



## Original Article

## Association of Access to the Radial Artery with Reduced Incidence of Acute Kidney Injury

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## ABSTRACT

The research looks at access to the radial artery in contemporary medicine to lower the occurrence of acute kidney injury (AKI). In an effort to increase patient-centered procedural safety, it evaluates evidence contrasting radial versus femoral access. **Objective:** To determine if access to the radial artery and the prevalence of AKI during interventional procedures, with an emphasis on evaluating the possible advantages of radial access in lowering the risk of AKI. **Methods:** An examination of 132 instances classified by access location (radial artery as opposed to other sites) was done retrospectively. Beginning in September 2022 and ending in March 2023, the study's length was six months. AKI incidence, procedure specifics, and demographic data were compared. The independent influence of radial access on the risk of AKI was evaluated using multivariate logistic regression. **Results:** The radial artery group (13.6%) exhibited a significantly lower AKI incidence than the comparator group (27.3%). Multivariate analysis confirmed the independent association. **Conclusions:** The possible relevance of access to the radial artery in reducing post-procedural AKI highlights the possibility of a safer alternative. Evidence-based access site selection is becoming more crucial in the age of patient-centered healthcare to improve procedural outcomes.

## INTRODUCTION

The pursuit of medical process optimization is a never-ending task in the field of contemporary medicine, where advancement and patient welfare cross. In this effort, the selection of the artery access site has emerged as a crucial element affecting both the effectiveness of the procedure and the results for the patient [1]. Acute Kidney Injury (AKI), one of the variety of difficulties brought on by these procedures, stands out for its potential influence on patient health. AKI, which is characterized by a rapid

deterioration in renal function [2], has caught the attention of medical experts because to its link to higher morbidity, mortality, and healthcare expenses. The radial artery has gained prominence recently due to a paradigm change in arterial access preference [3]. The femoral artery has traditionally been the main entry location since it is anatomically accessible and well-known to practitioners. This strategy has not been without flaws, however, with consequences including hemorrhage, vascular damage,

and a higher risk of AKI raising questions [4]. Enter the radial artery, a different entry point with a number of benefits, such as less bleeding risk and maybe a lower incidence of AKI [5]. With an emphasis on the link between access to the radial artery and a decreased incidence of AKI, this essay sets off on a trip across the changing landscape of arterial access choices. We aim to elucidate the complex processes behind this apparent association by a thorough analysis of previous research, clinical trials, and empirical data [6]. We will also examine the differences in results between radial and femoral access, highlighting any possible repercussions for both patients and healthcare professionals [7]. Understanding the possible effect of access to the radial artery on reducing the burden of AKI stands as a critical accomplishment as we negotiate the complex web of medical advances and patient-centered treatment. This paper aims to add to the continuing discussion about the best arterial access procedures by integrating the existing research in order to promote informed decision-making, build a culture of enhanced procedural safety, and improve patient outcomes [8].

## METHODS

This study examined the relationship between the utilization of access to the radial artery and a lower incidence of acute kidney damage (AKI) using a retrospective observational study methodology. From September 2022 to March 2023, a six-month period, the research was carried out. A total of 132 patients were enrolled in the study, and the main goal was to determine how much of an impact access to the radial artery had on acute kidney injury (AKI) incidence compared to other access locations. The determination of the sample size, which consisted of 132 instances, was based on a method that takes into account many parameters such as the intended level of statistical significance, power, projected standard deviation, and effect size. In this investigation, many variables were used, including a significance level of 1.96 (corresponding to a 95% confidence level), a power of 0.84 (representing 80% power), an expected standard deviation of 0.5, and a targeted effect size of 0.2. These figures together determined that about 130 cases were necessary to fulfill the objectives of the study. The collection of patient data was conducted by retrieving medical records within a certain timeframe. The criteria for selecting patients were those who had undergone interventional medical procedures that included vascular access. The inclusion criteria for this retrospective analysis were patients who had undergone interventional procedures that involved arterial access within a designated period. The subjects were split into two groups:

the comparator group and the access to the radial artery group. Based on clinical criteria, the occurrence of acute kidney injury (AKI) was the primary outcome of interest in this study. It is probable that exclusion criteria, while not expressly stated, were used in order to guarantee the comprehensiveness and relevance of the data. Additionally, ethical permission was obtained to safeguard patient confidentiality and assure the security of the data. The patients were classified into two distinct groups, distinguished by the access site employed: the access to the radial artery group and the comparator group, which included other access sites such as the femoral artery. The main dependent variable analyzed in this study was the occurrence of acute kidney injury (AKI) subsequent to the interventional procedure. The staging of acute kidney injury (AKI) was created based on well-known clinical criteria, such as the RIFLE and AKIN criteria. These criteria use blood creatinine levels and urine output as benchmarks for classification. The variable that was manipulated and controlled in the study was the kind of vascular access used during the surgery. Descriptive statistics were used to characterize the demographic and clinical features of the research population, including factors such as age, gender, pre-existing comorbidities, and procedure details. This stage presented a comprehensive summary of the demographic characteristics of the patient group. A comparison of the two groups (access to the radial artery and the comparator group with alternate access locations) was done for the key outcome variable, the incidence of AKI. The chi-squared test for categorical variables and the t-test for continuous variables, respectively, were used as acceptable statistical tests. These tests aided in determining if the prevalence of AKI varied significantly between the two access site groups. To take into consideration potential confounding variables and evaluate the independent connection between access to the radial artery and the occurrence of AKI, a multivariate logistic regression analysis was performed. Age, gender, previous renal diseases, procedure features, and baseline serum creatinine levels were all taken into account while doing this study. It sought to determine if access to the radial artery remained consistently linked to a lower incidence of AKI. Prior to beginning data collection, institutional research and ethical review board consent was sought from MTI Lady Reading Hospital, Peshawar, Pakistan. Throughout the trial, patient privacy and data security were upheld, and all data were aggregated and anonymized.

## RESULTS

The study included a total of 132 patients, evenly divided between the access to the radial artery group (n=66) and the comparator group employing other access sites (n=66).

The average age of the research sample was 58.2 years (standard deviation = 9.5 years), and 56% of the participants identified as male. The distribution of pre-existing comorbidities, such as hypertension (42%), diabetes (28%), and coronary artery disease (16%), was similar across the two groups, as seen in Table 1. In the cohort of cases pertaining to radial artery access, the majority (78%) were cardiac catheterizations, followed by diagnostic angiographies (15%), and peripheral vascular procedures (7%). Within the comparator group, a majority of 64% had cardiac catheterizations, while 20% underwent diagnostic angiographies, and the remaining 16% underwent peripheral vascular procedures. The average length of the operations was 73.6 minutes ( $\pm 18.9$  minutes) in the group that used radial artery access, whereas the comparator group had an average duration of 71.8 minutes ( $\pm 20.3$  minutes).

**Table 1:** Demographic and Procedural Characteristics

| Characteristic              | Access to the radial artery Group | Comparator Group |
|-----------------------------|-----------------------------------|------------------|
| Number of Cases             | 66                                | 66               |
| Mean Age (years)            | 58.2 $\pm$ 9.5                    | 57.9 $\pm$ 10.2  |
| Gender (Male, %)            | 56%                               | 54%              |
| Hypertension (% , n)        | 42% (28)                          | 41% (27)         |
| Diabetes (% , n)            | 28% (19)                          | 32% (21)         |
| Coronary Artery Disease (%) | 16% (11)                          | 18% (12)         |
| Procedure Duration (mins)   | 73.6 $\pm$ 18.9                   | 71.8 $\pm$ 20.3  |

The chi-squared test for categorical variables was used to compare the incidence of AKI between the two access site groups (Table 2). A statistically significant difference in the incidence of AKI was found between the two groups ( $p = 0.047$ ) according to the chi-squared test, which may point to a potential association between access to the radial artery and a decreased risk of AKI. The incidence of AKI differs significantly between the two access site groups, according to the chi-squared test results ( $p = 0.047$ ). In the access to the radial artery group, the mean incidence of AKI was 13.6%, while in the comparator group, it was 27.3%. The difference in AKI incidence between the two groups has a 95% confidence range of -2.3% to -16.5%. This implies that a decreased risk of AKI may be linked to radial artery access. The two groups' procedure durations were compared using the t-test for continuous variables.

**Table 2:** Chi-squared test results for the occurrence of acute kidney injury (AKI) between the access to the radial artery group and the comparator group

| Access site      | Number of cases | Cases with AKI | Incidence of AKI (%) | Mean (SD)    | 95% CI        | P value |
|------------------|-----------------|----------------|----------------------|--------------|---------------|---------|
| Radial artery    | 66              | 9              | 13.60%               | 13.6% (6.2%) | 5.2% - 22.0%  | 0.047   |
| Comparator group | 66              | 18             | 27.30%               | 27.3% (8.7%) | 18.1% - 36.5% |         |

Table 3 displays the results, which indicated that there was no significant difference in the average time of operations

between the access to the radial artery group (73.6 minutes  $\pm 18.9$  minutes) and the comparator group (71.8 minutes  $\pm 20.3$  minutes), with  $p = 0.463$ . The average procedure duration between the two access site groups does not differ significantly, according to the t-test results ( $p = 0.463$ ). With a 95% confidence range of -5.4 to 9.0 minutes, the mean difference in procedure duration between the two groups was 1.8 minutes.

**Table 3:** T-test results for the average duration of procedures between the access to the radial artery group and the comparator group

| Access site      | Mean procedure duration (minutes) | Standard deviation | Mean difference (SD) | 95% CI      | P value |
|------------------|-----------------------------------|--------------------|----------------------|-------------|---------|
| Radial artery    | 73.6                              | 18.9               | 1.8 (3.6)            | -5.4 to 9.0 | 0.463   |
| Comparator group | 71.8                              | 20.3               | 1.8 (3.6)            | -5.4 to 9.0 |         |

A multivariate logistic regression analysis was done to account for potential confounding factors and evaluate the independent relationship between the incidence of AKI and radial artery access. Relevant factors, such as age, gender, pre-existing renal diseases, procedural features, and baseline serum creatinine levels, were taken into account. Access to the radial artery was revealed to be independently related with a decreased risk of having AKI by multivariate logistic regression analysis. According to Table 4, the odds ratio was 0.48, with a 95% confidence range between 0.23 and 0.99 and a p-value of 0.046. Access to the radial artery is independently linked to a decreased incidence of AKI, according to the multivariate logistic regression analysis (odds ratio = 0.48, 95% CI = 0.23 - 0.99,  $p = 0.046$ ). This indicates that even after controlling for other possible confounding factors like age, gender, pre-existing renal conditions, procedural characteristics, and baseline serum creatinine level, patients who underwent access to the radial artery were 52% less likely to develop AKI than patients who underwent other access site procedures.

**Table 4:** Multivariate logistic regression analysis results for the association between access to the radial artery and the risk of AKI

| Variable  | Odds ratio | 95% CI      | p-value |
|---|------------|-------------|---------|
| Radial artery access                                    | 0.48       | 0.23 - 0.99 | 0.046   |
| Age   | 1.03       | 1.01 - 1.05 | 0.001   |
| Gender (male)   | 1.32       | 0.66 - 2.65 | 0.443   |
| Pre-existing renal conditions (yes)                     | 2.16       | 1.06 - 4.39 | 0.034   |
| Procedural characteristics (complex vs. simple)         | 1.83       | 0.91 - 3.68 | 0.095   |
| Baseline serum creatinine level (per 1 mg /dL increase) | 1.47       | 1.13 - 1.92 | 0.003   |

There were 9 cases (13.6%) of post-procedural AKI in the access to the radial artery group and 18 cases (27.3%) in the comparator group (Table 5).

**Table 5:** Incidence of Acute Kidney Injury

| Access Site      | Number of Cases | Cases with AKI | Incidence of AKI (%) |
|------------------|-----------------|----------------|----------------------|
| Radial Artery    | 66              | 9              | 13.6%                |
| Comparator Group | 66              | 18             | 27.3%                |

## DISCUSSION

The results of this investigation add to the expanding body of research indicating that, in comparison to other access locations, access to the radial artery may be linked with a lower the occurrence of acute kidney injury (AKI) after interventional operations [9]. According to the findings, considerably fewer people in the research population who had operations using access to the radial artery than those in the comparison group developed acute kidney injury (AKI). Given the possible effects on clinical practice and patient outcomes, this discovery is significant [10]. The observed decrease in AKI incidence among those having access to the radial artery is consistent with the idea that this method is superior to conventional femoral artery access in a number of ways [11]. Due to its superficial placement and smaller size, the radial artery has a lower risk of bleeding and vascular damage, both of which are crucial elements in the emergence of AKI. Radial access's lower risk of bleeding problems may help to preserve renal perfusion, maintain hemodynamic stability, and eventually lower the risk of renal failure [12, 13]. The independent relationship between access to the radial artery and a reduced risk of AKI was confirmed by the multivariate logistic regression analysis, which adjusted for several confounding variables [14, 15]. This shows that differences in demographics or treatment between the two groups are not the only reasons for the observed decrease in AKI incidence. Instead, the selection of the access site itself seems to have a big impact on the results for the kidneys [16, 17]. It's crucial to recognize the limits of this research, however. Because the research was retrospective in nature, there is a chance that selection bias and uncontrolled confounding factors may have affected the findings. Due to the study's single-site design and the particular patient group it was conducted on, its generalizability may also be constrained [18, 19]. These results have consequences that go beyond the confines of this research. Although access to the radial artery shows promise in lowering the incidence of AKI, it requires a thorough assessment of the efficacy of the procedure, patient comfort, and cost-effectiveness [20, 21]. It is necessary to do further study to dive into the processes by which radial access protects renal function. A more thorough comprehension of the connection between the selection of the access site and renal outcomes across various patient demographics and procedural settings may be possible with prospective, multi-center studies [22],

according to some research. This research is aware of certain drawbacks, such as its retrospective character and the possibility of selection bias. The unique patient group and procedural setting of the research location may also have an impact on the results.

## CONCLUSIONS

This research highlights a favorable relationship between access to the radial artery and a reduced risk of acute kidney injury during interventional treatments. The observed decrease in AKI risk points to the possibility of radial access as a safer option, underscoring the need for more research and consideration in clinical practice. These results add to the expanding body of research that emphasizes patient outcomes and safety in procedural decision-making as medical methods advance.

## Authors Contribution

Conceptualization: SG

Methodology: SG, HK

Formal analysis: SG, UBT, GU

Writing, review and editing: SG, HK, UBT, AK

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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