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ORIGINAL ARTICLE

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Standards for renal biopsies: comparison of inpatient and day care procedures

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Abstract There are no national standards for the adequacy and complications of percutaneous renal biopsies. We developed local standards that have been used in a prospective audit of biopsies undertaken in a tertiary pediatric nephrology unit between January 1997 and December 2000. We compared outcomes of biopsies performed on inpatients with day care procedures. A total of 251 biopsies (113 transplant) were undertaken, 114 (46%) as day care procedures. Adequate tissue for diagnosis was obtained in 245 (97.6%), with a standard set at >95%. This was also achieved for a mean number of passes in native (<3 in 80%) and transplanted (<2 in 80%) kidneys. Eleven patients (4%) developed macroscopic hematuria (standard <5%) and none required transfusion. Delay in discharge occurred in 4 patients, and a further 4 returned to the ward post discharge. There was no significant difference in complication rates between inpatient and day care patients. Our local biopsy standards were met in this audit. Such standards could provide useful comparisons between units in national audit programs, as well as permitting the monitoring of individual performance as part of clinical governance. Day care procedures benefit the patient and family, as well as significantly reducing costs.

Keywords Biopsy · Standards · Day care procedures · Audit

Introduction

Renal biopsies are an essential component of the management of renal disease in both children and adults. Biopsies in children have the added difficulties of patient size and ability to co-operate. Traditionally biopsies have resulted in patients staying in hospital overnight to monitor complications, with some units using general anesthesia routinely to perform the procedure [1, 2, 3, 4].

In recent years, there have been increasing reports of the use of percutaneous renal biopsies as a day care procedure. This has obvious benefits, including less disruption to family life and cost savings [5, 6, 7, 8, 9, 10].

The current health care climate in the United Kingdom is one of greater provision of information to, and involvement of, the patient and family as part of a patient-centered approach. This needs to be combined with public access to data on quality of care and outcomes [11]. Quality standards can be monitored by audit for which there needs to be agreed standards. Surprisingly, the standards document produced by the Renal Association of the United Kingdom provides no agreed standards with respect to adequacy of renal biopsies for diagnostic purposes or complication rates against which performance can be assessed [12]. It states only that the laboratory used should have the capability to process biopsies satisfactorily.

Percutaneous renal biopsies have been undertaken in our unit as a day care procedure since 1990 [10]. Annual review of biopsies performed suggested standards that have been used prospectively in the current study.

Materials and methods

From January 1997 to December 2000 all children undergoing a percutaneous renal biopsy, either as outpatients or inpatients (when time allowed), followed a standard preparation procedure [10, 13]. They were provided with an information booklet (*Rebecca has a renal biopsy*, Children and Young People's Kidney Unit, City Hospital, Nottingham) by post or on arrival at the ward. The play leaders (nursery nurses) meet with the child and family and use a play preparation package (including photo album, word search) to discuss the procedure with the child at an age-appropriate level [10, 14].

The biopsy is performed in the treatment room on the ward, which has been decorated with distraction materials. The child is fasted prior to the biopsy, but is allowed fluids up to 2 h before. Topical local anesthetic cream (EMLA, lidocaine 2.5% and pritocaine 2.5% or Ametop tetracaine 4%) is placed over the site to

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Table 1 Demography of renal biopsy patients and complications

	Native		Transplant		Total	
	Inpatient	Day care	Inpatient	Day care	Inpatient	Day care
Number	68	70	69	44	137	114
Mean age (years)	7.9	10.77	12.0	14.02	9.95	12.40
(range)	0.09–15.85	2.39–17.82	2.25–18.76	4.3–19.16		
Mean no of passes	2.56	2.59	1.44	1.6	2.0	2.1
(range)	2–5	2–6	1–5	1–5		
Gross hematuria	5	2	2	2	7	4
Hypoxia	1	0	4	0	5	0
Pain	1	2	1	2	2	4
Return	1	1	1	1	2	2

be used for intravenous cannulation and over the intended biopsy site. A full blood count and clotting studies (prothrombin time, activated partial thromboplastin time) are carried out prior to the procedure. No platelet function studies or bleeding times are routinely performed.

Two doctors are present throughout the procedure, one to perform the biopsy and a second to administer the sedation. At least one (if not both) of the doctors present will have undertaken an advanced pediatric life support course. The child is sedated while flat on his/her stomach with a slow intravenous injection of pethidine (1 mg/kg body weight – maximum 50 mg) and Diazemuls (diazepam 0.2–0.4 mg/kg body weight – maximum 20 mg), with heart rate and oxygen saturation being monitored throughout the procedure. Full resuscitation equipment is present in the treatment room. Ketamine (0.5–2 mg/kg body weight) is administered only if the child is still restless after the initial sedation.

Visualization of both kidneys is carried out with a portable ultrasound machine (Ultramark 4A, Advanced Technology Laboratories) by the nephrologist and the preferred biopsy site (left lower pole) marked on the back. The site is then infiltrated with warmed lignocaine [15]. All biopsies were performed using a spring-loaded 16-gauge needle (Cook Quick-Core). A minimum of two cores are obtained for diagnostic biopsies (one core for light microscopy, one core divided for electron microscopy and immunofluorescence) and one core for renal transplant patients. The cores are immediately passed to a histopathology technician for examination of their adequacy under a dissecting microscope.

Following the procedure the child returns to the ward and is monitored every 30 min (pulse and blood pressure) for 2 h and then hourly for a further 4 h. Patients are allowed home after 6 h if they are fully conscious, free of pain, and are drinking and passing urine without gross hematuria.

The audit form is completed following the biopsy, including the name and grade of the operator. Nursing and medical staff complete the audit form prior to discharge, with regards to complications such as oxygen requirement, hematuria, requirement for analgesia, delayed discharge from the ward, and return to the ward following discharge.

The quality and adequacy of the biopsy material obtained is reviewed at the time of the regular joint histopathology meetings. An adequate biopsy is defined as one in which the pathologist could achieve a confident diagnosis, and generally included >10 glomeruli.

Standards

The local standards used to audit our performance were:

1. Number of passes in native kidneys to obtain adequate material including cortex and glomeruli (judged by dissecting microscope) <3 in 80%
2. Number of passes in transplant kidneys <2 in 80%
3. Adequate tissue for histological diagnosis obtained in >95% (on review with histopathologists)
4. Major complication rate <5% (macroscopic hematuria that did not immediately clear and required checking hemoglobin levels and/or transfusion and/or surgical exploration; prolonged hospital stay due to requirement for analgesia; hypoxia that required intervention or facial oxygen >1 h post biopsy).

Results

A total of 169 patients (106 male) underwent 251 biopsies (113 transplant kidneys) (Table 1). The mean age at biopsy was 11.1 years (range 0.1–19.2 years) with 27 patients (undergoing 31 biopsies) being younger than 5 years of age. There were 17 biopsies performed under general anesthesia because the child was undergoing some other procedure (e.g., dialysis catheter insertion) or because the small size of the child made general anesthesia with control of breathing and needle insertion an apparently safer proposition (8 patients <5 years old, 4 <1 year). All biopsies were carried out percutaneously, with no open biopsies being performed during the 4-year period.

Of the remaining biopsies, 114 (49%) were carried out as a day care procedure. This is an underestimate as some patients were allowed home on the same day as the biopsy, but had been admitted overnight for other procedures or investigations and were therefore classed as inpatients. The greatest distance that a child travelled for a day care biopsy was 120 miles.

There were 22 (13%) patients who required ketamine in addition to the standard pethidine and Diazemul sedation. Only 5 patients (no day care patient) required transient oxygen administration (less than 1 h by face mask) on the ward post biopsy; of these, 1 had received additional ketamine. There were 5 patients who received no sedation whatsoever (mean age of 13.9 years, range 6–17.3 years). They were talked through the procedure by the play leader and were content with "verbal sedation."

There were 11 patients (4%) who developed macroscopic hematuria following the biopsy. This occurred in 7 inpatients and 4 day care patients. Of the 7 patients who had hematuria after a native biopsy, 5 had Henoch-Schönlein purpura/mesangial IgA nephropathy (34 patients in total, compared with 2 of 104 with other condi-

tions, P=0.01, Fisher's exact test). One patient returned to the ward with hematuria and required a check of the hemoglobin level, which was within the normal range (11.2 g/dl). No patients required a blood transfusion.

Delayed discharge from the ward occurred in 4 day care patients; 1 with prolonged drowsiness, 2 with hematuria, and 1 requiring analgesia. There were 4 patients (2 inpatients and 2 day care patients) who returned to the ward; 1 with gross hematuria (renal tract ultrasonography showed no abnormality), 1 with a urinary tract infection, and 2 without significant findings; they were discharged the same day.

There were no significant differences between the inpatient and day care patients in terms of hematuria (chi-squared test P=0.55), pain-requiring analgesia (P=0.06), or return to the ward (Table 1).

Comparison with standards

The mean number of passes in native kidneys was 2.6 (range 2–6), with apparently adequate biopsy material by dissecting microscope being obtained in 86% with <3 passes. The mean number of passes in transplant kidneys was 1.5 (range 1–5), with material being obtained in 91% in <2 passes. Adequate tissue for histological diagnosis was obtained in 245 (97.6%) biopsies. The major complication of gross hematuria occurred in 11 patients (4.4%), but only 1 required checking the hemoglobin level, and none required transfusion.

Discussion

This prospective audit has confirmed that we have met our own local standards. There are no major differences between biopsies performed in children undergoing this procedure as a day care patient compared with inpatients, with respect to complications or adequacy of the material obtained for histology. We are surprised that few pediatric or adult units undertake biopsies as a day care procedure, especially as our results are supported by others in the literature [5, 6, 9].

We would emphasize the importance of play preparation and sedation prior to renal biopsy in children, and the central role played by the play leaders. We increasingly involve even young children in the consent process and it is interesting to note that 5 children elected to have no sedation but were talked through the procedure. The ability to perform the procedure in the ward treatment room is much less disruptive to the families and has great savings on time. The majority of medical and nursing staff have now attended advanced pediatric life support courses and we feel that performing biopsies under conscious sedation, with appropriate preparation, is appropriate [16, 17, 18]. We have demonstrated no adverse complications and no child has required resuscitation in the 11 years we have been performing biopsies using this sedation protocol.

There are also advantages of performing day care biopsies with regard to cost. The estimated cost of performing a biopsy as a day care procedure is £334 (U.S. $ 481), whereas an overnight stay in hospital is estimated to cost £1,618 (U.S. $ 2,330). An estimated saving of £36,586 (U.S. $ 52,684) per annum has been made by performing biopsies as a day care procedure.

The complication rates found compare favorably with those previously reported [3, 8, 19, 20, 21]. Although 11 patients developed macroscopic hematuria, none required transfusion. We noted a significantly higher percentage of patients with macroscopic hematuria post biopsy with either Henoch-Schönlein purpura or mesangial IgA nephropathy. These patients may be particularly prone to develop this complication, which warrants prospective evaluation.

In order to monitor unit and operator performance, standards are necessary to audit against. Collaboration between nephrologists and histopathologists has resulted in the development of local standards. These will need to be continually refined. If standards are agreed upon nationally, this may lead to comparison between units and allow individual operators to monitor their own performance and hence fulfill health care directives.

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