

The findings reported in patients undergoing excretory urography for recurrent urinary tract infection

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SUMMARY. There was little difference between the proportion of lesions found by excretion urography in patients with recurrent urinary tract infections referred by general practitioners or hospital staff, or between Horton General Hospital which is a district general hospital, and the United Oxford Hospitals, which is a teaching group. Many patients with urinary tract infections may be saved an unnecessary visit to the hospital consultant if this is first investigated by the general practitioner.

About one fifth of all patients had significant lesions shown by excretory urography which suggests that the investigation is worthwhile in patients with recurrent urinary tract infections.

Introduction

Nearly one sixth of all excretory urograms performed in the United Oxford Hospitals were requested because the patient had recurrent urinary tract infection which was being investigated radiologically for the first time. This represents over 500 excretory urograms a year at considerable cost in scarce staff and equipment. In addition, the patient not only spends time and money attending for the examination, but he also incurs a potential risk to his health (Stewart, Webb

TABLE 1
AGE AND SEX OF PATIENTS

Age of patients	Oxford 1970 and 1971				Banbury 1971 and part of 1972		
	Hospital	General practice	Totals	% Females	Hospital	General practice	Totals
0—10	106	35	141	72	16	8	24
11—20	38	54	92	75	13	5	18
21—30	80	184	264	83	26	43	69
31—40	36	134	170	84	27	30	57
41—50	46	98	144	70	25	22	47
51—60	45	58	103	69	23	16	39
61—70	26	42	68	62	16	7	23
70 and over	15	9	24	67	19	2	21
Male	97	152	249 (24%)	—	52	37	89 (30%)
Female	297	467	764 (76%)	—	113	96	209 (70%)
Total patients	394	619	1013		165	133	298

and Hewitt, 1958; Pendergrass, *et al.*, 1958; Stewart, Pennybacker and Barber, 1962; Saxton, 1969; *British Medical Journal*, 1972) and this warrants an assessment of the results achieved.

Method

The request forms and reports of excretory urograms performed at the Radcliffe Infirmary and the Churchill Hospital for the two years from 1 January 1970 to 31 December 1971 were collected. The forms for patients with recurrent urinary infection without reference to any other symptom were separated, and the details listed in table 1 were extracted. Those patients who had previous urograms were excluded from the series. The reported findings on excretion urography are listed in table 2.

TABLE 2
X-RAY FINDINGS

Reported findings on excretory urography	Oxford 1970 and 1971					
	Hospital		General practice		Totals	
	Number of patients	%	Number of patients	%	Number of patients	%
Normal	280	71	435	71	715	71
Abnormal						
(a) 'Surgical'					113	11.1
Large prostate	11	3	14	2	25	2.5
Renal or ureteric calculi	10	2.5	13	2	23	2.3
Bladder diverticulum	6	1.5	9	1.5	15	1.5
Bladder tumour	5	1	7	1	12	1.2
Obstructive						
hydronephrosis	4	1	7	1	11	1.1
Renal cyst	4	1	6	1	10	1.0
Tuberculosis			5	1	5	0.5
Single clubbed calyx	3	1			3	0.3
Ureterocoele	2		1		3	0.3
Narrow ureter	3	1			3	0.3
Renal neoplasm			1		1	0.1
Bladder calculus	1				1	0.1
Prolapsed bladder			1		1	0.1
(b) 'Medical'					58	5.7
Pyelonephritis	21	5	25	4	46	4.5
Ureteric reflux	5	1			5	0.5
Polycystic kidney			3		3	0.3
Cystitis			2		2	0.2
Medullary sponge kidney			1		1	0.1
Renovascular disease			1		1	0.1
(c) 'Doubtful significance'					189	18.3
Wide ureter	27	7	38	6.5	65	6.4
Residual urine	22	5.5	34	5.5	56	5.5
Duplex kidney	18	4.5	33	5.5	51	5.0
Calyceal cyst	1		5	1	6	0.6
Absent kidney	1		2		3	0.3
Small kidney	2		1		3	0.3
Malrotated kidney			3		3	0.3
Horseshoe kidney			2		2	0.2

Totals exceed 100 per cent as some patients had more than one lesion.

All the findings are retrospective so that the doctors requesting the examinations would not be influenced by knowledge of the survey. Similarly, the radiological reports were not

checked against the films so that the survey was of results received by the doctor requesting the examination and reported in a routine way. In Oxford, excretory urograms are performed by all radiologists, but if the examination is performed by a radiologist without a radiological degree, the films and reports are checked by a consultant.

Excretory urography performed at Horton General Hospital, Banbury for patients with recurrent urinary tract infection were analysed to provide a comparison between a teaching hospital and a non-teaching hospital. The findings are summarised in table 3.

TABLE 3
ANALYSIS OF ABNORMALITIES

Reported findings on excretory urograms	Banbury 1971 and part of 1972					
	Hospitals		General practice		Totals	
	Number of patients	%	Number of patients	%	Number of patients	%
Normal	97	59	97	73	194	65
Abnormal						
(a) 'Surgical'					51	17.0
Large prostate	7	4	4	3	11	3.7
Renal or ureteric calculi	6	4	3	2	9	3.0
Bladder diverticulum	3	2	2	1	5	1.7
Bladder tumour	1	1	1	1	2	0.7
Obstructive						
hydronephrosis	8	5	1	1	9	3.0
Renal cyst	2	1			2	0.7
Single clubbed calyx	6	4	1	1	7	2.3
Ureterocele			2	1	2	0.7
Narrow ureter	1	1			1	0.3
Renal neoplasm	1	1	1	1	2	0.7
Prolapsed bladder			1	1	1	0.3
(b) 'Medical'					34	11.3
Pyelonephritis	16	10	11	8	27	9.0
Ureteric reflux	2	1	1	1	3	1.0
Cystitis	1	1			1	0.3
Medullary sponge kidney	1	1	1	1	2	0.7
Renovascular disease	1	1			1	0.3
(c) 'Doubtful significance'					46	15.3
Wide ureter	8	5	2	1	10	3.3
Residual urine	6	4	7	5	13	4.3
Duplex kidney	6	4	7	5	13	4.3
Calyceal cyst	3	2	1	1	4	1.3
Absent kidney			1	1	1	0.3
Malrotated kidney	2	1	2	1	4	1.3
Horseshoe kidney	1	1			1	0.3

Totals exceed 100 per cent as some patients had more than one lesion.

Most patients referred for excretory urography with the diagnosis of urinary tract infection had the diagnosis confirmed by bacteriology as general practitioners have access to laboratory services. However, request cards frequently did not indicate the criteria on which the diagnosis of recurrent urinary tract infection was made. This survey therefore covers all patients sent for radiological investigation.

Discussion

About 70 per cent of patients referred to the radiology department with the diagnosis of urinary tract infection were reported as having normal excretory urograms. This proportion was similar whether the patients were referred by hospital doctors or general practitioners in both the teaching and the district general hospital. The large proportion of normal findings is important, for these patients can be treated medically, usually by their general practitioner.

Approximately 30 per cent of the excretory urograms were reported as abnormal, between 11 and 17 per cent of patients had lesions which are usually managed by the urologist, between five per cent and 11 per cent had lesions usually managed by the physician, and between 15 and 19 per cent had abnormalities of doubtful significance (tables 2 and 3).

Wide unobstructed ureters, residual urine, and duplex kidneys are included in the doubtful significance group, but all three are associated with urinary tract infection.

Wide non-obstructed ureters were reported in 6.5 per cent of Oxford and 3.3 per cent of Banbury patients. This group depends on the radiologist recognising wide ureters as worthy of report, and it requires considerable skill to decide whether ureters are pathologically wide. Guyer and Delaney (1970) suggest that some patients have wide ureters because they are on the contraceptive pill, and several authors (O'Grady and Cattell, 1966; Hodson, 1968; Leigh, Grunberg and Brumfitt, 1968; Spiro and Kelsey Fry, 1968 and 1970) have suggested that wide ureters after pregnancy are more liable to infection. Nevertheless, unless the radiologist measures the ureters as suggested by Spiro and Kelsey Fry, he may dismiss the wide ureter as due to pregnancy and not report it.

Many authors have noted that wide non-obstructed ureters are much commoner on the right (Duré-Smith, 1968; Spiro and Kelsey Fry, 1968; Sidaway, 1968). Our findings confirm this. We also found that pyelonephritis and calculi were reported more commonly on the right, both associated with a wide ureter and when a wide ureter was not reported.

Wide unobstructed ureters were noted on the right in 50 patients, on the left in nine patients, and bilaterally in 16 patients.

Chronic pyelonephritis was reported in 73 patients; in the right kidney in 33 patients, on the left in 18 patients, and bilaterally in 22 patients. There was a female to male preponderance of four to one. The radiological diagnosis of pyelonephritis was based on signs varying from a single clubbed calyx to gross parenchymal scarring.

Thirty-two patients had renal or ureteric calculi; on the right in 22, on the left in nine and bilaterally in one patient.

Micturating cysto-urethrography was only performed on a few of the patients with dilated ureters and most of these were children who were shown to have ureteric reflux. Most of the patients with ureteric dilatation were women between the ages of 20 and 40 years.

Of Oxford patients 5.5 per cent were reported to have residual urine, of which 23 were male and all over the age of 40 years, and 33 female with seven under the age of 20, six aged 20-40 years, and 20 over the age of 40. The figures for Banbury were proportional to those of Oxford.

The radiological criteria for reporting residual urine are usually flexible, either because the radiologist does not regard a small residual urine as being of significance, or because there are so many factors mitigating against complete emptying of the bladder in the x-ray department (Margolis, 1963).

The radiological diagnosis of the volume of residual urine can be a reasonably accurate method in prostatic hypertrophy (Griffiths and Castro, 1970), and with more attention it could be so in other patients. Its relevance in urinary tract infection is that bacteria are not easily eliminated (Hinman and Cox, 1965 and 1966) whatever the cause of the residual urine may be. However, it is interesting to note that of the 56 Oxford patients reported as having residual urine, 14 had large prostates, two had bladder diverticula and two had dilated ureters, but none were reported as having either pyelonephritis or calculi. It seems unlikely that the latter conditions do not occur in patients with residual urine but rather that residual urine was not reported in patients with these conditions; a factor we are investigating further.

Duplex kidneys were recorded as such if the ureters joined inferior to the L5 vertebral body, or both entered the bladder. Duplex kidneys were found in five per cent of Oxford patients, and

4.3 per cent of Banbury patients. This is a lower proportion than the 7.5 per cent reported by Smellie (1967) and the eight per cent of Smallpeice (1968) both referring to children; but more than the 2.8 per cent reported in patients with symptoms of urinary tract disease (Nordmark, 1948), and the 0.7 per cent found at autopsy (Campbell, 1954).

Pyelonephritis or calculi were found in 20 per cent of Oxford and 30 per cent of Banbury patients with duplex kidneys, but in only six per cent of all other Oxford and ten per cent of all other Banbury patients with urinary tract infection.

Our findings are in agreement with the view that duplex kidneys are prone to infection (Lenaghan, 1962; Williams and de Backer, 1962; Ambrose and Nicholson, 1968; Smallpeice, 1968).

Four hundred and eight (40 per cent) of all Oxford excretory urograms were performed on women between the ages of 15 and 41 years. While many lesions were recorded in the kidneys and upper ureters in these patients, only six were said to have residual urine in the bladder, and three had bladder diverticula. Such a small return for irradiating the female gonads (and possibly the fetus) during the child-bearing period, makes us think that perhaps only a single film of the pelvic region is justified in women in this age group.

The findings in both Oxford and Banbury were broadly similar although a slightly larger proportion of abnormalities was reported at Banbury where there was a notably high incidence of pyelonephritis. We have not yet found the reason for this difference.

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