administration in lowering the serum cholesterol level. This has been reported previously.³³ The effect of bile acids on cholesterol metabolism has been known for a long time and has recently been reviewed.³⁴ No simple interpretation of previous work, however, satisfactorily explains the hypocholesterolaemic effect of DC. Further work is in progress to study the influence of bile salt metabolism on plasma lipid composition.

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Occasional Survey

Diseases Causing End-stage Renal Failure in New South Wales

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Summary

The nature of the original renal disease was determined in 403 consecutive cases of end-stage renal failure, in 317 of which the clinical diagnosis was corroborated by histological examination of the kidney. Five diseases accounted for 20 or more cases—glomerulonephritis (31% of the total), analgesic nephropathy (29%), primary vesicoureteral reflux (8%), essential hypertension (6%), and polycystic kidneys (5%). In only four cases did renal failure result from chronic pyelonephritis without a demonstrable primary cause. Greater use of micturating cystography and cystoscopy and routine urine testing for salicylate are advocated for earlier diagnosis of the major causes of "pyelonephritis".

The incidence of end-stage renal failure in people aged

15-55 in New South Wales was estimated to be at least 34 new cases per million of total population each year.

Introduction

Renal replacement therapy is onerous for the patient and costly to the community; morbidity and mortality constantly threaten the dialysis patient and allograft recipient alike. Prevention of renal failure, so desirable in the circumstances, depends primarily on recognition of the diseases which initiate injury to the renal parenchyma. Of the numerically important causes of destructive renal disease "pyelonephritis" offers, in theory at least, the best prospects for prevention or early cure so long as the primary aetiological agent or abnormality is identified.

In this study the primary renal disease has been sought in all people aged 15-55 years, who entered the renal replacement programme or who died with advanced intrinsic renal failure at Sydney Hospital in a seven-year period. An aetiological rather than a pathological diagnosis was made whenever possible in those in whom the renal disorder was identified as pyelonephritis, papillary necrosis, interstitial nephritis, or toxic nephropathy.

Patients

The records, histological sections of the kidneys, and pyelographic films of all patients who had either presented for dialysis or transplantation or died with intrinsic renal failure (serum

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creatinine 10 mg/dl or more) between 1 May 1967 and 30 April 1974 were examined to determine the original renal disease. Throughout this period cystoscopy and retrograde pyelography were performed unless a diagnosis of polycystic kidneys or histologically substantiated glomerular disease had been made. Micturating cystography was done when there was uncertainty about the primary diagnosis. Patients aged under 15 or over 55 were omitted from this analysis since our experience of the very young or old has been limited and may not have been representative.

During the first four years of this survey the number of patients seen gradually increased as it became generally known that cadaveric transplantation was available for all suitable patients. The number of dialysis units accepting such patients in New South Wales, however, rose from three in 1967-9 to seven in 1973. For this reason fewer new patients were seen in each of the last three years. About 37% of all patients treated by the dialysis/transplantation programme in New South Wales (population 4.6 million) in the period under review are included in this survey.

Diagnostic Criteria

The diagnoses were based on the criteria given in the references listed in table I. Special care was taken to ensure the accuracy of the diagnoses of analgesic nephropathy, ureteral reflux, pyelonephritis, glomerulonephritis, and essential hypertension.

Analgesic Nephropathy.—The minimum requirements for this diagnosis were a corroborated history of consumption of at least 4 kg of analgesic (mainly aspirin alone in three patients, phenacetin and codeine in one, and mixtures of aspirin and caffeine with phenacetin, paracetamol, or salicylamide in the remainder) together with histological (from nephrectomy in 33 cases, renal biopsy in one, and necropsy in 60 cases) or pyelographic (separated or calcified papillae in 12 cases and calyceal irregularity and pyelonephritic scarring in 12) demonstration of papillary necrosis. Necrotic papillae, with or without calcification, were seen in all histological sections except 10 in which no remaining papillary tissue could be identified.

Ureteral Reflux.—The minimum requirements for this diagnosis were cystoscopic demonstration of lateral and upward displacement of the ureteral orifices (26 cases) or demonstration on contrast radiography of vesicoureteral reflux passively or

during micturition (24 cases), together with pyelographic evidence of renal parenchymal scarring. In the one patient in whom none of these examinations was made pyelonephritic scarring, dilated ureters, and patulous ureteral orifices were found at necropsy. In all cases the only apparent cause for the reflux was a presumed developmental abnormality.

"Idiopathic" Pyelonephritis.—Histological (three cases) or pyelographic (one case) demonstration of coarse renal scarring in the absence of any recognized cause of renal infection or interstitial nephritis established this diagnosis.

"Primary" Glomerulonephritis.—The diagnosis was based on histological examination of specimens of renal tissue obtained at biopsy (68 cases), nephrectomy (seven cases) or necropsy (31 cases). In nearly half the cases of glomerulonephritis renal biopsy had been performed before the development of advanced renal failure. In patients from whom no renal tissue was available the diagnosis was based on a verifiable history of nephrotic syndrome (seven cases) or well-documented proteinuria preceding renal failure or accelerated hypertension together with a normal calyceal pattern on pyelography (10 cases).

"Essential" Hypertension.—This was diagnosed on the basis of accelerated hypertension preceding other manifestations of renal disease together with the absence of pyelographic or histological (nephrectomy 13 cases, biopsy one case, necropsy five cases) evidence of an alternative diagnosis.

Results

The primary renal diagnoses in the 403 cases (table I) were supported by histological evidence in 317 (79%) cases, and in 71 others (18%) there was sufficient clinical and pyelographic evidence to arrive at the probable diagnosis—but in 15 cases (4%) no diagnosis was reached. In only three patients of this last group was there a history of urinary infection at any time.

Five diseases—glomerulonephritis, analgesic nephropathy, ureteral reflux, essential hypertension, and polycystic kidneys—accounted for 20 or more cases each and together for 79% of the whole series. No other diagnosis was present in more than nine cases. The proportion of cases of end-stage renal failure due to analgesic nephropathy remained fairly constant throughout the seven-year period (table II).

Women outnumbered men in the ratio of 7:5, principally because of their preponderance in the analgesic nephropathy group in which there were 99 women and 19 men. Twenty-three women and 11 men had vesicoureteral reflux, seven women and 13 men had polycystic kidneys, six women and 17 men had essential hypertension, 51 women and 72 men had primary glomerulonephritis, and 48 women and 37 men had other primary diseases. The median age at the time of starting regular dialysis was 40 years. The number of patients in each age group increased with advancing years up to 45 (see fig.) but there were only a little more than half as many in the 50-55 year cohort (46) than in the preceding two five-year cohorts (82 and 93 respectively).

The average number of new patients established on the renal replacement programme each year in the period under review was 26 per million of the population served by this renal unit (1.7 million), and the total number of new cases of end-stage renal failure seen was 34 per million a year.

TABLE I—Primary Renal Diseases causing End-stage Renal Failure

Disease	No. of Cases	No. Corroborated Histologically	Diagnostic Criteria (References)
Analgesic nephropathy	118	94	Burry, ¹ Kincaid-Smith, ² Lindvall ³¹
Balkan nephropathy	1	0	Milojčić, ³² Danilović and Stojimirović ³³
Lead nephropathy	1	1	Emmerson ³⁴
"Primary" vesicoureteral reflux	34	23	Hutch and Amar, ³ Lyon <i>et al.</i> , ³⁵ Hodson ³⁶
Hydronephrosis	8	6	
Other anatomical malformations	3	3	
Calculi	9	9	
Uric acid nephropathy	5	4	Talbott and Terplan ³⁷
"Idiopathic" pyelonephritis	4	3	Hodson, ³⁸ Kimmelstiel <i>et al.</i> ⁵
Tuberculosis	1	1	
Granulomata of the kidney	1	1	
"Primary" glomerulonephritis	123	106	Hamburger <i>et al.</i> ³⁹
Glomerular/arterial involvement by systemic disease	24	21	Hamburger <i>et al.</i> ³⁹
Essential hypertension	23	19	Kincaid-Smith <i>et al.</i> ⁴⁰
Renal arterial disease	7	6	
Polycystic kidneys	20	16	
Hereditary nephritis (Alport's)	4	3	Alport, ⁴⁰ Perkoff ⁴¹
Laurence-Moon-Biedl syndrome	1	0	McLoughlin and Shanklin ⁴²
Bilateral renal carcinomata	1	1	
Uncertain diagnosis	15	0	
Total	403	317	

TABLE II—Analgesic Abuse Resulting in End-stage Renal Failure Each Year 1967-73

Year*	1967-8	68-9	69-70	70-1	71-2	72-3	73-4
No. of patients with end-stage renal failure	54	56	71	76	61	42	43
No. (%) of patients with analgesic nephropathy	18 (33)	13 (23)	19 (27)	22 (29)	18 (30)	15 (36)	13 (30)

*Starting 1 May.

Patients with end-stage renal failure according to age (by decade) at time of starting regular dialysis, or time of death if not treated by dialysis, and primary renal disease.

Discussion

Accurate aetiological diagnosis is not easy in many patients with end-stage renal failure. Only in adult polycystic renal disease, among the common causes of this condition, can the diagnosis be made reliably in virtually every case. Particular doubt arises in cases of "essential" hypertension and in cases when the diagnosis of chronic glomerulonephritis rests on histological evidence obtained when renal parenchymal destruction is already advanced. In this series contrast pyelography was used to exclude the presence of pyelonephritic scarring in all doubtful cases in these two categories. Papillary necrosis is characteristic of analgesic nephropathy,^{1 2} and the radiological or pathological demonstration of separated, calcified, or necrotic papillae together with a corroborated history of heavy analgesic intake placed this diagnosis beyond reasonable doubt in over 80% of the cases so designated. Vesicoureteral reflux is a functional abnormality and may not be present continuously.³ Moreover, micturating cystography was not performed on those of our cases in whom reflux seemed unlikely. Quite possibly, therefore, the true incidence of reflux nephropathy was underestimated in this series.

No matter how the available data are interpreted it seems most unlikely that infection alone could have been primarily responsible for more than a very small proportion of cases of pyelonephritic end-stage renal failure. This conclusion is in agreement with the results of carefully conducted necropsy surveys, in which advanced pyelonephritis was either not found⁴ or uncommon⁵ in the absence of an anatomical deformity or functional abnormality of the urinary tract, a history of exposure to a known nephrotoxin, or calculi. Schechter *et al.*⁶ came to a similar conclusion in their investigation of 173 candidates for maintenance haemodialysis though they relied principally on bacteriological and radiological, rather than histological, data. These results are in contrast to many published reports in which "pyelonephritis" has been given as the cause of 5%-30% of cases of end-stage renal failure in north-western Europe,⁷⁻¹² North America,^{12 13} and Australasia.¹⁴⁻¹⁹ Though some of this variation in incidence of "pyelonephritis" between different countries is real most can be attributed to the common practice of designating in a single category all cases of renal damage associated with bacterial infection of the kidney, whether or not an underlying cause has been identified.

CYSTOGRAPHY AND CYSTOSCOPY

If, as we believe, most cases of serious pyelonephritis are due to analgesic abuse or ureteral reflux prevention will depend as much on detection and surgical correction of the vesicoureteral

abnormality and control of excessive, unsupervised intake of pain-relieving drugs as on treatment of bacterial infections of the urine. All cases of urinary infections associated with fever, loin pain, vomiting, hypertension, or raised plasma creatinine or of persistent asymptomatic bacteriuria should have micturating cystography and cystoscopy performed as well as intravenous pyelography. The case for surgical correction of vesicoureteral reflux in adolescents and adults whenever accompanied by functional or anatomical evidence of renal scarring, no matter how mild, has been ably put by Hutch and Amar.³

URINE TESTING FOR SALICYLATE

While control of unwarranted consumption of analgesics is largely a matter of legislation and education of doctors, patients, and the public, recent introduction of routine urine testing for salicylate has proved useful in our own clinic for the initial detection and subsequent supervision of patients with analgesic-induced renal disease. The test is simple and reliable whether done using 1% ferric nitrate solution or Phenistix (Ames) and is a suitable screening procedure for analgesic abuse in Australia, where the commonly taken powders and tablets contain aspirin. The test should be used whenever patients with hypertension, renal calculus, peptic ulcer, or psychiatric disorders are seen, all of them conditions known to be associated with analgesic abuse.^{4 20-24} The advantages to be gained by close supervision of patients with papillary necrosis are well documented.²⁵⁻²⁸

INCIDENCE OF END-STAGE RENAL FAILURE

The number of new cases of end-stage renal failure aged 15-55—34 per million total population a year—is similar to that in previously published British surveys⁷⁻⁹ though the methods used to compile the information were different. The figure given here, however, is likely to underestimate the true incidence of end-stage renal failure in New South Wales because of probable incomplete referral to renal units of uraemic patients in three categories: those dying of renal failure during the first two years of the survey before the dialysis/transplantation programme had become known and accepted throughout the state (see table II); patients aged 50-55 (see above in Results); and those with glomerular or vascular involvement from systemic disease. If the rate of referral had been as great in 1967-9 as in 1969-71 and the number of patients aged 50-55 as many as those in either of the next two younger five-year age groups 70-80 additional patients would have been included in this series, bringing the total incidence of end-stage renal failure to 40 new cases per million total population each year. This figure is still short of the combined mortality, derived from death certificates, for hypertension with arteriolar nephrosclerosis (I.C.D. 446), nephritis and nephrosis (590-594), other diseases of the urinary system (757), and uraemia (792). The death rate from these diseases for people aged 15-55 in New South Wales was 57 per million of population in 1966 and 51 per million in 1967,^{29 30} the last two years before the renal replacement programme would have had a noticeable effect on mortality from renal failure.

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Surgery of Violence

II. Disaster Procedures

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One of the effects of bomb blast is that patients often arrive simultaneously in large numbers. This kind of multiple accident has been given many names, but recently the word disaster has become the generally accepted one. Bombing itself is a symptom of an illness in the community, and is unlikely to be an isolated incident. Over a three-year period the Royal Victoria Hospital, Belfast, had to receive multiple casualties from bombs on 48 occasions. (There were also 15 occasions when street rioting gave rise to a disaster situation). The repeated use of the hospital's disaster plan gave us unusual opportunities to assess the value of its provisions. At least we were delivered from the first great difficulty in disaster planning, which is the difficulty in believing that the disaster will ever really happen.

The second difficulty arises from the multidisciplinary nature of disaster planning. Within the hospital it is a co-operative venture co-ordinating medical, nursing, and administrative services. Outside hospital, as well as medical services, it involves police, ambulance, and fire services, and possibly welfare services and some voluntary bodies. Multidisciplinary agreement is always more difficult to achieve than agreement between people inside any one discipline.

Disaster Planning at Hospital: Two Basic Principles

1. A COMMAND STRUCTURE

Disasters are totally unpredictable in size, in the types of injuries, and in the proportions of minor and major injuries. The number of staff on duty at the time varies, and a dramatic disaster will bring many members of staff to hospital without being called. It is therefore impossible to detail in advance what resources should be called on. One should therefore quickly set

up a command structure whose responsibility is to monitor both the influx of casualties and the arrival of volunteer staff. The command team will direct people where to work and mobilize additional staff and other resources as required. This command structure will consist of the senior officers in the medical, nursing, and administrative fields, with the consultant of the casualty department.

2. VALUE OF STICKING TO THE DAILY ROUTINE

Working under stress, people tend without thinking to do the same thing that they do every day. If the disaster plan is drawn up with this in mind, it is likely to go smoothly. The more often procedures depart from the daily routine, the more mistakes are likely. For example labels tied to the wrists of patients are likely to cause more confusion than help unless those using them are accustomed to such a system in their daily work.

Some Important Aspects in Hospital

1. TRIAGE

This word means sorting out. It was used for the sorting out of battle casualties at forward clearing stations and is now often applied to disasters. Within hospital there are three points at which triage occurs.

On arrival the patients are sorted so that the space and facilities of the casualty are best used. The worst cases will go to the resuscitation room, the next worst to adjacent cubicles, and the less serious a case appears the farther from the resuscitation room will he be placed. Patients with mild injuries do not object if three or four of them are asked to share a cubicle normally used for one. A weeping room for the emotionally shocked but uninjured can be well away from the main stream of patients. An area for suturing wounds outside the department is also useful in allowing a more rapid turnover.

The actual placement of patients in cubicles can be done very well by the casualty sister. The casualty consultant will sort his resources of staff, allocating specific doctors to patients or

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