REFRESHER COURSE FOR GENERAL PRACTITIONERS

PYELITIS IN CHILDREN

BY

A. V. NEALE, M.D., F.R.C.P., D.P.H.

Professor of Child Health, University of Bristol

"Pyelitis" implies inflammation of the pelvis of the kidney. The term is conventional, for it is unlikely that infection will be exactly restricted to a single part of a mucous membrane continuous from the terminal collecting tubules to the urethra. It is this anatomical continuity of the renal pelvis and the renal substance which makes pyelonephritis such an outstanding danger in many cases of pyelitis.

"Chills" and debilitating disorders, including poor nutritional states, may so undermine a child's health that bacterial pyelitis may occur as a dramatic clinical event. The common infecting agent, *Bact. coli*, is usually innocuous so long as it is confined to the alimentary tract, and the clinical syndrome of acute pyelitis is generally a manifestation of its haematogenous dissemination. In addition, unhygienic conditions of the perineum and the genital areas in children, particularly in girls, can lead directly to an ascending urethrovaginal infection, with immediate or ultimate ascent to the uretero-pelvic mucosa.

In health, the ureters are able to eject their contents into the bladder, even against gravity, and any decline in their peristaltic activity may be an important contributory factor in the onset or prolongation of renal-tract sepsis; free urinary drainage usually ensures a self-limiting and clinically short infection. It may therefore be an advantage in pyelitis to support a child in bed in order to assist the urinary flow. Obstruction may arise as a direct result of some congenital abnormality in the urinary tract, or from a pelvic swelling, or there may be dysfunction due to a neurological lesion. Acute and chronic urinary infection is much more frequent in children with congenital anomalies or neurogenic stasis in the urinary tract.

Pyelitis in Infancy

Urinary infection probably has its greatest incidence in the first two years of life and is often part of a general infection in which *Bact. coli* or *Staphylococcus aureus* may be incriminated. The origin of the infection may be in the upper respiratory or the gastro-intestinal tract. Pyelitis may complicate gastro-enteritis, otitis media, or pink disease. Diagnosis may be difficult, and the course may be rapidly downhill in this early age group. Irregular fever, apathy, and limpness, with occasional twitching or even a convulsion, may occur in acute pyelitis. The bacteraemia which is often present in the early stages explains the general disturbance. An ill-looking, pale, and restless baby, with inexplicable vomiting, refusal of feeds, and a high temperature, or the fat infant who is feverish and flushed, restless and whimpering, and possibly with some meningismus, should arouse suspicion of pyelitis. Certain metabolic disorders in the first year of life, such as "renal acidosis," may present as pyelitis with episodes of fever and variable marasmus.

With infants some ingenuity may be required to collect a specimen of urine. Catheterization should be avoided if possible. Potting the baby at intervals, preferably for a few minutes just before or just after a feed, is often successful. Attachment of a test-tube to the penis is a practical method without difficulty so long as there is sufficient space around the penis for air to leave the tube. A female infant

can be placed on a shallow receptacle enclosed within a napkin, or a "clean specimen" may be collected by placing the baby on two small warm sandbags with a shallow dish between. An opalescent acid urine is strongly suspicious, and a drop under the microscope will show the pus cells in even suspension. Large clumps of pus cells suggest a more intense renal-tract infection; casts and red blood cells point to pyelonephritis.

Treatment of Infants

Treatment may be a matter of urgency: skilful nursing and the arrest of dehydration will be required. In the simple case the infant will drink well and thus ensure a good renal flow. The nursing needs are peace and quietness, warmth, and a comfortable slightly raised position in bed.

Usually the infection is due to *Bact. coli*, although in one series nearly half the cases were caused by *Staph. aureus* or streptococci. The drug of choice is a sulphonamide such as sulphadimidine; its use in the acute stage is commonly followed by quick success provided there is no obstruction. Naturally in babies the possibility of renal complications due to the sulphonamide itself must be borne in mind. Provided the supply of fluid is adequate a simple scheme of treatment can be followed: an initial dose of 0.5 g. is followed by 0.25 g. eight-hourly for infants aged 1 to 3 months, 0.25 g. six-hourly for those aged 3 months to 2 years, or 0.5 g. six-hourly for those 2 years or older. As the concentration of sulphonamide in the urine may be 100 times that in the plasma, these doses will normally produce a potent antibacterial effect. If the urine is kept neutral or slightly alkaline the sulphonamide is rendered more soluble in the urine. This is best achieved by prescribing a mixture of sodium bicarbonate and potassium citrate in equal parts, 5 to 10 gr. (0.32 to 0.65 g.) according to age, with each dose of the sulphonamide. Care must be taken not to disturb the sodium and potassium balance by giving too much potassium citrate, especially if there is severe oliguria or any suspicion of renal failure. It should be noted that orange juice and milk contain appreciable amounts of potassium salts. The ingestion of plenty of glucose or other easily assimilable carbohydrate is helpful during the oliguric phase.

As an alternative it may be useful to give a preparation such as "sulphatriad," which contains sulphadiazine, sulphathiazole, and sulphamerazine. This may ensure a minimum risk of irritative haematuria and crystalluria or renal tubular sensitivity, whilst at the same time the bacteriostatic effects of the sulphonamides in the mixture are additive.

In every case it is desirable to identify the causative organism and to test its sensitivity to sulphonamides and antibiotics. This is not a difficult matter nowadays, and the information may be very valuable in deciding upon the duration of treatment or when persistence of the infection or a recurrence may call for special selection in attack. Such tests may indicate the appropriate use of penicillin, streptomycin, or chloramphenicol for periods of up to seven days.

Infants are often slow in recovering from pyelitis. Natural resistance at this age is low, and there is a notable absence of inherited antibodies against coliform bacilli in the neonatal period. Sulphonamide treatment should be continued for ten to fourteen days. At the same time every effort should be made to restore the patient to a first-class state of nutrition and to raise the haemoglobin level to

normal. Oral feeding with milk mixtures should be continued or recommenced as early as possible. Milk proteins are necessary to protect parenchymatous tissues, especially liver cells, against secondary toxic and fatty changes and also to reverse as quickly as possible the rapid nitrogen depletion of the febrile infected infant. In protracted urinary infections with anaemia a small transfusion of fresh blood is specially valuable; the response to oral iron may be delayed until after every vestige of infection has been eliminated. Debility before, during, and after acute urinary infection may be associated with severe constipation, and the avoidance of faecal impaction may be important.

It is most important in these infants to be always on the watch for an unsuspected involvement of renal parenchyma, the "pyelitis," in fact, being quite often associated with an interstitial suppurative pyelonephritis. Deepening toxæmia, drowsiness, oliguria or even anuria, uraemic acidotic respiratory changes, persistent vomiting, anaemia, and possibly some facial oedema, together with a considerable increase in albuminuria, with red cells and casts and clumps of pus cells, are clear indications of the development of pyelonephritis. The passage of tubular and pus casts may be intermittent.

In such a case it is urgent to determine the causative organism and whether it has become drug fast. No time should be lost in intensifying the attack on the bacterial agent. Streptomycin, 10 to 20 mg. per lb. (25 to 45 mg. per kg.) daily intramuscularly, in two or three divided doses for five days may prove a life-saving measure in these circumstances. Chloramphenicol in oral dosage up to 50 mg. per lb. (120 mg. per kg.) daily divided into six-hourly doses for five to seven days may be used similarly. In infections by sensitive organisms a single daily dose of 500,000 units of crystalline penicillin may, under such conditions, maintain an adequate blood level.

Acute Pyelitis in Childhood

Acute pyelitis is commoner in girls than in boys, and, although this is probably owing to an increased incidence of ascending infections in girls, haematogenous infection is probably the usual route in both sexes. As in infants, there is always the possibility of pyelonephritis or relapse owing to the same underlying factors. Infection of congenital forms of hydronephrosis is quite frequent.

Toxaemia, with sweating and renal pain, may suggest the diagnosis. The renal symptoms are sometimes bizarre. There may be generalized upper abdominal or referred epigastric pain, with reflex vomiting. Sometimes severe attacks of pain, of sudden onset and almost equally sudden relief, occur irregularly. At the onset there may be a temporary profuse haematuria. In older children the symptoms are usually more clearly defined and approximate to the adult picture. There may be high pyrexia and rigors, and the excretion of a highly acid urine, with variable oliguria or simple frequency and some dysuria, which may precede the appearance of pyuria by a day or so. The bacterial agent is commonly *Bact. coli*, but in the relapsing forms other bacteria, such as *Proteus*, *Streptococcus faecalis*, *Pseudomonas pyocyanea*, or staphylococci, may become dominant at one time or another.

The typical acute *Bact. coli* infection, in the absence of any urinary-tract obstruction, may subside quite quickly following the simplest of procedures—rest in bed, warmth, and copious fruit-juice drinks. The former classical treatment of rapid alkalization of the urine is best achieved by the cheap and simple method of giving sodium bicarbonate, 20 gr. (1.3 g.) two-hourly, until the urine is strongly alkaline to litmus, when the reaction can be maintained by small doses of potassium citrate and sodium bicarbonate given together. Overloading with potassium salts in the stage of oliguria in the acute infection should be avoided. Colon bacilli are adaptable to wide ranges of urine reaction, so that, although the alkalization aids in the antibacterial treatment and may conspicuously relieve the dysuria, cure does not always result.

Despite the frequent success of these simple procedures, sulphonamides have now gained a reputation for shortening urinary infections of this type. But if sulphonamides are used they must be given in adequate doses, otherwise drug resistance may develop. The particular value of sulphadimidine has already been mentioned. Sulphacetamide is soluble in physiologically acid urine, and low plasma levels are consistent with a high urinary content. Sulphadiazine, a popular preparation, is rapidly cleared from the blood, but, as with sulphathiazole, there may be some extra risk of crystalluria. If sulphamerazine is used its dosage must be carefully regulated, because excess intake may cause masses of clumped crystals and epithelial debris in the bladder, and occasionally urethral impaction has occurred. An average dose of one of these sulphonamides is 0.5 g. six-hourly at 2 to 5 years, increasing to 1 g. at 10 years of age, preferably for not more than five days. An initial or loading dose of double these amounts should be given. In heavily infected cases one of the triple mixtures of sulphamerazine, sulphadiazine, and sulphathiazole or sulphacetamide may be used. Polymyxin has been found to be effective in some infections due to Gram-negative bacilli, especially *Ps. pyocyanea*. It is given intramuscularly in doses of about 10,000 units per kg. of body weight four-hourly for five days or longer.

Acute pyelitis is sometimes an index of poor general health, and a reasonable period of convalescence should be encouraged after the urinary symptoms have cleared. Also, if only bacteriostasis has been achieved, there may be a flare-up of active infection. A child quickly feels better after treatment and a false sense of security may lead to laxity in the supervision. At least two weeks' rest in bed should be insisted upon.

Complications

Fever is sometimes persistent, or irregular sudden bouts of high temperatures may be alarming, especially in an infant. Twitchings or convulsions due to cerebral irritability under conditions of the acute infective toxæmia may occur, and marked meningism may be added to the picture. If the anterior fontanelle is open and bulging, secondary meningitis should be excluded by lumbar puncture. Diarrhoea and/or vomiting may appear at any time during acute urinary infection, and special care must be given to fluid requirements in order to avoid the consequential troubles of dehydration oliguria. Oral sepsis, including thrush infection, may quickly supervene when the general care and oral hygiene are inadequate. An enlarging liver, with possibly a tinge of jaundice, indicates a selective toxic fatty swelling of the liver and is more apt to occur when fluid and glucose intake has been inadequate, or it may add to the dangerous clinical position obtained in the suppression of urine. Haematuria occurring at the onset or during the course of the infection may be alarming, but a single short bout of blood-stained urine is not of serious significance. However, sulphonamide haematuria must be suspected and the urine examined for crystalline material. Rapid worsening in the clinical state, with severe oliguria and haematuria coupled with increased fever, should cause suspicion of intrarenal spread of the infection.

Pyelonephritis and uraemia may supervene or hypertension may develop. If there is severe increasing toxæmia "persistent acute pyelitis" may, in fact, prove to be diffuse intrarenal suppuration or possibly a massive renal carbuncle, and these possibilities would specially be suggested by the presence of a heavy load of *Staph. aureus* in the urine. Perinephric abscess may eventually develop as a direct extension from a subcapsular pyogenic focus, and thus add to the confusing general and local symptoms and signs.

In infants under 6 months of age *Bact. coli* meningitis may develop. In staphylococcal urinary infection possible haematogenous dissemination to bones or pericardium must be kept in mind. In all or any of these complications anaemia may be quite evident, indicating the relative sensitivity of the haemopoietic tissues and the circulating blood to toxic infective states, especially in the infant. Lack of sleep may cause the child much distress and add to the

burden of dysuria. Local infection may reveal secondary balanitis or, in a girl, an irritative inflammatory acute urethrocele.

Relapses

Relapsing, resistant, or persistent pyuria in childhood must be regarded as a serious matter until proved otherwise. A thorough investigation is essential. Too often in the past "recurrent pyelitis" has been treated with courses of alkalis, ketogenic diets, mandelic acid, or, more recently, with sulphonamides and antibiotics with variable temporary or symptomatic relief. Congenital abnormality in the urinary tract is common and a superimposed infection may be most difficult or impossible to eradicate. Neuromuscular disorders are by no means rare. The anatomical structure of the tract must be studied by pyelography. Deformity of pelvis or ureters may be seen, or evidence obtained of spasm or congenital stricture at the pelvi-ureteral junction, at the uretero-vesical entrance, or at the bladder neck itself. Mega-ureter, diverticulum, or even a horseshoe kidney may be detected. Sometimes an unsuspected calculus is revealed. It is a serious clinical mistake to overlook any of these conditions, and perhaps most particularly the "bladder neck" syndrome which is so amenable to treatment. Delay in these cases is dangerous.

Prognosis

Many acute urinary infections in early life clear up quickly and completely. General ill-health or undernutrition may accompany simple recurrences. However, chronic urinary infection may be discovered only when an acute episode of pyelitis sets in. Similarly a period of enuresis or a single attack of apparent renal colic may bring to light the true problem. Occasionally, and unexpectedly, a sizable calculus is seen radiologically. Children who have so-called cyclical vomiting, accompanied perhaps by vague abdominal disorder and periodic pyrexia, should be examined carefully for concurrent upper urinary infection. The insidious development of a pyonephrosis in a child who has complained periodically only of feeling feverish and of lack of appetite may come as a clinical surprise. A clinically benign non-tuberculous infection with variable pyuria and adequate renal function may persist for many years, but there are inherent dangers of acute spreading disease with fulminating unilateral or bilateral pyelonephritis. It is noteworthy that chronic pyelonephritis accounts for a large proportion of patients who develop progressive renal failure. In "chronic pyelitis" an anatomical diagnosis must be sought, and ultimate disaster averted if possible.

Owing to the efficacy of modern urinary antiseptics a child's recovery from a urinary infection, even without recurrence for several months, does not preclude the presence of some obstructive lesions. Much of the anatomical damage in the renal tracts observed in later childhood might be avoided by thorough treatment in infancy. The story may be continued in the adult with persistent pyelitis in whom there is a history of "pyelitis" in childhood; cure may have been too readily assumed during a long asymptomatic period, while a latent pyelonephritic renal sclerosis, perhaps unilateral, has become the essential background of established hypertensive cardiovascular disease.

Behaviour problems can arise as a result of urinary symptoms connected with persistent or recurrent infection, and this may be particularly so where matters concerned with the bladder-neck dysfunction are allowed to pass undetected. Nervous exhaustion in child and parents and worry over persistent enuresis are sometimes, regrettably, the reflection of unsuspected causes.

Next Refresher Course Article.—"Leucorrhoea," by Professor C. S. Russell.

Refresher Course Book.—The first collection of articles of this series (fully revised) are available as a book containing 55 chapters, price 25s. Copies may be obtained either direct from the Publishing Manager, B.M.A. House, Tavistock Square, London, W.C.1, or from your bookseller.

THE TEACHING OF GENERAL PRACTICE BY GENERAL PRACTITIONERS

REPORT OF THE UNDERGRADUATE EDUCATION COMMITTEE OF THE FOUNDATION COUNCIL OF THE COLLEGE OF GENERAL PRACTITIONERS

There is a growing awareness throughout the profession of the need to teach medical students not only the science and basic principles of medicine but also certain important aspects of general practice. Some of this teaching can best be done by general practitioners themselves; and it is now being widely appreciated that medical students have much to gain from special instruction in that branch of medicine which the great majority are destined to enter.

This report (i) presents the case for the training of undergraduate medical students in those aspects of general practice best taught by general practitioners; (ii) examines critically the existing arrangements for this; (iii) discusses ways in which these may be extended and co-ordinated by enlisting the co-operation of medical schools and the help of established practitioners; and (iv) makes recommendations.

(i) The Need for Certain Aspects of General Practice to be Taught to Students by General Practitioners

The doctor of a family should be a privileged friend, with wide experience and up-to-date knowledge, able year after year to co-ordinate the medical care of all its members. In an age of increasing specialization it is easy to forget that this overall and continuous responsibility for the care of patients is shouldered only by the general practitioner, who works under conditions very different from those in hospital, where he learned his medicine. His responsibility continues even when specialized assistance is sought or when the patient is admitted to hospital. Whenever a patient brings a problem the doctor must feel that it is his duty to solve it himself, or to ask someone else to solve it for both of them, so that the patient is left with a lightened burden. General practice embraces a wide range of human relationships; and since health is intimately related to work, happiness, and purpose in life, this problem may concern almost anything and anybody; it may be medical or social or both.

The student who chooses general practice requires instruction in: (a) academic medical knowledge; (b) the application of this knowledge to conditions outside hospital; and (c) the doctor-patient relationship.

A hundred years ago the young medical apprentice attached himself to an older doctor and was taught the doctor-patient relationship before going to hospital to learn medicine and returning to practice to apply his knowledge. This system may have had faults, but hospital consultants in those days were in close touch with general practice; many of them had been for a long time in general practice, some were still working as part-time practitioners, others were meeting practitioners frequently in consultation. Even in hospital, students at that time were taught the "feel" of general practice. This liaison between medical schools and general practitioners is now in danger of being lost.

Since the abandonment of the apprenticeship system and dispensary teaching, with their influences of example and personal contact with family doctors, medical undergraduate education has taken place almost entirely in medical schools and hospitals. No one doubts that general practice must be built on the same foundation as any other branch of medicine, and that all students must undergo a scientific training; but we believe that nowadays the balance is wrong. In hospitals, students now learn the science and principles of medicine without enough emphasis on their application in general practice, so that they remain unaware of the true nature of general practice and of the essential difference between the care of patients in hospital and in