Safety profile of paediatric percutaneous ultrasonography-guided renal biopsies

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ABSTRACT

Introduction: Renal biopsy (RB) is a decisive diagnostic procedure for patients with renal disease. Our aim was to assess the safety of RB and the prevalence of associated clinical complications.

Methods: A total of 166 RBs were performed in 164 children (88 boys, 76 girls) in East Bohemia in 1997–2007. The mean age of the children was 12.9 +/− 4.1 years. All RBs were performed by a single consultant nephrologist. 27 biopsies were performed in 27 patients (16.3 percent) in 1997 under radiography control, while the remaining 139 biopsies (83.7 percent) were performed under ultrasonographic guidance. Renal ultrasonography (USG) following RB was not a general rule in patients who were biopsied under radiography control before 1998; therefore, only the USG results in patients after USG-guided RB (n = 139) were evaluated.

Results: No major complications were encountered, and only minor complications occurred in 39 (23.5 percent) patients, which did not require medical intervention. The most common complication was asymptomatic perirenal haematoma, which was detected by USG one to three days after a USG-guided RB (30 out of 139 biopsies; 21.6 percent). Perirenal haematoma accompanied by abdominal pain occurred in two (1.4 percent) patients. Macroscopic haematuria was present in seven (4.2 percent) patients on Days 1–3 post biopsy. The complications were neither age-dependent nor were they related to the serum creatinine levels.

Conclusion: The results obtained are consistent with those in other reports of paediatric patients. The absence of major complications is a favourable outcome. Thus, the present practice of USG-guided percutaneous RB in children is safe and clinically beneficial.

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INTRODUCTION

Renal biopsy (RB) is a decisive diagnostic procedure for patients with renal disease in that it can provide a final diagnosis in clinical practice. The current practice of ultrasonography (USG)-guided percutaneous RB is considered to be safe and clinically beneficial. There are both major and minor post-biopsy complications associated with RB. Minor complications are those that do not require medical intervention, and include macroscopic haematuria as well as perirenal/subcapsular haematoma with spontaneous resorption in less than three months.[1,2] Major complications are those that require intervention, such as transfusion of blood products or an invasive procedure (radiographic or surgical such as an arteriogram or embolisation), and these may result in acute renal obstruction, failure, septicaemia or death. Major complications of RB include macroscopic haematuria where blood transfusion is required, haematoma requiring intervention, arteriovenous fistula, aneurysm, acute urinary tract obstruction by a blood coagulate and renal rupture.[1,2]

The aim of this study was to assess the safety of RB and the prevalence of clinical complications in children and adolescents aged 1–19 years from our centre in 1997–2007. A secondary aim was to compare the safety of radiography-controlled and USG-guided percutaneous RB and to explore a possible relationship between clinical complications and age or serum creatinine levels, respectively.

METHODS

A total of 166 RBs were performed on the native kidneys of 164 paediatric patients (88 boys, 76 girls) between January 1, 1997 and December 31, 2007. Two biopsies were reconducted for therapeutic/diagnostic reasons at different time points of follow-up. All biopsies were performed at the Department of Paediatrics in Hradec Králové by a single consultant nephrologist. Informed consent was obtained from the patients before each procedure was conducted. The mean age of the patients

Table I. The diagnostic distribution of the biopsied patients (n = 164).

Diagnosis	No. (%)
IgA nephropathy	40 (24.4)
Mesangioproliferative glomerulonephritis	31 (18.9)
Thin basement membrane glomerulopathy	22 (13.4)
Alport´s syndrome	17 (10.4)
Minimal change disease	13 (7.9)
Henoch-Schöenlein purpura	10 (6.1)
IgM nephropathy	7 (4.3)
Membranoproliferative glomerulonephritis	5 (3.0)
Lupus nephritis	5 (3.0)
Focal segmental glomerulosclerosis	4 (2.4)
Tubulointerstitial nephritis	3 (1.8)
Membranous nephropathy	2 (1.2)
Acute postinfectious nephropathy	2 (1.2)
Wegener's granulomatosis	1 (0.6)
Normal finding	1 (0.6)
Non-diagnostic	1 (0.6)
Total	164 (100)

Table II. The diagnostic distribution of the biopsied patients with post-biopsy complications (n = 39).

Diagnosis	No. (%)
IgA nephropathy	15 (38.5)
Thin basement membrane glomerulopathy	7 (17.9)
Alport´s syndrome	6 (15.4)
Mesangioproliferative glomerulonephritis	3 (7.7)
Minimal change disease	3 (7.7)
Tubulointerstitial nephritis	3 (7.7)
Acute postinfectious nephropathy	1 (2.6)
IgM nephropathy	1 (2.6)
Total	39 (100)

at the time of RB was 12.9 ± 4.1 (range 1–19) years. Haematuria and haematuria with proteinuria were the two most common indications for biopsy. None of the patients presented with end-stage renal failure, and none was dialysed. All patients underwent a routine pre-biopsy assessment, including medical history-taking, a physical examination, blood pressure measurement, laboratory examination with blood and platelet counts, coagulation profile and blood group assessment. Blood pressure was found to be under control in all the patients. 27 (16.3%) biopsies were performed in 1997 under radiographic control by implementing Franklin's modification of the Vim-Silvermann needle. The remaining 139 (83.7%) biopsies were performed under USG guidance, utilising single-use biopsy guns, in particular, the Speed cut biopsy gun (Gallini Medical, Mantova, Italy) in 1998–2002 and the Monopty device gun (CR Bard Inc, Covington, GA, USA) from 2003 onwards. TruCut needle (Travenol Labs, Deerfield, IL, USA) was used in nine biopsies (5.4%). As a rule, general anaesthesia was used in all children under 12 years of age, while local anaesthesia was used in children older than 12 years of age. All biopsies were performed on an inpatient basis, with close post-biopsy monitoring that involved blood pressure control as well as blood count and urine assessment in all patients. 165 (99.4%) biopsies were diagnostic. Renal USG was performed 24 hours after the biopsy in all patients who underwent USG-guided percutaneous RB. Renal USG following RB was not performed as a general rule in patients who were biopsied under radiographic control (before 1998); therefore, we evaluated renal USG results in patients only after USG-guided RB (n = 139). We did not evaluate the number of punctures, as bleeding and its severity are not known to be correlated with this parameter.[1] For statistical evaluation, unpaired *t*-test and chi-square tests were used. For all results, $p < 0.05$ was required in order to achieve statistical significance.

RESULTS

No major complications were encountered, and only minor complications occurred in 39 (23.5%) patients, which did not require medical intervention. The most common complication was asymptomatic perirenal haematoma, which was detected by USG 1–3 days after RB (30 out of 139 patients; 21.6%). Perirenal haematoma accompanied by abdominal pain occurred in two out of the 139 patients (1.4%). Macroscopic haematuria on Days 1–3 post biopsy was present in seven (4.2%) patients: in two out of 27 patients after radiography-controlled RB (7.4% of this subgroup; 1.2% of total RB) and in five out of 139 patients after USG-guided RB (3.6% of this subgroup; 3.0% of total RB). There was no significant difference in the prevalence of macroscopic haematuria between the two subgroups ($p = 0.37$). Macroscopic haematuria resolved uneventfully in 24–48 hours. Blood transfusion was not necessary in any of the cases.

The diagnostic distributions of all biopsied patients and of the patients with complications are presented in Tables I and II, respectively. The difference between the diagnostic distributions of all biopsied patients and of patients with post-biopsy complications, both expressed in percentages, was not statistically significant ($p = 0.39$). However, all three patients with tubulointerstitial nephritis (TIN) experienced minor post-biopsy complications. The age and serum creatinine levels of patients with complications did not differ significantly from those of patients without complications (Table III).

Table III. The age and serum creatinine levels of the renal biopsy patients.

	Mean age ± SD (yrs)	p-value*	Mean serum creatinine ± SD (μmol/L)	p-value**
RB without complications (n = 127)	12.69 ± 4.21	NA	61.08 ± 21.61	NA
RB without complications after USG-guided RB (n = 102)	12.80 ± 4.20	NA	61.43 ± 23.26	NA
RB with complications (n = 39)	13.95 ± 2.96	0.08	64.49 ± 23.10	0.40
Perirenal haematoma after USG-guided RB (n = 32)	13.84 ± 2.93	0.14	65.41 ± 24.63	0.33
Macroscopic haematuria (n = 7)	14.43 ± 3.31	0.28	60.29 ± 14.87	0.92

* p-value when compared to the age of the subjects with uneventful RB. ** p-value when compared to the serum creatinine levels of the subjects with uneventful RB.
NA: not applicable; RB: renal biopsy; SD: standard deviation; USG: ultrasonography

DISCUSSION

We recorded similar rates of post-biopsy complications as other authors who have reported the incidence rate of complications to be 13%–45%.[3-9] Perirenal haematoma was the most frequently encountered complication (23%, with 21.6% asymptomatic and 1.4% painful). This corresponds with previously reported results of children post RB, where perirenal haematoma was present in 12.4%,[4] 18%–21%[6,7] and 26%[8] of patients. However, other paediatric nephrologists have reported lower perirenal haematoma occurrence rates of 0%–7.2%.[3,5,9,10] These differences might originate from a variety of interpretations of the USG findings regarding the size and/or surface area of observed haematomas. Our finding of 4.2% post-biopsy macroscopic haematuria was in the lower range of complications that are encountered when compared with other observations, where the rate of gross haematuria was 2.6%–16.8% and up to 30.8%.[3,4-6,8,10] Perirenal haematoma accompanied by abdominal pain was rarely encountered among our patients (1.4%) in comparison with other reports, where the incidence of abdominal pain/painful micturition was 7%–11%.[3,8]

The difference between the diagnostic distribution of all biopsied patients and of patients with post-biopsy complications was not statistically significant in our study. Based on the fact that all three patients with TIN experienced post-biopsy complications, TIN might be considered a potential risk factor for RB. However, this outcome might have been skewed by the small number of TIN patients in our study. No other risk factors or predictors of renal biopsy complications were identified. Some studies have reported an increased risk of post-biopsy bleeding in adults with high serum creatinine levels[2] as well as in younger patients,[1] but this finding was not confirmed among our paediatric patients. As there was no significant difference in the prevalence of macroscopic haematuria between the RB performed under radiography control and under USG guidance, USG-guided percutaneous RB can be considered to be a safe procedure. We did not encounter any major post-biopsy complications. This should be considered a favourable outcome, as the incidence rate of major complications has been reported to be 0.8%–4.8% in other studies.[6,7,9] Although no major complications occurred in our patient group, we still recommend performing RB on an inpatient basis. Based on the literature, up to 33% of major complications may be missed after outpatient RB.[2] Major complications are apparent in only 67% of patients after eight hours, but more than 90% are evident by 24 hours post biopsy.[2] In conclusion, the current practice of USG-guided RB is safe and clinically beneficial.

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