Radial Arterial Access for Hepatobiliary and Gastrointestinal Arterial Interventions: Initial Experience

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Abstract

Introduction Radial artery access is being more commonly used for visceral and peripheral arterial interventions. Its use in the Indian subcontinent is not well reported. The aim of this study was to report outcomes of radial arterial access during arterial interventions of the hepatobiliary and gastrointestinal system.

Methods In this retrospective study, patients who underwent radial artery access for hepatobiliary and gastrointestinal interventions from January 2015 to June 2017 were identified from the interventional database. Complications related to radial artery access and catheter placement in the visceral arteries, procedural modifications, and conversion to the standard femoral arterial access were analyzed.

Results Total 32 patients were included in this study. Total 46 procedures (radial artery access) were performed. Nine patients had radial artery access on more than two occasions; 95% of the procedures involved interventional oncologic treatments. Patients were followed up for an average of 4 months following radial arterial access. Technical success was 98.7%. One patient developed radial artery spasm, and the access was abandoned. This patient subsequently underwent brachial arterial access. No patient required conversion to a femoral arterial access. No other complications were encountered during the follow-up. Compared with femoral arterial access, radial arterial access required longer catheters were needed for super selective catheterization of the visceral arteries.

Conclusion Radial arterial access for arterial interventions in the hepatobiliary and gastrointestinal systems was technically feasible with no significant complications. Long catheters are required for selective catheterization of the visceral arteries with this approach.

Keywords
- radial artery
- access
- technique

Introduction

Hepatobiliary interventions such as transarterial chemoembolization (TACE), transarterial radio embolization (TARE), and gastrointestinal interventions such as mesenteric arterial stenting are generally performed via a transfemoral arterial approach. This requires the patient to be on strict bedrest post procedure. Radial arterial access is commonly undertaken during coronary interventions. It has multitude of advantages, including early patient ambulation following the procedure and increased patient satisfaction. Cooper et al showed that patients who underwent arterial interventions through a radial artery access had better social function and were able to walk and use the bathroom early compared

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with those who underwent femoral arterial access at 1 and 7 days after the procedure.[1] There is also a reduced risk of bleeding with radial artery access.[2] In addition, radial artery access may be more beneficial in patients who suffer from back pain or may have nausea and vomiting post interventions (e.g., following TACE). The authors have been performing peripheral arterial interventions through a radial arterial access since 2015. The aim of this study was to report outcomes of patients who underwent radial arterial access during arterial interventions of the hepatobiliary and gastrointestinal system.

Materials and Methods

Patients who underwent hepatobiliary and gastrointestinal arterial interventions via a radial arterial access were identified by reviewing the interventional database. The clinical notes of these patients were reviewed to identify whether any complications were encountered and their eventual outcome. Any procedural modifications or conversion to the standard femoral arterial access approach were also noted. Patients were consented after explaining the procedure along with possible complications.

Barbeau test was used to assess the patency of the palmar arch prior to obtaining a radial artery access. The patient was positioned supine on the interventional radiology (IR) table, with the upper limb being placed on a movable side board. The wrist was then hyperextended with the help of folded towel along the dorsal aspect of the distal forearm. The fingers were strapped to the side board (►**Fig. 1**). The puncture site was cleaned and draped as per institutional protocol. The puncture site was two/three finger breadths proximal to the distal wrist/palmar crease (►**Fig. 2**). This ensured that the puncture was not through the tough fascial layers of the flexor retinaculum. The radial artery was undertaken under ultrasound guidance using Seldinger technique.

Once access was obtained, "radial cocktail" was injected via the sheath side port. The cocktail is a mixture consisting of 100 µg of nitroglycerine and 3,000 IU of heparin. Long catheters (100 or 125 cm, 4F or 5F Cobra/multipurpose/vertebral catheters) were used to cannulate the celiac artery or the superior mesenteric artery. To secure hemostasis, a tight bandage was applied at the puncture site (transradial band/wrist band) following removal of the sheath. The bandage was kept in place for 2 hours. Once hemostasis was secured, the band was removed. Patients were nursed in an upright or semirecumbent position and were encouraged to ambulate at the earliest possible moment. Some were advised bedrest in view of the anticipation when a large portion of the liver was embolized.

Results

A radial artery access was obtained in 46 occasions in 32 patients. The radial artery was accessed on four occasions in one patient and on three occasions in another patient. Seven patients had radial artery accessed on two occasions. Most patients were men (85%). The average age of the patient was 60 years (range: 32–83 years). The right radial artery was accessed in 87% of the occasions. The procedures performed included TACE in 85%, planning angiography prior to TARE in 6.5%, and TARE in 6.5%. In one patient, the radial artery was accessed for superior mesenteric artery stenting. The individual Barbeau scores were not recorded. The patients were followed up for an average of 4 months (range: 1–20 months). There was no conversion from a radial access to a femoral access.

The technical success rate was 98.7%. In one patient, a radial artery access was obtained for a planned angioplasty and stent placement for superior mesenteric artery stenosis. However, the arterial access was abandoned due to severe arterial spasm. This was the only complication encountered in this patient cohort. In spite of adequate analgesia, the spasm was not alleviated. As the patient was getting restless and a possible surgical option was being considered, the patient was intubated. The spasm subsided without any further medical or surgical interventions, and the catheter was removed. Given the angle of the origin of the superior mesenteric artery to the aorta, a femoral approach was considered challenging. The patient underwent a successful stenting

Fig. 1 Position of the hand prior to radial artery puncture. The wrist is hyperextended and taped to the side board to prevent movement.

Fig. 2 Puncture site is demonstrated. This is two/three finger breadths proximal to the palmar crease.

of the superior mesenteric artery at a later date via a brachial artery approach after surgical exposure of the artery. In patients who had the radial artery accessed on multiple occasions, there was no incidence of arterial occlusion or injury. Irrespective of whether the right or left radial artery was accessed, standard length catheters were not sufficient and longer catheters (> 100 cm) were needed to catheterize the visceral arteries.

Discussion

Since its description in 1989, the radial artery access for coronary interventions has increased over the past two decades.[2] It has become the access of choice for primary coronary interventions (PCIs) in more than 65% of the cases in the United Kingdom and has recorded a 25% increase in its utilization every year since 2007.[3] Various studies have demonstrated the advantages of radial artery access over femoral artery access. The Radial Versus Femoral Randomized Investigation in ST-Elevation Acute Coronary Syndrome (RIFLE) study found statistical reduction in access site bleeding complications and overall adverse events with radial artery approach in their review of more than 1,000 patients undergoing PCI.[4] In comparison to the femoral artery, the radial artery is more superficial and there are no important structures near by, which are likely to be injured during arterial access.[5] In addition, its superficial position makes it easy to achieve hemostasis by manual compression, thus obviating the need for closure devices. It is beneficial in obese patients, in whom the radial artery access has been shown to reduce the risk of bleeding. It also contributes to patient comfort with reduced hospital costs.[6]

Selection of the radial artery for establishment of the access requires the operator to ensure that the flow of the hand will not be compromised if the radial artery is subsequently damaged. The Barbeau test is used to assess arch patency as it is more sensitive than the modified Allen's test.[7] A radial artery diameter of 2 mm and above is considered ideal to undertake radial arterial access.[5] Some authors consider 3 mm as the minimum diameter.[8] Most radial arterial accesses can accommodate sheaths ranging from 4F to 7F.[5] However, the use of larger sheaths is associated with a greater risk of arterial occlusion.[9] If guide catheters are to be used, sheathless guides can be used. However, other strategies are also needed to prevent arterial occlusion as discussed latter in the article.[10] Use of hydrophilic sheaths is recommended. Newer sheaths are available that have smaller outer diameter but accommodate a larger catheter. For example, hydrophilic 4F and 5F sheaths can accommodate 5F and 6F catheters, respectively.[5]

Traditionally the cardiologists prefer to use the right radial artery. In their practice, the authors initially started using the right side and subsequently shifted to the left side. Access via the left radial artery reduces the number of cranial vessels that need to be traversed. Only the left vertebral artery is crossed. Though either approach is associated with a very small but significant risk of neurologic insult (~0.11%), that risk is further reduced using a left radial approach.[8] Further studies are needed to assess this risk in patients undergoing noncoronary interventions.

Access to the radial artery can be undertaken either by palpation or under ultrasound guidance. Seto et al demonstrated that the first-time success rate and time to secure the access were higher in the group of patient who underwent ultrasound-guided puncture.[11] Once access is obtained, a radial cocktail is injected. The purpose of this cocktail is to reduce the risk of spasm and thrombosis. Caution should be exercised when using verapamil in patient with preexisting cardiac pathology. Some authors also add 2.5 mg of verapamil and lidocaine. The technical success rate in this study was approximately 98%. This is comparable to that reported by Posham et al.[12] However, they had a more varied case mix ranging from onco-intervention to fibroid and peripheral arterial intervention. The authors' study was confined to onco-interventional cases and one case of mesenteric vessel intervention. Though none of the patients required crossover to femoral arterial access, one patient required brachial artery access after abandoning the radial artery access that was complicated by severe radial artery spasm.

When the authors started obtaining radial artery access for visceral arterial interventions, they found that the standard catheters were of insufficient length. Longer catheters and sheaths are required to ensure adequate access and stability. The catheter should be at least 150 cm long to enable selective catheterization of the target vessels. Though traditional catheter shapes (cobra/multipurpose/vertebral catheters) are unstable, Berenstein, Sarah, and Tiger catheters offer better stability. When a stable position could not be achieved with traditional catheter shapes, an additional operator had to maintain the catheter position.

The authors found negotiating an unfolded aortic arch difficult, especially with right radial artery access. They found that this required additional equipment, increased radiation burden, and potentially an additional operator. Access via the left radial artery access avoids the disadvantages secondary to a redundant aortic arch. The authors also found when cannulating the celiac artery or superior mesenteric artery, the catheter tended to face posteriorly in the aorta and needed to be turned anteriorly. This can be challenging in anteroposterior/oblique projections. Hence a lateral projection may be needed to cannulate the origins, thereby increasing exposure time and the radiation dose.

Compared with the femoral arterial access, the radial artery access is safer with reduced complication rates. In their review of 1,000 noncoronary cases, Posham et al reported a complication rate of 2.5% with only two major complications.[12] The most common complication was minor hematoma. Other rarer complications included radial artery pseudoaneurysm, vessel perforation, radial arteritis, arterial spasm, and dissection.[5] They were no major complications in the authors' study group. Radial artery occlusion is a rare complication, and it tends to be asymptomatic given the dual nature of the blood supply to the hand. This risk can be reduced by using smaller-sized sheaths, increasing the heparin dose, and using hydrophilic sheaths.[5,13] Pancholy et al recommended the use of patent hemostasis technique to prevent arterial occlusion.[13] In their series, the authors had only one complication of severe arterial spasm that necessitated the

procedure to be cancelled. The authors did not convert it to a femoral approach, as the vascular anatomy was not suitable for a femoral approach. On subsequent review, the artery was approximately 2 mm in diameter with wall calcification. Both of these are the recognized causes of difficult radial artery access.

One of the limitations to this study is its small size. However, the initial outcomes are promising and comparable to other studies. Though widely reported, the authors did not assess patient satisfaction scores in this study.

Conclusion

Radial artery access for visceral arterial interventions is safe and technically feasible. Longer catheters, guidewires, and, at times, two operators were needed to obtain a stable catheter position. With increased experience and newer and longer catheters being available, the authors anticipate more peripheral interventions through a radial artery access.

Conflict of Interest
None.

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