AN ANALYSIS OF 400 PERCUTANEOUS RENAL BIOPSIES

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Percutaneous renal biopsy done in the sitting position using a serrated needle and applying suction to secure tissue was devised by Iverson and Brun in 1951. They claimed a success rate of 50 per cent in 164 biopsies done in 133 patients. Using a similar method, other authors reported success rates between 40 to 50 per cent only (Parrish and Howe, 1953; Kark and Muehrcke, 1954). Kark and Muehrcke (1954) were the first to perform renal biopsies with patients in the prone position, using Franklin's modification of the Vim Silverman needle. With minor modifications, this method is now widely used throughout the world.

In 1967, the author first performed percutaneous renal biopsies using the technique of Kark and Muehrcke to study cases of nephrotic syndrome. Later, this procedure was extended to other cases of renal disease for histological diagnosis as well as for assessment of progress. This paper is to present the author's experience of the first 400 renal biopsies done over a period of $3\frac{1}{2}$ years.

MATERIAL AND METHOD

The majority of patients in this series were derived from Medical Unit II, General Hospital, Singapore. Two patients were referred by paediatricians in the same hospital. Table I shows the indications for renal biopsy in 375 patients.

No renal biopsy was performed when a patient was unable to co-operate. Medical contraindications to renal biopsy were: bleeding diathesis, large renal cyst(s), renal neoplasm, renal artery aneurysm, malignant hypertension, perinephric abscess, hydronephrosis, pyonephrosis, blood urea of more than 100 mg.% and rising, and when the patient has only one functioning kidney.

Before a biopsy was performed, the patients were checked for any bleeding tendency. An intravenous pyelogram or a plain abdominal X-ray was obtained to show the position and size of the kidneys. In some cases, markers were placed on the skin at the probable site of the lower poles of the kidneys when a pyelogram was done with the patient lying in the prone position.

The patients were all admitted for at least two days. Biopsies were done in the consultation room in the out-patient clinic. Two pints of blood were kept in reserve before each biopsy. The biopsy procedure was carried out under local anaesthesia. For premedication, pethidine 50 mg. intramuscularly were given at the beginning of the series. This was later changed to promethazine 50 mg. intramuscularly as quite a few patients vomited during the procedure. Patients were put in the prone position with the upper half of the abdomen lying across a sausage-shaped sandbag about 4 inches in height. The proposed biopsy site, usually the lower pole of the left kidney, was marked on the X-ray film available. Its position in relationship to the spinous processes and the iliac crest was measured and marked on the back of the patient. In cases in whom I.V.P. with markers were done, the marker served as a guide to the position of the lower pole of the kidney.

After the subcutaneous tissue and deep muscles at the back were infiltrated with 2 per cent lignocaine, the skin was punctured with a triangular skin cutter. The biopsy needle itself with its stylet in position was introduced with the patient holding his breath in expiration. The patient was then asked to take several deep breaths. If the needle had entered the kidney, the hub of the biopsy needle would be seen to swing with the movement of the diaphragm, and hence the kidney. If no swinging movements were observed, the needle was then advanced slightly each time until the kidney was reached. The cutting needle was then introduced. A slight resistance could usually be felt when the needle entered into the kidney tissue. The outer sheath of the needle was was then pushed over the cutter to bite off a piece of tissue. The patient was always asked to hold his breath at any time the operator was handling the needle.

At the end of the biopsy procedure, the patient was kept in the prone position for ten minutes before returning to the ward. In the ward he was told to lie flat without using a pillow for 4 hours and to rest in bed completely for another 8 hours. Blood pressures and pulse rates were checked regularly. A liberal amount of fluid amounting to 2,000 ml. in 6 to 8 hours was given to the patient. Every specimen of urine was kept for inspection and blood transfusion was given when indicated. Analgesic tablets were given if patient complained of pain. In the majority of cases, the patients

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were fit for discharge and able to work the next day.

A biopsy was considered successful when 5 or more glomeruli were present in the specimen and gave adequate information for diagnosis. In some cases, because of the diffuse nature of the disease, such as in cases of idiopathic membranopathy, it was possible to make a definite diagnosis even though the number of glomeruli present was less than 5. Such biopsies were considered successful.

RESULTS

From January, 1967 to June, 1970, 400 renal biopsies were performed in 375 patients, including 2 patients under the age of 10. In 18 patients, 2 attempts at renal biopsy were made before an adequate piece of tissue was obtained, and in 3 patients, 3 attempts were necessary.

Out of the 400 renal biopsies, 331 were successful. The majority of biopsies yielded 5 to 25 glomeruli. In 16 patients, more than 40 glomeruli were obtained, the maximum number being 72. Sixty-nine biopsies were considered as failures. In 39 cases, no tissue was obtained, in 18 cases, the number of glomeruli present was inadequate for diagnosis and in 12 patients, no glomeruli were found in the tissues.

Table II shows the complications met with in this series. Twenty-four patients had frank haematuria. This occurred within 24 hours after biopsy in 19 patients and after 48 hours in 2. In another 2 patients, frank haematuria occurred soon after biopsy, cleared up and recurred 2 to 3 days later. In yet another patient with chronic glomerulonephritis, frank haematuria persisted for nearly a week. Blood transfusion was necessary in 5 patients. Only 5 patients complained of severe loin pain after biopsy but 11 patients had dullache over the biopsy site. Two patients, both females, developed feeble pulse and cold sweat soon after completion of renal biopsy. They recovered after being turned round to lie flat with head low in position. Two patients had subcutaneous bleeding and in one of them, severe loin pain and oliguria were also present. One patient developed infection of a small perirenal haematoma. Death occurred in one patient with acute on chronic renal failure.

DISCUSSION

Renal biopsy is now an accepted procedure in the management of renal diseases, particularly in cases of nephrotic syndrome. In Medical Unit II, General Hospital, all cases of nephrotic syndrome are biopsied prior to treatment. Renal biopsy had helped to elucidate renal pathology in cases of

TABLE I

INDICATIONS OF RENAL BIOPSY IN 375 PATIENTS

Nephrotic syndrome	100
"Obscure" haematuria	85
Young hypertensive	67
Asymptomatic proteinuria	39
Systemic lupus erythematosus	32
Leptospirosis	10
Acute nephritis	9
Acute renal failure	8
Chronic nephritis	8
Chronic renal failure	3
Miscellaneous	15

TABLE II

COMPLICATIONS IN 400 RENAL BIOPSIES

Frank haematuria	24
Dullache in loin	11
Severe loin pain	5
Subcutaneous bleeding	2
Clot colic	2
Syncope	2
Oliguria	1
Infected perirenal haematoma	1
Death	1

TABLE III

SUCCESS RATE IN 400 RENAL BIOPSIES

First 100	69 per cent
Second 100	87 per cent
Third 100	91 per cent
Fourth 100	86 per cent

TABLE IV

RESULTS OF 400 RENAL BIOPSIES

	Present Series		Kark *et al* (1958)	
	Number	Per cent	Number	Per cent
Biopsies	400	100	500	100
Patients	375	—	368	—
Renal tissue obtained	360	90	465	93
Inadequate tissue	30	7·5	64	13
No tissue	39	9·75	35	7
Overall success	331	82·75	400	80

"obscure" haematuria, asymptomatic albuminuria, and in young hypertensives in whom all other investigations had yielded negative results (Ooi *et al*, 1970). Renal biopsy also revealed focal nephritis in cases of systemic lupus erythematosus in whom no gross disturbances of renal function were present.

The author employs the method first devised by Kark and Muehrcke (1954) with slight modification. In the first place, no probing needle is used prior to introduction of biopsy needle as it is felt unnecessary to go through the tissue at the back twice to locate the kidney. The patients are also asked to hold their breath in expiration instead of in inspiration whenever the biopsy needle is being handled. This is done because the patients seem to be able to hold their breath better in expiration. As advised by Kark and Muehrcke (1954), the biopsy needle must not be touched while it is swinging during respiration. Failure to observe these points may cause the needle to tear the kidney. While moving the cutting prongs, care must be taken not to move the latter. One will fail to obtain any tissue if this cutting needle is pulled out during the manouvre. On the other hand, tubules only will be obtained if it is pushed in deeply and enters the renal medulla. A good strip of cortical tissue will be obtained if one tries to cut the kidney tangentially.

The overall success rate in this series was 82·75 per cent. However, if the results of every 100 biopsies are compared, it will be noted that as the operator gained experience and confidence, there was definite improvement in the results (Table III). Of the 69 failures, no tissue was obtained in 39 (9·75 per cent). All the patients were very co-operative and allowed at least 5 punctures during each attempt. In many of these patients, no tissue was obtained even though a good swing of the needle with respiration occurred. Kark and Buenger (1966) believed that this is because the needle is at the lower pole of the kidney but not in the kidney substance itself. The author has tried manipulating the needle obliquely upwards but has not always been successful in obtaining renal tissue. In other cases, no swing of the needle was obtained at all. This was probably due to failure to enter the kidney which was unusually mobile or when the subject was obese. Some tissue was obtained in 360 biopsies (90 per cent) but it was inadequate for diagnosis in 28 and muscle only was obtained in 2. The results of this series is thus similar to that reported by Kark *et al* on 500 renal biopsies (Table IV).

The complications of "blind" percutaneous renal biopsy are few and seldom disabling. Frank haematuria usually cleared up within 12 hours. None of the patients who bled early had clot colic. This is because they were asked to drink a large quantity of fluid within 6 to 8 hours to ensure a good urine flow thus preventing clot formation. Two of these patients had recurrence of frank haematuria 2 to 3 days later and it cleared again within one day after bed rest. Two more patients had only late bleeding which was believed to be due to dislodging of clot at puncture site after exertion. Kark *et al* reported a similar incidence of frank haematuria in their 500 renal biopsies (1958) but they had a higher incidence of renal colic (14 patients). However, they did not mention at what stage the colic occurred. On the other hand, Brun and Raaschan (1958) had a much higher incidence of frank haematuria (15 per cent) and 11 of their patients (2·2 per cent) required blood transfusion. Five patients had severe loin pain and 11 had dullache at biopsy site. In all of them, pain was readily relieved by analgesics. This was in accordance with the findings of Kark *et al* (1958) and Brun and Raaschan (1958). Two female patients, both of nervous and anxious nature, became cold and clammy immediately after biopsy but they recovered rapidly after they were turned round to lie supine. They did not have gross haematuria or loin pain subsequently. These syncopal attacks were believed to be vasovagal in nature. Two patients had ecchymoses over biopsy site but they did not have gross haematuria. Preliminary tests for bleeding diathesis were normal and in one of them, detailed coagulation studies revealed only mild factor IX deficiency. Syncope and ecchymoses were not recorded in reports by either Kark (1958) or Brun (1958). Massive peri-renal haematoma as evidenced by pain, shock and a fall in haematocrit value occurred in 3 cases reported by Kark *et al* (1958) and moderate peri-renal haematoma occurred in one patient reported by Brun and Raaschan (1958). In the present series, no massive peri-renal haematoma was present but one patient developed fever and loin pain 2 days after biopsy and this was thought to be due to infection of a small peri-renal haematoma. He responded readily to a course of tetracycline. None of our patients had ileus, renal infection with bacteraemia or became febrile after biopsy (Kark *et al*, 1958; Brun and Raaschan, 1958). In some patients, pain occurred when the biopsy needle entered the kidney and this was not always due to inadequate local anaesthetic. One patient died after an unsuccessful renal biopsy.

It is evident from the present series as well as from other larger series reported in the literature (Kark *et al*, 1958; Brun and Raaschan, 1958), that percutaneous "blind" renal biopsy is a relatively safe and simple procedure. With practice and improvement in minor points of biopsy technique, the success rate should be 90 per cent or more. Many methods had been devised to improve the chances of localising the kidney, such as making use of television monitored fluoroscopy (Kark and Buenger, 1966; Huddard and Mani, 1967), image amplifier (Gisberg *et al*, 1962; Lusted *et al*, 1964), radioisotope (Telfer *et al*, 1964; Posen *et al*, 1964), or the iron grid technique (Douglas *et al*, 1965). These authors claimed a nearly 100 per cent success and felt that such techniques also ensured more safety for the patients. On the other hand, these methods involve the participation of another department other than the operator himself. In a busy general hospital, this would be inconvenient, if not impossible. Further, the cost of these methods have been estimated at three times the present procedure (L. A. Lancet, 1967). It is therefore more practical and feasible to do "blind" renal biopsy routinely and to reserve any of these more refined methods to cases which present difficulties.

SUMMARY

The experience of 400 renal biopsies done in 375 patients are presented. A slight modification of the method devised by Kark and Muehrcke was made. The overall success rate was 82·75 per cent. Complications of renal biopsy were few and seldom disabling. Percutaneous "blind" renal biopsy is considered to be a simple and useful procedure in the diagnosis and management of renal diseases.

REFERENCES

1. Douglas, A. P., Kerr, D. N. S. and Warrick, C. K. (1965): "Locating the Kidney for Renal Biopsy." Lancet, Vol. II, 1048.
2. Grisberg, I. W., Durant, J. R. and Mendez, L. (1962): "Percutaneous Renal Biopsy under Direct Radiologic Direction." J. Amer. Med. Assoc., 181, 211.
3. Huddard, J. K. and Mani, J. L. (1967): "Percutaneous Renal Biopsy. An Improved Method using Television Monitoring and High Dose Infusion Pyelography." Arch. Intern. Med., 119, 157.
4. Iverson, P. and Brun, C. (1951): "Aspiration Biopsy of the Kidney." Amer. J. Med., 11, 324.
5. Kark, R. M. and Buenger, R. E. (1966): "Television-monitored Fluoroscopy in Percutaneous Renal Biopsy." Lancet, Vol. I, 904.
6. Kark, R. M. and Muehrcke, R. C. (1954): "Biopsy on Kidney in Prone Position." Lancet, Vol. I, 1047.
7. Kark, R. M., Muehrcke, R. C., Pollark, V. E., Pirani, C. L. and Kiefer, J. H. (1958): "An Analysis of 500 Percutaneous Renal Biopsies." Arch. Int. Med., 101, 439.
8. Leading Article (1967): "Technique of Renal Biopsy." Lancet, Vol. I, 1368.
9. Lusted, L. B., Mortimore, G. E. and Hopper, J. (1956): "Needle Renal Biopsy Under Image Amplifier Control." Amer. J. Roentgenol., 75, 953.
10. Ooi, B. S., Chen, B. T. M., Toh, C. C. S. and Khoo, O. T. (1970): "Causes of Hypertension in the Young." Brit. Med. J., Vol. III, 744.
11. Parrish, A. E. and Howe, J. S. (1953): "Needle Biopsy as an Aid in Diagnosis of Renal Disease." J. Lab. Clin. Med., 42, 152.
12. Posen, G. A., Kaye, M. and Rosenthal, L. (1964): "Radioisotope Localisation for Renal Biopsy." Lancet, Vol. I, 1043.
13. Telfer, N., Ackroyd, A. E. and Stock, S. L. (1964): "Radioisotope Localisation for Renal Biopsy." Lancet, Vol. I, 132.