

**Incontinence in Children.**—Infants have little or no control over their urination, especially at night, but after they leave off diapers they are expected to stop wetting the bed. There are doubtless few children who fulfil this expectation entirely. Up to the age of five or six an occasional accident may occur to the most normal child. But this is not enuresis. The true nocturnal enuresis of children—for it is only exceptionally diurnal—is not noticed, as a rule, until the child is five or six years old. Then he begins to wet his bed quite regularly, perhaps two or three times every night. He may also lose his urine involuntarily by day, and very rarely the incontinence occurs only by day and not by night.

**Etiology.**—While the enuresis of childhood may be symptomatic, it is usually idiopathic. Symptomatic incontinence may be due to tuberculosis or stone at the neck of the bladder, or to spinal disease, or it may be a reflex disturbance aroused by congenital stricture, by tight or adherent prepuce, etc. But the majority of cases are idiopathic, and due to a neurotic taint. Such children are, as a rule, shy, overgrown, pale creatures. They are often intelligent and given to quiet reading rather than to boisterous play. The tendency to enuresis often runs through the whole family, and the elders may show other neuroses. Even symptomatic cases often show a neurotic element.

**Prognosis.**—The prognosis is good. Even the most persistent cases recover spontaneously at the advent of puberty, so that while nothing is more common than enuresis in a child, nothing is more unusual than enuresis in an adult.

**Treatment.**—Symptomatic incontinence may be eliminated by a thorough examination of the urine, the prepuce, and the meatus, and an exploration of the urethra. The child's habits should be inquired into with an eye to indolence, masturbation, and mental overexertion. Such faults must be corrected, and a life in the open air, with plenty of exercise and not overmuch study, must be insisted upon. Good habits should be encouraged by awakening the child to pass water late at night and early in the morning, using moral suasion, and avoiding the use of fluids towards evening. Besides these means, absolute benefit may be expected from belladonna, commencing at a small dose, perhaps  $\frac{1}{10}$  of a grain of the extract, if the child is very young, and increasing gradually until some of the poisonous effects of the drug are noticed. A tonic of strychnin and iron may be useful. Guyon considers faradization quite specific when the urethral muscles are relaxed. He places one electrode in the membranous urethra, the other over the pubes. If the deep urethra is hyperesthetic (which is unusual) instillations of nitrate of silver will do good.

Stumpf has obtained good results by making the child sleep with its head low and its pelvis elevated. Phillips gives antipyrin and arsenic. Perlis reports 156 cases treated with rhus aromatica. He employs the fluid extract and in some cases increases the daily dose to gtt. lxxx. Recovery occurred in 102 cases. Thirteen were unimproved.

Another means which has been employed is sealing the prepuce at night with a drop of collodion. Mechanical appliances, encircling the penis or pressing upon the perineum, have the disadvantage of tending to beget a habit of handling the parts. Hypnotics should never be employed. The results of treatment cannot be predicted with any confidence; but, when all other means fail, tonics and hygiene succeed.

#### WOUNDS OF THE BLADDER

Wounds of the bladder are not common, since the position of the organ protects it from ordinary accidents, inclosed as it is, when in a state of relaxation, by the bony pelvis. Excepting the violence done by instruments in lithotomy, possibly in lithotrity, or during other operations, the bladder is but little liable to injury except when overdistended. It may be perforated by a fragment of bone in fracture of the pelvis. Rising above the symphysis pubis it becomes exposed to incised, punctured, and gunshot wounds. Wounds of the bladder are exceedingly dangerous to life without being necessarily fatal. Bullets and fragments of shell have entered the bladder without producing fatal consequences,<sup>1</sup> and there formed nuclei for calculus, as have also portions of bone.<sup>2</sup> Surgical wounds aside, Bartels<sup>3</sup> was unable to find among 405 reported wounds of the bladder any incised wound. Lacerations of the bladder not communicating with the external wound are, clinically, ruptures.

**Symptoms and Prognosis.**—The symptoms of wounds of the bladder are comparable to those of rupture (plus an external wound). The *prognosis* depends upon the presence and severity of the complications, the availability of surgical assistance, and the position of the rupture, whether it is intraperitoneal or extraperitoneal. Bartels collected 131 cases of intraperitoneal wounds, of which only 1 survived, while of 373 extraperitoneal wounds only 85 died.

<sup>1</sup> I have recorded in the New York Journal of Medicine, May, 1865, the case of an adult whose bladder was perforated by a bullet during the New York riots in July, 1863, terminating in complete recovery.—VAN BUREN.

<sup>2</sup> Consult P. Maltrait, Traumatismes de la vessie, Paris, 1881.

<sup>3</sup> Arch. f. klin. Chir., 1877, xxii, 519, 715.



Modern surgery would give a far better prognosis for intraperitoneal wounds.

**Treatment.**—The ideal treatment is immediate incision, suture of the bladder, and packing of the external wound to prevent infection and secondary infiltration. Nothing less than this could be expected to save a patient with an intraperitoneal wound of his bladder, and extraperitoneal injuries are certainly best treated in this way. But if the case is not seen until infiltration has set in, wide incisions, irrigation, and drainage are necessary.

#### RUPTURE OF THE BLADDER

A bladder, when overdistended by urine, may be ruptured by external violence, and this especially if it be atrophied or thinned by disease, ulceration, or otherwise; or the accident may occasionally happen by the accumulation of urine alone without any recognisable external violence, as in case of stricture. (The empty bladder is never ruptured.) Such a spontaneous rupture is undoubtedly attributable to muscular contraction.

Clinically speaking, the most frequent cause of rupture of the bladder is a fall, the bladder being overdistended. Imperforate urethra is an efficient cause in the fetus. Ulceration and atony are predisposing factors. Among the exciting traumatic causes, falls, blows, and crushing injuries, with or without fracture of the pelvis, or even appreciable injury to the soft parts, may be mentioned. The patient is usually intoxicated at the time of injury, the alcohol predisposing him to rupture of the bladder in a threefold way—viz., by causing the bladder to fill rapidly, by obtunding its sensibility, and by making the injury possible. The rupture may be intraperitoneal or extraperitoneal. Subperitoneal rupture, in which the fundus of the bladder is torn without lacerating the peritoneum, need not be distinguished, for it either remains extraperitoneal or becomes intraperitoneal. *Intraperitoneal* rupture is the more frequent variety. It is caused by a blow upon the hypogastrium bursting the distended organ as a blow bursts a paper bag. There are often no associated lesions. It has been surmised that the fundus yields to the distending force not through any weakness of the bladder wall at that point, but because the intestines give way before it, while below the bladder is supported by the bony pelvis. *Extraperitoneal* rupture is almost always associated with fracture of the pelvis. Mitchell<sup>1</sup> has collected 90 cases, of which 36% occurred on the anterior surface, and

<sup>1</sup> Annals of Surgery, 1898, xxvii, 151.

most of the others about the neck. Rupture of the sides or base is commonly intraperitoneal.

**Symptoms.**—The symptoms are sudden occurrence of intense pain in the abdomen (perhaps masked by alcoholism) with urgent desire to pass water, while attempts to urinate are usually, but not always, ineffective. Ordinarily the patient from the first is unable to walk. There are local pain, tenderness, and usually tenesmus, with the passage of no urine or of only a few drops of bloody fluid. Collapse soon follows. Death may occur in this stage, or the patient reacts and passes into a state of acute peritonitis or infiltration. If he survives the acute attack, the symptoms merge into those of local peritonitis, constant and often ineffectual desire to urinate being still a prominent symptom. The infiltration may extend up into the loin and down the thigh even to the knee.

**Diagnosis.**—If rupture of the bladder is suspected, the catheter is introduced. If the rupture is large no fluid at all, or only a little bloody urine may be obtained. Rarely the urine is quite clear. To confirm the diagnosis a known quantity (200 c. c.) of salt solution is introduced into the bladder and withdrawn. If only a portion of the fluid returns, there is rupture. If all returns, there may still be rupture, but cystoscopy should eliminate the doubt. Air may be employed for this test if salt solution is unavailable, for chemicals should not be injected. Moreover, the surgeon should be prepared to follow up the examination by immediate operation if rupture is discovered, since this instrumentation is calculated to spread urine and infection broadcast throughout the peritoneum or the cellular tissues. A speedy diagnosis, whether from the symptoms, by injection, or by cystoscopy, is imperative. For this reason Alexander<sup>1</sup> disapproves of the injection test, considering it a waste of time.

If the pelvis is fractured, the rupture is probably extraperitoneal. Otherwise it is probably intraperitoneal. Evidence of infiltration along the anterior wall of the rectum or above the pubes points to an extraperitoneal focus, while grave systemic disturbance and general abdominal distention and tenderness point to invasion of the peritoneum.

**Prognosis.**—Among Mitchell's 90 cases of extraperitoneal rupture of the bladder 37 were operated upon and 24 of these died (64.9%); while of the 53 treated expectantly 51 died (96.2%). Sieur<sup>2</sup> collected 34 cases of intraperitoneal rupture, all operated upon, with the following results:

<sup>1</sup> Annals of Surgery, 1901, xxxiv, 209.

<sup>2</sup> Archiv. gen. de méd., 1894, i, 129.



OPERATION.	Cases.	Cured.	Died.	Mortality.
Within 12 hours.....	13	8	5	38.4 per cent.
12 to 24 hours.....	10	3	7	70 "
24 to 62 hours.....	11	3	8	72.7 "
Total .....	34	14	20	58.8 "

Without operation practically all would have died.

These statistics encourage early operation so markedly as to call for no comment. Doubtless the relatively low post-operative mortality of intraperitoneal (58.8%)<sup>1</sup> as compared to extraperitoneal rupture (64.9%) may be due to the fact that the immediate gravity of the peritoneal cases enforces early operation, while the slower progress of extraperitoneal ruptures encourage ill-advised delay.

**Treatment.**—When the diagnosis is established there is no treatment other than immediate operation; when it is in doubt an exploratory operation affords the quickest and surest means of reaching a conclusion that must be reached quickly if at all. The only contraindications to operation are shock and grave visceral injuries, and if an infusion of salt solution improves the general condition the operation should be performed even in shock.

The first incision should open the peritoneal cavity through the median line. If an intraperitoneal tear is encountered, it is closed over with a layer of Lembert sutures in the bladder wall, and another in the peritoneum. All accumulations of fluid are then gently mopped up, and if the urine is infected the whole lower part of the peritoneal cavity is copiously irrigated with salt solution. If the urine is known to be clean this lavage may be omitted. Meanwhile the strength of the suture line is tested by filling the bladder with salt solution. If any escapes, the leaky portion of the wound is protected by additional sutures. This test is most essential. In 4 cases mentioned by Walsham<sup>2</sup> the cause of death was leakage through the sutured bladder wound. The abdominal wound is then closed with a single wick of gauze running to the point of rupture. A catheter is tied into the bladder until the seventh day.

If the peritoneum proves to be untoned, the abdominal wound is closed and the bladder opened through a small suprapubic incision (p. 460). If the hole in the bladder is found presenting, it is sutured, tested, and the external wound drained. But if the rupture is situated at the bladder neck or at some other inaccessible point, it may be treated by suture or left untouched, and drainage may be established through the abdominal wall and the urethra or the perineum.

<sup>1</sup> Or 51%, according to Alexander's figures.

<sup>2</sup> Univ. Med. J., 1895, iii, 200.

## CHAPTER XXIII

## ETIOLOGY OF INFLAMMATIONS OF THE UPPER URINARY TRACT—BACTERIURIA: ITS NATURE, SYMPTOMS, DIAGNOSIS, AND TREATMENT

THE upper urinary tract consists of the kidneys and their ureters, the bladder, and the posterior urethra. The cut-off muscle separates the upper from the lower tract. The former is inside the body, as it were, and is in its normal state entirely aseptic. The lower urinary tract—i. e., the anterior urethra—is in no way separated from the integument, and is always filled with the germs that flourish upon the surrounding parts.

**Bacteria of the Healthy Anterior Urethra.**<sup>1</sup>—The flora of the anterior urethra is subject to the widest variations. Among many non-pathogenic bacteria, such as are often found upon the skin, the urethra may also contain the bacillus coli, pyogenic staphylococci and streptococci, and the proteus vulgaris. The presence of these microbes is by no means constant. Indeed, in view of the fact that they cause no inflammation, and therefore get no hold upon the mucous membrane, and are being continually swept away by the stream of urine, it is small wonder that the urethral flora is subject to constant changes both in number and variety. Indeed, so great is the cleansing influence of the urinary stream that the urethral microbes are almost entirely confined to the balanitic portion of the canal. The microbes found in the normal bulbous urethra are few, and rarely pathogenic.

The anterior urethra becomes inflamed in one of three ways:

1. By the introduction into it of the gonococcus.
2. By injury to its wall (trauma, stricture, the congestion of sexual excess, retained catheter, stone, etc.).
3. By diversion of the stream of urine. Thus it may be noted that while a patient is urinating entirely through a hypogastric

<sup>1</sup> Lustgarten and Mannaberg, Vierteljahresschrift f. Derm. u. Syph., 1887. Rovsing, Die Blasenentzündungen, 1890. Melchior, Cystite et infection urinaire, Paris, 1895. Wassermann and Petit, Guyon's Annales, 1891, ix, 371.



wound he often complains of a mild urethral discharge which disappears as soon as urethral urination is resumed.

But the inflammations of the anterior urethra are taken up more fully in another section. Enough has been said of them here.

#### BACTERIURIA, CYSTITIS, AND PYELO-NEPHRITIS

Leaving aside prostatitis, the special characteristics of which have already been considered, the infections of the upper urinary tract are:

1. Infection of the urine with no appreciable lesion of the bladder or the kidneys—Bacteriuria.
2. Inflammation of the bladder—Cystitis.
3. Inflammation of the kidney, its pelvis, and the ureter—Pyelo-nephritis.

Inasmuch as the upper urinary tract is aseptic when in its normal condition, the three prime questions to be answered in regard to inflammations are:

1. What are the bacteria of urinary inflammations?
2. How do they obtain access to the urinary tract?
3. What are the accessory causes of inflammation?

#### BACTERIA OF URINARY DISEASE

Although the bacteriology of pyelo-nephritis has not been so thoroughly studied as that of cystitis and bacteriuria, the statistics of these latter two, collected by Albarran, Hallé, and Legrain,<sup>1</sup> probably express with fair accuracy the importance of the various microbes in all three varieties of urinary infection. These authors have collected 304 cases from the reports of Rovsing, Morelle, Denys, Reblaub, Krogius, Barlow, Melchior, and Bastianelli, and have classified the bacteria as *frequent* and *rare*. Their results may be tabulated as follows:

#### FREQUENT BACTERIA

Bacillus coli—131 times (43%)—89 times in pure culture.

Staphylococcus pyogenes—70 times (23%).

Proteus of Hauser—26 times (8.5%).

Streptococcus pyogenes—15 times (5%).

Gonococcus—10 times (the authors think this figure unduly small).

Bacillus typhosus.

<sup>1</sup> Guyon's Annales, 1898, xvi, 1159.

#### RARE BACTERIA

Pneumococcus, diplo-bacillus of Friedländer, bacillus longus ureæ (Rovsing), diplococcus ureæ liquefaciens (Melchior), and many others found in isolated cases by individual authorities. These rare bacteria possess no clinical interest, and require no description here.

The bacillus tuberculosis, it will be observed, has been omitted from the above classification, and its consideration is reserved for a subsequent chapter.

**Bacillus coli** (*Urobacillus non-liquefaciens*, *Coccobacillus ureæ pyogenes*).—This germ, the most common of all, has been investigated by every writer upon this subject, but with widely differing conclusions. While most authors have placed it among the most active causes of cystitis, Rovsing<sup>1</sup> finds that it never causes cystitis, though sometimes a slight pyelitis.<sup>2</sup> These opposing views can only be reconciled by admitting the personal equation, and by frankly recognising the fact that the virulence of this bacterium varies between wide limits. Numerous attested cases of cystitis prove it not always so innocent as Rovsing believes, while the ever-increasing number of reported cases of bacteriuria containing the bacillus coli in pure culture show that its venom has been overestimated in the opposite camp. On only one point are all agreed—viz., that the bacillus coli is not ammoniogenic; it causes *acid* cystitis, pyelitis, or bacteriuria.

Clinically the bacillus coli may be put down as almost the sole cause (the gonococcus and the tubercle bacillus excepted) of all urinary infections in which the urine remains acid. It is, as a rule, but slightly virulent. Without a predisposing factor—a fertile soil upon which to grow—it causes no infection whatever. When it takes root upon a slight lesion of the prostate or of the kidney (or its pelvis) it causes a bacteriuria or perhaps a very mild pyelitis. When assisted by retention (prostate, stricture, stone, or tumour) it causes a more severe inflammation which may do permanent damage to the kidney, but is not likely to arouse any very acute symptoms or to produce any deep-seated lesions in the bladder. The bacillus coli may be associated with other bacteria in inflammations of the most intense severity.

**Pyogenic Staphylococci and Streptococci.**—These bacteria effect the decomposition of urea with the formation of ammonia. They are the common causes of *alkaline* cystitis and pyelo-nephritis.

<sup>1</sup> Guyon's Annales, 1897, xv, 817, 1009, 1121, 1251, and 1898, xvi, 179, 278.

<sup>2</sup> Rovsing's position has been assailed by Melchior and by Albarran and Hallé (Guyon's Annales, 1898, xvi, 363, 388).



Their virulence is greater than that of the bacillus coli. Like it they do not set up or maintain any urinary affection unless aided by an accessory lesion, but they very rarely cause bacteriuria, and the alkaline cystitis or pyelitis caused by them is severe in its symptoms and grave in its consequences.

**Proteus of Hauser** (*Proteus vulgaris*, *Urobacillus liquefaciens septicus*).—Experiments on animals at the hands of Krogius, Schnitzler, Bastianelli, and Melchior have shown that an intense and even a fatal cystitis may be produced, without the assistance of any predisposing cause, by injecting into the bladder a pure culture of the proteus vulgaris.

Like the pyogenic cocci this bacterium decomposes urea and causes alkaline cystitis. Probably it cannot take root and flourish in man without the aid of a predisposing agent, but it is nevertheless the most virulent of the common bacteria of urinary infection. Yet it has been found once in a simple bacteriuria.

**Gonococcus**.—It has long been known clinically that a gonorrhoeal inflammation may extend from the anterior to the posterior urethra and thence to the bladder, and that the gonorrhoeal prostate may form a base whence repeated incursions into the bladder are quite possible. Yet the proof of the existence of gonococcal cystitis has been singularly slow in appearing, and the cases reported are remarkably few. Thus far we only know that the gonococcus alone, unaided by any predetermining cause, may cause an acute cystitis; that in such cystitis the urine is acid; and that this purely gonorrhoeal cystitis recovers or is replaced by a secondary mixed infection so that the gonococci, if still present, can no longer be found. Hence that striking clinical condition, acute gonorrhoeal cystitis, may be accepted as purely gonococcal in origin; while nearly all the subsequent chronic manifestations in the bladder are due to secondary infection by those bacilli coli and pyogenic cocci that everywhere follow in the wake of the gonococcus to perpetuate the inflammations inaugurated by it.

**Bacillus Typhosus**.—It is only within a few years that the importance of the bacillus typhosus in urinary infection has been appreciated. According to the recent studies of Richardson<sup>1</sup> and Gwyn,<sup>2</sup> typhoid bacilli appear in the urine during the second and third weeks of the fever. Typhoid bacteriuria occurs in from 15% to 30% of all cases of typhoid. Grave pyelo-nephritis is rare, and while the bacilli usually spontaneously disappear from the urine they may remain for

<sup>1</sup> J. of Exper. Med., 1898, iii, 349, and 1899, iv. J. of Mass. Ass'n of Boards of Health, 1899.

<sup>2</sup> Johns Hopkins Hosp. Bull., 1899, x, 109.

years. Typhoid bacilluria is peculiarly amenable to treatment. The urine is acid and closely resembles that of bacillus coli bacteriuria.

#### ROUTES OF INVASION

Bacteria may reach the interior of the urinary tract by one of four routes (Rovsing):

1. From the urethra—ascending invasion.
2. From the kidney—descending invasion.
3. By irruption of a neighbouring focus.
4. By the circulation—indirect invasion.

Scientists are still at odds as to the predominating importance of any one route over any other. For the first observers, Pasteur, Bouchard, and others, the urethra was all important. Then Rovsing, Melchior, and Bastianelli, while still attributing the majority of cases to the urethra, recognised a renal origin for some cases. Albarran, Hallé, and Legrain hint that descending infection is more common than is generally believed. Infection through the blood or the lymphatic current has been made by most authors the special attribute of the tubercle bacillus, but Reymond<sup>1</sup> and Van Calcar<sup>2</sup> believe that the bacillus coli passes directly out of the rectum and in through the bladder when there is constipation or other intestinal obstruction. In the present state of our knowledge it is not possible to reconcile these opposing views, and in our consideration of the various routes of invasion it will be more practical to confine ourselves as strictly as possible to the clinical aspect of affairs.

**Urethral or Ascending Invasion**.—The three methods by which microbes may ascend from the urethra are:

1. Through instrumentation.
2. By extension upward of a urethral inflammation.
3. By spontaneous ascension of the urethral bacteria.

1. The passage of an instrument into a clean bladder is a frequent cause of cystitis. The gentle passage of a smooth, soft, clean instrument through a normal canal into a healthy bladder never causes cystitis. Perhaps bacteria are carried into the bladder by every instrument. Perhaps numerous pathogenic germs are often introduced in this manner. But experiment and experience unite to proclaim that the healthy bladder is thoroughly able to sweep itself clean of these enemies. Whether the germs come from a dirty catheter, or from an inflamed or a normal urethra, the bladder may be absolutely protected from them by the prophylactic injection of nitrate of silver (p. 218). But this is not enough. The bladder may

<sup>1</sup> Guyon's Annales, 1893, xi, 253 and 343.

<sup>2</sup> *Ibid.*, 1899, xvii, 1253.