

appears to me probable that, when applied to acutely congested cords, in vocalists, it will reduce the swelling and congestion so thoroughly that the voice may be used for two or three hours with comparative ease, and possibly with normal efficiency.

### HYPOSPADIAS.

C. H. MAYO, M.D.

SURGEON TO ST. MARY'S HOSPITAL.  
ROCHESTER, MINN.

Hypospadias of some degree is one of the most common malformations of man. According to Rennes, Kaufman and others this deformity occurs in one of every 350 males.

There are several theories as to the cause of this condition. Some claim that from atresia of the urethra there is fetal retention of urine and finally a giving way of the urethra, or that the same result is caused by a delay in the development of the glandular urethra. The most probable is that of Reichel, who states that hypospadias is merely an arrest of development and the

some degree of incontinence and many are compelled to pass the urine in a sitting posture from the difficulty of directing the stream. In many cases the urethral opening is so small that there is difficulty in evacuating the bladder. The penis, from imperfect development of the corpus spongiosum, may be deformed, curving downward and at times adherent to the scrotum, perfect erections or coitus being impossible; and the majority of even the balanic type of cases are sexually impotent. It is a matter of interest in this connection that several aboriginal tribes of Africa and Australia make a fistula or slit in the urethra to prevent impregnation.

*Operations.*—There are several methods of operation for the relief of hypospadias, which Van Hook classifies according to the principles involved: 1. The method of simple canalization. 2. That by denudation and suture. 3. That by the use of penile flaps. 4. That by taking flaps from the abdomen or scrotum. 5. That by the combination of these fundamental methods. To these must be added a sixth: That by mobilization and dislocation of the urethra.

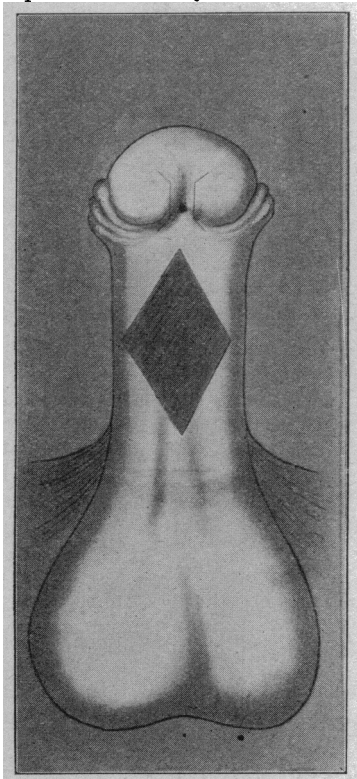


Fig. 1.—Duplay and Bouisson.

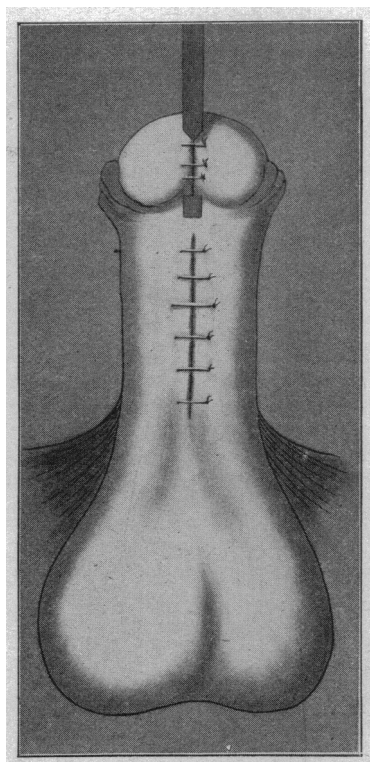


Fig. 2.—Duplay and Bouisson.

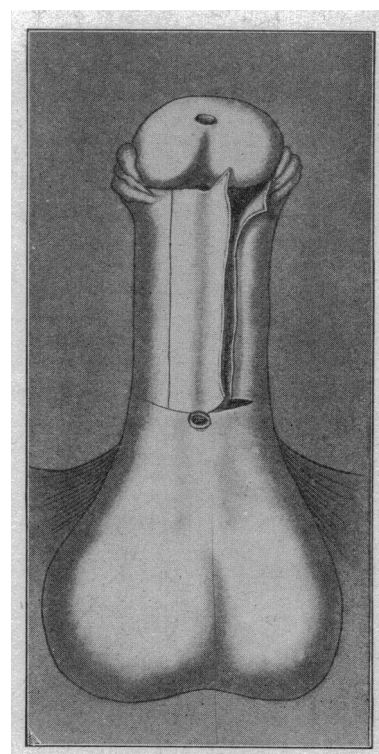


Fig. 3.—Duplay.

degree of deformity is an indication of the period of intrauterine life at which it occurred. Perineal openings develop in the sixth or seventh and glandular from the twelfth to the sixteenth week.

The more common variety is the glandular or balanic, in which the urethral opening is situated back of a broad, flattened and curved glans, the frenum being absent. The penile type of hypospadias opens at some point between the scrotum and glandis corona. The scrotal variety is presented by those cases with the urethral opening at the junction of the penis and scrotum, called peno-scrotal or in the extreme cases perineo-scrotal in which the scrotum is divided.

There is no malformation which may be the cause of more mental suffering and physical discomfort than the one under consideration, the trouble being none the less from its secret nature. A limited number have

The operation of Dieffenbach, first made in 1838, consisted in piercing the glans penis from its summit to the normal urethra, and allowing a canula to remain in position until the canal became lined with epithelium, the previous opening of the urethra being closed. This operation was abandoned from the difficulty of maintaining the lumen of the canal when formed. Dieffenbach was also a pioneer in the operation by denudation and suture. The flap operation of Duplay has until recently been the one most commonly employed. The first step was Bouisson's principle (Fig. 1), to straighten the penis by transverse incision at the point of greatest curvature and, after straightening the organ, to close the lozenge-shaped defects by skin grafts or sliding flaps. (Fig. 2.) The age of choice for this operation is 4 years.

The second step is the formation of the new urethra

over a catheter to a point in front of the hypospadiac opening. This is done by an incision on each side of the urethral groove, leaving a strip about one-half an inch wide which is dissected one-fourth its breadth toward the median line from each side and folded over the catheter. (Fig. 3.) Transverse incisions are made

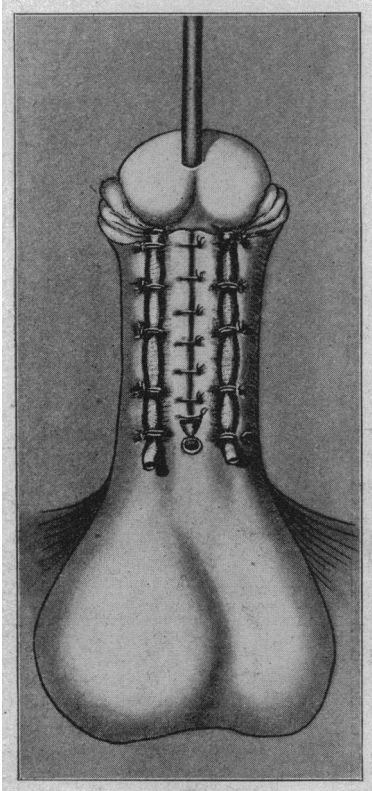


Fig. 4.—Duplay and Thiersch.

at the ends of the urethral incisions and the outer flaps dissected freely and closed over the catheter and new urethra by quill suture and accurate coaptation of the skin margins. (Fig. 4.) The lateral flaps were

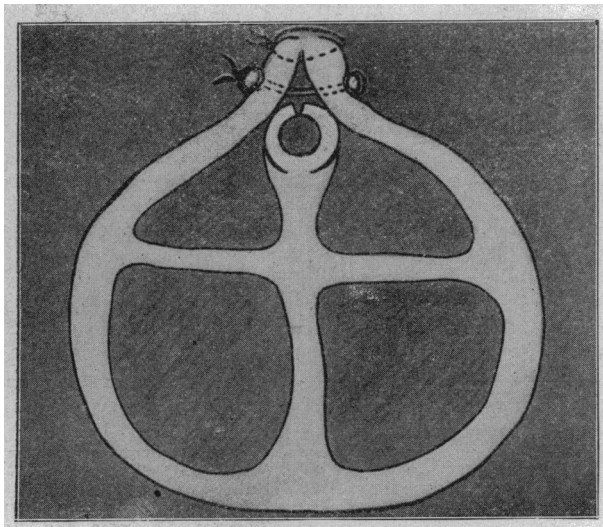


Fig. 5.—Duplay and Thiersch.

devised by Thiersch, Duplay making use of a flap of prepuce to cover the defect and new urethra. The glandular urethra is often constructed at the first operation. The age of choice being 5 or 6 years. (Fig. 5.)

The third step is the union of the two urethras, done by freshening the openings and accurate suturing; this

operation is best made at the age of puberty, to secure the aid of the patient in after care. Thiersch devised the method of double penile skin flaps, the base of one being near the urethral groove, the other on the opposite of the penis. (Fig. 6.) Flaps are dissected up and one turned skin side in, to form the urethra, the other drawn over the urethra and sutured to the opposite side of the penis. (Fig. 7.) Thiersch also deserves credit for temporarily deflecting the urine by a button-

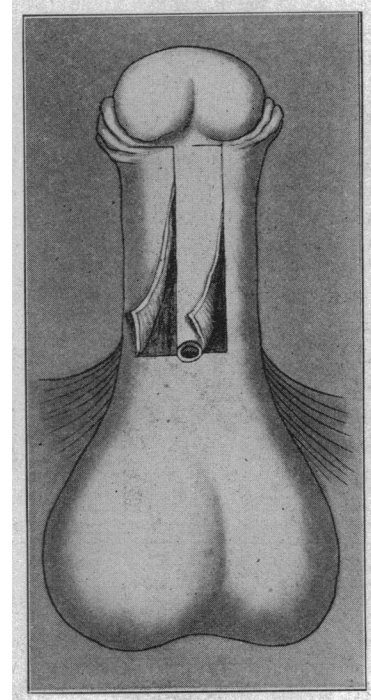


Fig. 6.—Thiersch.

hole in the perineal urethra, which he used in epispadias.

In the Wood method (Fig. 8), a large button-hole is made in the center of the prepuce near its attachment,

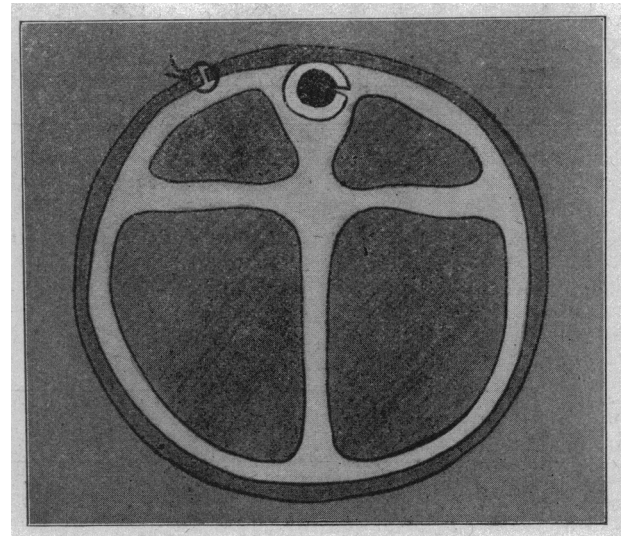


Fig. 7.—Thiersch.

and the glans drawn through the opening, leaving the prepuce underneath the glans. A skin flap with its base close to the urethral opening is turned up from the scrotum. (Fig. 9.) Two narrow strips are denuded from either side of the urethral groove and the scrotal flap sutured to these. The scrotal defect is closed by

sutures and the flap is covered by the prepuce which is unfolded for this purpose.

Beck, in his peno-scrotal cases, utilizes the Duplay method (Figs. 10 and 11) and covers the new urethra with a scrotal flap like the Wood operation by twisting the pedicle to turn the skin surface out. (Fig. 12.)

hypospadias by Landerer and Bidder, who denuded strips on the under side of the penis (Fig. 13) and sutured to incisions in the scrotum (Fig. 14), then, when healing was firm, dissection of the penis with its new canal from the scrotum and skin grafting or turning the skin margins over the defects in surface cover-

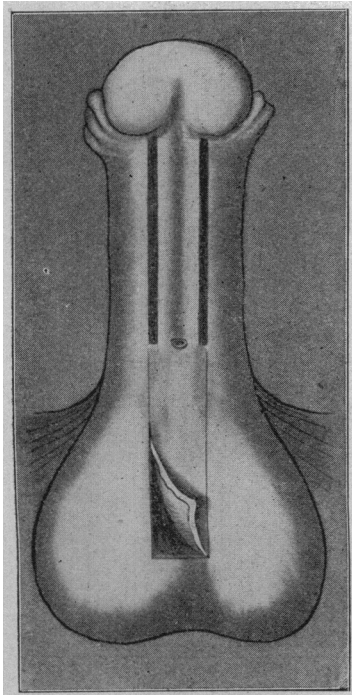


Fig. 8.—Wood

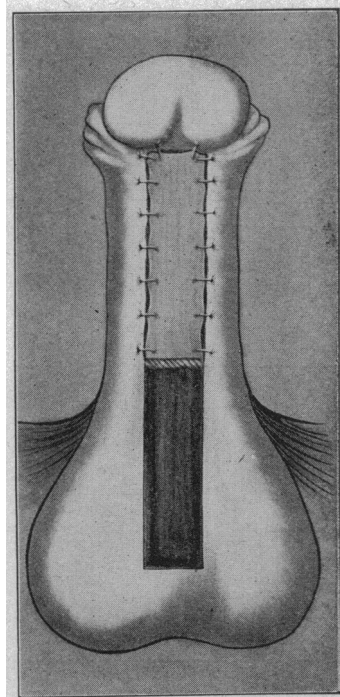


Fig. 9.—Wood.

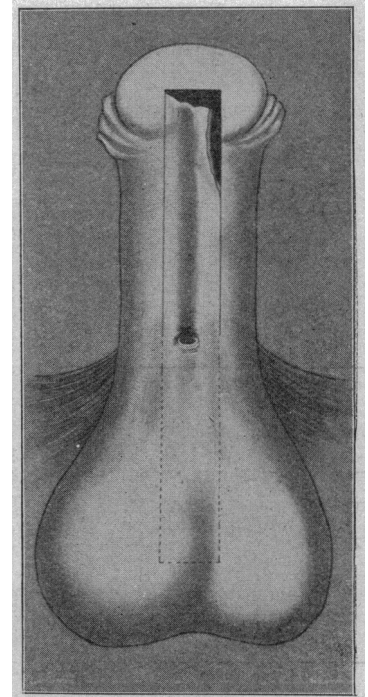


Fig. 10.—Duplay, Wood and Beck.

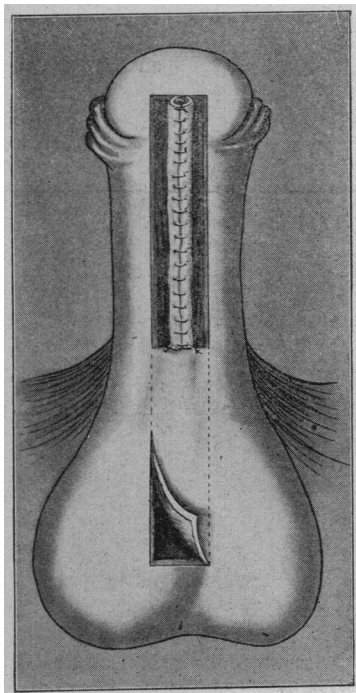


Fig. 11.—Duplay and Beck.

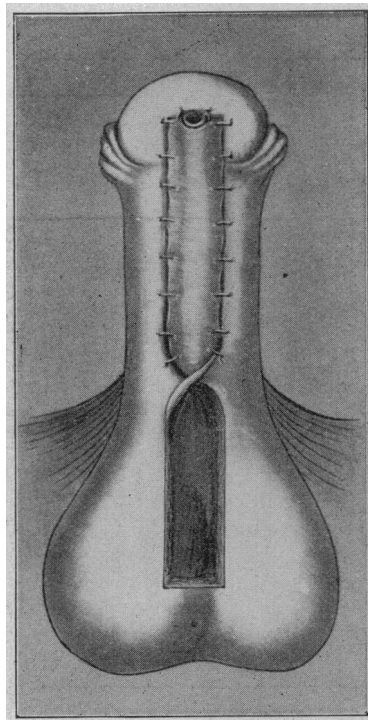


Fig. 12.—Beck.

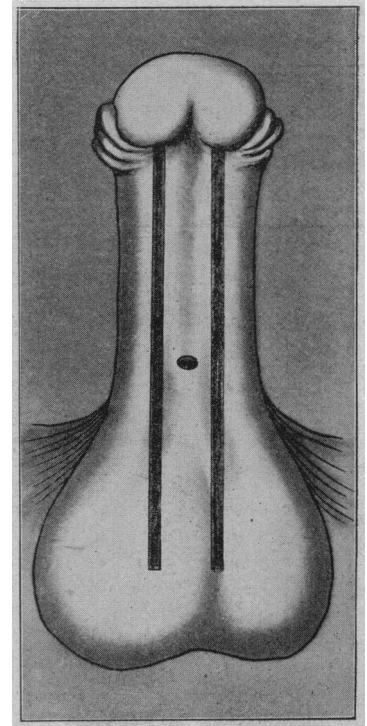


Fig. 13.—Rosenberger, Landerer and Bidder.

Rosenberger's operation for epispadias is made by incisions and denuding strips each side of the urethra, which are continuous with and sutured to similar denuded surfaces upon the abdomen, and later the organ with attached skin is separated from the abdomen and the denuded skin grafted. This method was so commonly successful that the principle was utilized in

ing. This operation leaves considerable deformity, but has fewer failures than many of the earlier ones.

*Causes of Failures.*—There are several causes of the frequent failures experienced by all operators in this class of surgery. The field of operation is difficult to render sterile. Flaps are made too small and closed under tension; dressings become soaked with urine.



The bladder is drained by a catheter fixed in the canal and, after the third day, there is the straining of an irritable bladder which frequently expels the catheter, or forces out urine along side of the instrument. Frequent erections are also a cause of much discomfort. In a considerable number of hypospadiac cases operated on in Czerny's clinic, about 35 per cent. of them were uncured from the patients' lack of persistence in having repeated operations, and 29 per cent. of the operations

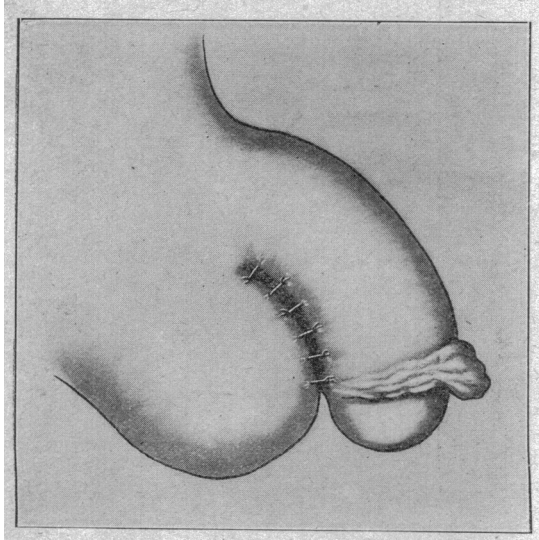


Fig. 14.—Rosenberger, Landerer and Bidder.

were failures from failures of previous operations, not counting cases healed with minute fistulae requiring cautery or caustic for their closure. Dr. Carl Beck of

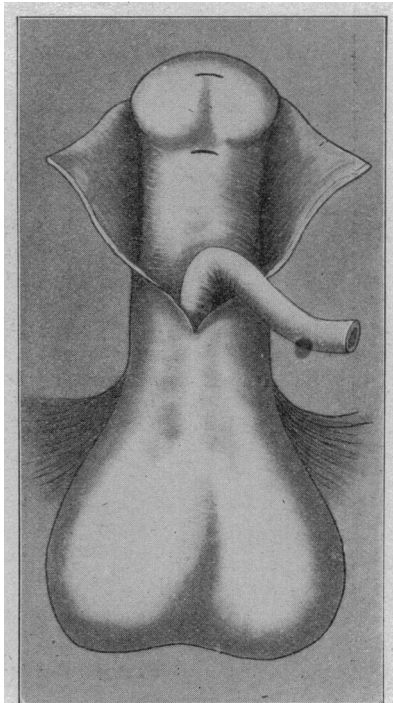


Fig. 15.—Beck.

New York, in 1897, and shortly afterward Professor Von Hacker in Europe, devised a new operation for the relief of the balanic type of hypospadias and for the penile cases with an opening near the glans. The distensibility and extensibility of the organ with all its structures furnished a basis for the operation. It is well known that the penis in a state of erection is nearly

double its length when flaccid, the corpus spongiosum and urethral walls containing much elastic tissue. The Beck operation consists in completely mobilizing sufficient urethra to extend to the position in which it is

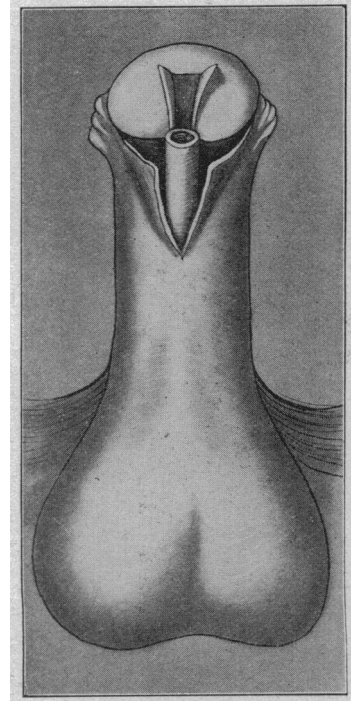


Fig. 16.—Beck.

wished to place the meatus. (Fig. 15.) The urethral site on the glans is freshened and made of sufficient

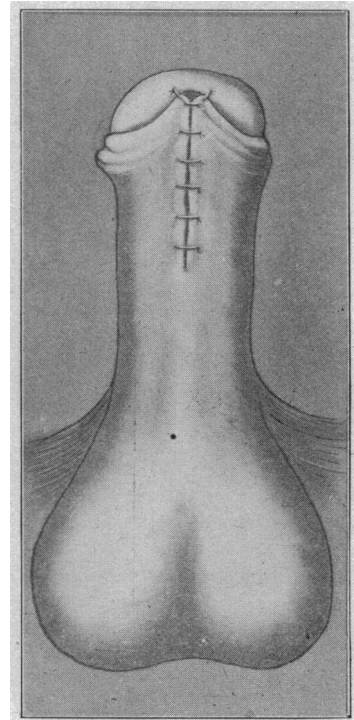


Fig. 17.—Beck.

depth to close the glans over the tube of urethra. (Fig. 16.) The urethra is exposed by an incision well back along the penis and is freed from its bed and its opening sutured to the glans. The incision is closed by sutures which also serve to build a frenum by attaching the freshened prepuce to the base of the glans penis. (Fig. 17.) When there is a shallow groove



and little deformity, the glans may be tunneled with a narrow bistoury or trocar and the tube of urethra drawn through and sutured to the opening on the surface of the glans. (Fig. 18.) The advantages of the method are many. The total length of urethra is normal in its mucous membrane. There is no catheter needed, patients pass urine freely during the healing process, and the wound pursues a normal course of repair free from urinary contamination.

The operation may be performed in cases of mild degree at a very early age. Dr. Beck has operated successfully on one infant of 5 months. While this operation is probably the best one possible for a certain class of these malformations, it must be combined with some other method to make it useful in relieving most of the penile, peno-scrotal and perineo-scrotal cases.

The 1899 report of the Heidelberg clinic presents

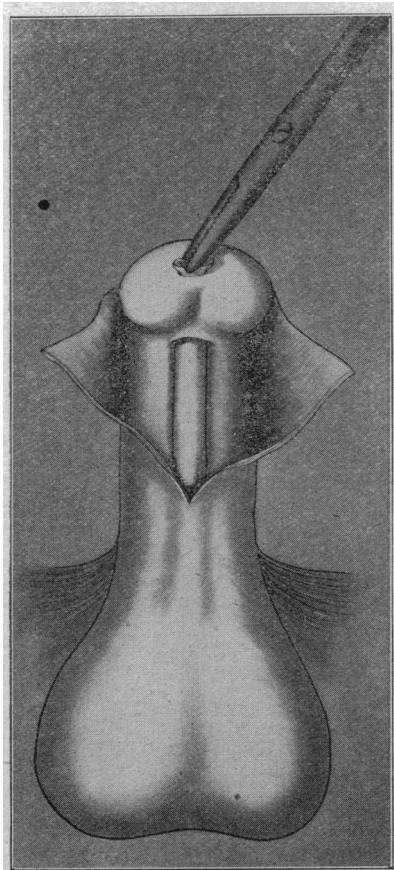


Fig. 18.—Beck.

three cases of hypospadias treated by the Beck method, in all of which the retraction of the dislocated urethra curved the glans downward and the meatus delivered its stream below as previous to operation, thus giving theoretical but not practical relief. According to a later report from this clinic, with a total of seven cases, better results had been achieved. Dr. A. J. Ochsner, to a great extent, relieves this downward contraction resulting from the Beck operation, by tunneling the glans at a higher point and bringing the urethra through it, locating the meatus above the apex of the organ. Bardenhauer has been credited with the tunneling by trocar instead of knife, but this was done by Dieffenbach in 1838. Any surgeon who has had experience in this class of surgery feels the necessity of having at his command several methods of procedure, and is well pleased if he can restore the functions of the organ as a whole, regardless of cosmetics, by means of one or a

part of several operations. The prepuce in cases of hypospadias is usually redundant and situated on the dorsal surface, overhanging the glans like a hood. The skin of the penis is noted for its thinness, having no adipose tissue, also for its looseness of attachment and elasticity. Where it is folded upon itself at its cervical attachment its character very nearly resembles mucous membrane. For the past four years we have utilized this membrane to build the tube of urethra in such cases as could not be relieved by the operation of Beck used alone. The principle of a urethra of prepuce was devised by Van Hook.

The prepuce is extended as for circumcision and two incisions are made, about 1 inch apart, extending from its free border to its attachment at the penile cervix; the prepuce is unfolded, forming a loop of thin skin about 2½ inches in length. Should this not be considered sufficient to reach from its attachment to the hypospadiac opening, the two incisions are extended back along the dorsum of the penis until sufficient tissue is obtained, when the two incisions are connected by a transverse one, and the flap of skin lifted but left attached to the cervix by the inner surface. Several

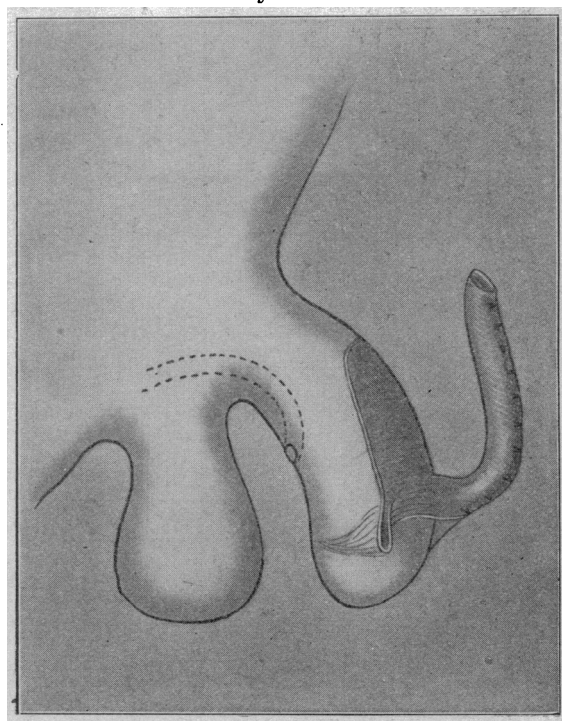


Fig. 19.

sutures now close the lateral integument of the penis over the denuded area. (Fig. 19.)

The pediculated flap of prepuce is constructed into a tube with its skin or outer surface inside, by means of a number of catgut sutures. The penis is tunneled by means of a narrow bistoury or medium trocar and canula, through the glans, above its groove, along the penis to a point beneath the hypospadiac opening, when it is made to emerge at one side of, but close to, the urethra; the tube of prepuce is drawn through the tunnel and sutured where it enters the glans and also where it emerges. (Fig. 20.) At the end of ten days the flap of pedicle is cut through close to the new meatus. The second operation, made at a later period, consists of a perineal opening into the urethra and insertion of a Jacobs' self-retaining female catheter; this is the least irritating and can be left as long as needed, usually from five to eight days. An incision

at the termination of the two urethras now admits of accurate coaptation by sutures, or the normal urethra may be mobilized (Beck method) to a sufficient extent to admit of its insertion into the caliber of the new urethra, where it is held by sutures and the external

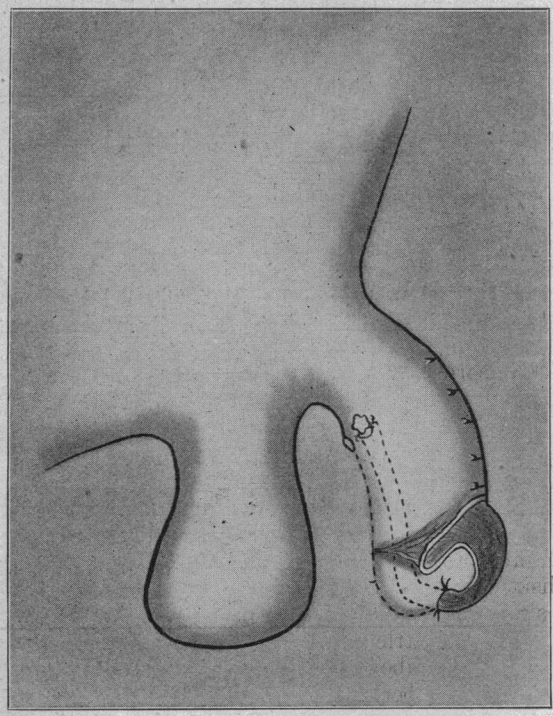


Fig. 20.

parts closed over this. (Fig. 21.) Occasionally a little urine escapes into the urethra and the entire canal is best drained by passing several silkworm strands of horsehair through the urethra and out alongside the catheter in the perineal opening. When union of the canals is complete the drains are removed and the perineal drainage will usually close itself in a few

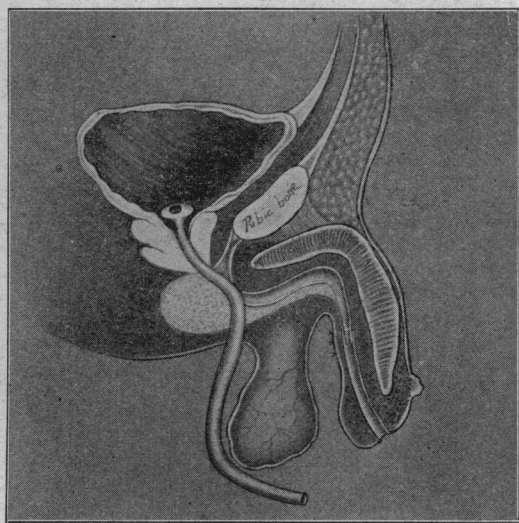


Fig. 21.

days. Horsehair and fine catgut have proved the best suture material for this form of plastic work.

The advantages of this combined operation are: 1, a urethral tube of thin elastic skin nearly approaching mucous membrane, yet having no hair surface to occasion later complications; 2, a perineal drain for the bladder, with a self-retaining Jacobs' female catheter;

3, a silkworm drain for the urethra; and 4, in being a method capable of application to the worst types of hypospadiac cases.

I report four cases of hypospadias cured by various methods:

CASE 1.—(St. Mary's Hospital Reports for 1897.) A boy of 4 years, penile type, was given two operations, the first a Duplay, with partial success; the second a Thiersch, with a good urethra.

CASE 2.—(St. Mary's Hospital Reports for 1898.) An adult, with the balanic type, was given two Thiersch operations, with a nearly perfect result.

CASE 3.—(St. Mary's Hospital Reports for 1900.) A boy 6 years of age, of the perineo-scrotal type with divided scrotum, at the first operation had two inches of urethra constructed from the prepuce and skin of the dorsum of the penis; at the second, bladder drainage, a Nélaton catheter in the perineum, but union at the juncture of the urethras failed. Urine passed by the catheter; bladder tenesmus. The third operation gave bladder drainage by means of Jacobs' self-retaining female catheter through the perineum, for eight days; silkworm strands in the urethra for drainage. Cure.

CASE 4.—(St. Mary's Hospital Reports for 1900.) A boy 8 years of age, the peno-scrotal type, was given two operations. The first was construction of  $1\frac{3}{4}$  inches of urethra of prepuce and skin from the dorsum of the penis; the second, bladder drainage, self-retaining Jacobs' female catheter through the perineum and union of the two urethras. Urethral drainage was by silkworm gut strands. Cure.

### THE POLLUTION OF STREAMS AND THE PURIFICATION OF PUBLIC WATER SUPPLIES.\*

#### COMPARATIVE EFFICIENCY OF SLOW SAND AND MECHANICAL FILTERS.

GEORGE M. KOBER, M.D.

Professor of Hygiene, Medical School, Georgetown University.  
WASHINGTON, D. C.

#### COMPOSITION OF RIVER WATER.

River water is a mixture of spring, ground, rain and surface water, but as the water-courses are the natural drainage channels of the country, it is not surprising that the wastes of human life and occupation should also find their way into the streams. It is for this reason that rivers, after passing through cultivated valleys with cities, towns, and villages or settlements on their banks, often contain a dangerous amount of mineral and organic matter. Rivers are always purer near their source; the amount of impurities increase as we descend the stream. Thus, for example, the Mississippi River at Minneapolis contains only 18.6 total solids per 100,000, while the same river at St. Louis contains 244.3 per 100,000.

#### RIVER POLLUTION.

The sanitarian recognizes two principal forms of pollution, viz.: The amount of mineral matter, and, second, the character and amount of organic matter contained in the water. The amount of mineral matter depends largely upon the geological formation of the country and the erosive powers of the streams, but water containing 50 parts per 100,000 or 30 grains of solid matter per gallon is unfit for drinking purposes on account of its irritating effects upon the gastrointestinal tract. Beyond this, however, it is of no special significance, unless the water also contains metallic poisons or objectionable chemicals.

In regard to the Potomac River, which may serve as

\* Presented to the Section on Hygiene and Sanitary Science, at the Fifty-first Annual Meeting of the American Medical Association, held at Atlantic City, N. J., June 5-8, 1900.