especially under fluoroscopic control. Brush biopsy produced malignant cells in 13 of the 22 cases in which it was used. We will use brush biopsy more often in future to investigate radiographic abnormalities when bronchoscopical findings are normal.

Bronchography.—The use of bronchograms in lung cancer has been declining recently. A catheter can, however, be introduced easily and atraumatically by the technique described. In half the patients with normal bronchoscopy findings who had bronchograms the technique showed peripheral blockage which we considered useful in suggesting cancer. Thus post-bronchoscopy bronchograms should be strongly considered in such patients.

Safety.—Like others,[3] we have found fibreoptic bronchoscopy to be a basically safe technique with few complications. In a review of 24 500 examinations in the U.S.A.[3] there was a major complication rate of 0·08% and a minor complication rate of 0·2%.

Controversy has arisen in both America[9-11] and Britain[12-14] on the future role of fibreoptic bronchoscopy. Though some[9 12 14] have claimed that fibreoptic bronchoscopy should be used only as an adjunct to rigid bronchoscopy the findings presented here show that fibrescopy on its own can give practical results at least as good as those given by rigid bronchoscopy. While rigid bronchoscopy must retain a place for tasks such as the removal of foreign bodies the claim of fibreoptic bronchoscopy to be the method of choice for routine bronchoscopy is well founded in practice.

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Hospital Topics

Needling Renal Cysts and Tumours: Cytology and Radiology

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Summary

Renal masses found by intravenous urography, ultrasound scanning, and arteriography were needled in 102 patients. Simple renal cysts containing clear fluid and no cytological abnormalities were found in 85 patients. Two unsuspected renal cell carcinomas were found on puncture; cytological examination showed malignant cells in the aspirate. Another five renal tumours were needled deliberately before nephrectomy, and a firm preoperative diagnosis of renal cell carcinoma was made on aspiration cytology in three. Benign cysts which had bled were particularly hard to diagnose. With care, radiology and cytology in combination can provide the firm diagnostic base needed for sound clinical management. The radiology-cytology team must be alert to the unusual finding that indicates a complex lesion, such as an unsuspected renal tumour.

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Introduction

The intravenous urogram (I.V.U.), renal ultrasound scan, and arteriogram may be used to point to a likely diagnosis for renal masses. Some renal masses with wholly characteristic findings, such as the displaced cortical island,[1 2] should be recognized at this stage and investigation not pursued, but most lesions will demand a further step toward definitive diagnosis and management. We have aimed to puncture all masses thought to be cysts using a fine-bore needle to aspirate tissue for cytological examination. Several renal tumours have been needled and diagnosed in this way together with other solid, though benign, renal lesions. We report here on 102 patients whose renal masses were punctured, including five in whom a suspected renal tumour was needled deliberately.

Patients and Methods

During the four years since our previous report[3] we have needled the renal masses of 102 patients. Most of the masses were discovered incidentally on routine I.V.U.s performed during the investigation of unrelated urological symptoms, usually affecting the lower urinary

tract. In the first two years of our study before ultrasound was available renal masses thought to be cysts were needled either on persuasive I.V.U. findings or after arteriography. Since then ultrasound scanning has become the second diagnostic step, and we punctured all renal masses that seemed to be simple cysts on ultrasonic evidence. Only patients with complex lesions on ultrasound scanning were asked to undergo arteriography.

Puncture.—was carried out in the prone position under local anaesthesia and fluoroscopic control after an intravenous injection of contrast medium. Needles of gauge 20, 18, or, rarely, 16 were used. When a cyst was entered about 10 ml of fluid was withdrawn for cytological studies and replaced by contrast medium to outline the lesion. More fluid was replaced by contrast medium in larger cysts; in this way we were careful to account for the whole renal mass shown on the I.V.U. The cyst was then emptied. We no longer perform double contrast studies of the cyst wall because we derived no clinically helpful information from this in our earlier series. We injected iophendylate (2 ml) only when we were particularly anxious to prevent recurrence of cysts either because of their size or local symptoms (10 of the 85 simple cysts seen in this series).[4] When a solid mass was found on puncture syringe suction was applied and continued during withdrawal of the needle through the lesion. To be certain of the diagnosis of a solid mass, as opposed to an error in aiming the needle, a mass was often repunctured at once. Aspirated material was spread on glass slides and fixed. The needle was then washed through with saline into a bottle containing fixative solution.

Failures and Complications.—One patient complained of chest pain during renal puncture and a small pneumothorax was found, which resolved without treatment. This was the only notable complication in this series, though in another patient the expected renal cyst was not found on puncture but at surgical exploration a typical cyst was unroofed. This was a technical renal puncture failure.

Cytological Methods.—Three kinds of material were available for cytological examination: cyst fluid, placed immediately into a bottle containing fixative; aspirated material, which was smeared directly on to slides and made into thin films; and saline washings of the needle when solid tumours were punctured, which were also put into fixative. Fixed slides and deposits were stained with haematoxylin and eosin and by the Papanicolaou technique, and air-dried slides were stained with Leishman's stain.

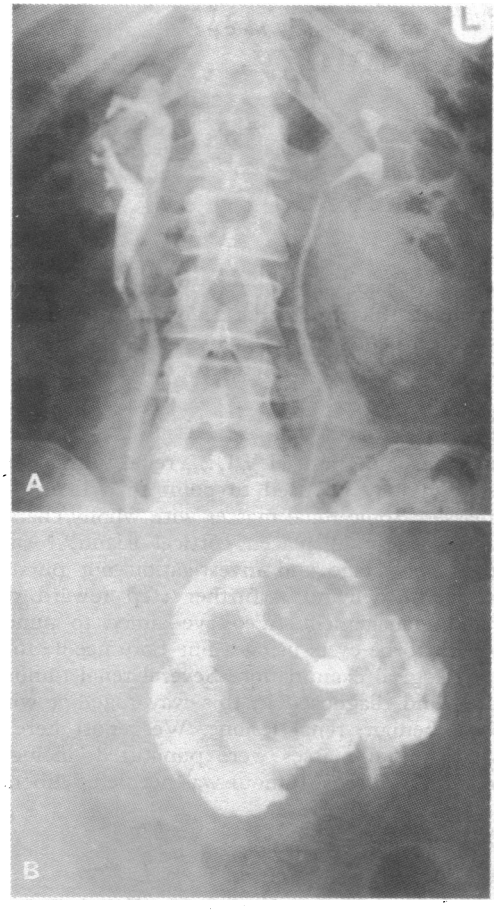

FIG. 1—(a) I.V.U. showing mass expanding left lower renal pole. Note small right duplex kidney. (b) Needle puncture of mass. Altered blood was aspirated and an irregular cavity outlined, which contained filling defects (clot.).

FIG. 2—Cyst wall lined by inflammatory cells with pigment-containing macrophages in deeper layers. (H. and E. ×46)

Results

Simple Cysts.—Eighty-five patients had simple renal cysts with clear amber fluid on puncture. Cytological examination of the cyst fluid showed a few benign cuboidal epithelial cells and an occasional polymorph.

Simple Cysts which had Bled.—The cyst fluid from three patients was discoloured, suggesting altered blood, but cytological examination of the fluid gave negative results in all three cases and showed many inflammatory cells, including pigment-containing macrophages. Two of these patients had the characteristic *x*-ray appearances of a cyst—that is, a smooth-walled cavity that accounted for the whole of the lesion seen on the I.V.U. These were probably simple cysts that had bled in the past, and this conclusion was supported by exploration of the lesion in one patient and unremarkable clinicoradiological follow-up in another. The third case, reported below, was more complicated.

This patient was a 57-year-old woman with a single attack of left-sided flank pain. An I.V.U. showed a small scarred duplex right kidney and a mass in the left lower renal pole (fig. 1). Ultrasound scanning suggested a complex lesion and a selective renal arteriogram showed that it was avascular. On puncture altered blood was withdrawn from an irregular cavity in the kidney. Cytological examination of this material showed no evidence of malignancy. The left kidney was then explored with a view to a partial nephrectomy because of the small right kidney. At operation an irregular cavity lined with clot was found in the lower renal pole and several fragments of the cyst wall were removed for rapid frozen-section examination. Examination showed a cyst lined by cellular inflammatory tissue, including pigment-containing macrophages (fig. 2). The findings were later confirmed in the permanent histological sections. The lesion seemed to be a simple cyst which had bled and in which the epithelial lining had become engulfed by reactive inflammatory tissue to form epithelial clusters embedded within the cyst wall. No further surgical measures were taken in this patient and she remained well.

SOLID LESIONS

Renal Cysts and Haematoma.—In three patients puncture of renal masses thought to be cysts showed solid lesions. Aspirates from these were negative for malignant cells. Exploration and nephrectomy disclosed solid renal lesions full of clot: two were renal cysts and one an intrarenal haematoma.

Renal Tumours.—Seven renal cell carcinomas were punctured. All diagnoses in this group were confirmed by surgical exploration and histological examination within a week of puncture. Two patients were at first thought to have renal cysts, though the ultrasound scan was atypical in one and not done in the other. Puncture of these lesions showed the correct diagnosis since cytological examination

of the aspirated tissue from a solid mass showed renal carcinoma cells. In five patients over 60 years old a mass correctly thought to be a renal carcinoma was punctured deliberately to facilitate a firm diagnosis. An I.V.U. and ultrasound scan had been done in each patient, but an arteriogram via the femoral route was either impossible because of the state of the iliac arteries or judged clinically inadvisable—for example, because of claudication. Two of these patients showed no evidence of carcinoma in the aspirated material, but in three cases the cytological findings were positive (fig. 3).

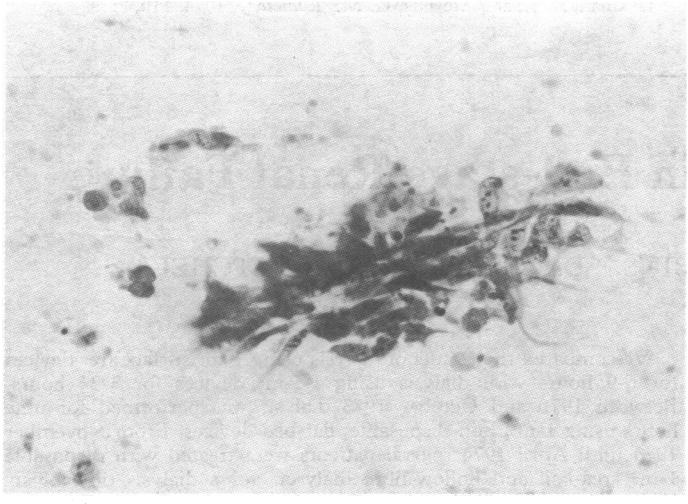

FIG. 3—Clump of carcinoma cells aspirated from solid renal mass. (Papanicolaou stain ×460).

Abscesses.—In two patients pus was aspirated on needle puncture of supposed simple cysts. These patients were surprisingly well, and the correct diagnosis was not suspected clinically. No ill effects followed abscess puncture. Both patients came to surgery and there was no evidence that needling had disseminated infection.

Discussion

When a renal mass found on intravenous urography is associated with obvious signs and symptoms there is usually little doubt about the likely diagnosis. But most renal masses are now discovered by I.V.U.s carried out for unrelated symptoms, usually of the lower urinary tract. In a general hospital about a third of all renal cell carcinomas seen might be asymptomatic lesions shown on the I.V.U. by chance.[5] Exploration of all renal masses found on the I.V.U. would run appreciable risks of morbidity and mortality, and might result in needless nephrectomy for benign lesions.

During the 1950s and 60s renal angiography promised much in distinguishing simple renal masses from those needing surgery, but unfortunately some renal tumours are avascular and mimic cysts on arteriography. In the best hands these may be only a few[6] and in average experience account for about 5%,[3] but if the investigation of renal masses is taken no further than arteriography the misdiagnosis of avascular renal tumours becomes the most common serious radiological mistake in this field.[7]

Whether a patient with a possible kidney tumour needs a renal arteriogram at all is now best decided by ultrasound scanning, arteriography being reserved for those cases in which a complex lesion is found. When a simple cyst is found on ultrasound scan renal puncture may be carried out at once, confirming the diagnosis and avoiding arteriography.[8-10] Puncture is essential because, like arteriography, ultrasound scanning has a significant diagnostic error rate.[11 12] In consultation with our clinical colleagues, therefore, we punctured all renal masses thought to be simple cysts, since most patients with a firm diagnosis of this lesion may then be managed conservatively. In 85 of our 102 patients we found a characteristic cyst containing clear amber fluid, which accounted for the whole of the mass. Cytological examination showed no malignant cells in any case.

Obtaining a correct diagnosis in patients with cysts which have bled may be extremely difficult for the radiologist, pathologist, and surgeon, as illustrated by our case history. If such cysts become filled by clot a solid lesion will be diagnosed on puncture. Two of our patients had such lesions and a third had a renal haematoma. Surgical exploration seems to be the only means of confirming the diagnosis though it might be possible to avoid operation as experience in aspiration cytology grows.

Of the seven renal cell carcinomas punctured the correct diagnosis had already been suspected in five. The remaining two would have been misdiagnosed as benign renal cysts if puncture had been omitted, which emphasizes the importance of this approach. Disappointingly, in another two of these seven patients cytological examination showed no tumour cells. We were, however, treading cautiously in a subject that is not well explored in Britain. The heterogeneity of renal cell carcinomas, where strands and islands of acellular tissue are commonly seen, makes the site of needle aspiration all important. We showed this by failing to obtain carcinoma cells when a fresh surgical specimen of renal cell carcinoma was aspirated immediately after removal of the carcinoma. It is therefore essential to aspirate solid tumours using continuous syringe suction while moving the needle into several different areas of the tumour.

We are confident that with greater experience in obtaining aspirates from solid tumours and recognizing cell fragments discharged on to the slide we will overcome these problems. We used once a fine corkscrew-like gimlet inserted through the aspirating needle to obtain a larger sample but the cytological findings were negative. Multiple sampling with a fine needle is likely to be less destructive and more rewarding.

There is room for further exploration of renal tumour aspiration cytology. The procedure is easy for patients, and it is valuable to be able to make an accurate preoperative diagnosis without arteriography in the elderly. The possible spread of tumour cells by the aspirating needle is an inevitable worry, but we know of no evidence that this has resulted from fine needle aspiration of renal tumours.[13] Indeed, in a large series there was no significant difference in five-year survival rates between patients who did and did not have their renal carcinomas needled.[14]

The conservative management of patients with an apparently simple renal cyst is sometimes questioned on the grounds that a small carcinoma in the wall of a cyst might be missed, but the likelihood of this is less than 1 in 1000.[15] We did not find double contrast renal cystography helpful in these cases since minor irregularities of the simple cyst wall are often seen at radiological examination.[3] One should of course be wary of the possibility of a carcinoma-within-a-cyst but not allow a rare lesion to dominate management of a common problem—the chance finding of a renal mass in a patient with unrelated symptoms. Each step in the diagnostic sequence must be followed through with care, and unexpected findings at any stage should warn that a complex lesion may be present. Failure to account for the whole of the I.V.U. deformity by the supposed cyst together with abnormal cyst fluid are valuable signs,[16] and enzyme estimation of the cyst fluid may give further help.[9] Though cysts which have bled cause particular difficulty surgical exploration need not inevitably follow the aspiration of bloody cyst fluid that contains no malignant cells.[17 18] In the light of these problems we have found aspiration cytology of renal masses an interesting and potentially highly rewarding investigation towards sound patient management.

We thank the many clinical colleagues who have referred these patients, particularly, Professor J. P. Blandy. Dr. J. J. Stevenson

carried out many of the cyst punctures. P. A. T. acknowledges the financial assistance of the Cancer Research Campaign.

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Regular Short Haemodialysis in End-stage Renal Failure

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Summary

A study was made of thrice weekly haemodialysis of 3-3½ hours' duration using a large surface area dialyser in patients with end-stage renal failure. Body water, potassium, and blood pressure control were satisfactory and comparable with the more widely used long dialysis schedules (6-9 hours thrice weekly). Patient rehabilitation was improved overall and the regimen enabled the dialysis unit to treat more patients despite a reduction in technical and nursing staff. The technique proved inadequate, however, in two patients with an intercurrent infection, and more intensive dialysis is recommended in such cases.

Introduction

In the United Kingdom there are probably about 50 patients per million population annually with end-stage renal failure who are suitable for dialysis or renal transplantation.[1] Most patients are treated in chronically overworked hospital centres. Many do not receive treatment because of lack of dialysis unit space and insufficient trained nursing and technical personnel. Shorter dialysis times would intensify the use of renal units. Several authors have shown that this is feasible.[2 3] This article describes the use of regular short dialysis treatment: the results suggest that it has a useful role in the current therapeutic crisis.

Patients and Methods

All patients receiving treatment in our renal unit during the period of the study were dialysed thrice weekly and maintained on a low potassium, 60-g protein diet with fluid intake related to urine volume. Aluminium hydroxide was given to lower serum phosphate levels.

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We compared the results of dialysis using 1-m² surface area devices for 6-9 hours with dialysis using 1·5-m² devices for 3-3½ hours. Between 1970 and October 1973 dialysis was performed for nine hours using 1-m², non-disposable, flat-bed devices. From November 1973 until April 1974 several patients were treated with disposable 1-m² area-coil and hollow-fibre dialysers for a dialysis time of six hours. Since May 1974 dialyses for 3-3½ hours have been carried out with a 1·5-m² surface area coil (Ultraflo 2 Travenol) in a recirculation pot with a fluid addition rate of 500 ml/min. Patients with Cimino Brescia fistulae were cannulated with 14-gauge butterfly needles (Abbot) and a blood flow rate of 250-300 ml/min was maintained with a roller pump. Heparinization was by continuous infusion during long dialyses and by a single injection on short dialysis. Pre- and post-dialysis blood urea, creatinine, phosphate, and potassium levels were assessed by autoanalyser. Haemoglobin was determined by Coulter counter. Ultrafiltration was assessed by body weight change throughout dialysis. Dialyses were continued for 3½ hours when sufficient ultrafiltration was not achieved in three hours.

The results of short dialysis have been assessed in 23 patients over 143 patient months. In 16 patients the effects of treatment on a long and short dialysis schedule could be compared. The remainder were dialysed on the 1·5-m² coil device immediately. There were no adverse effects. The costs of the long, non-disposable dialysis and of the short disposable regimen have also been compared.

Results

In a total of 1800 short dialyses the overall rate of coil bursts was 1·5%, of which 60% were during air tests.

COSTS

The effect of the short dialysis regimen on staffing, dialysis unit running hours, and dialysis costs are shown in table I. The items assessed under the cost of non-disposable dialysis were cuprophan membranes, arterial and venous lines, formalin sterilizing fluid, isotonic saline rinsing fluid, heparin infusion, and standby disposable

TABLE I—*Logistics and Economics of Different Dialysis Regimens*

Period	No. of Patients (Average)	Dialysers Used*	Dialyses/ Month	No. of Staff†	Renal Unit Use (h/month)	Cost/ Dialysis (£)
November 1970—October 1973	19	N.D.	238	16 N 3 T	456	7
November 1973—April 1974	23	N.D. and D	280	11 N 2 T	456	Not assessed
May 1974—April 1975	25	d	310	9 N 2 T	240	12·25

*N.D. = non-disposable; D = disposable (long); d = disposable (short).
†N = nurse; T = technician.