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Original Research Article

Accessory Renal Arteries and Their Branching Patterns in Adult Cadavers: A Multicentric Cross-Sectional Study

Ravi Prakash Kumawat[1], Chandrakala Agarwal[2], Jakir hussan[3]

[1]Resident, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India
[2]Senior Professor, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India
[3]Resident, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India

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Corresponding Author: Dr. Ravi Prakash Kumawat
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Abstract:

Background: Accessory renal arteries are the most common variation in renal vascular anatomy. Their branching pattern further adds complexity and has significant clinical implications.

Objective: To determine the prevalence, number, and branching patterns of accessory renal arteries in adult cadavers.

Methods: A multicentric cadaveric study was conducted on 60 adult cadavers. Renal arteries were dissected and analyzed for the presence of accessory renal arteries and their branching patterns.

Results: Accessory renal arteries were present in 21.7% of cadavers. Most were unilateral with right-side predominance. Double arteries were most common. Pre-hilar branching was the most frequent pattern, followed by pre-segmental branching.

Conclusion: Accessory renal arteries with variable branching patterns are common. Knowledge of these variations is crucial for safe surgical and radiological interventions.

Keywords: Accessory Renal Artery, Branching Pattern, Renal Vascular Variation, Cadaveric Study.

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Introduction

The kidneys are usually supplied by a single renal artery, but variations are common. The most frequent variation is the presence of accessory renal arteries.

In addition to their presence, the branching pattern of these arteries is clinically important. Accessory arteries may divide before reaching the hilum or supply specific renal segments.

Understanding both presence and branching pattern is essential in:

- Renal transplantation
- Nephron-sparing surgery
- Endovascular interventions

Failure to recognize these variations may result in ischemia or surgical complications.

Materials and Methods

Study Design: Descriptive cross-sectional cadaveric study

Study Setting: Departments of Anatomy of multiple medical colleges.

Study Duration: November 2025 – February 2026.

Sample Size: 60 adult cadavers.

Inclusion Criteria

- Adult cadavers (>18 years)
- Well-preserved specimens
- Intact renal vasculature

Exclusion Criteria

- Congenital anomalies
- Damaged renal vessels
- Pediatric cadavers

Procedure

- Midline abdominal dissection
- Renal arteries traced from aorta to kidney

Observations recorded:

- Presence of accessory renal arteries
- Number
- Side distribution
- Mode of entry (hilar/polar)
- Branching pattern

Branching Pattern Classification

- Pre-hilar branching
- Pre-segmental branching

- Segmental (within hilum)

Statistical Analysis: Descriptive statistics (percentage, frequency)

Ethical Approval: Obtained from Institutional Ethics Committee.

Results

Table 1: Prevalence of Accessory Renal Arteries

Observation	Number
Total cadavers	60
Present	13 (21.7%)
Absent	47 (78.3%)

Table 2: Number of Accessory Renal Arteries

Pattern	Number
Double arteries	11
Four arteries	2

Figure 1: Left Kidney with Two Arteries and Right Kidney with Four Arteries

Figure 2: Right-Sided Polar Artery Arising from Renal Artery

Table 3: Side Distribution

Distribution	Observation
Unilateral	Majority
Right-sided	More common
Left-sided	Less common
Bilateral	Few cases

Table 4: Branching Pattern of Accessory Renal Arteries

Branching Pattern	Number
Pre-hilar branching	6
Pre-segmental branching	3
Segmental (hilar)	4

Figure 3: Lower Accessory Renal Artery Entering into Lower Part of Renal Hilum

Observations

- Accessory renal arteries were the most frequent vascular variation
- Majority showed pre-hilar branching, increasing surgical complexity
- Some arteries directly supplied renal poles (polar arteries)
- Right side showed higher prevalence

Discussion

The present study showed a 21.7% incidence of accessory renal arteries, consistent with previous studies. Branching pattern analysis revealed that pre-hilar branching was the most common. This is clinically significant because early branching reduces arterial length available for anastomosis during transplantation.

Embryologically, accessory renal arteries arise due to persistence of mesonephric arteries. Their branching patterns reflect developmental variations in vascular remodeling.

Clinical significance includes:

- Increased complexity in renal transplantation
- Risk of segmental ischemia
- Challenges in laparoscopic and endovascular procedures
- Importance in radiological diagnosis

Previous studies (Satyapal et al., recent 2023–2025 studies) also emphasize the importance of both presence and branching pattern.

Conclusion

Accessory renal arteries with variable branching patterns are common anatomical findings.

Recognition of:

- Their presence
- Number
- Branching pattern is essential to prevent complications during renal surgeries and interventional procedures.

Limitations

- No demographic analysis
- No radiological correlation
- Limited sample size

Recommendations

- Routine CT angiography before renal surgery
- Inclusion of branching pattern studies in anatomy teaching
- Further large-scale studies

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