chiefly on the trunk and is diffuse, but deepest on areas normally pigmented. A characteristic feature is that the brown area is dappled over with lighter spots, as though it had been rained upon, the so-called "rain-drop pigmentation." Arsenical pigmentation is usually accompanied by keratoses on the palms and soles and possibly by other signs of arsenical poisoning.

There are two types of depigmentation which should not cause difficulty in diagnosis, viz., vitiligo and syphilitic leucoderma. Vitiligo occurs anywhere, often on the hands, face and neck. The areas are irregular, often large, the margins of the patches are sharp, and there is often hyperpigmentation around the patches. When the areas involved are large, sometimes it is difficult to decide which is the normal skin, the white or the dark. The convex edges of the white patches enable one to recognize that it is the white which is abnormal, while the dark is normal.

Syphilitic leucoderma is almost confined to the sides of the neck; the areas are small, oval, and of uniform size. They fade gradually into the darker areas, giving a very characteristic dappled effect.

Dermatitis artefacta is generally easy but sometimes difficult to diagnose. It always occurs on places which can be reached by the patient. The appearances are usually odd and not like any known skin disease. They may be produced in various ways, e.g., by applying lysol or carbolic acid to the skin, or merely by rubbing with a wet finger. The patients are usually women and often show evidence of hysteria, e.g., anaesthesia of the bulbar conjunctiva and soft palate, and suggestion anaesthesia to pin pricks. They often seem really to be unaware that they produce the lesions themselves, and it is generally impossible to persuade the sympathetic relatives, and sometimes even the family doctor, that the lesions are artificial!

I will close with a word about drug eruptions. Remember that acneiform lesions with comedones can be produced by chlorine or tar, usually on the penis, scrotum, and arms, while bromides and iodides can produce pustular lesions resembling acne, but without comedones, on the face and back. Iodides may produce also fleshy masses resembling gummatas or sarcomata on the face, forearms, and hands, and if these are mistaken for gummatas the iodide may be pushed and the condition aggravated. Bromides may produce papillomatous masses covered with numerous points exuding pus, especially on the legs. These may persist for some time after the ingestion of the drug has been stopped, and so lead to difficulty in diagnosis.
secondary one connected with calculus, growth or congenital abnormality.

About two years ago a Canadian worker named Bruce Chown investigated a large number of cases of pyelitis in infancy, with special regard to those fatal cases which had been examined by autopsy. In a period of twelve years he was able to find records of thirty cases in infants under two years old in whom pyelitis had been diagnosed before death, though in many instances the actual cause of death was some other condition such as bronchopneumonia or ulcerative colitis. In practically every instance the lesion in the kidney had been that of some degree of suppurative interstitial nephritis, varying from the mildest cases where a moderate degree of pyuria had complicated or co-existed with a different complaint, the kidney showing a few isolated foci of infection, to the gravest forms of suppurative nephritis which had in themselves been fatal. In every case the pelvis of the kidney was examined, and although in some a mild inflammatory condition of the mucosa was present, there was not one in which it gave the appearance of being the main site of disease, and in very many no changes were found in the pelvis at all. It is to be noticed that although these observations are based on post-mortem findings, the actual kidney condition in many of the cases was a mild or early one, and it seems reasonable to suppose that the picture presented was in essence the same as that which exists in those innumerable cases which recover.

The investigations of Bruce Chown were limited to children under the age of 2 years, and it is possible that older children react in a different manner to infection, but pyelitis, apart from stone or serious congenital malformations, is rarely a fatal disease in later childhood, though often a very obstinate one, so one has no better grounds on which to base the morbid anatomy of the disease than the post-mortem findings of younger and more fatal cases.

Since my attention was drawn to this aspect of the subject I have seen a large number of cases of pyelitis—we still for various reasons use the incorrect term—and have had fifteen under my direct observation for long periods. I have had three fatal cases all under a year old on two of whom an autopsy was allowed. In both, the appearance of the kidneys corresponded very closely with that described by Chown, there being multiple abscesses scattered over both kidneys, chiefly in the cortex, while the pelvis and bladder were but mildly infected.

Etiology.—A baby can scarcely be too young to get its kidneys infected, but as none of the warning symptoms met with in later childhood can be helpful in infancy, probably a large number of cases are overlooked, especially as few people take the trouble to collect and test the urine of infants unless something very obvious attracts the attention to the renal system. Actually the kidneys of the infant are very susceptible organs and are readily attacked by the Bacillus coli communis, either as a primary infection or more often as a complication of an existing debilitating condition such as enteritis, bronchopneumonia or otitis media. If the urine of all such babies is examined systematically it will be found that urinary infection is commoner before the age of two than after—twice as common according to Thomson.

Sex plays a less important part than has frequently been supposed. There is a definite preponderance in girls, especially after infancy, but that may at least in part be accounted for by the fact that one is more on the look-out for this condition in girls, and perhaps too because incontinence of urine is more difficult to control with the short urethra, so that relief is sought for this symptom sooner. Ascending infection via urethra, bladder and ureter is still thought to be a possible route, though the anatomical arrangement of the lesion in the kidney, which is mainly an interstitial infiltration, makes a blood-infection a more reasonable explanation.
PYELO-NEPHRITIS IN CHILDREN

The bacterium concerned is predominatingly the *B. coli communis*, and is probably endogenous. Other infections are much rarer; the streptococcus, staphylococcus, gonococcus, and bacilli of the typhoid group are found from time to time, but these do not produce the same syndrome of symptoms. Streptococcus sometimes occurs as a second infection in *B. coli* cases. It is noticeable that the reaction to the *B. coli* in the genito-urinary tract is a very variable one. Often there is scarcely any reaction at all, and a bacteriuria without pyuria may exist, only to be found by chance in some routine examination: this is, however, uncommon in children. Routine examinations among hospital children show that the kidney falls a victim to this infection quite commonly in the course of some other disease. Fromm states that 4.4 per cent. of 225 hospital children had a urinary infection. I should have thought that an underestimation, but it is difficult to be accurate as it is impossible to take catheter specimens in many young children. Certainly in the wards, when daily specimens are put up, a mild pyuria is frequently detected in cases such as bronchopneumonia in which no renal or bladder symptoms exist. At other times the infection is acutely resented and causes a profound constitutional disturbance as well as severe local reaction.

**Symptoms.**—An examination of the symptoms of this condition will show how impossible it is to conceive of it as a disease of the renal passages only, rather than an infection of the kidney substance. True, the renal function is not so much interfered with as in those conditions in which the parenchyma is directly attacked, but that it is interfered with is evidenced by the frequent occurrence of headache, vomiting, drowsiness and convulsions.

Symptoms may be conveniently described as they occur:—

1. In infants.
2. In children, with acute onset.
3. In children, with insidious onset.

In infancy the local symptoms are few or none, as frequency of micturition may well be overlooked in a baby of a few months old, but if the attack is severe, convulsions and vomiting may occur, together with high temperature, much general disturbance and restlessness. These cases simulate meningitis, and it is a good rule to make, never to perform a lumbar puncture before a urine examination has been made. This obvious precaution is quite often neglected, just because urinary infection has not been thought of as a common cause of acute illness in infancy, and because there is the slight difficulty to be overcome in collecting a specimen from a baby. In less severe infections the picture is one of general debility and slight fever, occasional vomiting, irregular and unsatisfactory stools, indeed not very different from a bad "feeding" case that does not get on but never seems to have any definite reason for the want of progress.

**Acute** cases in older children commonly start with a rigor. This symptom alone is a valuable diagnostic one, as it does not commonly precede children's fevers and is notably absent in appendicitis, which is the disease most likely to be mistaken for pyelo-nephritis. The temperature is high but not sustained, with daily remissions, like most pyrexias produced by pus formation; sweats may accompany the remissions. There is no crisis, the temperature gradually falling to normal during the second week. Pain is an almost invariable feature and may be complained of in either loin or in both. Quite often, however, the pain is referred to the middle of the abdomen, and is occasionally suprapubic. A feature of the loin pain is that it may be a severe and intermittent colic, suggesting calculus. As the intermissions of pain may be found to coincide with absence of and subsequent increased quantities of pus in the urine, it may be assumed that the ureter at times gets blocked by the exudate. Both headache and vomiting may be distressing and are not
easy to control. Drowsiness is a bad sign. There is generally considerable frequency and often pain on micturition. Urine is moderate in amount, highly acid, containing albumin in variable amount, pus, sometimes blood, and numerous organisms; hyaline and granular casts are frequently present, and emphasize the involvement of kidney substance.

The insidious onset or the relapse from an acute condition is characterized by bladder symptoms. The child is often brought for frequency and incontinence. The incontinence has at first been nocturnal only, but as the bladder becomes more irritable it is impossible to retain the urine during the waking hours, and the child’s garments are constantly soaked. There is general debility and misery, much contributed to by the shame of wet clothes. The urine shows much the same characters as in the acute condition, but as the pyuria is intermittent, it is important to examine a suspected urine more than once.

Urea excretion.—As might be expected, the function of urea excretion is interfered with; though to a less extent than in Bright’s disease. Blood-urea percentages of 0.03 to 0.06 are usual, and are high for children who are receiving a milk and water diet. On the other hand, water and salt excretion does not seem to be interfered with very much, though a certain puffiness may be noticed round the eyelids.

Vaginal discharge, apparently non-gonorrheal, is a not infrequent association of bacillus coli infection, and it is often hard to say which of the two conditions is the primary one, or indeed whether they have any connection. It occurs in the acute as well as in the chronic cases, is generally mild in degree, and may be overlooked if not sought for. The whole question of non-specific vaginitis in children is obscure, but here at least is a definite association which might well be followed up.

The diagnosis of a bacterial infection of the kidney is not usually difficult to establish, once the possibility of such a condition has been considered, especially as the only other acute diffuse lesions of the kidney—parenchymatous and hemorrhagic nephritis, show no causative organisms. If it were not for the presence of bacteria, there might be considerable difficulties in diagnosis, as there is no sharp dividing line between the characters of the urine as was formerly supposed; while on the one hand there is sometimes considerable effusion of pus cells in a case of nephritis (Bright’s), there is on the other hand the frequent presence of tube casts in cases of “pyelitis,” so that a cursory microscopic examination without the help of high magnification may not be enough to establish the diagnosis. The following difficulties may arise:—

1. The scarcely credible occurrence of a child’s acute abdominal condition being mistaken for appendicitis because nobody has thought of testing the urine.

2. The far more credible occurrence of an infant’s illness or mere lack of progress being left undiagnosed for the same reason. This is all the more likely to occur if the infection is a secondary one, e.g., to otitis media.

3. The urine may be tested once only at a period when there happens to be no albumin or pus, such periods being common in the course of the more chronic cases.

Collection of Urine.—It is often assumed by those who have not had much practical experience that it is quite a simple affair to collect a catheter specimen from a little girl. Let them try for themselves on a little girl who has decided against it. It is not a question of the small size of the meatus because it is possible to pass a very fine catheter into the urethra of almost the smallest infant, but in the years between infancy and self-control, children will often forcibly resent any handling of the external genitals, especially if there has previously been some unsuccessful fumbling which has given pain. It is generally only necessary
to clean the labia and surrounding parts thoroughly and let the child pass water naturally into a freshly sterilized bowl. Inoculation on to the culture medium must follow as quickly as possible. There will then be no difficulty in distinguishing between the diffuse growth from an infected urine and the few scattered colonies from contamination.

**Treatment.**—Rest in bed is a necessary condition even for the afebrile cases, though the patient should sit up or be propped up as much as he likes. During pyrexia food should be limited to water, milk, fruit and toffee, and a gradual transition made to bread and butter, bread and honey, puddings, and vegetables. Highly nitrogenous food should be avoided for a long period.

The alkaline treatment, in the shape of large and frequent doses of potassium citrate, is still found the most beneficial, though it is hard to tell exactly how it acts. It certainly does not have any directly lethal effect on the bacilli, nor does it neutralize any pre-existing acidosis in the blood. Hare, Lepper and Martland, writing on this subject, state that the administration of alkalies relieves the symptoms without curing the disease. They found that the hydrogen-ion content of the urine was altered and that the symptoms were relieved only when the pH of the urine had reached 7.4 to 7.6. They point out that the usual methods for testing alkalinity of urine are faulty, as pink litmus paper turns blue at a pH of 6.6, which is really still an acid urine. They suggest that relief comes from the cessation of tissue irritation by acid urine and that in the absence of this irritation, the tissues have a better chance of self-recovery.

The administration of hexamine has a more rational basis, as it seems certain that this drug releases formaldehyde when excreted into an acid urine. To obtain this release, the pH must be less than 6. Acid sodium phosphate is administered with the drug. Formaldehyde is lethal to *Bacillus coli* in concentrations as low as 1 in 20,000.

Actually it is impossible to say which of the two treatments, the alkali or the acid, is the more satisfactory. Some cases would get well on either, others are switched backwards and forwards with a week's trial of each, and still obstinately resist.

Other useful urinary antiseptics are ammonium benzoate and boric acid, either given in 10 gr. doses.

Vaccine treatment has generally proved a failure and is especially unsatisfactory for children.

Few cases resist treatment for more than two or three weeks. When they do, the following possibilities must be considered:

1. There is a hidden primary focus, such as appendicitis, which requires treatment.
2. The coli infection is masking a tuberculous kidney.
3. Stone is present.
4. Abnormalities of the urinary tract, such as cystic kidneys, dilated ureters, kinked ureters, may be the underlying condition.

The measures to be taken to discover these conditions are obvious.

**Summary.**—"Pyelitis" is probably always a form of nephritis. There is no evidence to show that the pelvis of the kidney is the main focus of disease. The involvement of the kidney is borne out by symptoms and clinical findings. Fatal cases show foci of suppuration in the interstices of the kidney.

Treatment consists of rest in bed, diet and citrate of potash, hexamine, or alternate courses of the two.

**REFERENCES.**

**Chown, Bruce.** *Arch. Dis. Childhood*, ii, 8, 97.

**Thomson.** Seventeenth International Congress of Medicine, London, 1918, Section X, 108.

**Fromm.** Centralbl. f. Kinderhälk., 1904, ix, 367.

Pyelo-Nephritis in Children

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