

A STUDY OF THE CONTOUR ABDOMINAL MEASUREMENT OF PREGNANCY

BY GEO. F. PENDLETON, A.B.; M.D., F.A.C.S., KANSAS CITY, MISSOURI

THE purpose of this paper is to study the contour abdominal measurements of pregnant women in regard to estimating the probable date of labor. I will recapitulate the ideas of the past and eliminate some of their undesirable factors, paying particular attention to the various positions and some abnormalities of pregnancy. To determine the value and possibilities and attempt to decide what method would be best to follow is the ultimate aim.

Ahlfeld, of Leipzig, was the original nineteenth century investigator and first used the tape and pelvimeter. Baume, his associate, studied a frozen longitudinal section of a dead pregnant woman and reported interesting details of fetal length in utero and thickness of maternal abdominal walls in regard to this measurement. Suttigen, of St. Petersburg, confirmed Ahlfeld's observations and conclusions. Through following years Reid, Tramer, Walraf, Tessier, Shatz, Issmer, Spiegelberg, Winckel, Hecker and Buhl, Schroeder, Krönig and Zweifel, Kleinwächter, Pfaunkuch, Karb, Morris, Voorhees, Stone, Ostreil, Blau and Christofolletti, and Reed reported various details concerning the duration of pregnancy and influences causing variations in the length and weight of babies, and the value of the introduction of premature labor. Pawlik, Müller, Schatz, Perret, Munroe-Kerr, Pinard and Stone observed especially details of the fetal head in regard to the maternal pelvis. Most men of the past were particularly desirous of more data concerning a definite relationship between fetal biparietal diameter and the maternal pelvis. McDonald (1906) first placed special emphasis upon the value of tape measurements in forecasting the probable date of labor which Ahlfeld and Suttigen formerly condemned. Reed (1920) popularized this method by advocating the introduction of labor to prevent postmature babies, using the measurements as a guide. Spaulding (1913) presented the first and only real statistical study of value from which he evolved a working rule more complicated than that of McDonald.

McDonald measures with a tape "from the upper edge of the symphysis over the abdominal contour to the highest point of the fundus save at the last dip where the tape continues to the ensiform (multipara with relaxed abdominal walls should be supported on the sides to make the occipital coccygeal axis of the fetus in the long axis of the body)." Spaulding measures "from the upper edge of the symphysis over the abdomen with the distal tape finally resting on the ensiform cartilage, being watchful that the uterus is at rest, of careful measuring, skill in estimating the degree of settling and thickness of abdominal walls and elimination of multiparity and hydramnios conditions." In both methods the height of the fundus above the symphysis is recorded from the tape.

From the past investigations let us record certain fundamental facts. Until 1905 all investigations condemned the method as very unreliable and inaccurate. The fetus has a natural position in utero, i.e., bending its head and crossing the arms over its breast with the bended knees brought forward up toward the abdomen and the spine

ORPLate Less Than 2 Wks

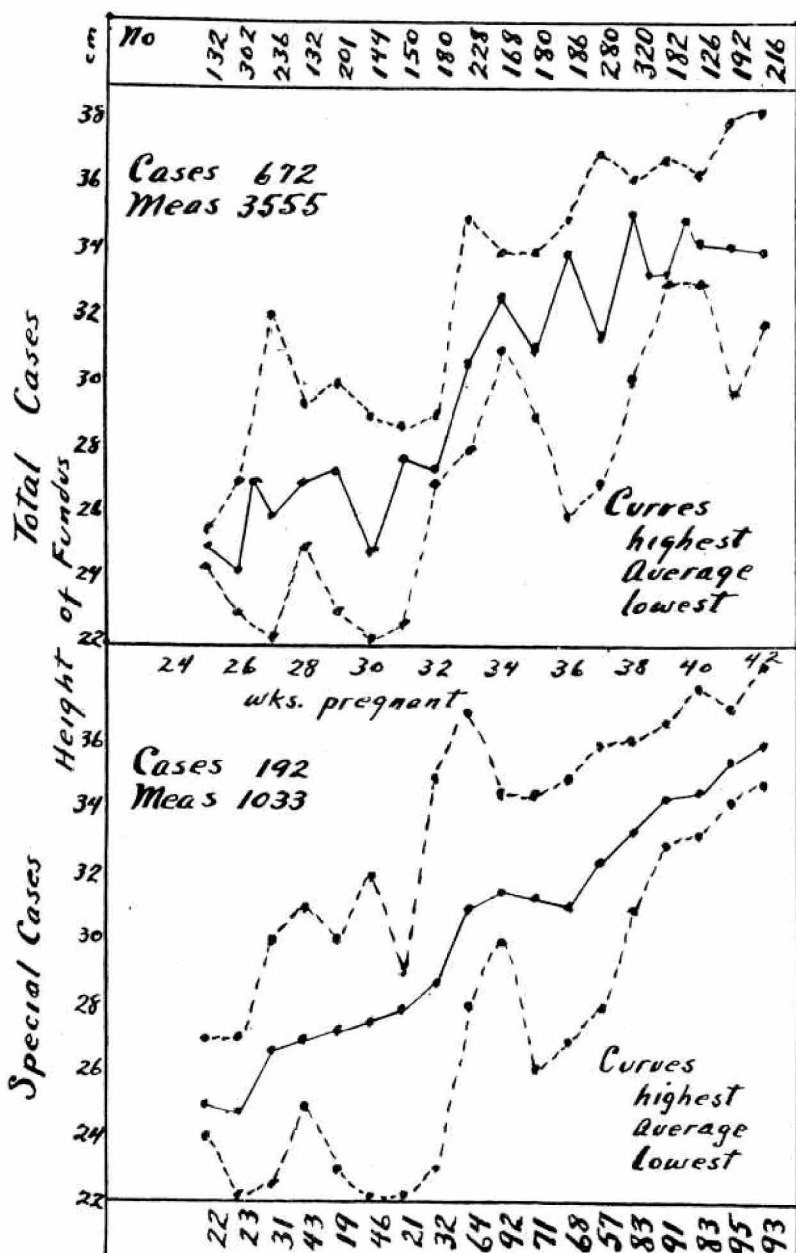


Chart I.—O.R.P. Late. Highest and lowest curves fluctuate less widely in late pregnancy but still are very far apart and their mean difference is the same in both classes. Average curve improves in special cases where it remains closer to the low curve. Therefore, in Chart I, measurements in early pregnancy are very unreliable with possibility of great error until the thirty-eighth week, regardless of the careful expurgations as in special cases. My observations have been that this position is very unreliable the reason for which I have attributed to flexion of fetal head and spine. Certainly no great operative procedure is justified because of an enlarged O.R.P., late McDonald.

flexed so that it represents an egg-shaped outline. Its position determines the shape of the uterus rather than the uterus causing fetal position. The length of the fetus is the surest indication of its age in gestation and equals twice the interuterine axis. Growth of the uterus increases gradually between the twenty-fourth and fortieth week of pregnancy. This fact is denied vigorously by Spaulding who declares that the rate of growth decreases as the weeks of pregnancy increase. Height of the fundus depends on the fetal occipital coccygeal diameter and at term approximates 35 cm. This height varies with the contraction of uterine muscle and oblique measurements. When at rest on the back the uterus rarely descends in ten lunar months of pregnancy. The convexity of the fundus is not constant. Abdominal measurements vary with certain influences, such as thick abdominal walls, full bladders, contracted pelves, lightening, hydramnios and multiple pregnancy. McDonald formulated the rule: "Divide height of fundus in centimeters by $3\frac{1}{2}$ to obtain the lunar month of pregnancy" which he claims is very accurate after six months gestation and more accurate under 35 cm. than above it, but Spaulding maintains it is close to Nagel's rule only during the last four to six weeks. Spaulding presented a more complicated rule as follows: To obtain the week of pregnancy

When 22 to 26 cm., add 2 to height of fundus in centimeters

When 26 to 30 cm., add 3 to height of fundus in centimeters

When 30 to 32 cm., add 4 to height of fundus in centimeters

When from 32 cm. on, add 5 to height of fundus in centimeters

He concludes that "abdominal measurements are of value in estimating the degree of maturity of the unborn child and the probable week of pregnancy can be determined by careful measurements, being especially good for those who go overtime." The impetus for this present investigation lies in the fact that few men have publicly declared the value of this measurement and only one of these offers statistical observations; yet these few men differ upon one important fact, i.e., the rate of growth of the uterus during the latter part of pregnancy, a fact which is vital in estimating the probable date of labor.

The value of this measurement centers upon its dependability. If reasonably accurate it would be another check to aid in forecasting the probable date of labor since conception occurs in the pre- and post-menstrual cycle and Nagel's rule (counting back three months and adding seven days) naturally varies accordingly. The following statistics have proved that Nagel's rule in 5198 cases was correct within two weeks in 87 per cent, in one week 81 per cent, and absolutely correct in 19 per cent. The height of the navel above the symphysis varied from 12 to 20 cm. in 2000 cases and from 12 to 23

em. in my 1200 cases. The ensiform notch varies in proportion from the symphysis and depends too upon the flexion of the maternal vertebral column. Quickening varies somewhat with the degree of

O.L.P. Late Less Than 2 Wks

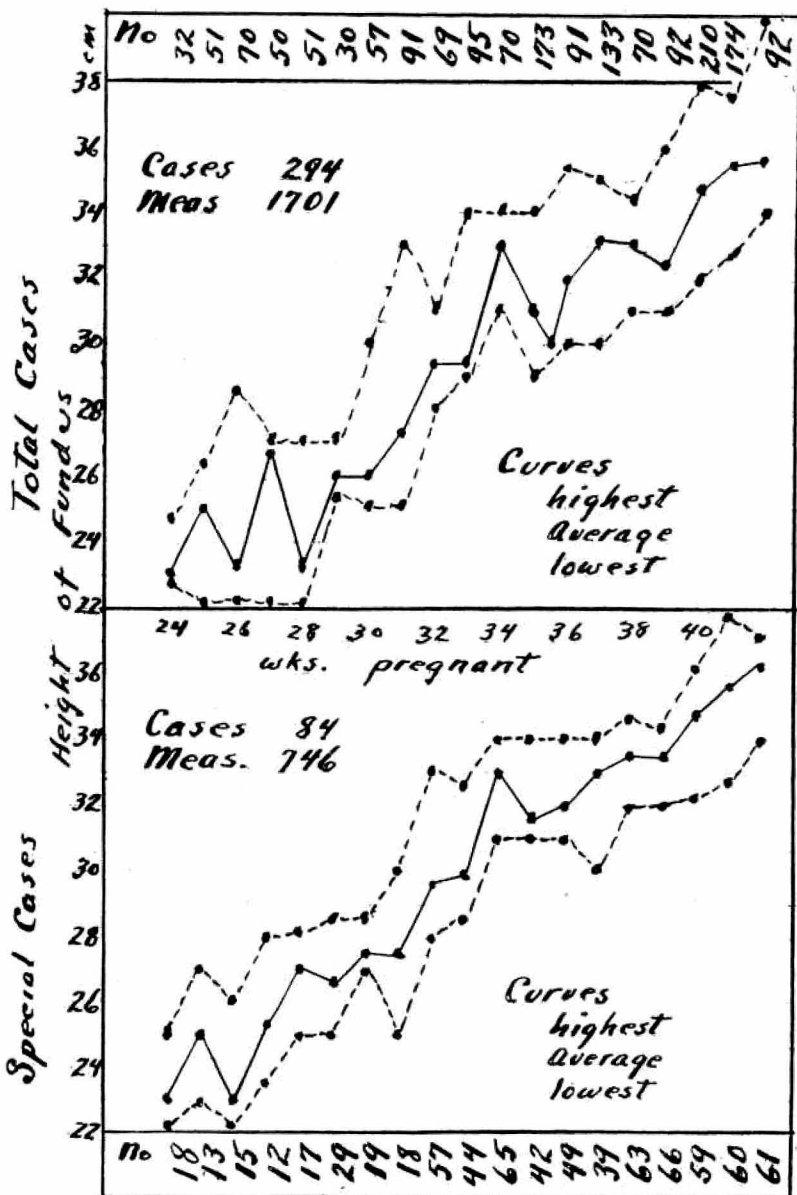


Chart II.—In O.L.P. Late. The special high and low curves have less fluctuation and remain closer to the average line, and their difference improves as pregnancy advances. The average curve fluctuates out of unison with high and low curves, meaning irregularities in measurements are common even in special cases. Before the thirty-sixth week under measurements predominate, after which over ones are more numerous. This chart might be classified as reasonably accurate.

sensitiveness of the individual nervous organism. At present in fact we have no real accurate method of determining the probable date of labor. Such a method would be a balm to the nervous and especially the greatly concerned, unexperienced, first-time pregnant woman and satisfy the frequent queries, "Am I too large?" "Am I all right?" We could truthfully advise the stranger whether she dared travel to her own home. Forgotten dates of last menstruation and quickening would not leave us so stranded as we are today and the confidence of our patients as well as better psychologic control would result. We could foretell and prevent oversized babies as well as those not infrequent postmature pregnancies with their accompanying hard labors and often permanent maternal morbidity and possibly fetal mortality. Borderline cesarean and version cases could often be treated by bag induction since the biparietal diameter of the fetus could be indirectly calculated from the estimated fetal length and checked against the Perret measurement. Legally the age of the fetus in utero might become of value. Abnormalities could be suspected and the obstetrician forewarned against misplaced positions, multiparity, extended head, or ovarian, uterine, and pelvic tumors. Lastly, for those who recognize the religious power of Rome and require rigid assurance of fetal viability, such a measurement if dependable would be of great value in the protection of baby mortality in early gestation where mothers are perhaps in the extremes of toxemia, nephritis, cardiac decompensation, typhoid, diabetes or chorea, etc.

In reviewing former observations certain weak spots become evident. The biologic factor of error has been increased through the use of measurements by a variety of different men in different clinics. McDonald lacks well recorded statistics. Spaulding lacks individual observations thereby increasing his factor of error. No study of the various common fetal positions has been presented nor has a method of estimating the result of fetal engagement been devised. Very few abnormalities have been emphasized and little attention paid to uterine contractions and their influence. In general, presented observations are comparatively small in number, Spaulding using 100 to 400, Ahlfeld 250, Suttigen 409, while McDonald lacks statistics. The present rules vary with the different weeks in pregnancy and are not very accurate. The lack of one large mass of material measured and observed by one individual, the small attention to various common normal positions and meager statistics are the outstanding defects in the present literature.

With the foregoing details in mind the following presentation has been studied with special stress upon the defects to date. From 1917 to 1924 I have collected a large mass of material in and around the regions of Kansas City which is presented in Table I, and totals 5500 cases with 22,500 measurements. One thousand three hundred two

O.L.A. Late Less Than 2 Wks

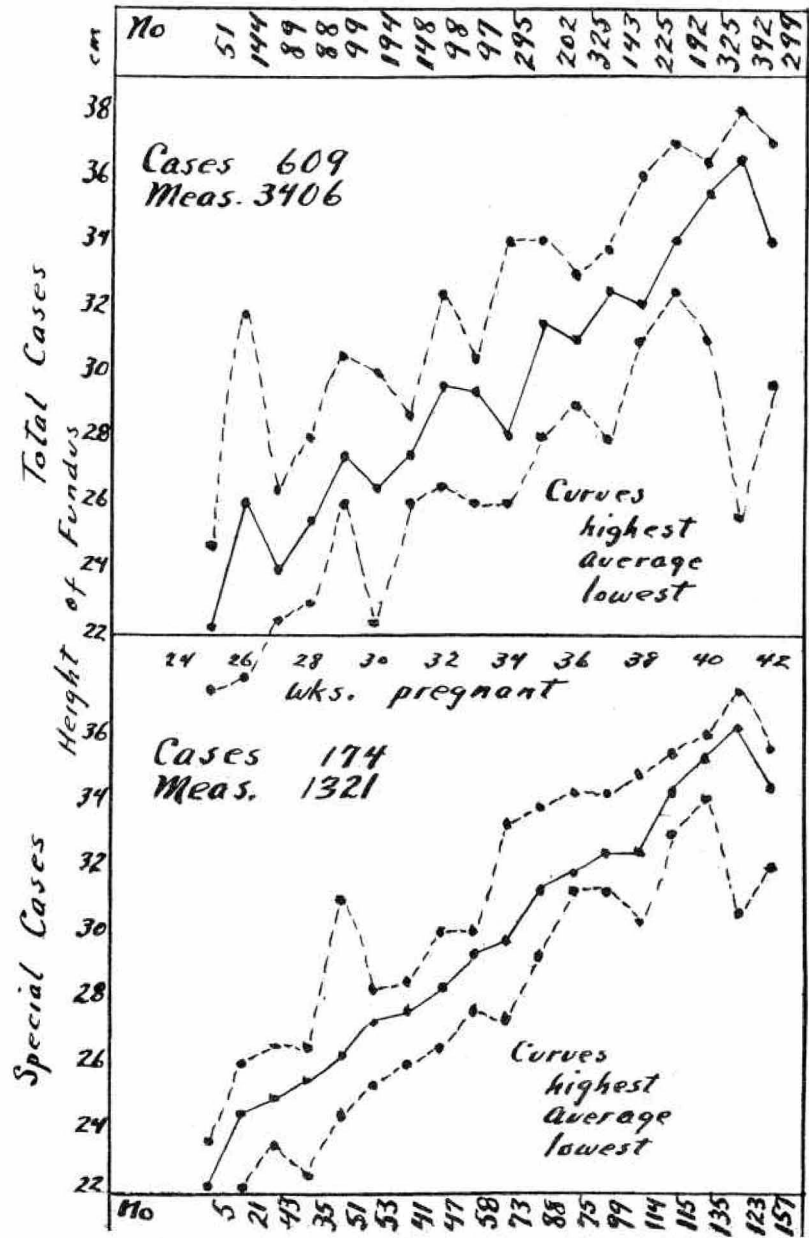


Chart III.—O.L.A. Late. Special cases show even high and low curves, closer together, steady throughout twenty-fourth to fortieth week, fluctuating in common with the average which is close to the center line. This chart is more reliable, less liable to erratic results and increases in value in special cases. The drop in the forty-first week not due to lightening probably results from increased Braxton Hicks contractions during that week which I have noticed often seem unusually strong.

cases totalling 2,832 measurements have been expurgated as representing gross mistakes through abnormalities or cases not paralleling Nagel's rule close enough for study. The remaining 4,198 cases with their 19,666 measurements all came within two weeks of the expected time according to Nagel's rule. Not included in this material are 1,209 cases with 7,268 measurements comprising private work and cases kindly loaned to me for study. These measurements were all made and their menstrual dates personally verified by me. It is my intention to compare these two classes of material thereby checking the work of the past on a larger scale than heretofore, as well as presenting a number of personally observed cases with a constant biologic factor of error in measuring reduced to one. Hereafter the two classes of material will be designated as "total cases" and "special cases." All material has been classified into the routine vertex positions, breech, twins, and cesarean. Where the material was sufficient, cases coming within two weeks of Nagel's rule were classified as early or late signifying whether they occurred before or after the standard predicted time of labor. In all cases certain factors of error have been eliminated where possible, the special cases being much more refined than the general material. Measurements vary with the individual performing them and his knowledge of the exact rules laid down by McDonald and Spaulding whose methods result practically the same. Too many read the tape first and fit it to the contour of the abdomen. One or 2 cm. error in reading have not been uncommon in my experience with other men. Measurements becoming smaller after a cathartic have been refused. Pendulous abdomen or much abdominal fat have so seriously upset calculations as to be laughable. Measurements smaller than those in the preceding two weeks have been eliminated as well as each following it.

Tumors of the ovary or uterus, much tympanites, hematoma of the broad ligament, full bladder, full rectum and ascites have in my experience completely upset scientific control. No contracted pelvis is included. All uterine suspensions which have been observed to produce shorter babies were not considered. No contracted uterus which occasionally varied 2 to 5 cm. or a uterus at rest during labor which has varied 2 to 8 cm. was retained. Hydramnios which McDonald insists caused no trouble, in my hands has changed science to the ridiculous. Poor presentations gave wretched measurements. Floating heads were pushed to the pubes or refused. Lightning which was very unusual was always carefully eliminated, often checked by rectal examination and attempts at skill in estimating this degree of settling were referred to a chart of its own. Where possible, extension of fetal head or fetal spine was eliminated but no doubt severe errors of this nature may be included due to the impossibility of the

O.R.A. Late Less Than 2 Wks.

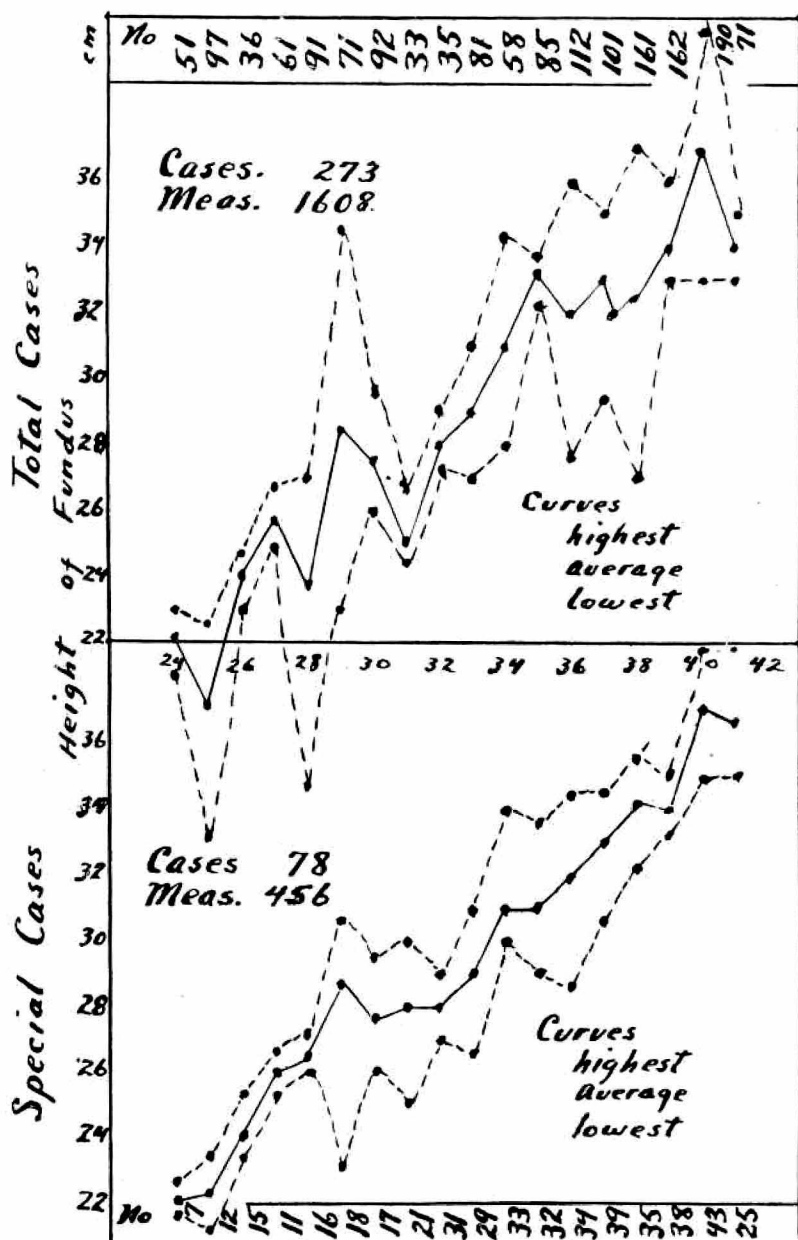


Chart IV.—O.R.A. Late. Presents special curves with less fluctuation and nearer the average in the center line throughout, which signifies a reliable curve with less chance of error, yet no better than O.L.A. or O.L.P., late curves.

Of the positions coming late O.L.A. and O.L.P. are most reliable. O.R.P. is almost hopeless. Curves in special material clearly show the value of careful elimination.

necessary diagnosis. It is my postulation that many of the posterior vertex position present such conditions and the uterus depending on the outline of the fetus compensates accordingly. An occiput impinging on posterior obstruction causing partial extension of the head might account for the large variability found in posterior vertex estimations. Weak abdominal walls were always supported to present the fetus in the uterine axis and the center line of the mother. Lastly all cases were required to start into labor without any method of induction and came within two weeks of Nagel's prescribed rule.

Notice, in Table I, the close similarity between the number of early and late cases for each vertex position with the exception of O. L. A., conditions where the earliest predominate and the difference in each set of cases is exactly the same, i.e., 13.8 per cent. In the charts the ordinates represent the height of the fundus. The abscissae represent the weeks of pregnancy by Nagel's rule. The curves represent the highest, lowest, and average measurements while the cases used and the number of measurements are recorded on each individual chart. These chart curves show certain facts in common as follows:

1. Curves begin at the twenty-fourth week of pregnancy from which this particular study has been made so as to closely follow observations done in the past.
2. Most of the curves give one the impression that errors still exist even in special cases.
3. As weeks pregnant advance height of fundus increases more or less irregularly.
4. The average curve in special cases always assumes less irregularity in its ascension due to elimination of outside disturbing factors hitherto discussed.
5. Special cases have less irregular and closer high and low curves.
6. High and low curves approximate within 6 cm. in general material and 4 cm. in special cases.
7. As pregnancy increases high and low curves become more regular and closer to the average in special cases than in general cases, i. e., in late pregnancy measurements are probably more stabilized and less liable to extreme fluctuation.
8. Early curves are more irregular than in late pregnancy which is probably explained by the difficulty of diagnosing the position of the fetus during the early weeks of pregnancy when the fetal heart and fetal movements are the only guides to that position. In this series of cases when the fetal heart was found outside the imaginary vertical line bisecting the distance between the symphysis and the anterior superior spine it was classified as a posterior position, or when motion was felt inside that line it was called a posterior position.
9. Special cases are always more reliable than their corresponding total case chart.

Table I is a complete summary of early and late material in the various positions with the number of cases and measurements used. Following this is a detailed comparison of the rules of Nagel, McDonald, Spaulding and my own with the number of measurements predicting labor within two weeks and within one week. These calculations are then reproduced in percentage. Special cases with their careful expurgations develop into much better results. My rule is better by 5 per cent in two weeks and 10 per cent in one week pre-

TABLE I
PREDICTION OF TIME OF LABOR
COMPARISON NAGEL'S RULE, McDONALD, SPAULDING AND MY RULE

POSITION	CASES	MEAS.	PREDICTED TO 2 WEEKS				PREDICTED TO 1 WEEK				PER CENT TO 2 WEEKS				PER CENT TO 1 WEEK			
Total Cases			Nagel	McD.	Sp.	My.	Nagel	McD.	Sp.	My.	Nagel	McD.	Sp.	My.	Nagel	McD.	Sp.	My.
O. R. P. Early	581	1432	1432	878	812	888	1031	717	698	721	100	61.3	56.7	62.	72.0	50.7	48.7	50.4
Late	672	3555	3555	2212	2192	2376	2737	2001	1991	2172	100	62.2	61.7	67.	77.9	56.3	56.	61.6
O. L. P. Early	301	1626	1626	1071	906	1084	1226	912	816	931	100	65.8	55.7	66.6	75.4	56.1	50.2	57.2
Late	294	1701	1701	1072	1001	1074	1070	819	799	826	100	62.5	58.	63.5	62.8	48.	46.6	48.5
O. R. A. Early	252	1422	1422	892	891	948	1077	791	782	802	100	61.9	61.9	66.8	75.5	54.8	54.3	55.6
Late	273	1608	1608	1071	989	1072	1396	921	903	942	100	63.7	58.9	63.7	86.8	57.	56.9	58.3
O. L. A. Early	805	2812	2812	1792	1718	1868	2110	1592	1521	1623	100	63.6	61.8	68.8	75.1	56.6	54.	57.6
Late	609	3405	3405	2261	2167	2270	3007	1961	1905	1969	100	66.7	63.7	66.6	88.3	57.5	55.8	57.6
Breech	231	1105	1105	159	114	171	594	83	76	88	100	14.4	13.	15.5	53.7	7.5	6.9	7.9
Twins	91	580	580	0	0	0	427	0	0	0	100	13.5	0	0	73.6	11.6	0	0
Cesarean	89	420	420	279	258	280	298	172	170	183	100	66.8	61.5	66.9	70.9	42.	41.	43.6
Total	4198	19666	19266	11687	11048	12031	14973	9949	9661	10257		54.8	55.3	60.7	81.0	50.0	47.0	52.8
Special Cases																		
O. R. P. Early	166	831	831	572	495	676	640	554	326	610	100	68.7	59.6	81.	77.	66.7	39.2	73.5
Late	192	1033	1033	922	901	925	660	832	618	860	100	89.3	87.5	89.2	63.8	80.6	60.1	81.4
O. L. P. Early	86	473	473	462	282	465	319	428	324	431	100	97.5	69.5	98.4	67.6	90.7	60.2	91.
Late	84	746	746	601	447	621	551	458	440	618	100	80.6	60.	83.3	73.9	61.4	59.1	82.8
O. R. A. Early	72	515	515	413	311	430	407	400	301	402	100	80.3	60.7	83.6	79.1	77.7	58.7	78.1
Late	78	456	456	356	273	380	374	318	252	328	100	78.1	59.9	83.4	82.	69.9	55.3	71.9
O. L. A. Early	230	1128	1128	1101	862	1108	980	752	675	940	100	98.1	67.3	98.2	86.1	56.7	59.9	83.5
Late	174	1321	1321	1112	1022	1301	1040	881	792	1100	100	84.2	75.9	98.6	78.7	66.8	59.9	83.4
Breech	66	391	391	46	32	49	312	26	22	27	100	11.8	8.2	13.5	79.9	6.65	5.63	6.91
Twins	26	198	198	0	0	0	130	0	0	0	100	0	0	0	65.4	0	0	0
Cesarean	35	176	176	116	165	146	106	65	65	67		75.5	64.3	81.2	60.3	38.3	36.9	38.1
Total	1209	7268	7268	5701	4790	6098	5519	4714	3815	5383		75.5	64.3	81.2	81.5	61.5	5.95	68.9

O.R.P. Early Less Than 2 Wks

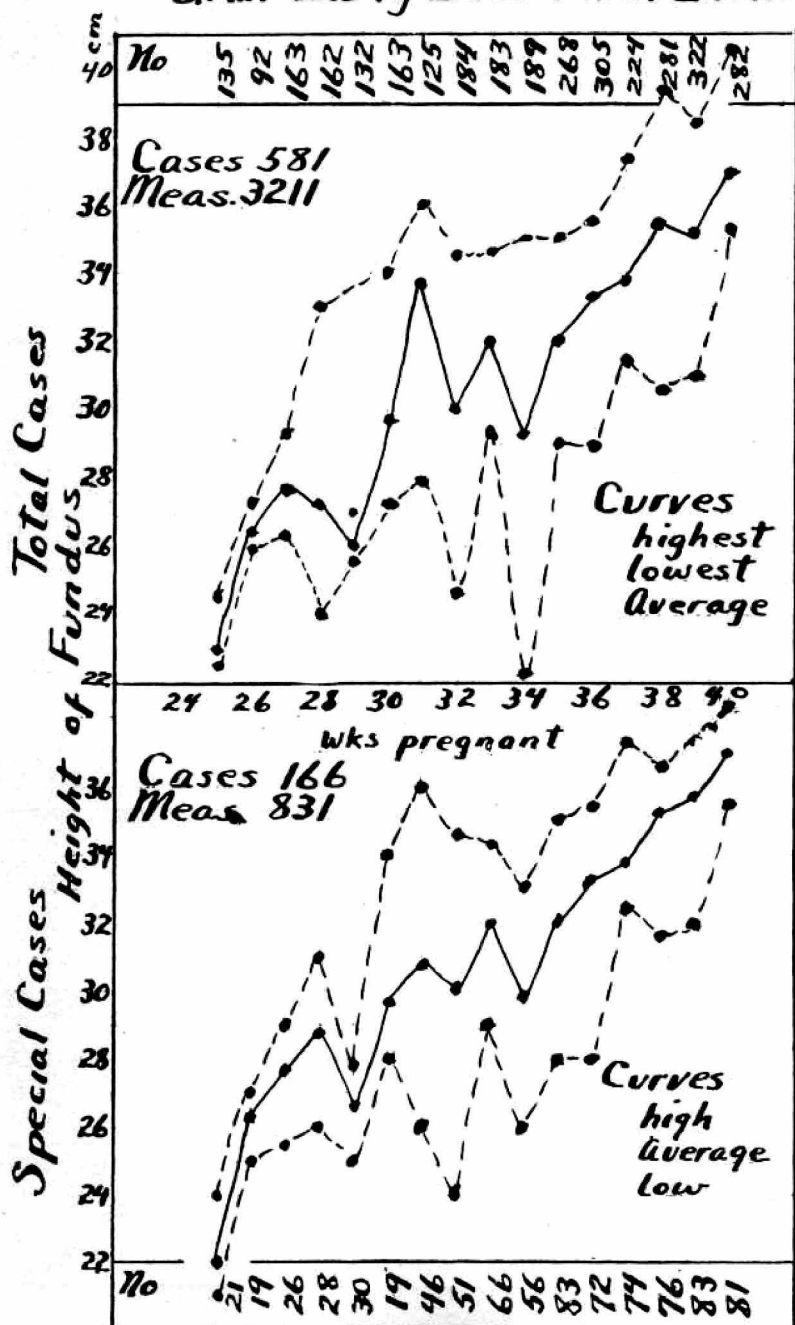


Chart V.—O.R.P. Early. Curves oscillate widely with the high and low far from the average which remains closely in the center line. The mean curves become more steady after the thirty-fourth week but the chart still remains very unreliable regardless of expurgations. Certainly no operative procedure should be considered when the McDonald measurement is the deciding factor.

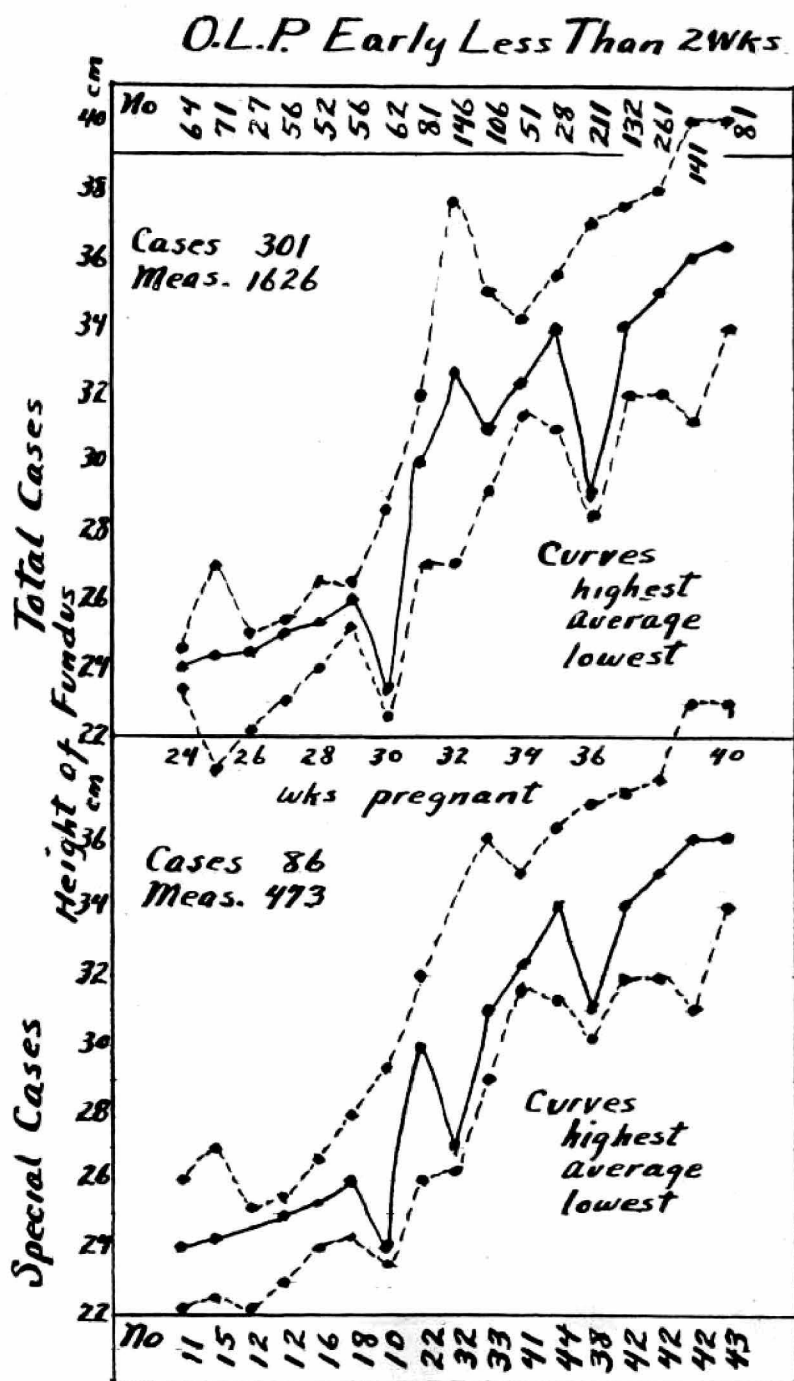


Chart VI.—O.L.P. Early. Presents an average curve closer to the low, fluctuating more widely than the high and low. This chart is more reliable than O.R.P. early with more measurements under than over the average. Even the special case chart fluctuates too widely to be a deciding factor for any operative procedure.

O.L.A. Early Less Than 2 Wks

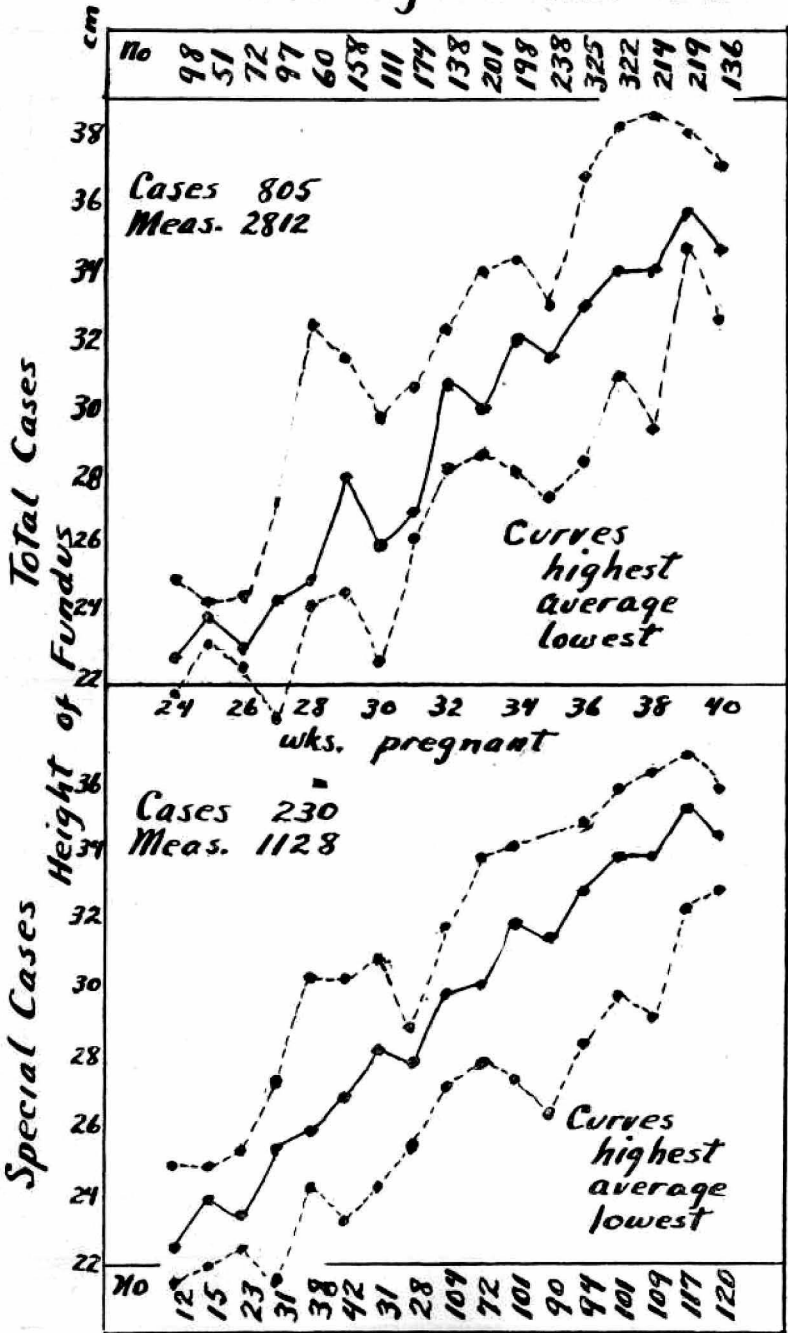


Chart VII.—O.L.A. Early. Curves are reasonably straight with most measurements closer to the high until the thirty-third week. This is a reliable chart with more numerous measurements slightly over the average.

O.R.A. Early Less Than 2 Wks.

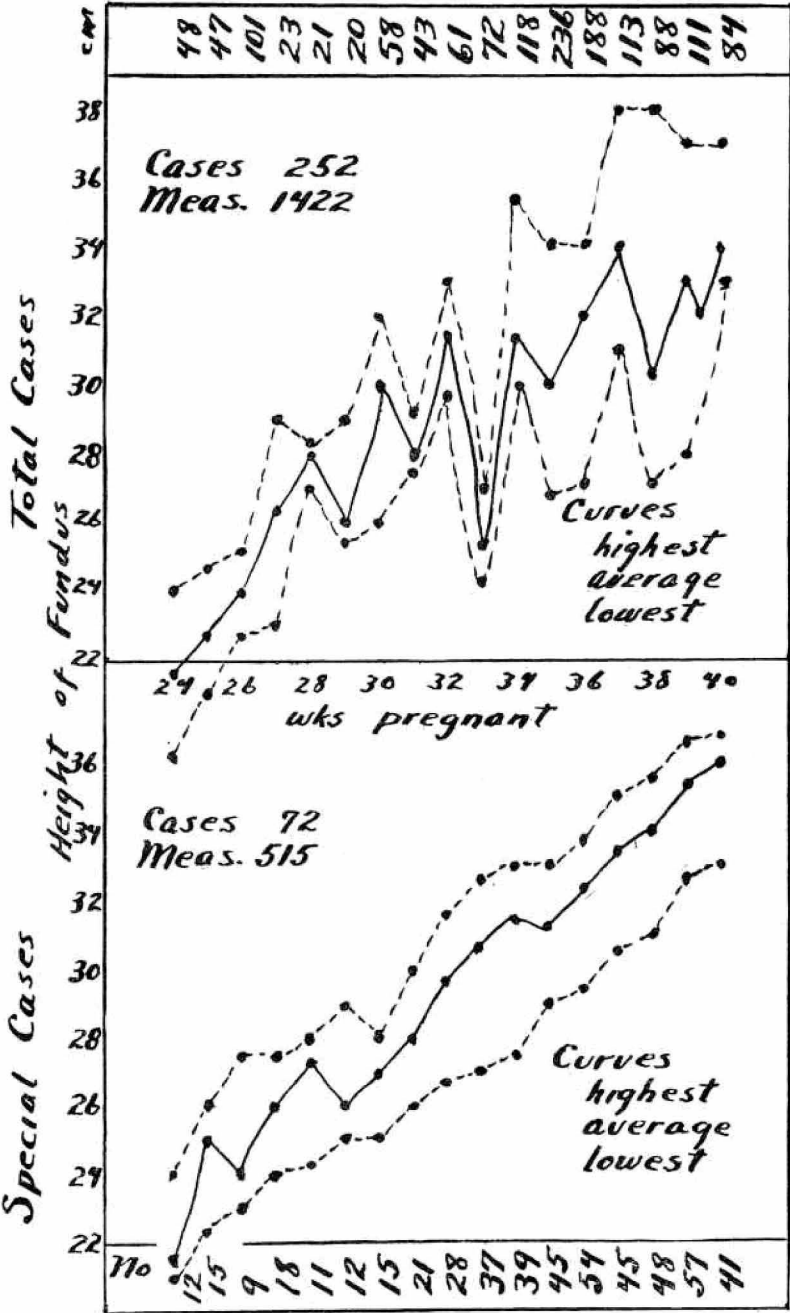


Chart VIII.—O.R.A. Early. Offers reliable high and low curves close together with the average closer to the low. It is very reliable and more apt to have a single measurement slightly below the average.
In the late positions the occiput anteriors are the most reliable and the O.R.P. can be classed as hopeless for our purpose.

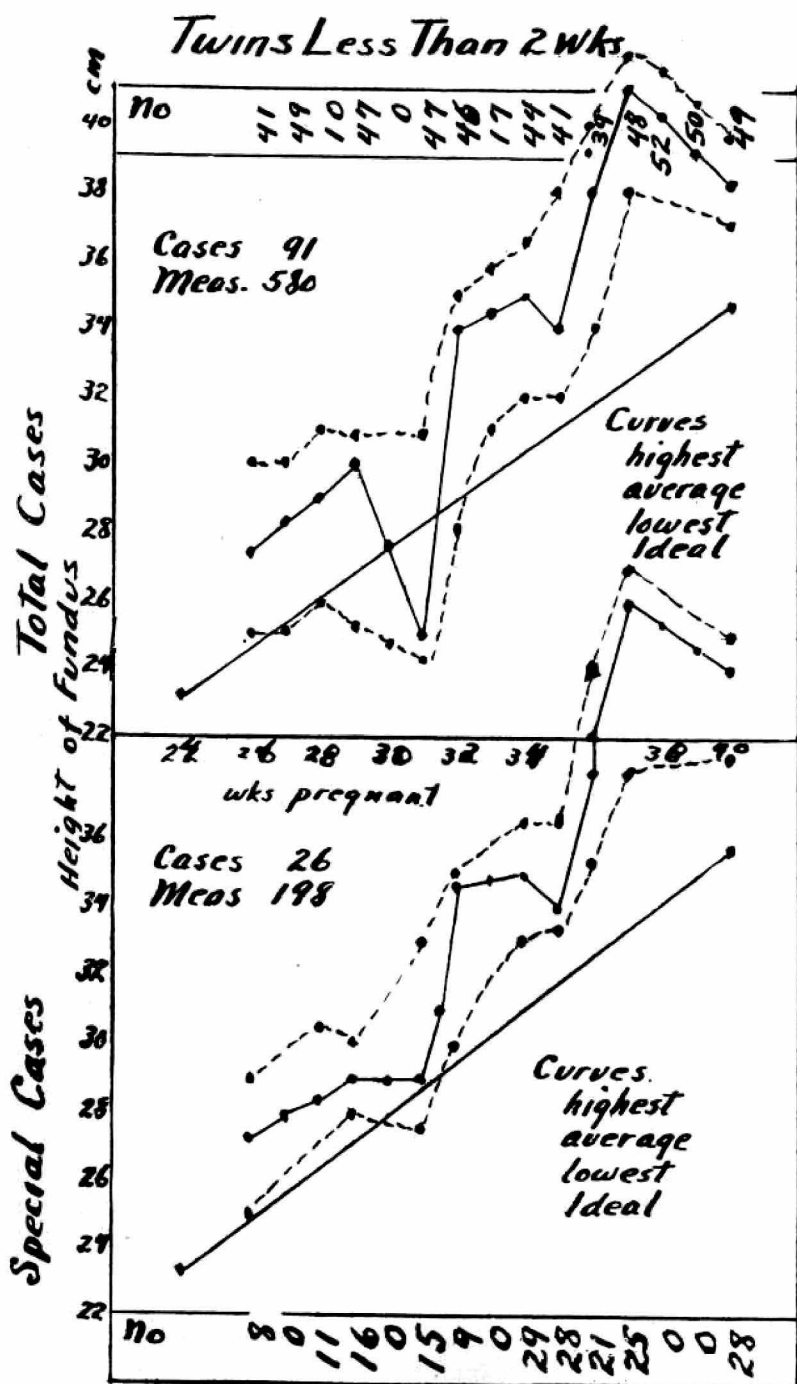


Chart IX.—Twins are all presented in one chart because of a small number. The irregular average curve ascends more sharply than vertex positions, while the high and low curves are reasonably uniform.

Twin measurements evidently vary widely without great uniformity. Their measurements are far above those of the vertex positions and should follow some rule of their own. They are presented here only as an illustration proving that multiparity should be eliminated from our predictions of the time of labor.

Breech Within 2 Wks.

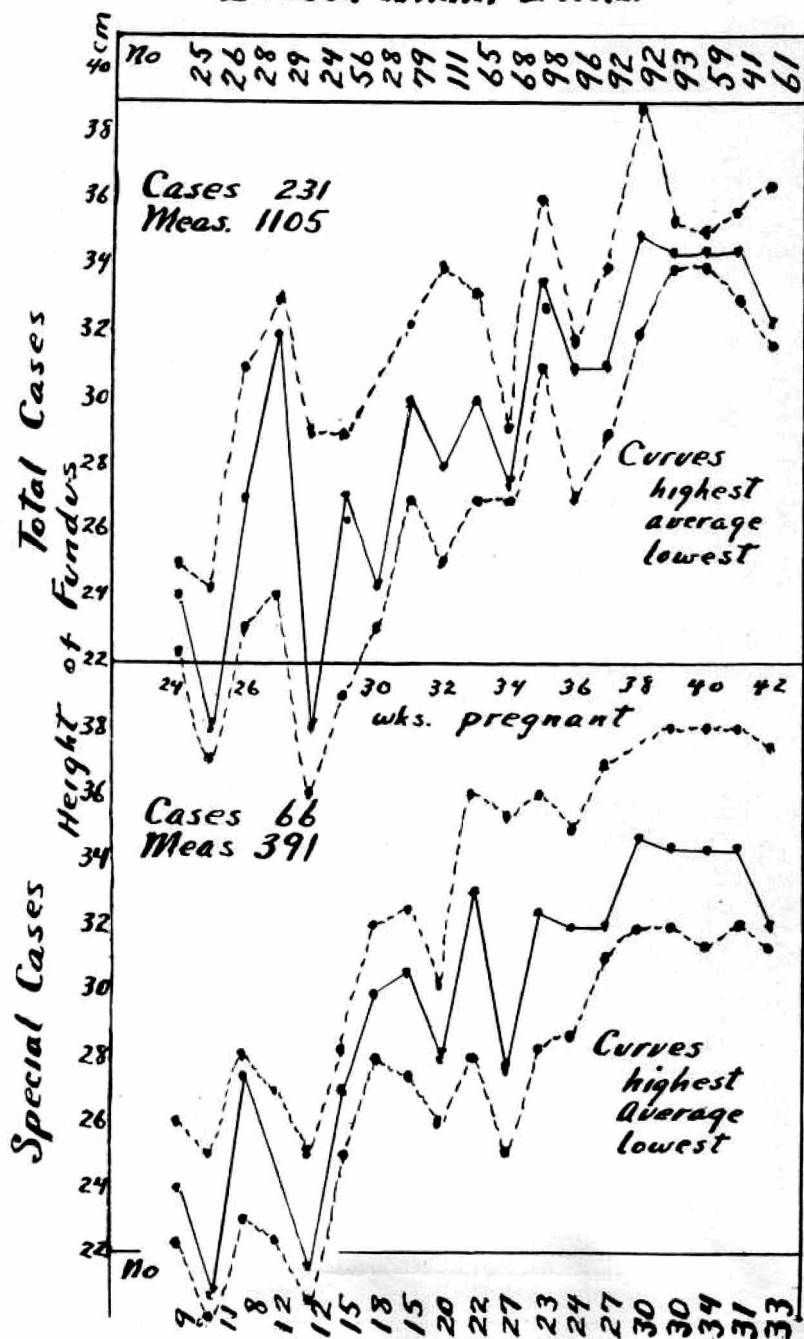


Chart X.—Breech curves are so irregular and fluctuate so widely that practical use of them does not seem fair to science. Such measurements are of no value even with careful elimination of material.

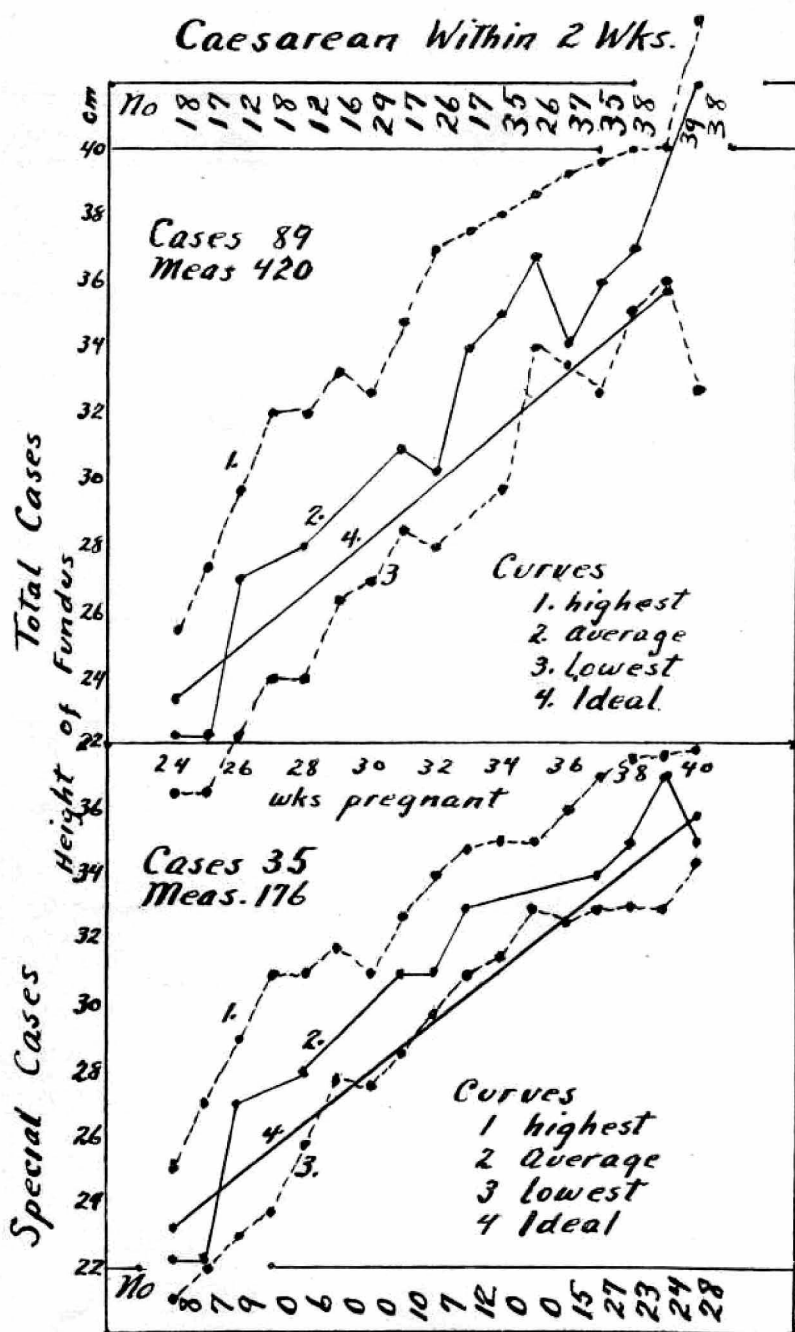


Chart XI.—Caesarean charts consist of all cases without engagement and were so studied for other purposes and include contracted pelvis cases as well as toxemias. The curves are orderly and the average is fairly straight, being somewhat over my ideal curve and reminds me of Spaulding's curve. This curve is too much over my ideal average to be of value, since this material was not carefully expurgated of the usual factors of error and the curve is somewhat like that of Spaulding's. I doubt whether he really used the same extreme care in his measurements.

dictions of labor and all rules are inferior to that of Nagel. Breech and twin measurements are of no value. Leftsided vertex positions are evidently most reliable and all can predict within 70 per cent of the time. With predictions of labor within one week my rule is almost as valuable as that of Nagel which is the only place wherein these two rules can be compared.

SUMMARY

McDonald first publicly declared the value of this measurement and justly deserves its name. Spaulding published the only real

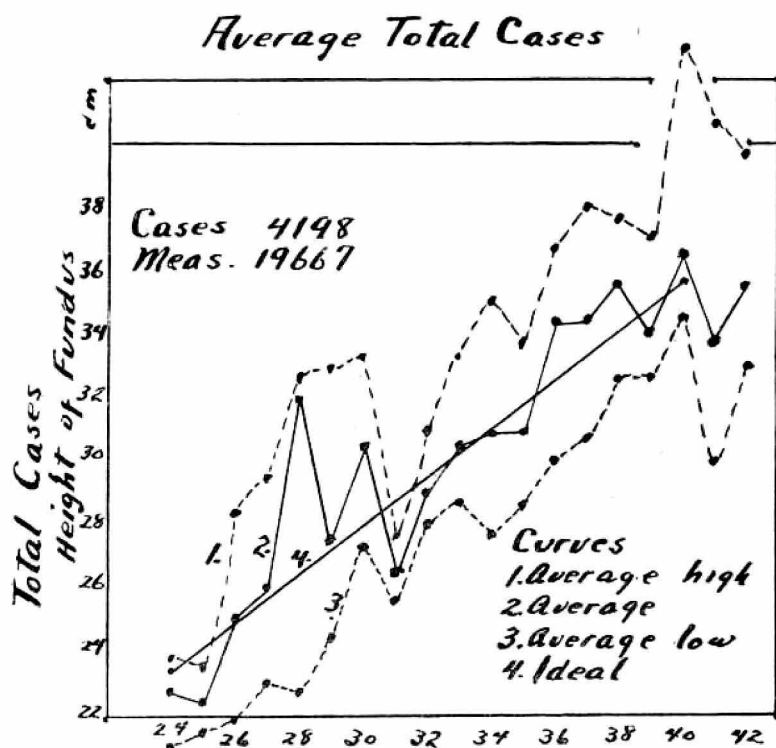


Chart XII.—The average chart of all cases is disappointing with very irregular curves up to the thirty-first week and still fluctuating badly thereafter. It represents many measurements by a variety of observers without more than ordinary care in eliminating undesirable factors. This chart is of no value except as a comparison with other charts.

statistical study. Their methods of measuring were practically the same and are followed by mine.

The normal vertex positions, breeches, twins, and a conglomerate mass classified as cesarean sections are used in this study. Breech and multiparity presented very unreliable measurements and were considered hopeless. Cesarean cases were offered to disprove Spaulding's declaration that the uterus has a changing rate of growth during pregnancy. The normal vertex positions gave fairly accurate results,

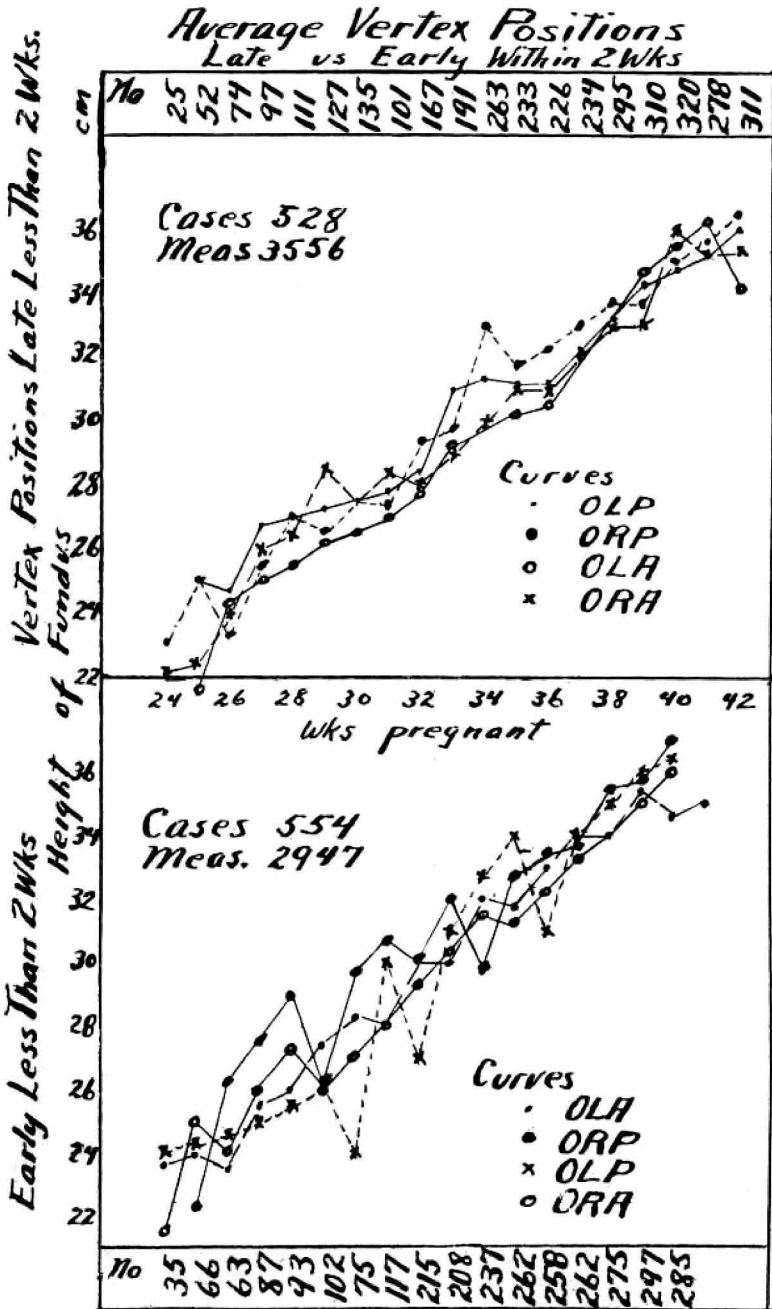


Chart XIII.—Interposed average curves of the early and late vertex positions of the special cases approximate closely. The average of these presents steady reliable curves with the early one predominating over the late curve as one would naturally expect.

Special Cases Average

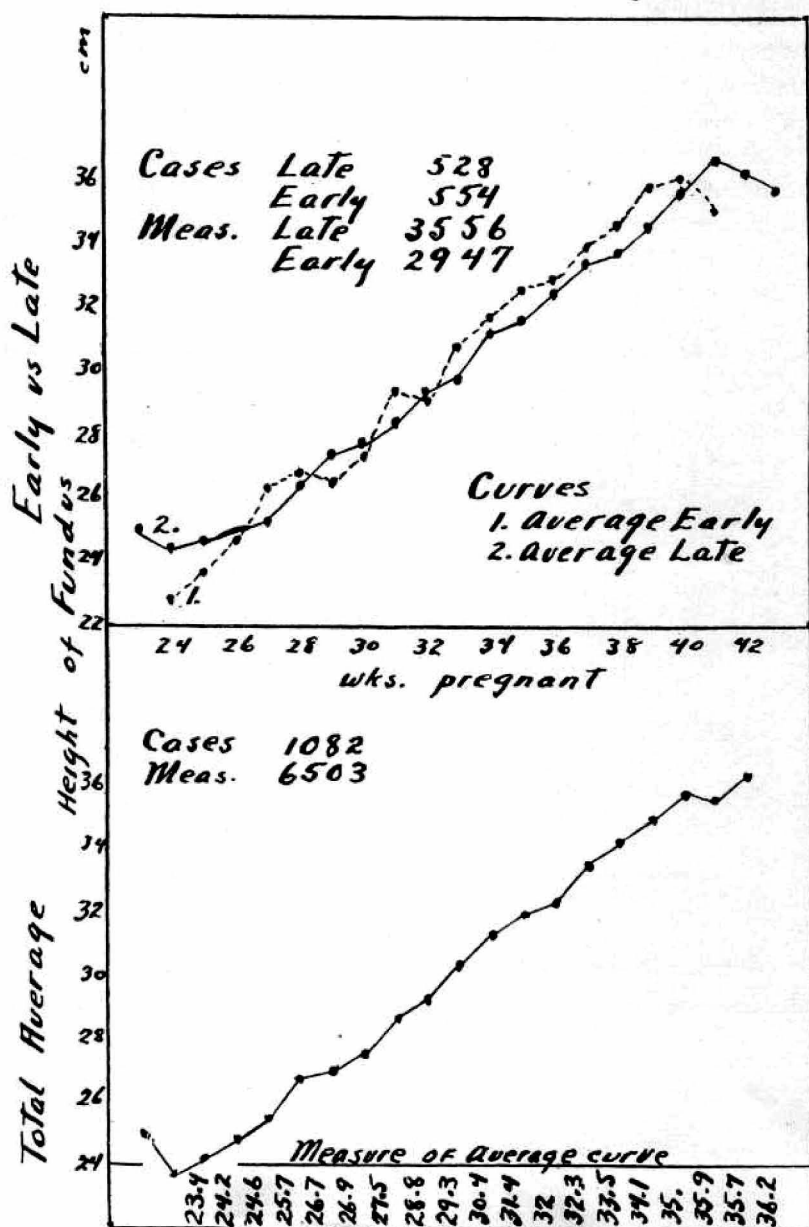


Chart XIV.—The general average has been calculated from the average curves of all the vertex positions wherein the number of cases in the early classification are about equal in number with those in the late and the resultant average is very close to a straight line.

the left side being more reliable than the right, and anterior positions were better than posterior ones. The latter allow the greatest variability and are therefore the least reliable. They fluctuate enough to be called too dangerous for use.

Abnormalities such as full bladder, full rectum, pelvic tumors, hydramnios, breech, multiparity, cord about the neck, abdominal adiposity, ascites, extension of fetal head or spine, all tend to cause oversize measurements, while careless measuring, lightening uterine contractions and uterine suspensions present shorter ones.

At present there is great error in predicting the probable date of

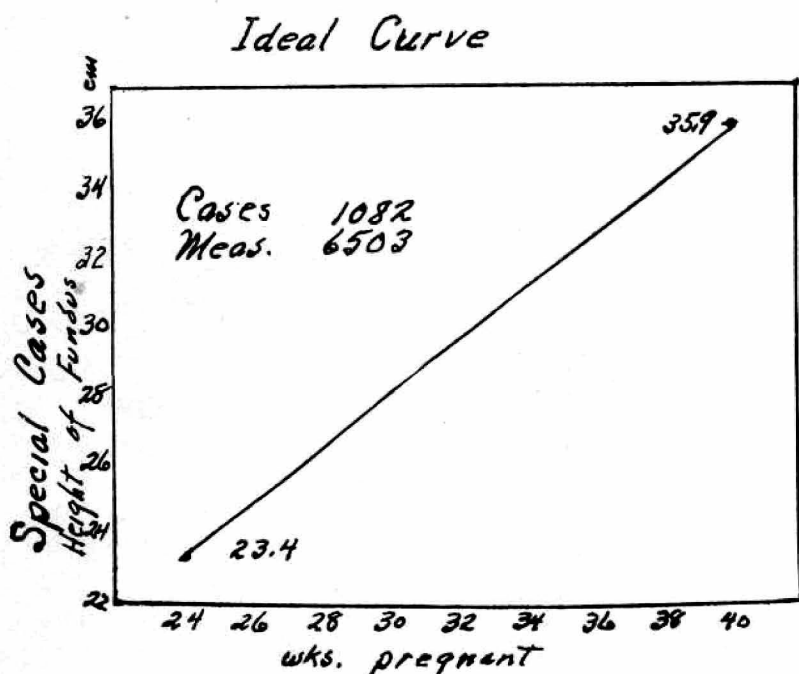


Chart XV.—I therefore present a straight line as nature's probable ideal curve, ascending from 23.4 cm. in the twenty-fourth week to 35.9 at the fortieth week with a definite regular rate of growth which has been so strongly denied by Spaulding.

labor. Nagel's rule missed 13 to 24 per cent. Height of navel from the symphysis varied 10 cm. in different women. Lightening with engagement is unusual and will not predict its proverbial two weeks before labor. Lightening is generally the result of abdominal relaxation without the fetal head engaging. Quickening varied from two to five months and was less accurate than Nagel's rule. McDonald misses in 40 per cent of his predictions. Spaulding is perhaps 10 per cent better. The Ahlfeld rule has not been considered here but has been reserved for future study.

Present formula relying upon statistics are not accurate due to careless measuring, meager materials used, unconsidered factors of error

his prediction. Lastly we present the postulation that abnormalities generally present overmeasurements and deny the reliability of occiput posterior positions.

We leave untouched statistics of the unusual true lightening cases with engagement and some formula for estimating the degree of descent because of the unreliable results obtained. The variability of the convexity of the uterus remains unproved. The differentiation between oversized babies and the abnormalities of pregnancy was eliminated in the original material chosen. Error in the position of the fetus in utero during early gestation probably remains uncorrected.

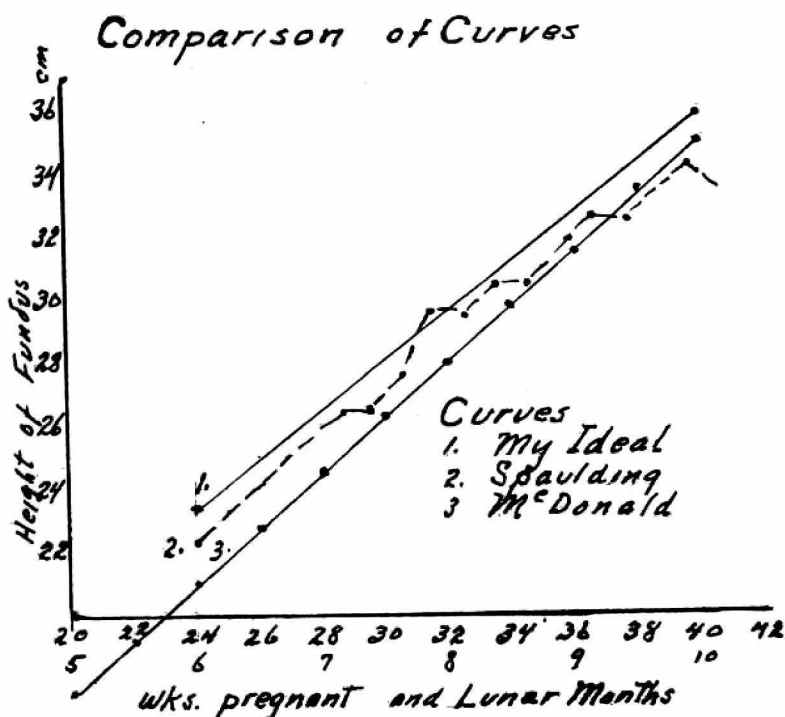


Chart XVII.—Comparisons of my ideal chart with McDonald, Spaulding and Nagel's rule show that McDonald and I agree that the fundus rate of growth is constant, which seems to fit present day theory that the uterus accommodates itself to fetal length which in utero has a definite increase each week according to the formula $x + 5 \times 5$ equals length in cm. where x represents the months of gestation. McDonald and I refuse to recognize a drop in our curves from the thirty-ninth to fortieth week and mention lightening as an unusual condition. I believe Spaulding either did not skillfully estimate the degree of lightening or else he used measurements of the fundus with the uterus momentarily at rest while the patients were in labor, which in my observations often varied 8 cm. above or below my prelabor measurement.

The value centers upon the dependability which we claim is very good providing extreme care is used as to measuring and eliminating possible factors of error. All known or possible errors have been removed to arrive at a definite normal result. The various charts clearly show the difference between single careful measurements and multiple and often slovenly done determinations. Ability also centers

upon continual daily use of these measurements and will no doubt vary some with each individual. In the long run careful measurements are as good as Nagel's rule and each may vary as much as 24 per cent as to accuracy, hence our formula is a greatly to be desired check to cover up the deficiency of Nagel's predictions.

The best method is probably Nagel's rule because it can be determined from the beginning of and does not vary throughout pregnancy. It, however, is not very accurate varying in 5,500 cases from 87 per cent in two weeks to 81 per cent in one week predictions. Our formula in the long run will equal Nagel's predictions but has the disadvantage of being applicable only during the latter part of pregnancy and requires great care in discriminating abnormalities. It is an added tool to the skilled workman and useless junk to the occasional user. As an aid to Nagel's rule to decrease the 13 to 24 per cent chance of error it has been of great value.

I am indebted to many friends who have helped me gather this mass of material. I wish to thank Dr. Geo. Clark Mosher for the use of his clinical material and the valuable suggestions he has given during this study.

CONCLUSIONS

Labor can be predicted in a reasonable number of times by means of abdominal contour measurements, provided extreme care is used in eliminating the many possible factors which easily cause great error in results.

Such a method is dependable and as accurate as Nagel's rule after the twenty-fourth week and should be used in conjunction as an arbitrary check to that rule or when the menstrual history has been peculiarly unusual.

Accuracy of prediction depends upon the fetal position and attitude in utero being more reliable in leftsided vertex positions, and those cases coming earlier than Nagel's rule are more accurate than the ones occurring later. Posterior vertex positions are very unreliable and subject to great variability. Certainly no decision as to the method of procedure in an unusual posterior position should be decided by such measurements.

Abnormalities of pregnancy and labor present larger measurements than normal while careless measuring, lightening, uterine contractions and uterine suspensions generally give smaller ones. Undermeasurements are more valuable than overmeasurements because of less chance of error.

Measurements during labor are unreliable.

The uterus in gestation has a definite regular rate of growth throughout pregnancy.

Lastly this rule and abdominal contour measurements are of value only to those who use them daily and practice the art of obstetrics rather than occasional midwifery.

REFERENCES

- Ahlfeld, F.: Arch. f. Gynäk., 1871, ii, 353.
 Allen: Am. Jour. Obst., 1907, lv, 4.
 Baume: Die Lage des Uterus und Foetus (quoted by Ahlfeld), 1872, Leipzig.
 Blau and Christofletti: Clinics of Schauta and Chrobak (quoted by McDonald), Monatschr. Geburtsh. und Gynäk., 1904.
 DeLee: Obstetrics, Philadelphia, W. B. Saunders Company.
 Fraruer, D.: Über die Bestimmung der Grösse des Kindes vor der Geburt, 1881, Berne.
 Hecker and Buhl: Klinik der Geburtsk., 1861, Leipzig, ii, 131-145.
 Hirst: Obstetrics, Philadelphia, W. B. Saunders Company.
 Issmer: Arch. f. Gynäk., xxx, 277; xxxv, 310.
 Karb: Ztschr. f. Heilk., 1903, xxlv, No. 4, p. 12.
 Kleinwachter: 1902, viii.
 Krönig und Zweifel: "Die Therapie beim Engen Becken," Leipzig, 1901.
 McDonald, E.: Jour. Am. Med. Assn., December 15, 1906, p. 1979; Am. Jour. Med. Sci., September, 1910.
 Norris: Am. Jour. Obst., 1904, i, No. 3.
 Ostreil: Monatschr. f. Geburtsh. u. Gynäk., 1905, No. 1.
 Perret: Bull. Soc. d'Obst. de Paris, 1898, p. 58; and Obstetrique, Paris, November 1, 1899.
 Pinard: Dictionnaire de Physiologie, 1905 (see Gestation).
 Reed, C. B.: AM. JOUR. OBST. AND GYNEC., 1920, i, No. 1.
 Reid: Lancet, Duration of Pregnancy, 1850.
 Richelot: Zur Diagnostik der Schwangerschaft, Königsberg, 1868.
 Schatz: Arch. f. Gynäk., lxxxiv, 2; lxxx, 3.
 Schroeder: Geburtshilfe Vierte Auflage, Bonn, 1874.
 Spaulding, A. B.: Jour. Am. Med. Assn., 1913, i, 746.
 Spiegelberg: Textbook Obstetrics. Quoted by McDonald.
 Stone, W. S.: Med. Rec., New York, November 4, 1905, p. 725.
 Suttigen, V.: Obst. Jour. Great Britain, 1875-6, iii, 397.
 Tessier: Memoirs Acad. Roy de Sci. de l'Institute de France, 1819, ii, 1.
 Voorhees: Am. Jour. Obst., 1905, iii, No. 2.
 Walrof, J.: Über Längemessung der Frucht Während des Geburtsaktes, Berlin, 1873.

BRYANT BUILDING.