our Institutional Review Board. All procedures were performed in accordance with Institutional protocol and ethical standards. Written informed consents for the procedure were obtained from all patients in this study.

Pre-procedure evaluation

We used on-table ultrasound screening of the radial artery to look for the calibre, course as well as for anatomical variations. Modified Allen's test described for testing the patency of palmar arch, was not performed as a routine screening in our cases, in keeping with recent literature.[6-8]

Location and type of access

The right radial artery access was taken for neurovascular procedures.

Left radial artery access was taken for peripheral vascular procedures, as it has an advantage of not crossing the arch of aorta as well as saving the catheter length. For peripheral vascular interventions, conventional radial access was taken due to catheter length whereas in neurovascular procedures, both conventional as well as distal radial artery access was taken. Exception was made for bronchial artery embolization that had diseased right lung where right radial artery access was taken. Conventional trans radial access is taken just 1-2cm proximal to the wrist crease. A distal trans radial access involves making in the radial artery puncture at the anatomical snuff box. The arteriotomy site is made further away from the superficial palmar branch of the radial artery, which keeps the patency of the palmar arch as well as preserves the radial artery for future use.

We used conventional radial access with the hand near the groin and hyperextended wrist, or distal radial access with the hand at 0°–15° to the side and neutral wrist.

Radial access Technique

A radial board and padding were used for patient comfort. We cleaned and draped the skin and anesthetized the radial artery site with 1-2ml of 1% lidocaine. We used ultrasound guidance to puncture the artery with a 21G needle at 30–45° and confirmed the needle position and brisk arterial bleed. We inserted a 0.018 guide wire and a standard 5F radial sheath (Terumo glide slender or Merit prelude 23cm). We used single wall puncture technique in all cases. After the sheath insertion radial cocktail combination of 200 mcg of nitro-glycerine, 2.5mg of diltiazem and 2000U heparin was given after 20ml hemo-dilution. Radial artery angiogram [Figure 1] was performed to look for the course and anatomical variation of the radial artery.

Catheter Choice

The diagnostic catheter shape used for neurovascular procedure was 5F Sims 2 and peripheral vascular procedure 5FTiger (Terumo), 5F Ultimate 1(merit) 1, 4F R.A.V.I (Terumo) and 5F vertebral (Terumo/Merit). The microcatheter used for various embolization procedures was 150cm 2.4F Progreat microcatheter (Terumo). For neurovascular procedures a 5F Sim2 diagnostic catheter for cerebral vessel catheterization [shown in Figure 2]. We formed Sim 2 by three ways [shown in Figure 3]: advancing the wire to the descending thoracic aorta and pulling it back to the subclavian artery, advancing the wire around the aortic valve and tracking the catheter around it, or withdrawing the wire and pushing the catheter forward after selecting the right common carotid.[3,13-15]

Haemostasis

Radial artery access haemostasis was obtained by compression bandage in 66 cases which was removed after 4hrs. In 6 cases we used the TR Band (Terumo and Merit) as shown in [Figure 4], to achieve patent haemostasis and minimise RAO risk. We placed the device on the wrist with a tight strap and inflated the balloon with 10-15 mL of air while removing the sheath. We adjusted the air until the bleeding stopped. The TR band was removed after 4hrs.

Statistical Analysis

All the data were tabulated and expressed as mean + SD. The two-sample t test was performed to compare variables between trans radial and transfemoral procedures. Differences were considered statistically significant when p values were < 0.05.

RESULTS

Demography

A total of 72 patients had radial artery access for a vascular and interventional radiology procedure with mean age of 43 years as shown in [Table 1].

Procedures

The neurovascular procedures performed were diagnostic cerebral angiogram (n=36), head and neck tumour embolization (n=4), and carotid artery stenting (n=1). The peripheral vascular interventions performed were trans-arterial chemoembolization (n=16), bronchial artery embolization (n=9), uterine fibroid embolization (n=2), pseudo aneurysm embolization (n=4).

For neurovascular diagnostic cerebral angiogram, conventional (proximal) radial access was taken in 24 cases and distal radial access was taken in 12 cases as shown in [Table 2].

Procedure parameters

The mean radiation dose (air kerma) as well fluoroscopic time of all the procedures is listed in the [Table 3]. For diagnostic cerebral angiogram, mean radiation dose (air kerma) and fluoroscopic time done through trans radial route was 743+/-143 mGy and 18:51+/- 3:32, whereas for transfemoral route values were 662+/- 147 and 0.21 respectively [Table 4]. However, the difference was not statistically significant ($p = 0.0895$ and $p = 0.21$)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Technical Success

Intended procedure was successfully completed through radial artery access in 95.84% (69/72) cases shown in [Table 5]. Three cases (2 diagnostic cerebral angiogram and 1 head and neck tumour embolization) required cross over from the radial artery access to the femoral artery as the patient experienced pain in the forearm due to radial artery spasm.

Complications

Except for radial artery spasm (n=3), no major complications like hematoma, hand ischaemia, vessel perforation, dissection or stroke were seen in our cases.

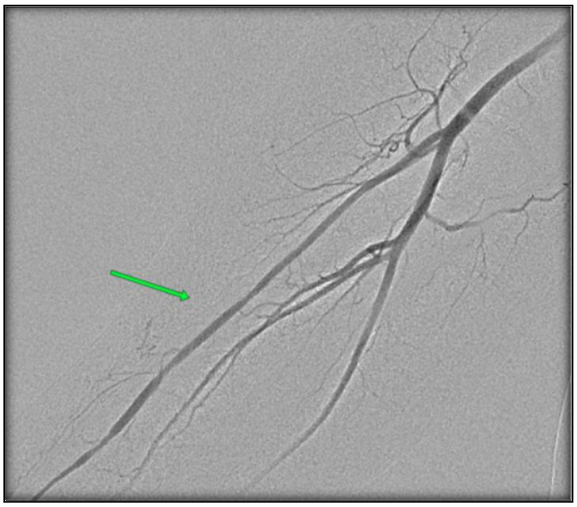

Figure 1: Radial artery angiogram

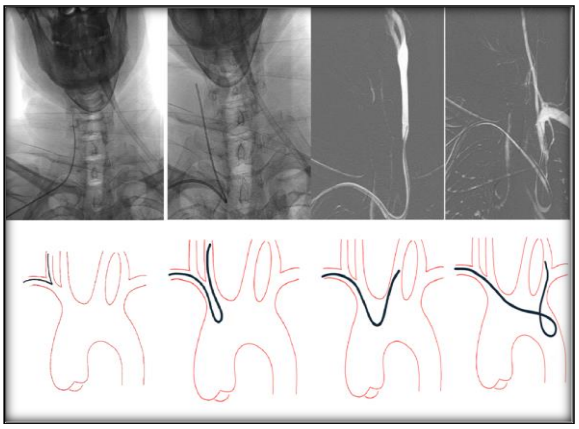

Figure 2: Cerebral vessel catheterization using Sim2 catheter

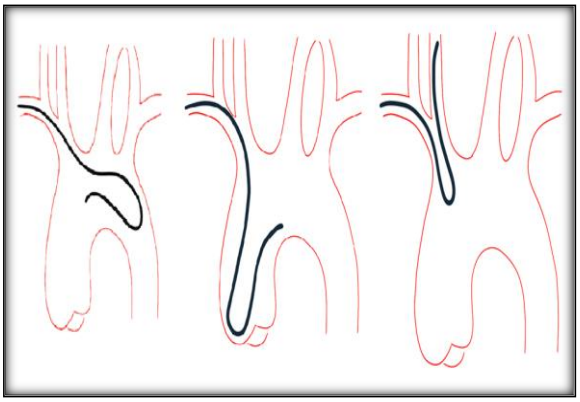

Figure 3: Sim2 formation in the arch of aorta, across the aortic valve and right common carotid artery for cerebral vessel catheterization

Figure 4: Trans radial compression band

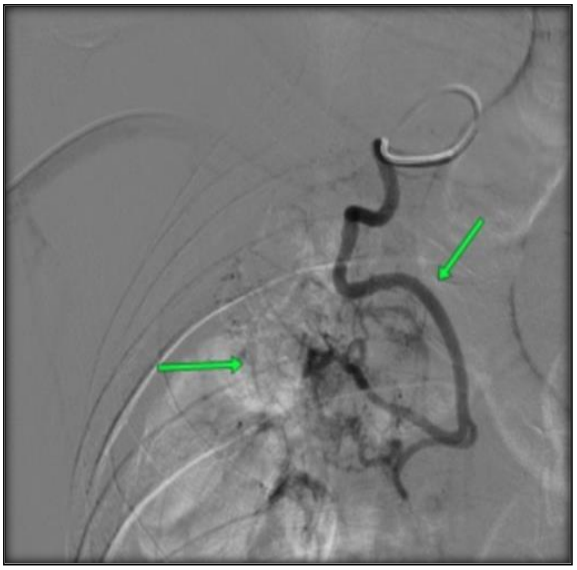

Figure 5: Case of ectopic bronchial artery arising from tortuous subclavian artery with failed femoral access for catheterization showed abnormal lung blush with pulmonary arterial shunting

ISSN (O): 2687-5365; ISSN (P): 2753-6556

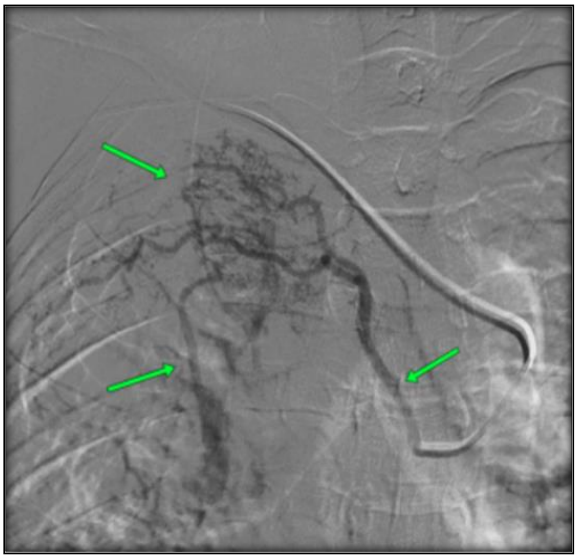

Figure 6: Bronchial artery angiogram with Tiger (Terumo) catheter showing abnormal lung blush with pulmonary arterial shunting

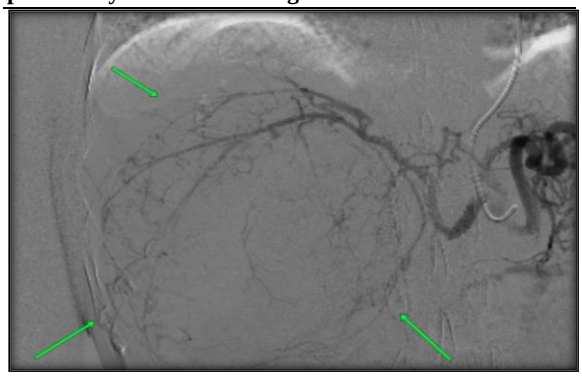

Figure 7: Celiac artery angiogram with Ultimate 1(Merit) catheter showing hyper vascular right lobe hepatocellular carcinoma

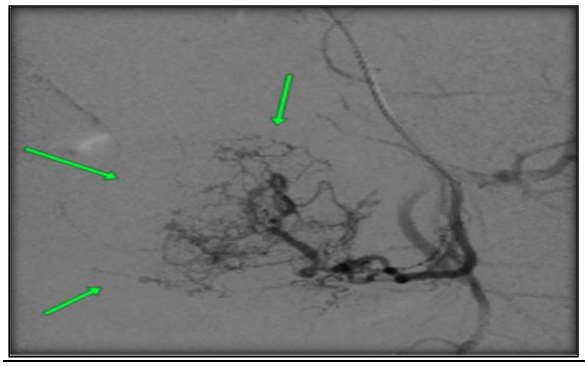

Figure 8: Uterine artery angiogram with RAVI (Terumo) catheter showing abnormal hyper vascular fibroid blush

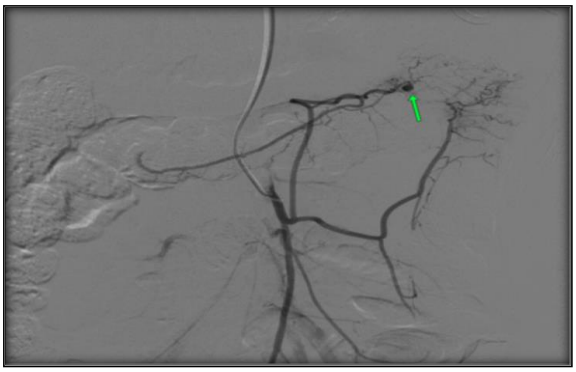

Figure 9: Inferior mesenteric artery angiogram with RAVI (Terumo) catheter showing pseudoaneurysm

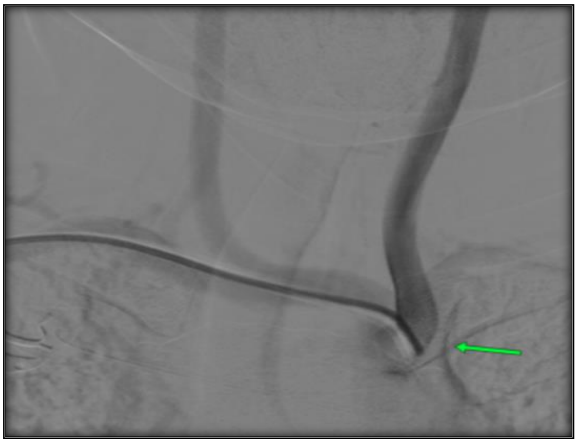

Figure 10: Bovine arch anatomy

Table 1: Demography

Demography	
Male (n)	48
Female (n)	24
Mean Age	43+/-13

Table 2: Radial access for cerebral angiogram

Radial Access (Cerebral angiogram)	
Conventional (Proximal)	24
Distal	12

Table 3: Procedures with mean radiation dose and mean fluoroscopy time

Procedure	**No of Cases**	**Radiation dose (Air Kerma) mGy (Mean)**	**Fluoroscopy Time (Mean)**
Diagnostic Cerebral Angiograms	36	743+/-143	18:51+/- 3:32

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Carotid Artery Stenting	1	1453	28:20
Head and neck tumour embolization	4	1053+/-360	37:70+/- 8:34
Visceral Pseudoaneurysm embolization	4	295 +/- 106	28:70+/- 6:22
Trans arterial chemoembolization of HCC	16	1306 +/- 302	26:33+/- 5:28
Uterine fibroid embolization	2	1386 +/- 351	17:51+/- 3:18
Bronchial artery embolization	9	534 +/- 125	43:08+/- 9:45

Table 4: Radiation dose and fluoroscopy time for cerebral angiogram

Procedure	n value	Radiation dose (Air Kerma) mGy (Mean)	Fluoroscopy Time (Mean)
Trans radial cerebral angiogram	36	743+/-143	18:51+/- 3:32
Trans femoral cerebral angiogram	86	662+/- 147	16:25+/-2:02
P value		0.0895	0.21

Table 5: Outcome of trans radial access procedures

Outcome	Technical Success
Radial access procedure completion	95.84%
Radial access procedure with cross over to femoral access	4.16%

DISCUSSION

We share our early experience in trans radial access in the vascular interventional radiology. Multiple publications show safety and benefits of the radial access.[1-5,9-15]

Dual blood supply of the hand and superficial position of the radial artery are its intrinsic advantage. Haemostasis can be achieved via compression without the need for closure device. For cases with INR>1.5 with moderate risk of bleeding, trans radial access can be safely used. Therefore, trans radial access appears to be superior as compared to transfemoral access in coagulopathy status. The major potential drawback in trans radial access is not able to use vascular sheath larger than 7F and use of long length catheters. Regardless, potential complications even though the risk appears small, stroke was discussed and explained in the informed consent.[1-3,9]

Conventional and distal trans-radial puncture using ultrasound guidance makes radial access safe and effective. Trans radial approach has definite learning curve, both for access and catheter manipulation. However, this shouldn't be difficult task for interventional radiology community as they have good hand eye coordination with ultrasound guidance.

Earlier literature stated modified Allen's test as a pre-requisite for trans radial access. However, on-table ultrasound screening of the radial artery gave more valuable information like radial artery calibre, course and anatomical variations which would help in successful completion of the intended procedure. Our experience also concurs with the existing literature not making modified Allen's test mandatory.[6-8]

In our early cases we used 5F short sheath and three patients had radial artery spasm even after administration of radial cocktail which resulted in the forearm pain, loss of the catheter torq-ability and cross over to femoral access for completing the intended procedure. In all these cases the catheter was safely withdrawn, and the wrist haemostasis was obtained. Therefore, we switched over to 5F long radial sheath in which the sheath tip would eventually be in the distal brachial artery. This change helped us overcome the radial artery spasm and resulted in completion of the intended procedure as repeated catheter movements in radial artery was bypassed.[16-18]

Among the 69 successfully completed procedures, three cases were noteworthy. First, a patient referred for carotid artery stenting had bilateral iliac artery occlusion and aorto-bifemoral bypass, so radial artery access with 6F guiding sheath was the only option. Second, a patient referred for trans arterial chemoembolization, failed to catheterize the celiac artery via transfemoral approach due to mild stenosis, but succeeded via trans radial approach later, as the celiac artery was oriented caudally. Third, a patient referred for bronchial artery embolization failed to catheterize an ectopic bronchial artery from the right subclavian artery via transfemoral access due to subclavian tortuosity but succeeded via right radial artery access. [Figure 5]

For bronchial artery embolization cases, we used ipsilateral radial access for patients with unilateral lung disease from TB sequelae. [Figure 6] In our study, all unilateral lung disease cases were on the right side. For bilateral lung disease from TB sequelae, we preferred femoral access for catheter stability, as trans radial catheterization of the contralateral subclavian artery for embolizing non-bronchial systemic supply to the lung could be challenging and difficult.[11]

For the peripheral vascular interventions, 5F diagnostic catheters like Tiger (Terumo), Ultimate1 (Merit) or RAVI (Terumo) have secondary curve which gives good stability after visceral vessel ostial engagement. Use of simple angle catheters like vertebral catheter doesn't give much support to the catheter after ostial engagement. Catheter length of minimum 120-125cm must be used for peripheral interventions in view of long course traversing the arch of aorta.[1,2,4,5,9-12] Embolization for trans arterial chemoembolization [Figure 7], uterine fibroid [Figure 8] and pseudoaneurysms [Figure 9]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

was done with 150cm 2.4F Progreat microcatheter (Terumo).

For neurovascular cases, we used both conventional as well as distal radial access for diagnostic cerebral angiograms. Bovine arch anatomy [Figure 10] makes cerebral catheterization easy via trans radial approach than via transfemoral approach.[3,14] We compared the mean radiation dose and fluoroscopy time for diagnostic cerebral angiogram done via trans radial and trans femoral approaches which showed no statistically significant difference. Similar results were obtained with respect to fluoroscopy time by Ge B, Wei Y.[14]

The radiation dose and fluoroscopy time for our vascular interventional procedures are within acceptable limits. In 66 cases, we resorted to use of manual haemostasis and compression bandage due to non-availability of radial compression device. In the remaining 6 patients, radial compression device was used for patent haemostasis which helps in preserving antegrade flow towards palmar arch thereby reducing the chances of digital ischaemia and minimises the chance of radial artery occlusion in long term.[1,2,9]

The limitation of this study was smaller sample size and non-availability of a long term follow up for radial artery status due to its retrospective nature. However, our results show that radial access can be a valid alternative vascular access in interventional radiology with high technical success and no major complication.

CONCLUSION

Trans-radial access is reliable and better alternative vascular access in Interventional Radiology and improves the departmental efficiency as well as patient satisfaction. Trans-radial access in Interventional Radiology will evolve rapidly, with new development of catheters, devices and will become a routine Access route with increasing expertise.

REFERENCES

1. Titano JJ, Patel RS, Fischman AM. Transradial Access in Interventional Radiology. *Advances in Clinical Radiology*. 2020 Sep;2:127–38.
2. Thakor AS, Alshammari MT, Liu DM, Chung J, Ho SGF, Legiehn GM, et al. Transradial Access for Interventional Radiology: Single-Centre Procedural and Clinical Outcome Analysis. Can Assoc Radiol J. 2017 Aug;68(3):318–27.
3. Zalocar LAD, Doroszuk G, Goland J. Transradial approach and its variations for neurointerventional procedures: Literature review. Surgical Neurology International. 2020 Aug 15; 11:248.
4. Titano JJ, Biederman DM, Marinelli BS, Patel RS, Kim E, Tabori NE, et al. Safety and Feasibility of Transradial Access for Visceral Interventions in Patients with Thrombocytopenia. Cardiovasc Intervent Radiol. 2016 May;39(5):676–82.
5. Lee M, Wong Y, Lee A, Fung H, Chiang J, Kwok C, et al. Single-centre Initial Experience of Transradial Access for Abdominal Interventional Radiology. Hong Kong Journal of Radiology. 2022 Sep 26;25(3):214–20.
6. Ghuran AV, Dixon G, Holmberg S, De Belder A, Hildick-Smith D. Transradial coronary intervention without pre-screening for a dual palmar blood supply. International Journal of Cardiology. 2007 Oct;121(3):320–2.
7. Hage F, Benamer H. Faut-il encore faire le test d'Allen chez les patient's devant avoir une voie d'abord transradiale pour un cathétérisme cardiaque ? Annales de Cardiologie et d'Angéiologie. 2013 Dec;62(6):419–23.
8. Bertrand OF, Carey PC, Gilchrist IC. Allen or No Allen. Journal of the American College of Cardiology. 2014 May;63(18):1842–4.
9. Hobby S, Stroebel M, Yamada R, Johnson T, Uflacker A, Hannegan C, et al. Transradial Access: A Comprehensive Review. Vascular and Endovascular Review. 2021 Mar 8;4:e02.
10. Iezzi R, Pompili M, Posa A, Annicchiarico E, Garcovich M, Merlino B, et al. Transradial versus Transfemoral Access for Hepatic Chemoembolization: Intrapatient Prospective Single-Center Study. Journal of Vascular and Interventional Radiology. 2017 Sep;28(9):1234–9.
11. Lee Y, Lee M, Hur S, Kim HC, Jae HJ, Chung JW, et al. Bronchial and non-bronchial systemic artery embolization with transradial access in patients with hemoptysis. Diagn Interv Radiol. 2022 Jul;28(4):359–63.
12. Ghosh A, Agnihotri T, Gupta V, Sitwala P, Stanley M, Cai S, et al. Transradial versus transfemoral arterial access in the uterine artery embolization of fibroids. pjr. 2022;87(1):672–7.
13. Pons RB, Caamaño IR, Chirife OS, Aja L, Aixut S, De Miquel MÁ. Transradial access for diagnostic angiography and interventional neuroradiology procedures: A four-year single-center experience. Interv Neuroradiol. 2020 Aug;26(4):506–13.
14. Ge B, Wei Y. Comparison of Transfemoral Cerebral Angiography and Transradial Cerebral Angiography Following a Shift in Practice During Four Years at a Single Center in China. Med Sci Monit. 2020;26:e921631.
15. Goldman DT, Bageac D, Mills A, et al. Transradial Approach for Neuroendovascular Procedures: A Single-Center Review of Safety and Feasibility. AJNR Am J Neuroradiol. 2021;42(2):313-318.
16. Caussin C, Gharbi M, Durier C, Ghostine S, Pesenti-Rossi D, Rahal S, et al. Reduction in spasm with a long hydrophylic transradial sheath. Cathet Cardiovasc Intervent. 2010 Nov 1;76(5):668–72.
17. Luther E, Chen SH, McCarthy DJ, Nada A, Heath R, Berry K, et al. Implementation of a radial long sheath protocol for radial artery spasm reduces access site conversions in neurointerventions. J NeuroIntervent Surg. 2021 Jun;13(6):547–51.
18. Williams C, McQuinn A, Whitley J, Cheung A, Wenderoth J, Manning N. Safety and Feasibility of Transradial Access for Neurointervention Procedures in Patients With Radial Artery Occlusion. SVIN. 2023 Mar;3(2):e000670

ISSN (O): 2687-5365; ISSN (P): 2753-6556