

OUTLET PELVIMETRY AND ITS IMPORTANCE

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AFTER what perhaps might be termed a rather limited though diligent obstetric practice, I desire to present some of the impressions I have had regarding the pelvic outlet, based on practical experience and the opinions of modern authorities. I have long wondered why, in our average modern textbook, to a greater degree in our obstetric teaching, and by far a still greater degree in practice, so little stress is placed upon the pelvic outlet compared with the pelvic inlet. The experience of all who have done only a moderate amount of obstetrics and the experience of those who have done enough to compile long lists of reliable statistics, has shown that difficulties arising at the outlet are not only oftentimes equally severe to both mother and baby, but are also many, many times more frequent, and the resulting pathology and permanent injury perhaps ten to one as common as at the inlet. Again, all common measurements of the inlet except the internal conjugate are external, indirect, and inaccurate and of no value except in classifying the type of pelvis, while those of the outlet are direct, easily accessible and accurate as far as exactness is possible. Then, too, the baby's head, which after all is the only real pelvimeter, can be readily applied either manually or by test of labor to the inlet, and the proportions adjudged, but certainly not to the outlet until late in labor, which, indeed, is too late if the outlet proves small.

The normal female pelvic outlet may be considered a true rhomboid, whose transverse and anteroposterior diameters are 11 and 11.5 cm. respectively. For practical purposes it is composed of two triangles, an anterior or urogenital and a posterior or rectal. These triangles have a common base, the bisischial or transverse line joining the ischial tuberosities. The apex of the anterior is formed by the lower

edge of the symphysis while that of the posterior is formed by an equally rigid, fixed point, the tip of the sacrum. The boundaries of the two triangles differ chiefly in that the legs of the anterior are composed of rigid nonyielding bony barriers, the descending and ascending rami of the pubis and ischia, while the legs of the posterior are composed of the soft, yielding parts, mainly the levator ani, coccygeus, the superior and inferior pelvic fasciae, and less immediately the great and small sacrosciatic ligaments.

The diameters of the outlet commonly taken are the transverse, the anteroposterior, the anterior sagittal, and posterior sagittal. It is also customary to note the angle of the pubic rami as narrow, broad, or normal by outlining the rami with the fingers or thumbs. As to the diameters, my experience has demonstrated to my satisfaction

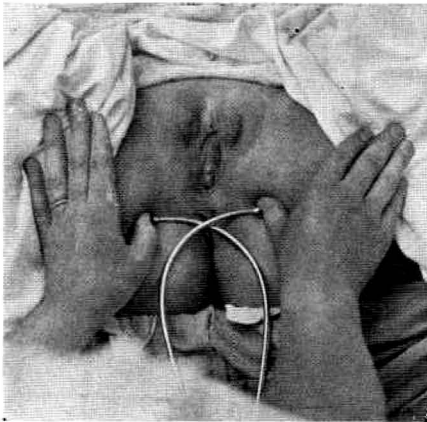


Fig. 1.—Measuring transverse diameter with an inlet pelvimeter.



Fig. 2.—Measuring transverse diameter with Williams' outlet pelvimeter.

that there are but two practical diameters, the transverse or bischial and the posterior sagittal, first described by Rudolph Klien, in 1895, as that diameter extending posteriorly from the middle of the transverse or bischial to the tip of the sacrum.

The technic of taking these diameters is as follows: The patient is placed in the exaggerated lithotomy position with the hips well over the edge of the table. This position greatly facilitates measurement because it forces the ischial tuberosities into prominence, and is little short of imperative in order to obtain accurately the posterior sagittal. The patient having been placed in this position, the ischial tuberosities are carefully palpated with the thumbs at the widest transverse diameter. This line will be found to pass transversely across the anterior border of the anus. I wish particularly to emphasize this point, because I find that the average student or the one unfamiliar with pelvimetry almost invariably locates this diameter one or two centimeters anterior to the anus, and thereby gets a reading erroneously short because of the converging rami. Having located the diameter, the thumbs are then so arranged that the planes of the thumb nails correspond to the planes of the inner surface of

the ischial bones. An assistant then measures the distance between the thumb nails with an appropriate pelvimeter (Fig. 1), or the examiner can conveniently perform the measurement alone by employing a special outlet pelvimeter, such as designed by Williams (Fig. 2), or DeLee. He may still more simply perform this maneuver by using an ordinary linen or steel tape stretched against the tuberosities over the thumb ends (Fig. 3). And what is still a more ready, though inaccurate, yet practical method in noting lateral contraction is passing the fist transversely between the ischial tuberosities (Fig. 4). The average fist is 8 cm. wide and if it can be comfortably passed the average head will come through.

The measuring of the posterior sagittal is much less simple, largely because its extremities are decidedly less accessible. The anterior extremity is centrally located on the fixed transverse interischial diameter, while the posterior is represented by the tip of the sacrum. The latter is rather difficult to demonstrate unless the patient's hips are well over the end of the table and the thighs well flexed. With the index finger in the vagina, the thumb is placed over the region of the coccyx. By moving the coccyx back and forth, the sacrococcygeal joint is determined and indicated by marking on the skin with a blue pencil.



Fig. 3.—Measuring transverse diameter with tape.

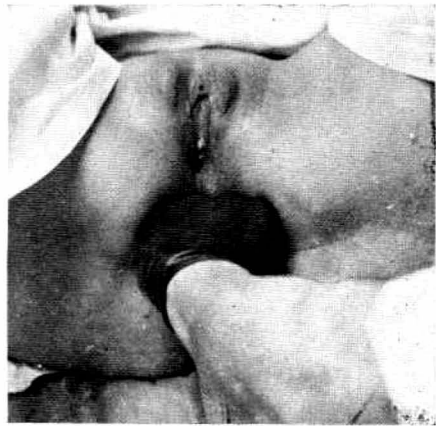


Fig. 4.—Estimating transverse diameter by passing fist between ischia.

The original instrument devised for measuring this diameter was first described by Klien.¹ The common objection to it and to some of the modifications that followed was that it required an assistant. Thoms' modification is supposed to avoid this objection, and although I am quite familiar with it, and use it altogether, I must admit that an assistant is an added advantage and I believe that so far as the instruments that have been devised up to date are concerned, an assistant is always quite necessary in taking the measurement accurately. An instrument which bids fair to be a one man instrument (Fig. 5) devised by George H. Pierce,^{1a} of New York, has recently come into my possession. The device of Thoms as well as the original of Klien, is so constructed that it may also be used to measure the transverse by placing the thumbs in the hooks and pressing them against the inner surface of the ischial tuberosities. The reading on the crossbar is noted, and then the thumbs are removed and the transverse bar is held in place with the fingers of one hand, while the free compass point is applied to the tip of the sacrum indicated by the pencil mark (Fig. 6). The extent of the measurement is indicated by a scale graduated on a special arm of the fixed leg of the compass. Owing to the thickness of the

sacrum, the reading is over correct by 1 cm., which should be subtracted. The normal net is 7.5 cm.

Some consider the posterior sagittal as measured from the middle of the transverse to the tip of the coccyx, but as pointed out by J. C. Hirst, II,² this is incorrect because the coccyx rarely obstructs labor, and in addition its tip does not lie in the true plane of the pelvic outlet. To obtain the anterior sagittal, the instrument is rotated 180 degrees and the distance similarly measured from the transverse to the lower margin of the symphysis (Fig. 7). This normally is 6 cm.

If one is not equipped with a special pelvimeter he may satisfactorily take this diameter in average cases by placing a tongue depressor or probe along the transverse and measure with an inlet pelvimeter from the middle of the straight edge to the tip of the sacrum (Fig. 8), subtracting 1 cm.; or he may measure from the middle of the straight edge to the tip of the coccyx with either the inlet pelvimeter or ordinary tape (Fig. 9) adding 2.5 cm. to allow for the backward deflexion of the coccyx.

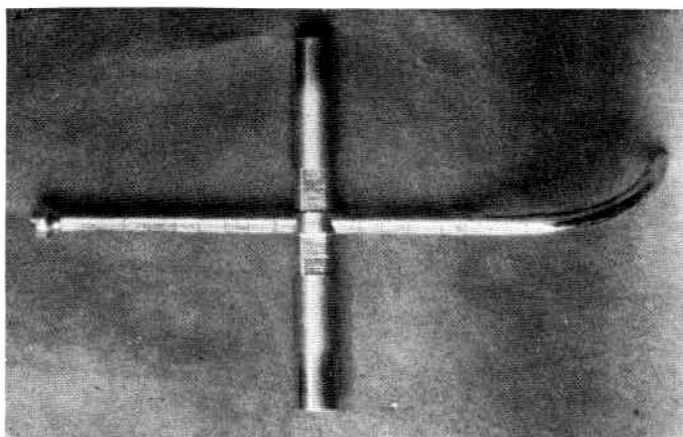


Fig. 5.—Outlet pelvimeter designed by George H. Pierce.

The simple direct manual method described by Edgar has not been found practical, especially where contraction exists. It is performed as follows: Make horizontal pencil marks over the ischial tuberosities indicating the extremities of the interischial diameter. The whole right fist is pressed into the rectal triangle, the ulnar border being carefully adjusted to the sacrococcygeal joint. The upper surface of the index finger or the semiflexed thumb is made by extension or flexion to come in contact with the center of the interischial diameter represented by a straight edge, such as a uterine applicator or heavy probe, joining the horizontal marks over the ischial tuberosities. The fist is then withdrawn and measured with a pelvimeter and the posterior sagittal diameter ascertained. In this instance 1 cm. is not subtracted.

Again, the geometric method of calculating the diameter in question, first suggested by Biddle, may be accepted as satisfactory. Take the square root of the difference between the square of the ischiosacral and the square of one-half the interischial. The result will be the posterior sagittal. Calculation may be avoided by constructing a table, giving both the ischiosacral and the posterior sagittal diameter for each centimeter of shortening of the transverse.

There seems to be a sufficiently constant relation between the distance between the superior posterior iliac spines, ordinarily known as the transverse diameter of the

rhomboid of Michaelis, and the transverse of the outlet to give this relation some practical value. I have found these diameters equal within 0.5 cm. in over 95 per cent of cases measured, ranging from 6 to 11 cm. In other words, a narrow rhomboid of Michaelis is very indicative of a narrow outlet, and a routine prenatal examination should include inspection of this rhomboid. Because in addition, the length of this rhomboid seems to have a definite relation to the conjugata vera—a short rhomboid foretelling a contracted inlet.

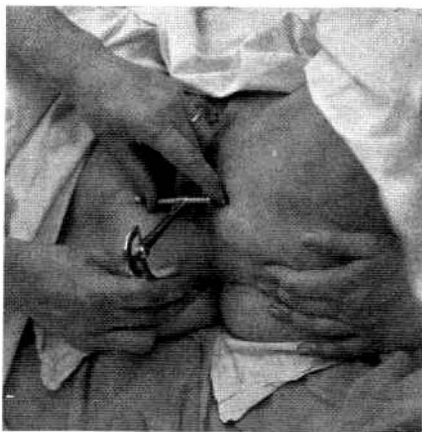


Fig. 6.—Measuring posterior sagittal diameter with Thom's instrument.

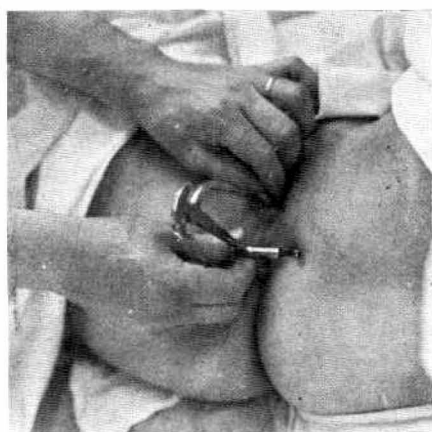


Fig. 7.—Measuring anterior sagittal diameter with Thom's instrument.



Fig. 8.—Measuring posterior sagittal diameter with straight edge and inlet pelvimeter.

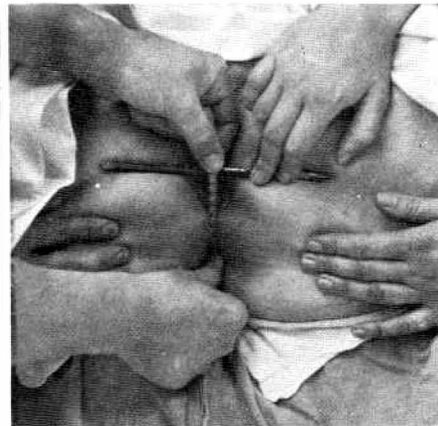


Fig. 9.—Measuring posterior sagittal diameter with straight edge and tape.

It would be unjust not to mention the diligent effort made during the last five or six years both abroad and at home in the field of roentgenology³ as regards pelvimetry, and strangely enough in many instances emphasizing the outlet. The articles are largely technical and appeal chiefly to the x-ray technician. The limitations of this paper do not allow of further discussion except that roentgenographic measurements in women far advanced in pregnancy are unreliable,

and if abnormalities are suspected, especially at the outlet, the examinations should be made early in gestation. Then, too, quite recently a series of cases has been reported by two very reputable authorities,^{3a} questioning the safety of roentgenography during gestation, especially during the early weeks, because of the deleterious effect upon the fetus.

Outlet pelvimetry allows us to recognize the most common pelvic deformity in the American white woman, namely, the contracted outlet pelvis, commonly known as the funnel pelvis. Of all pelvic deformities in the white woman, it constitutes 44 per cent.⁴ This is in marked contrast to 15 per cent in colored women. Its frequency, according to Williams,⁵ Thoms,⁶ and Williamson⁷ is from 5.3 per cent to 7.7 per cent. Without pelvimetry this deformity is usually not found until late in labor, and is the most common cause of outlet difficulties.

This deformity, where outlet pelvimetry is not employed as a routine, is especially liable to be noted in that form of funnel pelvis known as the muscular type, which has been given considerable consideration in recent obstetric literature.^{8,9} The characteristic, abnormally large inlet measurements together with the muscular make-up of the patient, is quite likely to throw the novice off his guard. He may also overlook the accentuated lumbosacral angle bearing the high promontory which prevents head engagement, and he is liable to be further misled by not taking into account the fact that these patients characteristically give birth to stocky, bony-headed babies. Early recognition in these cases often thwarts disaster to both baby and mother by calling for early cesarean section.

In contracted outlet the transverse diameter is 8 cm. or less, the arch thus being of the male rather than the female type. In this particular an 8 cm. or less transverse is to an outlet, what an 8 cm. or less conjugata vera is to an inlet, in that both afford warning of probable difficulty.

The prime significance of the narrowed outlet is in the fact that in the normal female pelvis the pubic angle varies from 70 to 100 degrees and usually is a right angle, the occiput rotating under the arch emerges immediately beneath the pubis, the stress of the delivery is borne by the urogenital triangle, while in the narrowed outlet, the occiput is made to escape away from the arch and the head is forced on the perineum and against the coccyx and sacrum, the posterior triangle thus becoming the available outlet. Consequently various degrees of lacerations of the perineum, levator ani, pelvic fascia, and rectum result, with perhaps fracture of the coccyx, and should the sacral tip be far forward, delivery becomes impossible.

In deciding whether the head will or will not pass the outlet, it is

important to know the transverse and posterior sagittal diameters. In general, if the transverse is over 8 cm. no further measurement of the outlet need be taken. However, if it is 8 cm. or less, it is important to measure the posterior sagittal as above described. If the physician is not equipped or does not feel competent, he should, for his patient's sake and his own peace of mind, obtain the help of one sufficiently qualified to make the measurements. This is especially true in cases having a history of previous outlet difficulties.

It often happens that, although the transverse diameter is contracted, the posterior sagittal may be normal, or, indeed, may be of a compensatory extent, thus allowing the passage of a normally sized baby. The compensatory relation of these two diameters as compiled by Williams¹⁰ is as follows:

Transverse diameter 8 cm.	Post. sagittal 7.5 cm.
“ “ 7 cm.	“ “ 8 cm.
“ “ 6.5 cm.	“ “ 8.5 cm.
“ “ 6.0 cm.	“ “ 9.0 cm.
“ “ 5.5 cm.	“ “ 10.0 cm.

A similar analysis of the importance of the relation of these two diameters in contracted cases has been emphasized by J. C. Hirst¹¹ through the formula known as the “Index of the Outlet” devised by C. D. Daniels, of Philadelphia. This index is derived by taking one-half the product of the transverse multiplied by the posterior sagittal; i.e., one-half the base by the altitude. Hirst gives this normally as $\frac{11 \times 10}{2}$ or 55 square cm. This 55 square cm. is called the normal “Index of the Outlet.” If this index is 55 to 35, spontaneous delivery is the rule; if 35 to 25 considerable difficulty will be experienced; and under 25, delivery from below is very liable to be insurmountable.

These variations may be graphically given thus:

$$\frac{11 \times 10}{2} \quad \frac{7 \times 10}{2} \quad \frac{10 \times 7}{2} \quad \frac{6 \times 9}{2} \quad \frac{6 \times 7}{2}$$

Normal index of the outlet, 55,—spontaneous.

Index down to 35,—possible outlet forceps.

Index from 35 to 25,—usually forceps.

Index 25 or below,—practically obstructive.

This formula assumes the normal posterior sagittal to be 10 cm., the same as originally described by Klien, which, to be exact was 9.95 cm. Practically all American clinics find it to be 7.5 cm. It is difficult to reconcile this discrepancy but possibly the German women of Klien's clinic normally have approximately 10 cm. posterior sagittals, for he found a lateral contraction of 24 per cent, which is four times that found among American women.

Of course this index, as well as the table of Williams in general applies to the baby weighing at least 7 pounds and not necessarily to smaller babies. J. C. Hirst, II,¹² reports two cases in which the babies weighed over 6 pounds, the one case having an index of 23.5 and the other 22. Each child survived; in the latter case, however, the baby showed signs of cerebral pressure for a time.

I have found this "Index of the Outlet" very applicable for teaching purposes in that it readily clarifies the subject for the average student.

Neither of these two mathematical guides should be accepted too dogmatically in all cases, because the occasional exception does occur. The ability of a child's head to mold, the position, the *vis a tergo*, and the patient's age are potent factors.

However, I do not believe that a pallid, gasping baby, finally resuscitated, beginning existence with minute hemorrhages permeating its brain, and a mother with a mutilated perineum left to bear the sequelae of disease and discomfort therefrom, constitutes good obstetrics.

It is not within the realm of this paper to discuss the effect of the contracted outlet upon presentation, mechanism, and conduct of labor. Yet it is difficult not to correlate a few practical facts arising from outlet pelvimetry; e.g., if pelvimetry shows a contracted outlet and the baby is of average size, an episiotomy is indicated, when delivery is to be conducted from below. Not only is an episiotomy indicated, but the type suggested; namely, the mesiolateral instead of the median. The median would lead to a possible extension of the tear into the rectum, especially if the size of the baby or the amount of contraction is underestimated. The mesiolateral episiotomy would permit of further extension, if necessary, into the less important tissue of the ischio-rectal fossa, and if still further extension of the incision is indicated, it may be continued posteriorly as a concentric incision from 1.25 to 1.5 inches about the anus toward the midline, thus permitting the baby to be delivered *beside* the rectum rather than *through* it. This modification of the mesiolateral episiotomy was first advocated by Schuckart.

Again, the obstetrician, if cognizant of a contracted outlet, is most likely to be prepared to assist with forceps, if indicated, and knowing the situation, is apt to interfere earlier and not permit an unnecessarily protracted labor. His interest in the oversize and presentation and position of the baby will also be stimulated. This early interference may take the form of a pubiotomy or cesarean, depending upon the situation and individual operator. F. S. Newell¹³ in a recent communication reports having seen 3 or 4 cases of ruptured symphysis from the leverage of forceps in endeavoring to work a head

through a contracted outlet. He states further that if the outlet had been carefully measured and the condition appreciated the deplorable accident could have been avoided by selective cesarean.

The accoucheur will put a very unfavorable prognosis on a breech presentation and will avoid, if possible, a breech extraction because of the inability to deliver with sufficient rapidity the after-coming head, which not seldom requires forceps. DeLee¹⁴ states clearly that a large number of these babies are lost, if not through forceps, by craniotomy.

For the same reasons the accoucheur, once awakened to a narrowed outlet, most likely will forsake that most commonly used of all emergency operations, the internal podalic version. Large shoulders and extended arms will afford him additional anxiety in both these groups of cases.

Narrow outlet pelvimetry will make the physician skeptical of a posterior position, especially if the head is high when labor begins, even though the transverse is up to 8 cm. He will also realize his handicap in attempting a Scanzoni on these cases. He will assume an unfavorable attitude even in the anterior positions if the head is above the spines when labor begins and the transverse is less than 8 cm. Thus the pelvimetry makes him place a special value on the different positions of the head. Also, if aware of lateral contraction, the conduct of labors complicated by eclampsia, placenta previa, prematurely separated placenta, and other emergency complications, will be governed differently than in normal outlet pelvis.

From the foregoing, it may be conservatively concluded that pelvimetry of the outlet has a most distinct importance in successful obstetrics. I agree with Ehrenfest¹⁵ that too much attention is given to the measurement of the true conjugate and mensuration of the pelvic outlet neglected. As a matter of fact I firmly believe there is more practical obstetrics at the outlet than at the inlet. It certainly is the most important pelvimetry for the general practitioner. As pointed out by Jellinghaus¹⁶—"It is so easy—requires no fuss or pain to the patient. Even if a man were too lazy to measure the posterior sagittal—he could benefit a whole lot by just measuring the transverse."

Because the bulk of obstetrics today is performed by the general practitioner, and the majority of our medical school graduates become general practitioners, and because contracted pelvic outlets with their sequelae are so prevalent, I am of the emphatic opinion that the progress of obstetrics cannot be advanced any more rapidly today than by greatly emphasizing this important subject of outlet pelvimetry in our textbooks and in all our practical obstetric teaching.

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504 MEDICAL ARTS BLDG.