Percutaneous renal biopsy in the district general hospital

ABSTRACT—This paper reports a retrospective study of the clinical value of percutaneous renal biopsy in secondary referral centres. Between 1984–90, 205 patients over the age of 16 had 218 biopsies at three district general hospitals. Adequate tissue was obtained in 194 patients (95%, 89% of the biopsies). Significant complications occurred in only four patients. In 170 patients (83%) the biopsy yielded information of diagnostic and prognostic value and influenced management.

The main indications for biopsy were nephrotic syndrome, in 63 patients, and chronic renal failure, in 58 patients. The most frequent findings were minimal change disease, focal segmental glomerulosclerosis, IgA nephropathy, membranous glomerulonephritis and mesangiocapillary glomerulonephritis. The most obvious association between indication and histology was between haematuria and IgA nephropathy.

Percutaneous renal biopsy in the district general hospital in patients selected by a nephrologist and performed by experienced or supervised operators is a safe procedure. There is a high yield of renal tissue which is of clinical value in patient care.

Published series of the results of percutaneous renal biopsy originate largely from tertiary referral centres [1–5]. However, many patients with renal disease are managed in district general hospitals where the renal workload may more closely reflect the prevalence of renal disease in the general population. We therefore performed a retrospective study of renal biopsies performed in three district general hospitals in South-East England (with a total catchment population of 700,000). Each hospital has a single consultant physician specialising in renal medicine. All refer patients to tertiary centres for renal replacement therapy but have facilities for managing acute renal failure.

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Method

Patients over the age of 16 on whom renal biopsies had been performed at the Whittington Hospital, Broomfield Hospital, and Basildon Hospital between September 1984–August 1990 were identified from renal unit records and histology. Details of the clinical characteristics and indication, histological diagnosis if made, complications of biopsy and effect of biopsy on clinical diagnosis and management were recorded for each patient.

The clinical indications for renal biopsy were defined as follows:

> *nephrotic syndrome:* proteinuria and hypoalbuminaemia sufficient to cause oedema;
> *asymptomatic proteinuria:* more than 1g of proteinuria over 24 hours in the absence of oedema, renal insufficiency, significant haematuria, or other relevant pathology;
> *haematuria:* persistent microscopic haematuria or episodes of macroscopic haematuria in the absence of a urological explanation;
> *persistent urinary abnormalities:* presence of both significant haematuria and proteinuria in the absence of significant renal impairment or other relevant pathology;
> *acute and subacute renal failure:* decline in renal function over days or weeks;
> *chronic renal failure:* evidence of chronic renal insufficiency;
> *other:* where the indication did not fit one of the above categories.

Percutaneous renal biopsies were performed using a modified Vim-Silverman, renal Menghini or 'Trucut' biopsy needle [6,7] by the renal consultant or registrar at each hospital. Localisation was performed at two centres by ultrasound [8] and by intravenous urogram at the third centre [9]. Light microscopy, electron microscopy, and immunohistochemistry were performed on all samples where appropriate and tissue was available.

Clinically significant complications were identified from the case notes. Haemorrhage, either perirenal or manifest as haematuria, was not considered a significant complication unless it caused hypotension or required blood transfusion. The clinical utility of biopsy was assessed from the case notes and after discussion with the responsible consultant as being of value when the biopsy influenced management (including being diagnostic or prognostic without necessarily producing

a change in therapy), or of no value when no tissue was obtained or no definite histological diagnosis made.

Results

Yield of tissue

Each of the three centres contributed about one-third of the 205 patients on whom renal biopsies were performed. Eleven patients had more than one biopsy. Fig 1 shows the age and sex distribution of the patients studied. Adequate renal tissue was obtained in 194 of 205 patients (95%) and of 218 renal biopsies (89%). In seven patients (3%) the renal tissue obtained was normal and in a further seven patients, despite abnormal renal tissue, no histological diagnosis was made. Hence, pathognomonic histology was obtained in 180 of the patients who underwent renal biopsy (88%) and in 83% of renal biopsies performed.

Indications for biopsy

The most frequent indications for renal biopsy were nephrotic syndrome (63 patients) and chronic renal failure (58 patients). Twenty five patients were found to have asymptomatic proteinuria, 22 had haematuria, 14 patients presented with acute or rapidly progressive renal failure, and 14 patients had persistent urinary abnormalities. In the remaining nine patients, reasons for biopsy included four with a suspected diagnosis of vasculitis without a specific renal manifestation of vasculitis.

Histology

Figure 2 shows the results in the 180 patients in whom a pathological diagnosis was made on biopsy. Of the 13 patients with lupus nephritis, six were biopsied to make a diagnosis and seven to assess disease activity.

Fig 1. *Age and sex distribution of 205 patients undergoing renal biopsy (120 men, 85 women)*
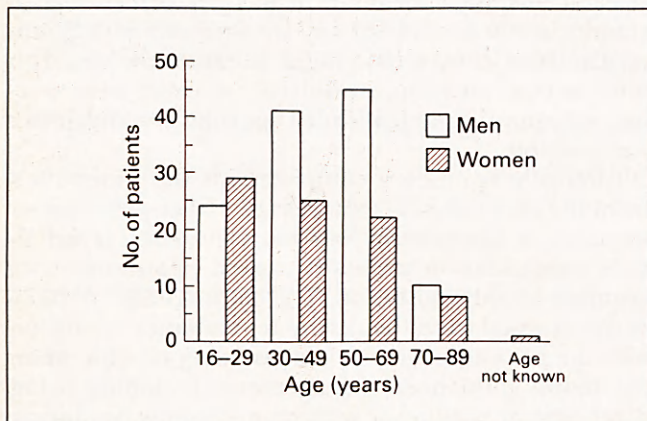
Four of the 13 cases of interstitial nephritis were due to sarcoidosis and one was due to tuberculosis. Wegener's granulomatosis accounted for four of the 10 patients with a diagnosis of vasculitis.

Diabetic glomerulosclerosis was present in eight patients but a diagnosis other than diabetic glomerulosclerosis was present in four of the 11 diabetics who underwent renal biopsy; two showed minimal change disease, one focal segmental glomerulosclerosis, and one pyelonephritis. Other less common diagnoses included hypertensive changes in four patients, post-streptococcal glomerulonephritis and thin membrane disease each present in three patients, acute tubular necrosis and ischaemic changes each in two patients, and obstruction and renal vein thrombosis in one patient each.

Relationship between indication for biopsy and histological diagnosis

The most obvious association between indication for biopsy and histology was the finding of IgA nephropathy in 13 of the 22 patients biopsied for haematuria, in contrast to the 14 patients presenting with persistent urinary abnormalities who had a wide range of diagnoses. The commonest findings in the 63 patients who presented with nephrotic syndrome were minimal change disease in 16, membranous glomerulonephritis in 11, focal segmental glomerulosclerosis in nine, lupus nephritis in seven, and mesangiocapillary glomerulonephritis in six patients. In the 25 patients with asymptomatic proteinuria findings were similar apart from the absence of minimal change disease, with focal segmental glomerulosclerosis accounting for four, membranous glomerulonephritis for three, mesangiocapillary glomerulonephritis for three, and vasculitis for three patients.

The 58 patients biopsied for chronic renal failure with adequate renal tissue obtained at biopsy from 50 patients (86%) showed a spectrum of disease. Five biopsies showed focal segmental glomerulosclerosis, five diabetic glomerulosclerosis, four sarcoidosis, four mesangiocapillary glomerulonephritis, four interstitial nephritis, four endstage disease, three membranous glomerulonephritis, three Wegener's granulomatosis, and three hypertensive changes. Other diagnoses included two each of lupus glomerulonephritis, other vasculitides and crescentic glomerulonephritis.

Only 14 patients were biopsied for acute renal failure: five showed crescentic glomerulonephritis, two acute tubular necrosis, and two interstitial nephritis. Three of the nine biopsies performed for other indications (including exclusion of vasculitis without renal manifestations) had normal histology and two showed vasculitis (including one case of Wegener's granulomatosis). A table with the full details of the histological diagnoses found in each indication for renal biopsy is available on request from the authors.
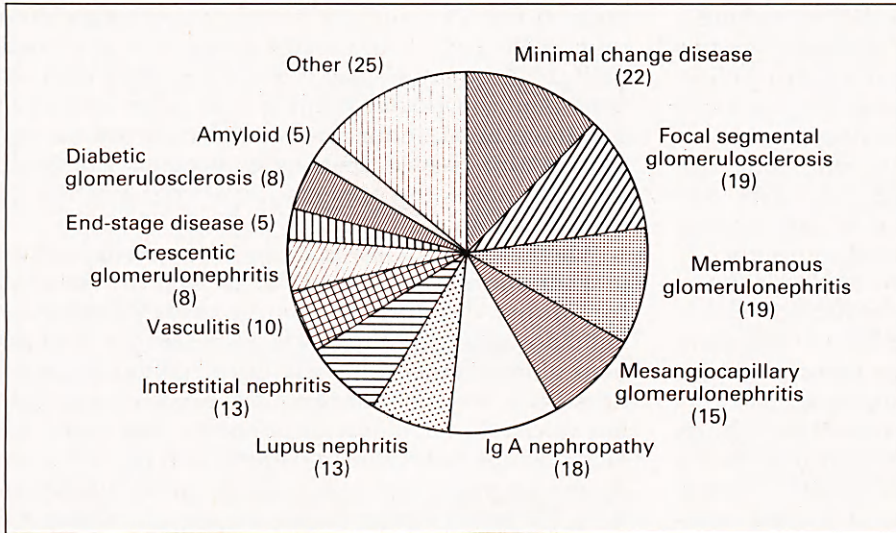
Fig 2. *Histological diagnoses in 180 abnormal renal biopsies (numbers in brackets)*

Value of renal biopsy

Table 1 shows the value of renal biopsy for the different indications for renal biopsy. Renal biopsy was of most value in patients with proteinuria and nephrotic syndrome but was of value in over 70% of patients in all diagnostic groups. Overall, renal biopsy influenced management in 170 patients (83%).

Complications

No patient died as a result of renal biopsy, but four had significant complications. One patient (aged 19), who presented with acute renal failure due to a rapidly progressive glomerulonephritis, developed a renal artery aneurysm after renal biopsy which had been performed without kidney imaging at the time of biopsy and eventually required a nephrectomy. Three patients (aged 59, 65, and 74), all of whom were in chronic renal failure, had bleeding sufficient to necessitate blood transfusion although no further intervention was required.

Discussion

Previously reported series of renal biopsies in developed countries have largely reflected the workload of tertiary referral centres [3]. Other large published series of biopsies demonstrate the clinical and histological features of different presentations of renal disease [10–12], or disease processes [13,14], or the value of renal biopsy in certain groups, such as the elderly population [15,16]. We report here the first large series to originate from district general hospitals in the UK. The indications for renal biopsy in this series reflect the clinical presentations of renal disease to the district hospital physician, and may therefore reflect more closely the patterns of renal disease in the population.

Adequacy of tissue obtained by renal biopsy was defined by the opinion of the histologist rather than as an absolute number of glomeruli, to take account of the focal, evolutionary, and often non-specific nature of many of the pathological processes affecting the kidney (eg mild basement membrane thickening) and hence the varying amount of tissue required to make a definite histological diagnosis [17,18]. Almost all (95%) renal biopsies yielded adequate tissue for histological assessment, which compares favourably with other studies which yielded adequate tissue in 79–96% [1,3,19,20].

The clinical benefit of biopsy was assessed as valu-

Table 1. Value of renal biopsy for the different indications for renal biopsy

	Biopsy of value (diagnostic/ influenced management)	No value (no tissue or no definite diagnosis)	Total number
	n (%)	*n* (%)	
Nephrotic syndrome	59 (94)	4 (6)	63
Asymptomatic proteinuria	24 (96)	1 (4)	25
Haematuria	17 (77)	5 (23)	22
Persistent urinary abnormalities	10 (71)	4 (29)	14
Acute renal failure	10 (71)	4 (29)	14
Chronic renal failure	43 (74)	15 (26)	58
Other	7 (78)	2 (22)	9

able if it influenced management, including making a diagnosis, or as being of no value. For several reasons it was not considered useful to make a distinction between a biopsy which is diagnostic but does not result in a change in therapy, and a diagnosis which results in a change in treatment. For many renal diseases, such as IgA nephropathy, there is no disease-modifying therapy, and this method of categorising the value of renal biopsy would reflect the incidence of the underlying diagnoses in that the diagnosis determines whether specific treatment is available. Further, individual clinical practice as to whether to treat some renal diseases varies: eg, the use of immunosuppressive therapy in membrane glomerulonephritis, and this would influence the assessment of value of renal biopsy. Combining diagnostic biopsies that lead to no change in therapy with biopsies that do alter therapy has the advantage of recognising the value of not missing treatable conditions as well as avoiding unnecessary and potentially hazardous medication. Of equal importance is the real benefit to the patient and physician of knowing the diagnosis and prognosis with its associated implications for life assurance, follow-up assessments, and other matters affecting the patient's lifestyle.

Renal biopsy was of value in 83% of our patients when assessed in this way. Prospective studies also confirm the clinical utility of biopsy. There were differences between the prebiopsy and pathological diagnosis in 44–63% of biopsies, and a change in the therapeutic approach in 31–34% [4,5]. It was not possible to predict the likely clinical value of renal biopsy from the clinical presentation and indication for biopsy in our study, but renal biopsy was of value in over 70% of patients for each indication.

Nephrotic syndrome was the most common indication (31%); this was also the case in several other studies where it accounted for 21–37% of presentations [2,3,5,19]; however, in our study chronic renal failure was a much more common indication for biopsy (28%) than in these other studies (3–12%). The subclinical presentations of asymptomatic proteinuria (12%), haematuria (11%), and persistent urinary abnormalities (7%) were found as often as in a community-hospital-based series in the United States [19]. Fewer patients (7%) presented with rapidly progressive renal failure than in some series [5,17,20], reflecting differing referral patterns.

Comparisons with published series show similar prevalence of glomerular disease including minimal change disease, focal segmental glomerulosclerosis, IgA nephropathy, membranous glomerulonephritis, and mesangiocapillary glomerulonephritis [19,21]. The correlations between indication for biopsy and histology were also in general agreement with the literature [10,22], in particular the strong association between IgA nephropathy and haematuria [11].

Renal biopsy in diabetic patients was not performed routinely but was considered whenever there were atypical features, such as heavy proteinuria without retinopathy [18]. Using such criteria, 36% of diabetic patients in our study had a diagnosis other than diabetic nephropathy, in keeping with other series [23, 24]. It was also not our practice to biopsy patients presenting with classical acute post-infectious glomerulonephritis unless the presentation or course of the disease was unusual.

Whether renal biopsy is always indicated in nephrotic syndrome is still disputed [25,26] and the threshold for biopsy depends to some extent on whether immunosuppressive therapy is advocated for membranous glomerulonephritis and other glomerulonephritides [27]. The renal physicians in our hospitals had a low threshold for biopsy in nephrotic syndrome, and biopsy was of most value in patients with nephrotic syndrome or proteinuria, as in some other studies [1, 3–5]. There is a similar debate on the role of biopsy in lupus nephritis, either to establish a diagnosis or to assess disease activity (with regard to the need for immunosuppressive therapy); we had a low threshold for biopsy in both these situations [28–30].

Renal biopsy was a safe procedure in this series. There were no deaths; the reported mortality associated with 19,459 renal biopsies performed between 1951 and 1990 was 0.08% (31). Blood loss severe enough to require transfusion occurred in 1.4% of our biopsies, similar to the 0–2.9% reported in other series [31,32]. One patient, whose kidney was not imaged at the time of renal biopsy, required a nephrectomy. This 0.5% incidence of nephrectomy falls within the published 0.06–2.6% range of incidence for nephrectomy as a complication of renal biopsy [8,31].

Renal biopsy is increasingly being performed by radiologists using ultrasound and CT-scan guided spring-loaded needle biopsy devices [20,32,33]. Whilst this method is safe and has a high yield of tissue in carefully selected patients, its increasing use may result in non-nephrologists asking radiologists to perform renal biopsies. We believe that the risks of the procedure and the potential benefits to any one patient can only be fully assessed by a nephrologist, who will generally work with a pathologist with a renal interest.

In conclusion, percutaneous renal biopsy with localisation of the kidneys can be performed safely in the district general hospital by experienced or supervised operators. There is a high yield of adequate renal tissue which is diagnostic and of clinical utility in a high proportion of cases. Renal biopsy continues to be an important investigation in the management of selected patients presenting with renal disease to the district general hospital. All patients in whom renal biopsy is considered require assessment by a nephrologist.

References

1 Kark RM, Muehrcke RC, Pollak VE, *et al.* An analysis of five hundred percutaneous renal biopsies. *Arch Intern Med* 1958;**101**: 439–51.

2 Diaz-Buxo JA, Donaldio JV. Complications of percutaneous renal biopsy: an analysis of 1,000 consecutive biopsies. *Clin Nephrol* 1975;**4**:223–7.

3 Paone DB, Meyer LE. The effect of renal biopsy on therapy in renal disease. *Arch Intern Med* 1981;**141**:1039–41.

4 Turner MW, Hutchinson TA, Barre PE, *et al.* A prospective study on the impact of the renal biopsy in clinical management. *Clin Nephrol* 1986;**26**:217–21.

5 Cohen AH, Nast CC, Adler SG, Kopple JD. Clinical utility of kidney biopsies in the diagnosis and management of renal disease. *Am J Nephrol* 1989;**9**:309–15.

6 Kark RM, Muehrcke RC. Biopsy of the kidney in prone position. *Lancet* 1954;**1**:1047–9.

7 McGonigle R, Sharpstone P. Procedures in practice: kidney biopsy. *Br Med J* 1980;**280**:547–9.

8 Mailloux LU, Mossey RT, McVicar MM, *et al.* Ultrasonic guidance for renal biopsy. *Arch Intern Med* 1978;**138**:438.

9 Bolton WK, Vaughan ED. A comparative study of open surgical and percutaneous renal biopsies. *J Urol* 1977;**117**:696–8.

10 Blainey JD, Brewer DB, Hardwicke J. Proteinuric glomerular disease in adults: cumulative life tables over twenty years. *Q J Med* 1986;**230**:557–67.

11 Copley JB, Hasbargen JA. 'Idiopathic' hematuria: a prospective evaluation. *Arch Intern Med* 1987;**147**:434–7.

12 Tiebosch ATMG, Wolters J, Frederik PFM, *et al.* Epidemiology of idiopathic glomerular disease: A prospective study. *Kidney Int* 1987;**32**:112–6.

13 Tateno S, Kobayashi Y, Shigematsu H, Hiki Y. Study of lupus nephritis: its classification and the significance of subendothelial deposits. *Q J Med* 1983;**207**:311–31.

14 Esdaile JM, Federgreen W, Quintal H, *et al.* Predictors of one-year outcome in lupus nephritis: the importance of renal biopsy. *Q J Med* 1991;**295**:907–18.

15 Kingswood JC, Banks RA, Tribe CR, *et al.* Renal biopsy in the elderly: clinicopathological correlations in 143 patients. *Clin Nephrol* 1984;**22**:183–7.

16 Preston RA, Stemmer CL, Materson BJ, *et al.* Renal biopsy in patients 65 years of age or older: an analysis of the results of 334 biopsies. *J Am Geriatr Soc* 1990;**38**:669–74.

17 Gault MH, Muehrcke RC. Renal biopsy: current views and controversies. *Nephron* 1983;**34**:1–34.

18 Madaio MP. Renal biopsy. *Kidney Int* 1990;**38**:529–43.

19 Flood MT. Renal biopsy: a 9-year study at an osteopathic referral center. *J Am Osteopath Assoc* 1983;**83**:285–93.

20 Cozens NJA, Murchison JT, Allan PL, Winney RJ. Conventional 15 G needle technique for renal biopsy compared with ultrasound-guided spring-loaded 18 G needle biopsy. *Br J Radiol* 1992;**65**:594–7.

21 Herdson PB, Ojeda VJ, Teague CA. Renal biopsy pathology in Auckland 1969–76. *N Z Med J* 1977;**86**:5–6.

22 Farrington K, Levison DA, Greenwood RN, *et al.* Renal biopsy in patients with unexplained renal impairment and normal kidney size. *Q J Med* 1989;**263**:221–3.

23 Kasinath BS, Mujais SK, Spargo BH, Katz AI. Non-diabetic renal disease in patients with diabetes mellitus. *Am J Med* 1983;**75**: 613–7.

24 Taft JL, Billson VR, Nakervis A, *et al.* A clinical-histological study of individuals with diabetes mellitus and proteinuria. *Diabetic Med* 1990;**7**:215–21.

25 Kassirer JP. Is renal biopsy necessary for optimal management of the idiopathic nephrotic syndrome? *Kidney Int* 1983;**24**:561–75.

26 Levey AS, Lau J, Pauker SG, Kassirer JP. Idiopathic nephrotic syndrome: puncturing the biopsy myth. *Ann Intern Med* 1987;**107**:697–713.

27 Ponticelli C, Passerini P. Alkylating agents and purine analogues in primary glomerulonephritis with nephrotic syndrome. *Nephrol Dial Transplant* 1991;**6**:381–8.

28 Waldherr R. Predictive value of renal biopsy in lupus nephritis. *Contr Nephrol* 1984;**43**:36–44.

29 Kuhn K, Menninger H. Is renal biopsy overused in patients with systemic lupus erythematosus? *Contr Nephrol* 1984;**43**:45–50.

30 Raine A. Renal biopsy and the prognosis of lupus nephritis. *Q J Med* 1991;**295**:879–81.

31 Schow DA, Vinson RK, Morrisseau PM. Percutaneous renal biopsy of the solitary kidney: a contraindication. *J Urol* 1992;**147**:1235–7.

32 Tung KT, Downes MO, O'Donnell PJ. Renal biopsy in diffuse renal disease—experience with a 14-gauge automated biopsy gun. *Clin Radiol* 1992;**46**:111–3.

33 Parker SH, Hopper KD, Yakes WF, *et al.* Image-directed percutaneous biopsies with a biopsy gun. *Radiology* 1989;**171**:663–9.

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