Section of Urology

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Meeting October 30 1969

President's Address

The Ureter, the Urologist and the Pædiatrician

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It is my intention in this Address to examine the clinical management of ureteric disorders in children, with particular reference to the relative roles of pædiatrician and urologist. In the forseeable future it is inevitable the hospital care of children should be carried out at two levels. There is first the district hospital, where a pædiatrician is the only specialist concerned with children and is assisted by system specialists, among them urologists, whose chief work is in adults. Then there is the referral hospital, particularly the large children's hospital or very large department of a general hospital, where pædiatrics is split up into its own system specialties on both medical and surgical sides, the consultants devoting all or most of their time to the treatment of children. At the district hospital level the post-war years have seen a satisfactory increase in the number of pædiatricians, although there are still far too many departments staffed by a single consultant. It is, however, only in the last few years that urologists have been appointed in anything like adequate numbers; and there is still a long way to go. At referral hospital level there are still insufficient centres: a children's hospital to be effective must be large, and although the country was formerly dotted with small children's hospitals, only a few of these have been sufficiently upgraded, so that there is seldom adequate system specialization on either the medical or the surgical side. Pædiatric nephrology has scarcely had any recognition, yet it is increasingly apparent that neither the general pædiatrician nor the adult nephrologist is competent to cope with the very difficult biochemical problems of renal failure in infants. On the urological side things are as bad: few urologists have devoted a substantial part of their effort to the management of children's problems and they have not, in general, worked in the large children's hospitals which alone can provide a specialist referral service. Here urology has often been left to pædiatric surgeons, a number of whom have made urology their specialty and have made a considerable contribution to the subject. I do not believe it matters greatly whether pædiatric urologists of the future come from urological or from pædiatric surgical stock, provided they are adequately trained in adult urology and in general pædiatric surgery, and provided they devote a very large proportion of their time to the practice of pædiatric urology. It will not be sufficient for the busy urologist to do a 'couple of sessions at the kids', or for a pædiatric surgeon to attempt urology as well as cardiac, thoracic, neurological and intestinal surgery. Although, therefore, the district hospital set-up may soon be adequate there is a distinct gap at the referral hospital level, both in the number of centres and particularly in the number of pædiatric urologists.

Case Finding and Management

It might seem almost axiomatic that the general practitioner should have primary responsibility and refer suspect cases to the urologist, and certainly there is a need for greater awareness by GPs of the problems or urinary infection: it is depressing how often one sees a child with advanced pyelonephritis who has a history of recurrent febrile attacks, which were diagnosed as upper respiratory infection but in whom the urine was never examined. However, closer examination of the problem shows that it is the district hospital pædiatrician who has the greatest responsibility for case finding. A great many congenital disorders should be discovered at routine postnatal examination or in welfare clinics where regular well-baby examinations are performed. Microscopy and culture of the urine should be a routine examination on these occasions and during inoculation programmes. It has

recently been suggested that routine urine cultures on schoolchildren would pick up early cases of urinary infection, and surveys in Birmingham and Dundee have demonstrated that a few cases could be thus discovered, although the economics of this exercise still require attention, but the most serious urinary infections start long before school age and only the relatively mild problems will be picked up on these later examinations.

It is clear, too, that many diseases of the urinary tract do not produce urinary symptoms in infancy and childhood, and it is only by acute awareness of the possibility of urinary tract involvement in children with a whole variety of nonspecific complaints that diseases will be picked up at an early stage. Where any doubt exists as to the nature of the child's illness it will be better for the practitioner to refer him to the pædiatrician than directly to the urologist; for one thing an infant or toddler is out of place in adult urological outpatient departments, and the adult urologist is much less able than the pædiatrician to assess the significance of general findings. To the credit of the pædiatricians it must be said that they have in recent years shown great interest in the recognition of urinary tract disorders, although not all have had the backing of the investigatory services they deserve. Urine cultures, IVPs and cystograms can be ordered as well by the pædiatrician as by the urologist and normality established without much difficulty. Of course, consultation will be required for the assessment of abnormalities, and endoscopy remains the privilege or burden of the urologist, but I believe that endoscopy does not play the predominating part in the management of children that it does in adults; I think the fact that all urinary infections in the United States are apt to be seen by urologists has led to overemphasis on instrumental methods in diagnosis and treatment.

I believe, then, that the district hospital pædiatrician has the primary responsibility for case finding by routine postnatal examinations, by supervising welfare and inoculation clinics, and by educating the general practitioners. I hope that the district hospital urologists will have sufficient interest in and knowledge of children to cope with the simpler forms of urological surgery in older children; and that both pædiatrician and urologist will recognize that many infantile renal failure problems require the facilities of a referral hospital, from both the nephrological and the urological standpoint. Only by concentration of these rare cases shall we achieve efficient treatment and a sufficient basis for research to define a more effective policy of management.

Reflux

In any discussion of the ureter in childhood reflux must take first place if only because of the frequency with which it is discovered. Despite much discussion it is still difficult to define a firm policy regarding management of many of these cases and certain fundamental questions remain. So commonly is reflux found that the first question asked is: 'Is it abnormal?' The second: 'Does it matter?' The third: 'Will it get better of its own accord?' And the fourth: 'Is surgery more dangerous than doing nothing?'

Reflux in the normal ureter: A sufficient number of neonates and children have now been subjected to routine cystograms to confirm that reflux is not found in the normal. These are very valuable investigations, although one might feel happy that they were done elsewhere. Some doubt on this subject has recently been suggested by the writings of Krepler (1968) who investigated children with urinary infection and mentions a control group in which 33% of children under 2 years of age and 2% of children over that age had reflux. However, it proves that his controls were not normal children, having been investigated for fevers of unknown origin, failure to thrive and suspected malignancies, and his evidence does not therefore contradict other reported findings. It does, of course, indicate that reflux occurs much more readily in the infant than in the child, a fact which many observations confirm.

Does reflux matter? The answer to this simple question is almost intolerably complicated, for there are clearly many causes of reflux with different associated defects and complications. There are many degrees of reflux with a different prognosis and many possible complications. We may take as a starting point, however, the straightforward observations that in a child, where we observe a coarsely scarred, contracting kidney with a radiological diagnosis of chronic pyelonephritis, reflux can be demonstrated or can reasonably be supposed to have been present in the past from the appearance of the ureter and renal pelvis. Urinary infections without reflux in childhood are not associated with atrophic pyelonephritis. The term 'non-obstructive pyelonephritis', favoured by some physicians, is in childhood synonymous with reflux. Secondly, it may easily be observed that where reflux complicates an obstructed, contracted or neuropathic bladder it produces much more rapid deterioration of ureteric and renal function than would occur if the ureterovesical junction remained valvular.

Reflux and pyelonephritis: The classical case here is a child with recurrent attacks of pyuria associated with fever, who has very few urinary symptoms but has a kidney progressively destroyed and is found to have reflux. It is true that many refluxing ureters are associated with normal kidneys; also that some pyelonephritic kidneys have reflux but sterile urine, and very little evidence to suggest infection in the past. Nevertheless

it is reflux plus infection which is known to carry the risk. Reflux here could play its part by predisposing to infection, by facilitating the ascent of infection or by mechanical back-pressure upon the kidneys. It is reasonable to believe that reflux predisposes to infection by maintaining a residual urine and therefore an opportunity for the multiplication of bacteria. Confirmation of this hypothesis is found in the observation that infections ordinarily cease to occur after reflux-preventing surgery. This is not invariable, since there are many other predisposing causes, but in boys especially the elimination of reflux usually prevents further infection. The ascent of bacteria from bladder to kidney in reflux can scarcely be doubted: in some cases it is evident that the opaque medium, and therefore presumably bacteria, can penetrate deeply into the renal parenchyma. Many cystograms with reflux do not show this deep penetration and it could be that the difference between reflux with and reflux without chronic pyelonephritis lies in the defences at the renal papilla rather than at the ureterovesical junction: until we have clearer evidence on this point we must assume that any child with reflux is liable to urinary infections and that there is a possibility that they will lead to chronic pyelonephritis. It is possible that the situation in adults is different and that reflux is less hazardous. We do not ordinarily observe in adult life the atrophic pyelonephritis characteristic of children, although pyelonephritis may nevertheless damage the kidney substance. However, in certain circumstances in adults where reflux is present, as for instance after treatment of carcinoma of the bladder, pyelonephritic scarring of the childhood type may be observed.

Reflux and obstructive atrophy: There is clearly the possibility that reflux might damage the kidney itself by mechanical back-pressure even in the presence of sterile urine. It has already been observed that from an obstructed bladder reflux does cause much more rapid deterioration, as can often be observed in cases of unilateral reflux in urethral valve obstruction. It is therefore reasonable to suppose that a similar deterioration would be suffered by the kidney where reflux took place from a normal bladder, though at a much slower rate. Renal deterioration in these circumstances might be expected to correlate with ureteric dilatation but, as Hodson (1967) has pointed out, there are many examples of obstructive atrophy of the kidney where a relatively small organ has uniformly clubbed calyces and thinned out parenchyma but no deep cortical scars, and obstructive disease can undoubtedly damage the kidney without enormous ureteric dilatation. Some of the late cases of renal failure with reflux have no history of infection and there is therefore a strong possibility that obstructive atrophy might be responsible for this disorder. However, the time scale of such an event makes clear-cut observations difficult, and although we have often observed pyelonephritic deterioration of the kidney in the course of its development it cannot be affirmed that we have done the same with obstructive atrophy in recent years. There is also the difficulty of knowing when renal insufficiency is congenital in origin due to malformation of the parenchyma itself.

Reflux and ureteric dilatation: The back-pressure effect of reflux might be easier to assess from ureteric dilatation than from obstructive atrophy of the kidney, but here again we are in difficulty since in reflux cases the calibre of the ureter depends almost entirely upon the state of the bladder at the time the film is taken. It is very easy in comparing two series of pyelograms to think that the dilatation has got better or worse, when in fact the difference is entirely due to the fullness of the bladder at the time. We should probably always estimate the range of calibre of the ureter in reflux cases from pyelograms taken with the bladder empty and from cystograms at the height of micturition pressure. By making such critical assessment it is, in fact, very uncommon to observe increasing dilatation in reflux associated with the normal bladder, or even with megacystis, provided the urine is sterile. Deterioration is undoubtedly observed in obstructed, neurogenic and some infective conditions, but with sterile urine and a normal bladder the dilatation may, in fact, get less from the period of infancy to that of later childhood. Sometimes this dilatation is present at birth and remains unchanged with sterile urine over a period of ten years. But ten years is not a lifetime and until we have sufficient data on renal function in such cases we cannot draw a firm conclusion that reflux with a normal bladder and sterile urine is of no danger to the kidney.

Spontaneous cessation of reflux: Granted, then, that reflux is potentially a dangerous phenomenon, can we rely upon it to cure itself? Then we need guard the child only temporarily against complications. It is well known that reflux is much less commonly observed in adults and that therefore there is a strong case for believing that most cases of reflux will cease spontaneously: this conclusion was drawn by Baker *et al.* (1966) who published the figures in Table 1. Some caution is required, however, in accepting this conclusion since these were not individual cases followed up over a long period; they were children with urinary infection having their initial investigation, and it would be just as valid to conclude that children who had infection plus reflux presented to their doctors earlier than if they had infection alone. If we look next at the results of conservative treatment of reflux (Table 2) and infection we see varying estimates that somewhere between one-third and two-thirds of ureters spontaneously

Table 1
Age incidence of reflux in urinary infections in 588 children of whom 26·4% had reflux (Baker *et al.* 1966)

	Percentage with reflux	
Age group	*Males*	*Females*
Under 1 year	65	75
1–2 years	40	55
2 years and over	20	30

Baker *et al.* (1966) also report 5.2% incidence of reflux in 210 adults with infection

Table 2
Reflux without obstruction treated conservatively

Authors	*No. treated*	*Results*
Smellie (1967)	84 children	76% infection free on drugs
	100 ureters	61% spontaneous cure of reflux
Blight &	28 patients	82% infection free on drugs
O'Shaughnessy (1969)		43% spontaneous cure of reflux
Stephens & Lenaghan	59 ureters	31% spontaneous cure of reflux
(1962)		29% spontaneous improvement
O'Donnell *et al.* (1969)	79 children with	39% cured or improved
	mild and	48% static
	moderate reflux	13% worse

cease to reflux. A further word of caution is required here. Reflux is frequently asymmetrical in its incidence and in many cases the less severely affected ureter ceases to reflux, leaving the opposite side unchanged. The situation for the child is still serious even though he has a 50% chance of cure of reflux. These figures strongly suggest that a large number of children with recurrent infection and reflux are better treated by medicine than by surgery, since long-term chemotherapy will prevent infection, and spontaneous cessation of reflux will ultimately remove the risk of development of pyelonephritis. But we still have a proportion in which drugs do not prevent infection and between one-third and two-thirds in which reflux persists. How can we spot these less satisfactory cases at an early stage? If surgery is required it is reasonable to perform it earlier rather than after years of failed medical treatment.

Spontaneous cure and the degree of dilatation: There is some evidence that the chances of spontaneous cure may be assessed from the radiological appearance of the ureters at the time of first examination. Several investigators have graded their degrees of reflux, with Grade 1 representing the least severe and Grade 3, 4 or 5 the most severe. All have found that the chances of spontaneous cure were greatest in the minor degrees, as would be expected. A representative report is that of Heikel & Parkkulainen (1966) (Table 3): they found no improvement in their Group 5, the most severe cases, cure in 27% of the series and improvement in 17%. It would then be generally agreed that the severely dilated refluxing ureters are unlikely to get better of their own accord, although this group, of course, includes those who are most difficult to manage by surgical treatment.

Spontaneous cure and the anatomy of reflux: Another method of predicting the outcome might be assessment of the ureteric orifice itself, and Lowell King *et al.* (1968) have been particular advocates of this point of view. If we omit cases with obstructed or neuropathic bladders, and cases where there has been passage of a stone or surgical damage to the ureter, there is still a considerable variation in the causative pathology of reflux which is summarized in Fig 1. Fig 1A shows the normal submucosal segment: in Fig 1B the submucosal segment is rendered rigid and œdematous by inflammation which is capable of subsiding under medical treatment alone and therefore allowing rapid cessation of reflux. An assessment of how often this occurs would require the routine performance of cystograms while the bladder is actually inflamed and the urine infected, and repeated soon afterwards. King *et al.* (1968) believe that this is a common occurrence, but my data do not allow judgment on this aspect since I have very few cystograms taken during the acute inflammatory phase and most children I see continue to reflux for weeks, months, or more after the urine has been rendered sterile. Fig 1C shows a congenitally short submucosal segment without any other abnormality. The measurement of the submucosal segment might therefore be a method of predicting the possibility of spontaneous cure. It can be done very roughly at cystoscopy by passing a ureteric catheter up the ureter and noting the number of centimetres which enter the orifice before the tip can be seen disappearing from the submucous zone. This method could provide a satisfactory criterion for deciding on early surgical treatment or upon a trial of long-term chemotherapy. It involves, of course, the urologist as well as the pædiatrician: while I believe that in Britain the district pædiatrician should be responsible for case-finding in this group, I consider that the decision on medical or surgical treatment should be a matter for joint consultation at an early stage between pædiatrician and urologist;

Table 3
Reflux without obstruction treated conservatively (Heikel & Parkkulainen 1966: 78 patients)

	Degree of dilatation					
	V	*IV*	*III*	*II*	*I*	*Total*
No. of ureters	5	20	38	48	9	120
Cured	0	2 (10%)	9 (24%)	19 (40%)	2 (22%)	32 (27%)
Improved	0	7 (35%)	9 (24%)	4 (8%)	0	20 (17%)
Unchanged	5 (100%)	11 (55%)	20 (52%)	25 (52%)	7 (78%)	68 (56%)

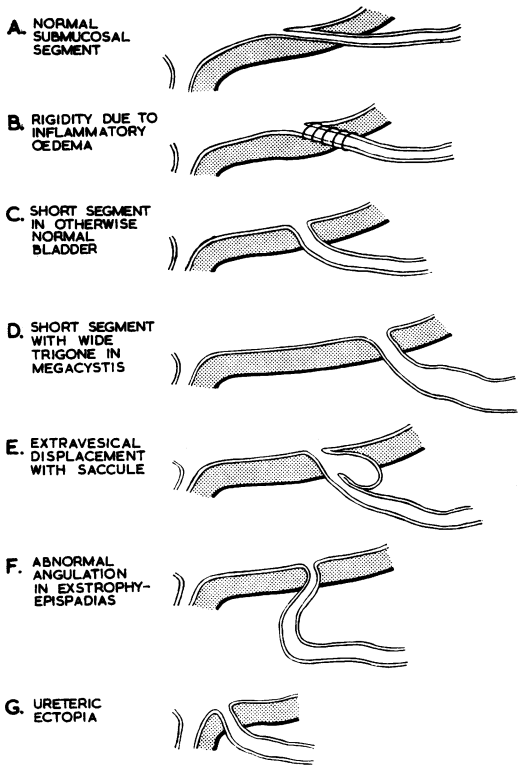

Fig 1 *The anatomy of reflux*

in some circumstances endoscopy might be essential. Fig 1D shows the short segment associated with the wide trigone in megacystis: this is also unlikely to improve spontaneously and can be observed cystoscopically although it may well be suspected radiologically. The formation of a saccule in the para-ureteric space (Fig 1E) is another important factor, perhaps best observed radiologically. I believe that a male with such a saccule is very unlikely indeed to cease to reflux spontaneously although a small saccule in a girl can disappear. Figs 1F and 1G represent much rarer conditions.

Reflux and bladder pressure: Many investigators have attempted to correlate bladder pressure with the appearance of reflux. In their terminology low pressure reflux occurs on simple bladder filling, and high pressure reflux during micturition or when the bladder is passively distended. Thus low pressure, although it sounds more benign, is in fact more dangerous. However, Krepler (1969) and others have shown that the relationship between pressure and reflux is not at all straightforward. Passive distension of the bladder under anæsthesia often fails to produce reflux, which nevertheless occurs from the same bladder during micturition. In contrast a little opaque medium sometimes enters the lower end of a normal ureter when it is first introduced under low pressure into the bladder; it appears to catch the bladder unawares, for it is then rapidly repelled and later micturition does not produce reflux. I therefore believe that pressure studies in this group will not give a satisfactory prognosis.

Reflux and continuous chemotherapy: It is clear from figures already shown that on long-term chemotherapy many, perhaps most, children with reflux will cease to have urinary infections and may in time cease to reflux. Long-term therapy may need to extend through most of childhood, and it is clearly no small matter to order this, nor can we be certain that it will be harmless. In general, the sulphonamides have given little trouble and, provided the child does not vomit and the dose is low, nitrofurantoin is equally effective. There are sometimes difficulties in persuading parents and children to consume drugs over very long periods and much depends upon the enthusiasm of the prescribing doctor, but it is clear that so long as a child has reflux, infections are a serious potential danger and to protect the child, we must watch the child. Such long-term supervision is, I am sure, best in the hands of the district pædiatrician: the general practitioner has seldom the laboratory background required, nor the secretarial assistance to maintain a relentless follow up. The surgeon, on the other hand, is often impatient with years of medical treatment and is not competent to advise on the numerous side issues which inevitably crop up when one follows a child for many years. There is clearly an imperative obligation upon the medical profession to supervise these children over a long period, and it is my opinion that in present circumstances the district pædiatrician is the best placed individual. Children who have infection but no reflux still require follow up, although they are much less at risk, a point in favour of early surgical correction.

Surgery and reflux prevention: Almost all reports of the surgical treatment of reflux describe a selected series in which only those which have resisted medical treatment or have some unusual features when first observed have been chosen for operation. The only attempt at a strictly controlled series of medical and surgical treatment is that reported by Scott & Stansfield (1968) who found a small but significant overall advantage for surgery in the diminishing number of recurrent infections, in diminishing dilation and in increasing renal growth. Since, however, spontaneous cessation of reflux is common in the lesser degrees it will, I believe, be common ground between physician and surgeon that mild cases will be treated conservatively. What we need to know is whether surgery is better for those in whom infections continue to occur, where the ureter is irreversibly dilated and reflux does not cease. In my first series up to the end of 1964

I tried to compare the incidence of recurrent infection in those with successful and those with unsuccessful operations, for at that time, when trying various methods of reimplantation, there was a proportion in which we failed to prevent reflux. At that time we found that 14% of successful cases continued to have infection; in unsuccessful cases the figure was 64%. Follow up in some cases was short at that time, and certainly more recurrences have taken place since then. Politano (1963) had a total series of 100 patients with 6 failures to prevent reflux, infection persisting in 25. Hutch *et al.* (1968) had 31% of patients with some recurrence of infection, and Hendren (1968) 20%. In all instances the cases treated were those in whom medical treatment was not preventing recurrence of infection, and it therefore seems that three-quarters of patients in whom medicine has failed can be relieved by surgery.

Refluxing megaureter: Where there is no evidence of bladder outflow obstruction but nevertheless reflux takes place into grossly dilated ureters we have a much more difficult surgical problem. We have seen that in these circumstances reflux is very unlikely to cease spontaneously and in them the apparently obstructive atrophy of the kidney is most likely to be seen. The courses open to us are briefly as follows: We may admit that correction of the urinary tract is impossible and simply attempt to prevent infection by long-term chemotherapy and perhaps assist evacuation of the urinary tract by a triple micturition regime. A few cases do remarkably well on this programme over a number of years, but it is unlikely that any of them will reach old age. We may attempt to reimplant the ureter by a reflux-preventing technique bearing in mind that this is more difficult to accomplish with ureteric dilatation, and that it may require an operation to narrow the ureter throughout its length. Success in reimplantation depends less upon the precise calibre of the ureter than upon its capacity for contraction. Examples can easily be found where an apparently enormous ureter comes down very satisfactorily after reimplant but there are others in which a smaller ureter has poor function and improves not at all. With the atonic ureter there is even a danger that we make things worse by attempting reflux prevention. Secondary pelvi-ureteric obstruction, or at any rate atony of the renal pelvis, is not uncommon in these large refluxing ureters so that pyeloplasty may be required even if we do not need to narrow the upper end of the ureter. A third possibility lies in a bladder neck revision without interference with the ureterovesical junction. This may be a deliberate attempt to lower urethral resistance in an otherwise normal urethra, but has quite often been performed on the erroneous diagnosis of bladder neck obstruction. In general I have found it a very disappointing operation, although there are a few cases where significant improvement was obtained. Finally we may opt for urinary diversion, cutaneous ureterostomy being the most obvious technique to employ. Sometimes where the ureter is still contractile, ureterostomy results in a surprisingly satisfactory return of ureteric function and calibre so that subsequent reimplantation is possible; but all too often the grossly dilated ureter is also atonic and never recovers, so that diversion has to be permanent.

Ureteric Dilatation in Children

The factors involved in ureteric dilatation in childhood are multiple and complex and in any one case more than one factor is likely to be involved. The most important other than reflux are discussed below. Probably there are others: endocrine influences are seen in pregnancy but have not yet been recognized in childhood. Metabolic causes are suspected in cases of low serum calcium with infantile hypoparathyroidism, but have not yet been proved. Neurogenic dilatation is omitted, since I believe that the ureter is affected only through the bladder by obstruction or reflux and not by changes in its own nerve supply.

Age: The age of the infant and the developmental state of the ureter govern its response to the other causes of dilatation. The ureter of a newborn child becomes much more easily distended than that of an older child, but has at the same time a greater power of recovery (Fig 2). Probably the fœtal ureter has this distensibility to a greater degree. It has been shown that the number of muscle cells and the number of elastic fibres increase from the newborn stage to early childhood; this is presumably related to the degree of distensibility and to the chances of recovery in the infant ureter. Most dilatations in the newborn are not acute but of long standing; they do not recover quickly but nevertheless recovery over a period of years is possible and can be observed in cases of ectopic ureterocele (Fig 3) and other obstructions.

Polyuria: It is well known that simple polyuria produces minor distension of the ureter: this can be seen in the process of osmotic diuresis observed in the course of intravenous pyelography. Occasionally a more dramatic example is seen in pituitary diabetes insipidus and this may be reversible by the use of vasopressin. There are in childhood some peculiar and interesting cases of familial renal diabetes insipidus in which a very high fluid intake and output must be maintained from early infancy to avoid brain damage, and in them polyuria is a primary cause of dilatation which may become permanent.

Bacterial toxins: It is frequently observed that urinary infection is associated with dilatation. This often accompanies reflux and other causes of dilatation, but it has been shown experimentally

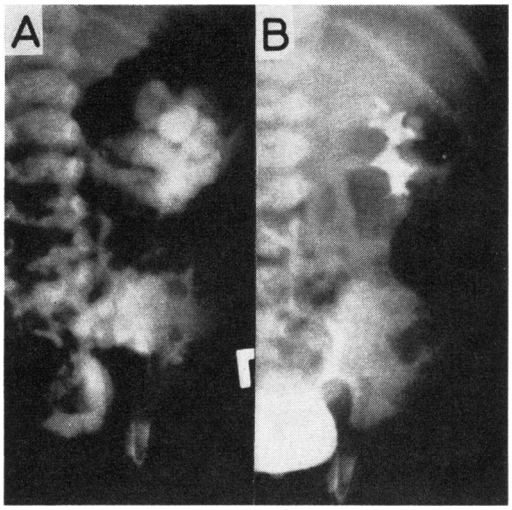

Fig 2 *Acute ureteric dilatation in the newborn.* A, *intravenous pyelogram in newborn infant with complete procidentia due to breech delivery; present for three days before X-ray.* B, *intravenous pyelogram a week after reduction of procidentia*

that bacterial toxins are capable of causing muscle paralysis and there is little reason to doubt that the same effect may be observed *in vivo*. Sometimes in infected renal calculi we observe a definite dilatation of the upper ureter which is due neither to demonstrable obstruction nor to reflux and is perhaps an isolated bacterial toxin effect.

Obstruction: Dilatation may be due to obstruction at the ureterovesical junction or to the bladder outflow but there is a considerable overlap of causes and effects and simple concepts of stricture or achalasia are not always appropriate. Although the idiopathic megaureter with a terminal non-propulsive segment is the most important, there are a few cases with genuine atresia or stricture. There are quite a number in which a ureter involved in a bladder saccule is obstructed but does not reflux. The ureteric wall is probably deficient at this point and is therefore non-propulsive, but it is important to recognize this complication of saccule formation, whether it is primary or a complication of bladder outflow obstruction. It might be added that a refluxing dilated ureter which has ceased to reflux may remain somewhat dilated even though there is no true obstruction present.

Obstructive Megaureter

Obstructive megaureter is an important cause of ureteric dilatation without reflux and with a normal bladder, and is a condition in which surgical correction is extremely effective. It occurs in all degrees of severity but the most severe are likely to be seen in infancy and in males. The presentation is usually by urinary infection although at times sterile hæmaturia, pain and uræmia cause the child to be brought to hospital. The diagnosis is usually evident from a good intravenous pyelogram showing filling of the ureter and a cystogram showing no reflux but normal bladder emptying. It is a disease which has many similarities to pelvi-ureteric obstruction and like that disorder may not always be progressive. In 27 ureters treated conservatively, only 4 deteriorated, and 10 actually improved. These were, of course, mild cases and in them urinary infections had always been controlled by chemotherapy; the interesting thing is that a number improve as growth occurs, while only a few deteriorate.

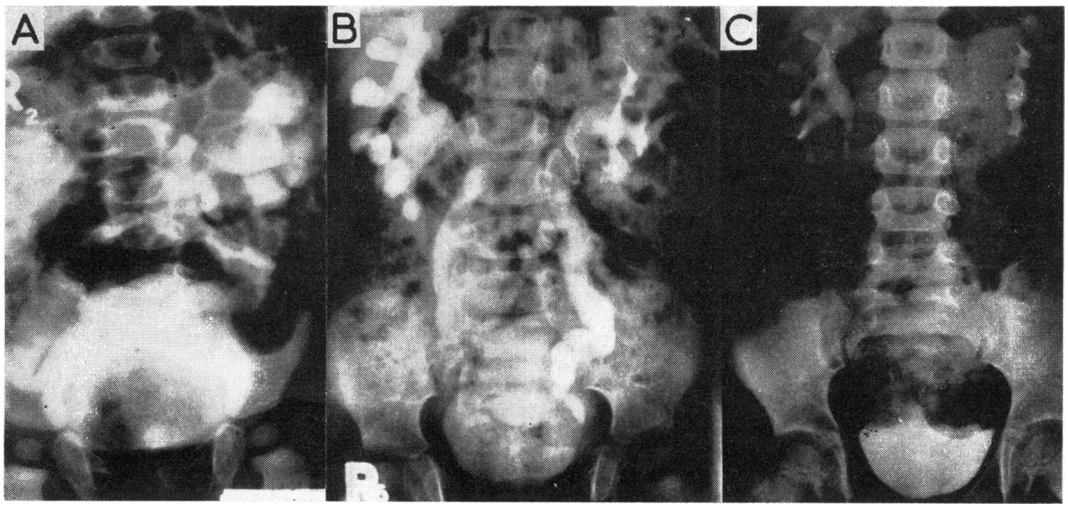

Fig 3 *Chronic ureteric dilatation in the child with recovery over a three-year period.* A, *intravenous pyelogram in a child with ectopic ureterocele.* B, *intravenous pyelogram soon after heminephrectomy and uncapping of the ureterocele.* C, *intravenous pyelogram three years afterwards showing complete recovery*

Nevertheless in the great majority such a conservative regime would be dangerous because of persistent infection which would destroy the kidney. Nevertheless surgical correction must be adequately performed: prior to 1957 when we did not use a satisfactory method of reimplantation into the bladder the results of surgery were bad and only 2 of 12 ureters improved. We now have better procedures, results are usually good and if there is failure it is usually due to a technical fault or failure in selection, but surprisingly satisfactory correction can be achieved; of 45 ureters, 31 were improved. Here then is a disease which ordinarily presents to the pædiatrician, which must be differentiated from the reflux problem and which has a satisfactory prognosis after a well-contrived operation.

Dilated Ureter with Bladder Outflow Obstruction

Few things better illustrate the difference between adult and infantile urology than the dilatation which accompanies obstruction to the bladder outflow. By outflow obstruction I do not, of course, mean bladder neck obstruction, a diagnosis which should be very seldom made in children. It is rash to say that this disease does not exist, but I find the criteria more and more difficult to define and have had the humiliating experience of having to revise this diagnosis in favour of neurogenic bladder or urethral obstruction at a later date. Urethral valves present the simplest and most clear-cut form of urethral obstruction and we may therefore study the results of removing this obstruction in terms of ureteric dilatation. Naturally our experience with the prostate would lead us to believe that most dilatations would return to normal after simple resection; often, however, the dilatation is very considerable and does not immediately respond to treatment. Regrettably, the dilatation often persists and for a variety of reasons: because of detrusor bulk, local ureterovesical obstruction, reflux, or terminal ureteric atony. In the very young where dilatation is considerable the early post-operative picture often shows residual dilatation with formation of kinks, yet a picture some years later demonstrates that these have straightened themselves and ureteric dilatation is very much less.

Secondary ureterovesical obstruction in urethral valve cases is not at all uncommon. In one example, one ureter was involved in a saccule; the cystogram shows no reflux, the pre-operative IVP bilateral hydronephrosis, while the post-operative films show improvement on the right side with deterioration on the left to the point where the kidney no longer functions. Nephrostomy was performed and the ureter reimplanted, following which there was return of function and improvement of dilatation. In another example resection of the valves made no difference, but reimplantation of the ureters in which there was a distinct long narrow segment very similar to that found in megaureter, led to immediate improvement. At other times the satisfactory correction of bladder function plus reimplantation of the ureters still makes no difference to the upper tract. In these we appear to have a condition of atonic musculature, though even these may be improved by temporary cutaneous ureterostomies allowing the ureters a chance to regain their motility as well as their calibre.

Dysplasia

In childhood many dilatations of the ureter are accompanied by a general defect of form and function in the urinary tract, and in these there are often irregular dilatations which are apparently neither obstructive nor refluxing in origin, and which are sometimes associated with good thick renal parenchyma, sometimes with dysplastic renal tissue. A typical example occurs in the prune belly syndrome, but many other similar dysplastic ureters can be observed where the abdominal wall is normal and we must always be prepared to take this into account when advising conservative treatment or surgery.

Conclusion

I would like to thank the many pædiatricians who sent me such interesting cases: the discovery of these urinary disorders is an important part of their work and while the treatment of many of these children must remain in their hands, it is hoped that they will continue to seek urological consultations and recognize the valuable place of surgery in many of these disorders. I hope urologists will recognize that children's diseases require special study, and that some instruction in this subject should be part of the training of all urologists but that there is an important need for a few of our number to devote a very large part of their time and enthusiasm to the treatment of children, particularly within a large children's hospital providing referral service in all system specialties. I hope that all concerned will realize that in this field there is still an ample opportunity for research and potentially rewarding results.

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