IV. HISTOTOPOGRAPHICAL DESCRIPTION OF THE TRIGONE AND OF THE VESICAL NECK

We consider as vesical neck, the supramontanal urethra, the anterior portion of the trigone, the internal orifice and the vesical mucosa contiguous to it.

It is well known that the trigone and the portion near the vesico-urethral orifice, is the only region of the bladder where the mucosa is closely adherent to the underlying planes; on account of this it is not possible for folds to form, as it happens in the rest of the vesical mucosa. It is due to the fact that there is no submucosa and that the chorion of the trigonal mucosa and surrounding portion of the vesico-urethral orifice, allows the insertion of some extremely fine muscular fibres in great majority running in a longitudinal direction and some in a transversal direction.

a) LONGITUDINAL FIBRES: THE SUPERFICIAL TRIGONAL MUSCLE

In the diagram of figure 77 the trigonal muscle (12) appears represented by a compound of fibres that insert into the chorion of the trigonal mucosa. When they arrive at the vertex of the trigone, following a descending path, they end in the superior pole of the verumontanum. In describing the sagittal series we have defined in detail what we intend by superficial muscle and muscularis mucosae. For the moment we shall limit ourselves to relate some important points that it is well to elucidate.

Examining sagittal cuts which pass through the centre of the trigone, it can be ascertained that the fibres of the superficial trigonal muscle in the part contiguous to the interureteral ridge hardly exist; but as we approach the internal orifice by degrees they grow thicker, owing to the input of new fibres, some originating in the chorion of the trigonal mucosa, and others issuing from underlying bundles and running in a transversal direction, but having the same significance; they are small bundles that originate in the derma of the vesical mucosa contiguous to the trigone. All these elements can be considered, we believe, as a

muscularis mucosae. We have the impression that this rudimentary muscular compound terminates inserting into the mucosa of the internal orifice and into the mucosa of the posterior wall of the vesical neck. We believe it has the task of keeping both the trigonal mucosa and the internal orifice firm, preventing the formation of folds that could be an obstacle to urination. It is possible and even probable, that the appearance, either congenital or acquired, of a permanent fold in the mucosa of the internal orifice, or in both its urethral and trigonal sides, is sufficient to give origin to one of the varieties of the disease called of the vesical neck. It must be kept in mind that this is a strategical area, inasmuch as small alterations are sufficient to provoke dysectasiae.

It must be very clearly pointed out that the very fine fibres which form the superficial trigonal muscle, do not intervene in the formation of the important group of the vesico-cervical fibres placed in the posterior wall of the supramontanal urethra; they are constant in all individuals and always well developed. This posterior vesico-cervical group originates, we have seen, principally in the plexiform tunica and also in the trigonal loop. When we study the musculature of the posterior urethra, we shall have occasion to relate in detail the disposition of these elements.

b) TRIGONAL FIBRES RUNNING IN A TRANSVERSAL DIRECTION

The disposition of transversal trigonal fibres is extremely complex, as we have seen describing the different series. In reality we already know almost all its component elements; although we are repeating ourselves, we shall give a description of the whole that will be of help for a better understanding.

If we examine the sagittal cut of figure 81 pertaining to an infant of a few years, it can be ascertained that the compound of fibres of the trigone cut transversally, extend from the interureteral ridge to the vertex of the trigone (1), forming a slightly oblique plane, and from there continue without limits of any sort, with another analogous system of fibres cut transversally, which extends from the vertex of the trigone as far as a few millimeters above the superior pole of the verumontanum. That is to say, both these portions, the trigonal (1) and the urethral (1') conjoin in the vertex of the trigone: the former follows an almost vertical direction; the latter, a vertical or slightly oblique one downwards and backwards, forming together, in the adult, a right, or almost, right angle that can become acute in old age while it is extremely obtuse

at birth and during infancy, as seen in this figure. This compound of fibres which appear cut transversally, have as a characteristic their fineness and the fact of being closely conjoined by a junction of an elastic connective nature. This great compound must be thoroughly analyzed, as it is one of the most difficult structures of the urogenital musculature. In this systematic and analytic study we will begin by describing the trigonal branch and later we will describe the urethral branch.

The trigonal portion. We must distinguish two elements in it: first, ureteral and peri-ureteral fibres; and second, fibres of the trigonal loop.

1) URETERAL AND PERI-URETERAL FIBRES. In the study of these formations we must distinguish: the bundles that pertain to the ureteral musculature properly called, and the ones that belong to the peri-ureteral muscular sheath. When we described the different series we were able to confirm that the intrinsic musculature of the ureter in its terminal portion, is exclusively formed by extremely fine longitudinal fibres that accompany it until they reach the ureteral orifice. Upon arriving there, a part of its fibres in the form of delicate small tendons insert into the chorion of the vesical mucosa, in a point in which this continues with the mucosa of the ureter, so that the fixation of the ureter to the mucosa is the result. Another part of the ureteral fibres follow a horizontal path reaching the middle line, where they mingle with the ones of the opposite side and form a smooth bundle, perfectly homogeneous, that constitutes the hindmost and superficial part of the trigone known with the name of interureteral ridge, and also by the name of torus uretericus.

The peri-ureteral or extrinsic fibres correspond to what we call the peri-ureteral muscular sheath. This muscular sheath has been very well described by dissection, as we have seen, by UHLENHUTH; he gave it the name of vesico-ureteral fibres because they all issue or set out from the detrusor of which they are dependent. WOODBURNE is of the same opinion. He admits a group of ascending fibres that issue from the external tunica of the detrusor and end above, inserting in the dense connective atmosphere that surrounds the ureter in its juxtavesical portion; and a deep group that comes from the circular tunica of the detrusor and penetrates into the trigone of which it forms the posterior half. It is important to stress that the bundles of the peri-ureteral muscular sheath are dependent of the detrusor. What these authors have described and we have been able to confirm, is commonly accepted; however the possibility cannot be discarded that the plexiform tunica may sometimes intervene in the constitution of this sheath.

As a demonstration of what we have now stated, we present th cut of a series sectioned obliquely from above down and from back t front (Fig. 101), in which the formation of the interureteral ridge clearly appears, in what refers to the peri-ureteral muscular sheath. In

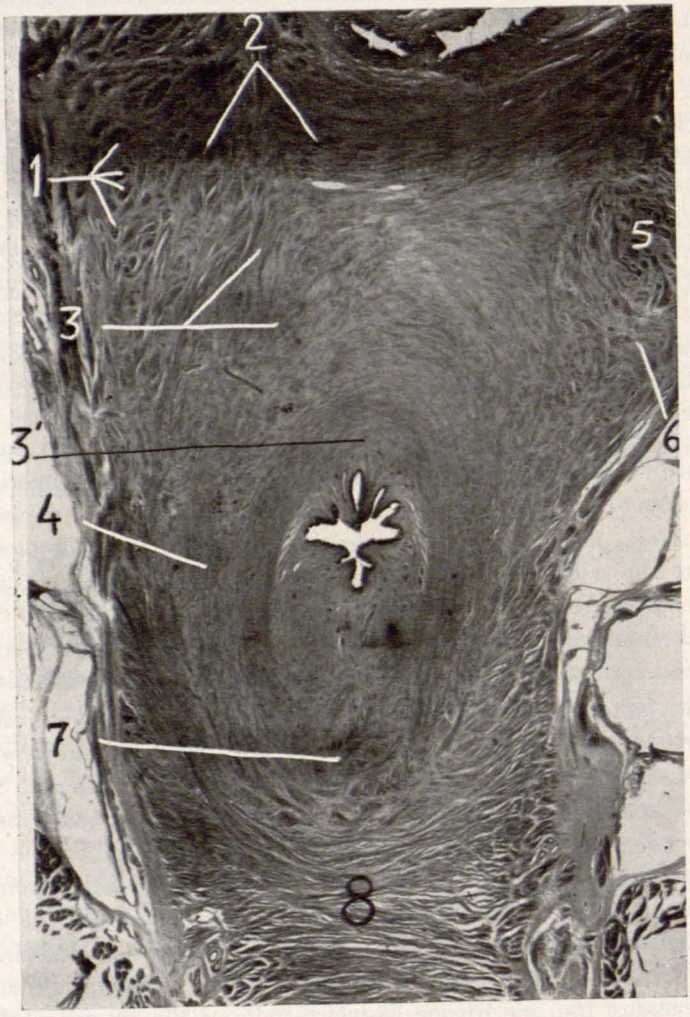

FIG. 101.

the point signed with number 2, two muscular streams, both depending on the detrusor muscle: one going forward, formed by relatively thick bundles cut obliquely, corresponds to the loop of the detrusor in its

point of origin; the other, a muscular stream formed by very fine bundles, running horizontally inward so as to join with the homologous ones of the opposite side and form the interureteral ridge. This muscular stream we believe is in some way in agreement with the drawing made by UHLENHUTH (Fig. 31); namely, with those small bundles marked with number 5, which issue from the circular tunica of the detrusor and incorporate in the thickness of the trigone so as to form the interureteral ridge. However, as we have said, we cannot discard the possibility that these fibres of the peri-ureteral sheath may issue from the plexiform tunica or the postero-lateral group of the posterior wall of the bladder.

In the series shown cut frontally, which involves the interureteral ridge (Figs. 54, 55 and 56) the conjunction of the intrinsic fibres of the ureter can be seen in the middle line; and immediately below we observe the conjunction of the peri-ureteral fibres. They describe posterior concave arcs, and occupy approximately the posterior half or one third of the trigonal area, as can be seen in figure 85.

If we follow the course of the peri-ureteral bundles in the sagittal cuts from out to inside in the juxtavesical portion and in the outer portion of its intramural path, it is confirmed that they form relatively thick bundles and separated by an atmosphere of connective tissue. But gradually as they approach the point of the ureter's outlet, these fibres undergo a structural change, dividing and subdividing into bundles that gradually become finer and more delicate, joined together by a dense and poor connective tissue that is a characteristic of all the muscular elements which constitute the vesical trigone. We said that the periureteral fibres when they come into the bladder in the side corners of the trigone, divide spreading out and cover the posterior half of the trigonal area. Sometimes small aberrant bundles are noticed; in dissections this gives the impression that they go towards the vertex of the trigone; but it is only an appearance, in reality they are plexiform fibres not depending from the periureteral sheath.

The muscular fibres that constitute the periureteral sheath are always evident, they never present a changeable development according to the individual. Their development is in proportion with the rest of the vesical musculature; it is natural for it to be so, because this formation is nothing more than a part of the detrusor muscle. Therefore when there is hypertrophy of the detrusor, there is also hypertrophy of the peri-ureteral muscular sheath. However we must stress that this hypertrophy does not mean in any way that these fibres intervene in opening the vesical neck; but only that it is an expression of an act of defence to

protect the ureter from the repeated contractions, at times violent in the cases of dysuria.

2) TRIGONAL LOOP. These fibres have already been described; however on account of their complexity we shall deal with them again in order to complete the study of them. Underneath the tunica of the longitudinal fibres of the submucosa which constitute the superficial trigonal

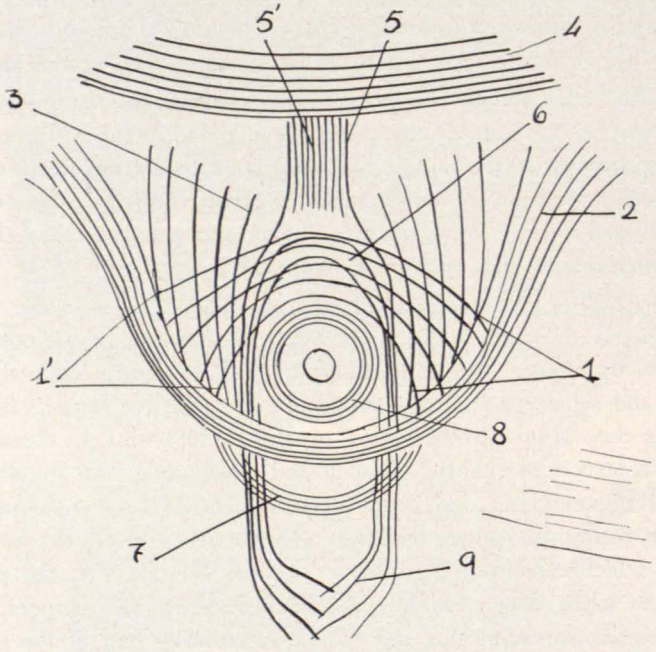

FIG. 102. - Pattern of the sphincterial system disposed around the vesical neck. 1 and 1') Fibres of the trigonal loop that conjoin the lateral portions of the loop of the detrusor; 2) superficial portion of the loop of the detrusor; 3) deep portion of the loop of the detrusor; 4) interureteral ridge; 5) vesico-prostato-urethral fibres; 5') small posterior longitudinal fascia; 6) subsphincterial arc; 7) terminal portion of the deep loops of the detrusor; 8) intermedial sphincter; 9) termination of the subsphincterial arc and of the vesico-prostato-urethral fibres.

muscle, we find a series of bundles running transversally so that they cross at a right angle the fibres of the superficial trigonal muscle situated in the anterior half of the trigone. These fibres are also called transtrigonal. Some authors present them as a compound of fibres that when they arrive at the borders of the trigone, expand at the surface on the adjacent zones of the base of the bladder. Describing the fibres that form the trigonal loop, we have declared that it is one of the most dif-

ficult points of the vesico-urethral musculature, and has not been perfectly made clear yet.

To understand the true significance of the trigonal loop, it is advisable to explain as far as possible its anatomical constitution. In reality four disctinct elements, as we have already seen, intervene in the formation of the trigonal loop: 1st) fibres that are not interrupted and form real arcs disposed in the form of an anterior concave loop, establishing a connection between the lateral portions of the loop of the detrusor;

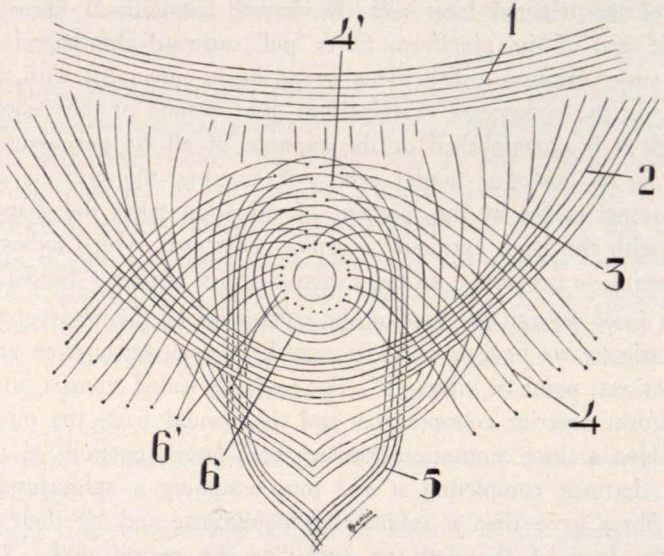

FIG. 103. - Pattern of the disposition of the dilatory fibres of the superior sphincterial system pertaining to the transverse precervical arc. 1) Interureteral ridge. 2) Superficial loop of the detrusor. 3) Deep loops of the detrusor. 4) Trigonal loop. 4') Termination of the trigonal loops in the interfascicular spaces of the sphincterial system. 5) Subsphincterial arc. 6) Internal sphincter. 6') Fibres of the trigonal loop, of the plexiform group, continuing in the vesico-cervical fibres.

they will have the task during the intervals between urinations, of adapting the bundles of the loop of the detrusor, contributing to close the vesico-urethral orifice; these fibres are signed by nr. 1 in figure 102. 2nd) Fibres that occupy the foremost part of the trigonal loop, and upon reaching the vesico-urethral orifice change direction going downwards, and contribute to form the group of the posterior vesico-cervical fibres. These fibres are signed with nr. 5 in figure 84 and nr. 6 in figure 100. 3rd) Fibres, in our opinion the most numerous, which occupy the front half of the trigonal area and do not anastomise with the ones of the

net of the trigone, establishing by means of them a connection with the posterior longitudinal fascia; this dispositions is indicated with nr. 4 in figure 103. 4th) Group of plexiform fibres indicated by nr. 3 in figure 84. If things go as we have described and are represented in the said diagrams, the action of these fibres (except those of the first group), at the moment of urination, would be synergic with the action of the dilative elements of the vesical neck, especially with the robust bundles of the posterior longitudinal fascia. This fascia, when contracting, pulls back the posterior border of the neck. The synergic contraction of the fibres of the trigonal loop and the lateral longitudinal fibres of the detrusor and of the plexiform fibres pull outward the lateral borders of the vesico-urethral orifice. This would be in agreement with what we observe in the endoscopic examination: the opening of the vesical neck, although it is accomplished at the expense of all its perimeter, occurs mainly in its posterior border where it acquires the greatest opening. The internal orifice at the moment of urination takes the shape of an ovoid, with the large extremity running backwards, which indicates that the opening is performed at the expense of its posterior border.

In brief we can say that in the compound of the transversal fibres of the trigone we have to consider two distinct elements from an anatomo-functional point of view: 1st) The properly called transtrigonal fibres which form anterior concave arcs and that would have the purpose of establishing a close connection between both lateral portions of the loop of the detrusor completing it and thus assuming a sphincterial form. These fibres have then a sphincterial significance and by their tonicity close the loop of the detrusor, occluding the vesical neck. 2nd) The component elements of the trigonal loop constitute a formation antagonistic to the loop of the detrusor and the internal sphincter.

From what has been said we infer that the ureteral musculature does not intervene at all in opening the vesical neck. The superficial trigonal muscle as we described it, is independent from the ureteral musculature. The classical conception considers the muscle, named after Bell, as a dependence of the ureteral musculature; this is a mistake that it is now time to rectify. The action that many authors still attribute to the intrinsic ureteral musculature of opening the vesical neck, undoubtedly is illusory. The opening of it is due to the combined action of the powerful elements that we have described. The action of the insignificant small bundles of the superficial trigonal muscle and of the muscularis mucosae in opening the neck is negligible; their task is to avoid that the mucosa could form folds that would render urination difficult.

The urethral portion. We have finished the analysis of the component elements of the trigonal portion of the big trigono-urethral compound, that extends from the interureteral ridge up to the superior pole of the verumontanum and now we shall examine the behaviour of the different constituent elements of the urethral portion. This compound is also characterized as it forms a compact mass of fine small bundles cut transversally and joined by a net of elastic connective tissue closely held together that gives it a massive aspect and so it is impossible to isolate it by dissection. In the urethral portion three elements are to be distinguished: the internal urethro-vesical sphincter; the subsphincterial arc, and the supramontanal arc.

1) THE URETERO-VESICAL INTERNAL SPHINCTER. This small muscular formation in the past has aroused controversy between anatomists, physiologists and clinic doctors. Beginning with its denomination, some call it internal sphincter of the bladder (HENLE, LANGER-TOLDT, LUSCHKA, SAPPEY, etc.); others, among whom WALDEYER, give it the name of sphincter of the urethra; ZUCKERKANDL, vesico-urethral sphincter; KALISCHER, trigonal muscle, and VESSON and YOUNG, internal arched muscle. We accept the name of internal vesico-urethral sphincter, because without impairing its morphological significance, it expresses its topographical situation. Some authors of the past and of modern times deny the sphincter's existence (PILLET, GRIFFITHS, HIS, GUTHRIE and PISANI). BARKOW interprets this sphincter as a fiction, for he considers it exclusively formed of elastic tissue.

There is a considerable number of authors of the present and past times that believe that the internal sphincter is a continuation of the circular tunica of the bladder, and not an independent muscle. According to KOHLRAUSCH, the circular fibres of the vesical musculature concentrate around the vesico-urethral orifice, so as to form a compact mass of circular fibres that surround the said orifice. Of a similar opinion are many authors among whom HYRTL, KRAUSE, TESTUT, PANSECH-STIEDA, and RAUBER etc. HENLE judges that the internal sphincter of the bladder is a part of the prostate and describes it as a circular tunica that surrounds the initial portion of the urethra. The tunica of smooth muscular fibres that fills the angle between the urethra and the bladder is characterized by its particular conformation. It appears in the form of fine minute muscular bundles. LUSCHKA admits a sphincter around the vesico-urethral orifice and that it clearly differentiates from the vesical musculature by the disposition and constitution of its musculature; SAPPEY, JARJAVAY and QUENU are of the same opinion.

VERSARI admits the existence and the denomination of internal sphincter of the bladder. According to him it differs from the musculature of the bladder for the density of its bundles, its lesser size, the scarcity of longitudinal bundles that issue from the detrusor and penetrate into the sphincter and are considered as dilators of the neck of the bladder.

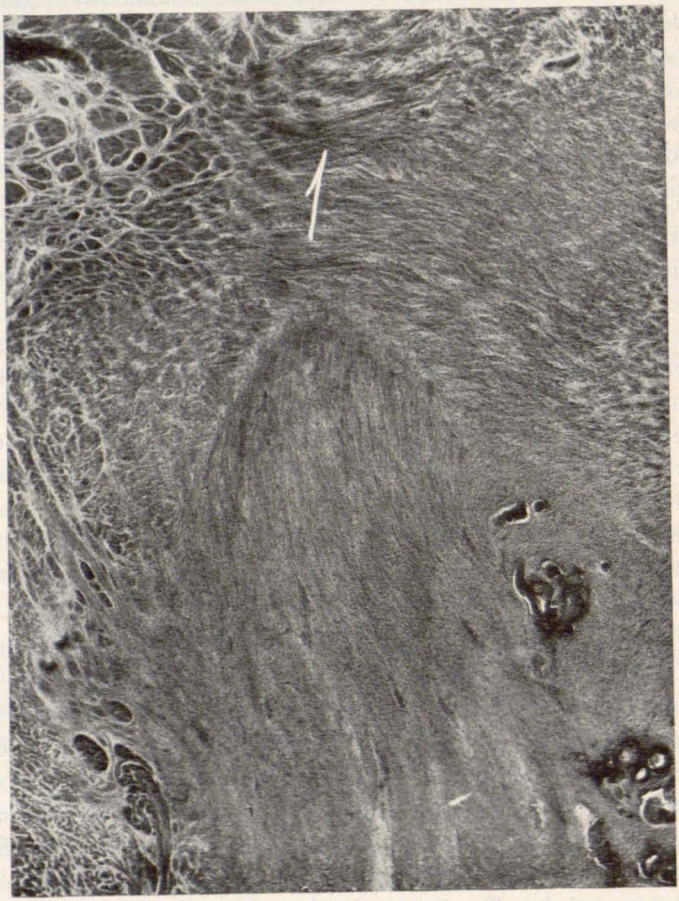

FIG. 104.

KALISCHER admits the existence of the smooth sphincter at the limit of the bladder. The back part, which is the most spacious and most developed, is found in the trigone and in the part near the urethra towards the prostate. The front part, the smallest, is situated exclusively in the anterior wall of the urethra below the thickening of the transversal circular musculature of the bladder; consequently the sphincter does not surround the

urethra horizontally but follows an oblique route from back to front and from up down, its fibres are fine and delicate, very close one to the other, separated by scarce connective tissue, and these qualities represent its homogeneous aspect. Its fine and compact structure contrasts with the musculature of the bladder, that consists of strong bundles isolated one from the other by abundant connective tissue. The same author describes the annulus uretralis vesicae, formed, in front, by the thickening of the circular tunica of the bladder, and in back, by the trigonal sphincteric muscle, coinciding in this with the description given by DISSE. Both authors consider as circular fibres of the bladder what in reality are fibres pertaining to the loop of the detrusor.

So many are the differences that exist between these opinions and they are so disparate from the notion that we have formed of what is known by the name of internal sphincter and of the formations that present analogous structure that we will abstain from commenting upon them. We believe it is more useful and convenient to relate in the most objective way what we have seen and commented.

In the first place the situation of the fibres in the internal sphincter in the posterior segment of the vesical neck is to be remarked: these fibres are situated in the vertex of the trigone, comprising, in addition, a part of the underlying fibres. If we examine the sagittal cut that passes exactly at the middle line, figure 78, the front border of the sphincterial ring (7) is situated in the space limited above by the loop of the detrusor (3), below by the uppermost part of the prostatic portion of the external sphincter (8), in front, by the transverse pre-cervical arc (2), and in back, by the anterior vesico-cervical fibres. In this space of a rectangular shape (7) occupied by fibres cut transversally we must remark that not all of them belong to the urethro-vesical sphincter. Only a part of it, the most internal and uppermost portion, is the one that belongs to the sphincter proper to which the fibres that proceed from the posterior neck (7') go and surround the side parts of the vesical neck forming a real muscular ring around it with an oblique direction from above down and from back forward; below the internal sphincter the other smooth fibres belong to the deep loop of the detrusor (3'). We must observe that the internal urethro-vesical sphincter occupies only a part of the neck, and this equally occurs in the posterior portion as well as in the anterior and the lateral ones. In fact, in the anterior segment, on top of the sphincter there is the loop of the detrusor proper (3) and below we find the deep loops of the detrusor (3') in the mixed loops of the external sphincter (8). In the posterior segment below the sphincter, there is the subsphincterial arc and

lower still the supramontanal arc. In the lateral portions, that is to say, the intermediate space between the anterior and posterior segments there is below the sphincter a space devoid of sphincterial fibres, the glandular acini of which are in immediate contact with the vesico-cervical fibres and with the vesico-prostato-urethral fibres .

Examining complete series cut sagittally, it can be confirmed that as we gradually go away from the middle line, the anterior and posterior portions of the sphincter tend to come nearer to each other until they

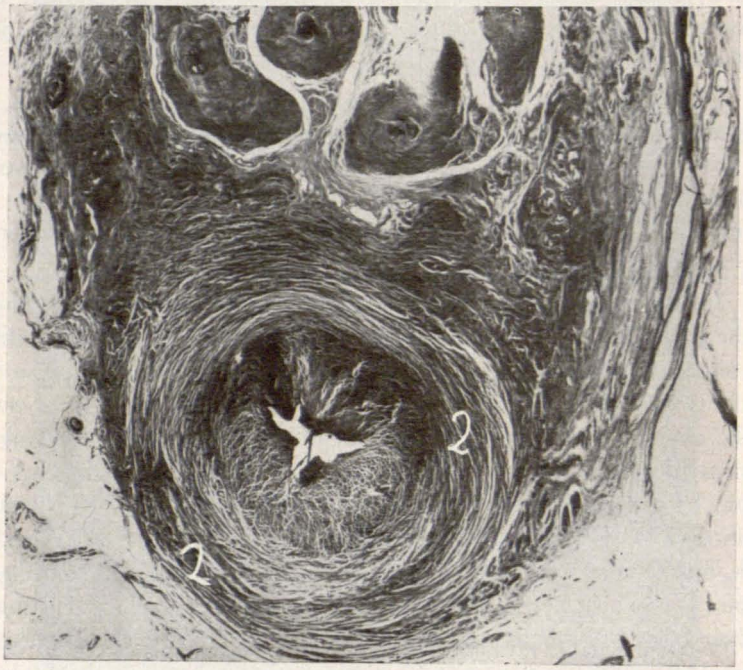

FIG. 105.

join, as can be seen in figure 101 in which we can clearly see the lateral portion of the internal sphincter (1). This portion follows a slightly oblique direction from up down and from back forward, and only occupies a portion of the vesical neck or supramontanal urethra. The description that we have now given of the internal sphincter muscle is a repetition of the one we made in 1953. During these years publications have appeared of several authors who insist on denying the existence of the mentioned anatomical formation, without giving however objective proofs. They compel us to present new demonstrative proofs in the hope of convincing these authors that the internal sphincter is a reality.

We could present hundreds of cases analogous to the ones we are going to relate.

Figure 105 refers to a patient affected by genital tuberculosis which shows vesicules in the phase of sclerosis and cure. The cut is slightly oblique downward and forward; in the center the vesical neck is seen and around it the system of vesico-cervical fibres (1) that are cut trans-

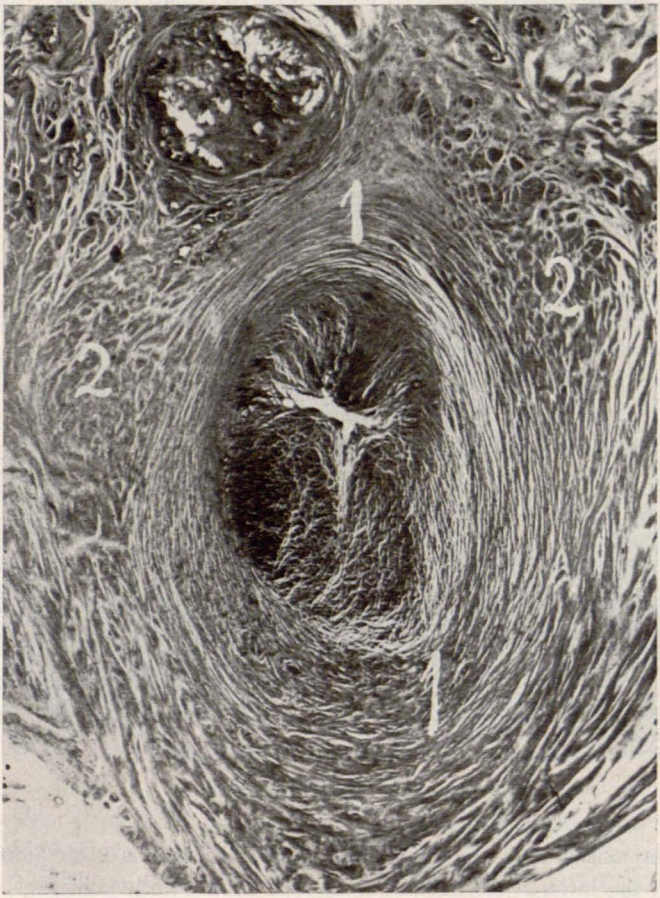

FIG. 106.

versally; outside, the internal sphincter (2) can be seen in such a way that there is no place for doubt.

Figure 106 is a piece obtained at necropsy cut in the same direction as the previous one, and this is a good way to clearly show the internal sphincter. In the center the lumen of the vesical neck is seen and outside

are seen the vesico-cervical fibres; and outside of these the internal sphincter is visible (1). Further outward in the lateral parts, the sphincter is in relation with the deep loop of the detrusor (2).

Figure 107 is a pathological piece that comprises the central part of the neck and is cut in an almost horizontal direction. At this level the internal sphincter (6) is about to disappear. This is a pathological piece that shows the onset of prostatic hypertrophy in the form of a histiocytic infiltration (1a), and some fibromyoma situated inside the internal sphincter (3).

Figure 108 is an operation piece that comprises the pathologic intrasphincterial medial lobule and two lateral lobules developed at the expense of subsphincterial lobules of the cranial gland. The internal sphincter clearly appears wrapping the pathologic medial lobule.

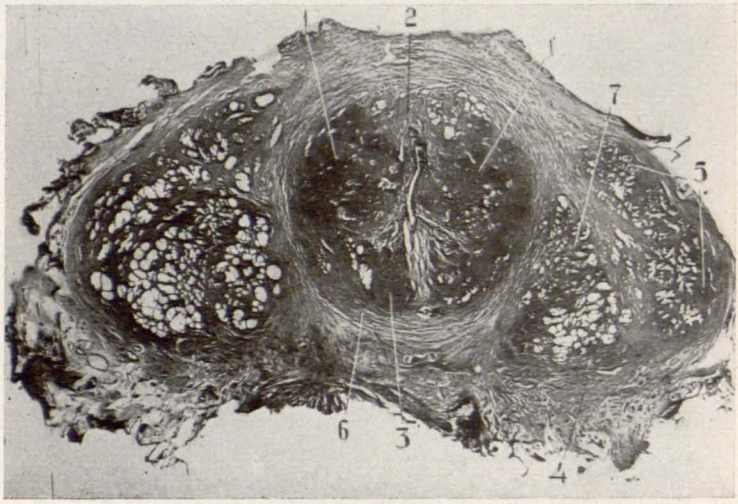

FIG. 107.

The existence of the internal sphincter, which is situated immediately beneath the internal orifice, can always be anatomically confirmed in man. It is limited in front by the loop of the detrusor, and in back by the trigonal loop, forming between both a kind of sphincter; this disposition also exists in woman. But in woman the vesical neck is shorter than in man; in woman it has not been possible to find a real annular formation worthy of the name of internal sphincter of the vesical neck like it is constantly seen in man. What we have confirmed in woman is the existence, a little underneath the internal orifice, of a striated sphincter that forms

a complete ring; this striated sphincter is accompanied in its internal part by a smooth sphincter.

Physiological reasons in favour of the internal sphincter in man. From a physiological viewpoint, it is evident that the existence of the internal sphincter is necessary in order to keep the vesical neck closed during the intervals between urinations, with the collaboration of the elastic tissue of the region, and the muscular circle formed by the trigonal loop and the loop of the detrusor. In man the internal sphincter has also a genital significance: to keep the neck hermetically closed at the moment of the ejaculation, and avoid the reflux of the semen into the bladder.

FIG. 108.

This explains why in man the internal sphincter appears very developed, in contrast with what occurs in woman: in reality it has no real existence nor is physiologically needed.

In reality the internal sphincter corresponds more to the genital apparatus than to the urinary apparatus. At the moment of venereal orgasm the contraction of the smooth musculature of the vesicules and ampullae is produced as also of the intrinsic musculature of the prostatic gland and has the result of evacuating in the prostatic urethra the semen and the prostatic secretion. Afterwards in a second moment, the brusque contraction of the striated sphincter of the membranous urethra is produced

to expel the semen outwards; and it is precisely in this moment that in a reflexed way the spasmodic contraction of the internal sphincter is produced so as to avoid the vesical reflux of the semen. This spasmodic contraction persists for a certain time after the ejaculation, during which, urination is impossible. This is a property of the smooth muscles, that do not contract nor inhibit in a brusque manner like the striated muscles, but they need a few moments for what begins or what stops. What we have said is in agreement with the structure of the internal sphincter, that does not resemble at all the bundles of the loop of the detrusor.

But the evident genital action that the internal sphincter performs, does not exclude it from intervening in the phenomenon of urination. In reality it is a smooth urogenital sphincter, in an analogous way, like the striated external sphincter of the membranous urethra is, known by the name of urogenital sphincter.

Surgical reasons that prove the existence of the internal sphincter. In favourable cases, when performing the ablation of the adenoma, this appears constituted by two lateral lobules and a medial lobule, a piece is obtained as shown in figure 104, in which the internal sphincter appears in a very evident way wrapping the pathologic medial lobule. In these cases, in the post-operative period, the reflux of the semen in the vesical cavity is always observed. When there is only the pathologic medial lobule that bulges in the vesical cavity, this lobule at times can be extirpated without damaging the internal sphincter muscle; in these cases a reflux of the semen in the post-operative period does not happen.

For all that we have reported, we believe that the internal sphincter belongs to the prostate and has to be considered as a circular ring that surrounds the initial portion of the prostatic urethra. This explains the close connection of the internal sphincter with the cranial gland.

2) THE SUBSPHINCTERIAL ARC. Continuing the analysis of the constituent elements of the urethral portion, we are now going to describe the route, termination and connections of the group of fibres that appear cut transversally, and are situated immediately below the fibres of the internal vesico-urethral sphincter.

To have an idea of the behaviour of these fibres, it is necessary to pursue the study of frontal and elliptical cuts. In these cuts, figure 109, can be observed on top (5) and on the sides of the supramontanal urethral duct, the existence of a muscular formation constituted by fibres that are finer and more compact than those that constitute the internal sphincter proper. These fibres form an antero-inferior concave arc, the central portion

of which comprises the posterior face of the urethra, and its lateral parts run downwards and forward in an almost vertical direction, surrounding the lateral parts of the urethra which are separated by the vesico-cervical fibres (8); outside they are in relation in part with the acini of the sphincterial lobule, and in part, with the corresponding portion of the vesico-prostato-urethral fibres. When the fibres of the subsphincterial arc reach

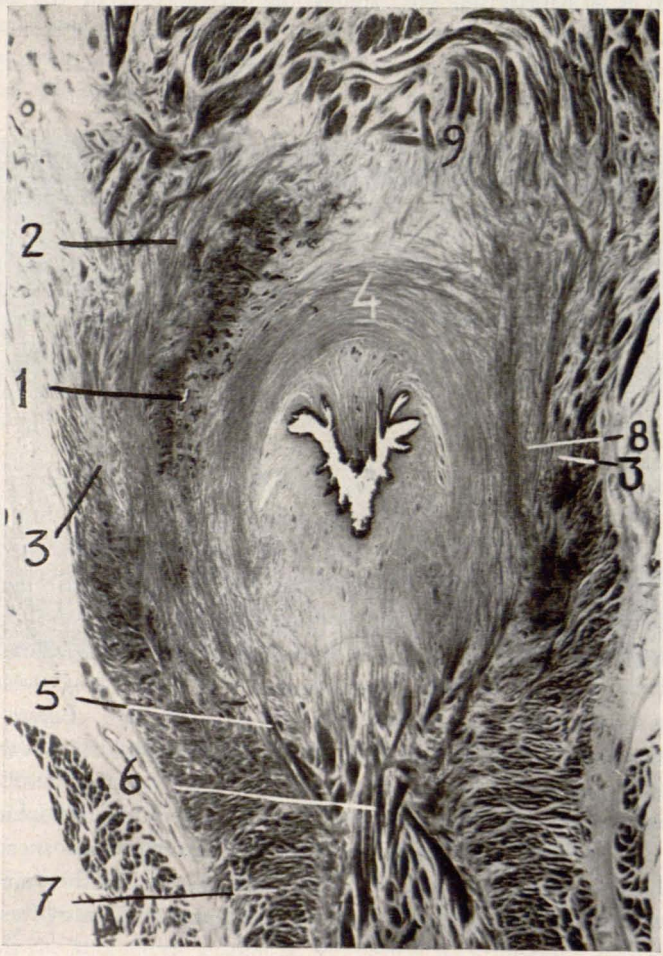

FIG. 109. - Frontal cut. 1) Subsphincterial lobule. 2) External postero-lateral fibres of the bladder. 3) Mixed bundle of the external vesical sphincter. 4) Subsphincterial arc. 5) Vesico-prostato-urethral fibres. 6) Anterior muscular columns of the infra-montanal urethra and of the membranous urethra. 7) External sphincter of the membranous urethra. 8) Deep loops of the detrusor. 9) Middle portion of the small posterior longitudinal fascia.

the antero-lateral part of the urethral duct, in part they anastomose with the ones of the opposite side, and in part, following a longitudinal path, they enlarge the group of the vesico-prostato-urethral fibres. During this descending route, both portions of the subsphincterial arc establish a transversal anastomosis that holds them together. This disposition is schematically illustrated in figure 90.

The sagittal cuts complete what we see in frontal cuts. In fact figure 39 which is a parasagittal cut, shows the lateral part of the internal sphincter (1) and below the extremely fine fibres of the subsphincterial arc are seen in their descending route (2), as they go and join with the group of vesico-prostato-urethral fibres (3).

What is the functional significance of the subsphincterial arc? We have the impression that its upper part, where it forms the arc proper, is closely connected with the compressed connective net, an elastic emanation of the posterior lateral fascia. When this fascia contracts, it pulls back the subsphincterial arc, and in an indirect way would act as the system of vesico-prostato-urethral fibres does, shortening and enlarging the membranous urethra. To this indirect action exercised by the powerful posterior lateral fascia is to be added the direct action of the fibres of the subsphincterial arc.

3) THE SUPRAMONTANAL ARC. With what we have described we could consider to have completed the analysis of the constituent elements of the trigonal-urethral region. But in the lower extremity of the urethral branch there still exist some small tenuous bundles that have rather an elastic connective than a muscular aspect. They are disposed in such a way that from the centre they go to the sides loosing their extremities in the stroma of the medial lobule of the cranial prostate, describing together a very open inferior concave arc that surrounds and in a certain way isolates the secretory ducts of the medial portion of the cranial gland. Figure 110 is a frontal cut that involves the supramontanal arc and shows the said formation constituted by a compound of very fine small bundles (2), that above continue in the corresponding portion of the subsphincterial arc (3) and below are in relation with the fibromuscular sheath that wraps the utricule and the ejaculatory ducts, from which they are found to be separated by the secretory ducts of the medial portion of the cranial gland.

In reality the morphological and functional significance of these minute bundles is not clear to us. From a conjectural standpoint one is led to think that they have the task of isolating the secretory ducts of the cranial gland, and from a morphological point of view they can be consid-

ered as developed at the expense of the mesenchyma of the genital cord, in the point where it joins with the cord of the primary urethra.

Summary. If now just to summarize, we glance over the numerous muscular elements placed in the great trigono-vesical-neck compound, we come to the conclusion that only a very small number of the abovesaid bundles turn completely around the vesical neck: they are the ones that constitute the internal urethro-vesical sphincter. This well specified muscular formation acts in an evident way keeping the vesical neck closed in the intervals between urinations; but its predominant role is a genital one, of producing the hermetic closing of the neck during ejaculations,

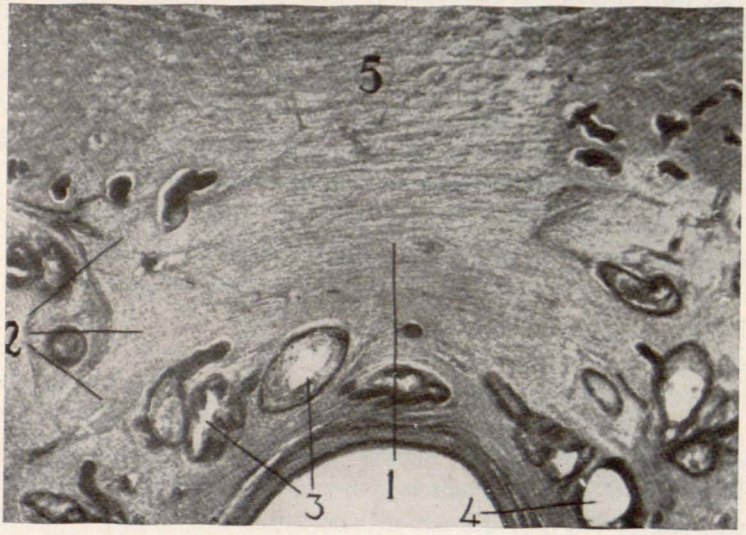

FIG. 110.

and avoiding the reflux of the semen towards the vesical cavity. The loop of the detrusor and the fibres of the trigonal loop with a sphincteric significance, assist the action of the internal sphincter in what has relation with the urinary aspect.

All the other component fibres of the trigono-vesical-neck compound are alien to closing the vesical neck. Almost all of them act antagonistically towards the sphincteric system of the vesical neck, opening it in the act of urination. The dilating action of the trigonal loop must be stressed, as well as that of the anterior and lateral longitudinal fibres of the detrusor, and also of the plexiform fibres, that end in the elastic connective net depending from the powerful posterior longitudinal fascia that surround

the sphincteric elements. Upon contracting synergically the posterior lateral band together with the other bundles mentioned, act in dilating the vesical neck. The muscular bundles depending from the ureteral and peri-ureteral musculature, totally alien to the abovesaid function, must be excluded as active elements in opening the vesical neck. The action of the peri-ureteral muscular sheath is the active protection of the terminal portion of the ureter when the detrusor contracts. The internal sphincter, the subsphincterial arc and the supramontanal arc, namely, the three components of the urethral area of the trigone, belong to the prostatic urethra and are independent up to a certain point from the vesical musculature. They differ for their structure, the aspect of their extremely fine bundles and for their situation in close relation with the cranial gland and for their embryologic development.