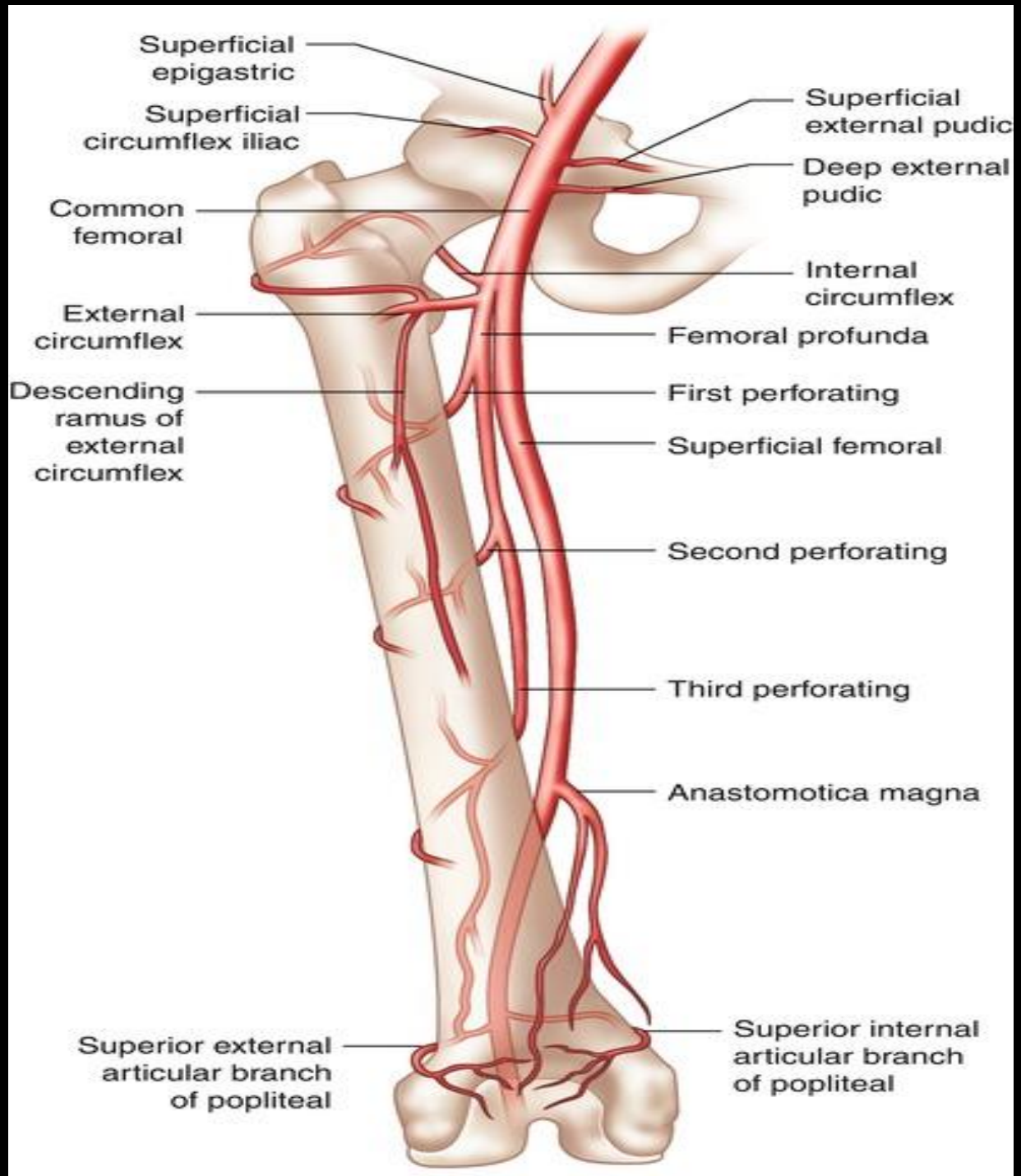
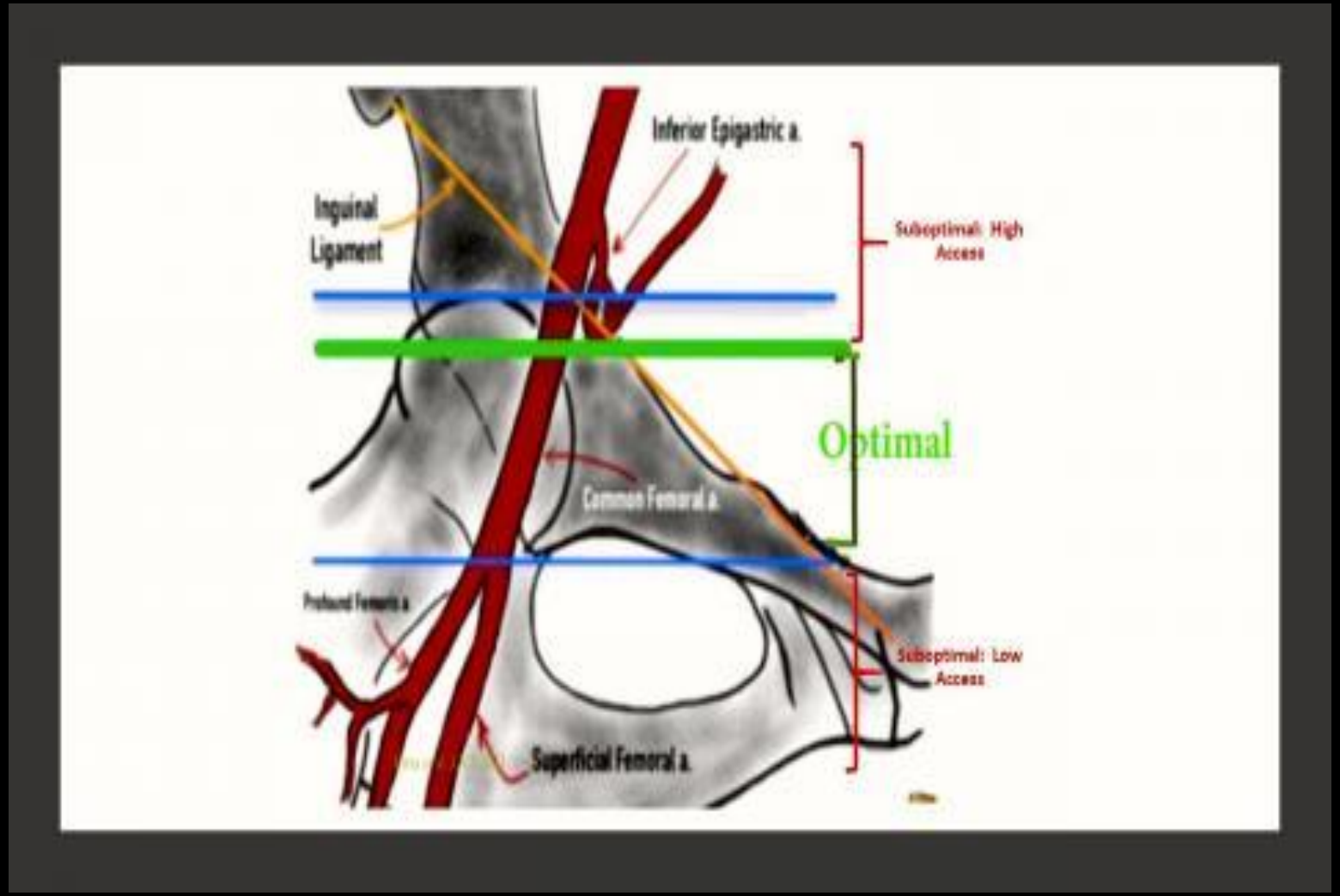
TRANSFEMORAL ARTERY PUNCTURE APPROACH

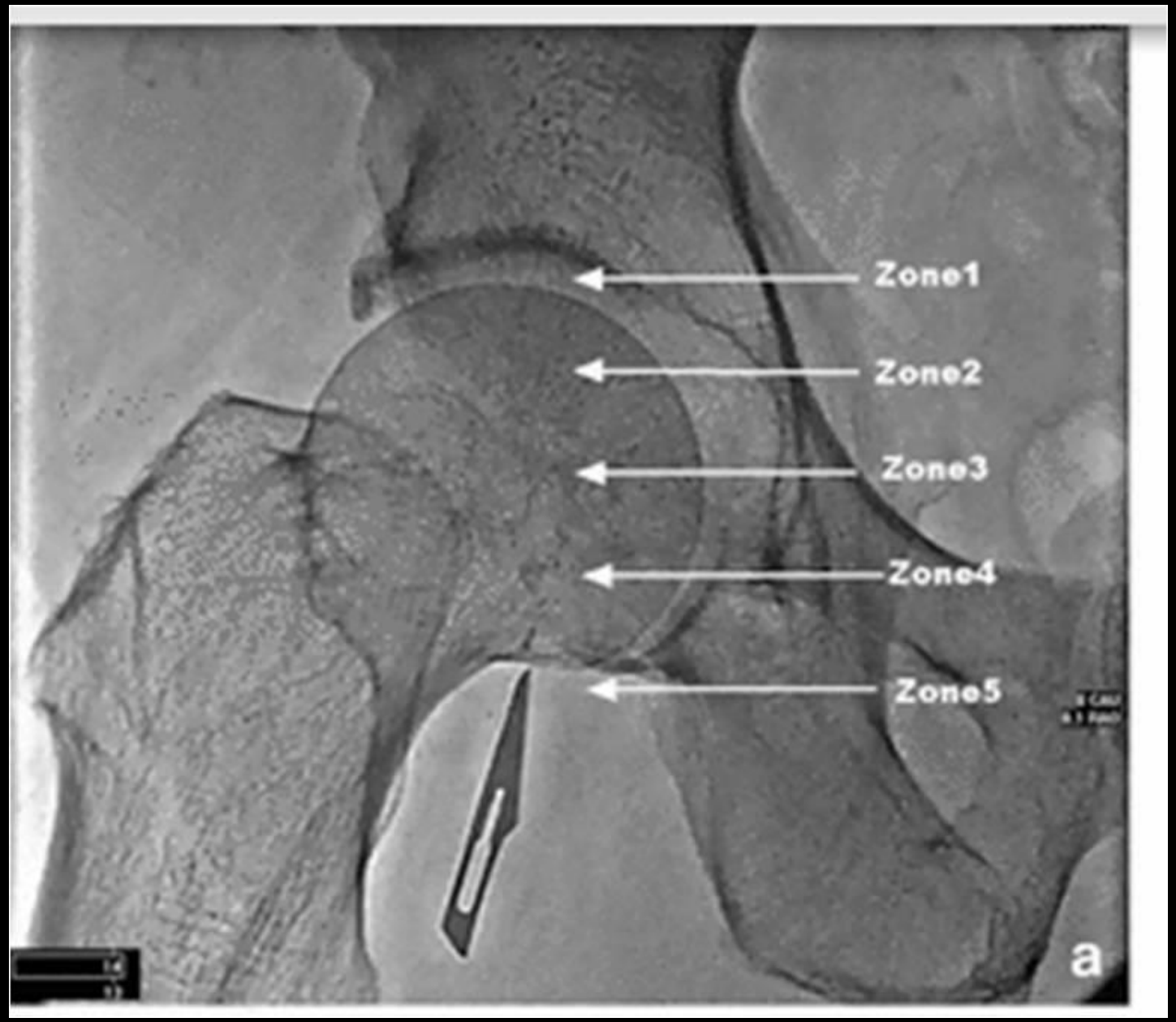
Presenter: Dr Kamil

- Known as common femoral artery.
- Continuation from external iliac artery.
- Continue downwards as superficial femoral artery.
- Main branches:
  - Superficial epigastric artery
  - Superficial circumflex iliac artery
  - Superficial and deep external pudendal artery
  - Descending genicular branch
  - Profunda femoris artery

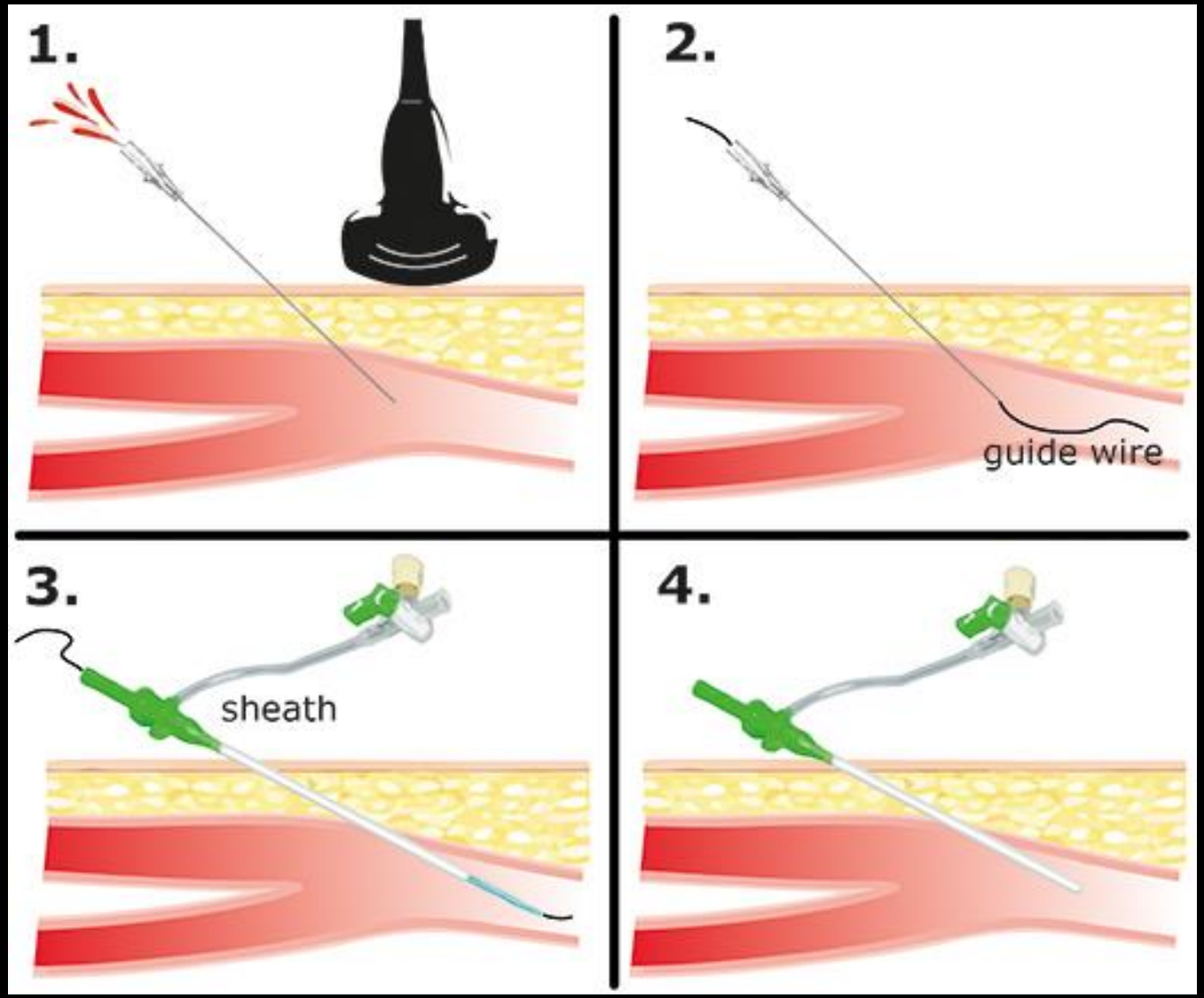

Superficial epigastric
Superficial circumflex iliac
Common femoral
External circumflex
Descending ramus of external circumflex
Superficial external pudic
Deep external pudic
Internal circumflex
Femoral profunda
First perforating
Superficial femoral
Second perforating
Third perforating
Anastomotica magna
Superior external articular branch of popliteal
Superior internal articular branch of popliteal

Femoral artery usually favoured as access site in view of wider diameter and less vascular angulation.



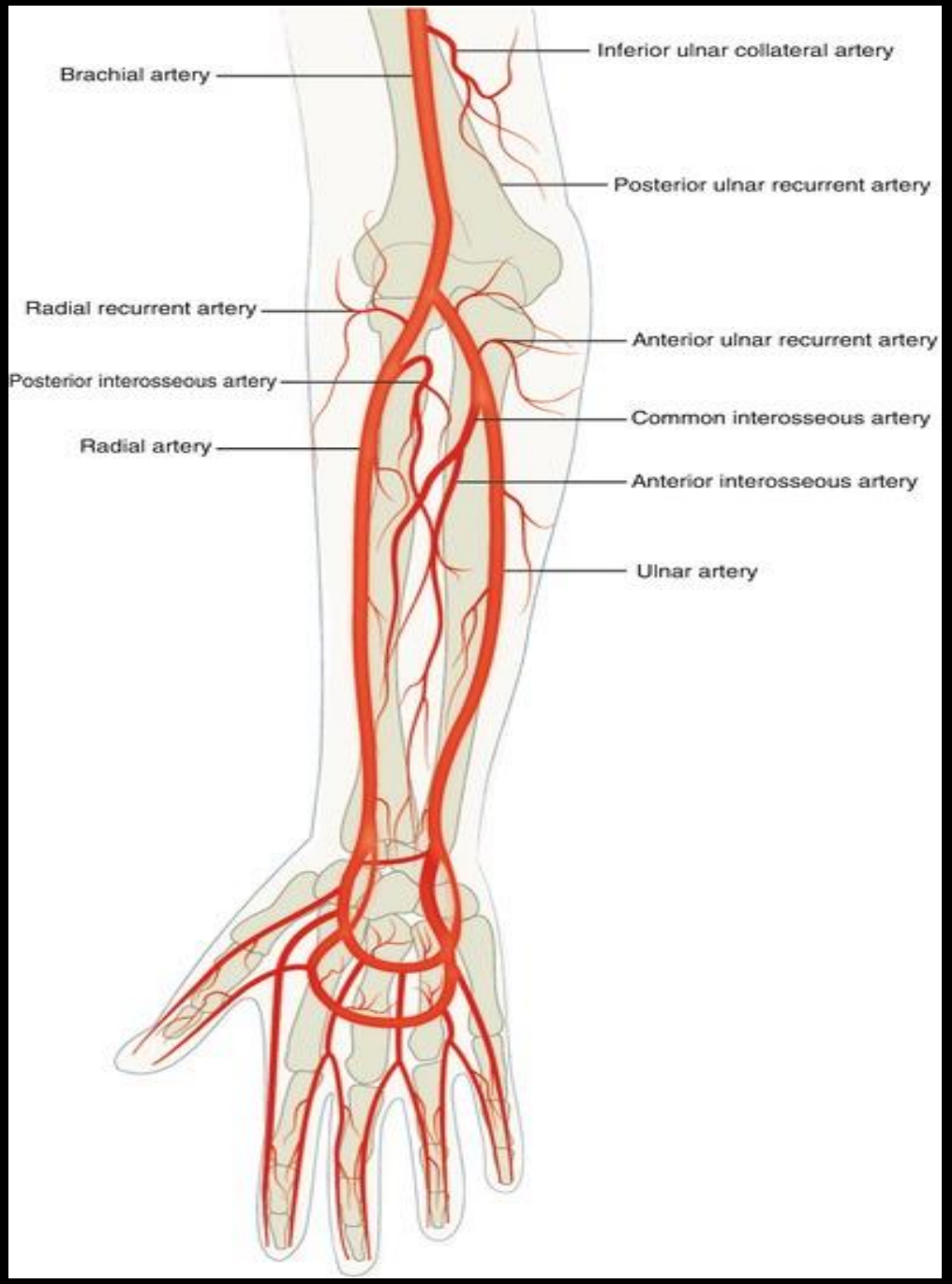

Zone1
Zone2
Zone3
Zone4
Zone5
a

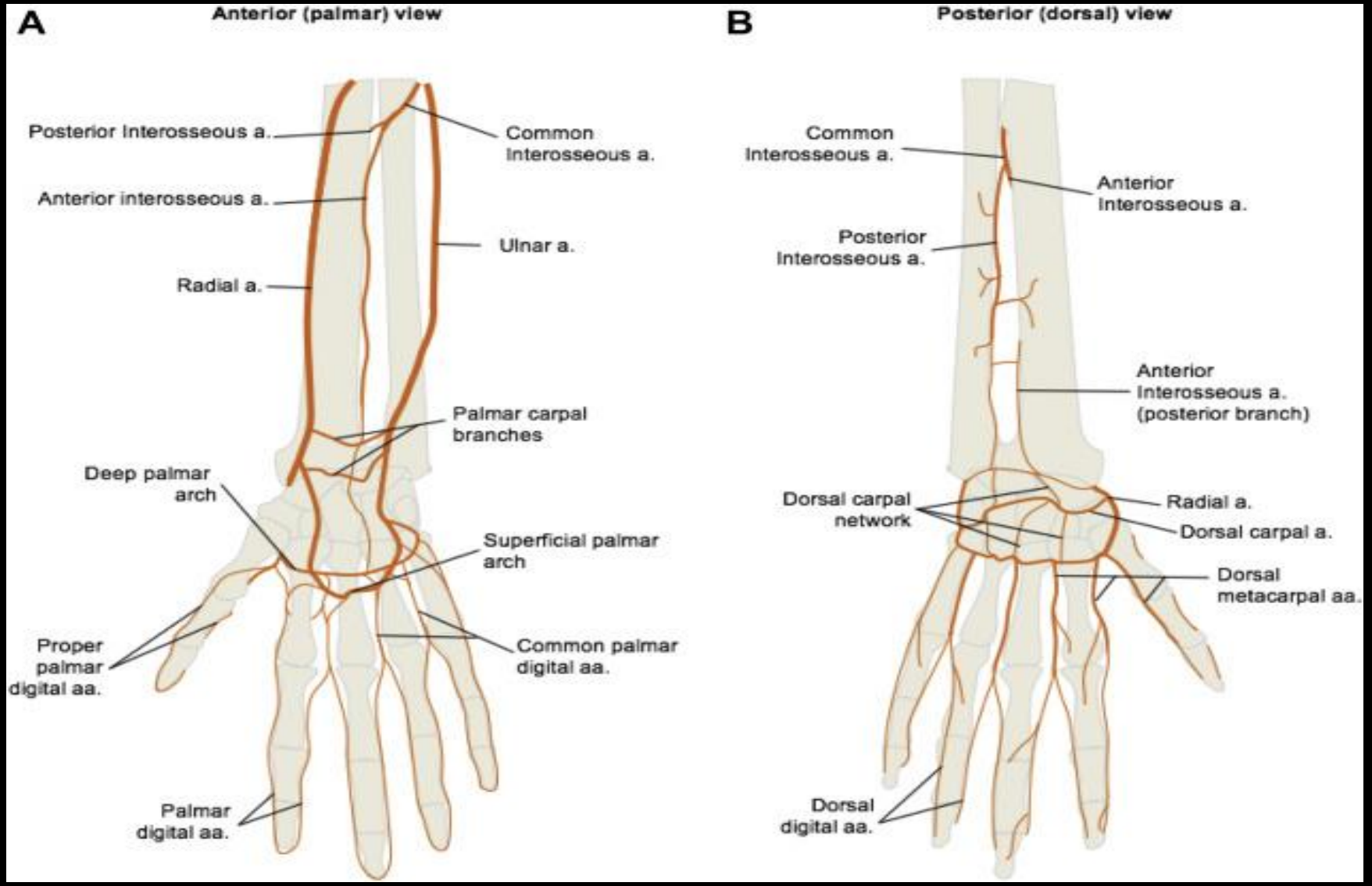
Modified Seldinger technique



RADIAL ARTERY AS AN ALTERNATIVE ARTERIAL APPROACH

- Terminal branch of brachial artery.
- Originated at cubital fossa.
- Distal radial artery runs on dorsal surface of radius and proceed along floor of anatomical snuffbox
- Branches:
  - Radial recurrent artery
  - Palmar and dorsal carpal branches
  - Muscular branches

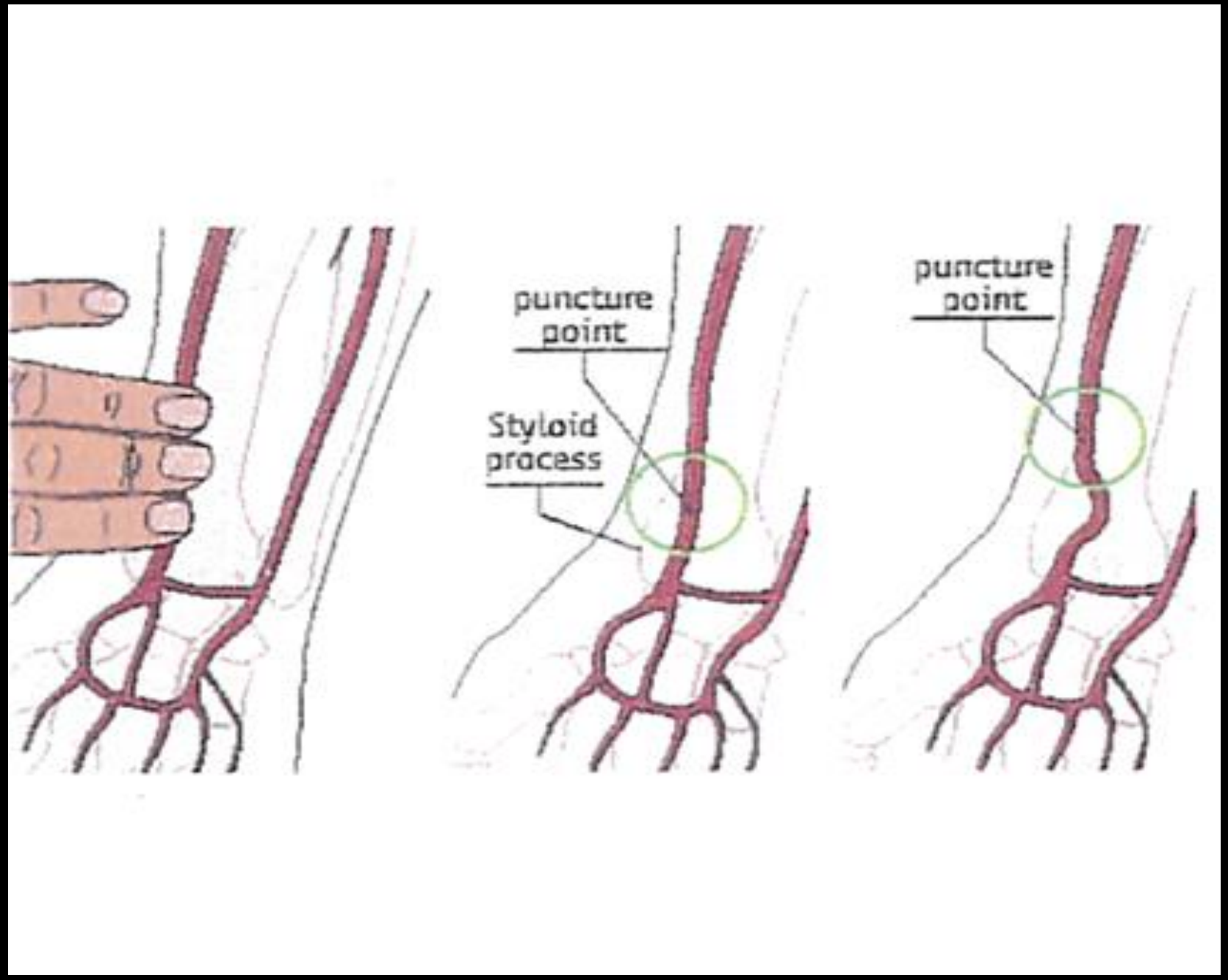



A
Anterior (palmar) view
Posterior Interosseous a.
Common Interosseous a.
Anterior interosseous a.
Ulnar a.
Radial a.
Palmar carpal branches
Deep palmar arch
Superficial palmar arch
Proper palmar digital aa.
Common palmar digital aa.
Palmar digital aa.
B
Posterior (dorsal) view
Common Interosseous a.
Anterior Interosseous a.
Posterior Interosseous a.
Anterior Interosseous a. (posterior branch)
Dorsal carpal network
Radial a.
Dorsal carpal a.
Dorsal metacarpal aa.
Dorsal digital aa.

- Few advantages of radial artery approach compared to femoral artery.
  - Less local vascular complications reported compared to femoral approach.
  - Reduce length of hospital stay.
- However, few disadvantages:
  - Smaller diameter artery.
  - Higher rate of procedure fail.
  - Total procedure time is longer.
  - No change in total radiation exposure.

Dorsal Radial

Radial or Ulnar Access


puncture
point
Styloid
process
puncture
point

COMMON COMPLICATIONS TRA VS TFA

- TRA
  - RADIAL ARTERY SPASM (RAS)
  - RADIAL ARTERY OCCLUSION (RAO)
- TFA
  - AV FISTULA
  - PSEUDOANEURYSM
  - RETROPERITONEAL HAEMORRHAGE
  - DISSECTION
  - ACUTE LIMB ISCHAEMIA

Transradial access for diagnostic angiography and interventional neuroradiology procedures: A four-year single-center experience. ~Critical Appraisal~

Presenter: Dr YapTC
Radiologist incharged: Dr Bazli Md Yusoff
Date: 21.2.2022 (Monday)

Transradial access for diagnostic angiography and interventional neuroradiology procedures: A four-year single-center experience.

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NIEMAH BASRI

Abstract

Purpose: The objective of this study was to assess the efficacy and safety of transradial access for diagnostic angiography and interventional neuroradiology procedures.

Methods: This was a retrospective analysis of a single-center experience based on 225 patients attended between August 2015 and October 2019, in which transradial access was used for diagnostic angiography and endovascular interventions. Ultrasound-guided access was done at the level of the forearm or anatomical or snuffbox (distal transradial access). Conventional forearm transradial access was done in 179 procedures (right, left and bilateral in 169, 5 and 5, respectively), while distal transradial access was done in 46 cases (41 right and 5 left). Primary outcome measures included successful catheterization, need to change access, or technical complications.

Results: In the group of 131 diagnostic angiographies, the technique success rate was 100% to target the right vertebral artery, 97% for the right internal carotid, 93.5% for the left internal carotid, 82% for the left vertebral artery, and 100% for both common and external carotid arteries. All patients were discharged within 2–4 h after the procedure. A total of 94 interventional procedures were performed, including aneurysms in 39 cases, stroke in 34, and other procedures (carotid stents, arteriovenous malformations, carotid-cavernous fistula) in the remaining 21. The overall technical success in both diagnostic angiographies and interventional procedures was 97.7%. In four cases of diagnostic angiography and in 1 intervention, it was necessary to switch from transradial access to transfemoral access. Three cases of hematoma related to the access site were recorded.

Conclusions: In our experience, transradial access is an alternative approach for diagnostic angiography and neuro-interventions.

Keywords

Radial artery, transradial, thrombectomy, endovascular therapy, angiography

Introduction

- There is a vast experience with the use of transfemoral access (TFA) in interventional neuroradiology and as approach for supra-aortic and intracranial vessels catheterization.
- In reviewe of 19,826 patients underwent diagnostic cerebral angiography using TFA, only 4.2% of patient had groin hematoma- most common complication.
- The use of transradial access (TRA) had gain popularity especially based on the mounting evidence of its clinical benefits in coronary angiography and percutaneous coronary intervention (PCI).
- The outcomes for TRA in meta-analysis of 24 studies- total 22,843 patients: reduces mortality and major cardiovascular events and improve safety with reduction of major bleeding and vascular compication compared with TFA.

Introduction

- In 2018 ESC/EACTS guideline in myocardial revascularization, radial access is preferred for any PCI irrespective of clinical presentation, unless there are overriding procedural consideration.
- Recent use of TRA in neuroendovascular techniques are
  - Diagnostic angiography,
  - Carotid artery stent placement
  - Coil embolization of aneurysm
  - Intervention of acute ischemic stroke

Introduction

- Condition that precludes for TFA (require alternative vascular access).
  - Vascular tortuosity
  - obese patients
  - marked atheromatosis
  - patients with high risk of bleeding

- Complication of TRA are radial artery spasm (RAS) (6- 10%) and radial artery occlusion (RAO) (<5%).
- Prevention of the complication-
  - assessment of collateral circulation from ulnar artery
  - Assessment of radial artery size
  - Spasmolytic cocktail infusion
- To reduce chance of RAO, the distal transradial access (dTRA) technique can be use.
- dTRA also gives more convenient position for operateor when a left radial access is required.

Introduction

- purpose of this study is to present our experience concerning the feasibility, efficacy, and safety of TRA for diagnostic angiography and complex interventional neuroradiology procedures.

Study design

- Retrospective analysis of all patient undergoing diagnostic angiography and neurointerventional procedures at the Department of Neuroradiology
- Duration : 4 year (Aug 2015- October 2019)
- Informed and written consent taken

Access and procedures

- Preliminary ultrasound using Hockey stick transducer
- Patients with radial artery diameter <1.8 mm are excluded.
- Allen test and Barbeau test done (Pulse oximetry and plethysmography)
- Preferred artery is right, however approach via left / left dTRA only when:
  - This is the only accessible site
  - Bilateral access required
  - Interventional procedure for vertebral artery was needed.

METHODS

- Artery punctured under us guide
- 5F sheath for diagnostic angiography, 6F sheath for most of interventional procedures
  - Intraarterial heparin
  - Verapamil (prevent radial artery spasm).
- For diagnostic angiography, Sim 1 and 2 were most favourable for catheterizing the supraaortic trunks

Patient selection to use TRA- undergoing neurointerventional procedures:

- (a) as a rescue vascular access when catheterization of the supraaortic vessels was unsuccessfully attempted through the femoral approach
- (b) as a combined method with TFA in cases in which multiple vascular access were needed, particularly in patients with arteriovenous malformation (AVM)
- (c) as a primary access when CT angiography showed a favorable anatomy for TRA and there were contraindications for TFA
- (d) as the initial vascular access.

- The configuration for aortic arch and branching patterns was evaluated in stroke patients, as these were the only patients that had a previous CT angiography of the neck.

Different combination of introducer sheath and intermediate catheters were used according to type and sire of the procedure

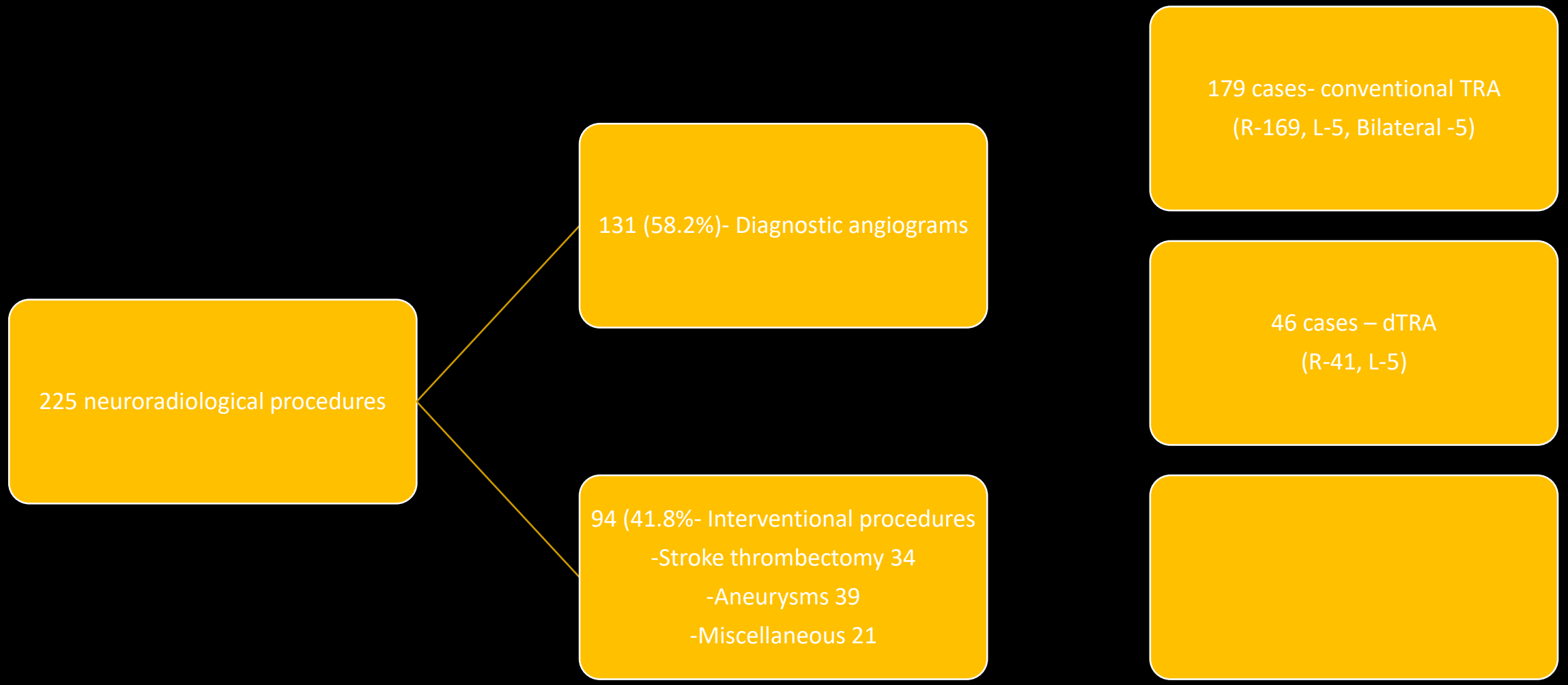
- Simmon 2 6F- when used, could catheterize directly both ICA.
- A 5F /6F intermediate catheter used to catheterize both vert A.
- If more inner working lumen needed (double thicker microcatheters, larger stents) or vessel tortuosity required more support, a 6F 90 cm sheath (Cook Shuttle or Balt Ballast) was used.
  - exchange through a 0.35 guidewire was used from a short 6F radial sheath
- stroke patients with vascular tortuosity, a long sheath gave support to advance a distal aspiration catheter such as Sofia 6F (Microvention) or ACE 68 (Penumbra)

Anterior and posterior circulation stroke approach

- Anterior circulation stroke- using 6-7 F radial sheath accompanied by 6F Cello balloon (Medtronic) or Flowgate 2 balloon (Stryker) sheathless were placed.

- Posterior circulation stroke- a distal aspiration catheter were directly placed with 0.035 wire.
  - If vessels are more tortuous, a 6F 90 cm sheath was used.

Result


225 neuroradiological procedures
131 (58.2%)- Diagnostic angiograms
94 (41.8%- Interventional procedures
-Stroke thrombectomy 34
-Aneurysms 39
-Miscellaneous 21
179 cases- conventional TRA
(R-169, L-5, Bilateral -5)
46 cases – dTRA
(R-41, L-5)

Result

- 4 patients , radial loop was encountered
  - 2 cases crossed with “j” bended 0.35” wire.
  - 2 cases a 0.18” guidewire was required to cross and rectify the loop

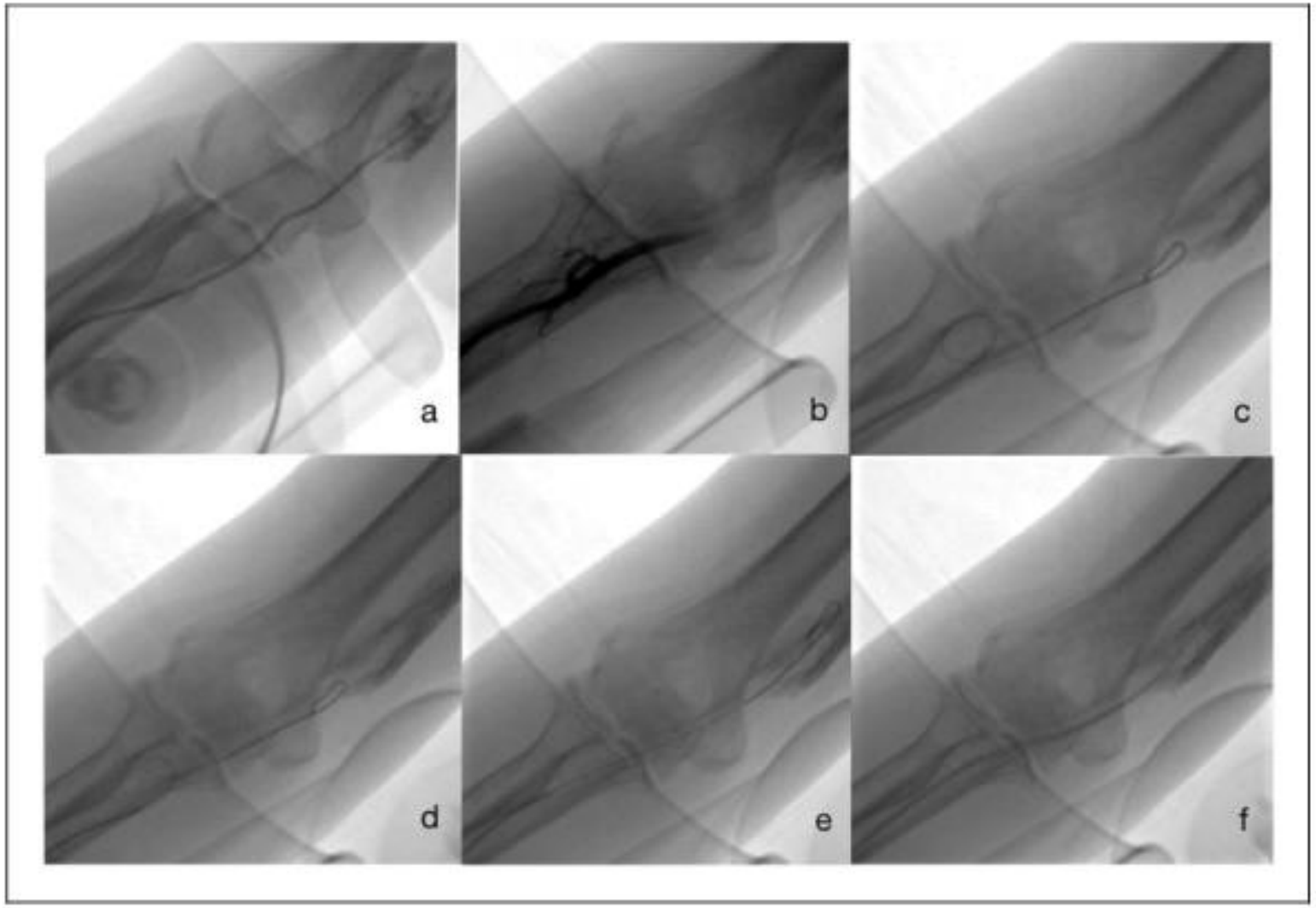


Figure 4. (a) 0.35″ guidewire and catheter resistance. Contrast injection shows catheterization of a muscular branch; (b) Catheter retrieval and contrast injection. Presence of a 360° radial loop; (c) Crossing of the loop with a 0.18″ guidewire; (d, e) Guidewire withdrawal maneuver to unbend the loop; (f) The 0.35″ guidewire and catheter could be advanced properly with a resolution of the loop.

Result

- Technical success rate for diagnostic angiography
  - 100% for Rt Vert
    97% for Rt ICA
  - 82% for Lt Vert
    82% for LtICA
  - 100%. For both CCA and ECA
- Time to vessel catheterization
  - 3.8 min/vessel for TRA vs 4.2 min/vessel for TFA
  - In case with radial loop, TRA time increased to 4.7 min/vessel.
- Stay after procedure
  - All patients undergoing diagnostic angiography were discharged after 2–4 h of the examination.
- Success rate for interventional procedure
  - 98.9% success rate for selective catheterization

Interventional procedure

- Total 94 patients- stroke thrombectomy (34), Aneurysm 39 and miscellaneous 21

Table 1. TRA stroke treatments performed in 34 patients.

Localization	Total cases	Radial first (%)	TICI 2b-3 (%)
Right TICA	3	3 (100%)	2 (67%)
Right MCA	7	6 (86%)	6 (86%)
Left TICA	7	7 (100%)	7 (100%)
Left MCA	13	11 (85%)	8 (61%)
Basilar artery	4	3 (75%)	4 (100%)
Global	34	30 (88%)	27 (79%)

MCA: middle cerebral artery; TICA: terminal internal carotid; TICI: thrombolysis in cerebral infarction.

- 88% revascularization technical success rate
- 4 patients use TRA after failure of TFA.
- The rest 30 cases TRA is used as first approach.

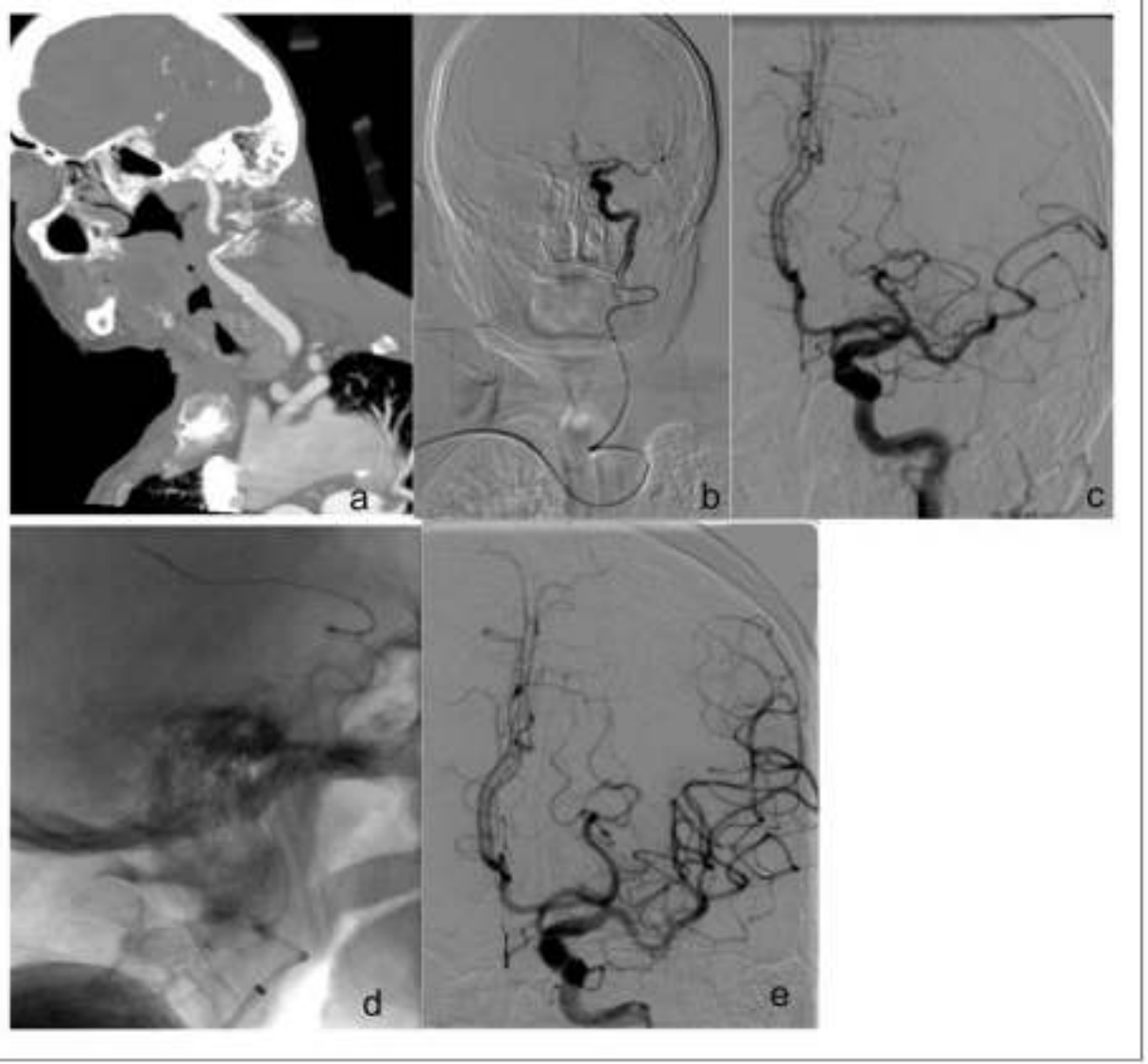


Figure 1. A 93-year-old women with M2 left superior division occlusion and moderate stroke severity (NIHSS scale score 12). (a) Type 3 arch and curvature of proximal left common carotid. Right transradial access is decided after transfemoral unsuccessful catheterization; (b) a 6F cook Shuttle is placed in left carotid artery; (c) M2 superior division occlusion on selective angiography; (d) thrombectomy is performed with a 6F ACE 68 catheter aspiration and 4 × 40 solitaire stent retrieval; (e) TICI 3 recanalization is achieved (radial puncture to recanalization in 33 min).

39 patients with aneurysm

- successful occlusion was achieved in all cases
- Periprocedural complications occurred in two cases.

Table 2. Treatment of TRA aneurysms in 39 patients.

Localization	Total cases	BAC	FD	Complications
Posterior circulation	7 (18%)	3	4	-
Basilar artery	6	3 (1+SAC)	3	-
Left PICA	1	-	1	-
Anterior circulation	32 (82%)	29	3	2
ACoA	7	7	-	-
Left A1	1	1	-	-
Left pericallosal	3	3	-	1. Aneurysm rupture
Left ICA	6	5	1	-
Left PCoA	3	3	-	1. coil migration, gooseneck snare
Left MCA	3	3	-	-
Right pericallosal	1	0	1	-
Right ICA	4	3	1	-
Right MCA	1	1	-	-
Right PCoA	3	3	-	-
Global	39	32	7	2

BAC: balloon-assisted coiling; FD: flow diverter; PICA: postero-inferior cerebellar artery; ICA: internal cerebral artery; PCoA: posterior communicating artery; posterior communicating artery; MCA: middle cerebral artery.

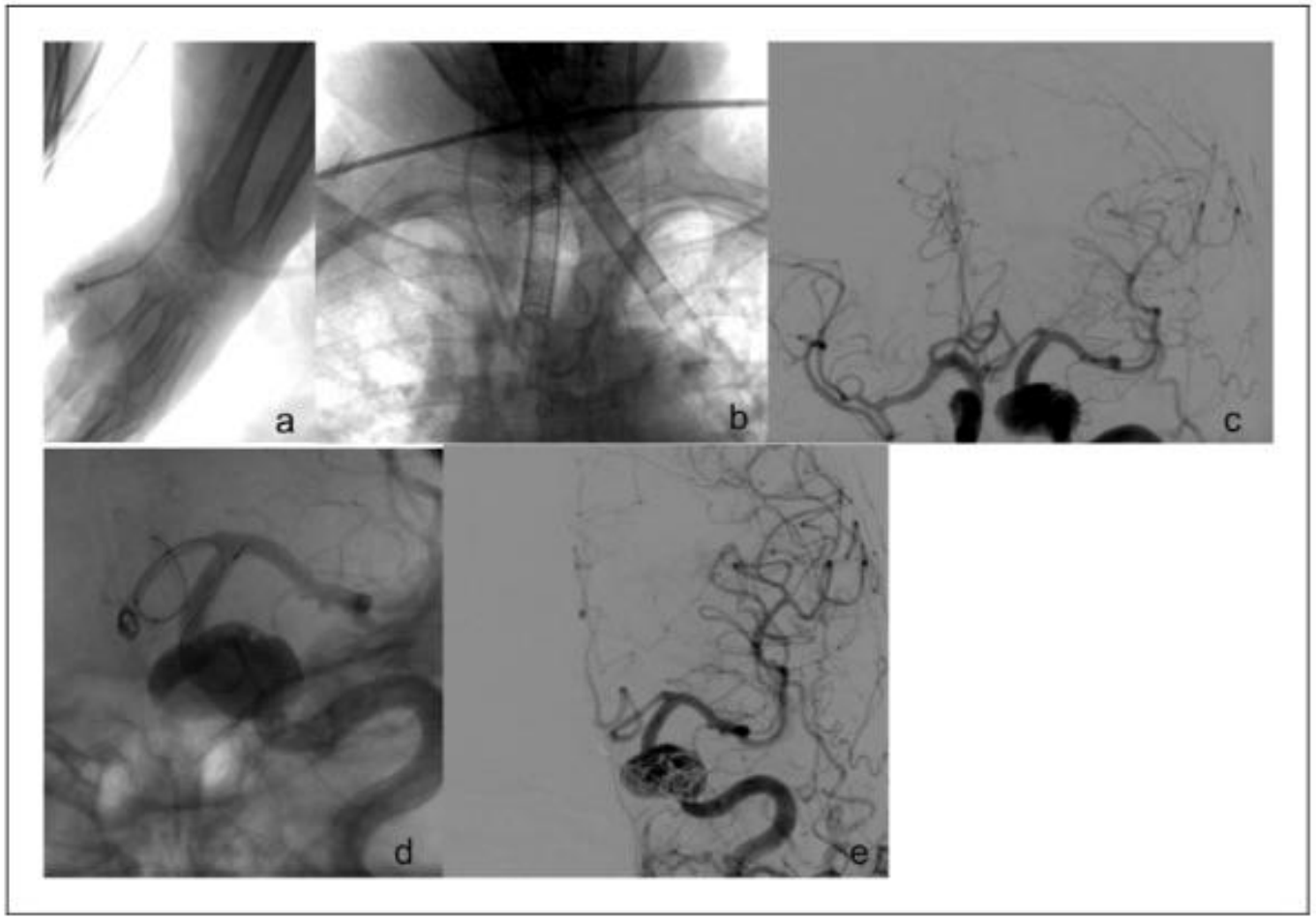


Figure 3. A 76-year-old woman with two incidental aneurysms, anterior communicating, and left cavernous. Double access was decided to perform occlusion test and an embolization of the anterior communicating aneurysm. (a) Left distal transradial access with diagnostic catheter and right radial access with guiding catheter; (b) crossing of the catheters at the aortic arch; (c) bilateral initial angiography; (d) balloon-assisted coiling of the anterior communicating aneurysm; (e) it was then decided to preserver left carotid artery and to perform partial occlusion of the cavernous aneurysm with coils.

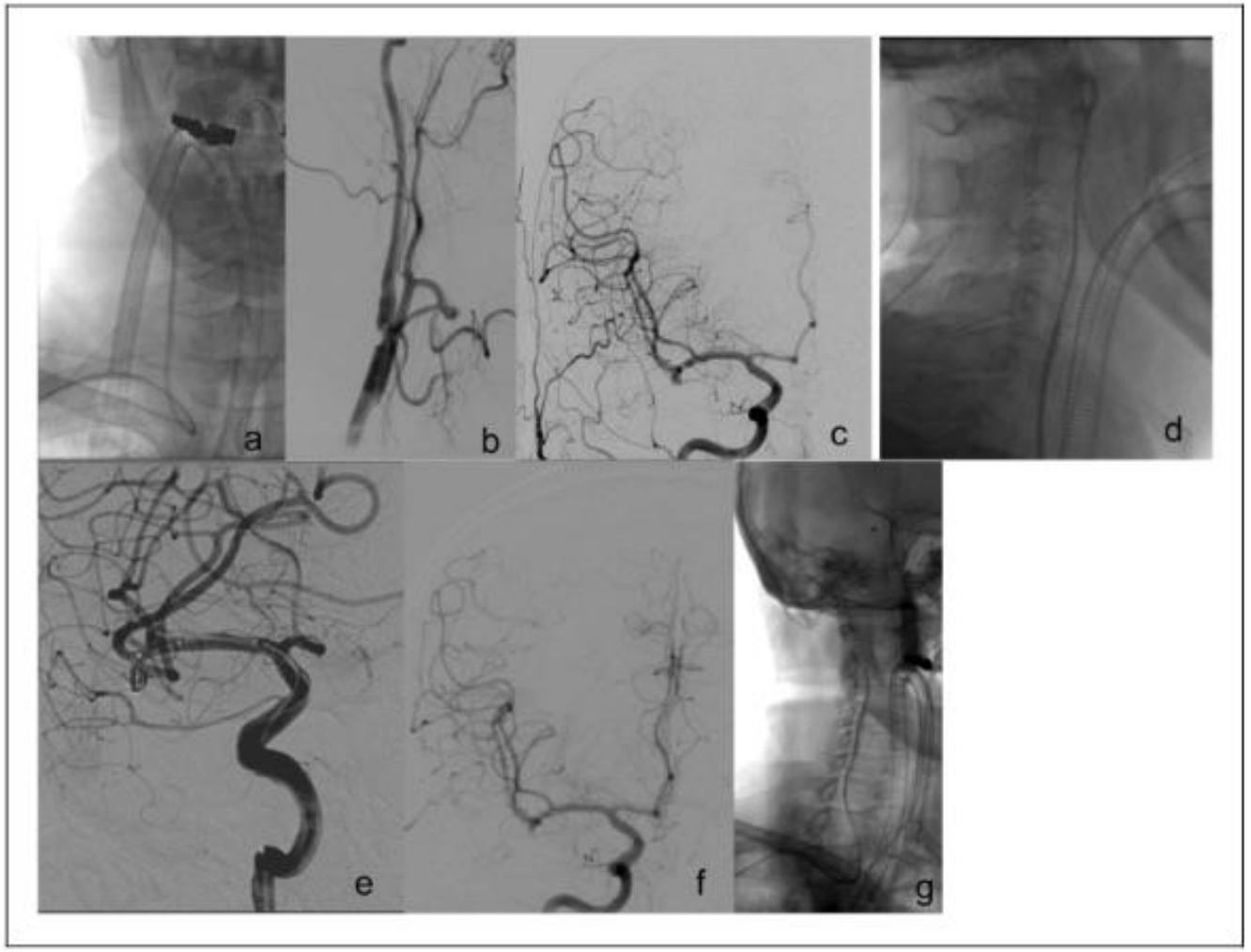


Figure 2. A 74-year-old man with right amaurosis fugax and right internal carotid artery stenosis and incidental Silvian aneurysm. Carotid stenting and aneurysm embolization is decided. (a) 6F Envoy Simmons catheter is placed in right common carotid artery; (b) and (c) proximal internal carotid artery focal stenosis and 3 mm middle cerebral artery bifurcation aneurysm; (d) once the stent is deployed, the 6F guiding catheter is moved upwards with help of a 4F catheter; (e) balloon-assisted coiling is attempted, but finally embolization is done using double microcatheter technique; (f) and (g) final angiogram showing 6F guiding catheter positioned upper the stent.

Other interventional procedures in 21 patients

Table 3. TRA miscellaneous interventional procedures in 21 patients.

Procedure	Cases	Technique	Complications
Left ICA stenosis	4	Carotid stenting with filter	No
Right ICA stenosis	4	Carotid stenting with filter	No
Carotid-cavernous fistula	1	Comaneci-assisted coiling	No
Torcular AVF	1	Phil + Onyx embolization	No
Right Tentorial AVF	1	Onyx embolization	No
Left Tentorial AVF	1	Phil + Onyx embolization	No
Ponto-cerebellar AVF	1	Phil embolization	No
Mesencephalic AVM	1	Glue embolization	No
Pericallosal AVM	1	Onyx embolization	No
Frontal AVM	1	Phil + Onyx embolization	No
Lumbar Cordoma	1	PVA embolization	No
Right common carotid artery and subclavian artery stent	1	Stenting + angioplasty+ filter	Filter entrapment. Use of gooseneck snare
Lingual artery bleeding	1	Coils embolization	No
Left carotid occlusion test	1	Balloon occlusion	No
Left ECA bleeding	1	Coils + glue embolization	Need crossover to TFA

SAC: Stent-assisted coiling; AVM: arteriovenous fistula; ECA: external carotid artery; PVA: polyvinyl alcohol particles.

Patency of radial artery at 30 days

- Not registered until 2019
- 3 cases of superficial local hematoma which resolved spontaneously without increase hospital stay length

Patient’s preference

- 32 patients had both TRA and TFA experience
- 75% (24/32) prefer TRA for next procedure
- 15.6% (5/32) prefer TFA
- 9.4% (3/32) no preference

Discussion

- Low rate of complication of TRA vs TFA (in the field of interventional cardiology)
- Right radial artery TRA is feasible for diagnostic cerebral angiography (in agreement with other study).
- Left vertebral A is the most challenging vessels in which in large serries of 1240 cerebral DSA, success rate for selective catheterization of left vert A is 52.2%
  - the use of 0.35” Stiff or Half Stiff guidewire allowed successful progression of the catheter through vertebral artery.
- TRA is attractive in anticoagulated patient- decreased risk of bleeding at access site

Discussion

- Post procedure RAO remain issue although rarely associated with immediate clinical sequelae.
- It has been shown that patent hemostasis using an inflated band is highly effective in preventing early RAO and has the benefit of cost saving.

Discussion

- For endovascular treatment, almost all interventions can be performed through a 6F sheath or guiding catheter.
  - Aneurysm- Simple coiling, balloon remodeling or stent assisted coiling (Envoy 6F)
  - For carotid stenting and depending on the external diameter of the stent-carrying catheter, a 6F sheath of guiding catheter can be used (Cordis Precise RX delivered with Envoy 6F).
- 7F catheter may be useful when 3 microcatheter are needed.

Discussion

- When an intervention through left vertebral artery is needed (basilar thrombectomy, arteriovenous mal- formation embolization, treatment of a basilar aneurysm), it is preferable to use a left radial access (forearm or dTRA).

- When double access is needed, both right and left TRA or combined with TFA can be used.
- For scheduled interventional procedures, patients are usually discharge after 24 hours.

Discussion

- Previously, there is little experience on the use of TRA in stroke patient.
- Sur et al. reported successful revascularization in 10 out of 11 acute ischemic stroke in which radial A chosen as primary site. The treatment is standard thrombectomy including stent retriever deployment with aspiration through the guide.
- In treatment using direct thrombus aspiration (ADAPT) or distal aspiration combined with stent retriever, a 6F catheter is adequate. This method is use for posterior circulation thrombus in this study.

Discussion

- The use of 8F sheath and an 8F balloon-guided catheter may be feasible in selected patient only. However the incidence of severe flow reduction in the radial artery after coronary intervention was 8.3% in patients with 8F sheaths used, which increased significantly to 13% if the ratio of the radial artery inner diameter/sheath outer diameter was less than 1.0.

Discussion

- For balloon occlusion aspiration, feasible options include the use of a 6F Cello balloon (Medtronic) that requires a 7F sheath introducer, or a 6F slender sheath (Terumo) or the Preclude Ideal hydrophobic sheath (Merit) that allows 7F catheter diameters.

Discussion

- direct carotid artery puncture may be an alternative to TFA and TRA in cases of stroke of difficult anatomy including unfavorable arch type, carotid tortuosity, or an ostial
- Recent case report and small case series shown that direct carotid puncture could be an alternative for endovascular thrombectomy when TFA is not possible.
- However evidence regarding the safety of the trans- carotid approach is currently limited and more studies on this alternative mode of access are needed

Limitations

- Single center retrospective study
- Study were focused on TRA.
- Comparison with TFA was not performed .

Recommendation

- Starting using TRA once catheterization skills have been achieved.
- Start with scheduled aneurysms and then move forward to more complex interventions.
- For stroke treatment , the first case used TRA as an alternative to TFA when access not feasible. After gaining experience, TRA was used as the initial vascular access.

Conclusion

- TRA is a valuable options in whom TFA is challenging.
- Radial access approach can be adopted smoothly for a large percentage of diagnostic and interventional neuroradiological procedures.

- THANK YOU

Original Article

INR INTERVENTIONAL NEURORADIOLOGY

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- Date of received, revised, and accepted are clearly stated down.
- Authors and institutions are stated down.
- Single-center study stated down
- Open access: Pubmed, NCBI, Sage journals

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- Concise
- Purpose/Aim of the study, study design, duration, samples population involved: clearly stated down
- Results are briefly and clearly summarized.
- Conclusion: clearly stated down.

Introduction

There is a vast experience with the use of transfemoral access (TFA) in interventional neuroradiology, being the vascular approach most frequently used for catheterization of the supraaortic and intracranial vessels. In a review of 19,826 consecutive patients undergoing diagnostic cerebral angiography using TFA, groin hematoma was the most common complication, which was seen in 4.2% of patients.[1] The use of the radial artery (transradial access, TRA) as the point of entry instead of TFA has gained popularity based on the mounting evidence of its clinical benefits in coronary angiography and percutaneous coronary intervention (PCI).[2–4] Clinical outcomes of radial access for coronary interventions in patients with coronary artery disease (CAD) were examined in a meta-analysis of 24 studies, with a total of 22,843 patients.[5] Compared with femoral access, radial access reduces mortality and major adverse cardiovascular events and improves safety, with reductions in major bleeding and vascular complications across the whole spectrum of patients with CAD.[4] In the 2018 ESC/EACTS guidelines on myocardial revascularization, radial access is preferred for any PCI irrespective of clinical presentation, unless there are overriding procedural considerations.[6]

The radial artery approach has more recently been applied to neuroendovascular techniques, including diagnostic angiography, carotid artery stent placement, coil embolization of aneurysms, and intervention for acute ischemic stroke.[7–9] Some studies have shown the feasibility and safety of TRA for diagnostic and interventional neuroangiographic procedures,[7–10] but the clinical experience with catheterization of the supraaortic vessels is still limited. Vascular tortuosity, obese patients, marked atheromatosis or patients with high risk of bleeding may be precluded from TFA, and require alternative vascular access. Complications specific to TRA include radial artery spasm (RAS) and radial artery occlusion (RAO). RAO occurs in less than 5% of patients and RAS in 6–10% with appropriate prevention, including assessment of collateral circulation from the ulnar artery, radial artery size, and spasmolytic cocktail infusion.[4] Also, the distal TRA (dTRA) at the anatomical snuffbox reduces the chance of RAO at the distal forearm and allows a more convenient position for the operator when a left radial access is required.[11]

The purpose of this study is to present our experience concerning the feasibility, efficacy, and safety of TRA for diagnostic angiography and complex interventional neuroradiology procedures.

- Brief written introduction about TRA, which commonly used in cardiology and CTC side.
- Brief introduction of complications in between TFA and TRA.
- Brief introduction of different types of TRA
- Purpose of study is clearly mentioned.

Study design

Study design

This was a retrospective analysis of all consecutive patients undergoing diagnostic angiography and neurointerventional procedures at the Department of Neuroradiology of a 900-bed acute-care teaching hospital between August 2015 and October 2019. Patients were fully informed about the details of the procedure, and written informed consent was obtained in all cases. Local institutional review board approval was not required to review retrospectively our database for the purpose of this study.

- Retrospective study is clearly mentioned.
- Numbers of recruited patient was not mentioned.
- Place of study carried out mentioned, but not in detailed as in where.
- Duration of study is clearly mentioned.
- Recruited patients are consented – which is good.
- Had mentioned regarding why review board is not required – which is good.

Access and procedures

All patients underwent an ultrasound examination (Hockey stick transducer) in order to measure the diameter of the radial artery. Assessment of the collateral circulation to the hand via Allen's test (time needed for maximal palmar blush after release of the ulnar artery compression with occlusive pressure of the radial artery) and the Barbeau (using pulse oximetry and plethysmography)[12,13] test was used prior to TRA. Patients with a radial artery diameter of less than 1.8 mm were excluded. The preferred access was on the right arm, as it is more suitable for neuroradiology. An approach via the left or left dTRA was used when this was the only accessible site, a bilateral access was required or an interventional procedure in the vertebral artery was needed.

When distal access was performed, the patient's hand was placed with dorsal flexion to help the progression of the wire. The artery was punctured under ultrasound. A 5F radial sheath (Terumo Medical, Somerset, New Jersey, USA or Merit Medical, Utah, USA) was used for diagnostic angiography and a 6F sheath for most of the interventional procedures. As the introducer sheath was placed within the artery, an intra-arterial injection of a mixture of heparin (2000–4000 IU) and verapamil (5 mg) was infused through the side-port of the introducer to prevent radial artery spasm and thrombosis.

In patients undergoing diagnostic angiography, Simmons type 1 or type 2 catheters were the most favorable for catheterizing the supraaortic trunks. In patients undergoing neurointerventional procedures, the decision to select TRA was based on the following considerations: (a) as a rescue vascular access when catheterization of the supraaortic vessels was unsuccessfully attempted through the femoral approach; (b) as a combined method with TFA in cases in which multiple vascular access were needed, particularly in patients with arteriovenous malformation (AVM); (c) as a primary access when CT angiography showed a favorable anatomy for TRA and there were contraindications for TFA; and (d) as the initial vascular access. The configuration for aortic arch and branching patterns was evaluated in stroke patients, as these were the only patients that had a previous CT angiography of the neck. Different combinations of introducer sheaths and intermediate catheters were used according to the type and site of the procedure.

When a Simmons 2 6F Envoy guiding catheter was used, we could catheterize and directly place the catheter in the desired vessel. This method was commonly used for both internal carotid arteries catheterization. To catheterize any of both vertebral arteries, a 5F or 6F intermediate catheter was normally used directly through a radial sheath. For posterior circulation thrombectomy, a distal aspiration catheter was directly placed with a 0.35 wire. In cases in which more inner working lumen was needed (double thicker microcatheters, larger stents) or vessel tortuosity required more support, a 6F 90 cm sheath (Cook Shuttle or Balt Ballast) was used. To use it, an exchange through a 0.35 guidewire was used from a short 6F radial sheath. In stroke patients with vascular tortuosity, a long sheath gave support to advance a distal aspiration catheter such as Sofia 6F (Microvention) or ACE 68 (Penumbra). Finally, in cases of anterior circulation stroke performed through a balloon occlusion catheter and aspiration, either a 6–7F radial sheath accompanied with a 6F Cello balloon (Medtronic) or a Flowgate 2 balloon (Stryker) sheathless were placed.

- Recruited patients are consented as mentioned previously.

- Pre-procedural preparations are mentioned, however:
  - who did?
  - hockey stick transducer was used but what USG machine was used?
  - did the colour Doppler or waveform taken?

- Was mentioned about diameter of RA <1.8mm was excluded?
  - How about other exclusion and inclusion criteria???

- Which hand was used for puncture and reason of chosen was explained – which is good.
- Different size of vascular sheath was chosen in different condition - explained well.
- Drug to used for preventing complication – written down.
- How to choose patient for TRA was clearly stated down.
- Catheters to use, how to choose, methods – are stated down briefly.

Results

During the study period, a total of 225 neuroradiological procedures were performed, 131 (58.2%) of which were diagnostic angiograms and the remaining 94 were interventional procedures. Conventional forearm TRA was used in 179 procedures (right, n = 169; left, n = 5; bilateral, n = 5) and dTRA in 46 cases (right, n = 41; left, n = 5). Diagnostic angiograms were either primary initial studies or control of previously treated patients, and included complete (both internal carotid arteries and both vertebral arteries were catheterized) and selective (catheterization of a single vessel) angiographies. In all cases, access through the radial artery was feasible, but four cases required crossover to TFA. In two cases, TRA was not possible due to vasospasm, even after intra-arterial injection of 200 µg nitroglycerin, one case due to a subclavia lusoria, and another due to impossibility to catheterize the left vertebral artery. In other four patients, a radial loop was encountered, two cases was crossed with a "j" bended 0.35″ wire and in the two other cases a 0.18″ guidewire was required to cross and rectify the loop, after which the progression of the catheter was adequate.

All patients undergoing diagnostic angiography were discharged after 2–4 h of the examination. The technical success rate was 100% to target the right vertebral artery, 97% for the right internal carotid, 93.5% for the left internal carotid, 82% for the left vertebral artery, and 100% for both common and external carotid arteries. Fluoroscopy time was recorded for diagnostic angiographies performed by one of the authors (RB) in 2018. Time for vessel catheterization, including centering was 3.8 min/vessel for TRA compared to 4.2 min/vessel for TFA. In cases with radial loop, TRA time increased to 4.7 min/vessel.

In the group of 94 interventional procedures involving selective catheterization of the vessel of interest, the success rate of the technique was 98.9%. The indications of interventional procedures were stroke thrombectomy in 34 patients, aneurysms in 39, and miscellaneous in 21. In the group of 34 stroke patients (Table 1), thrombectomy using TRA had a revascularization technical success rate of 88% (TICI 2b/3). TRA was used after failure of TFA in four patients and used as a first approach in the remaining 30 cases. No TFA was required as a crossover after TRA failure.

In the group of 39 patients with aneurysms (Table 2), successful occlusion was achieved in all cases. Periprocedural complications occurred in two cases. Details of other interventional procedures performed in 21 patients are shown in Table 3.Patency of the radial artery at 30 days was not specifically registered in all patients until 2019. There were three cases of superficial local hematoma at the puncture site that resolved spontaneously without increase of hospital stay length.

A total of 32 patients had both a diagnostic TRA and a prior diagnostic TFA, and telephone interviews were successfully conducted. Of patients who had experienced both TRA and TFA previously, 75% (24/32) would prefer TRA for their next procedure, with 15.6% (5/32) preferring TFA, and 3 declaring no preference.

Illustrative cases of interventional procedures using TRA are shown in Figures 1 to 3. Figure 4 shows the steps to solve the presence of a 360° radial loop.

- What methods of statistic analysis was used? – not mentioned.
- Total of cases of neuroradiology interventions, further subdivision, and failed cases - mentioned.
- However, if demonstrated in chart or table – better
- Discharge timing for diagnostic procedure was mentioned, but discharged timing of interventional procedures was not mentioned.
- Successful rate of cannulation of each vessels are stated down. However, those vessels which are not 100% cannulated – reason not stated.
- Fluorotime was stated down at recorded, but exact time was not mentioned is what.
- Time for vessel for TRA and TFA catheterization mentioned – good.
- Group of patient for interventional/treatment procedure are stated down briefly, along with the cases with the complications.
- Numbers of patient which TFA and TRA both procedures and their statistic was mentioned – good.

Table 1. TRA stroke treatments performed in 34 patients.

Localization	Total cases	Radial first (%)	TICI 2b-3 (%)
Right TICA	3	3 (100%)	2 (67%)
Right MCA	7	6 (86%)	6 (86%)
Left TICA	7	7 (100%)	7 (100%)
Left MCA	13	11 (85%)	8 (61%)
Basilar artery	4	3 (75%)	4 (100%)
Global	34	30 (88%)	27 (79%)

MCA: middle cerebral artery; TICA: terminal internal carotid; TICI: thrombolysis in cerebral infarction.

- Tables of interventional procedures are clearly summarized.
- Too bad that there is no patient demographic data.

Table 2. Treatment of TRA aneurysms in 39 patients.

Localization	Total cases	BAC	FD	Complications
Posterior circulation	7 (18%)	3	4	-
Basilar artery	6	3 (1+SAC)	3	-
Left PICA	1	-	1	-
Anterior circulation	32 (82%)	29	3	2
ACoA	7	7	-	-
Left A1	1	1	-	-
Left pericallosal	3	3	-	1. Aneurysm rupture
Left ICA	6	5	1	-
Left PCoA	3	3	-	1. coil migration, gooseneck snare
Left MCA	3	3	-	-
Right pericallosal	1	0	1	-
Right ICA	4	3	1	-
Right MCA	1	1	-	-
Right PCoA	3	3	-	-
Global	39	32	7	2

BAC: balloon-assisted coiling; FD: flow diverter; PICA: postero-inferior cerebellar artery; ICA: internal cerebral artery; PCoA: posterior communicating artery; posterior communicating artery; MCA: middle cerebral artery.

Table 3. TRA miscellaneous interventional procedures in 21 patients.

Procedure	Cases	Technique	Complications
Left ICA stenosis	4	Carotid stenting with filter	No
Right ICA stenosis	4	Carotid stenting with filter	No
Carotid-cavernous fistula	1	Comaneci-assisted coiling	No
Torcular AVF	1	Phil + Onyx embolization	No
Right Tentorial AVF	1	Onyx embolization	No
Left Tentorial AVF	1	Phil + Onyx embolization	No
Ponto-cerebellar AVF	1	Phil embolization	No
Mesencephalic AVM	1	Glue embolization	No
Pericallosal AVM	1	Onyx embolization	No
Frontal AVM	1	Phil + Onyx embolization	No
Lumbar Cordoma	1	PVA embolization	No
Right common carotid artery and subclavian artery stent	1	Stenting + angioplasty+ filter	Filter entrapment. Use of gooseneck snare
Lingual artery bleeding	1	Coils embolization	No
Left carotid occlusion test	1	Balloon occlusion	No
Left ECA bleeding	1	Coils + glue embolization	Need crossover to TFA

SAC: Stent-assisted coiling; AVM: arteriovenous fistula; ECA: external carotid artery; PVA: polyvinyl alcohol particles.

Discussion

Safety of TRA in diagnostic arteriography has been extensively confirmed in numerous studies in the field of interventional cardiology, with a low rate of complications versus TFA.[3,4] In agreement with other studies,[7-9] vascular access via the right radial artery is feasible for diagnostic cerebral angiography. Through a right radial approach, the success rate of the technique is almost 100% for accessing carotid arteries and the right vertebral artery. Depending on the anatomy of each individual, the left vertebral artery is the most challenging vessel. In the largest series of 1240 cerebral angiographies performed via a TRA, the success rate for selective catheterization of the left vertebral artery was 52.2%,[8] which is lower than 82% found in our study. In some cases, the use of 0.35″ Stiff or Half Stiff guidewire allowed successful progression of the catheter through the vertebral artery.

TRA is an attractive option in anticoagulated patients or those treated with antiplatelet agents due to the decreased risk of bleeding at the access site. The rates of post-procedural RAO remain an issue, and although rarely associated with immediate clinical sequelae, RAO can deny patients the benefits of TRA catheterization if future examinations or procedures are required. It has been shown that patent hemostasis using an inflated band is highly effective in preventing early RAO[14] and has the benefits of cost savings especially with regard of the closure devices used for TFA and patients' preference due to post-procedural immediate deambulation.[15]

- Results are presentable and similar in btw neuro and cardiac intervention.
- Relatively low successful rate of left vertebral artery cannulation (similar with other study) - reason was explained and methods to overcome was introduced.
- Which condition is preferred to use TRA was stated down.
- Complication is stated down and explained. Method to overcome was stated down.

In relation to endovascular treatment, without considering the access site, almost all interventions can be performed through a 6F sheath or guiding catheter, although a 7F may be useful when three microcatheters are needed. Aneurysms can be successfully treated with simple coiling technique, balloon remodeling, or stent-assisted coiling for which 6F guiding catheter is adequate (Envoy 6F in our experience). For carotid stenting and depending on the external diameter of the stent-carrying catheter, a 6F sheath of guiding catheter can be used. In our experience, the Cordis Precise RX could be delivered with an Envoy 6F catheter, whereas the Terumo RoadSaver required a 6F sheath (Cook shuttle), although in both cases filter-assisted stenting can be used.

When an intervention through left vertebral artery is needed (basilar thrombectomy, arteriovenous malformation embolization, treatment of a basilar aneurysm), it is preferable to use a left radial access, being in the forearm or the left dTRA variant. However, in some cases, left vertebral artery catheterization can be successfully performed via right TRA. When double access is needed, both right and left TRA or combined with TFA can be used. Patients undergoing scheduled interventional procedures are usually discharged after 24 h with one overnight hospital stay.

With regard to endovascular treatment for acute large-vessel occlusion for appropriately selected patients, the ability to gain vascular access and achieve reperfusion has a major impact on outcomes. There is little experience with the use of TRA in stroke patients. Sur et al.[16] reported successful revascularization in 10 out of 11 acute ischemic stroke patients in whom the radial artery was chosen as the primary access site and treated with standard thrombectomy including stent retriever deployment with aspiration through the guide. In stroke treatment using direct thrombus aspiration (ADAPT) or distal aspiration combined with stent retriever, a 6F catheter is adequate, and in our center, this is the technique of choice for cases of posterior circulation thrombus. In case of anterior circulation thrombus, we use balloon occlusion and aspiration. The use of 8F sheath and an 8F balloon-guided catheter may be feasible in selected patients only.[17] Saito et al.[18] studied the feasibility of using guiding catheters equal to or greater than 7F in transradial coronary intervention and measured the inner diameter of the radial artery and its flow using two-dimensional ultrasound and Doppler examination before and after the procedure. The incidence of severe flow reduction in the radial artery after coronary intervention was 8.3% in patients with 8F sheaths used, which increased significantly to 13% if the ratio of the radial artery inner diameter/sheath outer diameter was less than 1.0.

For balloon occlusion aspiration, feasible options include the use of a 6F Cello balloon (Medtronic) that requires a 7F sheath introducer, or a 6F slender sheath (Terumo) or the Preclude Ideal hydrophobic sheath (Merit) that allows 7F catheter diameters. An 8F balloon occlusion catheter may also be used sheatless.

- Specific methods or steps are suggested in different conditionS which is good point.

Limitation

The present findings should be interpreted taking into account the limitations of a single-center and retrospective characteristics of the study, and the fact that the study was focused on TRA, so that a comparison with TFA was not performed. In relation to the learning curve in the use of the radial artery as vascular access, we started with follow-up angiographies of one or two vessels (internal carotid or right vertebral artery) followed by complete angiographies in young patients and, then, in elderly patients with tortuous anatomy.

- Single center
- Retrospective
- Just focus on TRA and does not compared with TFA in proper way

- As mentioned in previous study patient demographic does not shown in current study.
  Old vs young?
  Vessels anatomy?

- Did not fix the operators?
  Experience

Regarding interventions, we recommend starting using TRA once catheterization skills have been achieved. Again, it is advisable to start with scheduled aneurysms and then move forward to more complex interventions. Regarding stroke treatment in which thrombectomy is limited by a narrow time window, in the first cases, we only used TRA as an alternative to TFA when the access was not feasible, but after gaining experience and in patients with favorable anatomy, TRA was used as the initial vascular access.

The use of radial access has been progressive, with 13 cases in 2015–2016, 49 cases in 2017, 95 cases in 2018, and 67 in January until October 2019. In the first three years period, most of the procedures were diagnostic angiographies. As the experience has been gained and seen the advantages for patients, familiarity with the use of ultrasound for vascular access is expected to reduce the learning curve associated with the transition from TFA to TRA. The use of ultrasound for conventional TRA can give the proper skills to move to dTRA easily. The present experience indicates that almost the full range of endovascular interventional procedures can be performed using the TRA.

Although radial access is preferred for any PCI according to the 2018 ESC/EACTS guidelines on myocardial revascularization,[19] direct carotid artery puncture may be an alternative to TFA and TRA in cases of stroke of difficult anatomy including unfavorable arch type, carotid tortuosity, or an ostial lesion.[20] Recent case reports[20,21] and small case series[22] have shown that direct carotid puncture could be an alternative for endovascular thrombectomy when TFA is not possible. Safety of radial access is supported by 2018 ESC/EACTS guidelines,[19] but evidence regarding the safety of the transcarotid approach is currently limited and more studies on this alternative mode of access are needed.

- Recommendation was given to improve the skill by using scheduled cases – which is very good.
- Increasing number of TRA for pass years stated down and reason was explained – good.
- Other methods was mentioned – which can be used as study – good.

Conclusion

In our experience, TRA is a useful approach for diagnostic angiography and the vast majority of interventional procedures. It is a valuable option in patients in whom TFA is challenging. We found that the learning curve is not too steep and that the radial access approach can be adopted smoothly for a large percentage of diagnostic and interventional neuroradiological procedures.

- Brief and conciese

Overall

- Good and interesting article
- Although focused only on TRA, but quite detailed in explaining how to tackle different neurointervention, especially in treatment part.

- Practically applicable.
  - Save time
  - Save cost
  - Less complication rate
  - Discharge earlier

New devices and techniques

Review

Radial artery access for neuroendovascular proced

Kazim H M
Ethan Wir
Daniel L C

Vascular and Interventional Radiology / Radiologie vasculaire et radiologie d'intervention

Transradial Access for Interventional Radiology: Single-Centre Procedural and Clinical Outcome Analysis

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New Devices and Techniques

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REVIEW

Transradial approach for neurointerventions: a systematic review of the literature

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