

## Further Observations Concerning Premature Separation of the Normally Implanted Placenta.\*

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IN 1915 I described two uteri which I had removed on account of their inability to contract and retract satisfactorily after Cæsarean section as the result of disorganization of their walls by intramuscular hæmorrhage. At that time I reviewed the literature critically, and I pointed out that my experience had led me to believe that premature separation of the normally implanted placenta resulted in ante-partum hæmorrhage quite as frequently as placenta prævia.

In this communication I shall describe in some detail the clinical and anatomical findings in a case of concealed hæmorrhage due to this accident, and treated by supravaginal hysterectomy, and afterwards I shall consider critically my experience with the condition during the nine years following my original publication. I shall, however, refer only incidentally to the considerable literature upon the subject, as I reviewed it in 1915, and it has since been amplified by Gordon Ley, Willson, Holmes, Portes and others.

*Description of Case.* L. W., history 13795, a 33 year old white woman, who had previously had two normal deliveries, was registered in the prenatal clinic July 23rd, 1924. She was in the ninth month of pregnancy and in good condition. No œdema, urine and Wassermann negative, blood pressure 116/74.

Eighteen days later she complained of feeling very weak and was seen at her home by the out-patient assistant. He realized that she was seriously ill and at once sent her into the clinic. On admission she complained of great weakness and an occasional uterine contraction. She was very pale and presented an ashy appearance; pulse-rate 140, temperature 101, blood pressure 110/70, and hæmoglobin 32 per cent. The full-time uterus was ligneous in consistence, and the fœtus could not be palpated through it. There was no sharp abdominal pain and foetal heart sounds could not be heard. Vaginal examination showed that the external os was closed and the cervical canal unobliterated. There was no vaginal bleeding.

Dr. Gray, who saw the patient in my absence, diagnosed concealed hæmorrhage, and properly concluded that her only

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chance lay in prompt Cæsarean section. Catheterization just before operation showed that the bladder was empty. When the uterus was exposed its characteristic mottled metallic appearance caused him to feel that it would retract poorly, and, in order to reduce the loss of blood to the minimum, he decided to remove it unopened. Accordingly, a typical supravaginal amputation was done, leaving the normal Fallopian tubes and ovaries. Practically no blood was lost, and the abdominal wound was closed in the usual four layers. The abdominal cavity contained a small amount of blood-stained fluid, but its origin was obscure, as the patient had not been long in labour, nor could any fissures be found on the peritoneal surface of the uterus.

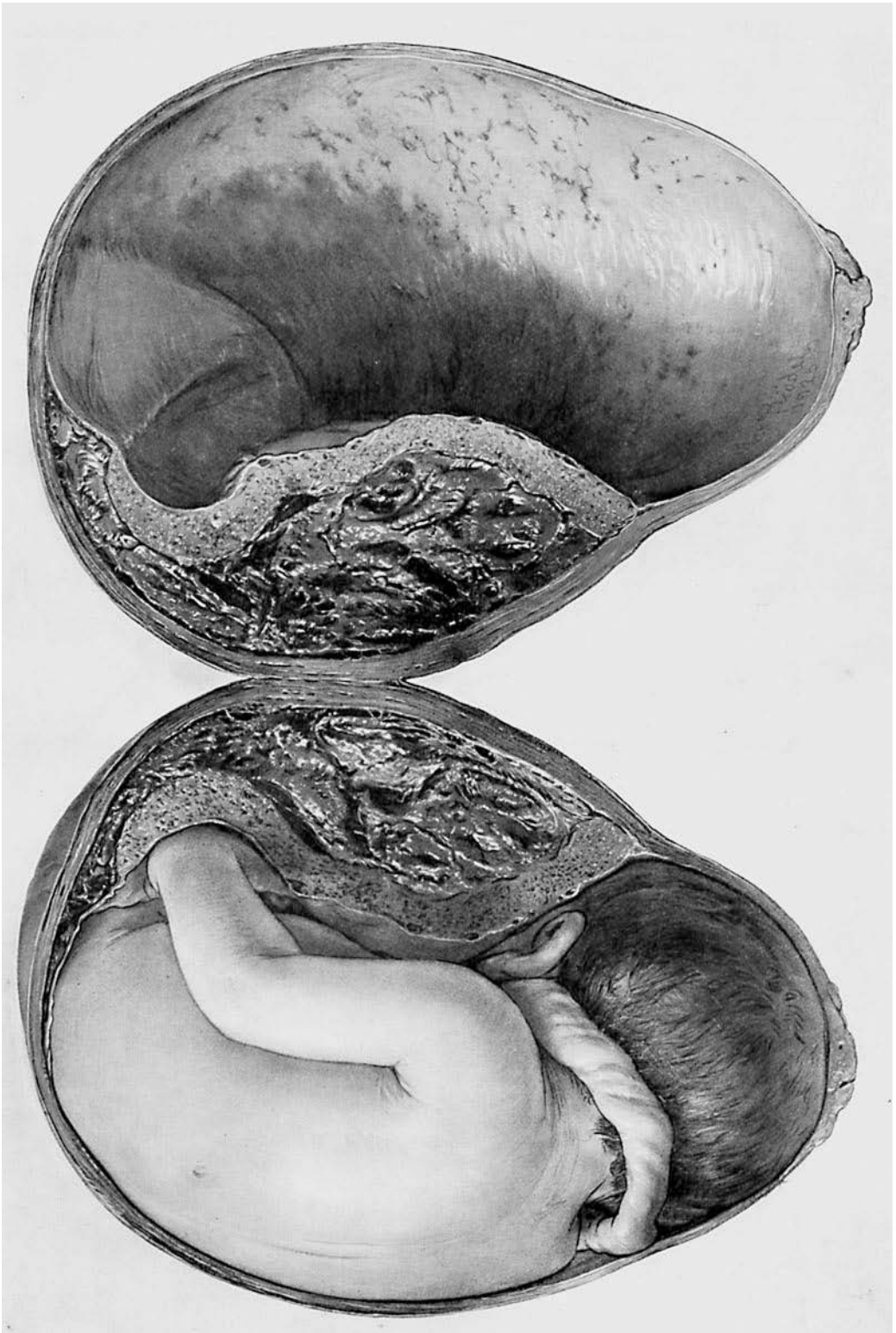
Preparations were made for blood transfusion, and 1,500 cc. of normal saline were infused under the breasts during the course of the operation. The patient left the table in fair condition, but twenty minutes later the pulse-rate became very rapid and compressible and death occurred a few minutes later.

An autopsy was permitted, and the anatomical diagnosis was "Clinical history of premature separation of the placenta, with hysterectomy; bloody fluid in the abdominal cavity; corpus luteum in right ovary; old tuberculosis of right apex, with pleural adhesions; caseous and calcified peribronchial glands; carious teeth." Microscopic examination showed that the various organs were normal except for slight parenchymatous changes in the epithelium of the convoluted tubules of the kidneys, but there were no signs of advanced toxemia of pregnancy.

The specimen consists of the unopened full-time pregnant uterus, which, after hardening overnight in formalin, measures  $28.5 \times 21 \times 19$  cm. in its various diameters. From the peritoneal duplication upwards, the entire anterior wall, except in the region of the right horn, presents the characteristic metallic discoloration; while a similar condition obtains in the posterior wall, except in the region of the left horn. Below the peritoneal duplication there is no discoloration.

One hundred ccm. of amniotic fluid was drawn off by means of a syringe and replaced by 40 per cent. formalin, and some time later the specimen was divided by a sagittal mesial section, when it was found that the full-time male child lay in L.O.A. (3020 gms.) while the placenta, which had been implanted upon the posterior wall, was completely separated from its original site, except at its lowermost end, by an oval collection of coagulated blood measuring 6 cm. at its thickest part.

The illustration, which was kindly drawn by Mr. Max Brodel, shows that the placenta is 18 cm. in length and varies from 1 to 2 cm. in thickness. Its lower pole is still in contact with the uterine wall,



while the rest of it is completely free. In the fundal region, the separation extends about 5 cm. into the membranes, but elsewhere they are closely attached to the interior of the uterus.

The clot separating the placenta from the uterine wall is oval on sagittal section, measures  $6 \times 14$  cm., and does not exceed 500-750 cc. in amount. The foetal surface appears normal. The cord is inserted centrally, but somewhat to the right of the mid-line.

For a distance of about 10 cm. from the left margin of the placenta, the interior of the uterus presents a homogeneous purplish appearance, from the upper boundary of the lower segment to the fundus. A similar discoloration extends from the right margin of the placenta, but involves a smaller area, which nowhere exceeds 4 cm. in width and is irregular in outline. The rest of the uterine cavity is free from discoloration, but presents numerous petechial spots, varying from a pin point to  $2 \times 8$  mm. in area.

The amputation extended through the cervical canal, of which about 1 cm. forms part of the specimen. It presents an oval lumen,  $4 \times 16$  mm., over which the intact membranes extend. The uterine wall varies greatly in thickness, measuring 2 mm. at the lower part of the anterior wall and 10 mm. at the placental site on the posterior wall.

Microscopic study of sections through the uterine wall at the centre of the area of separation, shows that the decidua basalis has been completely disorganized by hæmorrhage, so that the individual cells are isolated and lie free in the surrounding blood. The process also involved the musculature in contact with the decidua.

Sections through the placenta at the opposite side of the hæmatoma show that its maternal surface is covered by a thin layer of normal decidua. On the foetal surface the amniotic epithelium is well preserved, beneath which is the typical chorionic membrane. The chorionic villi present a normal appearance with an abundance of blood in the intervillous spaces.

Sections through the entire thickness of the uterine wall, both at the placental site and elsewhere, show that the muscle fibres pursue an almost parallel course, which apparently indicates that the uterine contents had been subjected to considerable distension. In general the musculature is normal, but especially in the outer layers it is spread apart by small collections of hæmorrhage, which apparently are venous in origin. The disassociation of the muscle fibres is, however, less pronounced than in most specimens of premature separation which I have studied. In the musculature beneath the placental site are many small areas in which the fibres

are spread apart by œdema, and in these areas many clasmatocytes may be seen.

Outside of the placental site the normal foetal membranes are *in situ* and present the usual appearance. The petechial areas noted in the gross description are in part due to the distension of small veins and in part to small areas of intra-muscular hæmorrhage. Nowhere in the specimen could be found any trace of degenerative changes in the muscle fibres nor of decidual inflammation.

Sections through the cervical region show normal cervical mucosa, without any signs of inflammation.

Diagnosis: Premature separation of the placenta; concealed hæmorrhage (retroplacental hæmatoma); moderate intra-muscular hæmorrhage, no inflammatory lesions.

From the description, it is apparent that we have to deal with a complete separation of the normally implanted placenta, associated with concealed hæmorrhage, as well as with hæmorrhagic lesions in the uterine musculature, identical with those described by Couvelaire, Essen-Möller, Gordon Ley, myself and others, and which will be discussed later.

There are, however, several points which deserve mention at this juncture. In the first place, in view of the negative autopsy findings, it would scarcely appear justifiable to attempt to connect the condition with an ordinary toxæmia of pregnancy; although it was unfortunate that urine could not be obtained at the time of operation and thus permit a positive statement as to the presence or absence of albumin. Furthermore, the normal blood pressure reading would speak against such a contention; although it might be objected that it was deceptive, in that the original pressure had been much higher but had fallen to the level noted as the result of hæmorrhage, as I have seen happen upon numerous occasions. Such an objection, however, can scarcely be considered, as the hæmorrhage was entirely limited to the retroplacental hæmatoma, which could not amount to more than 750 ccm.

Furthermore, the question arises as to why the patient should present a pulse-rate of 140, a pallid appearance, and other signs of shock, if the actual loss of blood were so limited. Had an autopsy not been performed, it might have been surmised that additional hæmorrhage had occurred into the peritoneal cavity or elsewhere, but the fact that the autopsy was conducted by trained observers in the Pathological Department negatives such a supposition, and reduces us to the alternative of attributing the symptoms to the shock connected with the dissociation of the uterine musculature, or to the action of some suppositious toxin. Whatever the real explanation may be I am convinced that the loss of an amount of

blood corresponding to that contained in the retroplacental hæmatoma cannot supply a satisfactory explanation for the serious condition of the patient.

*Frequency.*—In my article of 1915, I stated that premature separation of the placenta was probably as frequent a causal factor in the production of antepartum hæmorrhage as placenta prævia, and I reported that 17 and 14 examples of the two conditions, respectively, had occurred in the previous 2,000 admissions to my service. Recently I have gone over our material up to December 31st, 1924 (Histories 7200—14200), and find that in seven thousand admissions there were 40 cases of premature separation and 50 cases of placenta prævia. Or, upon combining the two sets of figures, we have observed the two conditions in 57 and 64 instances in 9,000 consecutive admissions—an incidence of six-tenths and seven-tenths of 1 per cent, respectively (0.006, 0.007). This means that premature separation of the placenta is a relatively common complication of pregnancy and labour, and one with which every one practising obstetrics must sooner or later meet. Moreover, it is interesting to note that the condition is reported less frequently from Germany and Austria than elsewhere. For example, Frankl and Hiess noted it only 34 times in 35,352 labours occurring after the 28th week in the first Clinic in Vienna to January 31st—an incidence of less than one to one thousand. Can this mean that conditions in England, France and America favour the production of the accident, or must some other explanation be invoked?

In our last forty cases, the accident occurred in women of all ages and at every stage of their reproductive career, the youngest being a 15-year primipara and the oldest a 43-year x-para. The accompanying tables give the necessary details.

<i>Age.</i>		<i>Parity.</i>			
15—19 years	... 10 cases	Para 0	... ..	12 cases	
20—29 "	... 14 "	" i	... ..	7 "	
30—39 "	... 13 "	" ii	... ..	6 "	
40 or more	... 3 "	" iii	... ..	2 "	
		" iv	... ..	1 "	
		" v	... ..	2 "	
		" vi or more	... ..	10 "	
40 cases		40 cases			

In other words, the accident occurred most frequently in women pregnant for the first time or in those who had six or more children. As would be expected the majority of cases were observed in women

in full reproductive vigour, namely between the 20th and 39th year, but it is surprising that exactly one-quarter of all the cases occurred in women who had not reached their twentieth year. Naturally our figures are too small to permit accurate statistical deductions, but they clearly show that radical differences must exist between premature separation and placenta prævia, as it is exceptional for young primiparæ to present the latter condition. It should be noted that in 21 instances the pregnancies went to term, while in 19 the child weighed less than 2,500 grams or measured less than 45 cm. in length (prematurity).

In a condition whose clinical course is so variable as in the one under consideration, it is difficult to classify the individual cases, but in order to emphasize the seriousness of the condition to both the mother and child, I have divided the cases into three groups: mild, severe, and those requiring Cæsarean section; though it will of course be realized that such a division is very defective, as some of the severe cases would have been delivered by section, had they been seen earlier in labour, and probably some of the sections would not have been done had I seen all of the patients personally.

I have classified as mild all cases in which the patient did not appear to be seriously ill, and in which the chief symptoms seemed to be a so moderate loss of blood that radical intervention did not appear indicated. As serious, I have grouped together the patients in whom the loss of blood or the shock was alarming. These include five cases of absolutely concealed hæmorrhage, some of which would have been treated more radically had the cervix not been fully dilated when the patient was admitted. Finally, I have grouped together the 10 patients upon whom Cæsarean section was performed; and the accompanying table gives information concerning each group, together with data as to whether the child was term or premature and whether it lived or died.

	Total No.	Term. Child dead.		Premature. Child dead.	
	No.	No.	dead.	No.	dead.
Mild—spontaneous ... ..	12	6	1	6	4
Mild—operative ... ..	7	4	3	3	3
Severe, external bleeding, spontaneous	2	1	0	1	1
Severe, external bleeding, operative ...	5	4	3	1	1
Severe, concealed bleeding, spontaneous	3	1	1	2	2
Severe, concealed bleeding, operative	1	1	1	—	—
Cæsarean section ... ..	10	4	3	6	6
	40	21	12	19	17

Or, to state the facts in another way, there were 19 mild cases with external bleeding, as opposed to 16 severe cases with combined external and internal bleeding, and five severe cases with entirely concealed bleeding.

Some idea of the gravity of the condition may be gained by stating that 17 cases terminated spontaneously and 23 required operative assistance. Included in the latter were the 10 Cæsarean sections, and 13 other less radical operations, divided as follows: version and extraction 4, forceps 3, introduction of bag 3, breech extraction 2, and manual dilatation followed by version, 1.

Three mothers (all in the Cæsarean group) and 29 children died, a gross mortality of 7.5 and 72.5 per cent., respectively; the mortality of the term and premature children being 57.1 and 87.5 per cent., respectively. Or, to state the results differently, there were no maternal and 11 foetal deaths in the 19 mild cases, as contrasted with 3 maternal and 18 foetal deaths in the 21 severe cases, a mortality of 0, and 57 per cent., and of 14.3 and 85.7 per cent. in the two groups, respectively. In other words, our figures indicate that in the severe cases, at least, the accident is serious for the mother and alarming for the child.

Those who are interested in details will find in the Appendix condensed histories of (a) five cases of concealed hæmorrhage treated by the usual obstetrical procedures, and of (b) one case of concealed and nine cases of combined external and internal hæmorrhage treated by Cæsarean section.

A—Histories 8899, 10049, 10125, 11610, 14142.  
 B— „ 9965, 11478, 11535, 11626, 12219,  
 12990, 13037, 13128, 13795, 14209.

Of these, case 13128 is of sufficient interest to be recorded here. The 28-year-old patient had two previous labours in which she was attended by my associate Karl M. Wilson. In the last of these, which occurred in October, 1922, she had premature separation of the placenta, with characteristic symptoms and lesions, and just escaped with her life following a conservative Cæsarean section. When she became pregnant for the third time, she was very much alarmed and consulted me frequently during the course of the pregnancy. It progressed normally, and when I saw her on the afternoon of January 3rd, 1924, she was at term with a large child presenting in L.O.A. urine negative and blood pressure 110/80. Thirty hours later she fell in labour, and shortly afterwards began to bleed profusely. She at once entered the Clinic and was seen by Dr. Wilson, who found the uterus ligneous in consistency, the patient considerably shocked and complaining of



severe abdominal pain. The heart sounds were audible. Immediate preparations for Cæsarean section were made, but before the operation was started the foetal heart sounds had disappeared. The uterus was opened within less than four hours after the first pain and a dead full-time child extracted. The placenta, which had been inserted upon the posterior wall, was found free in the uterine cavity, along with 500—600 ccm. of clotted blood. The posterior wall of the uterus presented typical hæmorrhagic lesions in the fundal region, but as it contracted satisfactorily it was sutured and not removed. There was no involvement of the tubes, ovaries or broad ligaments.

The patient was much shocked after the operation, pulse scarcely perceptible, blood pressure 66 systolic, diastolic not obtainable. Prompt recovery followed the transfusion of 500 ccm. of blood and the patient was discharged in excellent condition on the 18th day. The bladder was empty at the time of operation, but the following day the urine contained 6 grams of albumin per litre and many casts. These, however, rapidly disappeared, so that the urine was normal on discharge and remained so some months later. On the second day the hæmoglobin reading was 32 per cent.

This case is of the greatest interest, as it demonstrates that the condition may recur in succeeding pregnancies and bears out the experience of Couvelaire, as recorded by Portes, who observed one patient in whom the condition recurred once, and another in whom it recurred in two succeeding pregnancies, and it demonstrates the necessity for caution in expressing a prognosis in all such cases.

The case is also of interest on account of the fact that the urine and blood pressure were normal thirty hours before the accident, and that the pronounced albuminuria rapidly disappeared during the puerperium and normal conditions continued afterwards. For these reasons chronic nephritis can be eliminated as a causal factor, and the question arises, whether the accident was due to a foudroyant pre-eclamptic toxæmia, or whether the urinary disturbance was a secondary phenomenon.

*Anatomical Lesions.*—In all of the Cæsarean cases, except No. 12219, the uterus at the time of operation presented the characteristic purplish-bluish, metallic discoloration of its walls with which we have become familiar during the past few years—the so-called utero-placental apoplexy of Couvelaire. The extent of the hæmorrhagic infiltration varied greatly in the individual uteri, sometimes involving the entire body, and sometimes being limited to a relatively small portion of it. In several instances the hæmorrhagic lesion extended beyond the uterus. In Case 9965 it involved the right ovary and broad ligament; in Case 11535 the right broad ligament; while in Case 14209 both broad ligaments

were distended with blood, but the appendages were intact. Moreover, in a recent case (March, 1925) both tubes and ovaries were involved, the broad ligaments were converted into huge hæmatomata, and the peritoneum was dissected off from the iliac fossæ by large collections of dark semi-coagulated blood.

Whether similar hæmorrhagic changes were present in the non-operative cases we naturally are unable to state, but the occurrence of atonic post-mortem hæmorrhage in several instances makes such a supposition probable.

It should also be mentioned that, in Case 14209, a linear tear extending through the peritoneum was noted on the lower part of the posterior wall of the uterus, similar to the fissures described by Fraipont, Krauer and others, and which afforded a satisfactory explanation for the intra-abdominal hæmorrhage observed.

In six instances we were able to study the uterine lesions histologically. In three, including the case which forms the basis for this report, the entire uterus was available; while in three others a strip of muscle was excised from one side of the incision at the time of operation. In each instance lesions were noted similar to those described in my original article, and wherever the disassociation of the muscle fibres was not excessive, it could be seen that the smaller intra-muscular hæmorrhages always occurred about the periphery of veins of small or moderate calibre. It was also noted in every case that the intramuscular hæmorrhage was more pronounced in the outer than in the inner layer of the uterine wall, thereby affording additional support to the contention of those who hold that such observations render it unlikely that the blood originated from the interior of the organ, and was forced into the muscularis as the result of increased intrauterine tension. This localization of the lesion was particularly striking in Case 11626, in which an intramural myoma, 12 cm. in diameter, occupied the posterior wall of the uterus, and whose thick capsule presented the characteristic hæmorrhage involvement, while no blood was present in its necrotic interior.

Unfortunately, in none of the six specimens was I able to find the degenerative vascular changes, which I described in my previous article; consequently I cannot claim that they are of constant occurrence. Nor could I verify the statement of Gordon Ley that individual muscle fibres, far removed from the hæmorrhagic areas, present degenerative changes.

On the other hand, I am able to confirm my previous observation, that areas of œdema occur in the muscularis outside of the hæmorrhagic areas. In each of the six uteri, I was able to demonstrate that in places the muscular fibres were spread apart by a coagulated clear fluid, in which many clasmatoocytes were

present. Whether these cells represent a defence mechanism, or serve some other purpose, I have no means of knowing.

Furthermore, I was unable to find any signs of leucocytic infiltration in the layer of decidua still attached to the uterine wall, whether at the placental site or elsewhere. This tends to confirm the statement of Frankl and Hiess, and is opposed to the belief of Gordon Ley, that inflammatory lesions are frequently present. Moreover, every placenta in the series was studied microscopically, and in none of them was any sign of decidual inflammation demonstrable.

In this connection I might add that, except where complete separation had occurred, each placenta afforded ocular proof of the occurrence of separation by the presence on its maternal surface of one or more depressed areas of varying size, which were either filled by old clot or lined by fragments of coagulated blood. When the depression was deep, the placental tissue at its base showed definite signs of compression and was only a fraction as thick as elsewhere. Moreover, microscopic examination showed that the interior of such depressions was lined by a layer of decidual tissue, thereby indicating that the hæmorrhage, which had inaugurated the separation, had originally begun in the decidua. At the same time, I should not care to be understood as claiming that the primary hæmorrhage never originates in the depths of the placenta; as in a recent case, which has not yet been studied microscopically, conditions obtained which are at least suggestive of such a possibility.

*Causation.* As yet we are entirely ignorant of the ultimate cause of the accident, and can do little but speculate concerning it. At the same time, our observations afford a good deal of negative evidence, and enable us to dispose effectually of various factors whose etiological significance has been urged by numerous writers.

In the first place, there is nothing in our material to support the traumatic origin of premature separation. It is true that in Case 7243 the patient reported that she had slipped on the stairs before the accident, and in Case 9253 that she had done an unusually heavy wash the morning before the hæmorrhage commenced. A similar history, however, can be elicited from many women who have normal labours, and in my opinion must be regarded as coincidental; particularly as in the case just referred to the patient suffered from chronic nephritis. Moreover, the fact that the first indication of the accident frequently occurs while the patient is at rest in bed clearly demonstrates that traumatism is not an essential etiological factor.

Furthermore, the observation that the umbilical cord was not

unusually short in any of our cases, renders it unlikely that detachment of the placenta often results from excessive traction.

The experiments of Morse, who showed that hæmorrhagic lesions can be produced in animals by artificial torsion of the uterus or by interference with its circulation, are undoubtedly correct. But, in my opinion, the changes observed are to be correlated with those occurring in ovarian tumours with twisted pedicles, and do not prove that such mechanical factors are concerned in the production of premature separation in women. Since the appearance of his paper, we have been careful to note the position of the uterus whenever the abdomen is opened, but in none of our patients treated by Cæsarean section did the uterus present evidence of being markedly twisted upon its vertical axis. It is true that Polak has reported and pictured an instance in which such torsion had occurred that the Cæsarean incision lay in the neighbourhood of the insertion of left round ligaments; but, so far as I am aware, it is the only evidence which has been adduced in support of Morse's contention. Accordingly, it would appear that torsion of the uterus can be concerned in the production of the accident only in the most exceptional circumstances.

I have already referred to the absence of decidual endometritis in all of our cases, so that I feel no hesitation in denying that it plays any etiological rôle; and that when it is noted it should be regarded as a coincidental finding. The same may be said concerning syphilis. Wassermann tests were made in 37 of our patients, and were positive in only three—which is lower than the incidence of 11.2 per cent. reported by me in 4,547 consecutive pregnant patients or that of 9.4 per cent. observed by Cruikshank in one thousand patients.

In my previous paper I stated that I believed that a toxæmia of some kind was responsible for the production of at least the majority of the serious cases, and all subsequent writers hold similar views, although they differ among themselves as to its nature and mode of action. The chief argument in favour of this theory is based upon the sudden onset of the accident, its occasional occurrence in toxæmic or eclamptic women, the occasional demonstration of degenerative lesions in the kidney or liver, but particularly upon the presence of albuminuria in a large proportion of the patients. This was noted in 91.3 per cent. of the cases collected by Portes, in 86 per cent. by Willson, in 84 per cent. by Gordon Ley, and in 56 per cent. by Frankl and Hiess, although each writer stated that the quantity of albumin might vary from a mere trace to an alarming amount.

As such gross statistical evidence does not appear entirely convincing, I have analyzed our findings. In two cases, which

ended fatally a few minutes after Cæsarean section, which was performed promptly after admission, no urine could be obtained upon catheterization, but in the remaining 38 patients more or less satisfactory observations were made; although it is unfortunate that in many instances an ante-partum examination was not possible, while in others it was made so long before the accident as to be devoid of significance. The accompanying table gives a resumé of our findings.

*Table showing the presence or absence of albumin in the urine of 38 patients.*

	<i>Antepartum.</i>			<i>Postpartum</i>		
	None	Trace	Much	None	Trace	Much
11 showed no albumin 1—7 days before labour	5	4	2			
4 showed no albumin 8—21 days before labour	3	1	—			
3 showed toxæmia or nephritis before labour	—	—	3			
1 showed trace of albumin at time of labour	—	1	—			
1 showed much albumin at time of labour	—	1	2			
16 had no note before labour	7	7	2			
<hr/>						
38	15	14	9			

Accordingly, it is seen that of 38 patients, 15 showed no albumin at any time during the puerperium, 14 showed only a trace, while 9 presented marked albuminuria, which in one instance was as high as 6 grams per litre. Upon analyzing these figures, it seems fair to conclude that the women in the first group (40 per cent.) gave no evidence of suffering from any of the usual forms of toxæmia. In the second group such an association is debatable, more particularly as in many instances only voided specimens were examined, and it is notorious that the urine of a large proportion of normal puerperal women presents a trace of albumin. On the other hand, it must be admitted that the nine patients in the last group (26 per cent.) presented marked albuminuria, and were the most seriously ill of the series.

As has been pointed out, three of the patients presented indubitable evidence of toxæmic conditions preceding the accident. Case 10049 was sent into the clinic from the prenatal service on account of pre-eclamptic toxæmia, with œdema, albumin + + + +, and a blood pressure of 180—115. Premature separation occurred the following day, and 16 months later the urine contained a trace of albumin.

Case 11535 was normal 18 days before the accident, but presented mild pre-eclamptic toxæmia on admission—0.25 grams of

albumin and a blood pressure of 150/95. On discharge, the albumin had disappeared and the pressure was normal.

Case 7243 presented definite signs of chronic nephritis ten days before the accident, and was discharged in the same condition with a phthalein output of 18 per cent.

Three other patients presented marked albuminuria when admitted in labour, but, as they had not been observed previously, the association with toxæmia is not proven, as it might well be that the albuminuria had resulted from the accident instead of being associated with its cause.

On the other hand, it is important to realize that the findings in the two fatal cases, which came to autopsy, showed no anatomical signs of toxæmia, and, strangely enough, they were the two patients in whom no urine could be obtained upon catheterization immediately before operation. The findings in one of them have already been mentioned in connection with Case 13795, which forms the basis of this article, while in the other (Case 13037) nothing was found but signs of pronounced anæmia. Such negative results are of special significance, as they were recorded by trained pathologists, who had no interest in any particular theory concerning the etiology of the accident.

Finally, Case 11626 is of particular interest in this connection, as the patient had been under treatment in the medical clinic, where a diagnosis of essential hypertension had been made before the beginning of the present pregnancy. She was under our observation for some weeks prior to the accident, showed no signs of albuminuria, but presented a very high pressure, which showed great variations, but averaged about 200/110. During the day of labour it was 240/140, but no albumin was present. Unfortunately she died immediately after Cæsarean section and an autopsy could not be obtained.

From the evidence here adduced it is clear that premature separation may occur in women who at no time present any manifestations of the ordinary toxæmia of pregnancy; while, on the other hand, it may develop in those who present the typical picture of pre-eclamptic toxæmia or actual eclampsia. Moreover, it may occur in patients suffering from chronic nephritis or from essential hypertension without albuminuria. Furthermore, it is clear that the cases associated with marked albuminuria tend to be more severe than when albumin is absent or is present only in small amounts. For example, in our series, seven of the nine patients belonging in the former category presented concealed hæmorrhage or required Cæsarean section, as compared with six of the 29 patients in the latter category.

In this connection, one should bear in mind the observation

of Douglas Miller, who found that a mild albuminuria was demonstrable in a considerable proportion of his patients with placental prævia, and he attributed it to changes which had taken place in the separated portion of the organ. It is equally possible that alterations which may occur in the prematurely separated placenta may give rise to similar phenomena. In which event the albuminuria would be secondary, and not associated with the factor or factors responsible for the primary production of the accident.

However this may be, I have attempted to direct attention to some of the fallacies inherent to the toxæmic theory, not for the sake of being captious, but simply to enable me to emphasize that the problem is more complex than it appears to many, and that we only conceal our ignorance when we talk glibly of a suppositious toxæmia, concerning whose nature we are ignorant. Furthermore, it may be advisable to consider the possibility that the same etiological factor is not concerned in all cases of premature separation, but that some may be due to comparatively simple causes, while others are attributable to a toxæmic process, which may or may not be identical with that causing pre-eclamptic toxæmia or eclampsia.

*Symptoms and diagnosis.* Certain remarks in Holmes' suggestive study concerning diagnostic errors resulting from a too dogmatic belief in the pathognomonic significance of the ligneous consistence of the uterus, lead me to say a few words concerning the general question of diagnosis.

When the bleeding is external, the condition is readily recognized, and the diagnosis is assured by introducing the finger through the cervical canal and demonstrating the absence of placenta prævia. The course to be pursued later will depend upon the severity of the symptoms and the condition of the cervix. In the concealed variety, on the contrary, the diagnosis is frequently made much later than when external bleeding suggests the possibility of the accident, although the severe pain, shock and pallor, and the possible enlargement of the uterus should rarely escape observation. It is particularly, however, in this type of case that the board-like consistence of the uterus enables one to make a positive diagnosis before the appearance of symptoms indicative of concealed hæmorrhage or of shock, and in several instances the recognition of this sign in association with severe abdominal pain has caused me to resort to Cæsarean section while the pulse-rate is still slow and the patient in good condition. Unfortunately, however, this sign is not always available, but when it is present, I consider it pathognomonic.

It was present in 14 of our 40 cases, and was not limited to any particular type of the condition, though it was present relatively

more commonly when the hæmorrhage was concealed, and was more frequent in the serious than in the milder cases. Our records show that ligneous consistence was present in six patients with concealed, in five with concealed and external hæmorrhage, and in three with external hæmorrhage alone. Three of the cases ended spontaneously, eight required Cæsarean section, and the remaining three were delivered by other obstetrical procedures.

The publication of Levant and Portes served to crystallize my experience with the pulse in this condition. They stated that it varied greatly in both rate and character, and "that the rhythm of the pulsations does not enable one to predict the amount of hæmorrhage, for other factors (visceral lesions, toxæmia, shock) may be superadded and tend to modify it."

Naturally, a rapid thready pulse, associated with other signs of hæmorrhage, makes the prognosis more sombre, and in all of our fatal cases the rate varied between 120 and 140 before intervention was undertaken. On the contrary, a slow pulse-rate does not necessarily indicate that serious bleeding has not occurred. Thus Cæsarean section was undertaken in Case 9965 when the pulse-rate was 72, while the red-cell count had fallen to 2,200,000 and the hæmoglobin reading to 24 per cent. Moreover, the pulse-rate may suddenly change, and it is not unusual for an approximately normal pulse to become suddenly converted into one of great rapidity and poor quality while preparations for intervention are in progress, or the change may immediately follow the intervention although no additional loss of blood has occurred.

*Treatment.* The question of treatment can be disposed of in a few words. If the cervix is fully dilated or easily dilatable delivery should be promptly effected by the most conservative means, always bearing in mind the possibility of atonic postpartum hæmorrhage. On the other hand, if the cervix is not dilated, or only partially so, the treatment should vary according to the exigencies of the case. If the bleeding is slight and the patient in good condition, an expectant course may be indicated, whereas if the bleeding is profuse or concealed and the patient shows signs of excessive loss of blood, Cæsarean section should be performed, and the uterus should be retained or removed according as it retracts satisfactorily or not. Supravaginal amputation is necessary in only a fraction of the cases, but if the uterus remains flabby it should be promptly undertaken, and with less hesitation, since we have learned that the accident may recur in a subsequent pregnancy and put the life of the patient in jeopardy for a second time.

In any operative procedure it should always be remembered that the pulse which had been satisfactory up to that time, may suddenly become rapid and weak, and that the sovereign remedy in



such circumstances is the transfusion of compatible blood. For this reason, preparations for transfusion should be made in every serious case, and employed or not as circumstances indicate. Furthermore, it should be borne in mind that the uterine musculature disassociated by hæmorrhage offers a diminished resistance to infection, so that a febrile puerperium is likely to follow a conservative section.

#### CONCLUSIONS.

1. The article is based upon the report of a fatal case of separation of the normally implanted placenta with concealed hæmorrhage, in which the amount of blood lost was insufficient to account for the symptoms of shock, and in which autopsy failed to show the existence of toxæmic lesions.

2. The natural history of the accident in a personal series of 40 cases is considered, and details are given of a patient who suffered from it in two successive pregnancies.

3. Antepartum hæmorrhage is almost as frequently associated with premature separation as with placenta prævia, 57 and 64 cases of the two conditions, respectively, having been noted in 9,000 consecutive admissions.

4. The prognosis is serious for the mother and alarming for the child, the mortality being 7.5 and 75.5 per cent., respectively.

5. Most severe cases are associated with the utero-placental apoplexy of Couvelaire, but not always.

6. In many of the severe cases, pre-eclamptic toxæmia, eclampsia, chronic nephritis or "essential hypertension" precede or accompany the accident. But in 15 of the 37 patients, who survived delivery, albuminuria was entirely absent during the puerperium.

7. If many of the severe cases are the result of a toxæmia, it must be admitted that its origin and mode of action are unknown.

8. Evidence is adduced to show that traumatism, syphilis, inflammation of the decidua, shortness of the umbilical cord, and torsion of the pregnant uterus are rarely, if ever, concerned in the production of the accident.

9. Ligneous consistence of the uterus was observed in about every third case. When present it is a pathognomonic sign, but its absence does not accord equally valuable negative evidence.

#### APPENDIX.

(Abstract of histories of five cases of concealed hæmorrhage and of ten cases treated by Cæsarean section.)

No. 8899. 22 years, 0-para at term. Brought to clinic by her physician with positive diagnosis. In labour 8¼ hours. No

external bleeding, uterus ligneous, pulse 140, Hb. 36 per cent. Child dead. Cervix fully dilated. Low forceps after artificial rupture of membranes, delivery of dead full-time child, followed by 1600 cc. of old clotted blood. Uterus retracted well, poorly, intrauterine pack. Patient returned to bed, collapsed, pulse 160. Rallied after infusion, and made a good recovery, notwithstanding a streptococcus infection. Trace albumin in urine.

No. 10049. 26 years, 1-para, 8 months pregnant. Mild toxæmia in prenatal clinic. Admitted after  $4\frac{1}{2}$  hours in labour, intense abdominal pain, uterus ligneous. Child dead. No external bleeding, cervix 2 cm. in diameter, albumin + + + +, B.P. 180/115, œdema. Spontaneous birth of still-born premature child an hour later. Placenta expressed at once, with 500 cc. of old clotted blood. Pulse slow. Good recovery. Signs of chronic nephritis one year later.

No. 10125. 32 years, 5-para. Normal when seen in prenatal clinic seven days previously. Admitted in labour,  $8\frac{1}{2}$  hours after onset with intense abdominal pain, ligneous uterus, and no external bleeding. Cervix 4—5 cm., child dead. Spontaneous birth of still-born child of 4050 grams. Placenta expressed and followed by 1000 cc. of old clots, showed depressed area of separation  $10 \times 12$  cm., no decidual inflammation. Pulse normal, no albumin, uneventful puerperium.

No. 11610. 16 years, 0-para, 8 months pregnant. Seen in prenatal clinic 15 days before admission, no albumin, B.P. 154/100. Admitted in labour, no bleeding, ligneous uterus. Child dead. Spontaneous birth of still-born premature child after 44 hours' labour. Expressed placenta showed large central depression, 600 cc. of old clots; followed by postpartum hæmorrhage of 2000 cc., necessitating intrauterine pack. Next day red count 2,120,000, Hb. 19 per cent. Transfusion. Febrile puerperium, streptococcus hæmolyticus and colon; broad ligament abscess opened on 16th day. Pronounced albuminuria. Eventual recovery.

No. 14142. 16 years, 0-para, at term. Normal in prenatal clinic, 13 days previously. Admitted six hours after onset of labour with live child in R.O.P. Two hours later child died, so little bleeding that condition was not suspected until second stage when uterus became ligneous. Albumin + +, no casts. Low forceps, delivery of dead 3710 gms. child. Placenta expressed immediately, followed by 500 cc. of old clots, characteristic depression on maternal surface. Uneventful puerperium, urine normal at end of first week.

#### CÆSAREAN SECTIONS.

No. 9965. 15 years, 0-para, eight months' pregnant. Night before admission sharp abdominal pain, early next morning profuse

bleeding. Admitted three hours later. Excessive abdominal pain, ligneous uterus. No external bleeding, pulse 72, red-cell count 2,200,000. Prompt Cæsarean section. Escape of amniotic fluid under pressure. Extraction of dead child, followed by 600 ccm. of old clots and the completely separated placenta. Uterus flabby, but eventually contracted after three injections of pituitary extract and hot compresses. Characteristic appearance of uterus, particularly at cornua, with hæmorrhagic infiltration of right broad ligament. Appendages normal. After operation pulse 110; day later Hb. 27 per cent., red cells 1,656,000. Gradual improvement after transfusion on sixth day, Hb. 62 per cent. and red cells 3,768,000 on discharge 26th day. Puerperium febrile for six days. First day 1.5 grams albumin, falling to 0.25 gms. on discharge. No torsion of uterus, no decidual inflammation.

No. 11478. 25 years, o-para, at term. Sent in by her physician on account of profuse bleeding before onset of labour. On admission external bleeding, pulse 80. Uterus soft, cervix admits finger tip. Child alive in R.O.P. Prompt conservative section, live 2670 gram child. Placenta attached to posterior wall with 200 cc. hæmatoma behind it. Child alive. Characteristic lesions of uterus, which remained flabby until after the injection of pituitrin and ergot. Placenta showed depressed area of separation, but no signs of decidual inflammation. Normal puerperium. Hb. 47 per cent. first day, 80 per cent. on discharge. Trace of albumin in voided specimen third day, none later; no casts.

No. 11535. 33 years, o-para, eight months' pregnant. Normal on last prenatal visit 18 days previously, mild pre-eclamptic toxæmia on admission, 0.25 grams albumin, blood pressure 150/95. Sudden onset of profuse bleeding and intense abdominal pain. On admission ligneous uterus, child dead, membranes intact, external os 3 cm., pulse 88, Hb. 50 per cent. Conservative section four hours after onset. On incising uterus large amount of old extraovular blood escaped. After rupturing membranes dead premature child was extracted. Placenta still partially attached with hæmatoma behind it. Uterus did not contract satisfactorily until pituitrin was injected directly into its substance. Excision of strip of muscle for microscopic examination. Characteristic discoloration, practically limited to right half of uterus and extending into corresponding broad ligament. Placenta showed depressed area of separation but no decidual inflammation. Good recovery, febrile puerperium, urine and blood pressure normal on discharge.

No. 11626. 37 years, iv-para, nine months' pregnant. Followed for three months before labour. Diagnosis of essential hypertension in Medical Clinic before beginning of pregnancy. In clinic for several weeks, with pressure varying between 266/150 and 200/110,

no albumin. When she fell in labour foetal heart was audible; began to bleed some hours later when heart had disappeared. Diagnosis of premature separation, and balloon introduced through 1 cm. cervix. When seen by Harris, uterus was definitely larger than day before and was ligneous in consistence. Pulse 120—130. Transfusion before operation. On opening abdomen, small amount of blood-stained fluid escaped. Uterus incised and dead child extracted. Placenta on anterior wall, almost entirely separated, 500 cc. of old clots. As uterus would not retract, it was amputated with minimal loss of blood. Patient died 15 minutes after completion of operation. No autopsy. The uterus, which presented a myoma 12 cm. in diameter on its posterior wall, showed the characteristic lesions, especially on its right side. These extended into the capsule, but not into the depths of the myoma. Appendages not involved. No signs of decidual inflammation in the amputated uterus.

No. 12219. 28 years, 0-para,  $7\frac{1}{2}$  months' pregnant. Began to bleed while being prepared for examination in the prenatal clinic and was immediately sent into the hospital. No albumin, blood pressure 140/80, Hb. 60 per cent. Child alive, cervix admits finger tips, no placental tissue felt, uterus not board-like. Immediate Cæsarean section, premature child, which died in four hours. The uterus was darker than usual, was very flabby and required 2 cc. of pituitary extract and vigorous massage before it could be sutured; 400 to 500 cc. of blood lost before operation and same amount of old clots removed from the uterus. Placenta showed characteristic depression, but no decidual inflammation. Puerperium uneventful, no albumin. Urine normal fourteen months later.

No. 12990. 17 years, i-para, eight months' pregnant. Not seen in prenatal clinic. Entered service after bleeding for twelve hours. Pulse 120, uterus rigid but not ligneous. Cervix admits finger, albumin ++. Conservative section, dead 2030 gram child. Placenta almost entirely separated from site of insertion on posterior wall; 500 ccm. of blood behind the membranes. Uterus flabby, only contracting after massage and pituitrin. Characteristic uterine lesions, no involvement of appendages or broad ligaments. Placenta showed typical depression, but no decidual endometritis. Puerperium febrile (102). Trace of albumin, but no casts on sixth day. Urine normal one year later.

No. 13037. 27 years, 2-para,  $7\frac{1}{2}$  months pregnant. No prenatal care. Admitted after seven hours of bleeding, pallid, pulse 120, temp. 97. Not in labour, uterus firm, cervix not dilated. Conservative section, still-born, 1130 gram. child. Placenta free in uterine cavity, which contained 200 cc. of old clots. Uterus not flabby, very little operative loss of blood. Pulse poor throughout,

and ceased five minutes after conclusion of operation. No urine obtainable on catheterization just prior to operation. Uterus presented typical lesions. Autopsy: "The organs show nothing except great anæmia," no signs of toxæmia.

No. 13128. Second Cæsarean for repeated premature separation. Details in text.

No. 13795. Complete separation. Concealed hæmorrhage. Supravaginal hysterectomy, death, autopsy. Details in text.

No. 14209. 19 years, 2-para, at term. Normal in prenatal clinic ten days before labour. Admitted after some hours of labour with usual symptoms. When I saw her, pulse was rapid, hæmoglobin 23 per cent., uterus boardlike, cervix 2 cm. Child dead. Immediate section, delivery of full-time child. Placenta free in uterine cavity, which contained 1000 cc. of old clots. Uterus contracted poorly, requiring 2 cc. of pituitary extract, massage and hot packs before it could be sutured. Excision of strip of muscle for histological study. 1000 cc. five per cent. glucose solution intravenously. Uterus presented typical lesions, extending into both broad ligaments, but not involving the appendages. Vertical peritoneal fissure on lower part of posterior wall, which had resulted in some intra-abdominal bleeding. Typical placental depression, no decidual inflammation. Puerperium febrile. Considerable bleeding for 12 hours after operation in spite of repeated doses of pituitrin and ergot. Marked anæmia; transfusion on ninth day. Good recovery, discharged on 20th day. Urine contained albumin ++, but no casts day after delivery; normal from fourth day.

#### LITERATURE.

- Couvelaire. "Deux nouvelles observations d'apoplexie utéro-placentaire." *Ann. de Gynéc. et d'obst.*, 1912, ix, 539.
- Cruikshank. "Maternal syphilis as a cause of death of the fœtus." *Med. Research Council Pub.*, 1924, No. 82.
- Essen-Möller. "L'hémorrhagie retro-placentaire." *Arch. Mens. d'obst. et de gyn.*, 1913, iv, 145.
- Fraipont. "Fissures péritonéales du corps utérine dans les cas de décollement du placenta normalement inséré." *Ann. de gyn. et d'obst.*, 1914, xi, 200.
- Frankl u. Hiess. "Ueber die vorzeitige Placentar-lösung." *Archiv. f. Gynäk.*, 1921, cxiv, 225.
- Holmes. "The relationship of utero-placental apoplexy to Ablatio placente—a clinical study." *Trans. Amer. Gyn. Soc.*, 1923, xlviii, 162.
- Knauer. "Einige seltene Fälle von Gebärmutterzereissung," etc. *Monatsschr. f. Geburtsh. u. Gynäk.*, 1903, xvii, 1279.
- Levant et Portes. "Etude semeiologique de poulx dans l'hémorrhagie retroplacentaire." *Gynéc. et Obst.*, 1923, vii, 43.
- Ley. "Utero-placental (accidental) hæmorrhage." *Journ. Obstet. and Gynæcol. Brit. Emp.*, xxviii, 69.

- Miller. "The association of placenta prævia and the albuminuric toxæmias." *Trans. Edin. Obstet. Soc.*, 1924, xliv, 65.
- Morse. "Premature Separation of the normally implanted placenta." *Surg., Gynecol. and Obstet.*, 1918, xxvi, 133.
- Polak. "Is Cæsarean section justifiable in ablatio placentæ?" *Amer. Journ. Obstet. and Gynecol.*, 1924, 384.
- Portes. "Contribution a l'étude de l'apoplexie utéro-placentaire." *Gyn. et Obst.*, 1923, vii, 56.
- Williams. "Premature separation of the normally implanted placenta." *Surg., Gynecol. and Obstet.*, 1915, xxi, 541.
- Willson. "Utero-placental apoplexy in accidental hæmorrhage." *Surg., Gynecol. and Obstet.*, 1922, xxxiv, 57.