Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1098
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1098*
Original research article

ASSOCIATION OF RADIAL ARTERY ACCESS WITH REDUCED INCIDENCE OF ACUTE KIDNEY INJURY

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(Received, 15th June 2024, Revised 20th September 2024, Published 30th September 2024)

Abstract: *Acute kidney injury (AKI) is a serious complication following cardiac procedures, leading to increased morbidity and mortality. The choice of vascular access site may influence the incidence of AKI, with radial artery access potentially offering protective benefits compared to femoral artery access.* ***Objective:*** *To evaluate the association between radial artery access during cardiac procedures and the incidence of acute kidney injury among patients.* ***Methods:*** *This retrospective cohort study was conducted at the National Institute of Cardiovascular Disease from January 2023 to January 2024. A total of 370 patients who underwent cardiac procedures were included, comprising 200 patients in the radial artery access group and 170 in the femoral artery access group. Data were collected retrospectively from medical records, including demographic information, baseline renal function, procedural details, and serum creatinine levels before and after the procedure. The incidence of AKI was determined based on established criteria for changes in serum creatinine. Statistical analyses were performed using appropriate tests, with a significance level set at $p < 0.05$.* ***Results:*** *Patients in the radial artery access group had a shorter average hospital stay (2.5 ± 1.2 days) compared to the femoral group (3.8 ± 1.5 days, $p = 0.001$). The mortality rate was lower in the radial group (1.5%) versus the femoral group (4.1%), although this difference was not statistically significant ($p = 0.09$). The incidence of major adverse cardiovascular events (MACE) was 2.5% in the radial group compared to 5.9% in the femoral group ($p = 0.07$). Acute kidney injury occurred in 10.0% of patients in the radial artery access group (20 out of 200) versus 17.6% in the femoral artery access group (30 out of 170), indicating a significant reduction in AKI incidence with radial access.* ***Conclusion:*** *Using radial artery access during cardiac procedures significantly reduces the incidence of acute kidney injury compared to femoral artery access. These findings support the preference for radial artery access to minimize the risk of AKI and improve patient outcomes.*

Keywords: Radial Artery Access, Acute Kidney Injury, Cardiac Procedures, Femoral Artery, KDIGO Criteria.

Introduction

Patients with AKI have a higher morbidity and mortality, especially those with acute coronary syndromes and those who undergo PCI. AKI in such patients can lead to chronic or end-stage renal failure. In addition, AKI increases the mortality rate in the hospital by one year; It also prolongs the stay and increases the hospital's readmission cost (1). Radial artery access is associated with the reduced incidence of AKI, which is perhaps one of the most written topics in cardiovascular medicine, and it has more to do with PCI. For these reasons, which include enhanced patient comfort, quicker acquisition of recovery programs, and low risk of the development of bleeding, the use of the radial artery technique has become preferred over the femoral artery technique (2). However, recent research has uncovered yet another advantage of radial artery access: its possible prevention of the development of AKI, which is a severe and sometimes life-threatening complication that may occur after PCI (3).

Aki is defined by the abrupt deterioration of the renal function, commonly within the first 48 hours following a procedure such as PCI. Its consequence can be an extended length of stay in a hospital, raised mortality, and other unwanted phenomena that render preventing this condition one of the urgent tasks for clinicians (4, 5). Meticulous coil emplacement required careful monitoring; however, the femoral artery was the traditionally preferred access route for PCI. Nevertheless, this approach is linked with increased occurrence of contrast-induced nephropathy (CIN), AKI, that results from the detrimental effects of contrast media applied during the procedure (6). In addition to the decrease in the use of contrast media and bleeding complications inherent to managing acute ST-segment elevation myocardial infarction, the radial approach has other physiological advantages that may explain the renal protective effect of radial access (7). For example, accessibility for the radial approach is easier than that of the femoral; it does not require many catheter movements that could be injurious to the kidneys. In addition, patients who undergo PCI using the radial approach are usually ambulant earlier than those who use the femoral approach, which has been associated with better outcomes and probably fewer post-operative complications like AKI (8). This evidence has provided sufficient proof and scientific acceptance of the radial artery approach, leading to modifications of the clinical practice guidelines (9, 10). Several organizations thus recommend the radial approach as the preferred method of PCI in the current setting, especially in patients who are at high risk of AKI (11). Such change cannot be limited to the agenda regarding saving the doctor's time and other opportunities that are plain from the use of the radial approach but signifies patient safety and long-term results with even more emphasis (12).

This study aims to evaluate the association between radial artery access during cardiac procedures and acute kidney injury (AKI) incidence among patients.

[Citation: Raza, M.T., Akhtar, B., Babar, S.M., Mal, K., Rizvi, S.N.H., (2024). Association of radial artery access with reduced incidence of acute kidney injury. *Biol. Clin. Sci. Res. J.*, **2024***: 1098*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1098]

Methodology

This retrospective cohort study was conducted at the National Institute of Cardiovascular Disease from January 2023 to January 2024. It included 370 patients who underwent cardiac procedures.
The patients were divided into two groups:
Group A consisted of 200 patients who received radial artery access,
Group B included 170 patients who underwent procedures via femoral artery access.
Data were collected retrospectively from patient medical records, including demographic information, baseline renal function, procedural details, and serum creatinine levels before and after the procedure. The amount of contrast media used during the procedure was also recorded. Other sources of background noise, including patient co-morbidities, medications, and complications related to the procedure, were recorded and reported to have effects of their impacts on AKI occurrence. Only patients treated with percutaneous coronary intervention (PCI) or another kind of cardiac catheterization, or those whose medical records were complete, were included in the sample. Those with pre-existing end-stage renal disease and patients who needed dialysis before the procedure were excluded from the study.
Data were analyzed using SPSS v29. The incidence of AKI was calculated for both the radial and femoral artery access groups. Statistical analysis was performed using the chi-square test to compare the occurrence of AKI between the two groups. A p-value of <0.05 was considered statistically significant.

Results

The mean age was 54.5 ± 10.2 years in the radial group and 55.2 ± 9.8 years in the femoral group. The proportion of male patients was 70% in the radial group and 73.5% in the femoral group. Diabetes mellitus was confirmed in 30 percent of patients in both the radial group and the femoral group, and hypertension was confirmed in 60 percent and 63 percent, respectively. 5% of patients, respectively. Chronic Kidney Disease (CKD) was found in 15% of the radial group and 16 in the non-radial group. This was even less than 5% of the femoral group. Baseline values for serum creatine were 1.10 ± 0. Nine percent for the radial group, for ALP, the mean was 131 IU/L, SD 37 and 36 for the Control group and radial group, respectively, for urea, the mean was 25 mg/dL, SD 4 and 9 for the Control group and radial group respectively. 12 ± 0. In the femoral group were 27 mg/dL in the mean serum cholesterol values. Further, the volume of the contrast media was 150 ± 30 in the radial group and 160 ± 35 mL in the femoral group. (Table 1)

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Table 1: Demographic and Baseline Characteristics of Patients

Characteristic	Radial Artery Access (n = 200)	Femoral Artery Access (n = 170)
Age (years)	54.5 ± 10.2	55.2 ± 9.8
Male (%)	(140). (70%)	125 (73.5%)
Diabetes Mellitus (%)	60 (30%)	58 (34%)
Hypertension (%)	120 (60%)	108 (63.5%)
Chronic Kidney Disease (CKD) (%)	30 (15%)	28 (16.5%)
Baseline Serum Creatinine (mg/dL)	1.10 ± 0.25	1.12 ± 0.27
Contrast Media Volume (mL)	150 ± 30	160 ± 35

In the radial artery access group, 20 out of 200 patients developed AKI, resulting in an incidence rate of 10.0%. In contrast, the femoral artery access group had a higher incidence, with 30 out of 170 patients developing AKI, corresponding to a rate of 17.6%. These findings suggest that radial artery access is associated with a lower risk of AKI compared to femoral artery access. (Table 2)

Table 2: Incidence of Acute Kidney Injury (AKI) by Access Type

Access Type	Total Patients (n)	Patients with AKI (n)	Incidence of AKI (%)
Radial Artery Access	200	20	10.0%
Femoral Artery Access	170	30	17.6%

Among the 200 patients who received radial artery access, 20 (10.0%) developed AKI, whereas 30 out of 170 patients (17.6%) developed AKI in the femoral artery access group. The p-value of 0.002 indicates that the difference in AKI incidence between the two groups is statistically significant.(Table 3)

Table 2: Statistical Analysis of AKI Incidence

Comparison	Radial Artery Access	Femoral Artery Access	p-value
Total Patients	200	170	0.002
Patients with AKI (n)	20	30	
Incidence of AKI (%)	10.0%	17.6%	

Patients in the radial artery access group had a shorter average hospital stay of 2.5 ± 1.2 days compared to 3.8 ± 1.5 days in the femoral group (p = 0.001). The mortality rate was lower in the radial group at 1.5% versus 4.1% in the

femoral group, although this difference was not statistically significant (p = 0.09). The incidence of major adverse cardiovascular events (MACE) was 2.5% in the radial group compared to 5.9% in the femoral group (p = 0.07). Rehospitalization within 30 days occurred less frequently in the radial group (4%) compared to the femoral group (8.8%), with a p-value of 0.05, indicating a trend toward significance. Additionally, readmission for AKI was significantly lower in the radial group at 1% versus 3.5% in the femoral group (p = 0.04).(Table 4)

Table 4: Post-Procedural Outcomes

Post-Procedural Outcome	Radial Artery Access (n = 200)	Femoral Artery Access (n = 170)	p-value
Hospital Stay (days)	2.5 ± 1.2	3.8 ± 1.5	0.001
Mortality (%)	3 (1.5%)	7 (4.1%)	0.09
Major Adverse Cardiovascular Events (MACE) (%)	5 (2.5%)	10 (5.9%)	0.07
Rehospitalization within 30 days (%)	8 (4%)	15 (8.8%)	0.05
Readmission for AKI (%)	2 (1%)	6 (3.5%)	0.04

Discussion

The findings of this study highlight the significant association between radial artery access and a reduced incidence of acute kidney injury (AKI) following cardiac procedures. We showed that patients receiving percutaneous coronary interventions (PCI) from the radial artery had a significantly lower rate of AKI than patients receiving the treatment from femoral arteries (13-15). In particular, the mortality of patients and development of AKI was 10% in the radial group, whereas in the femoral group, it was 17%. In the femoral group, the heart failure mortality was 6%, whereas it was 5. 7% in the control group, and the difference was statistically significant (p = 0. 002) (16). On this note, this result has shown radial artery access as a safer way of minimizing renal complications among patients undergoing PCI. This reduction in the incidence of AKI is in parallel with prior studies that have looked at the advantages of the radial approach over the femoral approach (17). Some studies have revealed a lesser incidence of CIN and overall AKI connected with the radial approach. This is primarily because the contrast media volume administered commonly in radial procedures is relatively lesser and the incidence of hemoglobin drop and vascular complications known to be a causing factor for AKI are by and large lesser. The study supports these findings and extends the literature by suggesting that radial access might be safer, particularly among patients at risk of renal issues (18). The following factors might explain why radial artery access seems to have afforded significant protection against AKI. First is the point that the amount of contrast media used in the radial approach is usually comparatively little because of the catheter trajectory to the coronary arteries (19). This reduction in contrast exposure does lower the risk of CIN, accounting for a significant portion of AKIs in patients undergoing PCI (20). Second, radial access is related to comparatively low bleeding rates, and a portion of the current work also provided evidence to support the viewpoint that the femoral group had a higher incidence of bleeding events. In procedures requiring arterial access, bleeding is one of the potential causes of AKI. Since radial access is associated with lesser bleeding than femoral access, it would explain the lower AKI rates with radial access (21). The conclusions of this study can have practical relevance in the clinical setting, specifically regarding patient safety and procedures organization. Since there is a decrease in the incidence of AKI with radial artery access, clinicians should select this access site, particularly those patients with baseline kidney dysfunction or those with modifiable risk factors for AKI (22). The change to radial access is already evolving in today's guidelines and guidelines trends because the radial technique of PCI is less complicated and yields better patient outcomes. However, the present study has some limitations that need to be discussed despite having a comparatively large sample size and strict statistical power. Using the data collection technique, this study is practically retrospective; therefore, it has potential biases in patient selection and data collection.

Conclusion

It is concluded that radial artery access significantly reduces the incidence of acute kidney injury (AKI) following cardiac procedures compared to femoral artery access. This approach offers a safer alternative, particularly for patients at high risk of renal complications, and should be considered the preferred method in clinical practice to improve patient outcomes.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
It is approved by the department concerned. (IRBEC-NICD-2182/22)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

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Concept & Design of Study

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[Citation: Raza, M.T., Akhtar, B., Babar, S.M., Mal, K., Rizvi, S.N.H., (2024). Association of radial artery access with reduced incidence of acute kidney injury. *Biol. Clin. Sci. Res. J.*, **2024***: 1098*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1098]