CURRENT SURVEY

Percutaneous renal biopsy in childhood

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Introduction

Percutaneous renal biopsy in adults is usually performed by the method described by Kark & Muehrcke (1954) using the Franklin modification of the Vim-Silverman needle. The method was adapted for use in children by Gálan & Masó (1957) and Vernier, Brunson & Good (1957) and further modified by White (1963) who used a light aluminium needle with a depth stop and adjustable cutting points. A recent development is the use of direct radiographic control (Edelman & Greifer, 1967).

Technique

An intravenous pyelogram is performed before the biopsy to confirm that the kidneys are normal in position and size. Haemostasis is assured by finding normal clotting and bleeding times, platelet count, prothrombin concentration and thromboplastin generation. A pint of compatible blood should be available. The procedure is explained in simple terms to the parents and the older children and a few minutes spent with the younger children familiarizes them with the operator.

The operation is performed in the morning with the child fasting. After premedication with pethidine and promazine (2 mg of each/kg up to 25 kg and 1 mg for each additional kg, with a maximum of 80 mg of each drug) the child lies prone on a firm couch with a sandbag underneath the upper abdomen. The back is cleaned and covered in sterile towels. Lignocaine (1%) is infiltrated into the skin just below the point where the sacrospinalis crosses the twelfth rib and then straight down into the subcutaneous tissue dorsal to the kidney. An assistant should steady the child at this stage, but after the local anaesthetic has taken effect, the child usually lies still and may sleep. The lower pole of the kidney is located with a spinal needle which is inserted through the area of anaesthetized skin and is felt to pass through two layers of fascia and then pierce the renal capsule. When in the kidney the needle swings with respiration (Fig. 1) and transmits arterial pulsations. The skin-to-kidney

depth is measured by sliding a marker down until it is touching the skin and measuring the distance between the marker and the point of the needle after removal.

Using the White-Silverman needle (Down Bros. and Mayer & Phelps Ltd) (Fig. 2) the depth-stop is adjusted to allow for the skin-to-kidney depth plus 2 cm for the cutting needle (1.5 cm for an infant). A small incision is made in the skin, and the biopsy needle advanced down the same track as the exploring needle until the renal capsule is felt; this is penetrated with a slight jab. The needle will then move with respiration. The stylette is removed and the cutting needle introduced and moved down to the kidney which feels firm. If the outer needle is still in the perirenal fat, there is little resistance to the cutting needle. During an expiratory pause, the cutting needle is plunged into the kidney. In the next pause, the outer needle is pushed into the kidney until the depth-stop reaches the skin, and both needles removed. A second piece of tissue may be obtained from higher up the kidney by angling the biopsy needle upwards at about 45°. It is important to move the biopsy needle and take the biopsy only

FIG. 1. The exploring needle swinging with respiratory excursions of the kidney.

FIG. 2. White-Silverman needle. A, Outer needle with adjustable depth stop; B, stylette; C, cutting needle.

during expiratory pauses, allowing the needle to swing freely at other times.

Biopsy with a disposable needle (Travenol Ltd) (Fig. 3), which has recently been designed, is similar. When the biopsy needle is in the kidney the inner needle is pushed downwards to its hilt, the outer needle slid inwards to the stop and the needle then removed. There is less sense of feeling the kidney with this needle and direct radiographic control after an intravenous injection of urografen is useful in ensuring that the needle is in the kidney before the biopsy specimen is obtained.

The specimen, which usually consists of a pale, cortical, portion and a darker, medullary, portion, is placed on a piece of card or glass slide (Fig. 4). A 1-mm cube of cortical tissue can be removed for electron microscopic studies, a further portion used for immunofluorescent studies and the remainder kept for light microscopy.

After the biopsy the child returns to the ward and the pulse and blood pressure are recorded every 15 min for 4 hr and the pulse hourly for a further 24 hr. The child is encouraged to drink freely so as to ensure a copious urinary output which minimizes the likelihood of clot colic. If macroscopic haematuria is observed the child is kept in bed until this has ceased. The child can usually get up the day after the biopsy and return home, and generally remembers little of the operation.

FIG. 3. Disposable needle.

FIG. 4. Specimen of kidney tissue obtained by needle biopsy.

Difficulties

Occasionally the biopsy has to be performed under general anaesthesia if the child will not lie still. It is dangerous to persist with a struggling child. Difficulty may be experienced in locating the kidney and the exploring needle should be angled slightly upwards and then medially or laterally. A further problem is failure to penetrate the renal capsule, shown by the inner needle recoiling after insertion. In this case the outer needle should be pushed in a little further with a small jab. Sometimes blood wells up the needle when the stylette is removed, but it is worth taking a specimen as the needle must be in the kidney. Bleeding from the biopsy needle does not usually lead to bleeding afterwards.

Complications

These are uncommon. Macroscopic haematuria occurs in 16% of patients (White, 1963), but usually clears quickly with bed rest. Clot colic and perirenal haematoma are rarer; two of the former and three of the latter have occurred in a personal series of 140 cases. Persistent bleeding requiring nephrectomy, or death due to the procedure itself, are exceptionally uncommon, neither occurring in 890 renal biopsies reported by Carvajal *et al.* (1971).

Contra-indications

Renal biopsy should not be performed if a child has only one functioning kidney, or if haemostasis is abnormal. The presence of small kidneys and chronic renal insufficiency is a relative contra-indication, as the biopsy procedure is usually very difficult and histological findings are often unhelpful. Hypertension may be a contributory factor to subsequent bleeding and is also a relative contra-indication.

Results

A specimen adequate for histological purposes should contain at least ten glomeruli (Vernier *et al.*, 1958). A satisfactory specimen has been obtained in 129 (92%) of 140 personally performed biopsies in children ranging in age from 6 months to 18 years. This compares favourably with an average success rate of 76.5% in 2593 biopsies collected from the literature by Edelman & Greifer (1967), but is less than the success rate of 98% achieved by White (1963) and 97.5% by Edelman & Greifer (1967).

Application

Histological examination of tissue obtained by renal biopsy may aid diagnosis and guide treatment and prognosis in many types of renal disease in childhood. It has been found particularly useful in the nephrotic syndrome when associated with haematuria and hypertension (White, Glasgow & Mills, 1970); 'acute nephritic syndrome' associated with a persistently low level of serum B_{1c} globulin (Cameron *et al.*, 1970); Henoch-Schönlein nephritis if the serum albumen is reduced (Meadow *et al.*, 1972); symptomless haematuria associated with heavy proteinuria (Glasgow, Moncrieff & White, 1970) and, sometimes, acute renal failure (Meadow *et al.*, 1971).

In a research centre renal biopsy may be indicated in rarer types of renal disease, but full use of the renal tissue obtained, including immunofluorescent and electron microscopical studies are important.

Conclusion

Renal biopsy in children is a safe procedure in experienced hands, and a useful investigation in many types of renal disease. It should not be undertaken by the occasional operator. Although practice on a piece of cheddar cheese, as advised by Kark & Meuhrcke (1954), is helpful, the procedure is best learnt from an experienced operator and frequent practice is necessary in order to maintain a high success rate. Only a small amount of tissue is obtained at biopsy and this must be processed for histological examination with care. Interpretation of the histological findings is considerably more difficult than the biopsy procedure itself and should be undertaken jointly by the clinician and the pathologist (for

discussion of renal pathology and its correlation with clinical syndromes see White, 1970). Because of these factors, renal biopsy is best performed in a few centres with a special interest in paediatric nephrology (Black & White, 1965).

Acknowledgment

I would like to thank Dr R. H. R. White, for teaching me the technique described, and for his advice on this paper.

References

- BLACK, J.A., WHITE, R.H.R. (1965) Renal biopsy. In: *Recent Advances in Paediatrics* (Ed. by D. Gairdner), 3rd edn, p. 307. Churchill, London.
- CAMERON, J.S., GLASGOW, E.F., OGG, C.S. & WHITE, R.H.R. (1970) Membranoproliferative glomerulonephritis and persistent hypocomplementaemia. *British Medical Journal*, **4**, 7.
- CARVAJAL, H.F., SRIVASTAVA, R., TRAVIS, B., DODGE, W.F. & DUPREE, E. (1971) Percutaneous renal biopsy in children. A report on 890 biopsies. *Proceedings of Second Symposium International de Néphrologie Pédiatrique* (Ed. by R. Habib and H. Mathieu), p. 166. Sandoz Editions.
- EDELMAN, C.M. & GREIFER, I. (1967) A modified technique for percutaneous needle biopsy of the kidney. *Journal of Paediatrics*, **70**, 81.
- GÁLÁN, E. & MASÓ, C. (1957) Needle biopsy in children with nephrosis. *Paediatrics*, **20**, 610.
- GLASGOW, E.F., MONCRIEFF, M.W. & WHITE, R.H.R. (1970) Symptomless haematuria in childhood. *British Medical Journal*, **2**, 687.
- KARK, R.M. & MUEHRCKE, R.C. (1954) Biopsy of kidney in prone position. *Lancet*, **i**, 1047.
- MEADOW, S.R., CAMERON, J.S., OGG, C.S. & SXTON, H.M. (1971) Children referred for acute dialysis. *Archives of Diseases of Childhood*, **46**, 221.
- MEADOW, S.R., CAMERON, J.S., WHITE, R.H.R., GLASGOW, E.F., OGG, C.S. & MONCRIEFF, M.W. (1972) In press.
- VERNIER, R.L., BRUNSON, J., GOOD, R.A. (1957). Studies in familial nephrosis. *American Journal of Diseases of Children*, **93**, 469.
- VERNIER, R.L., FARQUHAR, M.G., BRUNSON, J.G. & GOOD, R.A. (1958) Chronic renal disease in children. Correlation of clinical findings with morphologic characteristics seen by light and electron microscopy. *American Journal of Diseases of Children*, **96**, 306.
- WHITE, R.H.R. (1963) Observations on percutaneous renal biopsy in children. *Archives of Diseases of Childhood*, **33**, 260.
- WHITE, R.H.R. (1970) Glomerulonephritis in children *British Journal of Hospital Medicine*, **5**, 746.
- WHITE, R.H.R., GLASGOW, E.F. & MILLS, R.J. (1970) Clinicopathological study of nephrotic syndrome in childhood. *Lancet*, **i**, 1353.