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Brief report

Safety and cost effectiveness of pediatric percutaneous renal biopsy

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Abstract. Because of the rising cost of health care, more patients are undergoing procedures as outpatients rather than inpatients. The purpose of this study was to compare safety and cost of outpatient versus inpatient, overnight stay, for children undergoing percutaneous renal biopsy. Charts of all such patients between January 1989 through January 1995 were reviewed for the following: age of patient, native versus allograft biopsy and preparation costs (in 1995 U.S. dollars), and complications. Of the 75 biopsies reviewed, 58 were native and 17 allograft with 35 (47%) of the biopsies being outpatient and 40 (53%) inpatient. There were four complications (11.4%) in 2 patients for the outpatient group and seven complications (17.5%) in 6 patients in the inpatient group ($X^2 = 0.1003$, $P = 0.75$). The median cost for an outpatient biopsy was U.S. $ 1,968 while an inpatient biopsy was U.S. $ 3,178. We conclude that outpatient percutaneous renal biopsy in children is as safe as inpatient and more economic, with a saving of greater than U.S. $ 1,000 per biopsy.

Key words: Percutaneous renal biopsy – Outpatient procedure – Safety – Cost effectiveness

Introduction

With the rising cost of health care, many institutions are seeking shorter hospital stays and utilizing the outpatient area for what were previously inhouse procedures, as well as for observation and monitoring of common illnesses [1]. Currently, the standard of practice for children undergoing a percutaneous renal biopsy is to have the child admitted to the hospital on day 1, before or after the procedure, then observation of the child overnight to be discharged the next morning pending lack of complications. For selected patients at our institution, we have adopted the practice of having the child come to the outpatient department in the morning, performing the biopsy and then observing the child in the outpatient area or in short stay unit for the rest of day and discharging the patient to home the same day, unless complications occur. Thus we chose to investigate the cost effectiveness and safety of outpatient versus inpatient pediatric renal biopsy.

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Patients and methods

Charts were reviewed of all pediatric percutaneous renal biopsies performed by the Section of Nephrology at the Cleveland Clinic Children's Hospital between January 1989 and January 1995. Only biopsies performed on patients as either inpatient (admitted and observed overnight on the general pediatric ward or in the short stay unit $\geq$24 h) or outpatient (discharged the same day as the biopsy) were included in the study.

Demographic data gathered included: age and sex of patient at the time of biopsy. Data obtained from the biopsy procedure included: allograft or native kidney, if the tissue was obtained with or without ultrasound guidance, and any complications. Definition of complications was obtained from previous studies [2–6] and included gross hematuria, hematoma, severe pain, infection, blood transfusion, nephrectomy, inadequate tissue, and death.

The biopsy tissue was evaluated for the following: adequacy of tissue obtained, which we defined as adequate to be diagnostic, stains performed on the tissue, which included routine light microscopy and immunohistological stains, and lastly whether or not electron microscopy was performed.

Cost, calculated in 1995 U.S. dollars, included hospital charges, professional fees for performing the biopsy, professional fee for performing the ultrasound (e.g., ultrasound-guided biopsy), cost of sedation, professional fees to process the tissue, the cost of the stains used, as well as the charge for electron microscopy. A chi-squared analysis was used to evaluate the complication rates between the outpatient and inpatient groups.

Results

A total of 75 biopsies performed on 70 patients were evaluated. Fifty-eight (77%) of the biopsies were performed on native kidneys with 17 (23%) on transplanted

Table 1. Complications occurring after outpatient and inpatient percutaneous renal biopsies

Complications	Outpatient (n = 35)	Inpatient (n = 40)
Gross hematuria	1	3
Hematoma	1	0
Severe pain	1	1
Infection	1	0
Inadequate tissue	0	3
	4 (11.4%) In 2 patients	7 (17.5%) In 6 patients

kidneys. Thirty-five (47%) were performed as outpatient procedures and 40 (53%) were carried out as inpatient procedures. There were 18 males and 14 females in the outpatient group and 26 males and 12 females in the inpatient group. The average age of the patient in the outpatient group was 13.4 years compared with 11.9 years in the inpatient group.

For the 35 outpatient biopsies, there were a total of four complications (11.4%) in 2 patients compared with seven complications (17.5%) in 6 patients in the 40 inpatient biopsies ($X^2 = 0.1003$, $P = 0.75$ (Table 1).

Table 2 lists biopsy costs involved in 1995 U.S. dollars. All patients had professional fees charged for the biopsy procedure as well as sedation and pathology professional and processing fees. The largest difference between the two groups occurred in hospital charges. All inpatients had at least one overnight stay with a cost of U.S. $ 1,300, while 5 patients stayed more than one night. The mean cost per biopsy for hospitalized patients was U.S. $ 1,414. Nine outpatients stayed in the short stay unit for variable periods of time (5–9 h), while the majority had no charges since they were observed in the outpatient clinic. The mean cost per biopsy for the outpatients was U.S. $ 136. Other areas where charges may have been discrepant were in the performance of ultrasound and the performance of electron and immunofluorescence microscopy, since these carried the largest proportion of the overall cost.

Eighteen (51%) of the inpatient biopsies and 13 (32%) outpatient biopsies had ultrasounds of native kidneys; 3 (9%) inpatient biopsies and 1 (3%) outpatient biopsy had ultrasounds of allograft kidneys. Ultrasound-guided biopsies occurred in 14 (40%) of the outpatient biopsies and 8 (20%) of the inpatient biopsies. Twenty-six (80%) of the outpatient biopsies and 32 (74%) of the inpatient biopsies had electron microscopy performed, while (29 (83%) of the outpatient biopsies and 33 (83%) of the inpatient biopsies had immunofluorescence performed. The 35 outpatient biopsies were performed at a total cost of U.S. $ 68,885, averaging U.S. $ 1,968 per biopsy. The total cost of the 40 inpatient biopsies was U.S. $ 127,123, with an average cost of U.S. $ 3,178 per biopsy.

Table 2. Charge for percutaneous renal biopsy – 1995 U.S. dollars

Hospital charges	U.S. dollars	Patients	
		Out	In
Room (double)/day	650		34
Nursing/supplies/day	650		34
Short-stay unit			
0–4 h	315	0	0
5–12 h	530	9	0
13–23 h	650	0	0
>24 h	650	0	4
Outpatient clinic	0	23	0
Biopsy charges		**Biopsies**	
		Out	In
Professional fee	550	35	40
Ultrasound			
Native	400	13	18
Allograft	316	1	3
Ultrasound-guided	593	14	8
Sedation			
Venipuncture	80	35	40
Drugs	22	35	40
Tissue processing	92	35	40
Stains			
PAS	27	34	36
Trichrome	27	32	34
Silver	27	31	34
Immunofluorescence	240	29	33
Frozen section	129	29	35
Electron microscopy	544	26	32

PAS, Periodic acid-Schiff

Discussion

Our data suggest that pediatric renal biopsy performed as an outpatient procedure is as cost effective as an inpatient procedure, without an increase in complication rate. In a study closely related to ours, Gonzalez-Vallina et al. [1] compared complication rates for 184 outpatient percutaneous liver biopsies in children over a 4-year period with a group of 521 inpatient percutaneous liver biopsies. In this series, four complications were noted: 2 patients with respiratory depression from the sedation and 2 specimens which did not have adequate tissue in the 184 outpatient biopsies. Comparatively, the 521 inpatient biopsies recorded the following six complications: four peritoneal hemorrhages, one right hemothorax, and one subcapsular hematoma with pain.

Complication rates in our study were comparable to other published series [2–6]. Al Rasheed et al. [2], in a series of 120 percutaneous renal biopsies in children, showed a 25% complication rate for gross hematuria for less than 3 days, as well as a 1.7% rate for symptomatic perirenal hematoma, a 3.3% rate of severe pain at the biopsy site, and one death. Kolb et al. [3], in a series of 369 percutaneous renal allograft biopsies, found an overall complication rate of 13.0%, with a clinically significant complication rate of 4.3%. Colodny and Reckler [4], in reviewing 100 percutaneous renal biopsies in children, found gross hematuria in 32 patients, perirenal mass in 2 patients, and severe pain in 4 patients. Carvajal et al. [5] analyzed a series of 890 consecutive percutaneous renal biopsies in children. They showed a complication rate of

17.3% for mild and transient complications. Serious complications, requiring special management, prolonged hospitalization, or resulting in permanent sequela, occurred at a rate of 4.8%. Recently, Ogborn and Grimm [6] showed a complication rate of 8.7% in their series of 46 outpatient pediatric renal biopsies. Again, in our series we found the complication rate in the outpatient and inpatient series to be 11.4% and 17.5%, respectively, with no serious complications.

Finally, there have not been any recent studies comparing the two methods we described. However, based on our data and data from the previously described studies, we suggest that pediatric percutaneous renal biopsies can be performed as an outpatient procedure with reduced cost and no increase in complication rate compared with the inpatient procedure.

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Literature abstracts

Nephrol Dial Transplant (1995) 10: 2228–2234

Low-dose calcitriol prevents the rise in 1,84 iPTH without affecting serum calcium and phosphate in patients with moderate renal failure (prospective placebo-controlled multicentre trial)

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Background. Higher doses of calcitriol are effective in lowering markedly elevated 1.84 PTH levels of patients with renal secondary hyperparathyroidism. It has not been established, however, whether prophylactic administration of low doses of calcitriol prevents an increase of 1.84 PTH without causing side-effects, i.e. hypercalcaemia, hypercalciuria, or hyperphosphataemia.

Study design. We carried out a placebo-controlled, double-blind prospective multicentre trial over 12 months in 45 patients with mild to moderate renal failure. Criteria for inclusion were S-creatinine 1.4 mg/dl and 1.84 PTH >6 pmol/l (normal 6). Calcitriol 0.125 μg/day per os was compared with placebo. The patients received calcium carbonate per os if serum P exceeded 1.7 mmol/l.

Results. Baseline 1.84 iPTH concentrations were not significantly different, i.e. 14.0 pmol/l (6.7–63.3) on placebo vs 16.2 (6.85–82.0) on calcitriol. Intention to treat analysis revealed a significant difference of final 1.84 iPTH, i.e. 27.8 (4.2–68.5) on placebo vs 18.2 (4.45–75.5) on calcitriol. On post-hoc analysis the difference was even more pronounced at S-creatinine concentrations above 3 mg/dl. S-calcium, S-phosphate, and urinary excretion of calcium did not change significantly on either placebo or on calcitriol. There were no episodes of hypercalcaemia or hyperphosphataemia. There was no significant difference of final S-creatinine or change in S-creatinine between placebo and calcitriol. One patient on calcitriol and two on placebo progressed to terminal renal failure. Bone alkaline phosphatase as a non-invasive index of bone metabolism was not decreased to subnormal levels.

Conclusion. The results document that a therapeutic window exists in patients with moderate renal failure and elevated of 1.84 iPTH, where low-dose calcitriol (0.125 μg/day) prevents the increase in 1.84 iPTH without causing side-effects. This observation suggests that the parathyroid is more sensitive to calcitriol than intestine and bone.

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Consumption of soft drinks with phosphoric acid as a risk factor for the development of hypocalcemia in children: a case-control study

Efraín Mazariegos-Ramos, Fernando Guerrero-Romero, Martha Rodríguez-Morán, Gloria Lazcano-Burciaga, Ramón Paniagua, and Dante Amato

A comparison of 57 cases (in children with serum calcium concentration <2.2 mmol/l) and 171 controls (in children with serum calcium level ≥ 2.2 mmol/l) was carried out to assess whether the intake of at least 1.5 l/wk of soft drinks containing phosphoric acid is a risk factor for the development of hypocalcemia. A significant association was found: odds ratio = 5.27; 95% confidence interval, 3.17 to 8.74; $p < 0.001$. The hypothesis of a causal relationship between intake of phosphoric acid-containing soft drinks and hypocalcemia warrants further investigation.