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Reprinted from the BRITISH MEDICAL JOURNAL, June 22nd, 1901.

TRANSPLANTATION OF URETERS INTO RECTUM BY AN EXTRAPERITONEAL METHOD FOR EXSTROPHY OF BLADDER,

AND A NEW OPERATION FOR PROCIDENTIA RECTI IN THE SAME PATIENT.

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EITHER of the two surgical conditions—ectopia vesicæ and procidentia recti—is serious enough in itself, but the occurrence of both in one subject makes the sufferer's life so unutterably miserable, and renders him so repulsive to his friends, that life without relief is well-nigh intolerable.

B. S. G., aged 2 years 7 months, came under my care at the Victoria Hospital for Sick Children on September 29th, 1896.

History and State on Examination.—His parents were healthy and robust, as were also his four brothers and one sister. At birth the patient was found to present a healthy and well-developed appearance in all respects, except that there was an ectopia vesicæ or exstrophy of the bladder. He did not thrive, however, and was of a markedly constipated habit. This was doubtless the determining cause of a prolapsus ani (to which of course the absence of the pubic bone was contributory) that commenced when he was about 19 months old, and rapidly developed into an enormous procidentia recti. At first the protrusion was easily reduced, and remained in position until the next evacuation, but in a few weeks the act of reduction seemed to excite expulsive efforts so that it recurred immediately with violent tenesmus. At the time of admission the procidentia had been down continuously for nearly a year.

The Procidentia Recti.—As the child lay quiet the protrusion was about 4½ inches long, but during crying or straining at stool its apex reached 8 inches below the anal ring. The mass had the shape of a truncated cone, the larger circumference being adjacent to the sphincter, and the apical portion presenting an elongated depression flattened from side to side, which corresponded to the lumen of the bowel. The mucous membrane covering the cylindrical mass presented a somewhat undulating surface, the folds running transversely. These circumferential folds were, however, very much less distinctly marked than I had observed in similar conditions in adults. The colour of the surface varied greatly, being bright pink in the quiet state, but purplish during straining or when exposed to cold air. There were a few spots of granular ulceration which bled freely and also some patches of sloughing ulceration. For the most part, however, the mucous membrane appeared to be healthy. Some shreds of mucus were usually to be seen upon the surface.

The finger could be passed into a shallow sulcus surrounding the base, as if the outer fold of the protrusion had its origin just within the external sphincter. On passing the finger into the depression at the apex of the mass, the mucous membrane felt healthy. Under anæsthesia reduction was easily effected, and so far as could be made out no herniated intestine

existed in the *cul-de-sac* of peritoneum which occupied the anterior part of the prolapsed portion. Allingham has pointed out that the presence of a hernia in the anterior *cul-de sac* can always be determined by the fact that its presence causes the opening of the gut to be turned towards the sacrum. The reduction of the hernia causes the orifice to be restored to its normal position in the axis of the bowel. (He states that, though the condition is not uncommon, he has never found it in children.) During movement of the bowels great straining occurred, and each evacuation seemed to be accomplished only after agonising efforts, during which the child moaned and cried piteously, while the face and head became covered with beads of perspiration; moreover, the tenesmus persisted for some minutes after evacuation, and apparently without diminution of the exquisite suffering.

The Exstrophy of the Bladder.—In the middle line, about the pubic region, was a hiatus in the skin, which was filled up with the bright red mucous membrane of the posterior surface of the bladder. This was continuous by means of a narrow area of scar tissue above, with the imperfectly formed umbilicus and at each side with the adjacent skin, while below it could be traced downwards as a groove or furrow to the tip of a broad flattened and shortened penis, the prepuce, glans, and dorsum of the penis being cleft so as to expose the under segment of the urethra. On drawing the tip of the penis downwards and forwards, the rudimentary prostate could be seen presenting the minute openings of the seminal ducts and the uterus masculinus. A short distance higher up on either side could be detected the openings of the ureters. These presented at the summits of small papillæ, and around them were numerous excrescences of mucous membrane of a papillomatous character. At other parts the exposed bladder membrane was ulcerated, and the whole bladder surface was exquisitely tender, and bled readily though not very profusely. The surrounding skin showed very little irritation, though it was of course constantly bathed in the escaping urine. Both kidneys were greatly prolapsed and reached the iliac fossæ, as could readily be determined on examination *per rectum* under chloroform. The testicles, however, were both in the scrotum, which was somewhat shallow, cleft, and spread out as it were between the thighs. There was an entire absence of the bony pubic symphysis, the rounded ends of the horizontal rami being felt in each groin at a distance of about ½ inch from one another.

The recti muscles were thus widely separated at their lower attachments. The flow of urine from the mouths of the ureters was intermittent. The surface could be dried with absorbent cotton and would remain dry for from fifteen seconds to half a minute. Then from one of other ureter, but seldom from both simultaneously, a few drops of urine would well up with considerable rapidity as if propelled by a gentle peristaltic wave in the ureter, whose patent mouth could be plainly seen through the limpid fluid. A fine probe inserted into these openings passed almost directly backwards, showing that the ureter in its passage from the kidney first dipped over the pelvic brim in the normal manner before turning forwards to its debouchement on the exposed bladder wall. It is important to bear this in mind, else in making the transplantation a kink in the ureter may be produced.

A study of this case seems to make it clear that the congenital condition of exstrophy of the bladder is due to a defective development—not solely of the ano-urogenital apparatus—but to a failure of junction between the lateral segments of that portion of the somatopleure whose duty it is to furnish the anterior surface of the body which extends from the umbilicus to the floor of the urethra, together with a cleft condition (anteriorly) of the allantoic vesicle. The resulting deformity is such as would be produced by dissolving away the anterior wall of the abdomen below the navel, the anterior wall of the bladder, the symphysis and body of the pubes, and the dorsum of the penis to the depth of the plane of the urethra. Thus there is exposed to view the posterior wall of the bladder with the mouths of the ureters, filling in the space between the widely separated recti muscles; the urethral aspect of the prostate with the minute openings leading to the uterus masculinus and the seminal ducts; and a groove or gutter representing the posterior or lower wall of the urethra. Of the two conditions in this patient calling urgently for surgical relief, the proci-

dentia was, of course, the most urgent, and operation for this was performed on November 7th, 1896. It was not, however, until two years and eight months later (July 15th, 1899) that the ureters were transplanted into the rectum.

Operation for Procidentia Recti.—On December 7th, 1896, an incision was made in the median line above the umbilical opening (Fig. 3*d*). It must be remembered that there was really no proper umbilicus, as the open wall of the extroverted bladder occupied all the space between what should have been its lower margin and the public area. To one assistant was given the sole duty of preventing the urine from entering the wound or coming in contact with the bowel during the operation. A wound about 2 inches long having been made, the fingers were inserted, and the sigmoid felt for and identified. The procidentia was then reduced with great ease by traction from within the abdomen. The next step was to produce a narrowing of the lumen of the gut by folding in its anterior wall (Fig. 1, *a* and *e*), and stitching together the edges of the gutter so as to retain the fold. Six stitches of silk were inserted and made to include a goodly portion of the serous and muscular coats so as not to be readily pulled out. The lowest stitch was placed as low down towards the anus as it was possible to reach. In this way the wide part of the prolapsed bowel (the intussuscipiens) was narrowed so as greatly to prevent the tendency of the part above to effect a descent through it, and a strong fleshy column was created on its anterior unsupported aspect.

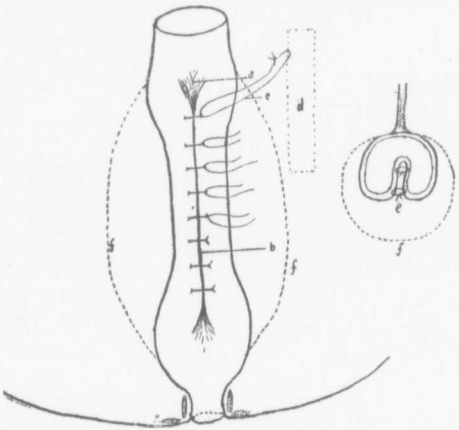

Fig. 1.—Narrowing lumen and forming fleshy column by infolding anterior wall of rectum. *a*. Top of fold; *b*, the fold stitched by one or two rows of Lembert sutures; *e*, suture in position to anchor rectum to abdominal wall *d*; *e*, transverse section showing fleshy column formed by fold; *f*, approximate relative size of rectum before infolding.

In order still further to secure the bowel one end of each of the sutures was passed by a needle deeply through the peritoneum and fascia of the abdominal wall (Fig. 1 *d*) as high up and as far outwards towards the crest of the ilium as possible. In this way the rectum was drawn up and anchored by tying the sutures a second time. The abdominal wound was then closed by silkworm gut sutures, and the buttocks and legs were strapped together by rubber adhesive plaster. Immediately after the operation violent straining came on and continued at intervals for about twelve hours. There was no protrusion, however, and the anus seemed well drawn up into the perineum. The bowels moved naturally on the

third day and every day subsequently. There was a good deal of straining, but no return of the prolapse whatever. Notwithstanding the difficulty of keeping the urine from soiling the dressings, the wound healed throughout by first intention, and the stitches were removed on the seventh day. Some ulceration of the stitch holes and the lower part of the wound occurred subsequently and gave trouble for a time, and the child had a rather sharp attack of bronchitis, with a temperature of 103.4° F. on the eighth day. Otherwise recovery was satisfactory.

Remarks on Procidentia Recti.

The various methods which from time to time have been advocated and practised for the cure of this condition may be divided into three classes:

1. The use of caustics and irritants to the outside of the protruded mass, such as the application of fuming nitric acid or acid nitrate of mercury; the injection of carbolic acid, ergot, etc.; and the use of the actual cautery as originally advocated by van Buren. For mild cases the latter is an excellent and efficient operation, but all the others may, I think, be discarded as being unsurgical and either inefficient or dangerous.

2. *Excisions and Amputations.*—Roberts excises a diamond-shaped mass, having one point 4 inches up on the posterior aspect of the rectum, the other at the tip of the coccyx and its broadest part at the sphincter. Mikulicz and Treves amputate the whole of the extruded mass with the knife, and Kleberg effects the same result by means of an elastic ligature.

3. External fixation by perineal section, "recto-coccypexy," as practised with various modifications by Verneuil, Panchet, and Marchant. Lange removes the coccyx and narrows the lower portion of the rectum by doubling in its posterior surface, stitching it almost exactly as is done on the anterior surface in my method. His case was a severe one of twenty years' standing, and the operation resulted successfully.

4. Internal fixation by abdominal section. Though previously recommended by Allingham, this procedure was perhaps first practised by K. McLeod, of Calcutta, in 1890, by a method which seems now to be crude and unnecessarily complicated. However, he successfully sutured the sigmoid flexure to the anterior abdominal wall above Poupart's ligament. Variously modified, this operation has since been done by Berg, Allingham (who at the same shortens the mesentery), and others.

The method which I adopted in the case herein described differs from any other in that its essential features consists in (1) narrowing the lumen of the lower dilated portion of the rectum so as to make it practically impossible for the original apex of the protrusion to fall into it, and (2) at the same time converting the part doubled in into a strong vertical fleshy column, the lower end of which is supported by the perineum, while the upper in turn supports the apex of the original protrusion. The rational character of this procedure is, it appears to me, well sustained by the observations of Ludlow and Marchant, who have shown that the yielding of the wall of the rectum occurs first at the level of the recto vesical *cul-de-sac*. The anterior wall first protrudes into the rectum and in course of time drags the lateral and posterior walls with it.

But I desire to point out that though this point may be the apex of the protrusion in the initial stage, it does not continue to be so, as the bowel unfolds itself downwards as the mass de-

scends. For example, in my case, the apex protruded eight inches from the anus, and in Lange's case six inches. Thus, on withdrawing the protrusion from within the abdomen, it is quite possible to deal with the offending bowel at the point where repairs are most needed, namely, at and below the apex of the protrusion.

In the case (unpublished) of a man aged 38 on whom I have since operated, I used a double row of sutures in forming the fleshy column by doubling in the anterior rectal wall, and did not stitch to the abdominal wall at all. Though more recent, this case also is so far perfectly successful.

As regards the permanency of the cure, I would point to the first case (Fig. 3) which has not only remained without relapse for four years, but whose rectum was one year and a half ago converted into a cloaca, and has since been called upon to negotiate the evacuation of both urine and fæces.

Operative Treatment of Exstrophy of the Bladder.

The operations may be divided into: (1) Those which aim at restoring some sort of bladder by a plastic operation; and (2) those whose object it is to divert the urine into the rectum. A third operation recently brought before the profession by so well-known a surgeon as Mr. Reginald Harrison consists in entire ablation of one kidney, while the ureter of the remaining kidney is brought out into the loin. This radical and heroic procedure indicates strongly to what extreme measures able surgeons are ready to resort to alleviate the misery attendant upon the patient's deplorable state, but I cannot believe that it will ever attain the sanction of the bulk of the profession as a method of treatment.

Plastic Operations to construct a Bladder.—It is not within the scope of this paper to discuss in detail all the operations which have been done for this condition, but I may mention the objections to all flap operations. It is not claimed even for the best of them that any adequate receptacle for the urine has ever been obtained. No sphincter acting automatically or voluntarily can possibly be produced, and consequently the artificially-formed bladder is in no sense a reservoir. When the bladder is formed of skin, phosphates accumulate upon the hairs which grow from its surface when puberty is reached, and calculous formations of large size may occur. Moreover, such a bladder is liable to ulceration, and is often extremely painful.

Even in those cases in which the amount of mucous membrane is so large that its margins may be dissected up and brought together in the middle line in such a way as to create a vesicle entirely lined by mucous membrane (and these cases are extremely rare) there is no sphincter, and consequently no retentive power.

The very best that can be hoped from any surgically-constructed bladder is that it may furnish a means of directing the urine into some mechanical receptacle which can be worn attached to the person—such as that originally devised in the eighteenth century by Jurine, of Geneva—and at the same time cover and protect the delicate and sensitive mucous membrane.

Transplantation of the Ureters into the Rectum.—The transplantation of the ureters into the rectum would appear to

hold out hopes of results highly preferable in those cases which survive, but unfortunately the mortality hitherto has been high. The deaths are due either to peritonitis or ascending pyelonephritis, but with increasing knowledge of technique there is hope that the death-rate may yet be greatly diminished. If by thus converting the rectum into a cloaca, the patient can hold his urine even from one to three or five hours, he is surely in a much better position to take his part in life than he could possibly be with the best apology for a bladder that can be expected to result from any flap operation.

The first attempt to divert the urine into the rectum in cases of exstrophy of the bladder of which there is any record occurred in 1851. In that year Mr. (afterwards Sir John) Simon, by means of an ingenious mechanical contrivance, endeavoured to establish a fistula between the ureters and the rectum. A partial success was obtained, but the patient died of chronic peritonitis. In the same year Lloyd of St. Bartholomew's Hospital made a similar attempt by means of a seton of silk thread. This patient also succumbed, but more promptly, to peritonitis.

With the introduction of antiseptics, more ambitious operations were devised; and Maydl in 1892 performed the first operation which really deserves to be entitled a transplantation. He practised the transplantation of the base of the bladder with the ureteral orifices into the sigmoid flexure, and in 1894 reported two successful cases.

Modifications of this operation, presenting features devised to limit the danger from peritonitis, on the one hand, and on the other to prevent septic processes spreading from the rectum to the kidney, have been advocated and practised by Krynski, Vignoni, Park, Pisani, Fowler, and Halsted, with varying degrees of success. Many of these operations are difficult and tedious to perform, and, moreover, they all involve opening the peritoneal cavity, and render that cavity liable at any time to infection through failure in the healing process, or leakage backwards, at the seat of operation.

The operation herein recorded was performed in July, 1899, and is, I believe, the first transplantation effected by an extraperitoneal route.

Extraperitoneal Method of Transplantation of the Ureters into the Rectum.

On July 15th, 1899, the patient was anæsthetised, and the parts were disinfected as thoroughly as possible. The sphincter was well stretched, and the rectum, having been previously cleared by a purge and enema, was washed out with an antiseptic solution of non-poisonous strength. A fair-sized sponge to which a tape was attached was then passed into the rectum as high up as possible. This not only prevented any passage of fæcal matter, but assisted materially in raising the anterior wall of the rectum towards the bladder. Turning now to the bladder, a Jacques soft rubber catheter (Fig. 2, *c*, *d*), about No. 5 (English), was passed for about 2 inches into each ureter. The part containing the eye was cut off so that the urine entered the opening upon the end of the catheter freely. A silk suture was then "caught" through the extreme end of the ureteral papilla (Fig. 2, *b*) once or twice, and was also passed by a needle through the substance of the catheter so as to effectually prevent its slipping out, as it was the intention to retain these catheters in position at least forty-eight hours. Care was observed not to obstruct the lumen by passing the thread across it or by tying too tightly. The distal end of the ureter with a goodly rosette (Fig. 2, *b*) of bladder muscle and mucous membrane was then dissected free, the catheter affording an excellent guide to its position. The idea was that whatever virtue

there might be in the peculiar termination of the ureter upon the inner surface of the bladder should be retained when the transplantation was completed. As soon as the entire thickness of the bladder wall (which is here uncovered by peritoneum) has been snipped through with scissors or scalpel, blunt dissection may be employed, and it will be found not to be difficult to free the lower end of the ureter along the wall of the pelvis without injury to the peritoneum.

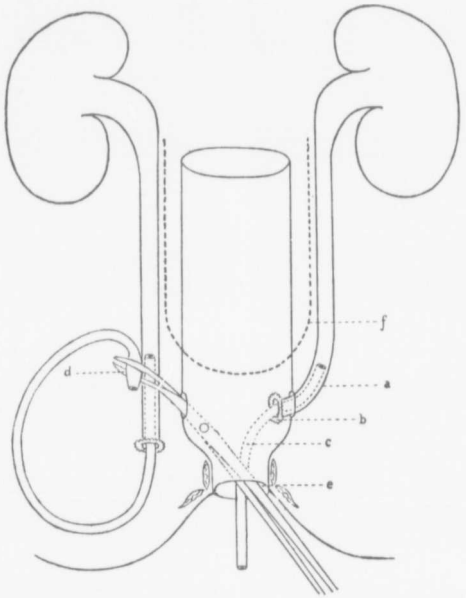

Fig. 2.—Scheme of transplantation of ureters into rectum by extra-peritoneal method. *a*, Ureter in transplanted position with (*b*) rosette of bladder mucous membrane and muscle; *c*, catheter stitched into ureter by suture at *b*, and protruding through *e*, the anus; *d*, forceps passed by the anus through the opening in the bowel and grasping the catheter; *f*, reflection of peritoneum.

Both ureters having been isolated, the whole of the bladder tissue was remorselessly ablated, from the perimeter, where it merged into the skin, to the prostate where the vesiculæ seminales debouched. (During this dissection great care must be taken not to expose or injure the peritoneum; and if its hazardous proximity be suspected, a portion of the bladder muscle may be left, though every vestige of its mucous membrane must be removed. In my case the peritoneum gave no trouble whatever, and was never in the least jeopardised.)

The next step was to expose the lateral aspects of the rectum at a point below the reflection of the peritoneum (Fig. 2, *f*). The deep dissection was found to be surprisingly easy, and by pressing back the retro-vesical cellular tissue I was able to expose the anterior and lateral walls

of the rectum with readiness. This part of the operation was greatly facilitated by an assistant, who inserted his finger into the rectum and lifted it into the wound.

The final step of the operation was the implantation of the ureters into the lateral walls of the rectum, and this was accomplished in the following manner.

With his finger in the rectum the operator carefully determines the exact point at which the implantation is to be made. The requisite qualifications are: (1) It must be above the internal sphincter (Fig. 2 *e*). (2) It must be in the lateral and not in the anterior wall, so as to avoid kinking. (This actually occurred in the first instance in the author's case, necessitating a subsequent adjustment of the implantation.) (3) It must be high enough up to permit the ureter to project slightly (say ¼ to ½ inch) into the lumen of the bowel without stretching (Fig. 2 *b*). If the ureter thus projects it forms a papilla, which when pressed upon from within the bowel becomes converted into a valve, similar to that at the entrance of the bile duct and the salivary ducts. This point having been decided upon, the operator or his assistant passes a slender forceps through the anus, presses them against it from the rectal aspect, and lifts it carefully into the anterior wound. The wall of the bowel is now incised upon the projecting forceps, which are then forced gently through. By stretching and cutting the wound is enlarged with great exactness, so that the ureter with its contained catheter will accurately fill it and yet not be injuriously pressed upon. The forceps are now opened, made to grasp the distal end of the catheter (Fig. 2 *d*), and withdrawn into the bowel and out of the anus, the operator at the same time carefully directing the ureter through the slit, and satisfying himself that its termination forms a papilla at least ¼ inch long upon the rectal mucous surface. In guiding the mouth of the ureter through the slit in the rectal wall forceps may be passed back again beside the catheter, and made to grasp the edge of the rosette of bladder tissue around the ureteral papilla. This process is repeated upon the other side. The sponge plug is now withdrawn, care being taken not to disturb the catheters while doing so.

There seems to be no necessity whatever for stitching the ureters in position, and in my case the attempt was not made. The catheters are left in position at least two or three days, or until they come away of themselves, which occurred in my case in about sixty hours.

The Dressing.—I do not think it judicious to attempt any plastic operation for immediate closure of the abdominal wound. The whole area to be healed will be found surprisingly small, and a moderately firm packing with iodoform gauze will afford efficient drainage, and at the same time furnish a support and splint to the delicate ureters in their new position. When the implantation has healed securely, and granulation has been established, a plastic closure may be done if it be deemed advisable. I allowed my case to heal entirely by granulation, and the scar is quite small and firm (Fig. 3 *a*).

Present Condition of the Patient, December, 1900.—It is now more than four years since the operation for procidentia recti was done, and one year and a-half since the rectum was converted into a cloaca by the transplantation of the ureters. The boy is to-day in perfect health, as is evident from his photograph (Fig. 3). There has never been the slightest tendency to a return of the prolapse, which is the more satisfactory testimony to the efficiency of the operation in consideration of the absence of a pubic arch. There is no evidence whatever of a disturbance of the functions of the kidneys. On examination *per rectum* the mouth of each ureter can be felt as a salient papilla as large as the tips of one's little finger. There is no eczema or excoriation of the anus or perineum, nor is there any evidence that the rectum resents the presence of the urine more—even less, perhaps—than that of any other fluid. The frequency of defecation depends largely upon the amount of fluid ingested, and upon the degree of activity of the lad. When playing about he requires to evacuate the urine at intervals of one, two, or three hours, but in bed at night he frequently goes six or even eight or ten hours without an evacuation. The following figures represent the intervals of an average day taken at random: Bedtime, six hours later, five hours, three hours, one hour and a-half, three-quarters of an hour, two hours, two hours and a-half, one hour and a-quarter, and two hours.

There is no evidence whatever of reabsorption of urine from the rectum. It seems reasonable to suppose that the mucous lining of the rectum may have the same disposition towards the urine that is observed in the bladder and kidney epithelium, since they have a common embryonic origin.

A remarkable feature of this case is the manner in which the cloaca seems to act habitually as a bladder, and only performs the function of a rectum at such times as a movement

of the bowels should take place under normal conditions, namely, once or twice a day. This feature also occurred, and

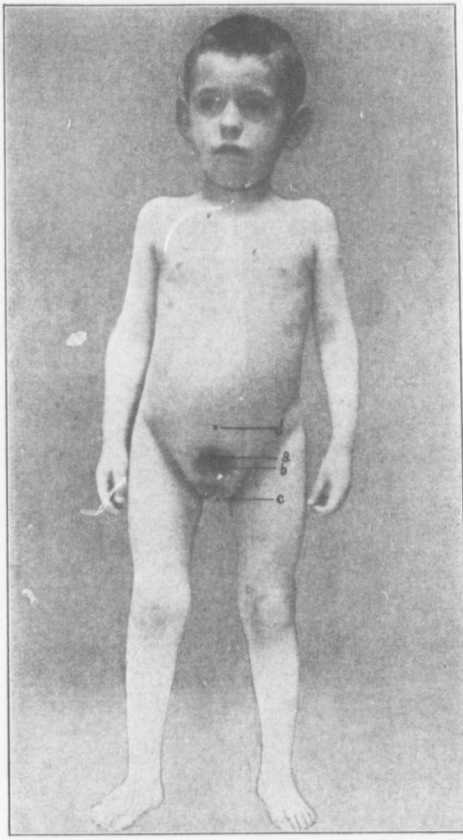

Fig. 3.—B. S. G., aged 6 years 10 months. Four years after operation for procidentia recti, and eighteen months after transplantation of the ureters into the rectum by extraperitoneal method. *a*, scar of transplantation operation; *b*, glans penis; *c*, cleft scrotum; *d*, scar of operation for procidentia. The attitude, with the legs separated, is characteristic of the imperfect and insecure pelvis. He walks well, but with a slightly waddling gait.

was ably commented upon in Fowler's case. He recalls O'Beirne's observations that between the acts of defæcation the rectum is practically empty, the accumulation of fæces taking place in the sigmoid flexure.

For this extraperitoneal operation the following advantages are claimed:

1. There is absolutely no danger of peritonitis.

2. A prominent natural papilla is secured. This is the natural manner of debouchement of a duct upon a mucous surface, and affords the best possible protection against spread of infection up the ureters.

3. The ureters are further protected against infection or sloughing by lying undisturbed in their natural environment almost to the point of implantation.

4. The operation is easy of performance, and practically free from shock and exhaustion.