





# Practice of Transradial Approach for Interventional Radiology

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## Abstract

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**BACKGROUND:** Interventional radiology (IR) is a specialized field within radiology that diagnoses and treats several conditions through a minimally invasive surgical procedure. The transradial approach (TRA) for endovascular interventions was introduced by Lucian Campeau in 1989. TRA gained great popularity in hemodynamics, with studies demonstrating its safety, feasibility, and superiority compared with the transfemoral approach. The use of the radial artery as the primary access vessel into the arterial system is not a new concept.

**OBJECTIVE:** The objective of the study is to evaluate the practice of TRA among interventional radiologists (IRs).

**AIM:** This study was conducted as a cross-sectional study, targeting interventional radiologists (IRs). The data were collected through an online questionnaire between May 2023 and June 2023. The data were analyzed through the Statistical Package for the Social Sciences.

**RESULTS:** Among 43 interventional radiologists in Riyadh, Saudi Arabia, 39.5% are not performing TRA; reasons for underuse among interventional radiologists (52.9%) include lack of training and (23.5%) distance from the access site; and finally, 17.6% have a potential higher risk for neurological complications; while 60.5% of them are performing TRA, mainly for pelvic procedures (80.8%), followed by hepatic procedures (53.8%).

**CONCLUSION:** In our study, the use of TRA was observed, almost among half of our respondents, and this may relate to reasons such as a lack of appropriate training and distance from the access site. On the other hand, TRA has been proven to have less access site complications and lower mortality. Therefore, better understand the real advantages of TRA and how it can offer higher value in patient care.

## Background

Interventional radiology (IR) is a specialized field within radiology that diagnoses and treats several conditions through a minimally invasive surgical procedure that involves the use of various radiological techniques [1]. In the last few years, the role of IR has expanded to include a variety of organ systems, which has led to an increase in demand for these specialties [2]. The transradial approach (TRA) for endovascular interventions was introduced by Lucian Campeau at the Montreal Heart Institute in 1989 [3]. TRA gained great popularity in the hemodynamic and interventional cardiology communities during the last three decades, with studies demonstrating its safety, feasibility, and superiority compared with the transfemoral approach (TFA). The use of the radial artery as the primary access vessel into the arterial system for transcatheter diagnosis and intervention is not a new concept [4]. Campeau suggested percutaneous radial access as a safer alternative to percutaneous and “cutdown” brachial or axillary access. His series of 100 patients demonstrated an 88% technical success

rate and a 6% asymptomatic radial artery occlusion rate, which was a significant improvement over brachial or axillary upper arm access [3]. Shortly thereafter, in 1992, Kiemeneij and Laarman performed the first successful transradial (TR) coronary angioplasty procedure, and then, in 1993, the TR coronary stent placement through the radial artery. Since then, the use of this technique has grown significantly worldwide [5]. Despite this growth, TRA is estimated to account for only 10% of percutaneous coronary interventions (PCIs) worldwide. There are some areas in Canada and Europe that perform approximately 95% of PCIs through the TR approach. Its usage is largely absent within the interventional radiology and vascular surgery communities, however. The brachial artery continues to be the most common upper extremity artery used for noncoronary interventions. Reasons for under-use of TRA outside the cardiac catheterization laboratory may include a lack of appropriate training, equipment limitations such as inappropriate catheter length and shape, and the initial learning curve. Despite the learning curve for this technique, the benefits of TRA are significant and include (1) an improved safety profile; (2) shorter hospital stays; (3) less post-procedural nursing

care; (4) patient preference due to the lack of ambulation limitations post-procedure; and (5) cost savings to the department (especially with regard to the closure devices used for transfemoral access) [6]. The most frequent reasons reported by IRs for not using TRA include lack of training, perceived disadvantages, and fear of complications with no clear benefit. There is limited information on the overall use of TRA by IRs and reasons for not adopting it [7]. The current literature suggests that TR access could result in complications such as arterial perforation, spasm, and/or occlusion [8], [9]. TRA has been proven to have less access site complications and lower mortality compared with TFA and has been adopted as the first-line approach for most coronary interventions. However, TRA remains underused by vascular interventional radiologists (IRs) regardless of its large-scale diffusion among their medical specialty “cousins” [4]. TRA is associated with reduced vascular and bleeding complications (73% reduction) with similar efficacy compared to femoral access. This and improved technology have led to TRA being adopted for body or peripheral interventional procedures [7]. TR access has been well described in the interventional cardiovascular literature and is the preferred access site for PCI and diagnostic angiography according to the 2018 European Society of Cardiology and European Association for Cardio-Thoracic Surgery guidelines [8].

### **Justification**

Determining the practice of TRA among interventional radiologists (IRs) will help in evaluating the reasons for selecting or refusing TRA according to the advantages and disadvantages of this endovascular approach.

### **Hypothesis**

It is expected that interventional radiologists (IRs) would be under-using TRA due to perceived disadvantages and related complications.

### **General objective**

The general objective of the study is to evaluate the practice of TRA among interventional radiologists (IRs).

### **Specific objective**

1. To assess the reasons for selecting or refusing TRA among interventional radiologists (IRs) according to advantages and disadvantages.
2. To identify the lab set-up for a transradial approach among interventional radiologists (IRs).

## **Methods**

This study was conducted as a cross-sectional study, and interventional radiologists from all fields who performed TRA were included in the study. Participants who did not meet the inclusion criteria were excluded from the study, such as Interventional Radiologist who did not practice Transradial approach. This study aimed to evaluate the practice of TRA among interventional radiologists (IRs). The sample size was 43 participants. Selection based on convenience. The data were collected through an online questionnaire, distributed to the eligible participants between May 2023 and June 2023. The questionnaire had a paragraph explaining the purpose of the study, the benefits of participation, the right to withdraw at any point, and requesting their voluntary participation by answering the questionnaire. Furthermore, assure the participants that the data will be used only for scientific purposes. The data were analyzed through the Statistical Package for the Social Sciences. The results are presented in tables as frequencies and percentages. Graphs are also used to present data. Suitable statistical tests of significance are used for data analysis.

### **Ethical considerations**

The ethical approval of the IRB at Almaarefa University College of Medicine was fulfilled before the start of data collection, and the aim of the study was explained clearly to the participants and conducted in accordance with the tenets of the Declaration of Helsinki for research involving human subjects and current legislation on clinical research. All participants completed a consent form for participation before starting the study. Participants were asked about their availability to participate in the survey. They were also informed that their participation is voluntary and will not affect their medical care. Information will be kept confidential. Only the researchers will have access to the database for analysis purposes.

## **Results**

In this study, we recruited 43 interventional radiologists from random hospitals in Riyadh, Saudi Arabia and presented the basic demographic data of 43 interventional radiologists. The most commonly known years of experience were 5–15 years (60.5%), with slightly more being males (95.3%). We further observed that 76.7% of them were working in public hospitals. More importantly, 60.5% of them are performing TRA (Table 1).

**Table 1: Basic demographic characteristics of interventional radiologists (n = 43)**

	Frequency	Percent	Valid percent
Gender			
Male	41	95.3	95.3
Female	2	4.7	4.7
Total	43	100.0	100.0
Years of experience			
<5	8	18.6	18.6
5-15	26	60.5	60.5
>15	9	20.9	20.9
Total	43	100.0	100.0
Type of practice			
Public hospital	33	76.7	76.7
Academic hospital	10	23.3	23.3
Total	43	100.0	100.0
Do you perform transradial approach			
Yes	26	60.5	60.5
No	17	39.5	39.5
Total	43	100.0	100.0

The selection of patients for TRA was mostly based on procedure type and vascular status, both of which were 61.5%, while 38% did not select their patients based on this way. Followed by physical examination (53.8%), on the other hand, 46.2% of the IR doctors do not use physical examination to select their patients. Finally, operator preference was agreed upon by 42.3% of doctors, while others (57.7%) disagreed. The majority of interventional radiologists (69.2%) perform a US-guided puncture on all of their patients, while 23.1% perform it only on selected patients, and the rest (7.6%) do not use it at all or use it after failure with the standard palpation technique. Suggestions to improve regarding TRA from a doctor's point of view are low-profile devices (46.2%), hemostatic devices (30.8%), and longer devices (26.9%). Other aspects, such as radial lounges and guidelines for intraprocedural medications, did not exceed the agreement of 10% of the doctors.

Table 2 describes the reasons for practicing TRA among interventional radiologists (IRs). Based on the results, the most frequently mentioned use of TRA among interventional radiologists is for pelvic procedures (80.8%), followed by hepatic procedures (53.8%) and aortoiliac revascularization (19.2%). We also observed that 92.3% of interventional radiologists do not perform TRA for infrainguinal procedures.

**Table 2: Reasons of practicing TRA among interventional radiologists (n = 26)**

Parameters	Frequency	Percent
Aortoiliac revascularization		
Yes	5	19.2
No	21	80.8
Total	26	100.0
Hepatic procedures		
Yes	14	53.8
No	12	46.2
Total	26	100.0
Pelvic procedures		
Yes	21	80.8
No	5	19.2
Total	26	100.0
Infrainguinal procedures		
Yes	2	7.7
No	24	92.3
Total	26	100.0

TRA: Transradial approach

Table 3 describes the screening methods for TRA among interventional radiologists. Based on the results, the most frequently mentioned method of screening patients for TRA is Barbeau's test (65.4%),

**Table 3: Screening methods of TRA among interventional radiologist (n = 26)**

Screening methods	Frequency	Percent
Screening for TRA elderly patients		
Yes	2	7.7
No	24	92.3
Total	26	100.0
Screening for TRA complex procedures		
Yes	2	7.7
No	24	92.3
Total	26	100.0
Screening outside the angio suite (preparation room)		
Yes	4	15.4
No	22	84.6
Total	26	100.0
Screening in the angio suite just before procedure		
Yes	12	46.2
No	14	53.8
Total	26	100.0
Screening for based on Barbeau's test		
Yes	17	65.4
No	9	34.6
Total	26	100.0
Screening for based on Allen's test		
Yes	4	15.4
No	22	84.6
Total	26	100.0
Screening based on ultrasound-check		
Yes	14	53.8
No	12	46.2
Total	26	100.0

TRA: Transradial approach

followed by an ultrasound check (53.8%), and in the angiosuite just before the procedure (46.2%).

Table 4 describes the reasons why some interventional radiologists do not practice TRA, and we found that 52.9% do not practice TRA because of a lack of training, 23.5% do not use TRA because of the distance from the access site, and 17.6% do not use TRA because of the potential higher risk for neurological complications (stroke).

**Table 4: Reasons why some interventional radiologists does not practice TRA (n = 17)**

Parameters	Frequency	Percent
Increased radiation exposure		
Yes	1	5.9
No	16	94.1
Total	17	100.0
Prolonged procedure times		
Yes	1	5.9
No	16	94.1
Total	17	100.0
Complex vascular anatomy		
No	17	100.0
Distance from the access site		
Yes	4	23.5
No	13	76.5
Total	17	100.0
Long learning curve		
No	17	100.0
Potential higher risk for vascular complications		
Yes	1	5.9
No	16	94.1
Total	17	100.0
Potential higher risk for neurological complications (stroke)		
Yes	3	17.6
No	14	82.4
Total	17	100.0
Lack of training		
Yes	9	52.9
No	8	47.1
Total	17	100.0
TRA offers no advantages		
Yes	2	11.8
No	15	88.2
Total	17	100.0

TRA: Transradial approach

Figure 1 shows the arm preference among interventional radiologists to be used for TRA. Surprisingly, 50% of the doctors prefer to use the left arm only, while 27% are using both arms but prefer left

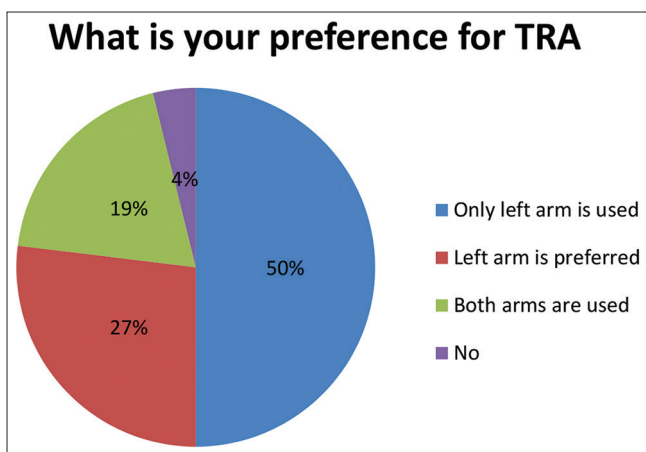


Figure 1: Arm preference to use for transradial approach among interventional radiologist (n = 26)

over right, 19% are using both arms, and finally, 4% do not prefer to stick to an arm preference.

Figure 2 shows the laboratory set-up to perform TRA. Most of the IR doctors (69%) are using an arm board with a lateral arm in abduction position (about 60°–90°), which is known as a dedicated setup. The minority (31%) are using a standard setup.

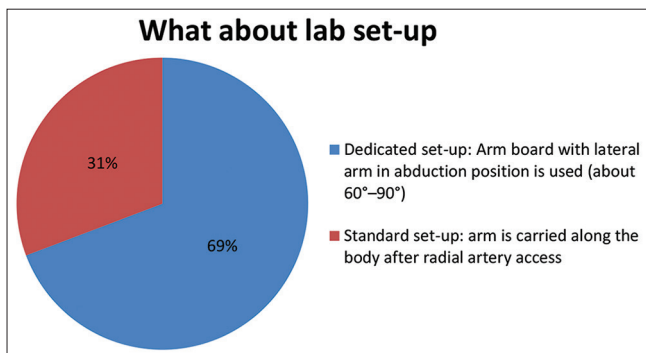


Figure 2: Descriptive of interventional radiologists in regard to laboratory set-up to do transradial approach (n = 26)

Figure 3 shows the types of intraprocedural medications used by interventional radiologists in this procedure. It showed that the majority (58%) are using heparin, and vasodilators are usually infused through radial sheath, followed by 31%, using heparin only, and the minority are performing standard systemic infusions of heparin.

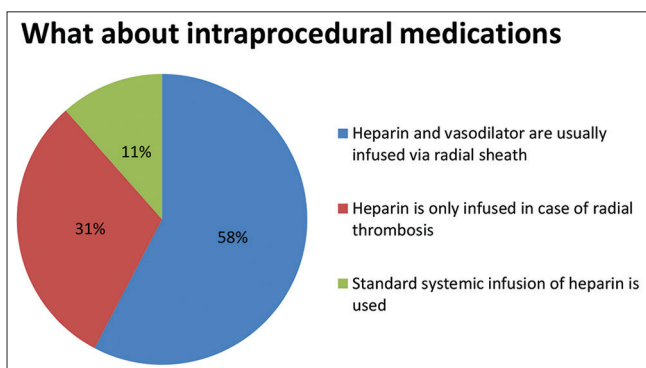


Figure 3: What about intraprocedural medications? (n = 26)

## Discussion

It is evident that reasons for practicing TRA among interventional radiologists are mostly pelvic procedures (80.8%), followed by hepatic procedures (53.8%), and aortoiliac revascularization (19.2%). This contrasts with a study done in Turkey, in which the majority of respondents used TRA for embolization procedures (87% for liver and 75% for pelvic embolization) [7]. TRA is effective, safe, and comparable to femoral access in patients undergoing transcatheter arterial embolization of the liver and pelvic procedures. Our study revealed that reasons for preferring TRA among IR doctors' were (57.7%) fast for patient discharge, (38.8%) reduction of bleeding time, and (30.8%) less intensive post-procedure observation and care. This is similar to a study done in Canada; the reasons for preference included recovery time following discharge (n 1/4 77; 89%), earlier ambulation following the procedure (n 1/4 81; 94%), ability to recover in the seated or semi fowler's position (n 1/4 62; 72%), and faster discharge from the hospital following the procedure (n 1/4 54; 63%) [6]. This similarity is mainly due to TRA performed through a small incision through the skin, which has multiple benefits for the physician and to patient's quality of life. This study shows that the arm preference among interventional radiologists to be used for TRA is surprising: 50% of the doctors prefer to use the left arm only, while 27% are using both arms but prefer left over right, 19% are using both arms, and finally, 4% do not prefer to stick to an arm preference. This is against to a study which revealed that for interventional procedures below the diaphragm, such as hepatic embolization, left radial artery access is preferred over right-sided access for several reasons. There is a slightly shorter distance to the target vessel from the left wrist, which can be crucial given the current limitations of catheter lengths [4]. This study revealed the intraprocedural medications used by interventional radiologists, as the majority (58%) are using heparin, and vasodilators are usually infused via radial sheath, followed by (31%) using heparin only, and the minority are performing standard systemic infusions of heparin. This is in a line to a study done in Turkey, the vast majority of respondents (93%) deemed mandatory the intraprocedural infusion of heparin, and vasodilators through the radial vascular sheath [7]. It is evident that the commonly used intraoperative medication was heparin as it was necessary to perform TRA to prevent serious complications. This study shows that the reasons for some interventional radiologists do not practice TRA, and we found that 52.9% do not practice TRA because of a lack of training, 23.5% do not use TRA because of the distance from the access site, and 17.6% do not use TRA because of the potential higher risk for neurological complications (stroke). This is in line with a study done in which the most common reasons for not performing TRA were the long learning curve needed (45%), lack of training (32%), prolonged procedural times (31%),

potential higher risk for neurological complications (31%), and the perceived increase in radiation exposure (28%) [7]. TRA requires a long course of training and practice; therefore, some interventional radiologists prefer to use alternative approaches for intervention. Explaining the benefit and outcome of TRA to the interventional radiologist would help to improve the concept and the importance of this approach.

## Conclusion

In our study, under use of TRA was observed in almost half of our respondents, and this may relate to reasons such as a lack of appropriate training, distance from the access site, and potential risk for neurological complications. On the other hand, TRA has been proven to have less access site complications and lower mortality compared with TFA and has been adopted as the first-line approach for most coronary interventions. Therefore, a better understanding of the real advantages of TRA and how it can offer higher value in patient care should be conducted to all interventional radiologists.

### Recommendation

We recommend encouraging the performance of TRA among interventional radiologist at early levels and informing them about its safety and effectiveness as an arterial access therefore improving a major issue in a patient care and quality of life.

## Ethical Approval

The study proposal and the questionnaire were approved by the Institutional Review Board of Almaarefa University. Ethical approval number: IRB23-058.

## Authors' Contributions

Shujon Mohammed Alazzam contributed equally to the work and should be considered co-first

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