

THE RELATIONS OF THE ANATOMY OF THE
PERINEUM TO THE MECHANICS OF
ITS LACERATION.

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IN the midst of all the study which has been lavished upon the repair of the lacerated perineum, the profession has, I think, been too easily satisfied with the statement that its production is due to the strain which is put upon the pelvic fascia during the expulsion of the head, and too little occupied with the study of the exact way in which this tension is exerted. It is to the result of some personal observations on this point that I wish to call your attention to-day; and, on account of the necessity for brevity which is imposed upon us by the conditions of our meeting, I wish to confine myself to but two points: first, an attempt to classify the various forms of tear which are constantly met with, into an intelligible system; and, secondly, an effort to explain the occurrence of these variations on anatomical grounds. Incomplete as my conclusions still are, I feel justified in presenting them, on the ground that they are the result of more than five years of constant study in a clinic in which nearly one thousand women are delivered annually by a succession of previously inexperienced men, with the natural result of a very large proportion of lacerations.

At the beginning of my observations I was impressed with the belief that though the crescentic intra-vaginal tear first described by Dr. Emmet in the *Transactions* of this Society

FIG. 1.

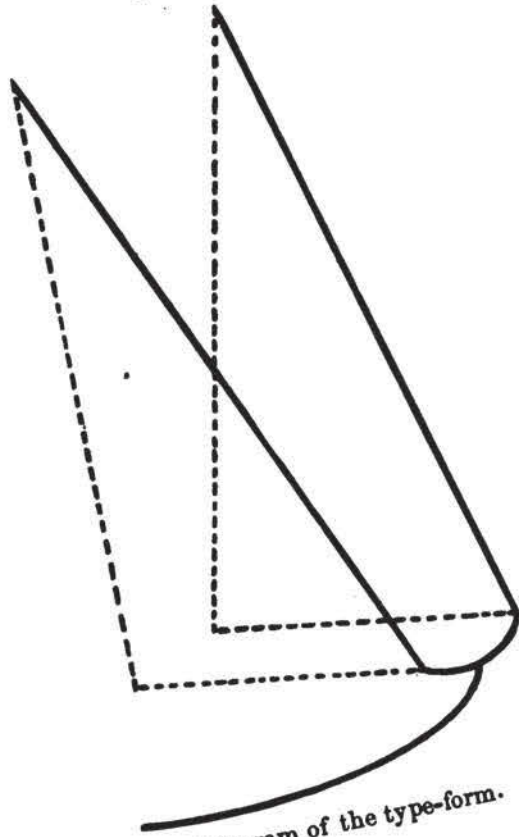


Diagram of the type-form.

FIG. 2.

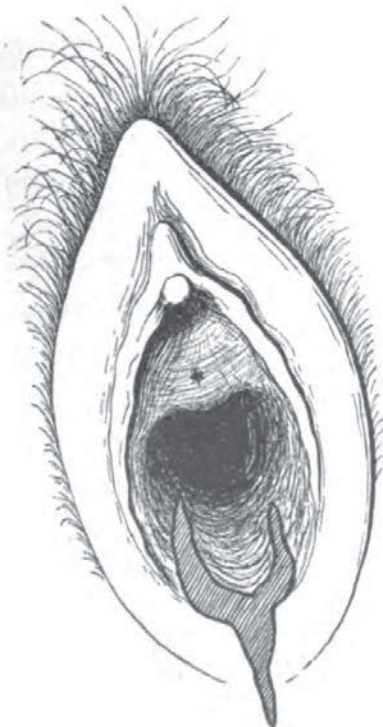
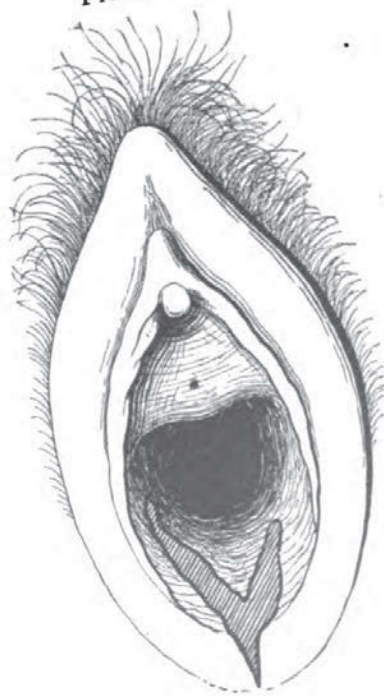


FIG. 3.



for 1883, did frequently occur, a longitudinal tear in the median line was much more common. At first I found a large proportion of these longitudinal tears; but, with increasing experience and better methods of observation, they became steadily more and more rare, until during the last two years I have failed to find a single instance in which I could persuade myself that this form of laceration was present; and I now believe that those of my earlier cases in which I thought it occurred, were mere instances of mistaken observation, due to the use of imperfect methods, and to an insufficient understanding of the alterations of shape which result from the muscular retraction of the distended tissues; and that, if the case is properly studied, such tears will be found to be at least extremely rare, and perhaps non-existent.

The method which I have of late pursued in the study of these cases is no more than that which is ordinarily adopted in secondary operations—*i. e.*, first, to evert the posterior wall of the vagina through the vulva by the insertion of two fingers into the rectum, and then, after carefully sponging the tissues, to draw them together with tenacula, first in one direction and then in another, until the position in which they unite with the most natural appearance and with the least degree of tension is found; but, simple as it is, it requires for success a degree of carefulness and an amount of time which I am inclined to think is seldom given to the subject during the busy moments which ordinarily succeed delivery.

After studying carefully, in this way, a very considerable number of cases, I am inclined to think that all lacerations of the vagina and perineum can be conveniently classified as mere modifications of one type-form which is in itself not infrequent.

This type-form is essentially that which was originally described by Dr. Emmet, and is illustrated diagrammatically in Figs. 1, 2, and 3. It is made up of three essential portions: first, two parallel, longitudinal tears of the vaginal walls, united at their lower extremities by a transverse tear,

which is the second and most essential portion of the typical laceration. The plane of this tear is approximately at right angles to the axis of the vagina, and its situation is just within the constricting band formed by the superficial muscles. To these two portions are added, in the typical laceration, a median tear of the superficial tissues—*i. e.*, of those which lie below the plane of the transverse tear. This type-form in its entirety is, perhaps, of more common occurrence than any other single variety; but, in the majority of instances, it is modified by the diminution or disappearance of some one or more of its component parts.

Although the variety which is found is extremely great, I wish, at this point in my paper, to briefly call your attention to a few illustrations of the more common types. I am fortunate in being able to use for this purpose some reproductions of a set of diagrams which were drawn from life by one of my house officers at the Boston Lying-in Hospital, entirely independently of any suggestion from me, and which are consequently free from any individual bias which I might personally have entertained. Fig. 2 represents one of the most complete instances of the type-form which I have ever seen; Fig. 3, less symmetrical, is a more ordinary instance. Fig. 4 shows diagrammatically a somewhat less common tear in which only the transverse crescentic laceration has been produced. With Figs. 5 and 6 we pass to the form which is perhaps second in frequency, in which one of the lateral vaginal tears has failed to occur, and the corresponding lateral half of the crescent is but imperfectly developed. This form is one which is, I think, commonly but erroneously considered a median longitudinal tear, because the muscular retraction of the tissues, in the swollen state which follows parturition, not infrequently distorts the tear into a shape from which its true characteristics can only be elucidated by very careful observation. Yet, even in these instances, the methods of repair which result from the approximation of the edges of the torn surfaces in such a way as to restore them to the situation from which they

FIG. 4.

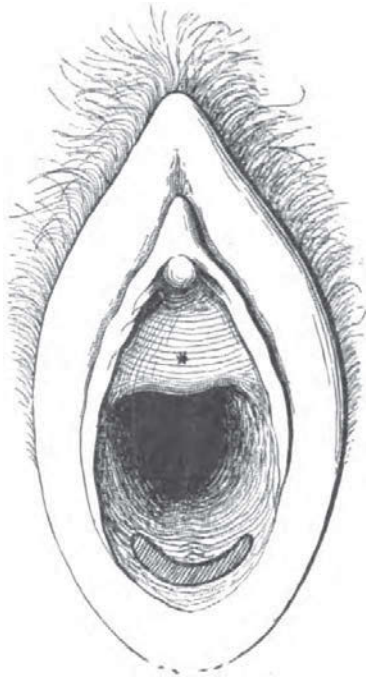


FIG. 5.



FIG. 6.

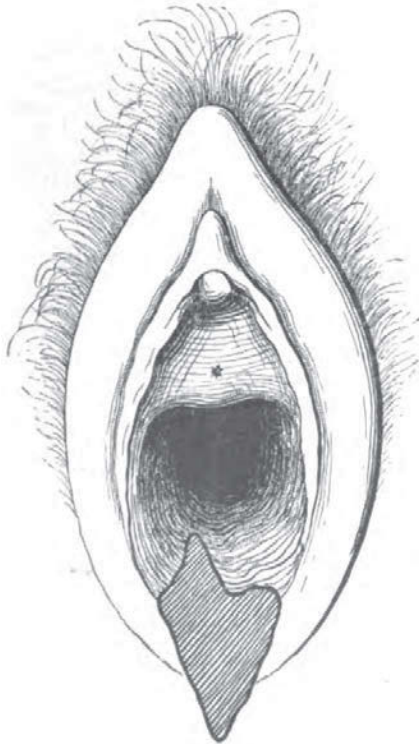


FIG. 7.



are here represented as having been torn apart, has seemed to me to yield invariably much better results than can be attained by their division into two symmetrical longitudinal halves, and their approximation from side to side.

Fig. 7 represents an instance of a very rare form of tear, of which I have seen only four cases. In these tears one of the lateral lacerations is alone represented, and is prolonged downward through the external tissues as a lateral tear well to one side of the anus.

In each of these four cases this form of tear was produced by an unusually rapid delivery occurring at an early stage of labor without previous preparation to the soft parts. Three of the deliveries were operative; one was the birth of a five-pound child by a powerful spontaneous labor at seven months. In each instance the tear began in the fornix as a continuation of a lateral laceration of the cervix.

Another not uncommon tear of which I have no illustration is the transverse rent with both lateral prolongations, but without the superficial tear.

Although many lacerations present at first sight a very irregular appearance, I believe that with a little study all the forms which present themselves can be shown to be but sub-modifications of these five common variations from the type form.

If this attempt at classification of these lacerations is sufficiently natural to be of value, and if my belief in the substantial uniformity in the situation and anatomical relations of all perineal tears is well founded, this uniformity must depend on some definite anatomical arrangement which determines the situation either of the weakest point of the tissues, or of the place of greatest tension along these particular lines. Such an explanation seems to me to be readily apparent from an examination of the arrangements of the fascia and muscles which form the pelvic floor; but I think that it is less likely to be gained by a review of our well-established knowledge of the anatomical entities in the non-

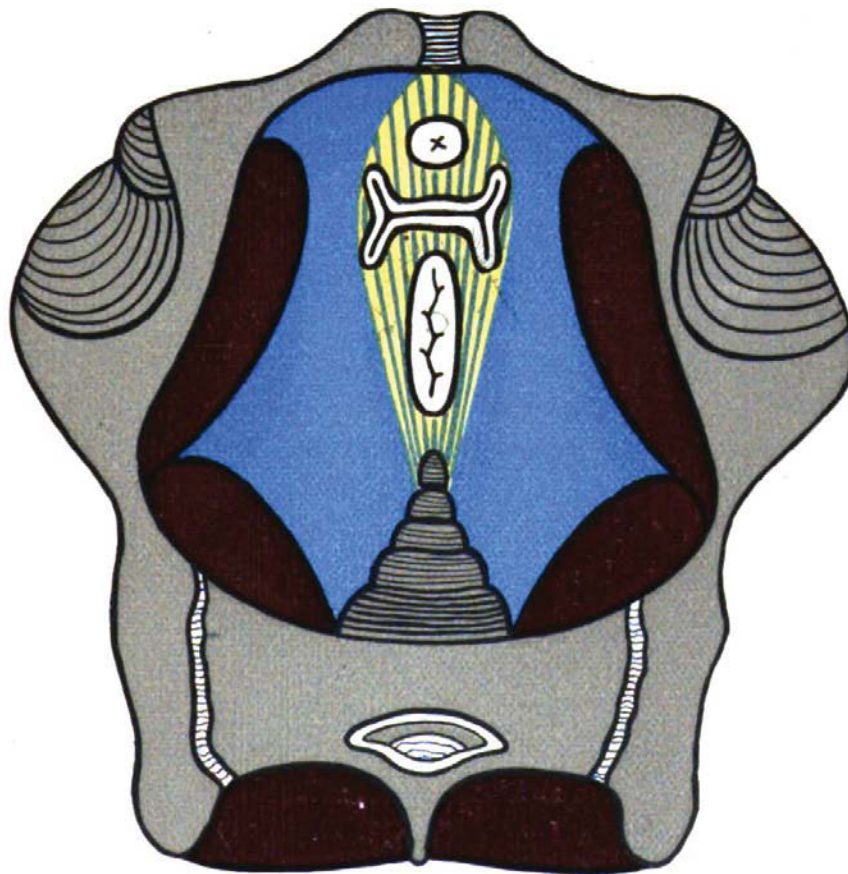
parturient state than by a consideration of their functional behavior during parturition.

In this connection it is of course unnecessary for me to burden the Society with a rehearsal of the ordinary details of pelvic anatomy ; but I may perhaps be pardoned for briefly enumerating the special points upon which this explanation rests. The pelvic floor, when considered in connection with parturition, seems to me to be functionally divisible into two strata, a superior or deep, and an inferior or superficial layer, and I think this division a natural one, because I believe that the mechanical action of these two strata during dilatation can be shown to be not only wholly distinct, but even antagonistic to each other ; and that it is this antagonism which results in the production of lacerations, whenever the elasticity of the tissues is deficient.

The upper or superior of the two strata into which I wish to ask you to divide the pelvic floor, is composed of the two layers of the superior pelvic fascia, with the enclosed three divisions of the coccygeus muscle, and is further reinforced anteriorly by the addition of the deep perineal fascia (the triangular ligament of the male) with the enclosed constrictor urethræ muscles. This sheet of tissue, taken as a whole, forms the floor of the abdominal cavity in the true pelvis, and is broken only by the apertures through which the tubular viscera pass. It is, however, much stronger at the sides of the pelvis than in its median portion, where it is of somewhat feeble construction, even when uninterrupted by the viscera (Fig. 8). It is firmly attached to the lateral edges of the vagina at the point at which this passage pierces it, and prolongations of its fibres pass behind the vagina to form a great part of the upper portion of the so-called perineal body. Its line of force is represented, diagrammatically, in blue, in Fig. 9.

The inferior layer of the pelvic floor is composed, anteriorly, of the bulbo-cavernosus, and the transversus perinei muscles, with the two layers of the superficial fascia which enclose

FIG. 8.



Diagrammatic view of the superior pelvic fascia, from above.

FIG. 9.



Diagram of the restraining forces.

The force of the upper layer of fascia is represented by the blue line, that of the lower layer by the yellow lines.

them; and posteriorly, of the sphincter ani and the fibres which bind this muscle to the coccyx. It must be remembered that anteriorly, as is stated by Ranney, the superficial perineal fascia is a somewhat firm sheet of non-elastic tissue, which is especially strong at the points where it is reflected over the transverse muscle; but that in its posterior portion it is so slightly developed that the sacral half of this lower layer is in reality composed of but little more than the yielding sphincter ani muscle, the peri-rectal fat, and the external skin. It is drawn in yellow in Fig. 9.

To arrive at the conclusion as to the etiology of perineal lacerations, to which I wish to lead you, it is now necessary to examine separately the action of these two layers during parturition.

When the head passes the cervix and meets the resistance of the pelvic floor, it must first dilate the vagina and the opening in the superior layer, by pushing to each side the stronger lateral portions of the superior fascia, and by putting upon the stretch the weaker central part, at the same time stretching the whole structure downward. This process is represented diagrammatically in Figs. 10 and 11. In the former, which is supposed to be a section through the superior pelvic fascia and vagina, at right angles to the axis of the passage, the stronger lateral portions of the fascia are shown as ending somewhat abruptly in their attachment to the vaginal walls. According to a well-known phenomenon of mechanics, it is probable that if the supporting sling which is so produced is to tear, the separation will occur at one of the two points where the stronger tissues join the weaker, *i.e.*, at A or B, and would then naturally result in the production of the first portion of the typical tear; *i.e.*, the two longitudinal lateral prolongations of the crescent.

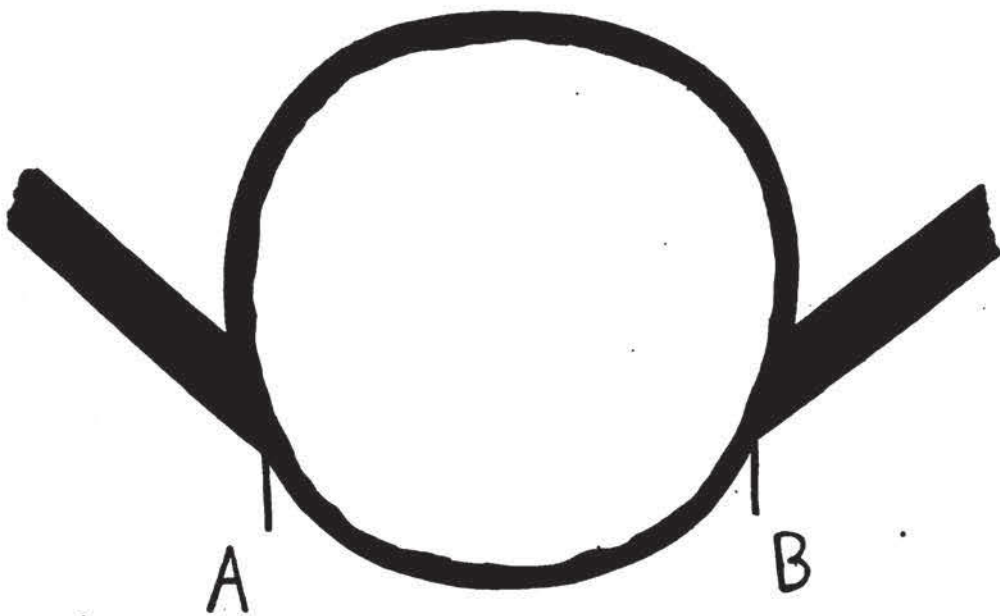
As the head advances, either by dilatation of this structure or by laceration of the vagina, it follows from the obliquity of the vaginal axis to the fascia, that the posterior portion is put more and more upon the stretch by the downward and

forward progress of the presenting part ; while its anterior half is, upon the contrary, carried up and forward and crowded against the pubes by the same process, as is represented in Fig. 11, in which the posterior half of this segment is represented in blue and the anterior half in red. If then the anterior half of this sheet of tissue is relaxed and the posterior half is stretched, by the process of dilatation, it is evident that the action of the whole may be considered as limited to that of the posterior segment, *i. e.*, to a crescentic hood of fascia, which is eminently well fitted to resist that downward and forward movement of the fourchette with which we all familiar during the stage of expulsion. If now this posterior segment could slip backward over the head, its tension would be relaxed and its resistance to the process of dilatation annulled, and it is the analysis of the force which prevents this, which is the next step in my argument.

The merest glance at the external surface of the perineum during the advance of the fourchette at the end of labor, will demonstrate to the most careless observer that the elasticity of the sphincter ani is so great that the restraining powers of the superficial layer of the perineal floor are limited almost entirely to the action of its anterior half. If, now, it is remembered that the efficient anterior segment of the superficial fascia is connected to the efficient posterior segment of the superior layer only by the comparatively feeble indifferent connective tissues of the perineal body, as is indicated diagrammatically in Fig. 9, I think it will be conceded that the point of least tensile strength is probably situated at this point, and that the diagrammatic view of the restraining forces which is given in Fig. 12 is not unfair.

In this figure, the passages are supposed to be already partly dilated and the perineum is bulging slightly before the head, the escape of which is still restrained by a hood of tissue, whose action may be summarized as that of a Y-shaped band, formed by the union of the posterior segment of the superior fascia with the V-shaped superficial fascia. If, when the

FIG. 10.



Diagrammatic section at a right angle to the axis of the vagina.

The superior pelvic fascia is represented in blue, the vaginal walls in red.
The black lines at A and B show the probable position of the lateral tears.

FIG. 11.

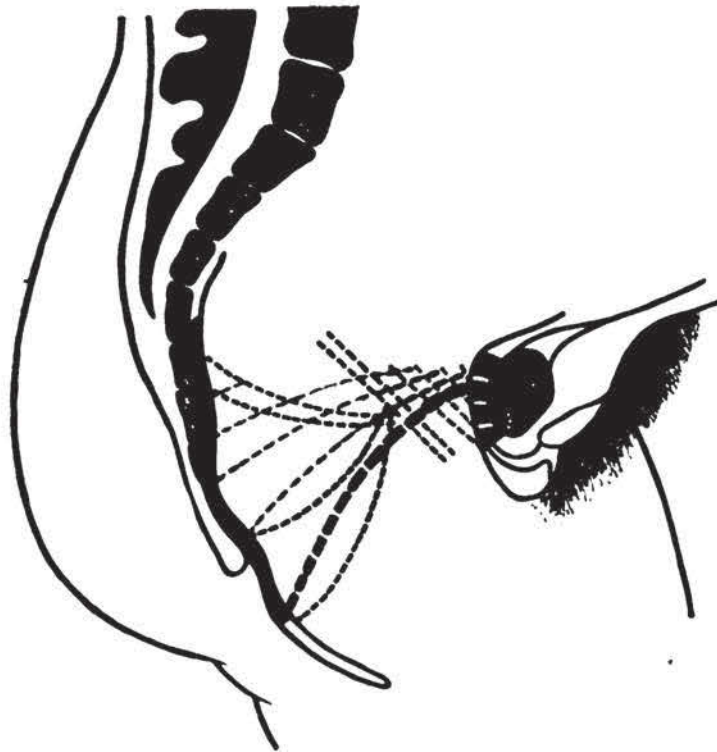


Diagram of the relations of the two segments of the superior pelvic fascia during full dilatation of the parturient canal.

The position of the posterior segment is shown by the heavy blue line, that of the anterior segment by the heavy red line. The broken colored lines show the lines of tension in their respective segments. The broken black lines show the relations of the posterior segment to its normal position.

head is in this situation, the tissues of the perineal body are supposed to yield along the black line A in Fig. 12, there will be an immediate gain in the length of the restraining band, which gain is exactly represented in Fig. 13, in which the dotted black line is an exact reproduction of the position of the colored lines in Fig. 12, while the colored lines are allowed to sink downward and forward by just the amount which is gained by such a separation, which is, of course, the transverse portion of the typical tear.

These separations having taken place, the head is restrained only by a thin hood formed by the superficial tissue, which, unless it is extremely distensible, will then tear along the median line, both because that is the weakest point of the fascia, on account of the decussation here of the fibres from the two sides, and because of the lateral tension exerted by the strong bands of fascia which cover the superficial transverse muscles. This tension is excellently demonstrated in Savage's *Anatomy of the Pelvic Organs*, and has long been received as a sufficient reason for the median situation of the superficial rent.

These explanations seem to me to be sufficient to account for the frequent appearance of the type-form, but even if they are correct to this extent, much yet remains to be said on the reasons for the variation of other tears from this form, and upon the precautions and processes which should be adopted for their prevention and repair. On these points my observations are, however, as yet rather too incomplete for full and satisfactory publication. I can only say that those tears in which the longitudinal element predominates, as in Figs. 5, 6, and 7, seem to be always the result of rapid labors with powerful expulsive forces; while those in which the transverse tear is extensive and the other elements of the type are ill-developed, as in Figs. 3 and 4, follow as a rule upon extremely slow second stages.

I am inclined to believe that when the second stage has been extremely rapid, the lateral wings of the tear are the

primary element in its production ; and that the existence of even one deep longitudinal tear frequently affords sufficient space to permit the expulsion of the head without the production of a well-developed transverse rent, as in Figs. 5, 6, and 7. On the other hand, when the tear follows a very slow expulsion, it is probable that the transverse rent is the primary element, and that its lateral prolongations, which are then seldom well marked, are merely secondary, and are the results of the momentary rapidity of progress which is permitted by the appearance of the transverse tear.

When only one of the upper longitudinal tears is well marked, it is usually found upon the side to which the forehead was originally directed. How far this last fact may be due to the friction of rotation remains to be determined, and the field for observation of the relative frequency of the several forms, in accordance with the varying presentations and with the differing positions of the head, may also afford another interesting point for observation, to which I hope to devote some study in the future.

It is at once apparent, if these views are correct, that the essential element in the repair of all lacerations must consist in the insertion of such sutures as will draw the torn edge of the upper layer downward and those of the lower upward, until they meet at the central point from which they were originally separated ; but the importance of such sutures is so well understood, and the choice of methods for their insertion has been so frequently discussed, that I have thought it best to leave that point untouched, and to restrict myself to-day entirely to the anatomical side of the subject.

FIG. 12.

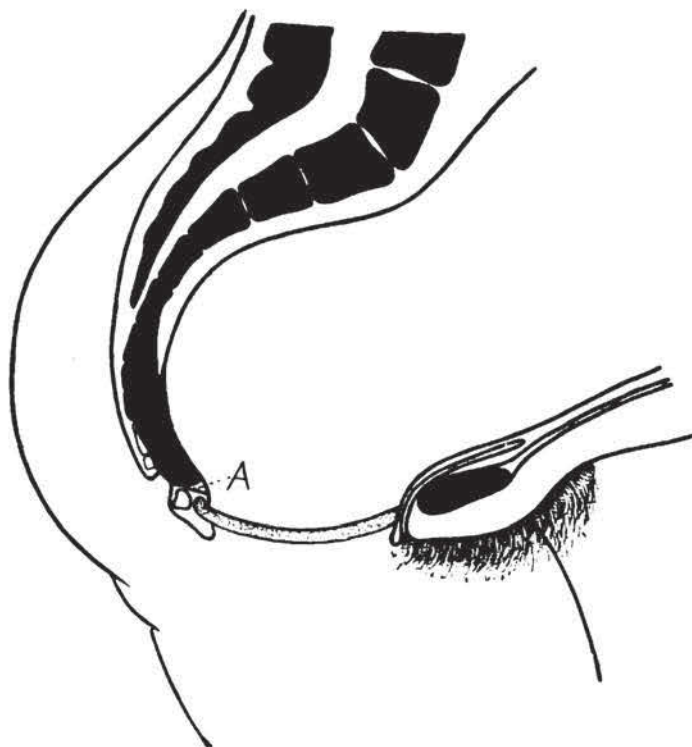


Diagram illustrating the position of the restraining tissues at the moment when the perineum first bulges before the head.

The posterior segment of the superior fascia is drawn in blue, the anterior segment of the superficial fascia in yellow. The black line A shows the situation of the probable transverse rent through the indifferent connective tissue of the perineal body.

FIG. 13.



Diagram illustrating the position of the restraining tissues after the occurrence of the transverse tear.

The broken lines are exact reproductions of the position of the colored lines in Fig. 12. The position of the colored lines shows the amount of space gained by a separation to the extent of the black line A in Fig. 12.