

THE PREMATURE SEPARATION OF THE NORMALLY IMPLANTED PLACENTA

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PREMATURE separation of the normally implanted placenta is a condition calling for the keenest judgment on the part of the attending obstetrician. Although it is true that in the majority of cases there is no need for interference because the degree of separation is so slight as to be followed by no serious effects, in a small group, however, the life of the patient may actually depend on accurate diagnosis and the procedure chosen to meet the situation. Each such event, therefore, must be considered as an entity and the treatment should wholly depend on the conditions to be met.

The cause of premature placental separation has not been definitely demonstrated but there seems to be a definite relationship between this condition and the toxemias of pregnancy. While there are unnumbered cases of toxemia of pregnancy in which there is no evidence of placental separation, it is rare to find a case of placental separation without toxemia.

It is rather commonly agreed that the condition is not an uncommon one, but the incidence varies markedly according to different observers. One clinic reports a frequency of one case in every one hundred and eighty-six deliveries while another clinic has reported only one case in every seven hundred and fifty-six deliveries. Doubtlessly, if obstetricians reported every case, in which, after an apparently normal delivery, they found evidence in the placenta of partial separation, the incidence would be much higher than is commonly believed. In a large proportion of these cases old retroplacental clots or blackened areas near the edge of the placenta indicate that some separation has taken place shortly before or during labor, although the portion detached may not have been of sufficient extent to threaten seriously either the life of the mother or child.

The placenta may separate at any time after its formation, with the curve of incidence rising sharply during the last six weeks of gestation. The accident is more common in multiparae than in primiparae and is apparently more prone to happen if successive pregnancies have been many and close together.

This article has been prompted by the observation of ten cases, three of which presented unusually extensive pathologic lesions. This

is a small series of cases but it was felt desirable to place them on record, together with an analysis of the salient points in order that they may be developed farther or at least be given consideration in any more comprehensive study of this condition.

GENERAL CONSIDERATION OF ETIOLOGY

The causes suggested for accidental separation of the placenta are numerous but those given most consideration may be catalogued as follows: (1) a short cord; (2) a short and severe, or unduly prolonged labor; (3) direct or indirect trauma; (4) syphilis or any form of nephritis; (5) persistently high temperature from any cause; (6) certain toxemias of pregnancy.

Most writers are willing to concede that a short cord may be the cause of separation of the placenta in a few instances but it is generally believed that the importance of this factor has been greatly overrated. J. Whitridge Williams¹ refers to the fact that "in the classical specimen which is figured in the Atlas of Pinard and Varnier the accident was attributed to traction upon the placenta by a relatively short cord." It would seem, however, that if the short cord is to have much effect it must be at the expulsive stage because at that time only will traction be exerted, for at other times the uterus and fetus move synchronously together in the same common direction with each contraction. The possibility of separation occurring from this cause must, of course, be admitted but Essen-Moeller² found that traction on the cord will rupture it before it will loosen the placenta. It is probable that every obstetrician can remember one or more cases in which the cord was short enough to cause symptoms of fetal distress during labor as evidenced by the irregularity of the heart rate, although the traction on the cord failed to detach the placenta. It is apparent therefore that if the short cord plays a part in this condition it does it so rarely that for all practical purposes it may be disregarded as an etiologic factor.

In cases where the labor is of the fulminating type and the pains are severe, the fetal heart may noticeably increase in rate and cause some anxiety for the safety of the infant. On deliverance of the child the placenta may come away almost at once because it has been loosened with the first violent pains. Thus it is possible for it to have been separated, somewhat after the manner and mechanism of the Credè maneuver whereupon it would be promptly extruded. This may likewise occur after the administration of pituitary extract late in labor if, as so often happens, the contractions become severe or tetanic in character. Under such circumstances the baby is born with the placenta trailing along almost immediately behind. The infant is delivered in beginning asphyxia and the physician congratulates himself that he administered pituitary extract at the opportune mo-

ment, when as a matter of fact the infant's condition is due to partial separation of the placenta plus the shutting off of the blood supply caused by the severe contractions induced by the drug. Occasionally in unduly prolonged labors, the placenta will be found completely detached with no other cause to account for the condition but they may be with propriety excluded from those which are considered as definitely abnormal, rather than merely accidental.

A few cases may present all the signs of separated placenta who give a history of trauma. The story may be that they have been riding in a train or an automobile and thus jolted or shaken, or there has been direct trauma to the abdominal wall. It may be, as some of the older obstetricians think, that in these few cases chronic endometritis plays a part. Meyers, as quoted by Ahlsrom³ believes that traumatism may initiate severe uterine contraction or even hemorrhage into the decidua thus causing placental separation. In many cases composing this relatively small group there is nothing else to account for the condition, so we are forced with such a history to accept this as a cause for placental separation although we do it with mental reservation.

In the outline of the causes given above, syphilis, nephritis, fever, and toxemias of pregnancy may be classified under the main heading "toxic type" of placental separation and as such will be discussed under the cases reported.

Considered from an etiologic standpoint, I believe there are only two types of placental separation, one of these may be called, for want of a better name, the traumatic type. In this group are included those cases which have a definite history of trauma, as well as those in which there is placental separation without demonstrable cause, as for example, the apparently healthy women who repeatedly abort. The other group, which is by far the larger and more important group is nearly always associated with toxemias and so may be termed the "toxic type."

It is immediately apparent that the general principles expounded and the theories advanced are not new, but such a strict limitation of the causes of placental separation is in marked contrast to the generally vague and indefinite ideas offered whenever the question arises in any given case as to why the accident occurred. I feel that sufficient evidence can be presented to indicate if not actually demonstrate, that practically such cases of separation are due either directly or indirectly to toxic processes. For example, the infarct is a result of an irritating process which finally blocks off a portion of the placenta and the sudden separation occurring in the severe toxemias is the same process from a standpoint of cause only carried out instantaneously. It is an accepted fact that fibrous tissue appears as a reaction to an irritative process and if a section be made through a placental

infarct the vessels will be found to be quite completely surrounded by a thick coat of fibrous tissue while in some portions they are entirely thrombosed. It seems reasonable to assume that the reaction in the fulminating cases is the same, only carried out more swiftly.

J. Whitridge Williams⁴ states that the primary cause of infarct formation in a great majority of cases is to be found in the primary endarteritis of the vessels of the chorionic villi, due to a coagulation necrosis of the portions of the villi just beneath the syncytium with the subsequent formation of canalized fibrin. As the process becomes more marked the syncytium likewise degenerates and is converted into canalized fibrin which is followed by the coagulation of the blood in the intervillous spaces. This results in the matting together by fibrin, of one larger or smaller groups of villi. Later the entire stroma of the villi degenerates so that eventually the infarct consists of a massive network of fibrin.

It will be commonly agreed that endarteritis is present in all cases and the arterial changes are identical with those observed in obliterating endarteritis in other parts of the body. Endarteritis pathologically is caused by some toxic agent, either mechanical or biochemical. In the case of the slow infarct the agent is working leisurely due to its low potency while in the termed fulminating type, a terrifically toxic agent is working almost explosively in the blood stream. It has been shown repeatedly that there is an easy transmission of blood soluble substances by virtue of the process of osmosis between mother and child, and if the toxic agent is a proteinogenous amin, transmission from the maternal to the fetal blood stream or vice versa, with its resulting destruction of end vessels, is definitely possible. Bigler⁵ in commenting on the failure of the various tests of pregnancy remarks that it has been impossible to induce anaphylactic reactions in the maternal organism with serum from the fetus. He thinks that the pregnancy toxin is not a ferment but more of the nature of a proteinogenous amin. These amins he considers the product of an atypical proteolysis in the placenta itself. He feels that the problem of pregnancy toxicoses is to be sought for in chemistry rather than in immunology.

The query of course arises as to whether the endarteritic processes result from the inability of a defective kidney to eliminate ordinary waste products or whether the trouble is due to toxins eliminated by the fetus plus the defective excretory function. It cannot be insisted that it is purely a defective excretory function for in the fulminating cases there is no evidence of previous difficulty and after the acute illness is over no apparent permanent damage is left. The conclusions of Prutz as stated in Williams' *Obstetrics*⁶ emphasize the point that we must not lay too much stress on the kidney as cause. He says "Notwithstand-

ing the frequency of kidney lesions we are not justified even in the majority of cases in considering them as the anatomic substratum of eclampsia for in many cases they are too insignificant." Accordingly, it must remain a question as to whether they are not purely secondary in many cases. If we consider the slow infarct process as being of the same type as the rapid and fulminating, the question may also arise as to why separation occurs in one case when in another the placenta becomes so densely adherent as to be a part of the uterus itself. A section through the placenta and uterus will show how difficult it may be in these latter cases to distinguish the line of union between placenta and uterus. The most rational explanation of this is that, in cases of separation the infarct has been on the placental side and the hemorrhage has dissected its way between the uterus and placenta. In the type that has the firmer attachment the infarct has occurred on the uterine side and as a fibrous ball has sunk into the uterus, locking placenta to the uterine wall and making hemorrhage between the two as practically impossible.

GENERAL CONSIDERATION OF TREATMENT

The treatment of placental separation can be narrowed down to two, depending upon whether the patient is a primipara or a multipara and whether the hemorrhage be severe or moderate.

If the hemorrhage is not alarming, as is often the case, rest in bed with enough morphia for relaxation may be sufficient. If, on the other hand, the bleeding is at all severe whether appearing externally or not, it is at once necessary to empty the uterus speedily. Under such circumstances the baby need not be considered, for the majority of them are already dead and the mother's life is of prime importance. It goes without saying that accurate and early diagnosis is essential and seldom will earlier diagnosis fail to be made if the obstetrician is giving the patient proper prenatal care.

The method of delivery to be chosen is often influenced by the parity of the patient. If she is a multipara there is an opportunity afforded for somewhat more conservatism than if she were a primipara. It may be felt that in a given case, provided the patient is a multipara and in fairly good condition, that merely rupturing the membranes artificially will allow the uterus to contract sufficiently to control hemorrhage and at the same time hasten labor. This may also be an aid, if the labor is already progressing, but otherwise valuable time may be lost awaiting the outcome of such an uncertain procedure. The use of bags too may be slow and uncertain. Manual dilatation may be considered when the cervix is soft and lax, remembering always that manual dilatation usually means laceration and is therefore dangerous. The Rotunda method of vaginal packing has

been well recommended but its benefit is questionable and at least in one case reported here valuable time was lost by the procedure. It goes without saying that the introduction of a gauze pack in the vagina for any time, means a definite increase in the chances of infection.

Kellogg of Boston states that cutting operations should be avoided whenever possible in toxemia, because there is a higher percentage of sepsis than in normal pregnancies, due probably to the lowered resistance to infections. There are times when section is the only safe and ideal method for emptying the uterus. In many primiparae, as well as some multiparae, the cervix is rigid and closed and there is no other method which permits rapid delivery. In cases where the infant is not over seven months and is not too large, where the cervix can be pulled down comfortably, vaginal section is the operation of choice. It should be done by skilled men in a hospital and when so carried out is ideal, for the patient may be delivered with little or no additional loss of blood. In other cases where the infant is too near term or too large to be delivered by vagina, abdominal cesarean is the operation of choice and in some cases the only choice because the uterus may be of the type which requires removal, a decision only that can be made when the abdomen is opened. Williams was the first to point out its advantages in his detailed reported results. They may be summarized by saying that abdominal cesarean affords a speedy and easy means of delivery and at the same time offers more information regarding local conditions than any other method of delivery. If the interstitial hemorrhage has damaged the uterine wall so extensively that the uterus cannot properly contract and thus stop the bleeding after the removal of the fetus, the exposure accomplished by section will immediately make this evident by both the appearance and action of the uterus. The organ will have a peculiar ligneous feeling, doughy in spots and will not contract well despite the use of pituitary extract or vigorous massage. Hysterectomy under these conditions is the only treatment and with the abdomen open the field is ready for such an emergency. The uterus can thus be removed immediately and the patient spared the risks of other slower methods of delivery termed "conservative" which really are not conservative but definitely dangerous. One case of this type is usually impressive enough to make the operator feel certain that abdominal section is the only way to handle such patients. There are of course a certain number of patients who do not survive the shock of section but it is usually because the diagnosis was made late and they would not have survived under any conditions. Supportive measures such as transfusion before operation are to be reserved as necessary, but here again the judgment of the operator must play the important rôle.

CASE REPORTS

CASE 1.—Mrs. K., multipara, thirty-six years old, in her third pregnancy, advanced to the latter part of the eighth month. She had reported every two weeks and nothing in the way of abnormality noted. At her last visit, two weeks before entering the hospital it was thought that there might be a twin pregnancy. Just before entrance she had gone to bed feeling quite well. About three o'clock in the morning she arose to urinate and after she had gotten back into bed noticed that she was bleeding. She bled moderately for two hours and then called a doctor. He was in doubt as to the accurate diagnosis but insisted that she enter the hospital. She hesitated for some time and during the delay the doctor noted that her uterus was becoming larger and more tender. The fetal heart had become irregular and had risen in rate from one hundred and thirty to one hundred and sixty. The patient's pulse had risen from sixty-four to ninety-six and she was complaining of pain in the left lower quadrant. She entered the hospital and a diagnosis of separated placenta was made. Since the cervix was soft, easily admitting two fingers, and easy to manipulate, it was decided to manually dilate and deliver. Two babies were born, one dead and one resuscitated with difficulty. During delivery a large amount of both clotted and fresh blood was evacuated. Since the uterus did not react promptly the hand was introduced into the uterine cavity and about half of the placenta was found to be free. When delivered half of the placenta was covered with old and new blood clot. The patient was discharged on the fifteenth day after an uneventful convalescence. Her blood pressure was 115/75 and there were no urinary findings to suggest a kidney lesion.

CASE 2.—Mrs. N., a primipara, twenty-seven years old, seven and a half months' pregnant. Her pregnancy had been uneventful and she was feeling well. She had travelled seven hundred miles by train and during the latter part of the journey had noted some vaginal bleeding. There had been no particular jarring or rough riding and she could assign no cause for the hemorrhage. On her entrance to the hospital she was in fairly good condition with a pulse of one hundred and twenty, respirations twenty, but she was pale and looked as though she had lost a good deal of blood. Her uterus was boggy and tender, well up under the costal margin while the fetus was palpated with difficulty and no fetal heart could be detected. There was a moderate amount of vaginal hemorrhage. Examination revealed full dilatation with the head lightly engaged. Internal podalic version was easily carried out and a large amount of fresh blood came away with the delivery of a dead baby. The placenta was completely detached but some membrane remained behind and as much as possible was removed manually. The uterus did not react well and pituitary extract and ergot were used intramuscularly. It still failed to react and after a hot douche was packed tightly. Because of her depletion she was given pectoral saline. She rallied well and her convalescence was uneventful. Forced feeding and iron given intramuscularly caused rapid improvement, so that she went home in fair condition although still somewhat anemic. She was seen four months later and was well although she had bled a little after leaving the hospital. Eighteen months later she was delivered of a full term child after an uneventful pregnancy and labor. During both these pregnancies she never showed any kidney disturbance and the urine was persistently negative.

CASE 3.—Mrs. T., primipara in the last month of her pregnancy. She had always been well and had no serious illness earlier in life. During her pregnancy she had been seen frequently by her physician and apparently was well.

For a week prior to entrance she had been troubled by swelling of the hands and feet together with some slight vaginal bleeding. During the thirty-six hours before entrance she had been having rather alarming vaginal bleeding with beginning tenderness in the lower abdomen. The baby had been noticeably more active for the last twenty-four hours but she had felt no movements for the last three hours. By the time she had arrived at the hospital the abdominal pain had become acute and almost unbearable. In addition she said that she had a headache which was driving her insane.

Examination showed a well developed woman with slight edema of the face, hands and feet. There was slight systolic murmur at the apex not transmitted. The pulse was ninety, the respirations twenty-two, and the blood pressure 130/82. The urine was loaded with albumin, and granular, blood, and occasional hyaline casts. The fundus of the uterus was just below the costal border and although tense and tender seemed to relax and soften at regular intervals. The fetal heart and position could not be made out. Vaginal examination showed three fingers' dilatation, a vertex presentation and a deal of clotted and fresh blood. A diagnosis of separated placenta was made and the membranes ruptured. Labor went on rapidly and the patient delivered herself of a dead fetus two hours later. The placenta was immediately expressed being free in the uterus. It was small and had numerous infarcts interspersed with normal placental tissue. There was abundant evidence of recent hemorrhage and no evidence of lues. Autopsy of the baby showed slight petechial hemorrhages over the lung coverings and subserous hemorrhages in the heart, brain, and kidney. The patient was given eliminative treatment with the usual diet for nephritics and she left the hospital two weeks later with a blood pressure of 112/72, a negative urine and nothing to indicate a kidney damage.

CASE 4.—Mrs. C., primipara, twenty-seven years old, in the eighth month of gestation, well until she began to bleed just prior to her entrance to the hospital. She had been properly cared for, having been seen by her physician every two weeks for general observation and for urinary analysis. Four weeks before this time her urine showed a slight trace of albumin and an occasional granular cast. She entered the hospital in active labor, the pains coming every five minutes. Her uterus was slightly tender and she complained that she was "sore," indicating the lower left quadrant. The uterus did not react particularly well between pains but the position was a left occiput anterior, the head well engaged, the fetal heart 136, strong and regular. There was nothing sufficiently abnormal to warrant active interference and she was allowed to go on under surveillance. Four hours later there was a sharp vaginal hemorrhage and her uterus became more tender while the fetal heart rose to 160, irregular. When the service was called in consultation no fetal heart could be made out and the uterus was tender and boggy. The cervix would barely admit one finger so the Rotunda method of packing vaginally was used and she was allowed to go on under careful watching. Three hours later she was delivered of a dead baby. The placenta was completely detached and a large amount of fresh and clotted blood followed delivery. The uterus reacted after pituitary extract and ergot was given intramuscularly but so slowly that uterine packing was deemed wise. During the first ten days of convalescence the uterus showed a tendency to relax and for that period fluid extract of ergot was given four times daily. The placenta showed two infarcts about nine centimeters in size together with numerous fresh and old clots. The patient was discharged apparently well on the eighteenth day still showing an occasional hyaline cast and a trace of albumin. Two months

later the condition still persisted so it seems fair to assume that a permanent kidney damage resulted from this pregnancy.

CASE 5.—Mrs. G., multipara, thirty-eight years old, in the eighth month of her eighth pregnancy. Her pregnancies had been close together coming at intervals of approximately eleven months. She had not seen a physician during this pregnancy and had been doing her work and feeling well up to the present time. The baby had been active for the past month but during the last week she had felt no movement at all. She had been working hard and four hours previous to entrance to the hospital had felt a severe pain in her right side which was distressing enough to force her to bed and call a physician. The doctor made a diagnosis of separated placenta on his arrival and ordered her to enter the hospital at once. The delay ensuing was an hour and a half. Examination at the hospital revealed an unusually distended and tender abdomen. Neither position nor fetal heart could be made out. Her clothes were soaked with blood, her pulse was one hundred and thirty-six, her mucous membranes were pale and she was restless, perspiring and very thirsty. Vaginal examination revealed a completely dilated cervix with a head slightly engaged. Version was easily accomplished and a dead child delivered. A gush of blood came away at once and the placenta was born before the cord could be clamped. The placenta was small, and one-half of it infarcted while the other half was covered with fresh and old blood clot. Convalescence was uneventful, except that the patient passed small amounts of urine with a fixed gravity of 1.016. She insisted on her discharge the tenth day after delivery and at that time the urine still showed a slight trace of albumin with an occasional hyaline cast, while her blood pressure was 138/76. It would not be accurate to say that a kidney lesion existed, for the patient was never seen again and whether she would show symptoms of kidney degeneration for some time, two months for example, could not be stated.

CASE 6.—Mrs. M., multipara, forty-one years old, in her sixth pregnancy and due in two weeks. She said that she had always been well but admitted that her family physician had been taking care of her over a period of two years for kidney trouble. This pregnancy had apparently been normal until eight days before entrance when the baby had begun to be very active and she had developed severe frontal headache. Her doctor had seen her from time to time but had never examined her urine or taken a blood pressure. For the last four days her headaches had been more severe and the fetal movements had ceased. For the past two days coincident with the headaches had come "flashing lights." Her physician sent her to the hospital because he "could not hear the baby." On entrance careful questioning brought out the fact that for a week past her face, hands and feet had been edematous, and twelve hours prior to entrance she bled about a cupful of bright red blood, per vagina.

Examination showed a stout, well developed woman, markedly edematous. The fundus of the uterus was two fingers' breadth below the costal margin, the position was a left occiput anterior, no fetal heart could be detected. The blood pressure was 215/120 and the urine was practically solid with albumin, loaded with casts of all description. The eye grounds showed a few scattered hemorrhages with a slight blurring of both discs. A diagnosis of beginning separated placenta was made, and this together with the toxemia present made immediate induction of labor the logical procedure. A Voorhees bag was used and the cervix was so soft that it easily delivered in an hour, allowing a simple version to be carried out. The fetus was about eight months and macerated. The placenta was free except for a small portion and was quickly delivered. It was com-

pletely infarcted, except for a small portion about three centimeters square. After the usual eliminative treatment and bland diet for sixteen days the patient left the hospital with her eye symptoms well cleared up. Her urine still showed small amounts of albumin and an occasional hyaline cast. Her blood pressure was 150/80. Her phthalein function test was fifty-five per cent and her eye-grounds still showed the typical nephritic picture. In this case it was assumed that the patient had a previous kidney lesion.

CASE 7.—Mrs. C., multipara, thirty-eight years old, in her fifth pregnancy and at the beginning of the eighth month. She had always been well except that during the last two years she had been getting stout. Her previous pregnancies had been quite uneventful and this one had been normal up until her present difficulty. Her membranes ruptured and for this reason she called a physician. He made a vaginal examination, found her bleeding, decided that she had a placenta previa and recommended entrance to the hospital. Physical examination aside from the pregnancy was negative. Her uterus, however, was tender and tense in the upper right quadrant. Although she insisted that she was only seven and a half months' pregnant the uterus was well up under the costal margin. No fetal heart could be detected and abdominal palpation was unsatisfactory. Vaginal examination revealed a soft, easily dilated cervix, filled with blood clot, this probably accounting for the diagnosis of previa. A diagnosis of separated placenta was made and because two fingers could easily pass through the soft, easily dilatable, cervix, it was decided to dilate slowly and deliver. The thick abdomen made external manipulation difficult. In bringing down a foot the right side of the cervix was torn deeply into the vault. A dead baby of seven and a half months was delivered and the placenta was found completely detached. A large amount of both fresh and old blood clot was expressed and the uterus was packed for safety's sake. The patient was put back to bed in good condition and her pulse promptly dropped from one hundred and thirty to eighty-four. Her blood pressure was 118/75. A red count showed 2,860,000 erythrocytes with a hemoglobin (Sahli) of 55 per cent. For the first seven days she had an elevation of temperature to 101° but finally recovered and was discharged in good condition on the eighteenth day. The results of her cervical repair were satisfactory. At discharge the urine showed a very slight trace of albumin with a few scattered hyaline casts and her blood pressure was 142/78. It was assumed in this case that a previous kidney lesion existed.

CASE 8.—Mrs. S., a primipara, twenty-one years old. She had been carefully followed throughout her pregnancy and had reported every two weeks for observation and urinalysis. She was last seen ten days previous and at that time the urine was negative and the blood pressure 114/76. She was feeling well, had no complaints and the baby was active, this being the last month of her gestation. On the morning she entered the hospital she had arisen at the usual hour and was preparing breakfast when suddenly she had an uncommonly sharp pain in the abdomen. The pain continued to grow worse and she was forced to go to bed. Shortly after retiring she noticed a slight amount of vaginal bleeding. Two hours later she began to feel faint and realized that her abdomen was becoming larger and more tender. Examination showed a well developed woman, distinctly pale, holding her abdomen and complaining of constant and violent pain. Her blood pressure was 98/76, pulse 140, and respirations 28. The uterus was well up to the costal margin and quite tender and tense. No fetal heart heard. The diagnosis of separated placenta was apparent from the history and

the findings, and the condition of the patient plus the fact that she was a primipara made abdominal cesarean the operation of choice.

When the uterus was opened the baby literally floated out with a gush of blood and the placenta was completely detached. Grossly it showed no marked changes. There were a few hemorrhagic changes in the uterus, especially in the anterior wall, but it reacted so readily that hysterectomy was not considered. The patient had an uneventful convalescence except that for the first five days she showed a slight degree of jaundice and some tenderness over the hepatic region. Her urine at entrance contained a large trace of albumin with various casts but two weeks later it was completely cleared up and when examined two months after delivery was still negative. It is fair to assume that this patient did not sustain any permanent kidney damage.

CASE 9.—Mrs. B., multipara, thirty-six years old, in her sixth pregnancy, at the beginning of the eighth month. Her past history was uneventful, the first four pregnancies terminating normally, and the fifth resulting in a miscarriage at the tenth week. She said that she had never seen a doctor until the present trouble. At the beginning of this pregnancy she was bothered with severe nausea and vomiting but it cleared up at the third month. She had been troubled with headaches and constipation at frequent intervals. Four days before arrival at the hospital she had a violent attack of vomiting with severe headache and her hands, face and feet began to swell. For the last thirty-six hours she had been bleeding from the vagina. Fetal movements had been quite violent twenty-four hours before entrance but she had noticed none for the last twelve hours. She said that her abdomen had grown distinctly larger and for the last three hours she had been feeling faint. A diagnosis of separated placenta was made on the history and findings but operative procedure was postponed because of the rather precarious state of the patient. She was put on toxemia treatment, her stomach washed out, the colon irrigated, and glucose given by mouth and proctoclysis. This was done because of the marked trace of albumin in her urine, despite the fact that her blood pressure was only 112/78. Twelve hours after entrance she was decidedly a better operative risk. Her abdomen had increased in size meanwhile and was more tender. The uterus had the peculiar ligneous feeling spoken of by Williams, and as a result the abdominal route was chosen for delivery so that hysterectomy could be carried out in case the uterus failed to react. Classical cesarean was done and the uterus was found filled with blood. The placenta was completely detached and a dead fetus, approximately eight months' gestation, was delivered. The uterus was plum colored, felt like a wet sack and would not react even when pituitary extract was injected directly into the uterine wall. The operator felt that he was dealing with the typical hemorrhagic uterus and immediately decided upon hysterectomy. For eight hours following the operation the patient was in precarious condition and finally transfusion was resorted to as a means of combating shock and loss of blood. She rallied well, became mildly septic, but finally was discharged six weeks after entrance. When she left the hospital there was no evidence of kidney lesion and she seemed well in every way, despite the ordeal she had been through.

Sections through the uterus showed hemorrhages widely scattered in the musculature, more marked anteriorly than posteriorly. Some of the hemorrhages were massive enough to separate the muscle and produce clots. There was a marked edema of all tissue and in some places an extensive infiltration of leucocytes suggested an infection or injury by a toxic agent with beginning repair.

CASE 10.—Mrs. O., primipara, twenty-six years old, considered herself between six and seven months' pregnant. She said that she had never had any serious

illness, nor had she been troubled with either throat or dental infections. From the beginning of her pregnancy up until five weeks before entrance to the hospital she had been well except for occasional nausea and vomiting. Then she noticed that her hands, face and feet were swelling. Two days before coming to the hospital she began to develop severe frontal headache with flashing lights before her eyes. She was markedly edematous and although she said that she only weighed one hundred and sixty pounds, the edema made her appear to weigh much more. She was complaining bitterly of flashing lights before her eyes and frontal headaches. There was a faint systolic murmur over the apex of the heart, not transmitted. The fundus of the uterus was just above the umbilicus and the position an L.O.A. with the fetal heart 144. Vaginal examination revealed a soft, easily dilated cervix, admitting one finger. The blood pressure was 178/110 and the urine loaded with albumin and all manner of casts. Immediate delivery was considered, but because of religious prejudices and the fact that she was a primipara it was compromised and she was allowed to go on for twenty-four hours under careful observation. Meanwhile she was given copious colonic irrigations of sodium bicarbonate solution, her stomach washed out, an ounce of magnesium sulphate given every four hours, morphia grain $\frac{1}{4}$, and seventy-five grammes of glucose in three hundred cubic centimeters of normal saline was given intravenously, allowing thirty minutes for it to run in, while in addition two ounces of ten per cent glucose was given every two hours by mouth and all other food stopped. When seen the next day, eighteen hours after entrance, she said that she was much better and she looked and seemed better. Her bowels were moving freely, the headaches gone, and the eye disturbances had practically disappeared. Her blood pressure remained at the entrance figure and her urine was unchanged. She was so decidedly better that it seemed to be fair to wait a little longer because she was anxious for a living baby. She was given a second dose of glucose and at this time 150 c.c. of blood was withdrawn, the blood clotting so rapidly that no more could be withdrawn. The glucose solution had hardly been started when it was noticed that the patient was cyanotic. An hour and a half later she had a chill which lasted for twelve minutes and her temperature promptly rose to 103°. She quieted down after a little time and the symptoms were attributed to glucose. Not long afterward she complained of epigastric pain. When seen she was propped up in bed, grunting with each breath and attempting to belch gas. She remarked that she had had similar attacks before and had always been relieved by vomiting. No definite tenderness could be made out and after washing out her stomach and giving a quarter of a grain of morphia she seemed relieved and quickly fell asleep. She slept throughout the night and the next morning at eight o'clock, fifty hours after entrance, the interne was called by a nurse who said that the patient had a temperature of 95° and looked bad. Fifteen minutes later the patient was in severe shock. Her pulse was 136, of poor quality and easily obliterated. Her blood pressure was 130/70 and for the first time there was a little external bleeding. The abdomen was tense and tender, the uterus well above the umbilicus and much larger than at entrance. The diagnosis of separated placenta was at once made and a hurried delivery attempted. The patient died before the anesthetic was started. The fetus was delivered dead and the placenta was found completely separated but showed no gross infarcts or changes. When the abdomen was opened a moderate amount of bloody fluid was free in the peritoneal cavity. The uterus was soft, pulpy and plum colored with many small hemorrhagic areas throughout. In addition the kidneys, adrenals and small intestine showed widely scattered petechial hemorrhages. The liver itself was riddled and there was scarcely any

normal tissue left. The end vessels with their endothelial linings were destroyed and it seemed as though some substance had suddenly ruined the vessel walls and allowed the hemorrhage to go through them. Autopsy of the baby presented a similar picture in brain, kidney, spleen, adrenal, lung and intestine.

ANALYSIS OF CASES

The cases as presented group themselves rather strikingly into two main classes. Cases one and two fall into the first or "traumatic group" and cases three to ten comprise the second or "toxic group." This latter group may be subdivided according to the rapidity of the process. In cases three to seven inclusive, the toxic action was gradual but nevertheless increased in speed and steadily, while in cases eight to ten inclusive the process was rapid enough to be termed fulminating.

In case one it is difficult to find a cause for the accident unless it be that the twin pregnancy caused an overdistention of the uterus and so brought about the separation. In the second case, no demonstrable cause can be assigned unless the trauma of the train journey can in some way account for it. It may be as Morse⁷ suggests that here there was torsion enough of the uterus, due to its mobility, to cause a venous interference, with stasis, back pressure, hemorrhage and the consequent loosening of the placenta. The argument that there is definite obstruction in cases where by multiparity, for example, undue mobility of the uterus, together with torsion, might account for the few otherwise apparently inexplicable cases of separation. It certainly does not apply, however, to those cases where hemorrhages are found not only throughout the uterus, but also throughout the liver, adrenal, kidney, brain, spleen and intestine.

In cases three to seven inclusive, a definite kidney lesion apparently has some relationship to the condition. All these cases excepting number three, show a definite and permanent kidney damage which was not an acute affair. It preceded rather than followed the placental infarction. The placentas of all showed infarcts ranging in size from a half inch up to what was practically an involvement of the entire placenta. The portions of the placenta not infarcted showed a definite increase of fibrous tissue suggesting an irritative endarteritis which would in time involve the whole placenta.

If it is acceptable that nephritis may be secondary to the irritative effects of toxins, this same type of process may be thought of as taking place slowly in the infarction of the placenta or very swiftly in cases of abrupt placental separation. A slight irritation and then the plugging of the delicate end vessels is begun. Thrombosis very speedily follows by reason perhaps of the enclosure of fetal cells or the reparative formation of connective tissue. It is possible that in the cases reported by Morse⁸ in which there was an increase in con-

nective tissue that this was merely an attempt at a reparative process following the toxic irritation.

In patients where the so-called placental apoplexy has taken place there may be a combination of hemolysis throughout the blood vessels due to toxins together with the bursting of the end vessels from a sudden rise in blood pressure. With the evidence thus far collected the most rational explanation which can be offered for the simultaneous hemorrhages in the uterus, brain, liver, spleen, kidney, adrenal, intestine and other organs, is that there is a sudden accumulation in the blood stream of violent toxins which directly injure the delicate endvessels of the structure affected, so that this, with a change in the viscosity and coagulability of the blood which they likewise produce, may bring about the mechanical and biochemical conditions necessary to permit these widely scattered hemorrhages. The organs affected are those in which the terminal vessels consist of practically nothing but endothelial vessels with a slight amount of connective tissue. Furthermore these local hemorrhages are not peculiar to the condition with which the paper is particularly concerned, but resemble strikingly the petechial hemorrhages produced by the violent septicemias and the lesions produced by the venom of rattlesnakes or cobras. It is fairly well known that the venom of the snakes mentioned speedily destroys the cells of the liver, spleen and kidney, acting especially upon the endothelial cells lining the vessels. It has the property of digesting coagulated blood, destroying the coats of vessels, penetrating muscle and raising blood pressure. Neurotoxin is one of the chief components of the poison and raises the blood pressure probably because of its irritative effect upon the nerve centers in this way being again comparable to the action of the toxins of the disturbances in pregnancies. In the last three cases something of this sort apparently happened.

It is of interest in this connection to note that Prusak-Tuna⁹ have shown recently that the blood of pregnant women suffering from nephritic conditions will hydrolyze normal placenta and liver to a striking degree, kidney and adrenals to a lesser degree.

SUMMARY

1. The premature separation of normally implanted placenta is more frequent than is commonly believed.
2. Complete separation of the placenta is a grave condition calling for both skill and good judgment on the part of the attending obstetrician.
3. Etiologically classified, there seem to be two main groups of cases, (a) a small indefinite group which for the want of a better name may be called the "traumatic group"; (b) the "toxic group" so named because the patients usually show varying degrees of toxemia,

which is so considerable that it could not be merely termed mild but may always be spoken of as moderate or severe.

4. Mild toxemias may act slowly and be responsible for the partially separated placentae or even those which separate almost entirely with all the warning that is given by days of moderate bleeding and other symptoms. These placentae show more or less infarction which apparently seems to be the result of attempted connective tissue repair of the end vessels after the irritative toxic effects.

5. The causes of abruptio placentae or placental apoplexy show the same process raised to the *n*th degree. The process is fulminating because the toxin is rapidly formed and poisonous. Its action may be compared to that of snake venoms or the toxins of violent septicemias. There is apparently a corrosive action on the endothelial blood vessels, the coagulability of the blood is disturbed and hemorrhages are still further favored by the sudden rise of blood pressure. Hemorrhages occur not only in the uterus but also in all other organs containing vessels of the endothelial type.

6. The treatment is expectant if the disturbance is only moderate, whereas the patient should be delivered promptly if the condition is at all serious. A method of delivery should be chosen which seems to offer the patient the greatest security, cesarean section usually being given the preference in fulminating cases where one suspects an unresponsive uterus because it not only gives a speedy method of delivery but because it gives more information regarding the prospects of the patient and permits hysterectomy if necessary.

(Since the preparation of this paper we have seen seven more cases all of which fall under the toxic group, three of which were fulminating in character and the four of the slow infarcting type. The histories in each case together with the findings add additional weight to the view presented in this paper.)

I wish to express my thanks to Dr. Franklin S. Newell, of Boston, for the privilege of reporting two cases seen by me during a service at the Boston Lying-In Hospital.

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