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Contributors

Lynch, Frank W. 1871-1945.
Royal College of Surgeons of England

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By FRANK W. LYNCH, M. D., Chicago
Assistant Professor Rush Medical College; Attending Gynecologist Presbyterian Hospital

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BLOOD PRESSURE DURING PREGNANCY[1]

By FRANK W. LYNCH, M. D., Chicago
Assistant Professor Rush Medical College; Attending Gynecologist Presbyterian Hospital

THE study of blood pressure begins with the work of Stephen Hales in 1733, one hundred and seventeen years after Harvey's first description of the circulation. Poiseuille, in 1828, made the first great improvement in the method with the description of the mercurial manometer, which Ludwig converted into a self-registering instrument, nineteen years later. These methods study blood pressure by direct measurement, and demand in consequence the opening of blood vessels for the insertion of the connecting cannula. Quite naturally, therefore, they are not suitable for clinical determinations on man.

From the myriad of men who have concerned themselves with the development of accurate clinical methods, three names stand out most prominently: Vierordt, who suggested in 1855 the principle of the indirect estimation of blood pressure by the obliteration of the pulse by the direct application of weights to the radial artery; Marey, who in 1876 utilized water under pressure as such weight, while depicting the pulse curve by a recording lever and tambour; and Basch, who in the same year specified the pressure in terms of mercury.

At the present time there are many instruments suitable for clinical use. For the most part they consist of a flat rubber bag encased in an unyielding cuff of 12 cm. width, which is placed about the upper arm and is blown up by air pressure. This is connected with a mercury manometer and dial, or a recorder which is influenced by the expansion of air in a chamber between two thin metal discs, giving its readings in terms of millimetres of mercury.

Two pressures may be taken, and from these others may be calculated. The maximum or systolic blood pressure is that pressure which obtains at the crest of the pulse wave, and may be determined by noting the pressure that is necessary to block the passage of the pulse wave. Taken in the brachial artery it tends to approximate the lateral pressure in the aorta. The minimum or diastolic pressure is that pressure which exists at the trough of the pulse wave; it measures the peripheral resistance, and represents the resistance made by the arteries to the expulsion of blood from the heart. The difference between the systolic and diastolic pressures is called the pulse pressure, and supplies an index of the output of the heart per systole. The greater the difference between the first two pressures, the greater will be the amount of blood entering the arteries. The mean pressure in the arteries may be computed as suggested by Dawson, by adding one third the pulse pressure to the diastolic pressure. Systolic pressure usually has been measured by determining the pressure at which the radial pulse becomes perceptible to the palpating finger after the pressure obliterating the brachial has been gradually released.

Since the auscultatory method was introduced by Korotkow in 1905, it has been shown that the palpatory method gives lower and more inaccurate readings than the former. Thus Korotkow found his determinations 10 to 12 mm. higher with the auscultatory method; Gittmas, differences of an average of 16.7 mm. in 61 cases; while Warfield in a recent paper records variations of 8 to 14 mm.

The systolic pressure should be determined with a small bell stethoscope placed over the brachial artery and just below the compressing cuff. It will be found to correspond to the first sound which appears in the vessel as compression is released sufficiently to allow the blood to rush again into the lower artery.

The phases of tone, described by Korotkow, which are heard during the different stages of pressure upon the brachial artery in man have been modified into five stages by Ettinger, Fischer, and others. The first phase is a more or less sharp, clear tone corresponding to the passage of the first pulse waves

[1] Read before the Chicago Medical Society, March 19th, 1913.

under the compressing cuff. This tone persists during the second phase but is modified by a series of murmurs. The third phase is a transition to a loud, sharp, clear tone, which gradually or suddenly becomes dull at the beginning of the fourth phase. The fifth phase marks the cessation of all sounds. Diastolic pressure has been read frequently in this country at the point of disappearance of all sound, following the statements of Ettinger, Hirschfelder, Gittings, and Goodman and Howell. Korotkow, however, from theoretical considerations placed the diastolic pressure at the point where the clear, loud tone was replaced by a dull tone — the beginning of the fourth phase. This has been confirmed by many observers, among whom we may mention Fischer, Lang and Manswetona, Warfield, and others.

The majority of pressure observations in obstetric literature concerns systolic pressure alone, determined by palpatory methods. Such observations, even though of limited value, possibly, in a comparison with more complete study, have been helpful occasionally in certain clinical conditions, especially since there are no large series in which diastolic pressure has received attention. However, we believe that these may be adduced occasionally in indirect applications to give a false sense of security. The term blood pressure, unless otherwise qualified, will be taken for systolic pressure in this paper.

It is my purpose in this article, after consideration of certain features of blood pressure observed in pregnancy, labor, and the puerperium, to emphasize the following points: That comparatively low blood pressure may be found in obstetric patients with no other evidence of abnormality in health; that eclampsia may occur with low blood pressure, notwithstanding the generally accepted belief to the contrary; and that extremely low blood pressure may be a forewarning of shock following labor, and not due to hæmorrhage.

NORMAL PREGNANCY AND LABOR

Attempts were early made to ascertain the influence of pregnancy, labor, and the puerperium upon blood pressure, yet the inaccuracies of the earlier instruments available did not permit of trustworthy data. Yet in 1884 Lebedoff and Porochjakow published their observations with a Basch sphygmomanometer. Two years later Louge, who had made some 4000 records during labor and the puerperium, concluded with Marey that the instrument of the latter did not permit of the study of the arterial tension under such conditions. The first well-known paper on kindred conditions records observations of the blood pressure in eclampsia, and considers the phenomena under normal conditions in less detail. This article was published in 1897 from the Paris Maternité by Vaquez, and his interne Nobecourt; and was followed in the next year by the paper of Vaquez and Millet, studying the normal phenomena. The Basch-Potain instrument was used in these series. Immediately following this the subject attracted fairly wide attention.

As a result of these investigations we are in the possession of many confirmed observations of the systolic blood pressure during normal pregnancy, labor and the puerperium. It appears that the blood pressure is lower during the earlier months of pregnancy than at term, as the averages of many readings during the last two months show a gradual rise. (Wiessner.) This rise is not marked, being 10 or 15 mm. Hg. on the average, and is attained about one week before labor. There is some recession from this level during the last week of pregnancy. We should expect such phenomena when we consider the alterations in intra-abdominal pressure which are caused by the presence of the growing fœtus. These may be influenced by other factors as suggested by Gnecchi, to-wit: Cardiac hypertrophy, or the effects of a very mild autointoxication. The observations of Vogeler do not support the view that there are constant differences in pressure with varying fœtal positions, nor yet from the patient's age *per se*. Differences between the pressures of multipara and nullipara also appeared as coincidental.

With the advent of labor there is an elevation of pressure not only during uterine contractions, but also in the intervals, unless the patient is in a state of exhaustion. Cook has shown that the rise during uterine contrac-

tions is not due in large part to the effect of voluntary abdominal contractions, since it appears but slightly diminished during anæsthesia. As would be expected, the painless contractions during pregnancy, termed the Braxton-Hicks contractions, cause a rise similar to that of labor pains, and differ from them only in degree. As labor progresses these features become more pronounced when the child is forced through the pelvis. The greatest rise which Vaquez and Millet recorded (between 18 and 25 cm.) occurs during the expression of the head. Extreme hypertension is sure to result from manipulations during artificial delivery through the natural passages. This is most marked during traction upon the child, either with instruments or in extraction following version. After birth, and usually immediately, the pressure falls at least to the level of that of pregnancy. Vogeler found the lowest readings by the eighth hour after delivery. There are usually no wide variations from the normal during the puerperium under normal conditions.

Quite naturally the averages of pressure readings vary considerably. Not only were the older instruments inaccurate, but some series of recent date are recorded with the narrow cuff, shown to be inaccurate by the work of Recklinghausen, Janeway, and Erlanger. All authors have not considered the modifying effect of posture, relaxation, and freedom from excitement, which may readily cause errors of more than 10 mm. Nearly all readings, moreover, have been taken by the palpatory method. The following figures, therefore, may not admit of direct comparison, yet are of relative interest:

The normal blood pressure of young adults has been variously estimated. Cook, in 1903, with the Riva Rocci narrow arm piece instrument, found it to average 115 for young non-pregnant women. Thayer, with the same instrument, attained an average of 140 mm. for 126 men between 20 and 40 who had not had typhoid. Erlanger in the same year found the average with his instrument as 110 for non-pregnant adults between 20 and 25 years. Sakurai, with the Haak instrument, a modified Riva Rocci, obtained ranges of 90 to 122 mm. Hg. for the non-pregnant women. Judging from the readings of Erlanger made with cuffs of differing sizes, there is less variation between these figures than is at first apparent. Vaquez, in 1906, announced that in his observations of ten years the systolic blood pressure of normal pregnancies ran between 130 and 150 with the Basch-Potain instrument. Fellner, 1901, with the Gärtner tonometer on the finger obtained ranges from 108 to 136. Schroeder the following year obtained higher readings with the same instrument. Goldwater, with the tonometer, obtained variations of 105 to 132 for eleven normal cases under 30 years. Vogeler, with a wide cuff Riva Rocci, writes (1907) that by carefully observing the necessary rules of technique, making the patient rest before taking pressure, eliminating the nervous causes, and ruling out cases with thickened blood vessels, nephritis, etc., he never obtained readings higher than 150 in normal cases (dorsal position). Hirst obtained an average of 118. Bailey, with the wide cuff Stanton instrument, obtained an average pressure of 118 mm. Hg. By recasting his cases we find that about 83 per cent of his 1,136 readings are under 130. There are 6.2 per cent below 100, and ½ of 1 per cent between 170 and 180. Slemons and Goldsborough, 1908, with the Erlanger instrument found average systolic pressure of 127 mm., with 74 mm. Hg. as the average diastolic pressure. Sakurai, 1909, obtained readings between 97 and 143, with an average of 118.6 mm. with the Haak instrument (palpation).

It has been my habit during the last ten years to take blood pressure readings on all private obstetric cases. During this period I have been constantly impressed with the fact that these readings were frequently lower than those generally given in the literature. The material studied comprised many women of neurasthenic disposition and of the poorly muscled physique, which are so frequently associated with generally contracted pelves. In these the pressure was invariably low, and the pulse commonly quite fast. Yet the pressure in the elderly primiparæ, of which there were ten more than 38 years of age in my

series here reported, did no more than bring up the average to normal.

Tabulating the systolic readings of 100 private cases, which have had at least 4 blood pressure determinations during their pregnancy, we find average systolic reading of 104.6 mm. Hg. with variations between 78 and 145 mm. The case giving 78 mm. will be considered later. There was one other reading below 90; viz., at 87. Grouping the pressures we find:

35.2 per cent of the entire series below 100.
43.5 per cent between 101 and 110.
13.1 per cent between 111 and 120.
8.2 per cent between 121 and 145.

I had hoped to compare with these figures the averages from a similar series taken in the hospital wards, yet this has proven impossible, as the majority of the cases enter the Presbyterian Hospital in labor. Dr. Carl Davis has kindly obtained for me the figures for 60 obstetric cases during the puerperium. The instrument was the same (Stanton), although in this series the pressure was determined by the auscultatory method, which Davis believes here gives an average of 6 mm. higher than that he would obtain by palpation. The average systolic reading was 124.6, with variations from 105 to 146 mm. It is of interest that the lowest pressure in his series was taken from a patient of mine on whom I obtained readings during pregnancy of 100, 105, 108, and 105 by palpatory method. Grouped according to percentages, we find the averages of these cases far higher than mine, even allowing 10 mm. as the difference in methods. The table is as follows:

Below 110 mm..... 12 per cent of 60 cases
111 to 120 mm..... 32 per cent of 60 cases
121 to 130 mm..... 28 per cent of 60 cases
131 to 140 mm..... 25 per cent of 60 cases
Above 140 mm..... 4 per cent of 60 cases

I am unable to explain the differences between these series save on the ground of Brunton's teaching. I conclude, therefore, that the ward cases were more vigorous and physically stronger individuals.

ECLAMPSIA

Following the report of Vaquez and Nobecourt in 1897, many others have called attention to the presence of high blood pressure in this disease. It is natural, therefore, that this phenomena should be emphasized as a premonitory sign of value. Vaquez, writing in 1907, after ten years' experience with blood pressure in obstetrics, voices the extreme view. He states that if blood pressure is very high, convulsions will follow, claiming that eclampsia seizures will never occur in cases of normal tension. Vogeler states that it is impossible to find in the literature a case of moderately high tension, which was carefully watched, and in whom the blood pressure was carefully taken which went on to eclampsia.

The majority of reviews, in this country at least, have accepted these teachings, especially in the light of the multitude of cases of eclampsia in the literature with extremely high blood pressure. While there is no doubt that eclampsia is usually signaled by a rising blood pressure, eclampsia may occur with normal pressure. The statements quoted above may be misleading, and the means of producing false security. The interpretation of blood pressure readings is not always simple. Much depends on the time and conditions when taken. Readings during labor are most apt to be unreliable. The unusual emphasis placed upon hypertension as a certain sign of toxæmia is largely due to the fact that arteriosclerosis is most uncommon during the child-bearing age. Yet Russell's work on arterial hypertonus, sclerosis and blood pressure in 1908 should make us cautious in ascribing all hypertensions to toxæmia. The contentions of Vaquez, Beau, Vogeler, and others, that blood pressure of 180 or more during pregnancy means toxæmia is not supported by the observations of Slemons and Goldsborough. The latter authors report the case of a IX-para who gave no evidence of toxæmia yet who several times had systolic pressure of 180 mm. Hg. with the Erlanger instrument, and an average pressure of 169 mm. during the last days of pregnancy. Green, in 1912, from a study of his cases, came to the conclusion that the height of the blood pressure is proportional to the severity of the case with toxæmias. On recasting his toxæmias with chief symptoms of albumin we obtain the following:

One case with blood pressure 130, albumin 1. %
One case with blood pressure 140, albumin 0.5 %
One case with blood pressure 140, albumin 0.7 %
One case with blood pressure 150, albumin 0.25%
One case with blood pressure 160, albumin trace
One case with blood pressure 175, albumin 0.25%
One case with blood pressure 180, albumin 0.3 %
One case with blood pressure 190, albumin 0.25%
One case with blood pressure 190, albumin 0.3 %
One case with blood pressure 210, albumin 1. %

From which we see it is not necessarily proportional to the amount of albumin.

I have in my own experience twice met with eclampsia developing in women on whom blood pressure reading during pregnancy had been found normal.

The first case was reported to the Chicago Gynecological Society February 19, 1909, as an example of eclampsia, which developed in a woman under careful observation, who had given no premonitory symptoms.

A multipara of 32 years. Nearly continuous nausea for three months without much vomiting, followed by good health, save for continuous indigestion during the last three months. Soda gave relief and was freely taken. One time I was quite startled by the patient's statement that she had just finished the second pound of soda taken for nausea during the last few months. Four blood pressure readings scattered through pregnancy ranged from 90 to 105 mm. Hg. Stanton wide band instrument; palpatory method. At the onset of labor, pressure was 113. The urine had been followed for albumin and casts daily for the last month, with negative findings. The twenty-four hour weekly specimens ranged in amount from 2,000 cc. to 3,800 cc., with 3,750 ccs. two days before labor. Labor began eighteen days before calculated term. After ten hours of very easy first-stage pains there was a single convulsion. There was no evidence of œdema. The pulse had felt soft and normal throughout the labor. Immediate delivery with forceps, easy extraction, chloroform anæsthesia. Four hours later the blood pressure was 93, and on the following morning 120, and 125 on discharge fifteen days later. Three nitrogen determinations made during the last weeks in pregnancy gave normal variations of total nitrogen and ammonia nitrogen.

The second case was a nullipara, thirty-seven years of age. The blood pressure during pregnancy was 110 on two determinations. During the first stage of labor between pains it was 125. Labor was normal, the first stage of sixteen hours, second stage of two hours. Child was spontaneously expelled in L. O. A. Chloroform was given as the head came over the perineum. A convulsion came on without warning two hours after birth, and one hour later there was another. The blood pressure two hours after the second convulsion was 135, and on the following day 125. The urine had been examined daily for casts and albumin during the last month of pregnancy, always with negative findings.

In addition to these, we may add a third case reported to the Chicago Gynecological Society March 24, 1911, as eclampsia without convulsions.

A III-para, 35 years of age, with no history of toxæmia conditions in any of her three pregnancies. During the last six weeks of her fourth pregnancy there were some signs of toxæmia. Dr. Loeb found no casts, nor œdema, nor cardiac complication, but enjoined rest in bed because of $\frac{3}{10}$ per cent albumin and diminished urine. It appears that the patient may have denied subjective symptoms, wishing to avoid the induction of labor. Nor did she keep to her bed. Six weeks after the first symptoms she fell into labor during which she complained of intense epigastric pain. Shortly after, she became comatose without convulsions. The child was delivered immediately without anæsthesia. Three hours later we found a rather soft pulse, about 120, blood pressure of 100 and temperature of 100½° F. A similar reading was taken an hour later. Death occurred 13 hours after the onset, with epigastric pain, preceded by anuria and a gradual rise in the pulse rate. The examination at the time the blood pressure was taken did not indicate shock.

We have also seen one case with a blood pressure reading of 85 mm. taken 22 hours after the onset of eclampsia, with immediate delivery, followed by shock and hemiplegia.

Similar instances are not unknown in literature. Little, in 1908, reports a series of 40 eclampsias. The blood pressure was elevated between 160 and 200 in 37 cases, yet in three cases was as low as 125, 133, and 150 mm. Hg. respectively. We believe we may also adduce one case of Vogeler's as an example of eclampsia occurring during medium blood pressure during labor, notwithstanding the fact that Vogeler classifies it under hypertension. The case was one of four which Vogeler states presented extreme hypertension, and is of interest in that he thus comments upon it. Of these cases, "one only developed convulsions, and was the case of lowest blood pressure in the group." The history shows that the patient was completely examined 3 days before convulsions, and the urine was examined and found to be negative. Two days later she complained of a gastro-

intestinal upset and was given a cathartic. The night following that day she awoke from sleep at 2 A. M. with a violent headache and epigastric pain. At 7 A. M. she became blind, etc. Blood pressure at 9:45, 10:15, and 10:45 A. M. recorded 155. At 10:55 there was a convulsion, and the blood pressure attained 182 mm. Hg. The cervix was dilated to two finger-breadths. Immediately after accouchement forcé, under chloroform, blood pressure was 80, rising shortly to 100, and ranging between 130 and 150 for some four or five days. We submit that this case, presenting a systolic pressure of 155 while in labor, cannot be adduced as an example of extreme hypertension by one who classifies normal pressures 100 to 150, moderate hypertension under 180, and extreme hypertension above 180. The case is merely one other instance of the type of true eclampsias so difficult to recognize until the presence of subjective symptoms.

Bailey, in 1911, reported two cases of profound fulminating toxæmias with low blood pressures. Both cases were admitted through police headquarters by whom they had been regarded as alcoholism. The first case had blood pressure of 70 mm. just before delivery. Eighteen ounces of urine were obtained in 14 hours. Death followed 19 hours after delivery.

The second case also had repression of urine, 13 ounces being the greatest amount in any day under admission. Blood pressure was 75 before delivery, and 80 mm. two days later. Death took place five and one half days after admission.

Bailey concluded that convulsions usually occur when the blood pressure is in the neighborhood of 200, but may occur as low as 155; also that convulsions do not occur when the blood pressure is lowered by poor resistance or by drugs producing collapse.

We believe, as a result of our investigation, that while eclampsia generally gives warning of its approach by a rise in the blood pressure of the individual, the disease may occur without warning; that we are forced to admit the possibility of eclampsia outbreaks, without warning of urinary or blood pressure phenomena.

LOW BLOOD PRESSURE AND SHOCK FOLLOWING LABOR

In the 1897 edition of Lusk's splendid treatise on Midwifery, there is an article of nearly two pages on a subject which frequently receives but as many lines in works of more recent date. Indeed, one may often find scant mention of shock following normal spontaneous labor not associated with hæmorrhage. Lusk in his chapter on "Nerve Exhaustion" and shock thus comments: "Twenty years ago these pathological states played a conspicuous part in the etiology of sudden death during childbirth. Now the fashion has changed. . . . None the less, the need remains to account for a class of cases in which death takes place without recognizable organic lesions. . . . In the absence of visible lesions or the characteristic symptoms of the conditions to which death is usually referred, we have the right to attribute the melancholy issue to the same causes which, outside of childbed, produce identical phenomena." With this preamble there follows a vivid description of the shock which has been met with by nearly all men who have had large series of cases in this country. As a hospital assistant, I well remember my chief's description of two cases of shock from causes that remained unexplained unless attributable to the labors. There was no hæmorrhage in either case. A few years later I saw a similar case in consultation. Quite recently there came under my care a patient who presents the following most remarkable history:

A young woman of 22 years was seen by me in the spring of 1910 when five months pregnant. The family history was negative. Measles and chickenpox were the only diseases in the patient's life. The examination disclosed no abnormalities. The patient's color appeared so good that the blood examination which I make as a routine was omitted. Blood pressure was 95. The patient was living in a neighboring city and was not seen again until the week before labor. The urine had been examined daily during the last month with negative results for albumin, casts, normal amount, and specific gravity. There was no constipation, nor yet looseness of the bowels. Labor began June 19, 1910, at 3 A. M., but did not settle down until morning, so that she did not enter the hospital until 7:30 A. M. The first stage was in no way unusual. The membranes were

ruptured artificially at 5 P. M. Second stage pains were at three-minute intervals. Birth of a 3,600-gram child in R. O. A. was without further incident. No anæsthesia was given save a few whiffs of chloroform at the moment of making a small episiotomy. Two catgut sutures and two silkworm-gut sutures were used for closure, without anæsthesia. The various stages of labor were as follows: First stage, 14 hours; second stage, 1 hour 7 minutes; third stage, 30 minutes; total, 15 hours and 37 minutes. The labor must be classed as easy. There was scant blood lost following the Schultze separation of the placenta. One dram of ergot was given by mouth. During labor the temperature at 7:30 A. M., 10 A. M., and 12 P. M. was 98.8, 98.6 and 99.2 respectively, with pulse of 92, 120, and 88 at the same periods. The fœtal heart rose from 35 to the quarter minute to 39 or 40 shortly before the onset of the second stage. One hour after the birth of the child the patient became shocked, the pulse began to be irregular, rose to 120, then shortly ascended to 150 and 160, and remained elevated at 150 during the night. There was no external hæmorrhage, and the uterus remained firmly contracted. Water and stimulants had been given, and the patient voided eight ounces twelve hours after delivery. The recovery from the shock consumed several days, as the pulse was 132 nearly twenty-four hours after labor. The respiration ranged from 18 to 24. About the eighth day the temperature rose between 100.5° and 101°, while the pulse, which had remained above 100, again ascended. The blood pressure was 88 as taken by a hospital interne. The hæmoglobin was 30, leucocytes 20,000 and red blood cells 2,080,000. The lochia now became more red, and it appeared as if something had been retained in the uterus after labor, although the placenta had appeared intact. The uterus was explored on July 5th without finding cause for the discharge. One week later the curette was used again and several pieces of placental tissue the size of rice bodies were removed from the left uterine cornua, together with a thickened and œdematous endometrium, with marked proliferation of the glands. Following this, recovery was gradual, although the hæmoglobin did not reach 70 until late fall. During the winter she attained her usual health and the hæmoglobin ranged about 85.

One year later the patient returned to me when four months pregnant. The blood pressure was 78 and Hb. 85. There had been comparatively little nausea. I sent her to an internist stating that I wished an opinion as to the condition of the heart and blood vessels, which appeared to me unlikely to stand the strain of labor, and that I was willing to abort her for that reason. The blood pressure reading was confirmed, but the internist thought that with care the patient could be put in shape for labor; that from the reasons given he could not agree to abortion. Tonic treatment was given. Three months later her blood pressure was found to be 75, pulse 96, and Hb. 80. Varicose veins on her legs now appeared, also dilated capillaries on the face and hands, for which she was sent to Dr. Ormsby for consultation. Three weeks later the blood pressure was 82, pulse 96, Hb. 85. A few days before labor the systolic blood pressure ranged between 85 and 90 on several examinations. The membranes ruptured on February 18, 1912, at 2 A. M., following which there was no pain for two days with the exception of a few feeble contractions. The patient was able to sleep. The following night pains reappeared, disappearing after a few hours. The temperature had now risen to 101.2°, and pulse frequently reached 120. A small sized Voorhees bag was inserted without anæsthetic at 4 A. M., February 20th. Pains shortly followed. At 8 o'clock the child was born after an easy second stage of less than one hour's duration.

Anticipating shock, the arms and legs were bandaged before the time of delivery; coffee and digitalis were given immediately after delivery. At that time the pulse was 108, temperature 100, respirations 20. Thirty minutes after labor, before the placenta had been separated and before an effort had been made to express it, she fell into shock and the pulse ascended to 160, immediately following which it could not be felt at the wrist for four hours. During this time she seemed barely alive, making feeble response to most vigorous stimulation. At 3 o'clock in the afternoon the pulse remained at 160. During the night it ranged about 140, with some vomiting. Respirations were about 32. The following day the pulse did not go below the level of 120, the respirations from 28 to 34. We had thus far made no attempt to remove the placenta, feeling certain that such effort would result only in immediate death. Forty-eight hours after delivery the placenta was removed without anæsthesia. This operation was followed by a chill and a pulse which again disappeared at the wrist and ranged, six hours after the removal of the placenta, at about 150. In spite of the fact that there had been extremely little loss of blood at the time of the labor, and very little oozing during the time the placenta remained in the uterus, hæmoglobin on the fourth day was read at 40 per cent, and on the eighth day 30 per cent. The puerperium was now complicated by an infection and thrombosis of the external iliac vessels.

After a long, stormy convalescence, interrupted at the very end by acute bronchitis, she was discharged on the 74th day following labor. The hæmoglobin was 60 per cent and R. B. C. 3,750,000.

Careful study of this case, we believe, impresses the importance of the diagnostic value of a low blood pressure as a sign of the patient's inability to stand the strain of labor. It appears from study of the literature that there are two types of low blood pressures, one of which appears to be compatible with good health; while the other generally follows

some acute infection or develops during early phthisis. Lauder Brunton has recently emphasized that the feelings of the patient with low blood pressure varies. While some work well and easily with blood pressure between 90 and 100, others tire and are incapable of prolonged manual work. He believes that rest in bed with diet and cardiac tonics is indicated when the pulse falls below 80 or 90. While many of my patients with blood pressures of 90 have passed through normal labor, I believe that all cases with pressure below this limit should be subjected to the most careful scrutiny. If this condition is associated with low hæmoglobin, there is no doubt in my mind that the prognosis is serious as a rule, as experience has convinced me that it is a difficult matter to raise the hæmoglobin or blood pressure during pregnancy. It seems highly probable, therefore, that through the study of blood pressure we may have a forewarning as to the possibility of a complication fortunately rare at the present time; i.e., shock following labor not associated with or resulting from hæmorrhage. It is extremely regrettable that my case was not studied as to pulse pressure. Only systolic pressures had been taken by those who studied the case.

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