We have so frequently found obstructive adhesions associated with the gastro-intestinal symptom complex seen in cholecystitis with or without gall-stones, that it seemed obvious that reflexes from a disturbed innervation to the viscera must take a secondary position in accounting for the symptoms.

Doctor Toland's paper affords suggestive interest for a more extended clinical study.

THE PELVIC FLOOR—CONSIDERATIONS REGARDING ITS ANATOMY AND MECHANICS*

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RÔLE OF THE LIGAMENTS

ALTHOUGH the obliterated and unobliterated vessels, the nerves and their surrounding connective tissue sheaths and also the fascial extensions upon the pelvic viscera, no doubt are important factors in the maintenance of the position of the pelvic organs, it would seem that the rôle played by the broad, and especially that played by the sacro-uterine and round ligaments in pelvic support, has been greatly overestimated. Schroeder,[16] 1922, emphasized this in connection with the question of malposition and prolapse. He regarded these ligaments as only of secondary importance, and the muscles, vagina wall and connective tissue as the real supports of the uterus. According to him the round ligaments are relaxed even in a retrodisplaced uterus.

It may be that the favorable results reported after shortening of the sacro-uterine or the broad ligaments may have been due in a considerable measure to the resulting adhesions and to the contractile effect of the scar tissue formed at the site of operation. Tschaussow,[17] 1887, also concluded that the uterosacral ligaments have only a negative influence. He added that muscle fibers are not always present in these "peritoneal folds" of children and that they are wholly insignificant in them as in the case of adults.

The sacro-uterine ligaments are really not such. This was implied by Somers and Blaisdell,[18] 1913, and by Blaisdell,[19] 1917, who spoke of them as "potential ligaments," and Dixon[6] quite correctly said that our attention frequently is directed "to strands of connective tissue often described as ligaments." It is clear that potential ligaments exist wherever there is considerable subserous tissue, but they have no existence in fact and they surely cannot be operated upon. Nor must it be forgotten that prolonged traction upon subserous tissues or the peritoneum may result in local thickening anywhere. The variously directed connective tissue fibers will assume a more parallel direction under these conditions. This is illustrated by the statement of Cuthbertson that "not infrequently the uterosacrals are so thin that they can be discovered only by making traction on the cervix."

Although the sacro-uterine plicae of peritoneum also contains smooth muscle they nevertheless are very inconstant both as to prominence and extent. They do not always reach the sacrum and never are attached to it firmly. Hence, even when they do reach the sacrum the terms rectogenital and recto-uterine would seem to be preferable.

Although these peritoneal folds are rather inconstant I cannot regard them as altogether unimportant, and if operations performed upon them or the included connective tissue and muscle, have resulted so favorably this is excellent proof of the fact that the peritoneum is not a negligible factor in pelvic support. Their direction is rather unfavorable for checking the descent of the uterus and vagina, and it would seem that they undoubtedly have been made too much of. The smooth muscle within them has even been named retractoruteri, much as we speak of a suspensory muscle of the duodenum, and these muscular fasciculi have even been regarded as tensors of the anterior vaginal wall and of the vesicovaginal fascia and Smyly,[20] 1919, regarded them as dilators of the fornices, causing ballooning of the vagina, said to be present in threatened abortion. The recto-uterine ligaments have been represented as fully a centimeter wide and one-half that thick in illustrations accompanying articles on operations for the correction of uterine displacements and in other literature in connection with this subject.

The pubovesical ligaments and the tendinous arches of the pelvic fascia firmly anchor the bladder, but it would seem that considerable displacement of it and of the urethra can occur by rotation about the lower border of the pubic symphysis as an axis, without much stretching of these ligaments. Hence they do not seem to be of such great importance in the beginning of prolapse, and I doubt whether general pelvic prolapse is initiated by lesions in the urogenital diaphragm alone, for injury to the pelvic diaphragm and fascia would seem to be a *sine qua non* for much yielding of the urogenital diaphragm. Nothing could better illustrate this than the drawing of a sagittal section of the pelvis of a multipara shown in figure 4. Although the bladder is markedly lowered in position, dislocation of it is not nearly so marked as in the case of the uterus, ovaries, and rectum. In this case the uterus, and especially the round and broad ligaments and, of course, the contained vessels and nerves were greatly stretched. The same thing was true of the pudic vessels and nerves, and had it not been for the firm resistance of the urogenital diaphragm and the pubovesical ligaments the bladder undoubtedly would have been displaced much more.

Muscles unsupported by other structures do not bear the strain of constant tension well. They are likely to yield under it. This applies particularly to the pubo- and iliococcygei, which are thin muscles and which play a rôle phylogenetically foreign to them, representing flexors and abductors of the tail. Since Williams[21] stated that the levator ani may be half a centimeter thick he probably had living hypertrophied muscles in mind, for I have never seen a muscle even in

* This is the second of two papers on this subject, the first paper being printed in this journal in last month's issue.

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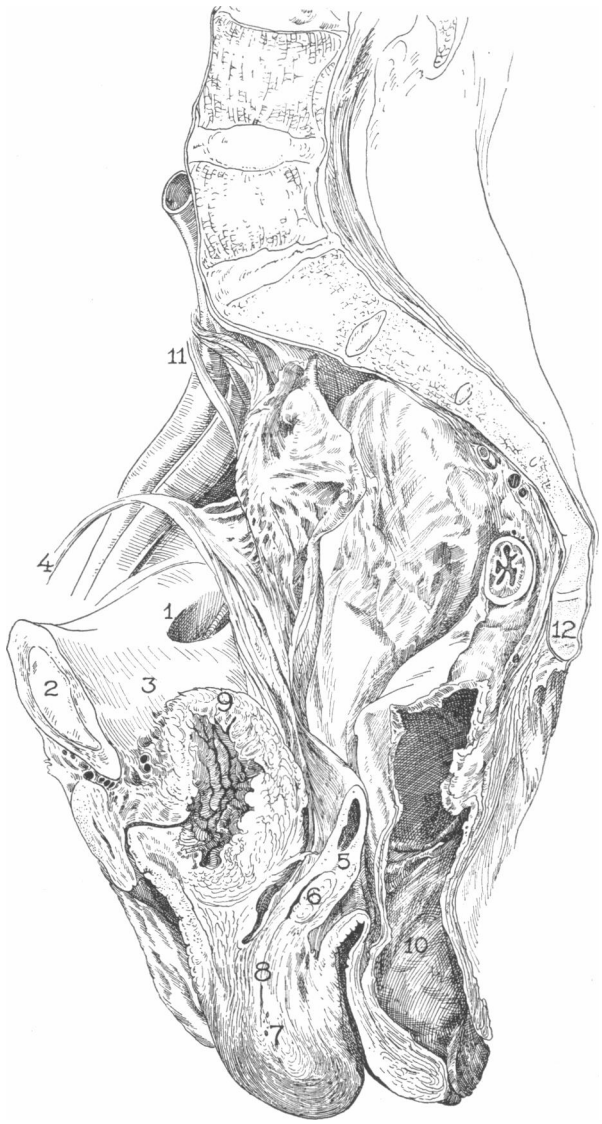

Fig. 4—Drawing of a sagittal section of a partially dissected female pelvis with marked prolapse of the uterus and displacement of bladder and rectum: (1) Obturator foramen. (2) Symphysis pubis. (3) Levator ani. (4) Round ligament. (5) Cavity of uterus. (6) Fibroid. (7) Cervix uteri. (8) Cervical canal. (9) Urinary bladder. (10) Rectum. (11) Ureter and ovarium vessels. (12) Coccyx.

muscular young male cadavers, more than very roughly approximating such a thickness. I realize fully that most of the subjects I have seen belong to later decades, but we have also had a small number from the third decade, and I surmise that such statements as well as others in which the perineal body is represented as five centimeters long, find their explanation in impressions obtained from torn, contused, swollen and perhaps hypertrophied, tissues seen after labor.

Although the superior fascia of the urogenital and especially that of the pelvic diaphragm, varies considerably in strength in its different portions and also in different individuals, it nevertheless is this fascia and the various reinforcements of it, such as the pubovesical ligaments and the lower tendinous arch which must bear the main burden of constant pressure exerted upon the pelvic organs. Did they not do so it would seem that the musculature easily would become elongated and undergo atrophy. Whenever the musculature is poorly developed or partly deficient, which is not uncommon, pelvic support necessarily devolves upon the fascia. Were the latter not able to assume this burden the pelvic floor of both sexes would yield far more commonly than it actually does.

A strong musculature may be accompanied by a strong fascia and a weak musculature by a weak one, but opposite conditions also are met with. Not infrequently the obturator portion of the pelvic fascia is surprisingly thin in otherwise very well-developed bodies and a strong thick pelvic fascia may accompany a really thin muscle.

Although I have not specially mentioned them, the inferior fasciae of these diaphragms no doubt are not negligible although far less important than the superior, except perhaps in case of the inferior fascia of the urogenital diaphragm. These fasciae are aided in their protective rôle toward the musculature of these diaphragms by the peritoneum and the subserous connective tissue and in a minor way by the ureters and the obliterated hypogastric arteries. The latter frequently lie in broad, thick folds of peritoneum which descend into the pelvis and which arch across the upper portion of its lateral walls. All these structures, however, play merely an auxiliary rôle as do the perineal and great gluteal muscles which support especially the coccygei. That their rôle is auxiliary is shown also by the fact that obturator, perineal and ischiadic herniae are not prevented by the mere presence of normally developed muscles in these regions. If the peritoneum and fascia yield the muscles no longer seem sufficient.

That the peritoneal folds or so-called ligaments, and the peritoneum elsewhere, and also the subserous connective tissues, yield easily to continued pressure is illustrated unusually well by the history of uterine suspensions and by the amazing shifting of the duodenum, stomach, and liver rarely met with. In rare cases of rotation of the liver, even to 90 degrees (Meyer,[22] 1924), following depression of the right dome of the diaphragm in cases of thoracic effusion or chronic tuberculous fibrosis, the pylorus may lie in a line to the left of the cardia, the upper portions of the duodenum having been pushed across the midline, the gall bladder lying directly above the displaced pylorus. As Keith,[23] 1924, put it: "The living peritoneum is the most ductile of structures."

However, if, as recorded in the literature, prolapse of the pelvic viscera is not an invariable consequence of deep injury of the female perineum, it is clear that other structures than the inferior fasciae and the muscles of the pelvic diaphragm must in these cases temporarily support the pelvic viscera. This should not seem surprising if the normal position of the uterus and the great strength of the pubovesical ligaments and that of the superior pelvic fascia is borne in mind. Injury of the fibers of the pubococcygei permits a separation of their medial borders through retraction. Injury to the iliococcygei has

a still more disastrous effect because they run more transversely. Contraction of the iliococcygei raises the pelvic floor, but causes tension laterally at the midline, thus permitting displacement of the medial portions after injury there.

Anyone especially interested in the rôle of the smaller bundles of the pelvic and perineal musculature will find a good discussion and representation of them in Kalischer,[24] 1900.

RÔLE OF FAT

Although increase in the quantity of extraperitoneal fat results in an increase in abdominal pressure, I am inclined to think that in spite of the increase in volume and consequent pressure, fat nevertheless can act as a fairly effective stopgap. This is suggested by the crowding of the pelvic viscera which often accompanies adiposity and by the fact that small lipomata frequently securely block the entrances of the obturator, the

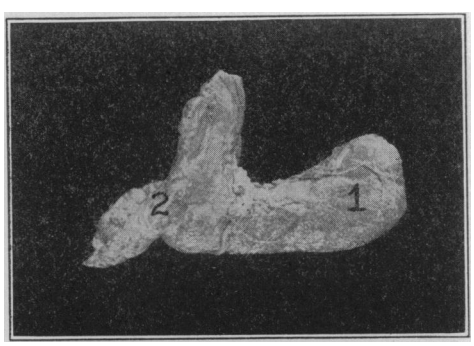

Fig. 5—Photograph of an obturator lipoma (1) with a small portion of the wall of the urinary bladder (2) attached. Natural size.

abdominal inguinal and femoral rings. When, as not infrequently is the case in the female, the amount of intrapelvic fat is so considerable that it hedges in all the pelvic viscera, it must be of considerable moment in supporting them as well as in greatly restricting their mobility, for it firmly binds them together.

It seems highly probable to me that the fat in the base of the ischiorectal fossa is by no means a negligible factor in pelvic support in both sexes. Were it not for this accumulation and for the subcutaneous fat surrounding the superficial anal sphincter, which is continuous with that in the ischiorectal fossa, it would seem that the weak pelvic fascia, often present in cases of poorly developed pubo- and iliococcygei, should more frequently yield to the normal intra-abdominal pressure. All this fat is bound together very firmly by coarse interlacing connective tissue septa, and united to the subcutaneous tissues and the deep fascia at the inferior borders of the glutei. Although the fat in the upper portions of the ischiorectal fossa is small in amount and can always be removed easily it nevertheless helps to hedge in the pelvic viscera and gives support to the pelvic floor from the outside.

The fact that the amount of fat contained in the ischiorectal fossa in emaciation or in thin persons, is relatively small in amount does not greatly affect this conclusion. One might just as well hold that lipomata in the obturator or inguinal canals cannot have a preventive effect when present because they usually are absent. I am not assuming an etiological relationship between these things, but am merely maintaining that when present they must strengthen the areas involved. Anyone interested in inguinal lipomata and their relation will find them considered in the articles by Broca,[25] 1888; Imbert,[26] 1897; and Blaisdell,[27] 1913.

I have already referred to Dixon's view regarding the important rôle played by the fasciculi of smooth muscle present in the subserous tissue about the cervix uteri. Dixon[6] further suggests that the support of the uterus is active and not passive and is due to the bundles of smooth muscle fibers described by him. Dixon[6] believes that these fasciculi are under control of the uterus and that contractions in the form of peristaltic waves which pass from it to them play a predominating rôle in uterine support. He further suggested that similar peristaltic waves in the round ligaments keep the uterus anteflexed on the bladder, and Tweedy,[28] 1919, went so far as to insist on the presence of tendons on these fasciculi of smooth muscle. These tendons in spite of Dixon's[6] wise admonition he insisted on calling "uterine tendons" because, according to him, they act as true tendons. Unfortunately for Tweedy[28] no tendons are known to exist on smooth muscle, and it is fairly safe to predict that no one will discover them.

Although living fat must be regarded much as a fluid as far as the transmission of pressure is concerned, it must not be forgotten that fat is composed of lobules each of which is surrounded by connective tissue. It is interesting that Keith,[23] 1924, regards fat as a factor in the formation rather than in the prevention of herniae. However, since fat is firmly attached to the surrounding tissues it should make a better stop-gap than loose areolar and connective tissues containing little or no fat, for it must be much more difficult to displace fat than to stretch them.

It would seem that the small lipomata so frequently found in the inguinal obturator and femoral canals must have formed *in situ* instead of being herniated there by intra-abdominal pressure as suggested by Keith.[23] The same thing undoubtedly is true of similar accumulations outside of foramina and hiatuses in aponeuroses. I find it difficult to accept the interpretation of Gladstone,[29] 1908, and Keith,[23] 1924, for it would seem that small lipomata, such as shown in figure 4, which develop outside the obturator foramina or in the inguinal canals frequently act as an effective stopgap and the former often also firmly anchor the bladder in the regions of the obturator foramina as reported by Meyer,[30] 1924. These lipomata may be attached firmly to the bladder or more indirectly with it through the surrounding connective tissue and fat.

In considering the contradictory results recorded in pelvic and perineal operations for prolapse, it seems to me that they can be largely accounted for by the variable anatomical conditions known to exist in the pelvic floor. More-

over to what extent *restitutio ad integrum* will occur in any particular case no doubt depends upon the age and habitus of the individual and upon the length of time that the various supporting structures have been subjected to abnormal conditions as well as upon the good judgment and surgical skill of the operator.

It is significant and surprising to some, no doubt, that the pelvic floor may and does yield caudally not only in multipara, but also in nullipara and even in the male. This yielding manifests itself in a general though not in an equal descent. Although the pelvic diaphragm mainly is affected, there is a depression of the entire perineal region and especially an enlargement of the anococcygeal interval in these cases. This downward displacement affects particularly the midportion of the levator ani and results from long-sustained, increased abdominal pressure. In elderly nullipara the anococcygeal distance may be 6 to 7 centimeters, and I found it as great as 9 centimeters in the body of a very muscular negro in whom gradual but complete occlusion of the superior mesenteric artery by arteriosclerosis had occurred at a point proximal to the origin of the right and middle colic arteries.

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REFERENCES

6. Dixon, Francis A.: 1919. The special supports of the uterus, Dubl. Jr. Med. Sci., cxlvii.

16. Schroeder, Robert: 1922. Lehrbuch der Gynecologie, Leipzig.

17. Tschaussow, M.: 1887. Über die Lage des uterus, Anat. Anz. Bd. 2.

18. Somers, George B., and Blaisdell, F. E.: 1913. The anatomy and surgical utility of the sacro-uterine ligaments, J. A. M. A., Vol. lxi.

19. Blaisdell, Frank E.: 1917. The anatomy of the sacro-uterine ligaments. Anat. Rec., xii.

20. Smyly, William: 1919. In comments on the special supports of the uterus by Dixon, Dubl. Jr. Med. Sci., Vol. cxlvii.

21. Williams, J. W.: 1903. Obstetrics. New York.

22. Meyer, A. W.: 1924. Uunique transposition of abdominal viscera from hydrothorax, California and West. Med., Vol. xxii.

23. Keith, Sir Arthur: 1924. On the origin and nature of hernia, Brit. J. Surg., xi.

24. Kalischer: 1900. Die Urogenitalmuskulatur des Dammes mit besonderer Berücksichtigung des Harnblasenverschlusses. Berlin.

25. Broca, A.: 1888. Etudes sur les lipomes inguinaux et les hernies inguinales. Paris, 8°.

26. Imbert: 1897. Un cas de lipocele inguinale, Bull. Soc. Anat. de Par., T. 72, p. 364.

27. Blaisdell, Frank E.: 1913. Anatomical observations on the lipoma simulating direct inguinal hernia. Anat. Rec., Vol. vii.

28. Tweedy, Hastings: 1919. Tendons of the uterus and their relation to the lower uterine segment, Dubl. Jr. Med. Sci., 147.

29. Gladstone, R. J.: 1908. Diaphragmatic hernia and fatty herniae of the obturator and femoral canal. Arch. Middlessex Hosp., xii, 3.

30. Meyer, A. W.: 1924. Femoral and obturator anchorage of the human bladder, Proc. Am. Ass. Anat., Anat. Rec., Vol. xxvii, No. 4.

THE AMBULATORY TREATMENT OF PEPTIC ULCER*

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DISCUSSION *by Roy E. Thomas, M.D., Los Angeles; George Dock, M.D., Pasadena; J. Edward Harbinson, M.D., Woodland.*

PEPTIC ulcer can usually be benefited and can sometimes be cured by carefully following a medical program. Very few internists or surgeons consider this disease surgical as soon as diagnosed unless there is definite chronic obstruction, uncontrollable bleeding or the possibility of malignancy. Ulcer is frequent; treatments are many. Is it not surprising that there should be so little standardization in the method of such treatment? Even those men who specialize in this field of medicine have methods which seem at variance. May it not be that the success of apparently diverse methods really rests on their fundamental similarity? May I, then, consider a few of the principles common to most of the medical cures and, on behalf of the patient, eliminate some of the non-essential ones? The remarks to be made are impressions rather than convictions. They are limited to a study of approximately 150 ulcer patients while assisting Dr. W. C. Alvarez, and eighty others seen while practicing independently. The x-ray is the only impersonal check upon results, and I have not had re-examinations on more than half the patients seen. A picture of the ulcer, however, does not tell the whole story, and it is therefore necessary to judge results in part by inquiring into the patients' symptoms. This has been done and the impressions which follow are taken from such inquiry, as well as from x-ray observation where possible. Most of the patients, both medical and surgical, have improved. Over half the patients seen, followed and questioned have been symptom free for months or years. Of the patients whom I have followed independently, six had surgical success after medical failure. One had a perforation, two had cholecystitis with a duodenal ulcer at a point of contact between the duodenum and gall bladder, two were definitely obstructive, and one had large hemorrhages. One patient is a medical failure who should benefit by surgical care when he decides to accept it. He is the only patient whom I know to be in worse condition than when he started treatment. Fortunately I have seen but two or three ulcer deaths, each from perforation or hemorrhage in patients not seen before the emergency.

THE AMBULATORY TREATMENT OF PEPTIC ULCER

It is difficult to speak of the treatment of any disease without a spoken or implied correlation with etiology. Is there any reason to suppose that peptic ulcer rests upon a specific etiology? The several theories for the origin of ulcer testify to the lack of such and force us to consider multiple causes. Bamberger's clinic finds that ulcer is common among kitchen personnel, and Decker finds

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