

## Moderately Contracted Pelvis and Induction of Labour.

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THE value of induction of labour in contracted pelvis is much debated amongst obstetricians. Those who practise it are enthusiastic, and those who are not familiar with its use, condemn it. The chief criticism directed against the measure is that the size of the child is so difficult to estimate that often induction is done and a very premature child is born to die from malnutrition and marasmus. If this objection is overcome, there seems to be no other good argument to advance against this excellent method of treating contracted pelvis of moderate degree. By waiting until the last moment when the fœtus can safely pass through the natural outlet, it is possible to save the mother from Cæsarean section and have the child born viable and in good condition. By keeping watch over the size of the child's head by external measurements, it is possible to determine the proper moment for intervention.

Obstetricians who condemn induction unite in saying that delivery is spontaneous in a very large percentage of contracted pelvis. They then advise other methods of operative delivery. These statements to me are conflicting: for, if in a large percentage of contracted pelvis of moderate degree spontaneous delivery occurs, in those where it does not occur trouble arises because the child is too large. Thus, if the size of the child can be estimated and its relation to the size of the pelvis be tested before induction, there will be a much better chance of obtaining living children in women with contracted pelvis of this type. It must be recognized that the size of the child and the duration of pregnancy vary within wide limits, and the relation of the size of the baby, particularly of the size of the baby's head, must always be taken into consideration when the course of procedure in any pelvis of moderate contraction is debated. A child weighing  $6\frac{1}{2}$  lbs. with a soft head to correspond to its weight will pass through a pelvis which would not allow exit to a child of 8 lbs. with a large firm head. The probability of delivery in large series of cases is therefore of interest.

### SPONTANEOUS DELIVERY IN CONTRACTED PELVES.

All statistics unite in showing that, in contracted pelvis, there is a very large proportion of births without operative assistance. Bürger, in 1,840 cases of contracted pelvis with a true conjugate between 10 and 9.6 cm., reported 89 per cent. of spontaneous

deliveries; in 2,486 cases with a true conjugate between 9·5 and 8·6 cm., 80 per cent, and in 840 cases with a true conjugate between 8·5 and 7·6 cm. there was 54 per cent. of spontaneous deliveries. Kronig and Zweifel report 84 per cent. of spontaneous deliveries in pelves between 8·5 and 7 cm. true conjugate. Scipiades in 949 cases of contracted pelvis had 76 per cent. delivered spontaneously. The truth of these reports may be attested by other series of cases too many for enumeration here. Suffice to say that, in contracted pelves with a true conjugate of 8 cm. or more, approximately two-thirds or more of the babies are born without interference or aid and by the natural forces. The reason of this is that these children are small enough to get through the pelvis and our effort must be directed to the saving of the other third by keeping these children also small enough to pass through the moderately contracted pelvis and large enough so that they will not suffer from prematurity. This involves a knowledge of the size of the pelvis and an idea at least approximate of the size of the child. If the size of the child can be approximately measured, then labour may be induced at the most auspicious moment in order to get the largest possible child which will pass through that particular pelvis.

#### TYPE OF PELVIS AND SPONTANEOUS DELIVERIES.

In the consideration of the size of the pelvis, the true conjugate will be taken in all cases as the basis of measurement and of indication for treatment. Also no distinction is made in this article as to the probabilities of delivery in flat and generally contracted pelves, because it is believed that, if the true conjugate is taken as the criterion for classification, there is little difference between the probabilities of delivery in pelves of the moderate degree of contraction (8 cm. and over) under discussion. In a collection of such cases, there was found to be 3 per cent. more spontaneous deliveries in generally contracted than in flat pelves of 8 cm., or greater, true conjugate. It is true that in pelves of greater contraction, 7·5—6·5 cm. there are more spontaneous deliveries in the flat type of pelvis; but in the medium degrees there is very little difference. Greater than 8 cm., there are, if anything, more spontaneous deliveries in generally contracted pelves, and this is believed to be due to the fact that generally contracted pelves have, as a rule, smaller babies. But, for the purposes of discussion as to treatment, there is little difference in prognosis in the various types of moderate contraction.

#### THE OBSTETRIC PROBLEM.

Any degree of pelvic contraction is only relative to the size of the fœtus, and a pelvis should be judged to be large or small as to whether or not it will admit the passage of the head. The ever present obstetric problem is whether a fœtal head of unknown

dimensions can be delivered through a pelvis whose measurements can be ascertained. Thus "obstetric judgment" is only gained through much experience of difficult cases, and any methods of measuring the pelvis and the foetal head within the uterus and before the date of labour are welcome additions to the present inadequate and unsatisfactory manœuvres. Exact pelvic measurement is a work of supererogation and futile unless some attempt be made to estimate the size of the foetal head as well.

A knowledge of the size of the foetal head and body offers a sure basis for prognosis in the moderate degrees of pelvic contraction.

In this class of pelvis, therefore, it is advisable to make some attempt to estimate the size of the child before term in order to have an exact basis for treatment and to fix the time for induction of labour.

#### SIZE OF CHILD AND ITS LIMITS.

The size of babies naturally varies in different cases: the average weight in this country is in the neighbourhood of 3,300 grams. The smaller the child at birth below a certain limit, the less chance it has of survival and the greater the danger of death from prematurity and malnutrition. In general, in prematurely born children, 2000 grams is the minimum weight with which a reasonable percentage of surviving children may be obtained. Ostreil, in a study of 1,542 prematurely born children, found that above this weight they showed only slightly less resisting power than children born at term. Maygrier, in a report from the Charité in Paris, states that, of 548 children between 2,000 and 2,500 grams, only 32 (5.8 per cent.) died before leaving the hospital. Among those weighing less than 2,000 grams ( $4\frac{1}{2}$  lbs.) the death rate was higher. He also traced them several years after leaving the hospital and did not find an increased death rate.

Thus, with reasonable care, there should not be an excessive death rate in children born after induction of labour for moderately contracted pelvis. The three great dangers which confront them are chilling, defective feeding and infections. If infections can be warded off and the child fed with breast milk, even if it is drawn and fed with a spoon a drop at a time, it is likely to grow strong and healthy after it has been tided over the stage of extra helplessness.

A weight of 2,000 grams is smaller than is required, as, for successful delivery in a pelvis of 8 cm. true conjugate, a child weighing 2,500 grams ( $5\frac{3}{4}$  lbs.) is not too great. This is the average size at 36 weeks and has an average bi-parietal diameter of 8 cm. A useful way to remember the average weight at any required time of pregnancy is Tuttle's rule:—The number of lunar months minus 2, squared and divided by 2 gives the weight in hundreds of grams. Thus, at 9 lunar months or 4 weeks before term the weight will be

$$(9-2)^2 \div 2 = (7)^2 \div 2 = 49 \div 2 = 2,450 \text{ grams.}$$

This weight of the child, 2,500 grams ( $5\frac{3}{4}$  lbs.), is about the lowest that will give constantly good results and, as may be seen, it corresponds with the average measurements four weeks before term. At this time also the biparietal diameter of the foetal head is 8 cm. The biparietal diameter is the most important, because it comes in direct relation in contracted pelves with the true conjugate or antero-posterior measurement of the pelvis. If the biparietal is greater than the true conjugate, the foetus cannot be born naturally, even with the help of moulding. When the two measurements are the same and in children with small soft heads where moulding is great, spontaneous delivery is possible. For this reason, in the attempt to prophesy the course of labour in contracted pelves the two important measurements are the true conjugate and the biparietal diameter of the head.

#### RESULTS OF INDUCTION.

A true conjugate of 8 cm. is the lowest limit of contraction in which induction of labour should be advised and then only with a proper sized child. The larger the pelvis, the better the results obtained. In a collection from European clinics, induction was done in 941 cases for contracted pelvis with the result that 88 per cent. of all the children left the clinic alive and one mother died (0.1 per cent.). And this in spite of the fact that v. Herff extends the limit for induction to a conjugate of 7.5 cm. and Kroemer to 7 cm. This compares favourably with the mortality in 3,000 Cæsarean operations, collected from the literature in the past 20 years, with 7 per cent. of maternal deaths and 4 per cent. of immediate foetal deaths, not to mention those children dying in the puerperium, or with Davis's large personal series of 104 Cæsarean sections in the New York Lying-in Hospital with 14.43 per cent. mortality in mothers and 17.92 per cent. mortality in babies, including the deaths of children in the puerperium.

These remarkable results of induction show that, when it is intelligently performed, it is, in pelves of moderate contraction, the operation of choice. Of course, it may be said that with large babies and moderate contraction of the pelvis, Cæsarean section is necessary. The average weight of Cæsarean babies is probably not above normal. In 100 cases collected at random, it was  $7\frac{1}{8}$  lbs (3,200 grams), a trifle under average weight.

The results of induction, however, depend upon its intelligent performance, upon an accurate measurement of the pelvis and upon an estimate of the size of the child before birth and while within the uterus. Without a knowledge of the size of the child and its relation to the size of the pelvis, no intelligent prognosis can be made. It is impossible to guess at the weight of the child from

inspection and palpation alone. It is most difficult even to guess the weight of a new-born child after birth. I have for years made trial of this by asking nurses and doctors to guess the weight of a new-born baby and have found that wide error was common and a correct guess the exception. How much more difficult is it for an estimate to be made of the size of the child within the uterus by inspection alone. It is for this reason that accurate methods are necessary to eliminate the personal factor of error. After the pelvis has been measured, a knowledge is required of the duration of the pregnancy, the size of the child, the size of the child's head and the relation of the child's head to the size of the pelvis.

#### THE DURATION OF PREGNANCY AND SIZE OF THE CHILD.

Unfortunately for the students of obstetrics, the duration of pregnancy is not a fixed term, but varies in length with 280 days as the average. Normal pregnancy may be prolonged to more than 300 days. In addition, there may be an error of three weeks or more in estimation from the last menstruation, due to the time of conception. Estimations, based upon a single intercourse, show, however, that the average duration is about 280 days. A complete review of the subject of the duration of pregnancy will be found in my paper on the subject. Cows, with almost the same length of gestation as the human animal, have an average duration of 285 days; but their pregnancy may vary from 240 to 321 days. This is suggestive of a similar variation in the length of pregnancy in women.

Prolongation of pregnancy beyond the average time is associated with increase in weight of the child. In Winckel's series, the average prolongation of pregnancy in children weighing 4,000 grams (8 lbs. 14 oz.), was 8.22 days, and of these children, one-eighth had a gestation period of longer than 302 days, the legally determined duration of pregnancy in Germany. In 31 babies of an average weight of 4,276 grams (9½ lbs.), the prolongation of pregnancy was on an average 31 days. Of babies weighing 4,000 grams, 71.8 per cent. had a gestation period of more than 280 days. Blau and Christofolletti also, in 1,778 children weighing more than 4,000 grams, found pregnancy lasted more than 300 days in 150 cases and more than 302 in 135 cases. Ciula, in an exhaustive study, showed that gestation was prolonged beyond 300 days in 4.5 per cent., beyond 310 in 1.9 per cent., and beyond 320 days in 0.5 per cent. of cases. Issmer, after a study of a large collection of cases, says that the larger the child the longer the pregnancy, and that the increase in length of gestation bears a definite ratio to the increase in the size of the child.

So, it may be seen that pregnancy is not a fixed term and that it may be extended over average limits usually when the children

are heavy. For this reason in the induction of labour if dependence is placed upon the patient's history of her last menstrual period, there may be an error in the estimation of the size and a small child be born to die from prematurity, or a child be allowed to become too large for the pelvis.

It is, therefore, better to attempt to measure the actual size of the fœtus within the uterus and so to check the menstrual history. One helpful aid is to adapt to this purpose my rule for the estimation of the duration of pregnancy. This rule is based upon the average size of the fœtus at full term, 3,300 grams, and depends upon the more or less regular growth of the uterus of 3.5 cm. each lunar month after 5 months. The measurement is dependent upon the height of the fundus which is due to the occipito-coccygeal measurement of the child, and this varies with the weight and length of the child.

The rule is as follows:—The duration of pregnancy in lunar months is equal to the height of the uterus in centimeters divided by 3.5. It depends upon the more or less regular growth of the uterus of 3.5 cm. each month of 4 weeks, and is very exact after the fifth month. The measurement is taken with the patient lying flat (see fig. 1), and one end of the tape is placed at the upper border of the symphysis, while the other is held by the thumb into the palm of the hand. The fingers of the upper hand are held at right angles to the fundus of the uterus, and the tape follows the contour of the uterus save at the last dip, as is shown in the illustration. Multiparæ with lax abdominal walls and thin uteri should be supported at the side so as to bring the occipito-coccygeal axis of the child into the long axis of the mother's body.

This method gives satisfactory results and is the most exact means of estimating the duration of pregnancy. It is strictly an estimation of the size of the fœtus; for when the uterus arrives at the height of 35 cm., or full term ( $\frac{35}{3.5} = 10$ ) lunar months, the fœtus

is of a weight of 3,300 grams, or average size, as is shown by the measurements in my former paper. Thus, an average-sized baby usually comes at the average period of pregnancy—hence the rule.

The rule depends upon the fixed point of 35 cm. fundal height, indicating an average-sized child of 3,300 grams ( $7\frac{1}{3}$  lbs.). From this, for the purposes of induction, deduction may be made of 200 grams for every centimeter below 35 cm. In this way an approximate estimate of the weight of the fœtus may be made. For example, if the fundus measures 31 cm., the weight of the child would be 2,500 grams, which would correspond with the average weight at 9 lunar months as shown by Tuttle's rule. The so-called "sinking" of the uterus does not enter as a factor as it is but seldom present in the recumbent position; if it is present, the head

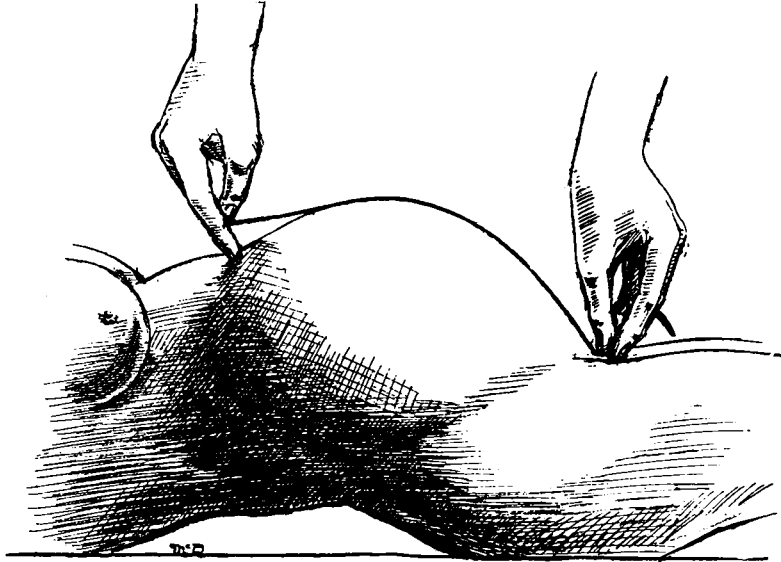


Fig. 1. Measuring height of fundus uteri.

Height in cms.  $\div 3\frac{1}{2}$  = duration of pregnancy in lunar months.

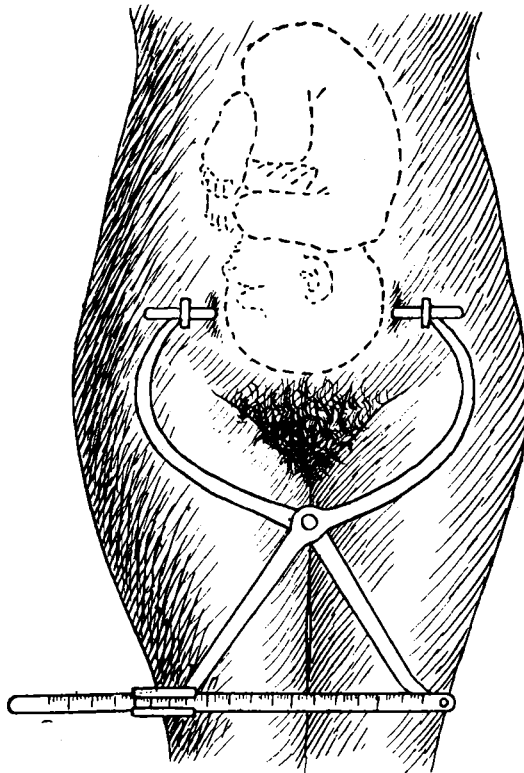


Fig. 3. Author's method.

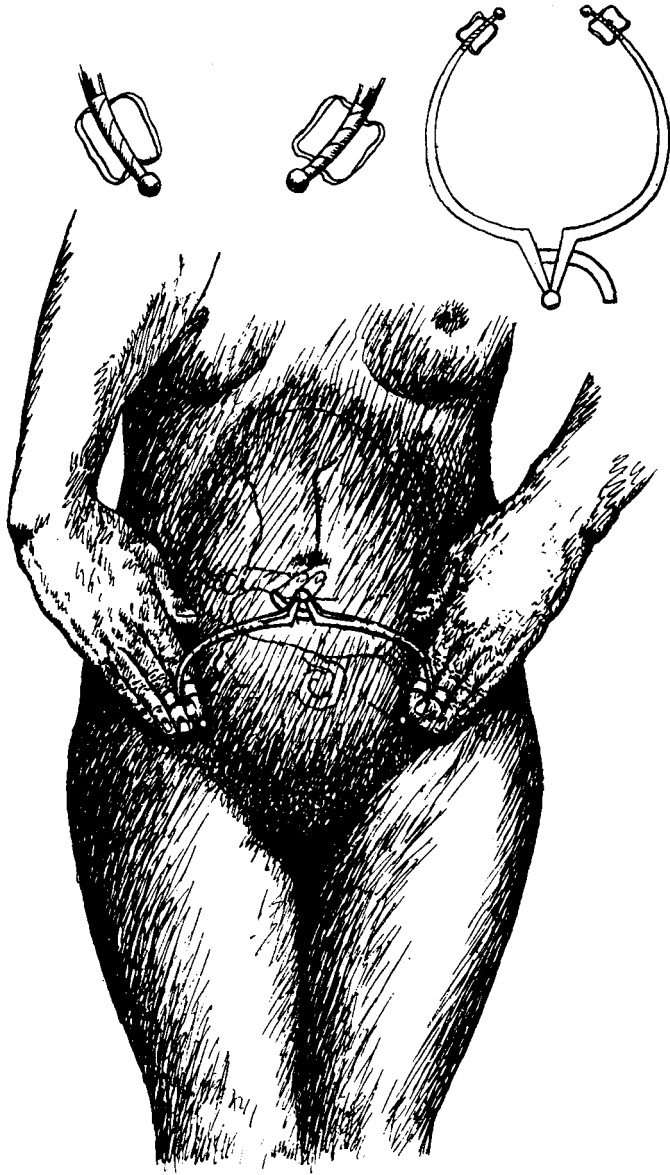


Fig. 2. Perret's method.



has entered the pelvic strait and other measurements are useless. All we want to know is that the head can enter and, if it is already in, the child can pass.

This method of estimating the weight of the child should be used in conjunction with other methods of estimating the size of the fœtus. It will be seen from the table, hereafter appended, that the weight of the child bears a fairly regular relation to the size and diameters of the fœtal head.

MEASUREMENT OF THE FŒTAL HEAD WITHIN THE UTERUS BEFORE  
LABOUR.

Actual measurement of the fœtal head through the abdominal walls has been practised by the French obstetricians for some years. Pinard, Tarnier and Perret have reported fairly good results with the method, and Perret has devised a special cephalometer by which he was able to measure the head with some accuracy. The occipito-frontal diameter of the head is measured, and in order to get the important diameter, the bi-parietal; he advised a deduction of 2.5 cm. from the occipito-frontal. His cephalometer gives good results: its only drawback is its expense and that, when the head lies in the L.O.A. or R.O.P. position, the sinciput being deeper and farther from the abdominal wall, the flat cephalometer is too rigid to get a very accurate measurement. Also his fixed deduction of 2.5 cm does not give exact result, as the difference between the occipito-frontal and biparietal increases with the size of the occipito-frontal diameter, the one that can be measured.

Stone has based his method of measurement upon a somewhat similar procedure. The occipital and frontal poles of the fœtal head are grasped and an assistant pushes the ends of an ordinary pelvimeter in between the fingers. This method requires an assistant with more or less skill in the manœuvre, and the extent to which the tips are thrust in is difficult to control.

THE AUTHOR'S METHOD.

I have sought to modify these methods in order to obtain one which, with a common instrument, will give equally good results in all hands. With this idea, an ordinary pelvimeter of simple construction (fig. 3) was taken and two rings of adhesive plaster, about 1 cm. in width, fastened to each tip. These rings are faced inside with adhesive plaster, back inward, and are made sufficiently large to admit readily the middle and index fingers. The knob-like tips of the pelvimeter should project about 1 cm. beyond the palpating fingers.

The patient is laid on her back and the operator stands as if to palpate for the position of the head. An accurate diagnosis of the fœtal position, not only in regard to the occiput but as to the amount of flexion of the head is essential to success. The bladder must be

empty. The occiput and sinciput are located; then the fingers are thrust into the rings and the knobs of the instrument approximated to these points as closely as possible. The weight of the hinge side of the pelvimeter is supported by the finger of an assistant or may be held up by a string attached to the operator's arm or button-hole. It is necessary that the hinge side should have free play of movement in order that one or other tip may be depressed, if occasion requires. The tips are held firmly against the cephalic poles and the scale read. This gives occipito-frontal diameter. No deduction is required. This fact is not satisfactorily explained. The abdominal walls of a pregnant woman are very thin (usually less than 1 cm. measured at Cæsarean section), and it may be that the exact prominences of the cephalic poles are not reached.

All heads above the brim or which may be thrust above the brim can be measured, although the greatest ease is found in thin women with flat pelves which push the head forward. Small heads with much liquor amnii are difficult to fix; breech cases offer no special difficulty. However, heads lying above the pelvic brim and firmly placed thereon give the best conditions, *e.g.*, in contracted pelves.

The measurement obtained by this means is the occipito-frontal diameter and from this is obtained the important diameter, the biparietal.

The amount to be subtracted varies with the size of the occipito-frontal. With an occipito-frontal diameter of 11.25 cm., 2 cm. is deducted to obtain the bi-parietal, from 11.50 cm. occipito-frontal 2.25 cm., and from 12 cm. occipito-frontal 2.50 cm. This amount deducted is based upon the following table of 100 heads measured by me:—

TABLE OF MEASUREMENTS OF 100 NEW-BORN BABIES.\*

No. of Cases.	O.F. Diameter,	Average Difference.	Average Weight.
1	10	1.00	2,600
4	10.50	1.55	2,716
8	10.75	1.81	2,975
17	11	1.91	3,100
21	11.25	2.07	3,156
19	11.50	2.26	3,247
9	11.75	2.50	3,313
13	12	2.30	3,514
5	12.25	2.35	4,100
1	12.50	2.50	4,100
2	12.75	3.12	4,350
100		2.33 average.	

\* Part of this Table was published with my permission in Stone's article. The relation of the weight to the size of the head was not noted: so the weights were not published.

## RESULTS OF METHODS.

It will be also noted that the weight bears a fairly definite relation to the size of the head. This is of use in checking the size of the pelvis as shown by the author's rule for the duration of pregnancy. As, for example, with a fundal measurement of 35 cm. and an occipito-frontal measurement of 11.50 cm. it can be safely estimated that the fœtus is of normal size, 3,300 grams. In this way it is possible to use the fundal measurement and estimated weight as a check upon the cephalometry with particular accuracy for the purpose of finding this ratio.

These methods have been in use in my hands for seven years and continue to give good results. In all I have measured 84 cases before and after delivery. In 60 cases, the occipito-frontal diameter was correctly estimated; in 17 cases there was an error of .25 cm., and in 6 cases there was an error of .5 cm.; and in one case there was an error of .75 cm. This last case was not a fair test, as the head was well in the pelvis and could not be properly reached. Skill and practice are decided factors, but the method is soon learned.

## A FEW SELECTED CASES REPORTED.

CASE I. iii-para, 4 years married. First baby still-born after forceps. Second baby dead after forceps. Pelvis generally contracted. Diagonal conjugate 11.25 cm. True conjugate 9.50 cm. Fundus and head were measured from time to time during last weeks of pregnancy and labour induced 2½ weeks before term. Fundus 33 cm., occipito-frontal estimated 11.25. Child weighing 6¾ lbs. delivered by forceps with an occipito-frontal diameter of 11.25. Sixteen months afterwards this woman was delivered of a second living baby by induction of labour and prophylactic version. She had delayed this time several days over the appointed time for induction, with the result that the child was longer than planned. The occipito-frontal was estimated at 11.50. Owing to her delay, the child weighed 7 lbs. 4 ozs. with 11.50 occipito-frontal and 9.50 biparietal. This woman thus had 2 living children after having had 2 dead babies, due to her contracted pelvis.

CASE II. Primipara, age 25, with mitral stenosis and regurgitation and flat pelvis with 9 cm. true conjugate. Labour was induced when the fundus measured 32 and the occipito-frontal as 10.75. This was three weeks before the estimated term. She was delivered after an easy labour of a child weighing 6 lbs. with a 10.75 occipito-frontal diameter and a 9 cm. (as estimated) biparietal. A severe labour would have endangered this patient.

CASE III. Primipara. Flat pelvis. True conjugate 9. Labour induced when the fundus was 34 cm. and the occipito-frontal 11.25 cm. Delivered of a 3100 gram child with an occipito-frontal 11.25 cm. and biparietal 9 cm.

CASE IV. ii-para. First child dead after forceps. Flat pelvis, true conjugate 10. Labour induced at term when she came under observation. Fundus measured 38 cm., estimated occipito-frontal 12 cm. Delivered after a tedious labour of a 4000 gram child, occipito-frontal 12, biparietal 9.75.

CASE V. Coloured primipara. Generally contracted pelvis, true conjugate 9.5 cm. Labour induced when she came under observation. Fundus

38 cm., estimated occipito-frontal 11·75 cm. Delivered by forceps of a 4000 gram child with occipito-frontal 11·75 and biparietal of 9·25 cm.

CASE VI. Primipara. Flat pelvis, true conjugate 8·5 cm. Labour induced when fundus measured 33 cm. and estimated occipito-frontal 11 cm. Delivered by medium forceps of 2925 gram child with 11 cm. occipito-frontal and 8·5 biparietal.

CASE VII. v-para. Three dead babies previously—two craniotomies and one version. Flat pelvis 8·75 cm., fundus 38·5 cm., estimated occipito-frontal 12·5 cm. As it was seen that there was a child too large for the pelvis, Cæsarean section was done and a baby delivered weighing 4100 grams and with occipito-frontal 12·5 cm. and biparietal 10 cm.

CASE VIII. Primipara. Generally contracted pelvis, true conjugate 8·5 cm. Fundus 37 cm. Estimated occipito-frontal 12 cm. Cæsarean, as child was too large. Weight 3750 grams, occipito-frontal 12 cm., biparietal 10 cm.

CASE IX. Primipara. Generally contracted pelvis, true conjugate 9 cm., estimated occipito-frontal 12 cm. Cæsarean, as child was too large—weight 3500 grams. Occipito-frontal 12 cm., biparietal 9·5 cm.

These selected cases give some idea of the course of the measurements. In all, they have been used in 31 cases of contracted pelvis as a basis of treatment; five of these cases were Cæsarean sections in which the measurements were confirmed.

#### TRIAL DESCENT OF THE HEAD INTO THE PELVIS.

In addition to these methods of measurement, an attempt was made to estimate the size of the head in relation to the pelvis. This was done by the Munro-Kerr modification of Müller's method, and consists in attempting to force the head into the pelvis by a grasp above, while the lower hand in the vagina gauges the descent of the cephalic pole. Munro-Kerr's modification consists in holding the thumb above the brim of the pelvis and with the fingers in the vagina.

#### COMBINATION OF METHODS NECESSARY.

By the use of these three methods it is possible to gain a reasonably sure idea as to the size and weight of the child before labour and so to form some idea of when labour should be induced and what the course of treatment should be. It should be remembered that the average-sized child measures 35 cm. fundal measurement, weighs 3,300 grams and has a biparietal diameter of 9·10 cm., and with this as a starting point, the time of induction is easy to reckon for any known pelvis. These figures are based upon my own measurements. My plan is to measure the foetal head and uterine fundus from week to week before labour, and so decide when induction should be done. This should be when the estimated biparietal is a trifle smaller than the true conjugate.

These methods require some experience and some patience. A combination of the methods gives the best results: he who depends

upon one alone will be deluded. The interruption of pregnancy need not be earlier than the amount of contraction requires, and the child need not be exposed to the risks of unnecessary prematurity. It is but seldom advisable to induce labour more than four weeks before term as then the child would be below the minimum weight, 2,500 grams, for good results. A child of this weight has an average biparietal of 8 cm., the lowermost limit set for induction of labour, 8 cm. true conjugate.

Watchful attention and careful measurements in the last weeks of pregnancy avoid the dangers of prolonged pregnancies and large babies because the size and growth of the child is measured and recognized. Induction may then be done in time. Large babies give more trouble in moderately contracted pelvis than does the size of the pelvis itself. All normal-sized babies should be born through a true conjugate of 9.25 cm., equal to the average biparietal diameter, but the big fellows give the trouble. The day will come when a ten-pound baby will become an accusation to the accoucheur instead of a boast to the parents.

The head of a large baby is much firmer, harder, and more difficult to mould than that of a small baby. This alteration in the consistence of the foetal skull of the large child accounts for the trouble it causes even more than does the increase of the diameters of the head. It is this fact that is responsible to a large extent for the success of induction of labour in contracted pelvis of moderate degree.

#### ALTERNATIVE METHODS.

The treatment of contracted pelvis by other methods shows a large mortality. Cæsarean section, the popular operation of the day, is vaunted as being almost without mortality: yet, a collection of 3,000 operations, done under modern aseptic conditions in the last 20 years, shows a mortality for the mothers of 7 per cent. In this I have only included series of 5 or more cases in order that it be sure that the operators have reasonable skill. It is true that the greater part of the mortality comes in cases in which the membranes had ruptured and repeated examinations or attempts at forceps delivery had been made, the so-called "suspect" cases. Thus, in Routh's collection from Great Britain, there was a mortality of 2.9 per cent. in the Cæsarean sections with intact membranes, and 17.3 per cent. in the operation after rupture of the membranes and repeated examinations or attempts at delivery with forceps. While this is true, the gross mortality of the operation must be considered, and it is not fair to pick and choose in regard to the estimation of the mortality.

It is difficult often in reports of Cæsarean sections to arrive at the correct mortality, so concealed are the deaths by excuses of

accident, unavoidable happenings or diseases not due to the operation. The true percentage of mortality in any operation is the total number of deaths following that operation, and it must be so reckoned in order to obtain an exact estimate. Anyone who attempts to dig this out from the labyrinth of confused reports and obscure tergiversations, has my sympathy.

However, in contracted pelves of moderate degree with the very large percentage of spontaneous deliveries, there is no excuse for doing a primary Cæsarean section, save when the child is known to be too large. Thus, Cæsarean sections in the moderate degrees of contraction must be secondary operations because the large percentage of spontaneous deliveries in this class makes it only fair that the woman should be given an opportunity to deliver herself, and thus the delivery, if by section, would share in the larger mortality of secondary operations.

The absolute indication for Cæsarean section should be a true conjugate through which it is not advisable to attempt pelvic delivery. This true conjugate is 7·5 cm. In this class Burger gives 9 per cent. of pelvic deliveries, but the child is so small that there is not a great chance of its survival. With large children, the indication for Cæsarean section may be enlarged; but if the case is seen in the last weeks of pregnancy and before the child has grown too large, induction of labour should always be considered. The ease of its performance deludes surgeons into the belief that Cæsarean section is a simple procedure.

It must be remembered that the mortality among Cæsarean section babies is considerable. In the collection of 3,000 cases, the maternal mortality was 7 per cent., and the immediate foetal mortality 4 per cent., with no record of those dying in the puerperium. In 197 Cæsareans, done in the New York Lying-in Hospital, the maternal mortality was 16 per cent., and the late foetal mortality 18 per cent. So it may be considered that induction of labour in selected cases will give as good results for the child and is very much safer for the mother.

The alternative operation of hebosteotomy (pubiotomy) has still to prove that it is to be a permanent obstetric procedure. Those who are familiar with the literature at the time when the operation of symphysiotomy, now abandoned, was saluted with a chorus of praise as solving all obstetrical problems, will consider the new procedure with scientific caution. Whether pubiotomy is to find a permanent place remains for the future to decide. In any case, it will be an emergency operation of use when the disproportion between the head and the pelvis is found to be unsurmountable after a trial of the spontaneous forces. Its use will be in pelves with a true conjugate of 7·5 to 8·5 cm. It may be used in conjunction with induction in pelves above 8 cm. However, in spite of its

enthusiastic admirers, the report of 664 collected cases by Schläfli makes for caution. The maternal mortality was 4·82 per cent., and the immediate foetal mortality 9·18 per cent. The bladder was injured in 12 per cent. of cases, and in 4·77 per cent. there was permanent incontinence. It is a mutilating operation, and mutilating operations in obstetrics should be avoided upon general principles. However, it will probably be proved eventually that this operation, as an emergency operation, will have a place in the treatment of the class of contracted pelvis which is too small for induction of labour and too large for Cæsarean section, namely pelvis from 7·5 to 8 cm.

#### INDUCTION OF LABOUR.

Induction of labour is done by many methods. The best of these is by the insertion into the uterus of the Champétier de Ribes rubber bag or hystereurynter. This may be conveniently inserted without an anæsthetic save in very nervous primiparæ when a little chloroform may be needed. This, however, after skill is acquired, is the rare exception.

The patient should have a dose of castor oil and ten grains of quinine the evening before induction. A douche of some non-toxic antiseptic which does not coagulate albumen is usually given and the vulva is cleansed and shaved as if for operation. The patient is put across the bed with her legs upon the operator's knees, as he sits in a chair. The cervix is grasped with a volsellum forceps and the os is explored with the finger to see that it will admit the rolled up No. 3 bag (9 cm. long; 7 cm. greatest diam.). The os will usually do so; but, if not, it may readily be dilated with the steel dilators. The rolled-up rubber bag is then passed along the fingers which are used as guides to the uterus and as a speculum by pressing downward and backward upon the perineum. The bag is thrust slowly into the uterus until the greater part has passed the external os. Care should be taken not to rupture the membranes. With the under finger held against the closed bag to prevent its being forced out and the cervix steadied by the volsellum, the forceps on the bag is slowly removed and withdrawn. The bag is then filled with sterile water from a large (8 oz. or more) syringe which has been previously filled. The bag will then slip away from the sustaining finger and pass into the uterus. A sterile lubricant is a useful adjunct and makes the manipulation less painful. The whole procedure may be easily done alone if the operator is skilful in doing three things at once and has a short-handled tenaculum which may be managed with one hand. Some prefer to insert the bag through a Goodell's bivalve speculum, but the fewer instruments in the vagina, the more room.

The danger of the induction is prolapse of the cord or an arm following upon rupture of the membranes. This accident will be

rare if the head is not displaced while the bag is rolled up, but, the bag placed against the head and allowed to raise the head by pressure of the water. In this way, if the head is displaced, the room is immediately taken by the filled bag and the cord cannot come down.

The bag is filled until it is tense which is judged by the finger placed at the os, the tube is tied and protected by a sterile towel. The patient is then allowed to walk around and pray for labour pains.

Labour begins in a very variable time. If the uterus is tense before the bag is inserted, labour often begins within an hour or two, but if the uterus is lax, labour is often delayed and postponed some time. The bag may be pulled upon every half hour or so, but it is not advisable to tie any weight to it. The average time before pains begin is about six hours.

A recent discovery of the specific effect of the extract of the pituitary gland upon uterine contraction promises to be an aid in stimulating labour pains. Stern and other German writers report that pituitrin in hypodermic doses of 0.5 to 1 c.c. and repeated, if necessary, has no bad effects, and has a distinctly stimulating effect upon uterine contractions. I have only used this in a few cases so far, but, from the German reports, it promises to be useful.

Other methods of induction are used by other operators. Various shaped bags have been devised, but none are as satisfactory as that of de Ribes. Those bags depending upon the hydrostatic pressure itself for the dilatation are dangerous. The insertion of a bougie has many advocates. Kroemer, in a report based upon 92 cases, found that birth took place 24 to 48 hours after the bougie and only 15 hours after the de Ribes bag.

The bougie should be kept for cases in first months of pregnancy where labour is induced for systemic disease and a viable foetus not expected. The use of a large bougie or small rectal tube only accentuates the disadvantages of the instrument. v. Herff advises rupture of the membranes alone for induction, and reports good success in 100 cases. The average length of labour was 26½ hours. Contractions began within 12 to 24 hours. Only seven of his 100 women had slight fever; one died from uterine rupture, following version.

#### FURTHER COURSE OF LABOUR.

After the pains have begun and the bag has been expelled into the vagina, it should not be removed too soon as its presence in the vagina seems to excite contractions. The attitude of the obstetrician should be one of expectancy. Forceps delivery should not be attempted until the head is well within the pelvis. The use of forceps to drag the head into the brim and overcome bony resistance is associated with a high foetal mortality. Version, so-called "pro-



phylactic version," is suitable to a very few cases of flat pelvis and, unless done in carefully selected cases, is accompanied by a high foetal mortality. Having induced labour the best thing to do is to wait patiently until the child is born or until some very decided indication for the life of the child requires version or forceps. But expectancy gives the best results. Munro-Kerr, for example, reduced the foetal mortality of forceps in contracted pelvis in his clinic from 27 per cent. to 4 per cent. by making a rule that there must be very decided indication for hastening the delivery.

If these precautions are taken and these rules followed, induction of labour will be found a very satisfactory operation, provided the child may be watched and labour induced at the most auspicious moment. It will be found particularly satisfactory in women who have a tendency to have large children and who have lost their first; but it will, if intelligently advised, be equally useful in primiparæ.

#### CONCLUSION.

Induction of labour is suitable treatment in contracted pelvis of moderate degree provided the size of the baby be estimated by measurements of the uterine fundus and foetal head and by the relation of the foetal head to the pelvis.

Labour may then be induced at the most suitable moment so as to get the largest sized baby that will pass the pelvic strait and avoid unnecessary prematurity. It is essential that cases be examined at least four weeks before the expected labour in order to estimate the proper time for induction.

The lowest limit of pelvic contraction, suitable for treatment by induction of labour, is 8 cm. true conjugate, as this will allow the birth of a 2,500 gram (5½ lb.) baby with an average 8 cm. biparietal diameter. This weight of baby avoids the dangers of unnecessary prematurity and has a mortality but little more than the average. Better results are obtained with pelvis larger than this, but this is the lowest limit.

If the child is measured in all cases by the methods of the author, the dangers of prolonged pregnancy and overweight babies will be avoided, because they will be recognized and may be treated.

Cæsarean section has a mortality in 3,000 cases of 7 per cent. and should be reserved for cases with pelvic contraction through which it is not advisable to have a baby pass (below 8 cm.), or to cases in which the child has already grown too large to pass through the moderately contracted pelvis. In these cases it may be done as a primary operation and the mortality reduced.

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Fig. 1. Author's rule for the duration of pregnancy. The height of the uterus in centimetres divided by  $3\frac{1}{2}$  equals the duration of pregnancy in lunar months.

Fig. 2. Perret's method.

Fig. 3. Author's method of measuring the foetal head before labour.