

# Balancing Safety and Value: Timing of Bleeding Detection after Renal Parenchymal Biopsies

Annika Agrawal, Sam Meiselman, Daniel Ludwig, MD, Malak Itani, MD, Benjamin Strnad, MD

Mallinckrodt Institute of Radiology, Washington University School of Medicine



## Purpose

- Percutaneous parenchymal renal biopsy is essential for diagnosing native kidney disease and surveilling transplant allograft rejection.
- Bleeding is the primary complication, with reported rates of clinically significant bleeding complicating up to 11% of renal biopsies.
- Data suggest native biopsies carry up to **twice the bleeding risk** of transplant biopsies, yet no consensus exists around optimal monitoring duration. Monitored recovery time varies widely by institution, ranging from 30 minutes to 24 hours.
- Our institution mandates a uniform **23-hour post-procedure admission** for all renal biopsies regardless of type—a unique opportunity to study complication timing without confounding by variable discharge practices.

**Objective:** Evaluate the rate and temporal distribution of 30-day bleeding complications across native and transplant kidney biopsies under a fixed 23-hour admission policy to inform timely and safe post-procedure discharge.

## Materials & Methods

**Study Design:** Retrospective chart review of all image-guided biopsies performed by abdominal radiology at a single tertiary center (Barnes-Jewish Hospital)

**Period:** January 1, 2021 – April 1, 2025

**Population:** Adult patients (age ≥18) undergoing native kidney or transplant kidney biopsy. ~1,100 patients identified via CPT code query (Montage).

### Primary Outcome

Clinically significant bleeding within 30 days, defined as:

- Moderate/large perinephric hematoma on post-procedure CT (defined by consensus review by 3 board-certified fellowship-trained abdominal radiologists)
- Procedural or surgical intervention for bleeding (embolization, nephrectomy)
- Death within 30 days where hemorrhage was suspected cause

### Secondary Outcome

- Timing of bleeding detection relative to biopsy: intraprocedural, <2 hr, 2-6 hr, 6-24 hr, >24 hr post-procedure
- Indication for post-procedure CT

**Data Collected:** Biopsy target, demographics, procedural parameters, pre-procedure labs, inpatient vs. outpatient status, imaging/intervention findings, and timing of bleeding detection.

**Statistical Analysis:** Chi-square/Fisher's exact tests for comparisons between biopsy types. All significance levels set to  $p < 0.05$ .

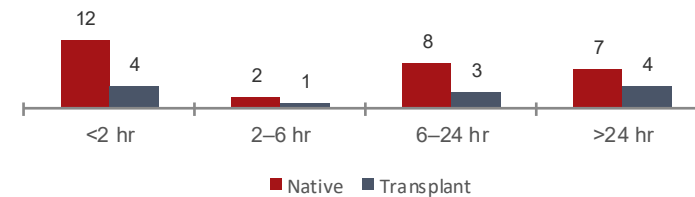
## Results: Complication Rates

<b>1,121</b> Total biopsies (508 native, 613 transplant)	<b>41 (3.7%)</b> Patients with clinically significant bleeding	<b>26 (2.3%)</b> Patients requiring intervention	
	Native (n=508)	Transplant (n=613)	p-value
Post-procedure CT within 30 days*	92 (18.1%)	90 (14.7%)	0.08
Moderate/large hematoma on CT	29 (5.7%)	12 (2.0%)	<b>0.0011</b>
Required intervention	21 (4.1%)	5 (0.82%)	<b>&lt; 0.001</b>
Death due to hemorrhage	0 (0.0%)	0 (0.0%)	—
<b>Total clinically significant bleeds</b>	<b>29 (5.7%)</b>	<b>12 (2.0%)</b>	<b>0.0011</b>

\*of which 115 (60 native, 55 transplant) were performed on suspicion for bleeding

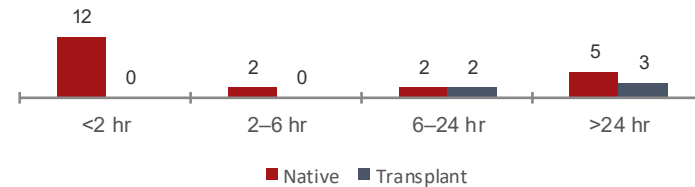
## Results: Timing of Bleeding Detection

Figure 1. Timing of Hematoma Detection (n=41)



Of all 41 hematomas: 16 (39.0%) were detected within 2 hours, 3 (7.3%) within 2-6 hours, 11 (26.8%) within 6-24 hours, and 11 (26.8%) >24 hours post-procedure.

Figure 2. Detection Timing in Patients Requiring Intervention (n=26)



Among patients requiring intervention: 12/26 (46%) were detected within 2 hours (all native), 8/26 (30.8%) were detected >24 h post-procedure (5 native, 3 transplant).

## Key Findings

- Clinically significant bleeding was **nearly 3x more likely** in native kidneys (5.7%) vs. transplant kidneys (2.0%), consistent with prior literature.
- Interventions were required in 4.1% of native vs. 0.8% of transplant biopsies.
- Bleeding detection was temporally heterogeneous: 26.8% of significant hematomas and 30.8% of cases requiring intervention were identified **more than 24 hours post-procedure**, beyond the standard monitoring window.
- Among transplant biopsies, no interventions were required within the first 6 hours post-procedure; all 5 cases of transplant bleeds requiring intervention were detected at 6+ hours. By contrast, the majority (14/21, 67%) of native kidney bleeds requiring interventions were detected within 6 hours.
- Across both biopsy types, the **most common indication for positive CT was abdominal pain** (15/29 native, 8/12 transplant, 23/41 overall), followed by post-procedure drop in hemoglobin on routine check.
- 31% (8/26) of patients who required intervention were detected in the biopsy suite. Of those detected later, 89% (16/18) presented with abdominal pain.

## Conclusions

- A 23-hour monitored admission does not reliably capture all clinically significant bleeding: over one-quarter of complications presented after discharge.
- Native kidney biopsies carry a significantly higher bleeding complication rate than transplant biopsies, but complications are typically detected earlier — potentially supporting a **6-hour observation protocol for native biopsies**.
- Transplant biopsies, with low rates of early intervention and few significant bleeding events overall, may be well-served by an even shorter observation period.
- Bleeding events were temporally heterogeneous, **limiting the utility of prolonged inpatient monitoring**.

**Clinical Implication:** A brief inpatient stay with routine hemoglobin check and/or risk-stratified symptom-based discharge protocols with clear patient education on warning signs may provide greater value than prolonged inpatient monitoring, particularly for transplant kidney biopsies.

## References

1. Whittier WL et al. Clin Kidney J. 2018;11(5):616-622.
2. Robert SC et al. AJR. 2023;221(3):344-353.
3. Brachemi S & Bollée G. World J Nephrol. 2014;3(4):287-294.
4. Poggio ED et al. Clin J Am Soc Nephrol. 2020;15(4):573-581.
5. Morgan TA et al. Radiology. 2016;279(1):281-288.
6. Moledina DG et al. Clin J Am Soc Nephrol. 2018;13(11):1633-1640.
7. Whittier WL & Korbet SM. Am J Kidney Dis. 2004;43(4):651-662.
8. Ahmad I. Clin Pathol. 2004;57(7):740-745.
9. White-Dzuro GA et al. Transplant Rev. 2025;39(1):100883.