

THE BLOOD PRESSURE DURING PREGNANCY AND THE PUERPERIUM.

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(With fourteen charts.)

THE influence on blood pressure of pregnancy and labor has been studied by a small number of observers since 1884, when the first work on the subject was published by Lebedoff and Porochjakow. Unfortunately the inaccuracy of the older instruments and the use of the narrow armlet in more recent work with the Riva Rocci sphygomanometer make all previous results of merely relative value. We are still without trustworthy data in this large field.

The most important of the previous observations are the reports of Vaquez and Nobecourt in 1897 of a rise in pressure during eclampsia, those of Vaquet and Millet in the following year of the existence of normal pressure during pregnancy, which Goldwater confirmed in 1903, the studies of Cook and Briggs, and the recent publications of Stengel and Stanton. Cook and Briggs were the first to show that there is a constant rise in pressure during each pain, and that between the pains the pressure is higher than before the onset of labor. During the last year appeared the work of Stengel and Stanton, confirming the results obtained before. They regret that "their observations were made before it was known that the width of the rubber cuff used in compressing the arm influenced the determination."

As Janeway has said in his book on blood pressure, "before definite statements can be made concerning the influence of pregnancy on blood pressure, there must be accurate records on the same woman at moderate intervals throughout its duration." As a rule, these are impossible in hospitals where the waiting women come late—generally just before delivery. Fortunately an unusual opportunity has been offered me of studying the question of blood pressure during pregnancy at the Nursery and Child's Hospital, where most of the women come in weeks before deliv-

Blood-Pressure and Pulse Chart.
Name _____ Age _____

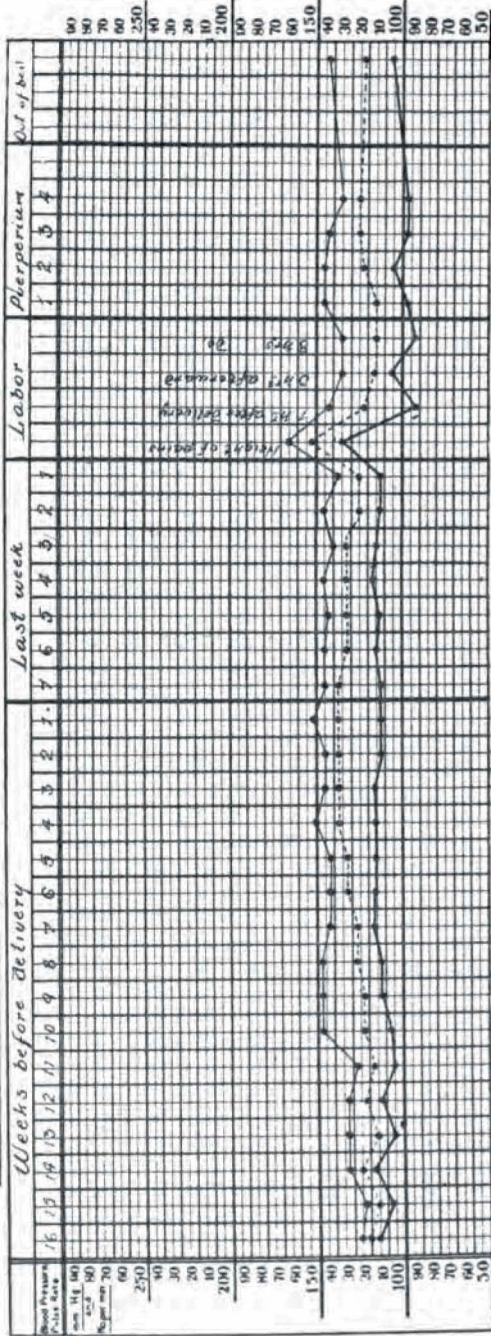


CHART I.—Composite curve of pressure records of fifty normal cases. Upper curve is composite of highest pressure records for that week or day. Lower curve is composite of lowest pressure records for that week or day. Middle curve is composite of the fifty cases.

ery, many months previous, while not a few enter as soon as they become aware of their pregnant condition. In addition, a rule of the hospital requires all free patients to serve two months after delivery in the capacity of cooks, laundresses, etc., making possible careful observations for a considerable period after delivery.

TECHNIQUE.

All observations upon which this article is based were made under the following conditions: Patient was invari-

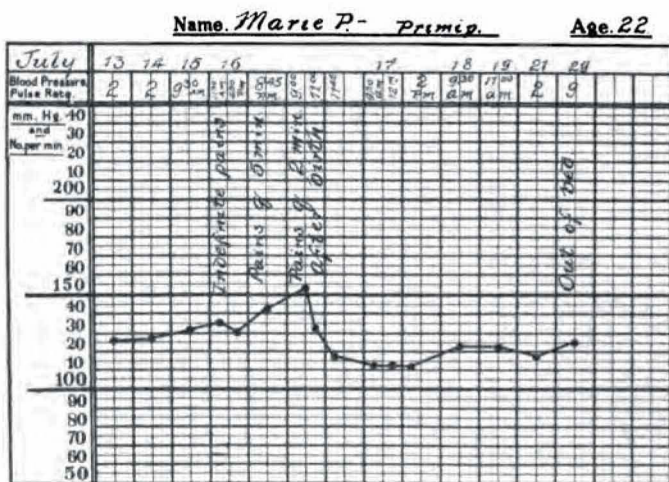


CHART II.—Marie P., age 23, primipara. Admitted July, 1906. Physical examination and history negative, except for pregnancy. Delivery normal. This chart is unusually typical, showing the rise in pressure with the pains, and the sharp drop after delivery with gradual return to normal.

ably in the dorsal position, body relaxed, and arm extended, with entire freedom from excitement, and after a sufficient time on the table to eliminate any effect of preceding exertion. The first reading was always made as soon as possible after the patient's admission; subsequent readings at 2 P.M., except during the earlier part of the work, when pressures were also taken at 9 in the morning.

The instrument used was a Cook's modification of the Riva Rocci sphygmomanometer, but for greater accuracy the Janeway 12 cm. armpiece was substituted for the Cook 5 cm. armpiece, thus rendering the readings absolutely, as well as relatively cor-

rect. In every case the armpiece was placed just above the elbow, so that the latter could be bent. The column of mercury was raised until the pulse was obliterated, then allowed to slowly drop until the pulse was again felt, and this point taken as the reading. It was in every case found to be identical with the pressure obtained by using Cook's method of raising the column until the pulse became obliterated and using this point as the reading.

It was at first aimed to make a reading once a week until approximately the last week of pregnancy, and then once a day.

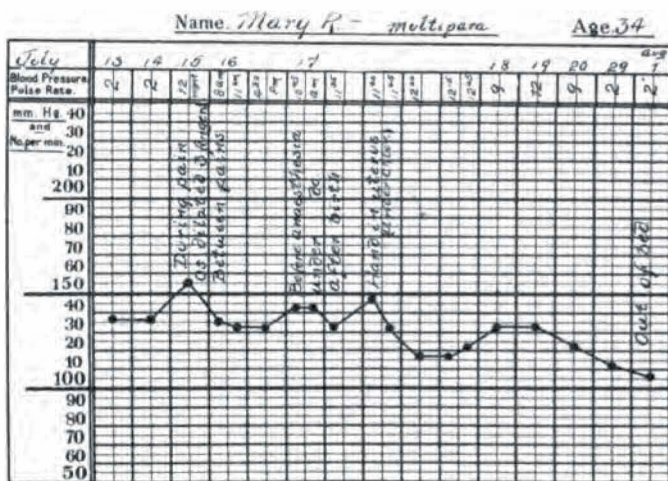


CHART III.—Mary R., age 34, multipara. Admitted July, 1907. History and physical examination negative, except for pregnancy. July 14, during the night, patient began to have labor pains. These continued for 3 days (day and night) with hardly any interruption until the morning of the 17th, when, because of the weakness of patient it was decided to deliver the child by version. The chart shows very well the fact that the pressure remained relatively high, even under anesthesia, and shows also what effect the introduction of the hand into the uterus has upon the pressure. Patient recovered entirely and pressure gradually returned to normal.

However, after enough charts had been made to get a good idea of the pressure during this last week, and after it was found that there was little change from day to day during this time the plan was given up and only weekly records taken. At first the attempt was made to take pressures as soon as patient commenced to have pains, and then every hour until birth occurred, but the results obtained were so variable, and depended so much upon whether the readings were made before, during, or just after a pain, that

this was given up after gaining some idea of the average height of the pressure. When labor had once set in, and pains were almost continuous, it was found impossible to get accurate readings because of other factors coming into play which had to be considered: *e.g.* contraction of arm-muscles, excitement, and other nervous elements. But in each case as soon as possible after birth of child a reading was made. In the early cases a reading was also made after expulsion of placenta, but as this in no case was found to affect the blood pressure, except when contraction of the arm-muscles during a severe pain provoked a fictitious rise in the pressure, these readings were abandoned. After

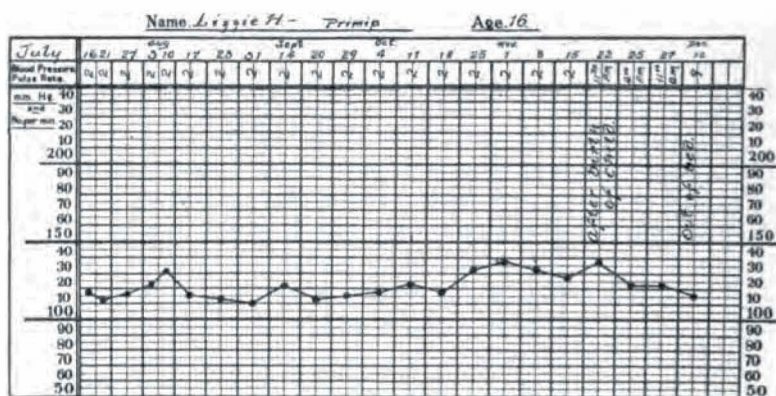


CHART IV.—Lizzie H., age 16, primipara. Admitted May 25, 1906. Physical examination and history negative, except for pregnancy. During the 18 weeks that patient was observed, pressure chart kept remarkably uniform. Patient was delivered by forceps on November 15. Puerperium normal.

this, readings were made at various intervals until a fixed point was reached which seemed to be normal for the individual in question. Should, however, any complication have arisen, or if there were found any degree of blood pressure which warranted the assumption that a complication had arisen, or was about to set in, hourly or four-hourly records were made, depending upon the urgency of the case (whether hemorrhage, eclampsia, etc.). If the pressure were within the normal limit to be described later, and whenever it was found to stay within this limit for a time sufficiently long to make one reasonably sure that the case were a normal one, the four-hourly readings were discontinued and daily

ones taken for three to four days. These were generally made at 9 A.M., if possible, because it was found that the pressure curve could be much more easily disturbed after delivery than before by the slightest provocation. As soon as patient was allowed out of bed another reading was taken, not, however, immediately on arising, but after patient had again returned to bed, for great disturbances in pressure must be expected at this time from the slightest cause.

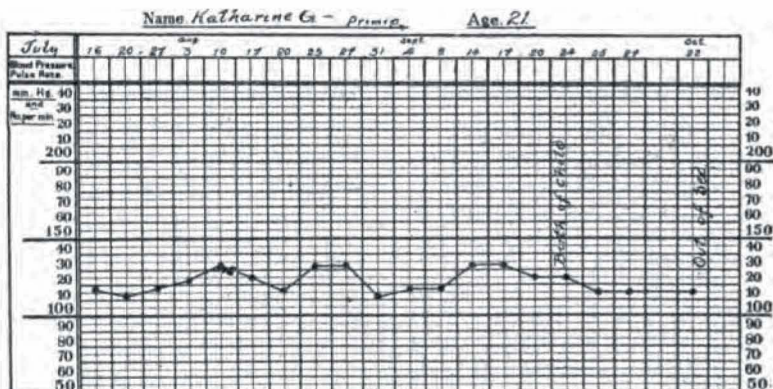


CHART V.—Katharine G., age 21, primipara. Admitted May 5, 1906. History and physical examination negative, except for pregnancy. Pressure curve was normal throughout pregnancy. Soon after delivery the temperature rose, and patient complained of pain and swelling of the leg. Examination revealed the fact that left leg measured more around thigh than the right, and there was marked tenderness on pressure over femoral vein. In spite of this there was not found any rise in the blood pressure, and patient went on to perfect recovery.

I.—NORMAL PRESSURE.

Under this head are included all cases in which the pressure (before labor pains had set in) was not above 150 mm. or below 100 mm. Other competent observers have made the upper limit 160, but by carefully following certain rules which were outlined under "Technic," such as making the patient rest before taking pressure, eliminating the nervous causes, and ruling out cases with thickened vessel walls, nephritis, etc., we never obtained readings higher than 150 in our normal cases.

In this group may be placed fifty cases of our series, with the usual proportion of vertex, breech, and other positions. So little difference in blood pressure was noticed depending upon the presence of any particular position that any such difference may be ruled out as being coincidental.

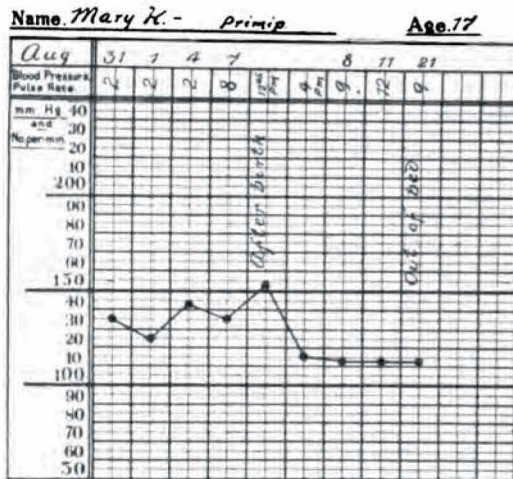


CHART VI.—Mary K., age 17, primipara. Admitted August 28, 1906. History and physical examination negative, except for pregnancy. Pressure was normal up to time of delivery. Not long after birth of child patient complained of pain in the left breast and had a severe rigor with rise in temperature and pulse. Abscess of the breast developed, which had to be lanced and drained, patient's temperature remaining up for several days. At no time was there noted any rise in blood pressure.

Of these fifty cases, thirty-eight were primiparæ and twelve were multiparæ. No constant difference of either class of cases was noted. The remark made by one observer that the age of the woman made a difference in the pressure does not hold good in our cases. The nervous element, on the other hand, plays a very important rôle in the production of high pressure.

Referring to Chart I., we have represented a composite curve of the pressure records of the fifty normal cases. The majority of these were taken for over ten weeks before delivery, some for over sixteen weeks, and the others anywhere from one to ten weeks. The upper line represents the highest pressure recorded in any case for that particular week before delivery; the lower curve the lowest pressure for that week, the middle line representing the average of the fifty cases, and not the mean between the highest and the lowest, as might be inferred at the first glance. This shows that during the earliest months of pregnancy the pressure is about normal, gradually rises during the last eight weeks, and reaches a maximum at the beginning of the last week

est point just before the birth of the child, when pains are most severe and frequent. That very high pressures may be obtained at the height of contraction, unless great care is taken to make readings only between the pains, is seen by figures in Gneccchi's table, who mentions one case where the pressure reached 210 mm. (with the 5 cm. armpiece). That the high pressure is not due entirely to the contraction of the arm muscles, excitement, etc., is shown in Chart III., where the pressure was taken while the patient was

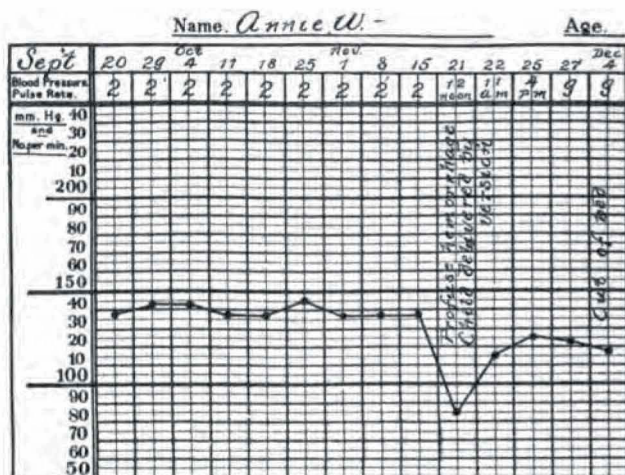


CHART VIII.—Annie W., age 46, multipara. Admitted September 16, 1906. History and physical examination negative, except for pregnancy. The course had been normal until November 21, when a profuse hemorrhage occurred from the uterus. The cervix was packed, but as bleeding continued in spite of treatment, and patient's condition became weak, she was removed to delivery room and version performed. The fall in pressure after hemorrhage was very marked. As there had been no indications previously that patient was going into labor, only weekly records had been kept and no reading made on the morning in which hemorrhage occurred. Patient went on to perfect recovery and pressure returned to normal.

under anesthesia, and found to be identical with pressure before anesthesia. This point was also brought out by Cook in one of his charts.

Soon after the delivery of the child there is a rapid drop in pressure which in some cases follows immediately. This pressure is practically little influenced by the expulsion of the placenta unless this incident be accompanied by sharp pain, when the rise could always be traced to contraction of the arm muscles, excite-

ment, etc. The pressure is decidedly affected by any manipulation inside of the uterus (point noted by Cook), shown in Chart III., our patient being under anesthesia at the time.

The pressure may continue to fall for some hours after delivery, but has usually reached its lowest mark by the eighth hour after, when it again begins to rise, and generally reaches a point a little higher than in the early months of pregnancy. (That there seems to be some difference in the lowest pressure obtained after birth

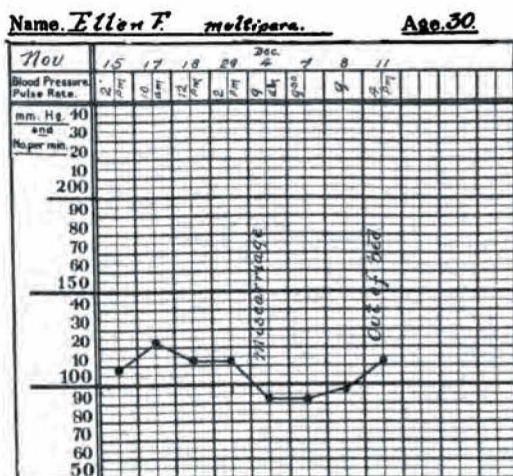


CHART IX.—Ellen F., age 30, multipara. Patient admitted November 15, 1906, complaining of slight flow of blood from uterus. Examination showed woman to be about four months pregnant and cervix dilated two fingers. In a few days patient had ceased losing blood. December 4, hemorrhage occurred again. December 5, patient had a miscarriage; pressure fell to 95, where it remained several days. It gradually returned to normal, and patient left hospital in good condition.

is shown by Gnecci's table again, in which he notes 114 mm. as the lowest point reached. It was very seldom that we obtained our lowest pressure immediately after labor, generally having to wait one hour. It might be well to bear this in mind in determining whether the pressure of patient had reached a dangerously low mark and stimulation was necessary). Here it continues with slight daily variation. If pressure is then taken when patient is first allowed out of bed, one is liable to find it rather high and greatly influenced by slight disturbances and subject to wide variations. But if one waits until patient has again returned to bed

and rested, it will generally be found at about the point which is normal for her. The statement is made by several observers that it frequently takes weeks for the pressure to return to the normal level, and occasionally as much as five or six weeks, but our cases do not seem to prove this. Very few of our women remained in bed longer than ten to fifteen days, and in almost every case the pressure had returned to normal by the time they were up.

In about 50 per cent. of these cases with normal blood pressure, albumen in varying amounts was detected in the urine at different times, which seemed to be accompanied by little change in the

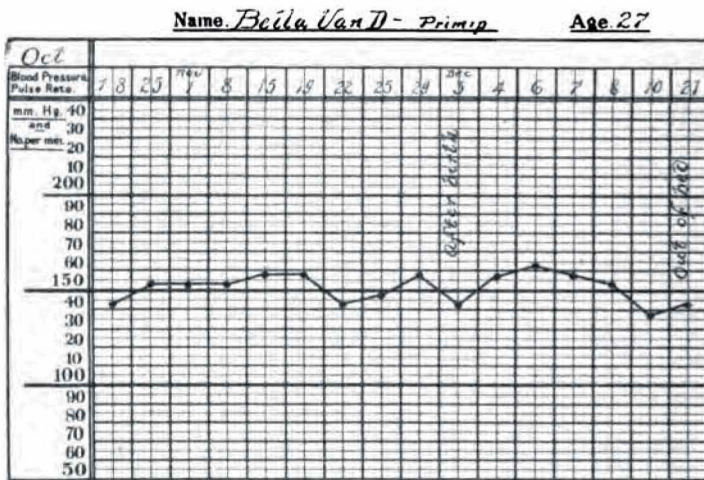


CHART X.—Bella Van D., aged 27, primipara. Admitted October 17, 1906. History negative. Physical examination shows marked thickening of radials. Pressure kept well above normal limits, stayed so during birth of child, and did not drop during puerperium. On discharge pressure was still somewhat high, but within normal limits. Labor was normal.

pressure, but it was noticed that some of the relatively higher normal pressures showed the presence of more than a mere trace of albumen. In some cases, even before any labor pains were felt by the patient, there was noticed a rise in pressure, when vaginal examination would show that labor had already begun.

How uniform a normal chart can be is shown by the following one of L. H. (Chart IV.), which was begun over seventeen weeks before delivery and pressure taken approximately every week. In this and some of the following charts the records during and after labor were incomplete (owing to unexpected delivery, etc.),

and the rise during pains and postpartum was sometimes missed.

In this series of cases the rise in pressure which some writers say accompany, and often foretell a complication during the puerperium, was not noted. For example, Chart V. is the record of a normal pregnancy followed during the puerperium by thrombosis of the femoral vein. The reading during the event does not show any change from the normal. Other similar cases were met with during the period of pressure observations. Chart VI. represents

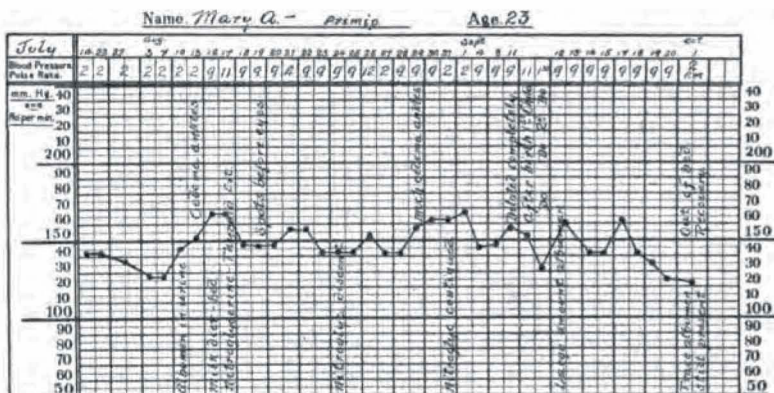


CHART XI.—Mary A., age 23, primipara. Admitted July 4, 1906. History negative. Physical examination showed presence of edema of leg from knees to feet. August 10, large amount of albumen found in urine with presence of casts, and pressure, though still within normal limits, began to rise. August 16, pressure rose to 165; albumen and casts in urine. August 18, under treatment pressure dropped to normal limits, and swelling diminished somewhat in size. Patient was kept in bed and put on diuretics. Between this time and September 11 (when she was delivered) pressure rose to above normal on several occasions, but dropped again soon after treatment was started, and patient kept in bed. September 11, patient delivered of twins. For over a week pressure kept moderately high, then gradually fell to normal. On discharge pressure was normal, but patient's urine still contained a trace of albumen.

the pressure during the latter part of pregnancy, in which delivery was followed in a few days by the development of an abscess of the breast which had to be incised and drained. No increase in pressure was noted.

Chart VII. is similar to others in our series in which the patient showed some slight sapremia during the puerperium with no effect on the blood-vessel curve.

What we particularly wish to bring out and emphasize besides, under this heading, is that all our cases which ran a normal course

before, during, and after delivery, and whose blood pressure was regularly taken, could be placed in this group of normal blood-pressure charts.

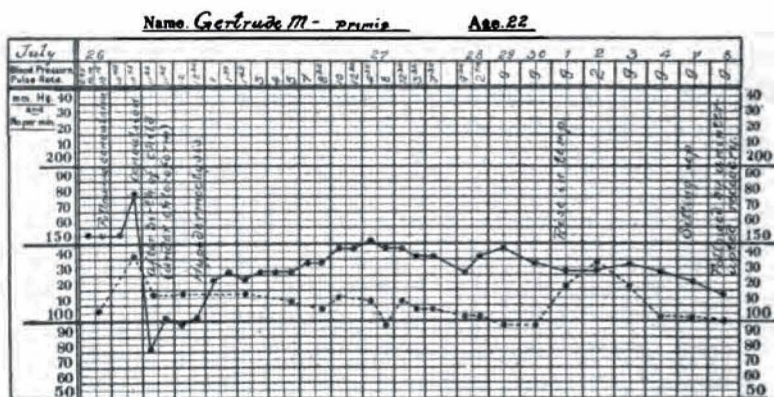


CHART XII.—Gertrude M. Patient was seen on June 23, 1906. Complete examination made; urine examined; found to be negative. Not seen again until July 25, when she complained of gastrointestinal upset, and given a cathartic, but left no urine to be examined. July 26, patient went to bed as usual, feeling well except for pain in epigastrium; woke up at 2 A.M. with violent headache and pain in region of stomach. She vomited four times before 7 A.M. At this time she went to bathroom, and, staying longer than was usual, her mother went to see what the matter was; she found her groping around the room, unable to find the door, stone blind; immediately brought her to hospital, patient up to this time having had no convulsion. Soon after entering hospital at 10 A.M., patient had first convulsion, another at 10:50 (typical clonic and tonic of face, body, and arms, lasting 2 minutes, checked only by the administration of chloroform. On examination, cervix was found dilated two fingers. It was immediately dilated completely and child removed by version (20 minutes' duration, child blue but living). Has had no convulsion since. Soon after patient came out of chloroform she became delirious, but quieted down during next six hours. The blindness, which was absolute just before and after delivery of child, continued for twelve hours, then gradually cleared up, it being, however, thirty-six hours before patient could see perfectly. During first six hours after delivery 1 oz. of urine was passed and that by catheter; about the same amount during second six hours, then under treatment 1,200 cc. in next six hours; albumen present in large amount at first, diminished a little in amount after delivery and on discharge of patient only a faint trace remained. Patient went on to uninterrupted recovery. Solid line represents pressure curve; dotted line pulse curve.

ABNORMAL PRESSURES.

I. *Hypotension*.—In this group were placed all cases in which the pressure fell below 100. In many of the normal cases immediately after delivery one would see such a drop, but it is without

significance unless persisting or going below 90. Of our series the following are typical cases of the different types:

(a) Cases of placenta prævia with profuse hemorrhage (see Chart VIII).

(b) Where there had been more or less prolonged bleeding, as

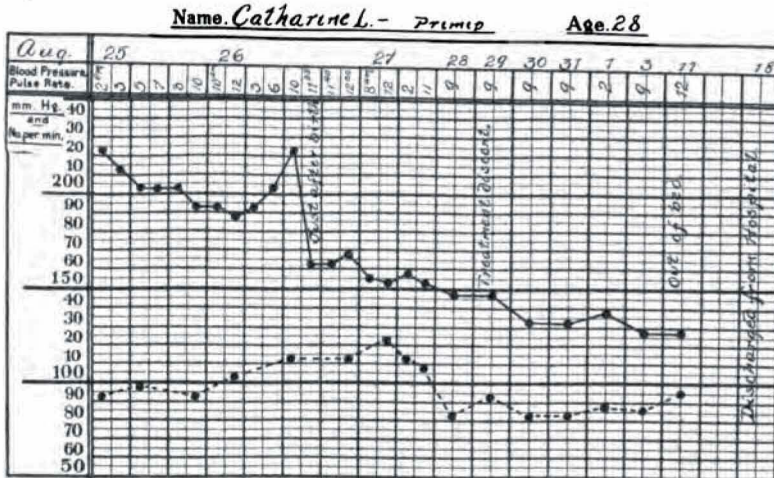


CHART XIII.—Catharine L., age 28; primipara. Admitted August 25, 1906. History of having voided little urine lately and frequent nausea and vomiting; complained of weakness. Physical examination showed presence of pregnancy, and excepting for a peculiar expression of face and cyanosis of lips, was negative. Feeling pulse, pressure seemed rather high, but not as high as was immediately recorded by sphygmomanometer, 220; urine contained albumen, some casts, high specific gravity; cervix admitted one finger; no labor pains. Patient put to bed; milk diet, cathartics, diuretics, and nitroglycerine. Passed 200 c.c. urine soon after admission; little since; vomited soon after admission; skin very dry. August 26, 3 P.M., dilated four fingers; cervix hard and firm; slightly delirious; 10:55 P.M., cervix dilated completely; child delivered by forceps; pupils irregular. August 27, mental condition better; skin covered with sweat. (See chart for record.) Interesting thing about this case was that there were absolutely no convulsions; nothing to tell seriousness of condition, except blood pressure and urine. Dotted line represents pulse curve.

in our case of miscarriage (Chart IX). This low pressure persisted for several days and required careful watching.

(c) Possibly in cases where there was prolonged chloroform anesthesia. The majority of our difficult forceps cases, and those in which version was performed, showed this drop (refer to charts on eclampsia). Whether this was altogether due to the anesthesia, or partly to the removal of the child is impossible to say.

II. *Hypertension*.—In this group are included all cases in which the pressure was above 150, the rise at the height of labor excluded because of its being a normal manifestation. The cases showing hypertension seemed to fall into two groups, which divis-

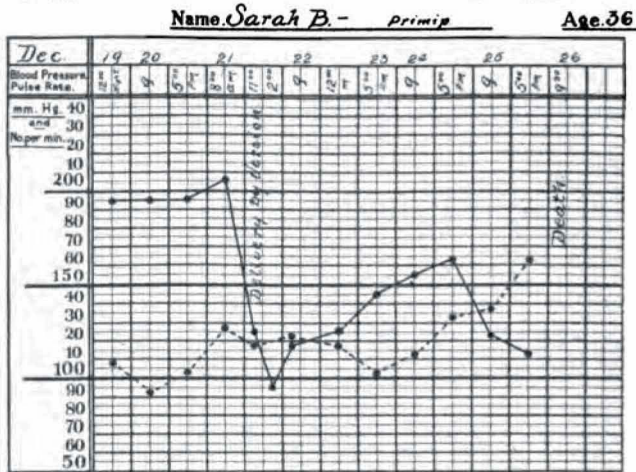


CHART XIV.—Mrs. B. Patient gave a history of having had edema of ankles over three weeks ago; this increased rapidly until on admission there was edema of ankles, legs, vulva, and all over back; distension of abdomen with some ascites. Patient had been nauseated and vomited for several days and on admission was slightly delirious; urine full of albumen and casts. December 19, 1906, admitted to hospital with above history; was very restless and showed marked hyperesthesia. December 20, in spite of treatment (diuretics, etc.) pressure and condition remained the same. December 21, patient not able to see; in state of coma. Taken to operating room and child delivered by version, under chloroform. All that afternoon pulse was weak and patient very delirious; continued so during the night. December 22, pulse somewhat improved because of stimulation; patient not secreting much urine; became rational during day but remembered nothing that had occurred during past twenty-four to thirty-six hours. December 23, in afternoon patient began to get weaker; needed increased stimulation. December 24, patient has now grown delirious and has marked tympanites; edema slightly less in ankles, but not diminished in back or labia. December 25, very delirious with heavy odor to breath; passes urine and feces involuntarily; beginning coma and stertorous breathing. December 26, patient gradually grew weaker, temperature rose to 104.8° and at 9:30 A.M. patient died. Dotted line represents pulse curve.

ion is particularly important because of the fact that the prognosis and treatment are greatly dependent upon the group to which the case belongs.

(a) *Moderate hypertension*, under 180, either with arterial thickening and no albumen in the urine (evidence of an abnormal

cardiovascular system) [see Chart X.], or with evidence of the existence of either acute nephritis or of an acute exacerbation of a previous existing nephritis (see Chart XI.). It is surprising that, in spite of all the good work that has been done on blood pressure of pregnancy, so little emphasis has been laid on just this class of cases, and attention called to the fact that it is in such a condition that the blood pressure work has reached its greatest usefulness. It is impossible to find in the literature an instance where a case of moderately high tension, carefully watched and pressure systematically taken, went on to eclampsia. Yet how many cases of eclampsia give a history of previous indisposition (perhaps mild) swelling of the ankles, diminished amount of urine, headache, etc., in which the convulsions could perhaps have been prevented had blood pressure records given warning of the more serious attacks to come. Every case in the hospital during the last nine months since these pressure observations were begun, recognized as belonging to this group and properly treated, went on to labor and subsequent recovery without any trouble whatever ensuing. Whenever the pressure rose above 150 treatment was immediately begun and continued until the lower level was again reached. The above chart (XI.), similar to others of our series, shows very well the manner and result of treatment. It is impossible to say how many of these cases might not have gone on to eclampsia. Clinically, these cases of moderate hypertension were distinguished by the very slight and long-delayed fall in pressure after delivery, in sharp contrast both to the normal cases and to those with marked hypertension to be described later.

(b) *Extreme Hypertension.*—That the blood pressure in eclampsia is unusually high has been an acknowledged fact among competent observers since the statement in regard to this was first made by Vaquez and Nobecourt in 1897, and conclusive records shown. Cook and Briggs always found the pressure high in their cases in the Johns Hopkins Hospital, and called attention to the sharp drop that occurred soon after the uterus was emptied. Since that time all pressure records on eclampsia have shown a high degree of tension present. Vaquez, in presenting his latest report before the Société d'Obstetrique de Paris in February, 1906, comes to the following conclusion:

1. Pressure is invariably high in eclampsia.
2. The rise in blood pressure is the best prodromal symptom, and does not depend upon whether albumen is present or not.

3. The staying up of the blood pressure, even if other symptoms disappear, makes the prognosis very unfavorable.

We go a step further. What we particularly wish to lay stress on in this paper is not the fact that high blood pressure with eclamptic symptoms (convulsions, blindness, etc.), exists, and is dangerous to the life of the patient and her child (for this has been amply demonstrated), but that high pressure can exist and continue without convulsions, and with only a small amount of albumen (if any) in the urine—a point which has not been sufficiently brought out and emphasized by previous writers. In these cases the prognosis is just as unfavorable as in those with convulsions, unless pregnancy be terminated; and they are the more important because not always to be recognized except with the sphygmomanometer, everyone knowing how difficult it sometimes is to tell the degree of pressure with the palpating finger.

It is impossible in this paper, which aims simply to state facts and draw certain conclusions from a study of our charts, to enter into a discussion as regards the causation of eclampsia. In the course of observations extending over nine months with readings on over eighty cases, four cases of extreme hypertension have been met with, three of which remained in the hospital and could be followed. Of these three cases, one only had typical eclamptic convulsions, and was the case of lowest blood pressure in the group. In all cases the urine was studied exhaustively by Prof. Ewing of Cornell Medical School, especially with reference to the nitrogen partition, and all have been classed as cases of eclampsia, and so reported by him in the March number of the *JOURNAL OF OBSTETRICS*. Apart from this, however, the two cases without convulsions presented a clinical picture which is difficult to interpret in any other way than as eclampsia, the phenomena being such as are commonly observed in severe types of uremia.

Chart XII. of our series is similar in many ways to these shown by Cook and other observers, in which the pressure before delivery is extremely high, drops sharply after removal of child, and gradually regains the normal level with ultimate perfect recovery. Convulsions were present. It is a typical eclamptic chart, about which no one with sufficient experience in the use of the sphygmomanometer would be in doubt, and a case in which no one would hesitate to empty the uterus, even should the pressure not be known.

Chart XIII. is of a different type. There were no convulsions,

and the history might be taken as that of a case of ordinary nephritis without edema. The pressure, on the other hand, was higher than in the previous case with convulsions, being 220 mm. It is to be noted that the pressure remained high in spite of treatment until child was removed.

Chart XIV. is of a case without convulsions and with death. Cook and Briggs, in their paper, emphasize the fact that in eclamptic seizures continuing or beginning after the removal of the fetus the pressure rose to a marked degree, and extreme hypertension persisted until the cause was overcome by the use of vaso-dilators. In our fatal case, on the other hand, there was a marked drop in pressure, the temperature and pulse curves, however, rising.

CONCLUSIONS.

1. The normal limits of blood pressure during pregnancy are 100 mm. to 150 mm. in all cases.

2. During labor the pressure is higher, but after delivery any pressure above 150 mm. or under 90 mm. must be considered definitely abnormal.

3. Hypotension (below 90 mm.) is of significance chiefly in estimating the importance of profuse or long-continued hemorrhage.

4. Hypertension (above 150 mm.) always demands close watching and appropriate treatment.

5. Moderate hypertension (150-180 mm.) is not incompatible with the completion of a full term pregnancy and labor.

6. Marked hypertension (over 180 mm.) is always a cause for grave anxiety lest eclampsia supervene.

7. Marked hypertension with convulsions is an absolute indication for removal of child.

8. Marked hypertension, persisting in spite of treatment, with increasing edema and the development of cerebral symptoms, is extremely dangerous, even if without convulsions. Interference with pregnancy would be the better policy.

9. Further systematic observations of blood pressures on all cases showing hypertension and in a large series of eclamptics are urgently needed.

In closing, I wish to express my thanks to Dr. Theodore Jane-way, at whose suggestion this work was undertaken, and under

whose supervision it was carried out; to Dr. Ewing, for his reports on the urine analysis, and to Drs. Charles F. Collins and Rowland G. Freeman under whose service at the Nursery and Child's Hospital the records were made.

LITERATURE.

Cook, H. W., and Briggs, J. B.: Clinical observations on Blood Pressure. Johns Hopkins Hos. Rep., 1903, Vol. XI., page 451.

Dreyzel, Max: Über Herzhypertrophie bei Schwangeren und Wochnerinnen. Inaug. Dissert, München, 1891. Quoted by Dienst., *Archiv f. Gynäkol.*, 1902, Vol. LXV., page 367.

Fellner: Über die Ursachen der Blutdrucksteigerung in den Wehen, Wien, 1904.

Füth und Krönig: Experimentelle Untersuchungen zur Analogie der Eklampsie, *Centralbl. f. Gynäkol.*, 1901, Vol. XXV., page 701.

Gnecchi: La variazioni della pressione arteriosa nello stato puerperale, *Rassegua d'ost. e Gin.*, Vol. XII., 1903, Nos. 9-11.

Goldwater, S. S.: Notes on blood pressure in Man, *Medical News*, 1903, Vol. LXXXII., page 926.

Lebedoff, A., und Porochjakow: Basch's Sphygmomanometer und der Blutdruck während der Geburt- und des Wochenbettes in Zusammenhänge mit Puls-Temperatur und Respiration, *Centralblatt f. Gynäkol.*, 1884, Vol. VIII., page 1.

Pal, J.: Zur Pathogenese der akuten transitorischen amaurose bei Blei Kolik, Urämie und Eklampsie, *Centralbl. f. in Med.*, 1903, Vol. XXIV., page 417.

Queirel et Reynaud: Tension artérielle et puerperalité, grossesse, accouchement, suites de couches, physiologiques et pathologiques, XIII. Congres internat. de Med., Paris, 1900. Vol XV., sect. d'obstet., page 170.

Savelli, Pierre: Tension artérielle et frequence du pouls dans la puerperalité, Montpellier, 1904.

Stengel, A., and Stanton, W. B.: The Heart and the Circulation in Pregnancy and the Puerperium. Contribution from the William Pepper Laboratory of Clinical Medicine, 1906.

Vaquet, H., et Millet: Du cour dans las grossesse normale, *La Presse Méd.*, 1898, Vol. VI., page 61.

Vaquez et Nobecourt: De la pression artérielle dans l'eclampsie puerperale, Bull. et mem. soc. med. des Hop. de Paris, Vol. XIV., page 117.

Vaquez, H.: De la tension artérielle pendant la grossesse et le suites de couches, Bull. soc. d'obst. de Par., 1906, IX. (30-33).

Same: Valeur diagnostique et pronostique de l'elevation de la pression artérielle au cours de l'eclampsie puerperale, Bull. soc. d'obst. de Par., 1906, IX. (34-37).

Wiener, Max: Über das Verhalten des Blutdruckes während der Menstruation, normalen Schwangerschaft, Geburt- und Wochenbett, und der Eklampsie (Leipzig, 1904).

Wiessner: Über Blutdruckuntersuchungen während der Menstruation und Schwangerschaft, *Centralblatt f. Gynäk.*, 1899, Vol. XXIII., page 1,335.