Safety of percutaneous renal biopsy as an outpatient procedure in pediatric patients

Abdulkarim Al Makdama,* Samhar Al-Akash †

*From *King Fahad Medical City Children Hospital and the †Department of Pediatrics, King Faisal Specialist Hospital and Ressearch Center, Riyadh, Saudi Arabia*

Correspondence and reprint requests:
Abdulkarim Said Al Makdama, MD
King Fahad Medical City
Children Hospital
P.O. Box 59046
Riyadh 11525, Saudi Arabia
Tel: +966-050-421 5071
al_makadma@hotmail.com

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Renal biopsy is the gold standard for definitive diagnosis of a variety of renal diseases. Being an invasive procedure, adequate patient preparation and evaluation are mandatory, in addition to having experienced personnel and adequate backup support for emergencies, such as interventional radiology and surgery. In most centers, renal biopsy in children is performed on an inpatient basis, with an average stay of 2 days in uncomplicated cases. This practice is very costly, and at busy institutions, the biopsy may be delayed due to unavailability of beds, which may adversely affect certain patients where immediate diagnosis is of utmost importance and urgency, such as in patients with renal transplantation who are suspected to have acute rejection.

To overcome logistical problems with beds, delay in diagnosis, unnecessary hospital stays, and time lost from school, we have resorted to performing renal biopsies on an outpatient or short-term stay basis in the day procedure unit for the past 2 years in most patients. Though invasive, renal biopsy is generally considered a safe procedure in pediatric patients.[1-4] The incidence of complications following percutaneous biopsy is 10% to 15% as reported in the literature.[5-7] Almost one half of these complications are considered minor complications, such as transient gross hematuria or perinephric hematoma that resolves spontaneously without blood transfusion or intervention. The rest are major complications that generally require intervention and/or blood transfusion.

While the choice of the most optimal setup for renal biopsy in children is somewhat of a controversy,[8] more recent studies have concluded that an outpatient procedure is safe both in adult[5, 9-11] and pediatric patients.[6-12] The incidence of post-renal biopsy complications was reported to be between 10% and 15%.[6,13] Most complications usually occur within the first few hours.[5] Some authors believe that all complications will be evident within 12 hours after the biopsy.[10] The incidence of complications is significantly decreased with the use of automated biopsy needle guns.[7,14,15]

These complications can be defined and classified in various ways,[5,10] and for purposes of our study we adopted those of Marwah and Karbet[10] to evaluate the safety of renal biopsies in both inpatient and outpatient settings.

Patients and Methods

Between January 2003 and August 2004, 88 consecutive percutaneous renal biopsies were performed on patients under the age of 15 years. The procedure at our hospital is performed by an attending pediatric nephrologist and/or a pediatric nephrology fellow under direct supervision of the attending pediatric nephrologist. Usual screening for coagulation abnormalities including a complete blood count, prothrombin and partial thromboplastin times, and a type and screen were done

in all patients, and normal results were accepted if done within 3 days of the scheduled biopsy. Patients with abnormal renal function received DDAVP 0.3 mcg/kg intravenously 30 to 60 minutes before the procedure to minimize bleeding risk. Biopsies were performed blindly under aseptic conditions after ultrasonographic localization by the radiologist. In addition to local anesthesia with lidocaine, we use either conscious sedation (for cooperative patients usually more than 7 years old) or deep sedation. All biopsies were performed using an 18-gauge/10-cm automated spring-loaded core biopsy needle (17 mm specimen cut notch) (ASAP; Boston Scientific/Medi-Tech, Cedex, France). In most cases, the lower pole was targeted in native kidney biopsies, and the upper of pole in transplanted kidneys. After the procedure, patients were kept flat in the supine position for at least 4 hours when possible, and vital signs, site pain, and hematuria were observed and recorded at regular time intervals. Stable patients were discharged home 4 to 6 hours after the procedure from the day procedure unit, or by next morning (at least 10 to 12 hours after procedure) if admitted solely for biopsy.

We have retrospectively reviewed the charts of 88 consecutive patients under the age of 15 years who have undergone percutaneous renal biopsies (native or transplanted kidneys). Information regarding the following information were collected and analyzed: age, sex, native vs. transplanted kidneys, inpatient vs. outpatient, minor or major complications, number of specimens obtained, and number of glomeruli.

Results

Over a period of 20 months a total of 88 consecutive percutaneous renal biopsies were performed in our institute; 43 (49%) from native kidneys, and 45 (51%) from transplanted kidneys. There was no difference in the percentage of biopsies done as inpatient vs. outpatient procedure; 45 (51%) and 43 (49%) biopsies, respectively. The percentage of inpatient vs. outpatient procedures was not affected by the type of kidney biopsied; 19 (44%) of native kidney biopsies and 24 (53%) of allograft kidney biopsies were done as outpatient procedures. The male to female ratio was almost 1:1 in both groups (Table 1). About 50% of all biopsies were done in children 7 to 12 years, 19% in children 0 to 6 years, and 31% in children 12 to 15 years of age. There were 4 complications (8.8%) in the inpatient group with only 1 major complication (2.2%) (severe gross hematuria due to an arteriovenous fistula that required repeated blood transfusions and was successfully embolized by selective renal arteriography that identified the bleeder), compared with 6 (13.9%) in the outpatient group with 2 major complications (4.6%) (gross hematuria in 1 due to ateriovenous fistula and 1 due to a bleeding abdominal wall vessel associated with site

Table 1. Demographic data for inpatient and outpatient biopsies (total=88).

	Inpatient Number (%) of biopsies	Outpatient Number (%) of biopsies
	45 (51)	43 (49)
Native vs. Transplant	24 vs. 21 (53 vs. 47)	19 vs. 24 (44 vs. 56)
Male vs. Female	23 vs. 22 (51 vs. 49)	22 vs. 21 (51 vs. 49)
Age		
0 – 6 years	9 (20)	8 (18)
7 – 12 years	24 (53)	20 (47)
12 – 15 years	12 (27)	15 (35)
Total no. of glomeruli		
0 – 5	6 (13)	6 (14)
6 – 10	16 (36)	14 (33)
11 – 20	14 (31)	16 (37)
21 – 30	5 (11)	6 (14)
> 30	4 (9)	1 (2)
Inadequate	2 (4)	4 (9)

Table 2. Complications

Complication	Inpatient n (%)	Outpatient n (%)	All n (%)
Gross hematuria	1 (2.2)	2 (4.6)	3 (3.4)
Perirenal hematoma	1 (2.2)	0	1 (1.1)
Severe pain	1 (2.2)	1 (2.3)	2 (2.2)
Arteriovenous fistula and bleeding	1 (2.2)	2 (4.6)	3 (3.4)
Sedation related	0	1 (2.3)	1 (1.1)
Total	4 (8.8)	6 (14)	10 (11)
Blood transfusion	1 (2.2)	2 (4.6)	3 (6.8)

pain, requiring blood transfusion in both patients) (Table 2). There were no deaths, and none of the patients with hemorrhage required nephrectomy. All complications were diagnosed within the initial 4- to 6-hour observation period following the procedure. None of patients who had outpatient procedures had to be readmitted after discharge from the day procedure unit. There were only 2 (4%) and 4 (9%) inadequate samples in the inpatient and outpatient groups, respectively (Table 1).

Discussion

Our program has witnessed an increased rate of renal biopsies in the past few years. To minimize hospital stays and to avoid delays resulting from delayed admission, and in view of the perceived relative safety of the procedure, we started doing most renal biopsies on an outpatient basis. The incidence of serious complications of percutaneous renal biopsy in the literature is rare.[1-4] Our overall complication rates of 8.8% and 13.9% for the inpatient and outpatient procedures, respectively, are in line with those reported in the literature. Chesney et al reported a 17.5% complication rate in patients who had the biopsy done as an inpatient compared to an 11.4% complication rate for outpatient procedures.[7] In our series there was only one patient who developed post-biopsy hematoma (inpatient); however, the true incidence is unknown since we did not perform post-biopsy ultrasound examinations routinely. A review of the literature suggests that asymptomatic intra- or peri-renal hematoma occurring within one month of the biopsy time would be of no clinical significance.[5,7,12]

The incidence of gross hematuria in our series was 2.2% and 4.6% for inpatient and outpatient procedures, respectively, which compares favorably to a 7% incidence in 119 outpatient procedures as reported by Bohlin et al,[2] and 7.4% in 177 outpatient (137 native and 40 transplant kidneys) procedures in the study reported by Davis et al.[6] Our overall rate of major complications was 3.4%, in line with a 3.4% incidence reported by Davis et al. The rate of major complications for outpatient procedures was 4.6%, which also compares favorably with an 8.9% rate reported by Ogborn et al.[16] In our series of patients, there were 3 arterio-venous fistulas; 2 were considered serious complications as both required blood transfusion and one was treated additionally with selective embolization of the bleeding artery (biopsy in this patient was done as an inpatient procedure). In both cases, there were no long-term effects on renal function as a result of the complication. One patient among the outpatient group had respiratory depression secondary to conscious sedation due to miscalculation of the sedating dose, but the patient recovered completely with reversal of sedation.

In conclusion, our study provides further evidence that it is safe to perform percutaneous renal biopsy in children on an outpatient basis after careful screening for bleeding risks, using an automated biopsy needle-gun system. We also suggest that observation for 4 to 6 hours after the procedure is adequate to detect complications. However, this should only be undertaken where backup services are readily available.

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