Short Communication

Nursing Assessment of Vascular Complications after Cardiac Catheterization through the Distal Radial Artery

Sara Khodabandehlooie[1], Davood Kazemi Saleh[2], Meimanat Hosseini[3]

[1]School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran, [2]Department of Cardiology, Bahman Hospital, Tehran, Iran, [3]Department of Community Health Nursing, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract

Background: Distal Radial Artery (DRA) is a new arterial access for coronary catheterization. Assessment of the vascular complications of this new procedure is important in the provision of nursing care to cardiac patients. The aim of this study was the nursing assessment of vascular complications of DRA in angiography and angioplasty. **Materials and Methods:** This qualitative longitudinal study was conducted on 315 consecutive patients who were candidates for coronary catheterization via DRA from 2017 to 2020 in three hospitals in Tehran, Iran. Patients who had palpable DRA and were capable and willing to consent to inclusion in the study were evaluated. Moreover, patients whose DRA access failed, and those who had previously undergone coronary artery bypass graft were excluded from the study. Vascular complications were assessed on the day of the procedure and about 1 month later. **Results:** After the procedure, 29 cases of ecchymosis, 8 cases of hematoma, and 1 case of arteriovenous fistula in the DRA were observed. We did not observe any major vascular complications. **Conclusions:** Nursing assessment of the snuffbox area indicated that this approach is a safe and convenient technique for cardiac catheterization with few minor complications.

Keywords: *Catheterization, coronary artery disease, Iran, nurses*

Introduction

Over the years, the transradial approach has been considered as the default choice for cardiac catheterization because of the decreased access site complications, shorter hemostasis time, lower health-care costs, and reduced mortality and adverse cardiac events. However, this approach is associated with complications such as hematoma, Arteriovenous (AV) fistula, pseudoaneurysm, perforation, artery spasm, and occlusion.[1-3] Coronary catheterization through the Distal Radial Artery (DRA) has been recently proposed by Kiemeneij to overcome some drawbacks of radial artery cannulation.[4] Due to anatomical and physiological factors, catheterization through the DRA is preferred to the radial artery. In this method, the arm lies in a neutral position—no need to twist the wrist—which is comfortable for both the patient and the operator. Moreover, if serious complications such as occlusion occur in DRA catheterization, rich collateral blood circulation supplies the palmar branches.[5] Furthermore, in comparison to the radial artery, DRA is finer and closer to the surface of the skin and is over a bony foundation. Therefore, it is easier to control the hemostasis of DRA.[6]

Since Kiemeneij's paper was published in 2017, several other papers have been published in different countries describing the feasibility and safety of this approach. However, they indicated that some complications of DRA such as bleeding, hematoma, and occlusion should be considered.[3,6-8] A systematic review of 19 studies from 2017 to 2020 indicated that the success rate of cardiac intervention via DRA varied greatly and ranged from 70% to 100%, and most of the studies had a high success rate (approximately 90%). In addition, the incidence of complications of DRA access such as hematoma (0–16%), artery spasm (0–16%), pain (0–9%), bleeding (0–4.5%), and occlusion (0–4%) varied and other complications like numbness, AV fistula, and arterial dissection was rare.[9] Although the complications of catheterization in coronary angiography and angioplasty are almost the same, the

Address for correspondence:
Ms. Sara Khodabandehlooie, Niayesh Complex, Niayesh Cross Road, Vali Asr Ave., Tehran, Iran.
E-mail: Sarakhodabandehlooie@gmail.com

Access this article online

Website: https://journals.lww.com/jnmr

DOI: 10.4103/ijnmr.ljnmr_467_20

Quick Response Code:

How to cite this article: Khodabandehlooie S, Saleh DK, Hosseini M. Nursing assessment of vascular complications after cardiac catheterization through the distal radial artery. Iran J Nurs Midwifery Res 2023;28:357-60.

Submitted: 22-Jan-2021. **Revised:** 06-Nov-2021. **Accepted:** 11-Oct-2022. **Published:** 21-Jun-2023.

prevalence of complications might be higher in angioplasty. This is due to the higher anticoagulant (such as heparin) dose used, and longer hemostasis and compression time in angioplasty compared to angiography.[7]

One of the duties of nurses is to evaluate and control sheath removal complications in coronary patients. Nursing practice guidelines for the improvement of care for patients after coronary catheterization recommend that bleeding, hematoma, ecchymosis, pseudoaneurysm, swelling, peripheral pulses, capillary return, warmth, sensation, and color be controlled at regular intervals.[10] Little has been reported in the literature with regard to the timing of complications. The majority of complications will be mostly evident before the patient is discharged. However, some complications will be evident within a longer period after the procedure.[4,7] The aim of this study was the nursing assessment of vascular complications after sheath removal of a new atrial access (DRA) on the day of angiography and angioplasty (prior to discharge) and 1 month after the procedure.

Materials and Methods

This qualitative longitudinal study was conducted from October 2017 to January 2020 on 315 consecutive coronary patients who had undergone coronary angiography or intervention via DRA in the catheterization laboratory and Cardiac Care Unit (CCU) of Bahman super specialty hospital, Yas Hospital, and Jamaran Heart Hospital in Tehran, Iran. The sample size in each hospital was determined using the Krejcie and Morgan table. Written informed consent with a dedicated description including possible complications was obtained from all patients. Procedures were performed by one individual cardiologist operator with vast experience in radial access (more than 2000 radial procedures performed). The operator used DRA as the default access in procedures. Patients who had palpable DRA in the anatomical snuffbox of the hand and who were capable and willing to consent to inclusion in the study were evaluated. The failure rate of DRA access was about 10%. Patients whose DRA access failed were excluded from the study. Moreover, patients who had previously undergone coronary artery bypass graft were excluded from the study.

After completing the procedure, the sheet was removed immediately and compressive dressing with a small gauze plug was applied to hemostasis. For the first 15 min, two fingers were used to increase the area of the compression. Pulse oximetry was applied to control and monitor the pulls and oxygen for 2 h. Then, the compression was decreased and hemostasis was checked. If bleeding or oozing, or pain was reported by the patient, compression was maintained for a longer period of time. Prior to discharge, the patient's access area was evaluated by nurses who had work experience in the CCU to assess the complications including AV fistula, hematoma, ecchymosis, massive bleeding, major adverse events, major neurological complications, and severe pain (using the Verbal Numerical Rating Scale). The nurses determined hematomas as mild or moderate if they were ≤6 cm, and serious if >6 cm.[1] They checked the arterial pulses of the arm to scan for any possible occlusion or insufficient blood circulation. They observed the arm to monitor any bleeding or oozing, or any soft-tissue structures like pseudoaneurysms surrounding the vessel.

After each catheterization, the operator asked the patients to return 1 month later for follow-up and medication adjustment. At that time, an experienced nurse reassessed the patient's access area in terms of any complications.

Ethical considerations

The present research was approved by the Ethics Committee of the Shahid Beheshti University of Medical Sciences with the code of ethics IR.SBMU.PHARMACY.REC.1399.265. Written consent was obtained from all patients, and they were informed of the general objectives of the study and ensured the confidentiality of their information.

Results

The patients included 212 men (67.30%) and 103 women (32.69%) with an overall mean age of 62.39 (10.24) years (range: 32–90 years). The results showed that 74.90% of patients only underwent angiography and 25.10% of patients underwent intervention after angiography. The vascular complications after catheterization via DRA are listed in Table 1, and samples of catheterization via DRA are illustrated in Figure 1.

Discussion

One of the most significant findings of this study was the lack of occurrence of major complications such as massive

Figure 1: Catheterization via the distal radial artery or snuffbox: (a) standard procedure of catheterization via DRA, (b) catheterization with hematoma complication, (c) catheterization with AV fistula complication, and (d) catheterization without any complications on the sheet removal day

Table 1: Vascular complications after catheterization via distal radial artery

Complication (*n*=315)	All	Angiography	Angioplasty
On the day of the procedure (prior to discharge)			
Ecchymosis [*n* (%)]	29 (9.20)	11 (3.49)	18 (5.71)
Hematoma [*n* (%)]	8 (2.53)	3 (0.95)	5 (1.58)
AV fistula [*n* (%)]	1 (0.31)	1 (0.31)	0 (0)
Massive bleeding [*n* (%)]	0 (0)	0 (0)	0 (0)
Major adverse events [*n* (%)]	0 (0)	0 (0)	0 (0)
Sever pain [*n* (%)]	0 (0)	0 (0)	0 (0)
Major neurological complications	0 (0)		
One month after the procedure			
Pain in wrist when doing delicate tasks [*n* (%)]	3 (0.95)	1 (0.31)	2 (0.63)
Minor numbness in the hand [*n* (%)]	2 (0.63)	2 (0.63)	

bleeding, severe hematoma, and intensive pain in the patients' snuffbox area after angiography and angioplasty. Moreover, since minor complications occurred in a small percentage of patients, cardiac catheterization through the DRA can be considered as safe and satisfactory.

Considering the rate of ecchymosis (9.20%) and hematoma (2.53%) after catheterization via DRA prior to discharge, the findings of the present study were in line with that of the study conducted by Aoi *et al*.[7] In the study by Aoi *et al*.,[7] hematoma was observed in only 7 out of 202 patients (3.5%). They also reported AV fistula in one patient. Similarly, in the research carried out by Mizuguchi *et al*.,[11] hematoma occurred in only 10% of the patients. Regarding transradial access, Hadad *et al*.[12] stated that hematoma formation at the site of transradial catheterization is common, with a reported incidence of 14%.

In the present study, after the procedure, DRA and radial artery pulses were palpable in all patients. However, since ultrasonography was not available for each patient, DRA occlusion could not be assessed. It is worth noting that DRA occlusion has been rarely reported; its incidence was reported as 0.0–5.2% in a review study of similar studies.[8] However, a meta-analysis by Rashid *et al.* showed that in catheterization via the radial artery, the incidence of radial artery occlusion was 7.7%.[13]

AV fistula formation after catheterization via the radial artery and DRA is a rare occurrence. Nevertheless, because of snuffbox anatomy, iatrogenic AV fistula formation in DRA access is likely more common compared to radial artery.[14] In our study, AV fistula was observed in only one patient, which closed after 30-min manual compression with a gauze plug. In addition, the results of ultrasound sonography immediately after the procedure and 1 week later were reported as normal in this case. Although AV fistula formation was observed after angiography, the percentages of other complications like hematoma and ecchymosis were lower in angiography compared to angioplasty.

Based on the findings, 1 month after catheterization, few patients complained about minor pain and numbness in their hands. Although these complaints are not major complications, they should be considered by operators.

One limitation of the present study was the lack of a control group as only patients who had undergone coronary angiography or angioplasty via DRA were included. Furthermore, ultrasonography was not used to assess the incidence of artery occlusion after catheterization in patients.

Conclusion

DRA is a safe and convenient access for cardiac catheterization and thus is suggested as the default catheterization approach in order to help reduce the nursing workload.

Acknowledgments

The authors would like to appreciate Bahman Hospital officials and cardiology clinic's staff for their assistance. The present research was approved by the Research Ethics Committees of Shahid Beheshti University of Medical Sciences with the proposal number (26001) on 2020.12.13.

Financial support and sponsorship

Shahid Beheshti University of Medical Sciences

Conflicts of interest

Nothing to declare.

References

1. Sanmartín M, Cuevas D, Goicolea J, Ruiz-Salmerón R, Gómez M, Argibay V. Vascular complications associated with radial artery access for cardiac catheterization. Rev Esp Cardiol 2004;57:581-4.
2. Mason PJ, Shah B, Tamis-Holland JE, Bittl JA, Cohen MG, Safirstein J, *et al*. An update on radial artery access and best practices for transradial coronary angiography and intervention in acute coronary syndrome: A scientific statement from the American Heart Association. Circ Cardiovasc Interv 2018;11:e000035.
3. Coughlan JJ, Zebrauskaite A, Arnous S, Kiernan TJ. Left distal trans-radial access facilitates earlier discharge post-coronary angiography. J Interv Cardiol 2018;31:964-8.

4. Kiemeneij F. Left distal transradial access in the anatomical snuffbox for coronary angiography (ldTRA) and interventions (ldTRI). Eurointervention 2017;13:851-7.
5. Sgueglia GA, Di Giorgio A, Gaspardone A, Babunashvili A. Anatomic basis and physiological rationale of distal radial artery access for percutaneous coronary and endovascular procedures. JACC Cardiovasc Interv 2018;11:2113-9.
6. Yu W, Hu P, Wang S, Yao L, Wang H, Dou L, *et al*. Distal radial artery access in the anatomical snuffbox for coronary angiography and intervention: A single center experience. Medicine 2020;99:e18330.
7. Aoi S, Htun WW, Freeo S, Lee S, Kyaw H, Alfaro V, *et al*. Distal transradial artery access in the anatomical snuffbox for coronary angiography as an alternative access site for faster hemostasis. Catheter Cardiovasc Interv 2019;94:651-7.
8. Cai G, Huang H, Li F, Shi G, Yu X, Yu L. Distal transradial access: A review of the feasibility and safety in cardiovascular angiography and intervention. BMC Cardiovasc Disord 2020;20:1-12. doi: 10.1186/s12872-020-01625-8.
9. Nairoukh Z, Jahangir S, Adjepong D, Malik BH. Distal radial artery access: The future of cardiovascular intervention. Cureus 2020;12e7201. doi: 10.7759/cureus. 7201.
10. Rolley JX, Salamonson Y, Wensley C, Dennison CR, Davidson PM. Nursing clinical practice guidelines to improve care for people undergoing percutaneous coronary interventions. Aust Crit Care 2011;24:18-38.
11. Mizuguchi Y, Izumikawa T, Hashimoto S, Yamada T, Taniguchi N, Nakajima S, *et al*. Efficacy and safety of the distal transradial approach in coronary angiography and percutaneous coronary intervention: A Japanese multicenter experience. Cardiovasc Interv Ther 2020;35:162-7.
12. Hadad MJ, Puvanesarajah V, Deune EG. Complications of transradial catheterization and cannulation. J Hand Surgery 2019;44:973-9.
13. Rashid M, Kwok CS, Pancholy S, Chugh S, Kedev SA, Bernat I, *et al*. Radial artery occlusion after transradial interventions: A systematic review and meta-analysis. J Am Heart Assoc 2016;5:e002686.
14. Shah SR, Kiemeneij F, Khuddus MA. Distal arteriovenous fistula formation after percutaneous coronary intervention: An old complication of a new access site. Catheter Cardiovasc Interv 2021;97:278-81.