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*D. Turnbull*  
*from the Author*



REMARKABLE CASE  
OF  
EXTROPHY OF THE URINARY BLADDER,  
WITH REMARKS.

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(*From the Edin. Med. and Surg. Journal, No. 141.*)

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ALTHOUGH there are on record many cases, and a few well-digested accounts \* of this connate deficiency of the urinary organs, yet, as the appearances of the malformation in the present instance, vary in some interesting particulars from what have been observed in other cases already recorded, I am induced to narrate shortly the details of these peculiarities.

James Forbes, from Campsie, Stirlingshire, aged 42, who since early life has been employed as a gardener, found it necessary eight years ago, to leave his occupation in consequence of severe chronic rheumatism, affecting particularly the articulations of the lower limbs. More lately, he has suffered under a protracted attack of rheumatic fever, accompanied by a severe affection of the articular apparatus of the left knee and hip-joints, which has terminated in luxation of the *os femoris* on the *dorsum ilii*, and consequent shortening of the limb. His constitution was formerly robust, and his body vigorous, though latterly his strength has

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\* See Vols. i. p. 39, and iv. p. 32 of this Journal;—Dict. des Scien. Med. xiv. 344, *Art. Epispadias*;—Cyclop. of Anat. and Phys. *Art. Bladder*, p. 391, &c.

become much impaired, and his body emaciated, and now he suffers considerably more than he used to do from a malformation in the genito-urinary organs, a great part of the urinary bladder being everted, and its delicate mucous surface likewise in a very irritable condition.

In height, this man measures five feet four inches and seven-eighths, while between the extremities of his middle fingers, his arms being fully expanded, he measures six feet two inches and seven-eighths. This disparity is remarkable, for although between eight and ten years ago, a curvature forwards in the dorsal region of the spine contributed materially to lessen his stature, yet very nearly the same amount of disproportion in his body was congenital, since we find that his height at the period of maturity did not exceed five feet nine inches.\*

At birth the subject of this narration was observed to have in the hypogastric region, a small reddish tumour, to the upper part of which the umbilical cord was attached; but all trace of the latter disappeared very shortly afterwards. He is the oldest of a healthy family of seven, (four of which number are males), and is the only one among his relatives exhibiting any malformation. As he advanced to maturity, the tumour increased rapidly, though not in an equal ratio to what it latterly has done, since eight years ago, it was in bulk one-half smaller in every way than it now is, and about three years ago, when I first saw him, it was one-fourth smaller in size than at present. It now presents the following characters. [See Plate IV.]

The anterior wall of the hypogastric region of the abdomen in the situation of the lower third of the *linea alba* is deficient at a part corresponding to the base or neck of the tumour, which consists of the everted posterior wall and lower fundus of the urinary bladder, protruded so as to form an elongated oval eminence, having its long axis placed transversely. The skin of the abdomen continuous with the upper part of the neck of the protrusion presents a triangular cicatrice two inches and a half broad, by one inch and a quarter in elevation, the base of which unites with the surface of the bladder. The integument closely bordering on the

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\* It is perhaps not superfluous here to remark, that, six years ago, I made a series of careful observations with the view of ascertaining the accuracy of a measurement of the expanded human body given by Du Piles, as taken from the statues of the ancients by M. du Fresnoy, and which measure is by artists assumed to be true in nature, viz. that "a man, when his arms are stretched out, is, from the longest finger of his right hand to the longest of his left, as broad as he is long." (See Sir Joshua Reynolds' Works, by Malone, edit. 1809, Vol. iii. pp. 115, 116.) By induction from the first twenty-five experiments of this nature made by me, I found that, at the period of maturity, there is a preponderance in the breadth over the height of the expanded body, amounting on an average to rather more than two inches and a half.

remainder of the neck of the tumour presents a similar opaque and cicatrized appearance.

The surface of the extrophied bladder is composed entirely of mucous tissue, with the exception of, *first*, a narrow portion on the upper surface of the neck of the tumour, continuous with the cicatrized skin already adverted to as marking the attachment of the umbilical cord, and *secondly*, an insulated triangular portion of small size on the anterior surface of the left side of the tumour. Both of these spaces are covered with skin and epidermis, exhibit irregularly undulating borders, and resemble old cicatrices. No change in the relative size or general appearance of these spots has been observed.

The mucous surface just referred to is of a florid colour, of a smooth and fine villous appearance when examined under a lens, and it is exquisitely sensitive. For partial defence of this delicate surface it is covered altogether with an exudation of thin mucus. This secretion, however, is, from the high temperature of the part, (afterwards to be noticed), constantly being inspissated, and acquiring the character of loose opaque shreds or laminæ, which in their turn are detached by the mucus effused beneath, so that the surface is, notwithstanding, kept constantly bedewed with this secretion. So sensitive to the touch and to the influence of a cool atmosphere is this surface (which, especially during the prevalence of frost, or previous to its approach, is very delicate and painful,) as to require the individual to guard it from exposure to the air, or to any irritation, with as much care as possible. This he succeeds moderately well in doing by the use of a shield made somewhat after the pattern recommended and figured by Dr Duncan.\*

On the lower surface of the protrusion is the well-marked *trigone*, bounding which space posteriorly, and at the distance of one inch and a half from each other, and three-fourths of an inch from the penis, are the apertures of the ureters, the left at the distance of one inch and an eighth, and the right three-eighths of an inch distant from the mesial line of the body. The border of the aperture of each ureter is surmounted by an elliptical projection of mucous membrane, which, from its thickness and obliquity, prevents the free escape of the urine. Nevertheless, this fluid is observed constantly and involuntarily to ooze out of the left ureter, the orifice of which is a little wider than that of the right; while, on the other hand, the upper surface of the penis being in close contact with the latter opening, operates as a valvular hindrance in opposing the free escape of the urine through it. The individual possesses, however, a power of propelling at pleasure a small stream of urine from the left ureter, and when the tumour is

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\* See Plate iii. in Vol. i. p. 140 of this Journal.

gently raised from the penis, he can, by powerfully contracting the diaphragm, abdominal muscles, and *levator ani*, urge forcibly a stream of urine from both ureters simultaneously. This flow of urine is rendered freer by previously dilating the orifices of the ureters, by introducing along them for about half an inch a moderately sized bougie. Beyond this distance these canals appear to be much dilated and very tortuous, constituting apparently supplementary bladders or receptacles for the urine. The correctness of this supposition I was enabled to put to the proof by plugging tightly the orifices of the ureters on one occasion for the period of two hours, and on another occasion for two hours and a half, so as to confine the urine within the dilated ureters. These experiments (which I repeated) produced in about an hour from their commencement, a sensation of great distension in the upper inguinal regions, and along the spermatic chord, attended with considerable uneasiness and pain, and a manifest recession of the protruded bladder, with a contraction of it in all its diameters. At the close of the experiments, I raised the tumour, and, much to the relief of the individual, removed the plugs, when a very little urine began to flow from each ureter; but on the introduction of my finger along the rectum, and the elevation by this means of what seemed to be a watery sac or dilatation, the urine was discharged abundantly, and exhibited a well-marked straw-colour, whereas, in ordinary circumstances, this fluid is voided quite transparent in appearance. It may be added, that the flow of urine has always been regular and uninterrupted, and the quantity of it discharged in the twenty-four hours amounts on the average to six pounds. Its constituents, however, are not altogether healthy, a sufficient quantity of albumen existing in it to form a precipitate on boiling, and there are present also about ten per cent. of thick and very viscid mucus. Farther, a round soft pellet of a white deposit like moist pipe-clay, of the size of a large pea, and composed of the ammoniaco-magnesian phosphate, entangled in this ropy mucus, has, during the last nine months, been voided along with the urine from the left ureter every morning.

The ordinary specific gravity of the urine varies from 1009.4 to 1022.1, and the specific gravity of that collected in a vessel between six P. M. and half-past one A. M., amounts to 1020.5. Fifty minutes after having taken one ounce of the infusion of rhubarb, the specific gravity rose from 1009.4 to 1022. Forty minutes after this, (an interval during which the urine was forcibly retained in the ureters by firm plugs introduced into their orifices,) its specific gravity rose to 1020.5;—however, one hour and fifty minutes afterwards, (the ureters having still been kept closed,) the specific gravity of this fluid when forcibly expelled was found to have fallen to 1010.4.

The following are the measurements and external relations of this extrophy of the bladder.

The length or transverse diameter of the tumour when in its ordinary relaxed state, (the individual being seated,) measures four inches and a half, its breadth or vertical diameter two inches and a half, and its depth or antero-posterior diameter, *i. e.* its elevation from the skin of the abdomen, one inch and five-eighths. This last diameter is, however, during any muscular exertion increased to three inches. When the body is placed in the horizontal posture, and is quiescent, the transverse diameter of the tumour is reduced to three inches and a half, the other diameters remaining as before; but after a night's rest in bed, the whole protrusion is reduced to the size of a large plum. When, however, attempts are made in ordinary circumstances, to retract the protruded mass, by calling into powerful action the muscles of inspiration, the tumour appears to be lessened in all its dimensions, its measurements being reduced to these; length three inches and a half, breadth one inch and a quarter, depth one inch. This diminution in its various diameters takes place synchronously with the contraction of the abdominal muscles, and may possibly be referred altogether to their action; yet an attentive observation of the surface of the protrusion during contraction, leads to the more probable conclusion, that in itself it evidences the possession of a distinctly fibrous or muscular coat. Again, upon plugging the ureters, the lower part of the bladder appears to retire or be drawn inwards, and the whole then assumes a collapsed and somewhat corrugated appearance.

A probable reason for the volume of this tumour being so variable is, that internally it constitutes a herniary sac, in which rest many convolutions of the small intestines. These indeed may, during expiration, be readily recognized as occupying this position, by the undulatory movements then perceptible through the very thin and attenuated texture of the parietes of the abdomen, immediately above and around the edge of the tumour.

The subject of this case has never been able to occupy any other posture when laid down, than resting on his back or his right side.

The *temperature* of this everted mucous surface, as indicated by a very delicate thermometer employed in an apartment the air of which was so low as 40°, amounted to 98°, while the temperature of the interior of the ureter (the bulb of the instrument being introduced for one inch and a quarter along the canal,) amounted to 99½° Fahrenheit.

In the present, as in much the greater number of narrated cases of this congenital malformation, a separation anteriorly of the bones of the pubes is found to exist, no symphysis (properly so named) being present. The *ossa pubis* appear in this instance

to be present throughout, although the summits of their spine are widely separated from each other to the distance of seven inches and a half, and are apart from the mesial line half that distance.

The *recti* muscles of the abdomen maintain their ordinary attachments to bone, but five inches above the tumour their mesial margins form, with the superior margin of the neck of the tumour, a triangular space, the area of which corresponds with the expanded *linea alba*, and that cicatrized spot formerly described as marking the seat of the umbilicus. The *pyramidales* muscles are of course wanting.

The remaining measurements of the pelvis are the following: Between the anterior superior iliac spines across the hypogastrium, 14 inches; do. on a plane surface,  $12\frac{1}{2}$  inches; do. across the last lumbar spine,  $16\frac{1}{2}$  inches; between the anterior superior iliac spine and the pubic spine, 5 inches; between the tuberosities of the ischium,  $4\frac{1}{2}$  inches. Again, the distance of the *scrobiculus cordis* from the neck of the tumour is  $11\frac{1}{2}$  inches; the latter from the pubic spine, 2 inches; from the anterior superior iliac spine, 6 inches; and from the *os coccygis*,  $6\frac{1}{4}$  inches.

The *penis* is adherent to the *trigone* of the everted bladder, but the *glans* alone is perceptible, which is cleft and imperforate. In length it is an inch and a half, in breadth two inches, and in depth (laterally to the frœnal cleft) seven-eighths of an inch. The anterior two-thirds of its upper surface or dorsum present a flattened shallow groove or gutter, on which the urine in part falls, and this gutter is terminated laterally by an edge or border about a line in extent. The posterior third is surmounted by a triangular elevation, exquisitely sensitive, resembling and corresponding to the *verumontanum urethræ*. The orifices of the two seminal ducts are situated at three-eighths of an inch distance from each other, and three-fourths of an inch from the side of the penis, and they open on the verumontanum; while on and around this elevation are several mucous lacunæ besides, one of which, placed in front, resembles the *lacuna magna* in its size, and in its extending backwards. The *glans penis* is devoid of præputial covering above, but below it is invested by prepuce, which anteriorly forms a corrugated semilunar frœnum, and laterally is prolonged upon the integument of the scrotum. The glans is capable of erection; in colour it is natural; the verumontanum and urethral groove present also their natural bright rose-tint. The *corpora cavernosa* are not distinguishable. The penis does not arise from bone through the medium of crura, but is attached to a dense ligamentous band, that may be felt by the finger introduced *per anum*, extending transversely across between the ascending *rami* of the pubes. These ridges of bone are four inches dis-

tant from each other. Towards its attachment to this transverse band, the neck of the bladder and adjacent portion of the *trigone* may at the same time be perceived drawn inwards and downwards at a very acute angle; and here the amount of thickness of parts between the surface of the abdomen and the finger does not exceed half an inch.

The *prostate gland* during this examination is not to be felt, although very probably it is present, as is manifestly indicated by the existence of a strong sexual appetite.

It is probable likewise that the *vesiculæ seminales* exist, although they too are imperceptible, since a very abundant secretion of mucus is discharged at the seminal orifices.\*

The *scrotum* in form is a small, triangular, and elongated pouch; in length, measured from the *frænum præputii* downwards, it amounts to three inches and a quarter, and at its lower half it is corrugated, collapsed, and empty. The *raphé* is well defined. The *testes* are of their natural size; they descended from the abdomen at the usual period, and occupy the base and upper third of the scrotum, where they may be at once recognized, the left one hanging a little higher up, and projecting a little further forwards than the right. Their secretion is regular and natural. The *vasa deferentia* are distinct; they can readily be felt by the fingers, and terminate naturally.

The spermatic cords are large, but no power, such as the *cremaster* confers, of retracting these or the testes towards the abdomen, exists in this case of extrophy. The individual is subject occasionally to hernia on both sides after any great exertion or fatigue in walking, or too laborious employment. He has, however, been less subject to this condition lately, though simply of course from having avoided the cause.

The anus is placed so far as two inches in advance of the coccyx, and only one-third of an inch from the base of the scrotum.

In the second part of this paper, I shall offer some observations on the structure and peculiarities of the mucous surface of the urinary bladder, and notice its secretion. I shall inquire also into the nature of the influence which the bladder is supposed to exert directly or indirectly, in producing certain modifications in the urine. And, finally, I shall detail a series of experiments and results, (for performing and obtaining which this case of extrophy has afforded so favourable an opportunity,) on the rapidity with which various colouring, saline, and smelling substances, &c. after being exhibited, appear in the urinary secretion.

\* See Dr Davy's recent researches on the fluid of the *Vesiculæ Seminales* in Man in this Journal, Vol. I. pp. 12, 13, note.



The first part of the paper is devoted to a description of the apparatus used in the experiments. The apparatus consists of a glass vessel containing a liquid, and a small tube inserted into the liquid. The tube is connected to a manometer, and the pressure in the tube is measured. The liquid is heated, and the pressure in the tube is observed to increase. This is due to the expansion of the liquid, and the increase in pressure is proportional to the increase in temperature. The apparatus is shown in the accompanying diagram.

The second part of the paper is devoted to a description of the results of the experiments. It is found that the pressure in the tube increases with the temperature of the liquid, and that the increase is proportional to the increase in temperature. This is in agreement with the theoretical prediction that the pressure in a liquid increases with temperature.

The third part of the paper is devoted to a discussion of the results of the experiments. It is shown that the results are in agreement with the theoretical prediction that the pressure in a liquid increases with temperature. This is due to the expansion of the liquid, and the increase in pressure is proportional to the increase in temperature.

The fourth part of the paper is devoted to a discussion of the apparatus used in the experiments. It is shown that the apparatus is simple and easy to use, and that it is capable of measuring the pressure in a liquid with a high degree of accuracy. The apparatus is shown in the accompanying diagram.

The fifth part of the paper is devoted to a discussion of the results of the experiments. It is found that the pressure in the tube increases with the temperature of the liquid, and that the increase is proportional to the increase in temperature. This is in agreement with the theoretical prediction that the pressure in a liquid increases with temperature.

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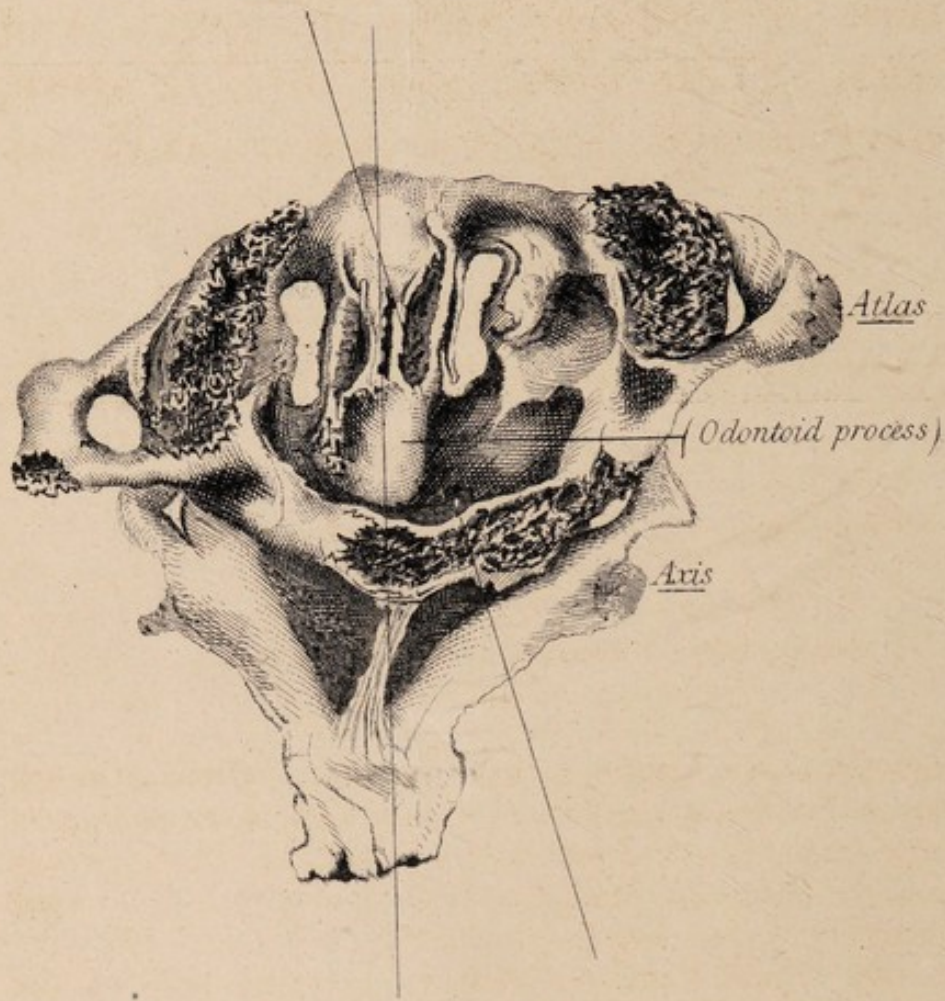
The twelfth part of the paper is devoted to a discussion of the apparatus used in the experiments. It is shown that the apparatus is simple and easy to use, and that it is capable of measuring the pressure in a liquid with a high degree of accuracy. The apparatus is shown in the accompanying diagram.

The thirteenth part of the paper is devoted to a discussion of the results of the experiments. It is found that the pressure in the tube increases with the temperature of the liquid, and that the increase is proportional to the increase in temperature. This is in agreement with the theoretical prediction that the pressure in a liquid increases with temperature.



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