

The Relations of the Perineal Muscles  
to the Functions of the Bladder.

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The subject taken up in the following pages is one which seems not to have received a just amount of study, and on which one finds but sparse statements in our physiological and anatomical books. Much no doubt has been written which has an indirect bearing on the subject, as any treatise dealing with the regions involved, could hardly fail to touch upon it; and thus we find that in works on structure of the urethra, and surgical ailments of this and the adjoining regions, the anatomy of the perineal muscles and their actions with regard to the bladder and urethra must be fully considered, but so far as these structures are concerned with the physiological actions of the bladder, but little information is given, and it would

appear that many do not look upon them as fulfilling any duty beyond that indicated by their names, and do not consider that they may sometimes play a most important part in the physiology of micturition. As described ordinarily, this process is always represented as a perfectly simple and undisturbed one, which it no doubt is, in many, and indeed in the majority of cases, if the call for micturition be immediately responded to by an evacuation of the contents of the bladder. But that this natural and happy result does not always take place, is the experience of most of us, and that in such cases, at least, if not in ordinary cases, that some power external to the urinary bladder comes into play, which has complete power up to a certain point over the

contents of the organ, will perhaps on a careful consideration of the subject become perfectly clear.

In the first place what does this process of micturition imply? The common theory as regards the manner in which the passage of urine is brought about, is briefly that given in one of the latest, if not the latest work on physiology by Hermann. He says "The passage of the stored up secretion into the urethra, is controlled by a ring of elastic fibres; and in males by the elasticity of the prostate also. As soon as the pressure of the urine overcomes the elasticity of these structures, and a drop of urine trickles into the urethra, an impulse to micturition is felt; whereupon either the closure of the neck of the bladder is rendered firmer by the voluntary contraction of the urethral muscles, or a voluntary evacuation of the

contents of the bladder & commences  
Now "an impulse to micturition" implies  
in a perfectly normal and healthy state  
that the bladder contains a certain  
quantity of urine, "a drop of urine  
trickling into the urethra" implies, a  
certain amount of pressure from within  
of the walls of the bladder and the urine  
combined, and a potency of the pas-  
sage between the bladder and urethra,  
i.e. dilatation of the sphincter.

But when this takes place, i.e. the mus-  
cular walls contracting upon the blad-  
der containing a considerable quantity  
of urine, is it likely that on dilatation  
of the sphincter, only a single drop,  
or say even a few drops of urine pass  
through the opening.

The most sensitive part of the urin-  
ary apparatus is at the Trigone of the  
bladder, and it is not more likely that

the pressure of the fluid against this sensitive part is the cause of the sensation produced, rather than that the first impulsion takes place when a certain quantity of urine has actually escaped from the organ? In support of this idea, a sentence in a recent paper by Esmerch may here be quoted - "As soon as the accumulation of urine has reached a certain height, it irritates the sensory nerves of the mucous membrane viz. those lying at the trigone, and produces the feeling of a desire to micturate" This is perhaps a most satisfactory and rational idea than the other, and from the extreme sensitiveness of the neck of the bladder, as witnessed both by the distribution of the nerves, & in the feeling produced on passing an instrument, it may surely be looked upon with some favour. To say that

the feeling of a desire to micturate is caused by "a drop of urine passing into the urethra", implies that no reflex action takes place till the pressure of the fluid is so great as to cause a certain dilatation of the sphincter, and implies also, that it is that part of the urethra immediately beyond the sphincter which is the most highly sensitive part of the urinary apparatus. If it is the case that there is no sensation produced till there is a certain quantity of urine in the urethral canal, then the pressure of the fluid against the neck, and the opening of the sphincter takes place without causing any sensation. But a certain reflex action produces the dilatation of the sphincter, and contraction of the walls of the bladder. Is it likely that these take place without sensation? Is it not more likely that this reflex action is



brought about by the sensations produced by the pressure of the accumulated urine on the neck of the bladder? Possibly then the sensation may be caused thus. As soon as there is a sufficient quantity of urine in the bladder to produce a contraction of its muscular walls, the pressure thus produced acting directly upon the neck of the viscus, and the sphincter, produces the sensation which gives rise to the reflex act. In cases where a frequent desire to pass water is felt, even when the bladder has been but lately emptied, the sensation must surely be produced before there is a sufficient amount of urine to cause sufficient pressure to produce the escape of any urine through the sphincter. Is it not probable that in such cases, the neck of the bladder is so sensitive that the mere contact of even a small quantity of urine is sufficient

to produce the sensation?

In order to arrive at a proper understanding of what follows, it will be well in the next place, to enter in some measure into the anatomy of the parts involved, namely, Urinary bladder, Prostate gland, Perineal muscles and urethra.

With regard to the bladder, we need only consider the muscular coat, and more especially the arrangement of the muscular fibres at the neck, and their relations to the so called Sphincter Vesicae, prostate gland & urethra. Speaking generally it may be said that the muscular fibres are arranged in three layers. (1) External or longitudinal (2) Middle or circular and (3) Internal also longitudinal

The external layer consists of parallel longitudinal fibres which extend from the neck of the bladder & prostate gland along the upper (anterior) surface of

the organ to the fundus, from which point many fibres pass down again to the neck, where they rejoin the prostatic gland in the male, & in the female become attached to the front of the vagina.

The circular fibres are found most conspicuously at the neck of the bladder, where they form the "Sphincter Vesicae" of Anatomists. The fibres entering into the formation of this structure are however not separate or distinct from the other fibres of this layer, which are continued onwards around the prostatic portion of the urethra. The internal layer is found mainly at the fundus, but on passing downwards the fibres become more longitudinal, and are continued through the cervix, where they form the longitudinal fibres of the urethra. It will be seen then that the neck of the bladder is a point of general meeting of the muscular fibres.

both longitudinal & circular, and that many of these fibres are continued either into the prostate gland alone, or still further into the prostatic portion of the urethra. Without going into details, it is sufficient to call particular attention to these relations of the Musc<sup>lar</sup> fibres of the bladder to the prostate gland and urethra - in the female to the urethra.

The prostate gland embraces the commencement of the urethra, immediately behind the triangular ligament - Certain muscular fibres from the levator ani muscles pass into the gland on either side (levator prostatae). The gland is largely muscular in structure, and contains a distinct layer of circular fibres, continuous with those of the neck of the bladder behind, and in front. Amalgamated with a thin muscular layer enveloping the membranous portion

of the ureters. Kölliker in speaking of this structure says, "the prostatic gland is a very muscular organ, the gland substance forming scarcely more than  $\frac{1}{3}$  or  $\frac{1}{2}$  of the whole organ" He names the muscular layer of circular fibres already described "Sphincter prostatae". In this powerfully muscular organ then, it is evident that we have a structure which from its relationship to the commencement of the urethra, must certainly be capable of exerting a considerable amount of pressure on the canal, thus causing contraction of the passage.

The levator ani is attached to the 5th pubis, spine of the ischium, pelvic fascia, and its fibres descend toward the middle line of the perinaeum, where they are inserted in conjunction with those of the fellow of the opposite side. It thus gives a flooring of support to the rectum & bladder. It is

however to the anterior fibres of this muscle.  
that particular attention is here directed,  
or rather to the effect of the action of these  
fibres taking their fixed point from the pubis.  
In such a case, the muscle would be pulled  
upward & forwards, and the upward pressure  
thus exerted would be brought to bear  
upon the neck and anterior part of the  
urinary bladder, which parts it would  
thus tend to raise, & thereby compress the  
outlet of the organ, and diminish its  
volume. In this way it would form a  
resistance in some measure to pressure  
from within the bladder, whilst those of  
its fibres which pass from the pubis and  
anterior ligament to the sides of the pros-  
tate gland, would taking their fixed  
point from above, tend to draw the pros-  
tate upward, and so aid in the closure  
of the urethra

The "Accelerator urinae" consists of two

Symmetrical portions. Its fibres diverging from the centre of the perinaeum, pass in three different directions - the posterior, pass into the triangular ligament and ramus of the pubis, the middle, encircle the urethra, & corpus spongiosum, and the anterior encircle the entire penis spreading out on the corpus spongiosum. The urethra penis arises from the tuberosity of the ischium & slight from the ramus, & the fibres passing forward be. come intermingled with the fascia on the sides of the crus penis.

The Compressor urethrae arises from the posterior surface of the ramus of the pubis, and its fibres passing transversely across the perinaeum embrace the membranous portion of the urethra, and join those of the opposite muscle. In connection with this muscle, may be mentioned the existence, doubted by some, of certain muscular fibres to which the name of

"Wilson's muscle" or "Pubis urethral" has been given. In English books on anatomy, if this structure is mentioned at all, it is only described as "inconstant" or "doubtful". It is however spoken of in Richet's "Traite Pratique D'anatomie Chirurgicale" as follows: "Wilson's muscle, or pubis urethral which, Mons. Cruveilhier confounds with the fibres of the Levator, from which it is separated by the lateral aponeurosis of the prostate, presents itself under such varied circumstances that it is difficult to give a good idea of it."

Between the aponeurosis and the longitudinal fascia of the levator in front of the transverse portion of the same muscle, certain muscular fibres are found, which arise from the posterior surface of the symphysis pubis, and from the body of the pubis, and pass towards the muscular portion of the urethra into which they are inserted:



these are the fibres easily isolated in certain subjects, which constitute the pubis urethral or Wilson's muscle. Its general form is that of a triangle, the base of which is directed forwards towards the body of the pubis, whilst the summit turns towards the urethra. It is somewhat obliquely directed at its base and posterior, & some fibres extend to the prostate, & even to the rectum. Wilson gave to these fibres the name of prostatic superior and inferior. Wilson's pubis urethral muscle is composed principally of fibres having their attachment to the skeleton, and a movable attachment to the urethra & prostate.

What may be the action of such a muscle? Evidently when it contracts, it brings its movable insertion towards its fixed origin, in other words it draws the urethra against the pubis in the same manner as the bulbo cavernosus

Compresses the Spongy portion, and the portion of the canal which it traverses against the corpus cavernosum.

With regard to its further action and use he says. "It accelerates the course of the spermatozoa, and the urine, and further it closes the portion of the canal to which it is attached, and indeed for this reason, it may be considered not as a sphincter, seeing it surrounds the urethra, but as a constrictor of the urethra. It is to it that is attributed the repulsion of the last drops of urine in the canal, and it is also it which, in conjunction with the circular fibres proper of the canal form an opposition to the catheter by their spasmodic contractions, and arrest the sound or catheter in that operation known to surgeons under the name of *functural spasm*."

Then the existence, and actions of this muscle as described above, must also be.

come in mind as having an important bearing on the subject under consideration. The "transversus Prinaei" extend from the inner side of the ramus of the ischium to the central line of the perinaeum, where its fibres join those of the opposite muscle.

It is unnecessary to go particularly into the anatomy of these parts in the female, as with the exception of the prostatic gland, they are so far as the present subject is concerned, practically the same.

A glance then at the attachments, method of arrangements, and actions of these muscular structures above described, will suffice to show that from their relationship to the penis and neck of the bladder, they are capable of acting more or less directly upon the neck, of and upon the canal of the urethra.

The urethra consists of three parts  
Prostatic. Membranous, and Spongy.

The Prostatic is the widest part of the canal, and is capable of great distention. The larger part of the prostate gland is situated below, the smaller portion <sup>above</sup> ~~is situated~~ this part of the urethra. The Membranous, the narrowest part of the urethra, has also been called "muscular". Remark in the paper already quoted from, in speaking of this portion of the urethra says "I prefer however to call it the muscular portion, because it is in fact provided with a very strong muscular apparatus." See Sir Henry Thomson says of it. "We might substitute with advantage Muscular or Contractile for Membranous portion".

The Spongy portion contains also many Muscular fibres.

To pass in the next place to the consideration of the Sphincter Vesicae. Considerable difference of opinion exists regarding this structure, for which many eminent

men are to be found denying that there is any true sphincter at all, and many speak of it as doubtful, we find it on the other hand, clearly described in anatomical books, and its existence is supported by many observers. If one dissect the part about the neck of the bladder in the expectation of finding in the Sphincter Vesicae a structure of any size, he will certainly be disappointed, as it consists merely of an extension or continuation of the middle or circular layer of fibres of the bladder, and is formed merely by an amalgamation of some of these fibres.

Of these who maintain that the existence of this structure is beyond doubt, many look upon it as fulfilling one great purpose, viz. a means of obstruction to the passage of the urine, and seem to believe in it as the only means whereby the urine is retained in the bladder.

On this latter point however, whether the existence of a true sphincter be denied or not, one might perhaps be pardoned for being somewhat sceptical, and for maintaining that in certain cases, when there is a necessity for preventing the escape of urine, the sphincter would be altogether incapable of doing so, were it not materially assisted by the muscular structures already described. This opinion has surely been almost expressed by those who speak of the urethral muscles as Sphincters, and that Sir Henry Thomson is somewhat sceptical of the power of the sphincter is clearly indicated when he says, Speaking of the fibres of which it is composed,

"their arrangement is certainly not sphincteric and again he says" they are no doubt chiefly concerned in the expulsive function of the bladder", and in another place he writes, "that some barrier to the flow of urine

exists at the neck of the bladder cannot be doubted, and the form & position of the Valvula Vesicae strongly suggest that this prominence may constitute it, since it need only be maintained in contact with the roof and sides of the outlet, in order to effect its closure, a position which appears to be its natural one in health." From this it would appear that Sir Henry Thomson does not believe much in the Sphincter as a means of retention of urine. And here another thought presents itself. The middle layer of circular fibres of which the walls of the bladder are in part composed, is concerned in the emptying of the bladder, these fibres by the pressure they exert are only expulsive in action. Now as already mentioned, the so-called Sphincter is a direct continuation of this circular layer, it is as it were part of the same muscle. Is it not then most

probable that the action of these fibres at the neck is also mainly repulsive?

As the bladder contracts upon the urine, the circular fibres in the fundus must first be brought into action, nature's object being to direct the stream towards the neck, then those in the middle part of the organ, and lastly the sphincteric fibres, which it is surely right to suppose must naturally act in the same manner. This does not imply, as might be thought, that they can therefore never act as an obstructive force to the passage of urine. But of this more will be hereafter said. To this idea of the action of these fibres, a possible objection might be raised, as the passive state of the sphincter is contraction, and it might be argued that from this fact alone, it must act as an obstruction. Doubtless it is true that the passive state of the sphincter is contraction, and doubtless it must



in this state act as an obstructive force, but let it be remembered that when the reflex act has taken place which brings about the commencement of the passage of urine, the sphincter is no longer in a passive state of contraction, but in a state of dilatation, and this dilatation is maintained. No spasmodic & involuntary contraction of its fibres takes place, until the bladder is emptied.

As already pointed out, the muscular fibres of the urethra are directly continuous with those of the bladder, and it has been shown, how that at the narrowing of the neck, the fibres must necessarily be as it were bunched together, there is a collection or fatherning together of fibres just before they pass into the urethra, and this accumulation of fibres has given rise to the name sphincter, & perhaps also to the idea of its action most generally believed in

As however most anatomists are agreed that the arrangement of the fibres is not spheric. the name "Sphincter" is here perhaps not very well applied.

Without however condemning the idea of the presence of a true sphincter, what it is intended to indicate here, is, that it is not, what it is very generally believed to be, the very powerful and all essential force, whereby the escape of urine is prevented, and that in certain cases, it would from the nature of the autogenetic forces brought to bear upon it, be incapable of exerting such a controlling influence over the contents of the bladder, were it not materially assisted by certain other forces external to the bladder viz. the perineal and rectal muscles.

The fibres comprising these muscles are partly voluntary, & partly involuntary.

The nerve supply is in some measure from the  
pedic, which may be excited by irritation  
of the pedunculi cerebri, in part from the  
hypogastric plexus of the sympathetic.  
If this be so, it is evident that these muscles  
may be brought into action, either through  
the brain by the influence of the will, or  
by reflex action. As a proof of the di-  
rect voluntary action of these muscles,  
and as a proof of their power of ar-  
resting the passage of the urine, the sud-  
den stoppage of the stream during erec-  
tion may be mentioned - a fact  
easy of demonstration - In such a case  
the sphincter has surely but little to do  
with the stoppage of the stream, or at  
least it is not the main or primary  
force in action - How then is the stream  
suddenly arrested? If an individual  
takes the trouble to analyse his feelings  
in such a case, he will be sensible

that the forces brought into action are to a large extent the perineal muscles, in conjunction with the muscular fibres of the urethra, the sudden action of which, sometimes causes a sensation amounting to actual pain.

In any case, it cannot be supposed that the sphincter is a primary agent in this matter, as it is wholly involuntary, and during micturition, as already noticed, is in a state of dilatation, and only an involuntary spasm of its fibre could make it a means of retention in such a case. The involuntary action of these muscles is well illustrated in cases of Spasmodic stricture.

If then the voluntary & involuntary actions of these muscles, as above expressed, be admitted, there can be no doubt of their being able to act as such powerful restraining forces as to prevent the passage

of wind, when one remembers the anatomy of these parts as already described, and takes into consideration the actions produced by their combined forces.

Here of course only the voluntary action is spoken of, the involuntary having been mentioned merely in proof of the power of resistance possessed by these structures, supposing they were called upon to act. But of course when a voluntary action takes place the involuntary fibres also sooner or later take part in the transaction. Thus the muscular fibres of the prostate, can be influenced only through these of the other structures, but the action soon extends to these involuntary fibres, and thus the whole muscular apparatus becomes involved.

Now, in the next place, it will be well to consider how these structures act, & under what circumstances they may

be called into action. Back muscle  
as we have seen, bears such a relation-  
ship to the canal of the urethra, that it  
is capable of acting in a manner which  
would tend to narrow its calibre, and  
in the case of their combined action,  
these structures must exert a very consider-  
able force and pressure. That the prostate  
gland is capable of acting in a similar  
manner has also been pointed out.  
Under ordinary circumstances, i.e. cases  
in which the call for micturition is  
immediately responded to by an evacuation  
of the contents of the bladder, these  
structures have probab but little to do  
with the process of micturition, unless  
indeed as aids to expulsion, but in cases  
where the contents of the organ have to be  
retained a considerable time must  
they not be sooner or later called into  
action?

Let us then consider what takes place when from any cause there is a necessity for the retention of urine.

The passage of urine as we have seen is brought about through the influence of a certain reflex act, which brings into play the muscular fibres involved. These fibres cause a dilatation of the neck of the bladder, and a contraction of its distended muscular walls, and these actions take place for a fixed and definite purpose - the emptying of the bladder. Whenever the bladder becomes sufficiently dilated with urine, this process of relaxation of parts about the neck, and contraction of the muscular walls, upon the fluid contents of the Viscus occurs, and this part of the process of Micturition as it is observed, is a wholly involuntary one. What happens then in cases where this involuntary action has taken

place, and the individual as often happens, has no opportunity afforded him of emptying his bladder? and here two things must be borne in mind.

(1) That the amount of urine instead of being diminished, is slowly increasing beyond the point at which nature comes into play to effect its expulsion, slowly increasing, & more slowly than when the bladder is empty or nearly so, as urine is secreted less freely when the bladder begins to become distended than when empty.

(2) That this being so, nature must still be making attempts to empty the bladder i.e. the physiological actions for bringing about the evacuation of the urine must still be going on. (It is fair to suppose that nature must make attempt to promote the emptying of the bladder, up to the point when from distension the walls become paralysed)



How then under such circumstances is the flow of urine arrested? Some say, and it is perhaps pretty generally believed, that the action of the sphincter vesicae is the restraining force. But the sphincter is involuntary. Were it known in its passive state of contraction it certainly would be a restraining force, and an obstacle to the passage of urine. It must however when the walls of the bladder become distended to a certain point, have become dilated, this dilatation being brought about by a reflex act in obedience to a law of nature, and now to ensure that it is kept dilated these forces come into play; the pressure of the urine in the bladder directed against the neck, and the contraction of its muscular walls, and hence it be remembered that the longitudinal fibres from the way they pass into the sphincter, must when they contract

on the contents of the bladder, not only act as  
repulsive agents by compression, but must  
also act by traction upon the sphincteric  
fibres, and so assist by drawing upon  
the sphincter in making patent the  
opening of exit from the bladder.

When just at this stage, i.e. when the Mus-  
cular walls of the bladder are contract-  
ing on its contents, the Sphincter having  
become dilated, it is evident that if  
the passage of urine is prevented, it must  
be by some external, voluntary means.  
If the physiological process consists in the  
dilatation of the sphincter, and contraction  
of the muscular walls. When the accumu-  
lation of urine reaches a certain point,  
and if the sphincter cannot be at will  
contracted when this point has been reach-  
ed, and if by a voluntary act, the  
contents of the bladder are retained,  
it is evident that some other force

is brought into action.

Such a competent force is to be found by the actions exerted by the perineal muscles, which, by their combined action, bring pressure to bear upon the neck of the bladder, prostate gland, Utricle, and cause thereby an obstruction to the passage of urine. After these muscles come into play, it is quite conceivable that the contraction of the muscular fibres about the neck may extend to the sphincter, and that then a spasmodic contraction of its fibres takes place. This may be so, but it is here attempted to point out what an important part the perineal structures may be called upon to play, when from any cause a voluntary retention of urine is rendered necessary.

Now to follow this subject out a step further. In such a case as has been above exemplified, where an individual

is compelled to refrain from passing water for a considerable time, and has had to call into action all the powers at his command to prevent its escape, if an opportunity of relief is at last afforded, it sometimes happens that the individual finds himself incapable of passing a single drop, no matter how much he may feel inclined to do so, or how much he may strain to relieve himself. How can this be? It is stated that in such cases it is in consequence of the tight contraction of the Sphincter at the neck of the bladder that the urine is retained. Well! from what has been already said, it may be concluded that the Sphincter is perhaps not the main obstructive force.

But it may be argued in such a case, that all the voluntary muscles are of course relaxed, the individual being

anxious to relieve himself, and yet no relief comes, the retention must therefore be due to the action of the involuntary fibres of the sphincter.

This objection must however be met, by recalling to mind the fact, that the whole of the voluntary muscles have been in a state of the utmost tonic contraction for a very considerable time, and that such a contraction has a tendency when prolonged to produce muscular spasm. Is it not therefore probable that in such cases, a spasm of these muscles takes place, which prevents the escape of urine - Here it is well to remember the many involuntary fibres also involved, and the action of the prostate in the male, as well as the fibres extending to it from the levator ani, & those of the pubic urethral muscle. But to bring the test of treatment as

additional proof on this point. A Surgeon if called to such a case of retention of ~~urine~~ of urine does not, if he has experienced in such matters, immediately attempt the passage of an instrument, or if so, he expects to find considerable resistance in the membranous or muscular, & prostatic portions of the canal, having overcome which however, his instrument slips into the bladder without hindrance from the sphincter. But in most cases as is well known, the Surgeon has first recourse to antispasmodic remedies, hot fomentations, hot hip baths, Opium &c. which remedies have often the desired effect.

There is however a certain class of cases, double but rarely met with, but never the less exemplifying the action of the Structures at present under consideration, namely, cases of overflow of the bladder

i.e. overflow apart from organic disease.  
It occasionally happens, that from long retention, although an individual is incapable of passing water, there is a certain amount of overflow, and on examination reveals the fact that the bladder is much distended with urine.

When this distention becomes exaggerated, the muscular walls of the bladder become paralysed, they no longer contract on its contents, but the whole muscular fibres must then be in a state of the utmost tension. This tension can act only on one point, viz. the outlet, as the longitudinal fibres pass into the sphincter and urethra. Now, before there can be overflow, it is evident that the longitudinal fibres and the urine together must overcome the opposing structures.

The more distended the bladder becomes the more stretched the fibres become.

and in consequence, they must pull upon the points of their insertion, & by this means the parts about the neck must become gradually stretched, & widened. When the internal pressure is sufficient to overcome the opposing structures, and these yield to the smallest extent, then a slight overflow is permitted, and in such cases this takes place over & over again, and first the sphincter gives way, & then the perineal & uterine structures. Here then, the action of these latter structures as important impediments to the passage of urine is well exemplified. In this case the method of procedure closely resembles what takes place in the gradual dilatation of the os uteri, when the longitudinal fibres have doubtless a great influence in overcoming the circular fibres about the neck.