

# SURGICAL DISEASES OF THE URINARY TRACT IN CHILDREN

WITH SPECIAL REFERENCE TO THE VALUE OF CYSTOSCOPY \*

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It is not generally recognized that children are subject to most of the urologic diseases common to the adult. A review of recent pediatric and surgical literature would lead one to believe that, excluding a few well recognized conditions (as vesical calculus, pyelitis and renal tumors), urinary diseases were very rarely encountered. However, as a result of clinical experiences and postmortem examinations, we are convinced that diagnosis, in affections of the urinary tract, is by no means accurate, and that, in consequence, many cases are overlooked.

The reasons for this are as follows: 1. Diagnosis in general is much more difficult in infancy and childhood. 2. We are deprived of the information obtained by a careful history. Too often we must be guided by fragmentary descriptions of symptoms given by parents or nurses. Unless the condition, therefore, is clear cut with characteristic symptoms (as in vesical stone), it may be impossible to differentiate, by ordinary means, bladder or renal diseases from other affections. 3. Palpation, unless performed under anesthesia, is rather unsatisfactory in children. Then again, palpation is, at times, unreliable as a diagnostic aid, for absence of enlargement of the kidney by no means excludes disease (as in early tuberculosis, and small renal tumors). 4. The modern methods of examination which are considered routine in the adult are seldom applied in the young. The latter probably furnishes the chief reason for the numerous mistakes and uncertainties in diagnosis in this field. Cystoscopy, ureteral catheterization, functional tests, and the roentgen ray have not supplanted the older, time-worn procedures. The subject of urology, in its newer conception, is given scant attention and rarely is reference made to the value of cystoscopy. A number of textbooks ignore these methods, a few describe them perfunctorily, with comments as to impracticality and difficulty. Instead of cystoscopy, it has been suggested that both kidneys be

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exposed and examined through lumbar incisions before attempting radical operative procedures. This, despite the fact that exploratory exposure of the kidney has often been shown to be of no value. At operation it has frequently been demonstrated that there may be no pathologic changes evident by inspection and palpation, and still serious disease be present (tuberculosis localized in the pelvis or papilla, renal calculus, etc.).

The object of this article is two-fold: first, to call attention to the feasibility of applying in the young in the great majority of cases, the same diagnostic procedures used in the adult, namely, cystoscopy, ureteral catheterization, roentgen ray, cystography, and the functional tests; and second, to the fact that surgical diseases of the urinary tract in infants and young children are not so uncommon as we are led to believe.

#### CYSTOSCOPY AND URETERAL CATHETERIZATION IN EARLY CHILDHOOD

Nitze<sup>1</sup> was the first to call attention to the use of cystoscopy and ureteral catheterization in children, having, in a few instances, successfully cystoscoped males as young as 8 years of age. In younger children where this examination was urgently indicated and the caliber of the urethra prevented instrumentation, a perineal urethrotomy was advised, through which the instrument could be passed. Casper<sup>2</sup> and Jacoby<sup>3</sup> each described a child's cystoscope, but made no mention of its use clinically. Since then, few articles dealing with this subject have been published. This is probably due to the fact that up to a short time ago, satisfactory cystoscopes of small caliber were not available. At present, when such instruments can be obtained, but few clinics are supplied with the armamentarium necessary for these examinations. In females over 6 years of age, the ordinary adult cystoscope (21 French caliber) may safely be used, for the urethra possesses marked dilatibility. In 1908, Portner<sup>4</sup> described a new child's observation and catheterizing cystoscope and reported its successful use in a number of cases. The observation cystoscope has a caliber of No. 12 French, the catheterizing instrument No. 17 French. With these he succeeded in cystoscoping boys of 2, and catheterizing them at 8 years of age. Portner's cystoscopes were found to be unsatisfactory on account of the flexibility of their long shafts. Beer,<sup>5</sup> in 1907, had two instruments made by the Kny-Scheerer firm (Reiniger,

1. Nitze: *Lehrbuch der Kystoskopie*, 1907, p. 97.

2. Caspar: *Handbuch der Cystoscopie*, Leipzig, 1911.

3. Jacoby: *Lehrbuch der Kystoskopie*, Leipsic, 1911.

4. Portner: *Deutsch. med. Wchnschr.*, 1908, No. 43.

5. Beer: *Cystoscopy and Ureteral Catheterization in Young Children*, *Jour. of Surg.*, March, 1911.

Gebbert and Schall), and published the results of his experiences with them a few years later. The catheterizing cystoscopes are Nos. 15 and 18 French, the observation instruments approximately 10.5 and 12.5 F. caliber. The shafts are made to fit the length of the urethra of a 5-year-old boy (8-10 cm.), and are 9.5 cm. and 12 cm. in length, respectively. Each is so constructed that the catheterizing sheath can be readily detached, making an examining and single catheterizing cystoscope in one. Both have an Albarran finger for guiding the catheter and take a No. 4 to 5 F. The optical system, which is modeled after Nitze, gives a very clear, though small, picture. With these instruments, Beer examined cystoscopically boys of 5 years, and girls as young as 14 months of age. The young child whose ureters were catheterized was a girl 5 years old. These cystoscopes have been in use since 1907 and have been found very serviceable, their great advantage being smallness of caliber and shortness of shaft.

We have records of more than thirty children under 9 years of age who have been cystoscoped during the past few years. The youngest patient was a boy of 17 months who was subsequently operated on for a kidney tumor. The youngest boy catheterized was under 3 years old — the youngest girl 22 months of age.

#### INDICATIONS AND CONTRAINDICATIONS FOR CYSTOSCOPY IN THE YOUNG

While cystoscopy in young children is devoid of danger, the indications for its application are not as broad as in the adult. The fact that a general anesthetic is required in most cases acts somewhat to restrict its use as a routine diagnostic procedure. It should be reserved for those cases in which surgical affections of the urinary tract are present; or as an aid in differentiating conditions which may be confused with diseases of the urinary organs. Care should be taken to rule out cases with urinary symptoms due to functional disturbances so frequently met with in young children (for example enuresis — hyperacidity of urine). Urinary findings unfortunately cannot be relied on to serve as a reliable guide on which to base indications. At times advanced lesions of the kidney may be present, and the examination of the urine give no intimation of the condition. A pyonephrosis with obstruction of the ureter on the diseased side may show an absolutely normal urine. Cases of congenital stricture of the ureter producing pyonephroses, with negative urinary findings have been reported from time to time in the literature.<sup>6</sup> In tumors of the kidney also the urine frequently fails to contain any abnormal constituents. Pyelitis can generally be

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6. Kahn: Congenital Stricture of Ureter Producing Pyonephrosis, *Med. Rec.*, New York, Nov. 16, 1912.

diagnosed without cystoscopy, and should therefore contraindicate this examination. Every case of pyuria which does not respond to the usual methods of treatment, especially when accompanied by fever, loss of weight and strength, should be cystoscopically examined. Hematuria is also a distinct indication, unless it be proved that the bleeding is but an expression of a hemorrhagic diathesis (purpura hemorrhagica, hemophilia, leukemia, scurvy); or a hemorrhagic nephritis. Renal diseases are often simulated by intraperitoneal conditions; in these cases, cystoscopy is of great value in the differential diagnosis, and its application will often render unnecessary exploratory operations. Before deciding to remove a kidney no matter how badly diseased, the presence of the second should always be ascertained. Cystoscopy is not absolutely essential if the roentgen ray shows the shadow of the other organ. It is of great service when no focal renal symptoms are present, and the kidneys cannot be palpated, in determining the side of the lesion.

Contraindications have been mentioned in discussing pyuria and hematuria. In addition, when the child's condition is such as to preclude a general anesthesia, should this be necessary. Every case, however, must be considered by itself, and if there exists the slightest suspicion that cystoscopy will aid in the diagnosis, it should be used.

Functional test: When ureteral catheterization is not feasible, chromo-ureteroscopy will be found invaluable. It is possible by using this method to make a positive diagnosis in the majority of instances with the ordinary observation cystoscope. Indigocarmin (10 c.c. of 0.4 per cent. solution) is injected about fifteen minutes before the examination, and both meati carefully watched. First the time of appearance of the dye on each side is observed; then the intensity of the color, whether light or dark blue; and lastly, note made of the contractile force with which the colored urine is ejected from the orifice. The latter points are of great importance; a very light blue stream which simply dribbles away is indicative of disease. Normally, the dye appears in ten to fifteen minutes; its absence indicates grave renal impairment. When combined with catheterization, we have the additional data obtained by the examination of the separated urines.

The status of the other functional tests now in vogue has been summed up as follows by Leopold and Bernhard:<sup>7</sup> "Figures for the nonprotein constituents of the blood as well as for the phenolsulphonephthalein excretion of children free from renal disease are practically identical with the figures obtained from adults, and vary within the normal figures as adult figures vary. The changes in these figures in

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7. Leopold and Bernhard: The Nonprotein Nitrogenous Constituents of the Blood, and the Phenolsulphonephthalein Test in Children, *AM. JOUR. DIS. CHILD.*, 1916, **11**, 432.

children the subjects of renal disease correspond with the changes observed in adults. The importance of the tests for diagnosis and prognosis amply demonstrated in adults will in all probability, hold true for children." We have not used the phenolsulphonephthalein test in conjunction with cystoscopy and ureteral catheterization, but have confined its use to estimating the total functioning capacity of both kidneys.

#### TECHNIC OF CYSTOSCOPY AND URETERAL CATHETERIZATION IN CHILDREN

This does not vary much from the routine followed in the adult. Most cases must be examined under narcosis, and a deep anesthesia is generally required before the bladder reflexes are abolished. Occasionally it is possible in very young children, especially girls (3 to 4 years), to use the cystoscope under local anesthesia (novocain). The indigocarmin is injected ten to fifteen minutes before the anesthesia is started. It is often advisable to insert a small catheter into the bladder and wait until the color first appears in the urine before administering the anesthetic. The bladder is then irrigated with a small syringe, and filled with a sterile solution. The capacity of the bladder in a 1-year-old child is approximately 100 c.c., so that 120 c.c. is a safe amount for those over 3 years. As most of the catheterizing instruments for children are single tunneled, but one ureter can be catheterized at a time. It is seldom necessary to catheterize the two. A specimen from the diseased side is generally taken, and the excretion of indigocarmin from the other side noted; this suffices. Occasionally difficulty will be experienced (especially when using a No. 4 catheter) in obtaining a specimen; under such conditions, it is advisable to employ aspiration with a small syringe, or to inject a few cubic centimeters of sterile solution through the catheter, to start the flow.

*Roentgenography.*—In children, roentgenography is of greater diagnostic value than in the adult and should be used more frequently, especially in cases where the cystoscope cannot be used. Its importance lies in the fact that with good technic the outline of the kidneys can be distinctly shown and deviation in position, size and shape noted. It is at times possible to distinguish an intra-abdominal tumor from renal enlargement.

*Cystography.*—Roentgenographic studies of the bladder with silver salts, or thorium, is a harmless and often valuable procedure. In chronic vesical retention of urine in children, cystography aids materially in corroborating the diagnosis and in determining the degree of

involvement of the ureters and the kidneys. The bladder is filled with one of the solutions mentioned, the child placed in the Trendelenburg position, and roentgenographed. The roentgenogram shows distinctly in the more advanced cases the considerably enlarged bladder with dilated ureters and renal pelvis. Diverticulae of the bladder are well shown in the cystogram, and a more accurate idea obtained of their size and shape than by cystoscopic examination. The diagnosis of this condition is practically impossible without recourse to one of the two methods mentioned.

In the examination of children suspected of urinary disease, it is advisable, as in the adult, to follow a certain routine. The different steps of the examination should be carried out in their proper sequence, thus avoiding unnecessary repetition. The following has been found the most satisfactory. 1, history; 2, physical examination; 3, urinalysis; 4, roentgenography; if cystoscopy is contraindicated, or cannot be performed — cystography; 5, instrumental examination, which may include bladder catheterization — the stone searcher, and cystoscopy combined with injection of indigocarmin. If cultures of the urine are desired, catheterization is advisable. It is seldom necessary to collect a twenty-four-hour specimen, a single one generally suffices. Roentgenography should include the entire urinary tract, not alone the side towards which suspicion is directed.

The material embodied in this paper is based on a group of thirty-eight cases from the children's surgical wards of Mount Sinai Hospital, and from private records.\* The youngest patient operated on was a girl, 11 months of age. This point emphasizes the fact which has been noted in a number of instances, that young children bear major operative procedures on the urinary tract very well. One should not hesitate on account of the extreme youth of the patient to operate, provided the child is in fair condition. As an instance, I may refer to a case recently reported by Kakels,<sup>8</sup> in which an infant, 6 weeks old, had a nephrectomy performed for a large congenital hydronephrosis. Operation was followed by an uninterrupted recovery.

The youngest patient in this group was 11 months old, the oldest, 13 years; the majority of the cases were in children between 4 and 8 years of age.

The series to be described by case reports illustrating the various points previously mentioned, comprises the following surgical diseases of the urinary tract.

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\*I wish to thank Dr. Beer for the use of his private records, which have been incorporated in this article.

8. Kakels: Large Congenital Hydronephrosis in an Infant Six Weeks of Age, *New York Med. Jour.*, March 18, 1916.

	Cases
Perinephritic abscess.....	4
Renal tuberculosis.....	3
Renal calculus.....	2
Ureteral calculus.....	1
Vesical calculus.....	1
Tumor of kidney (Wilms).....	2
Sarcoma of kidney.....	2
Pyelonephritis (unilateral).....	1
Pyelonephritis (bilateral).....	2
Hydronephrosis (congenital).....	1
Hydronephrosis (traumatic).....	1
Suppurative nephritis.....	1
Subacute nephritis.....	1
Diverticulum of bladder.....	1
Chronic vesical retention of urine.....	12
Nephroptosis .....	1
Perinephritis (nonsuppurative).....	1
Contusion of kidney.....	1

*Perinephritic Abscess.*—There were four cases in this series, the youngest an infant of 16 months. Two patients were cystoscopically examined, one a child 20 months of age. The urine was negative in all but one case in which pus and blood were present. The abscess in this instance was caused by the perforation of a cortical abscess of the kidney into the perinephritic tissue. At operation this could be definitely determined. Cultures from the pus in three cases showed *Staphylococcus aureus*, in the fourth *Streptococcus hemolyticus*. The diagnosis is not difficult, and is readily confirmed by aspiration. Cystoscopy is seldom required for corroboration. Incision and drainage effect a cure unless there is marked renal involvement. Two of the patients had crops of furuncles preceding the development of the perinephritic abscess.

#### REPORT OF CASES

CASE 1.—*Left Perinephritic Abscess.*—P. K., aged 3 years, had measles at 9 months; had furuncles on buttocks a few weeks prior to admission; these disappeared without surgical treatment. After fever, pain in the left loin, and vomiting, physical examination demonstrated a large, tender, fluctuating mass in the left costovertebral angle. On aspiration a thick pus was obtained. Culture showed *Streptococcus hemolyticus*.

Operation consisted of incision and drainage of the perinephritic abscess. The kidney was not explored; tube drainage was instituted. Recovery was uneventful. The patient was discharged from the hospital a few weeks later.

*Renal Tuberculosis.*—Tuberculosis of the kidney in children is considered a rare disease. Oraison,<sup>9</sup> in 1913, called attention to the fact that but fifty-one cases had been published in the literature. Wildbolz<sup>10</sup> collected 896 cases in which tuberculosis of the kidney, in a surgical form, was clinically recognized forty-eight times. Necropsy findings,

9. Oraison: Jour. d. Urologie.

10. Wildbolz: Chirurgie du Nierentuberculose, Neue Deutsche chirurgie, 1913, 6.

however, tend to prove that the condition is much more common than clinical statistics indicate. O. Muller<sup>11</sup> found renal tuberculosis thirty-three times in a series of 100 necropsies on tuberculous children, Dickinson,<sup>12</sup> forty-nine times in 300 cases; Rilliet and Barthez<sup>13</sup> found 15 per cent. of 312 tuberculous children had renal involvement. The Berne pathologic institute reports thirteen cases, in a series of 126—almost 10 per cent.

These figures thus indicate that renal tuberculosis in children is not such a rare condition, and that the application of the modern methods of examination would bring more cases to light. In every suspicious case, the urine should be most carefully examined for tubercle bacilli, and if found negative, inoculated into guinea-pigs. In children up to 10 years, the miliary type of tuberculosis predominates; after this age more cases of the chronic cavernous caseating form are observed.

*CASE 2.—Right Renal Tuberculosis.*—T. K., a girl, aged 10. The patient had nocturnal enuresis since childhood. For the previous few years she complained of infrequent attacks of pain in the right loin, and for the previous ten months had incontinence and loss of weight.

A poorly nourished child; kidneys not palpable; urine cloudy; albumin ++; considerable pus; cultures negative; tubercle bacilli found in smears; roentgen-ray examination negative.

The cystoscopy and ureteral catheterization showed bladder capacity considerably diminished; around the retracted right ureteral orifice an exudate; left orifice normal; left ureter when catheterized, showed deep indigocarmine concentration in twenty minutes; catheter was left in situ and bladder catheter introduced to obtain a specimen from the right kidney. The urine through this catheter became dark blue in one hour; urine from left kidney contained a few white and red blood corpuscles, hyaline and granular casts; urea 2.4 per cent.; no tubercle bacilli. Bladder urine representing the right kidney revealed white blood corpuscles +++; few red blood corpuscles; urea, 1.8 per cent.; tubercle bacilli present.

March 3, 1915, nephrectomy for right renal tuberculosis revealed areas of caseating tuberculosis in the upper and lower poles. Incontinence, daily and nocturnal, stopped before the patient left the hospital; convalescence uneventful.

*CASE 3.—Left Renal Tuberculosis.*—I. G., 10 years old, had had measles and scarlet fever.

Eight months previous to admission the patient suddenly experienced difficulty in urinating, followed by great frequency and urgency, but no hematuria. The symptoms persisted for three months, then improved somewhat; for the previous three months, he had complained of pain on urination in the end of the penis; passed bloody urine a few times; no lumbar pain.

An anemic child, but otherwise negative. The kidneys were not palpable (under anesthesia). Rectal examination was negative. The urine was cloudy, acid, with many pus cells; albumin +.

11. O. Muller, quoted by Wildbolz: *Chirurgie du Nierentuberculose*, p. 4 (Footnote 10).

12. Dickinson, quoted by Wildbolz: *Chirurgie Nierentuberculose*, p. 4 (Footnote 10).

13. Rilliet and Barthez, quoted by Wildbolz: *Chirurgie Nierentuberculose*, p. 4 (Footnote 10).



Cystoscopy showed the retrotrigonal area inflamed and in places ulcerated. The left ureter was golf-hole shape; the right ureter was normal, covered with fibropurulent exudate.

Indigocarmin appeared from the right ureter in fifteen minutes, in good concentration. The left ureter was catheterized and purulent urine obtained; there was no indigocarmin secretion. Tubercle bacilli were found in the urine from the left kidney. Roentgen-ray examination showed the left kidney slightly enlarged and ptosed. Nephrectomy was performed later for left renal tuberculosis. An enlarged, adherent, tuberculous kidney was removed; caseating areas were found in the lower pole. Uneventful convalescence.

**CASE 4.—Left Renal Tuberculosis.**—H. H., aged 11 years, was operated on for abscess on the lower end of the spine eight months previous to admission. Four weeks previously the child noticed blood at the end of urination and pain in the end of the penis. Since then he had frequency, urgency and burning.

A fairly well nourished child; kidneys not palpable; marked kyphosis of the lumbar spine; urine acid; slightly cloudy; albumin +; many pus cells and red blood corpuscles; smears negative for tubercle bacilli.

Cystoscopic examination under ether showed the bladder inflamed in the retrotrigonal region; left ureteral orifice did not contract or emit urine; good indigocarmin concentration from the right kidney, which was readily catheterized; no flow from left kidney in thirty minutes; tubercle bacilli found in twenty-four hour specimen; roentgen-ray examination, negative; no enlargement of kidneys. Diagnosis: left renal tuberculosis.

The pathologic report after nephrectomy for left renal tuberculosis showed tubercle bacilli present in the kidneys. Uneventful convalescence.

**Urinary Lithiasis.**—Not until the advent of radiography was it realized that urinary lithiasis in infants and young children is not an uncommon condition. Before then, it is true, vesical stone was recognized for generations, and its surgical treatment accorded a prominent place in the literature. Renal and ureteral calculi were considered extremely rare, and this is not surprising in view of the fact, that the diagnosis without the Roentgen ray is most difficult. That the condition is frequently overlooked is seen by the statistics of Rafin.<sup>14</sup> He reports a series of 322 cases of renal calculus in infancy; 139 were found at necropsy; 140 occurred in infants under 1 year, twenty-six in children from 1 to 5 years. The small calculi so often present in infancy may be the basis of further trouble in later years.

Vesical calculus is a rather common disease in certain localities. Bokay<sup>15</sup> has collected 1,836 cases of stone in infancy and young children; 1,319 were vesical, one half were urethral, and nine were renal calculi. The diagnosis of vesical calculus offers little difficulty; the rather characteristic syndrome immediately fixes attention to this region. Rectal palpation should always be practiced, and has at times clinched the diagnosis. The stone searcher and cystoscope are valuable aids; the roentgen ray is most important of all. Renal and ureteral stone offer more difficulties; for this reason roentgen-ray examination

14. Rafin: *Ann. d. Mal. d. Org. Genito-urinaire*, 1911, **29**, 481.

15. Bokay: *Ztschr. f. Kinderh.*, 1912.

should be used in a more routine manner. The presence of sand and gravel in the urine of young children, abdominal pain, spasmodic in character and accompanied by vomiting, are sufficient indications for roentgenography. Roentgen-ray examination should include the whole urinary tract, for stones may be located simultaneously in both kidney and bladder, as in the case to be reported.

**CASE 5.—Renal and Vesical Calculi.**—A. S., a boy. Patient had had measles and paratyphoid fever. Five weeks before admission the child had a sudden attack of retention of urine, and was in another hospital, no diagnosis being made. Nine days before he complained of pain in the right side of the abdomen, very intense at times, but not radiating. There was no frequency or difficulty in urination; he vomited twice. The mother noted that the urine was cloudy.

A well nourished child; abdomen lax and tympanitic; a definite, small, tender mass deep in the right hypochondrium; temperature ranged from 102 to 104; urine amber, cloudy with a trace of albumin and many pus cells; cultures showed *Staphylococcus aureus*. On roentgen-ray examination a triangular shadow was found in the region of the pelvis of the right kidney, and another in the region of the bladder like a calculus. A second examination confirmed this, except that the shadow in the bladder region had moved.

A cystoscopic examination, under ether, showed a calculus on the floor of the bladder. Suprapubic cystotomy was performed. A stone the size of a cherry was removed.

The pelvis of the right kidney was opened and a triangular stone removed. Patient had a stormy convalescence, developing a bilateral otitis media; but was discharged well, with wounds closed.

**CASE 6.**—A second case of renal calculus was that of a child 6 years of age, whose chief complaint was nocturnal and diurnal enuresis. Roentgen-ray showed distinctly a calculus in the kidney. Cystoscopy was not done; operation was refused.

**CASE 7.—Ureteral Calculus.**—P. E., girl, aged 13 years. March 15, three months previous to admission had cramp-like, intermittent pain in the right lumbar region; no urinary disturbance, no fever, chills or hematuria.

Physical examination revealed a slight tenderness in the lower part of the right iliac region; otherwise negative. The urine was acid, clear, specific gravity 1.028. There were a few white blood corpuscles and a little epithelium. Roentgen-ray examination revealed two calculi present in the right ureter about 1 cm. from the orifice; phenolsulphonephthalein, 45 per cent. in two hours; no red blood corpuscles in centrifuged specimens.

Cystoscopy and ureteral catheterization performed; bladder negative except in the region of the right orifice, which was covered with mucus; right ureter had an obstruction at 2.5 cm. which was finally passed and bloody urine obtained; no indigocarmine secretion in thirty minutes; in left ureter no obstruction; urine clear; good indigocarmine concentration in twenty minutes. Ureterogram of right ureter demonstrated shadows in the ureter. Extraperitoneal ureterotomy was performed; two stones were removed; convalescence was normal.

**Tumors of the Kidney.**—The growths most frequently seen in childhood are sarcomas and mixed tumors. The former are probably more common, and are of greater malignancy. The majority occur in early childhood; in a collection of 130 cases, 106 were found in the first five

years, and fifty-seven of these in the first two years of life.<sup>16</sup> Pain is a prominent symptom in sarcoma and is generally severe, whereas in the mixed form, it is only complained of very late in the course of the disease. The tumors rapidly invade neighboring organs; cachexia is rapid. Recurrences or metastases are the rule. The mixed types of tumor (Wilms<sup>17</sup>) are supposed to take origin in embryonic tissue, and are entirely different from other renal growths. They are composed of collections of epithelium in the nature of tubular or glandular structures, and may contain besides smooth and striped muscle fibers, cartilage, fat, bone and proliferating connective tissue. The latter tissue is the one most frequently found. These tumors originate in the substance of the kidney, and grow directly into the parenchyma, but do not infiltrate as the sarcomas or carcinomas generally do. Clinically, they are characterized by their large size (at times filling almost the entire abdominal cavity), absence of pain, and apparent good health of the patient. Often there are no subjective symptoms, and the growth is not discovered until it has reached a very large size. Metastases are rare, although the tumors are exceedingly malignant. The urine usually shows no changes; hematuria when present, is generally microscopic. The disease is most frequently seen in early childhood; occasional cases in the adult are reported. In a series of 165 mixed kidney tumors, 131 appeared within the first 6 years of age. Bilateral cases occur; Walker<sup>18</sup> reports ten instances in 141 cases. The prognosis is bad. Albarran<sup>19</sup> places the mortality from recurrence after operation at 86 per cent., Walker<sup>20</sup> at 93 per cent.

CASE 8.—*Tumor (Wilms) of Right Kidney*.—J. M., boy, aged 17 months, fell down a flight of stairs three months previous to admission but sustained no contusions or lacerations; there was no bleeding. About two weeks later the mother noticed a hard mass in the abdomen. This increased in size, but was not painful. Occupying the right half of the abdomen was found a firm, elongated mass, smooth, dull to percussion; the free border extending to the right iliac fossa; seeming to be adherent.

The urine was cloudy, acid, no albumin, few white blood corpuscles and little epithelium. Roentgen-ray shows a homogeneous mass occupying the entire abdomen and part of the false pelvis; it could not be determined roentgenographically what this mass was.

Cystoscopy under ether showed the bladder normal; left ureter discharging concentrated indigocarmin; right ureteral orifice not distinctly seen; no indigocarmin from this side during period of observation; under anesthesia the mass felt nodular, movable and hard.

Nephrectomy for right renal tumor was performed. Normal convalescence; primary union. Pathologic report—Wilms tumor.

16. Holt: *Diseases of Infancy and Childhood*, 1903.

17. Wilms: *Mischgeschwulste*, Leipzig, 1899.

18. Walker: *Ann. Surg.*, 1897, **26**, 585.

19. Albarran and Imbert: *Les Tumeurs du Rein*, Paris, 1903, p. 443.

20. Walker: *Ann. Surg.*, 1897, **26**.

CASE 9.—A second case was that of a child, 3 years old, who had two large hard kidneys. Diagnosis before operation was, either bilateral polycystic kidney or sarcoma. The operation was more in the nature of an exploratory procedure; the sections removed were reported as Wilms tumor.

CASE 10.—*Sarcoma of Kidney*.—F. A., girl, aged 2 years, had pain in the right hypochondrium; no radiation; no difficulty or frequency of urination; mother noticed abdomen becoming larger.

Examination revealed a protuberant abdomen, with visible, hard mass in right upper quadrant, reaching 1 inch below the surface of umbilicus; surface smooth; axillary, cervical and inguinal glands enlarged. The urine was amber, acid, clear, specific gravity 1.016; moderate number of white blood corpuscles; phenolsulphonaphthalein, 63 per cent.; urea, 10 mg. per 100 c.c.; urea, 36 mg. per 100 c.c.

Roentgen-ray examination revealed a large, dense, homogeneous shadow which occupied the entire right side of the abdomen, ending near the brim of the true pelvis. The shadow had the outline of an enlarged kidney.

Nephrectomy for sarcoma of right kidney showed the kidney firmly adherent in removing, parenchyma was torn and sarcomatous tissue expressed, radium applied through drainage tract for period of 4,067.5 mg. hours; recurrence and death some months after.

#### CONGENITAL HYDRONEPHROSIS AND HYDRO-URETER

This is not uncommon in infants and very young children. In a series of 500 cases<sup>21</sup> of hydronephrosis which came to operation, fifty-one were in children 1 to 10 years of age. A large number are found at necropsy — the congenital hydronephrosis of the new-born. The diagnosis may at times be difficult, as is shown by the following cases.

CASE 11.—*Congenital Hydronephrosis*.—W. P., aged 3 years, boy, had malaria one year and measles six months previous to admission. Had had poor appetite for a year, not gaining weight; for the previous ten days complained of hypogastric pains. His mother had noticed that the urine was cloudy.

Heart and lungs were negative; abdomen lax, tympanitic; no dulness, no masses palpable; urine cloudy, acid, specific gravity 1.020, with trace of albumin; many pus cells; negative for tubercle bacilli. Roentgen-ray examination showed the left kidney somewhat enlarged; right kidney normal. Cystoscopy under ether anesthesia showed bladder negative except for congestion in trigone, and slight swelling around the left ureteral region; indigocarmine seen emanating from right ureter in good concentration in fifteen minutes; none from left side in thirty minutes.

At a second cystoscopy one week later these findings were corroborated, and through a lumbar incision a considerably enlarged hydronephrotic kidney and ureter were removed; the ureter was the size of a small gut. Uneventful convalescence.

CASE 12.—Traumatic hydronephrosis occurred in a boy 10 years of age, appearing after the child had been struck by an automobile. A large tumor in the loin was noticed. Cystoscopy demonstrated absence of secretion from the right side; good function from the left. At operation a large hydronephrosis was found; nephrectomy; normal convalescence.

CASE 13.—*Diverticulum of Bladder*.—M. B., boy, aged 10 years, had had diphtheria at the age of 5. Five days before admission he had terminal hematuria, and pain on urinating; had occurred several times since; had some pain in hypogastrium, and felt he could not empty his bladder; slight tender-

21. Küster: Chirurgie der Nieren, Stuttgart, 1902.

ness in right costovertebral angle; right kidney palpable; hypogastrium filled by a globular mass not disappearing completely after urination; distended bladder; penile hypospadias; urine turbid; heavy trace of albumin; much pus and many epithelial cells. Phenolsulphonephthalein test gave color first in thirty-eight minutes; 45 per cent. excretion in two hours; residual urine 100 c.c.; cloudy; tubercle bacilli not found in urine; roentgen-ray examination negative.

Cystoscopy under ether showed the opening of a diverticulum in left bladder wall from margin of which indigocarmin issued; left ureter seemed open within the diverticulum, which was as large as a peach and the mouth of which was thrown into heavy folds.

There was a dilatation of the right ureter.

The diverticulum was found to compress both ureters, accounting for dilatation seen in roentgenogram. It was excised. The left ureter was found markedly distended and intimately adherent to sac, so that about 1 inch of its lower end had to be excised; the proximal end was then implanted into the posterior wall of bladder. Uneventful convalescence; bladder control excellent. Cystoscopy forty-seven days after operation showed the left (implanted) ureter in the median line, and functioning. Indigocarmin appeared in fair concentration in fourteen minutes; on right side in fifteen minutes; site of diverticulum not visible.

#### SUBACUTE NEPHRITIS

Surgery for this condition should not be undertaken unless all medical means have been tried for some time and found ineffectual. The Edebohls operation is not curative; it is usually undertaken for the relief of general anasarca, or for impending uremia. The patient in our series did not show any improvement after operation and succumbed within a few days. Koplik<sup>22</sup> in 1911 reported a series of five cases in which the Edelbohls operation was performed, with marked improvement in four.

CASE 14. —*Subacute Nephritis*.—A. Z., girl, aged 6 years, was admitted with pronounced edema of eyelids, legs, neck, abdominal wall, and marked ascites; urine, 350 to 400 c.c. daily; many hyaline and granular casts; red and white blood corpuscles. The child did not respond to any form of treatment; edema persisted; urinary output did not increase; patient began to show signs of impending uremia.

On bilateral decapsulation the kidneys were found enlarged and beefy red; the condition gradually became worse, and the patient died two days later.

The diagnosis<sup>\*</sup> of this condition is simple and does not require instrumental examination. Despite the fatal termination of this case, numerous favorable reports have been published from time to time, and operation should always be considered, after all methods of treatment have failed.

CASE 15.—*Suppurative Nephritis and Perinephric Abscess, Congenital Stricture of the Meatus and Urethra*.—J. R., boy, aged 7 years, had had scarlet fever four years previous to admission; three years previous to admission had had an attack of difficult urination, with passage of blood and pus; one year later had a similar attack; the urinary stream was always small. Examination revealed tenderness and swelling in left lumbar region; temperature 103 F.;

22. Koplik: Tr. Assn. Am. Phys., 1911.

genital examination disclosed a pin point meatus; urine acid, cloudy, specific gravity 1.014, albumin ++, full of pus and red blood corpuscles. The diagnosis of a perinephric abscess was made, and the patient was immediately operated on. A large abscess containing thick pus was opened, the kidney exposed, and a perforation in the cortex felt near its middle; tube drainage; culture, *Staphylococcus aureus*.

A month later nephrectomy was performed for suppurative nephritis. The kidney was found completely disorganized and studded with multiple suppurative foci. Meatotomy was then performed and instruments up to F. 15 were passed. Uneventful recovery.

#### CHRONIC RETENTION OF URINE IN CHILDREN

Under this heading are included patients suffering from chronic vesical retention due to various etiologic factors. The condition receives but scant attention in the literature, sporadic cases being reported from time to time. Beer<sup>23</sup> recently published a series of nine cases, and calls attention to the fact that the disease is often unrecognized until a late stage has been reached. The clinical picture is fairly characteristic; the patients have the pale, pasty appearance of chronic nephritis. Difficulty of urination often accompanied by straining, is an early symptom. The bladder is regularly found distended, at times reaching above the umbilicus. Residual urine is present in large amounts. On palpation the bladder can be felt to contract and become hard. The urine is clear in the early stages, but as a rule, becomes infected later on. As a result of back pressure dilatation of the ureters and pelves develop; this can readily be demonstrated by thorium cystograms. Cystoscopy reveals a trabeculation of the bladder with patulous ureteral orifices. Functional tests demonstrate marked renal impairment. Neurologic examination of these patients often shows nothing abnormal, in others distinct evidences of spinal cord or brain lesions are found. In the neuromuscular type instruments pass readily into the bladder without encountering an obstruction. The etiologic factors have been tabulated by Beer as follows:

1. Mechanical obstructions: (a) extravescical, as congenital folds and strictures, including tight prepuce, small meatus, new growth. (b) Intravesical, as diverticulum of bladder, vesical stone.

2. Neuromuscular: (a) brain disease; (b) spinal cord disease; (c) spasticity of sphincter without definite neurologic signs, probably disease of spinal cord.

The prognosis varies with the type; when due to mechanical factors, surgical procedures are often curative. The neuromuscular group all terminate fatally, generally from renal infection and insufficiency. Operation is only palliative—cystotomy for bladder drainage—and nephrotomy when the kidney becomes infected.

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23. Beer: Chronic Retention of Urine in Children, Jour. Am. Med. Assn., 1915, **65**, 1709.

CASE 16.—*Chronic Retention; Hypertrophied Bladder; Bilateral Hydro-nephrosis*.—Boy, aged 15 months, with a globular tumor mass in the hypogastrum, always present except when emptied by a catheter; that is, distended, hypertrophied bladder. In the left lumbar region was a mass corresponding to the position of the kidney. This was probably a hydronephrotic organ. No neurologic symptoms were elicited.

Cystoscopic examination revealed bladder trabeculated; otherwise normal; no obstruction in urethra; indigocarmin did not appear until four and three-quarters hours after injection, which suggests a bilateral kidney involvement.

Diagnosis of chronic retention, hypertrophied bladder, bilateral (probably) hydronephroses, due to spasm of vesical sphincter.

#### PYELONEPHRITIS

It is often difficult, especially in the chronic forms, to differentiate between pyelitis and pyelonephritis. In fact, it has been claimed that there is always involvement of the renal parenchyma in pyelitis. In the acute stage, the clinical manifestations of a pyelonephritis are more pronounced; the fever is higher and remittent in character, and apt to be accompanied by chills; the local signs, tenderness and pain more marked. Pus is present in the urine in varying amounts depending on the location of the abscess. If in the cortex, pyuria may be absent or insignificant. Of considerable diagnostic aid in differentiating these conditions is the late appearance in the urine of blue colored pus after the administration of methylene blue or indigocarmin. Weeks, and often months, after, one or more specimens of urine may suddenly become stained blue, due to the rupture into the pelvis of parenchymatous abscesses which have stored the dye. Beer,<sup>24</sup> who first called attention to this phenomenon, described cases in which methylene blue was excreted as long as two and three-fourths years after its administration.

CASE 17.—*Right Pyelonephritis*.—P. T., a girl, aged 6 years; two months before admission had a bullous eruption on the body; one month later double otitis media and mastoiditis. The patient's urine had been cloudy for two years; complained of urinations every 1 to 2 hours for a few months; for the previous few weeks had had pain in right lumbar region; pain, tenderness and resistance in right flank; temperature fluctuated between 99 and 105 F.; no chills; urine is cloudy; specific gravity 1.020; full of pus; von Pirquet test, roentgen and tubercle bacilli negative.

On cystoscopy the bladder was found diffusely inflamed; the right ureteral orifice swollen, the left normal; both ureters catheterized; no obstruction; right kidney gave fair indigocarmin concentration in twenty-five minutes; catheter became clogged with pus; few cubic centimeters urine obtained; urea 1.1; many white blood corpuscles; left kidney gave good indigocarmin concentration in twenty minutes; urea 0.9; occasional white blood corpuscles.

The child was given large doses of hexamethylenamin. At intervals of two, three and six days, and two weeks following the injection of indigocarmin, after the urine had been clear, the blue color suddenly appeared in one or two

24. Beer: The Diagnosis of Pyelonephritis, Jour. Am. Med. Assn., 1907, 48, 1936.

specimens. The temperature gradually came to normal, and pus disappeared from the urine. Cystoscopic examination before leaving the hospital, showed very slight cystitis; no pus in catheterized specimen.

The other two cases of pyelonephritis in this series were bilateral, and occurred in female children 22 months and 4 years old, respectively. Both were catheterized, pus obtained from each kidney, and the colon bacillus found in culture in each instance.

*CASE 18.—Retroperitoneal Tumor.*—The following case is cited to illustrate the value of cystoscopy as an aid in differentiating an extravescical from an intravescical condition.

Six days before examination of a boy, 3½ years of age, a large mass was accidentally noted in the hypogastrium, which was hard, solid, nodular, extending from below the umbilicus well down into the pelvis. The question arose whether this tumor was a vesical or prostatic neoplasm or retroperitoneal growth. Cystoscopy demonstrated a normal bladder; both ureteral orifices were normal. Indigocarmin appeared in good concentration from both sides in twelve minutes. The diagnosis of retroperitoneal tumor was made.

#### CONCLUSIONS

Urologic diseases in children are not as infrequent as we are led to believe. Many of the cases in this series would undoubtedly have been overlooked had not the methods of examinations commonly employed in adults been used. The feasibility of cystoscopy in very young patients, and its practical value are amply illustrated by a study of the case reports. Too much stress should not be placed on negative urinary findings. Cystoscopy will at times be indicated despite the absence of abnormal constituents in the urine.

Of the functional tests, indigocarmin is the simplest in application, and is generally reliable. Its use, combined with the observation cystoscope, will often render catheterization of the ureters unnecessary. Phenolsulphonephthalein and the blood tests (urea-nitrogen) are seldom indicated, unless from a prognostic standpoint. Roentgenography should be more frequently resorted to, and should precede every cystoscopic examination. In obscure vesical conditions, especially when cystoscopy is contraindicated or cannot be performed, cystography will often be found to give valuable information.

The proper application of the methods enumerated will seldom make it necessary to resort to exploratory operations on the urinary tract for diagnostic purposes. Operative procedures on the kidney, ureter or bladder are well borne in infancy and early childhood; in a series of over twenty-five major operations there was but one immediate death, that due to uremia following decapsulation for subacute nephritis.

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