5-1-1939

Placenta previa

Willis A. Melcher
University of Nebraska Medical Center

PLACENTA PREVIA

****

by

Willis A. Melcher

SENIOR THESIS

******

Presented to the College of Medicine

University of Nebraska, Omaha

1939

INTRODUCTION

While it is true, in obstetric practice, nearly four-fifths of all patients are normal, it is in the best interests of the practitioner to be prepared to meet the complications which arise in the remaining one-fifth. In recent literature, the tendency seems to stress various methods of treatment. To be sure, treatment is paramount, but before treatment may be undertaken, a diagnosis must be made. The emergencies which arise in obstetrics must be met with promptness. Nowhere in the practice of medicine is there such a responsibility as is found in obstetrics. The lives of two individuals, the mother and the child, must be considered. The practitioner has not time for sharpening his wits or for awaiting the assistance of a consultant in many instances. Placenta previa, ablatio placenta, ruptura uteri, and many other obstetric problems, although comparatively rare, may present themselves at any time. These problems must be accurately diagnosed before the proper treatment is instituted.

As stated, a greater portion of modern literature deals with management rather than diagnosis. In this paper an attempt is made to present one of the obstetric complications: namely, placenta previa, in all phases

except treatment. A history of placenta previa, as well as types, incidence, etiology, symptomatology, and diagnosis are taken up in the order mentioned with emphasis on the last three. Under diagnosis, the development of the use of the cystogram in placenta previa is discussed in detail.

HISTORY:- Placenta previa is the implantation of the placenta in part or wholly within the zone of dilatation of the uterus. Though not a common obstetric problem, it should be diagnosed promptly because of its seriousness. Naegele (1) was probably right when he said that "there is no error in nature to be compared with this, for by the very action which she uses to bring the child into the world is that by which she destroys both it and the mother." In other words, when there is this peculiar situation of the placenta, it becomes gradually detached either during the latter months of pregnancy or with the onset of labor. As dilatation proceeds it is unavoidably attended by an increasing, more or less profuse discharge of blood.

There is abundant evidence to prove that sudden hemorrhages during pregnancy, attended with circumstances of great danger to the life of the mother and her child, were known from the earliest times. This was especially noticed by Hippocrates, where he says that "the after-burden should come forth after the child, for if it come first, the child cannot live, because he takes his life from it, as a plant doth from the earth" (2).

Hippocrates evidently recognized the seriousness of the condition, but probably supposed that the

presentation of the placenta at the os uteri, with the resulting hemorrhage, was due to its having prematurely separated from its usual site in the uterus. Prolapse of the placenta, partially or wholly over the internal cervical os, was believed to have occurred as a sequel.

Guillemeau, in 1609, adopted the Hippocratic view (3), and we find him advocating prompt delivery in such cases. He states that "the most certain and expedient method is to deliver the patient promptly in order that she may not suffer from the hemorrhage which issues from the uncovered mouths of the uterine veins, to which the placenta has been attached; that, on the other hand, the child being enclosed in the uterus, the orifice of which is plugged up by the placenta, and unable to breath any more by the arteries of the mother, will be suffocated for want of assistance, and also enveloped in the blood which fills the uterus and escapes from the veins in it which are open." His teacher, Ambrose Pare, in 1550, began the practice of employing version. Guillemeau furthered the acceptance of the procedure by using it in all cases of profuse hemorrhage arising before delivery.

Guillemeau's explanation of the nature of placental presentations was still more explicitly adopted by Mauriceau, La Motte, and many others. Mauriceau (4)

speaks of the placenta, when at the cervical os, as "entirely detached" and adds that "even a short delay will always cause the sudden death of the child if it be not quickly delivered; for it cannot remain any time without being suffocated, as it is now obliged to breathe by its mouth, for its blood is no longer vivified by the preparation it undergoes in the placenta, the function and use of which cease the moment it is detached from the uterine vessels with which it was connected: the result of this is the profuse hemorrhage which is so dangerous for the mother; for if it be not promptly remedied she will quickly lose her life by this unfortunate accident." He also adds, "It must be observed that the placenta, which presents, is nothing more than a foreign body in the uterus when it is entirely separated, for when it comes into the passage before the infant, it is then totally divided from the womb." In sixteen cases which he mentioned, he states that in thirteen the placenta was entirely separated from the uterus and presented at the os uteri (5).

Paul Portal, in 1672, was the first to describe the placenta as adhering to the os uteri. However, it is strange that all authors in midwifery up to the time of Roederer and Levret were ignorant of Portal's explanation (6). Even Giffard entertained the prevailing

erroneous opinions of Mauriceau until he at last discovered the real nature of the condition himself.

The next author who observed the real nature of placenta previa was Giffard, whose posthumous work was published in 1734. In several of his case histories he definitely mentioned finding the placenta adhering to the internal cervical os.

Dionis (7) who wrote in the beginning of the eighteenth century, although later than Mauriceau, was not nearly so advanced in his ideas. He believed that the hemorrhage, and placenta presenting before the child, was due to placental prolapse.

Smellie (8) mentions that "the edge or middle of the placenta sometimes adheres over the inside of the os internum, which frequently begins to open several weeks before the full time; and if this be the case, a flooding begins at the same time, and seldom ceases entirely until the woman is delivered; the discharge may be intermitted by coagula that stop up the passage, but when these are removed it returns with its former violence." In one of his cases, dated 1752, it is evident that he was ignorant of what had been said on the subject by Portal and Giffard. He was uncertain as how to proceed after finding the placenta over the os internum.

Roederer, in his "Elementa Artis Obstetriciae" published in 1766, might be said to be the first to correct the erroneous idea of the ancients. He taught that in placenta previa the placenta occupied its abnormal site from the onset (9). He gave a distinct and complete description of this type of hemorrhage; he pointed out the etiology and accurately described the symptomatology and mode of attack. He showed that the placenta may be entirely or partially attached to the os uteri; that in one case the hemorrhage may be very profuse and artificial assistance will be required; in the other it will be slighter; and in many cases it may be left to nature.

Levret, contemporaneously with the first edition of Roederer's work, published a valuable paper on placental presentations. This paper and Roederer's work must be looked upon as the first observations in which the hemorrhage of placenta previa was made a distinct subject of consideration. Although Levret in no wise claimed the merit of being the first to notice the placenta implanted upon the os uteri, there can be no doubt that we are indebted to him and Roederer. They first investigated the subject and called the attention of the profession to its peculiar characters.

We are chiefly indebted to Rigby (10) for a

complete exposition of this important and interesting subject. His well known essay on uterine hemorrhage which precedes the delivery of the full-grown fetus has stood the test of time. To Rigby, without doubt, is due the merit of having first differentiated ante-partum hemorrhages into accidental and unavoidable. This division is practical and appropriate and places this subject in the clearest and simplest possible light. He gave the name of unavoidable hemorrhage to placenta previa and that of accidental hemorrhage to ablatio placentae. Hemorrhage in placenta previa is unavoidable because the placenta must be separated by the dilating cervix with concurrent bleeding. In ablatio placentae the hemorrhage is due to accidental separation of the placenta.

Since Rigby, a host of obstetricians have been interested in the study of placenta previa. Baudelocque (11) made definite mention of placental presentation as did Denman (12). Burns (13, 14) and Barnes (15) later in the nineteenth century, made quite a definite study of placenta previa as did Taylor (16). Goodell (17) gave case records of 106 cases in which bleeding occurred from the gravid uterus. Several of these might well be placenta previa. Goodell gave a good review of the literature in dealing with the subject of ante-partum hemorrhage.

TYPES:- The lower edge of the placenta must be at least ten centimeters from the internal os and well above the upper border of the isthmus uteri to be normal (18). When the lower edge lies just at the isthmus uteri, it may be spoken of as a low insertion. When this edge just reaches the internal os, it is called placenta previa marginalis. When only part of the opening of the cervix is covered, it is called placenta previa lateralis or partialis; and when the os is completely covered, placenta previa centralis or totalis.

Strictly speaking, the differentiation between the several varieties cannot be made until the cervix has fully dilated (19). The marginal variety cannot be felt until this has occurred. What may appear to be a central placenta previa during pregnancy or the first part of labor, may prove to be a partial placenta previa when dilatation is complete. In both the partial and central varieties, partial separation of the placenta is an inevitable consequence of the formation of the lower uterine segment and dilatation of the cervix. This is always associated with the tearing through of blood vessels. As the vessels cannot become constricted until after the uterus has been emptied, the resulting hemorrhage has been called unavoidable. In placenta previa marginalis, on the other hand, hemorrhage does not always occur. Then

the existence of the condition is frequently unrecognized as the placental tissue can be felt only after cervical dilatation has been completed.

Clinically only two types may be recognized (20). These are the partial and central varieties. This classification is more simple and practical as the main interest lies in whether the cervical os is completely or partially covered by the placenta.

INCIDENCE:- The frequency of this condition has been variously stated by writers on this subject to be from 1 in 34 to 1 in 506 pregnancies. These figures will vary considerably as the general practicioner may only see an isolated case while the obstetrician in a hospital practice may see a great number.

Irving (21) found 308 cases of placenta previa among 28,391 deliveries on the In-Patient Service of the Boston Lying-In Hospital during the period from January 1, 1916, to January 1, 1935, a frequency of one in every 92 confinements. During the period, 1916-1923 inclusive, there were 105 cases; during the period, 1924-1929 inclusive, there were 103 cases; and during 1930-1934 inclusive, there were 100 cases. Analyzing these figures the most striking feature is the rise in incidence of placenta previa. In the first eight year period there were 105 cases against 100 cases in the last five year period. Whether

this rise is due to better diagnosis is questionable. It would appear that more confinements are being cared for in the hospital now than in the first period. This may be due to the fact that the methods of diagnosis and treatment are being stabilized.

Hauch (22) collected all the cases occurring in Denmark during the five year period preceding 1933 and found 718 cases of placenta previa in over 346,984 deliveries--an incidence of only 2.07 per thousand or one in 483 deliveries. This frequency increased to 10 per 1,000, or 1 in 100, in hospital practice. This latter figure quite closely coincides with that of Davis (22) in which he found the incidence of placenta previa at the new Chicago Lying-In Hospital to be 9.02 per 1,000 in a study of 12,640 deliveries from 1931-1936.

In 1938, Findley (23) reviewed a total of 47,828 cases of placenta previa or more than twice the number ever before collected. In this large series of cases taken from records of clinicians and institutions the world over, he found, in a series of 21,706, an incidence of 1 in 159.6 (0.626 per cent). In a series of 9,513 cases of placenta previa, 2,830 (29.75 per cent) were of the central type, 3,127 (32.87 per cent) were of the marginal variety, while 3,525 (37.05 per cent) were lateral, and 31 (0.33 per cent) were of unknown classification.

Peckham (24), in a statistical study of the incidence at the Johns Hopkins Hospital, quotes some interesting figures. He found the incidence in negroes to be 1 in 158 which corresponds to Findley's estimate. The incidence in the whites, however,was 1 in 98 deliveries. He also notes that the incidence was the same in primiparas whereas placenta previa occurred once in every 52 white multiparas and once in every 80 colored.

ETIOLOGY:- Concerning the etiology of placenta previa comparatively little is known. No one knows what determines the site of implantation of a fertilized ovum. It is known that the usual site is well up on either the anterior or posterior wall, sometimes more or less laterally, very rarely in the fundus, and quite infrequently in the region of the cervix. These facts are in keeping with the anatomy of the pregnant uterus in that the walls of the contractile portion of the uterus are lined by a thick layer of decidua, whereas the decidual reaction in the segment of the uterus just above the cervix is usually scanty, and in the cervix itself entirely absent (25).

The older authorities believed that placenta previa was due to the separation from its attachment of a normally implanted ovum, which, falling to the lower portion of the uterus, subsequently contracted new

connections instead of escaping through the cervix. Later it was urged that such a view failed to explain the production of the central variety. It was inconceivable that the escape of the minute ovum from the uterus could be delayed sufficiently long to permit the formation of attachments in the neighborhood of the internal os. The fallacy of this view is apparent when one recalls the fact that the uterus at the time of conception is normally so anteflexed that the region of the internal os is at a higher level than the fundus. Hence the force of gravity would not necessarily aid in carrying the ovum towards the cervix. What part gravity may play in determining a site low in the uterus is unknown, but in general is considered an inadequate explanation.

There are several factors to be considered in the etiology of placenta previa; the more important of these are multiparity, especially when the children come in rapid succession, and endometritis. These conditions are likely to be associated.

The abnormality occurs comparatively rarely in primiparas. This seems to be more or less a fact when quoted statistics are analyzed. In the Chicago Lying-In Hospital, Davis (22) found it to occur in 35.1 per cent of primiparas and in 64.9 per cent in multiparas. Irving (21) found, in 308 cases of placenta previa, that

there were 274 multiparas and 34 primiparas, a preponderance of 8:1. Since the usual ratio of multiparas to primiparas in his clinic is 6:4, he feels that there can be no question that multiparity has a striking effect on the incidence of placenta previa. In the series studied by Findley (23), a great predominence of cases was found in multiparas. In a total 21,111 cases, placenta previa was found to occur in 2,918 primiparas (13.82 per cent) and in 18,193 multiparas (86.18 per cent).

The condition also seems to increase in frequency with the number of children which the individual has borne. This point is strikingly illustrated by the following figures of Doranth (19) which were based on 30,796 labors. In these the incidence of placenta previa was 0.17, 0.48, 1.37, 1.28, 3.39, 5.51 per cent, according as the patients had given birth to 1, 2, 3, 4, 5 or 6,7 or more children respectively.

The occurrence of placenta previa is not only favored by the absolute number of children, but also by the rapidity with which the labors followed one another. Strassman found the average age of his patients was 32.9 years and the average number of labors was 6.38. In 55 multiparous women with placenta previa on William's service, it was found that they averaged 5.9 children each in the ten years following the first delivery (19).

In 1902 Strassman (25) made a valuable contribution when he contended that one of the most important factors in its development was to be found in defective vascularization of the decidua. This being the result of inflammatory or atrophic changes, the latter being favored by repeated and closely following pregnancies. This deficient vascularization of the decidua makes it unsuitable, or at least insufficient, for the needs of the placenta. As has been pointed out, this condition is associated with increasing age and parity and is more common in those having had rapidly repeating pregnancies; that is, it is more common in women in whom there has been a greater possibility of endometrial infection or atrophy.

All subsequent investigators have accepted Strassman's view that previous endometritis or other abnormalities of the endometrium play an important part in the etiology of placenta previa. Although at the present time we do not recognize an endometritis which exists from month to month and year to year without causing definite symptoms, it is conceivable and probably true that permanent changes often follow endometrial infection or even pregnancy without succeeding infection. Many vessels become thrombotic at this time, thus diminishing the available vascular bed. With increasing age and parity these vascular changes

with the accompanying fibrosis may become so wide spread as to reach a point of paramount importance. It is certainly a common experience to find the uteri of older women, who have had numerous pregnancies, large, fibrotic, and containing many thrombosed vessels. These conditions are quite distinct from those found in nulliparous women of the same age.

Solomons and Canter (26) attempted to artificially produce an endometritis in rabbits so as to study the effect on the implantation of the ova. They found, that by traumatizing a portion of the uteri of rabbits, no implantation would occur in that portion of the uterus. The theoretical observations of Strassman and these experiments suggest that the fertilized ovum attempts to find the requisite supply of nutriment if the lining of the corpus has been injured, inflamed, or has developed defectively for one reason or another.

Even after the placenta has located itself, it may spread out over a large area if for some reason the soil is inadequate. It is well known that placentas from cases of placenta previa are frequently very extensive in area, though they may be quite thin. Barnes (15) recognized this in 1885 but attributed the placental abnormality to the pressure of the child on the placenta. A particularly good example of a thin placenta is illustrated

in the specimen described by Thompson (27) in 1921, which shows a central placenta previa in which the placenta covers almost four-fifths of the uterine cavity; the entire placenta is below the insertion of the cord which is attached through the membranes and presumably indicates the original point of nidation. In one of Williams' (19) cases which came to autopsy, the placenta was almost membranous, and its site occupied nearly four-fifths of the interior of the uterus.

Further evidence of the placenta's ability to spread out is contained in Goodall's recent study of circumvallation of the placenta (28). He showed quite clearly how the placenta extends beyond its ordinary margins when there has been infarction or sclerosis, presumably as a compensatory mechanism. He further pointed out that the extension is opposite the area of infarction. These observations seem to furnish adequate proof of the placenta's ability to extend, and in doing so its lower portion may approach the region of the internal os, completely or partially overlapping it as the case may be. Whether it be because of defective soil or disease of the placenta itself, nature's effort appears to be the same, i. e., to obtain adequate vascular connections for the placenta and fetus. Whenever a placenta does extend, the likelihood of the development of a previa

becomes increased.

How the placenta grows over the internal os has given rise to much discussion. All investigators agree that the ovum must be inserted low in the uterus (18). Since the ovum burrows into the mucosa and then, in its growth, splits the decidua in all directions, it is easy to see how part of the placenta could come to cover the internal os. The decidua vera and reflexa are carried across the narrow cervical slit and come to lie in apposition of the opposite side, where fusion may or may not occur. If the placenta splits the decidual membrane circularly around the os, the remaining minute hole is easily bridged over, and a horseshoe-shaped or placenta fenestrata results.

An entirely different mechanism was described by Hofmeier and Kaltenbach in 1888. Until that time the gravitation theory was generally accepted. They advanced the theory and showed definitely that some cases of placenta previa are due to a persistence of cotyledonous development on the capsularis or reflexa, the so-called reflexa placenta previa. Just why a part of the chorion laeve continue to grow instead of undergoing involution early in pregnancy is not known unless it is due to some peculiar nutritional condition. When the capsularis has been carried out to the decidua vera and becomes fused

with it, that portion having persistent villi may gradually bridge over the internal os. If the villi continue to develop, a definite previa will exist and vascular connections with the uterine wall will become established. The case described by Titus and Andrews (29) is a particularly good example of this type of placenta previa.

SYMPTOMS:- It has often been stated that the hemorrhage of placenta previa is a complication of the third trimester of pregnancy. This is the rule. However, it is well known that symptoms may arise at any time after the formation of the placenta. In the most recent study (23) it was found to occur in 3,753 (84.98 per cent) of 4,416 cases after the thirty-first week of gestation and in 663 (15.02 per cent, prior to this period.

Hemorrhage is the first and most constant symptom in placenta previa. Other symptoms are both inconstant and equivocal, as pain, pressure, and throbbing in the lower abdomen, frequent urination, leukorrhea, and "carrying the child differently" (18).

The initial hemorrhage in placenta previa is rarely alarming. It may vary from a few drops, hardly a stain on the linen, to a profuse "flooding" which may be fatal at once. Usually a few ounces are lost as the initial symptom. Usually there is no assignable cause. The patient may wake from sleep to find herself lying in a

pool of blood, or, on arising from the toilet, see fluid or clotted blood in the vessel. A painless, causeless uterine hemorrhage in the third trimester of pregnancy is almost pathognomonic of placenta previa. The characteristic course is small repeated hemorrhages, and finally a serious hemorrhage (22). These small hemorrhages are a warning sign of a serious calamity, and unless treated, a high grade of anemia may develop. The accoucheur must not be misled by apparent recovery. This is never complete during pregnancy--the blood is only "patched up". The system is not in a condition to withstand a new drain, one that is inevitable at labor, and a fatal issue may ensue. It is impossible to foretell how great the loss of blood may be at any recurrence of the bleeding. Some of the worst cases of secondary anemia are produced by a condition called "stillicidium sanguinis," i. e., a continuous but very slight dribbling of blood, hardly commanding the notice of the accoucheur, but slowly undermining the woman's constitution, robbing her of her ability to stand bleeding at labor and increasing her susceptibility to infection. Another important sign of hemorrhage is a constant seepage of blood-stained serum. This indicates the formation of a large blood clot in the lower uterine segment and vagina.

The onset of the bleeding usually varies with the

type of placenta previa, although exceptions may be found at any time. In a central placenta previa the bleeding usually occurs earlier in utero-gestation than in the other varieties. However, exceptions have been noted, the cervix remaining closed and there being no hemorrhage until full-term labor begins. Such cases may be unfavorable as the pains may be weak. In a partial placenta previa the pains of pregnancy, the so-called Braxton-Hicks contractions, are usually present; hemorrhage is, therefore, more constant; the cervix softens and dilates; and labor commences. Marginal placenta previa may not cause any hemorrhage until the very beginning of labor, or even toward the end of the first stage; the hemorrhage in this case may be very slight. The accoucheur may suspect the type of placenta previa from the above symptoms, but as stated before, exceptions to the rules are very common. DeLee (18) has seen a severe and almost fatal hemorrhage from a marginal insertion and mild bleeding in a central placenta previa.

The origin of the hemorrhage may be from one or several places. It may arise from the sinuses of the placental site, or from the intervillous spaces of the placenta. The circular sinus of the placenta may be involved, and rarely, then only as the result of interference, from the villi--that is, from the fetal blood vessels.

Concerning the production of bleeding, it must be remembered that during the last weeks of pregnancy the lower part of the uterus is developed to accommodate one pole of the infant, the so-called lower uterine segment being formed.

The relation of the cervix to the lower uterine segment has been the subject of conflicting theories for a long time. Older writers taught that the cervix was unfolded, or effaced, drawn up and expanded to form a part of the uterine cavity, until at term only a small part of the cervix was left. Modern investigators hold that it is the lower part of the uterine body which is developed to cover the inferior pole of the fetus, and that the cervix usually remains closed, at least not shortened, until labor begins.

At term the cervix is apparently slightly shortened, the external os hardly admits a finger to the internal os. From the internal os, extending toward the fundus uteri a variable distance, usually about eight centimeters, the uterine wall is thin, the outer layer whiter and fibrous. A distinct layer of fascia, the continuation of the vesicovaginal fascia, can also be isolated. The peritoneum over it is very loosely attached. The upper boundary of this part of the uterus is marked by three signs: first, the peritoneum becomes adherent to the

muscle; second, a large transverse sinus is present; third, the muscle of the uterus suddenly becomes thicker, forming a sort of ridge or ring. This ring is demonstrable in pregnancy but becomes more marked during labor. It is called Braune's ring, because he first described it, or Bandl's ring, because he showed its immense clinical importance. It is more often and better called the contraction ring, because it marks the lower limit of the contracting or motor portion of the uterus.

The region from the contraction ring to the internal os is called the lower uterine segment. Its origin has been much discussed. The old theory that it came entirely from the cervix is supported by many of the older authors. Rigby (2) states that the cervix will have almost entirely disappeared at term, having been utilized in the formation of the lower portion of the uterus. A later view is that it comes in part from the uterus, that is, from the lower part of the corpus.

Aschoff, in 1906, showed that there exists between the internal os and the proper body of the uterus a slightly differentiated zone which he called the "isthmus". In it the musculature is not so well developed as in the corpus, but more so than in the cervix. The glands are fewer and less vertical, and there is less stroma. During pregnancy the isthmus develops greatly, but not as

much as the corpus uteri. It stretches to accommodate the downward growing ovum and forms, with some of the outer fibers of the cervix, the lower uterine segment. This, in the fully formed structure, varies from six to nine centimeters in length.

It is probable, in some cases, most noticed in multiparas, that the mucous membrane and a few layers of muscle--mostly circular--of the cervix remain unchanged until very near the advent of labor pains. It is just as probable that the outer layers of cervical muscle are drawn up and expanded during the latter months of pregnancy to form a part of the uterine cavity--the so-called lower uterine segment. The upper boundary of this zone is the "contracting ring", or the lower edge of the contracting muscle of the corpus; the lower boundary is the so-called internal os of the cervix, the edge of the cervical mucous membrane. This zone is sometimes covered with decidua, but the membranes are loosely attached to it, showing its late formation. It has little, if any, contractile power. The movability of the muscular layers on each other permits the employment of cervical fibers for the formation of the lower uterine segment, or with the cervix, the dilating portion of the uterus during labor.

It is quite evident, from the foregoing description,

that if the placenta is in the zone of dilatation, it must be more or less disturbed by the formation of the lower uterine segment. If the placenta actually covers the internal os, or a part of it, as the opening becomes enlarged or retracted the attachments of the placenta are bound to be torn through and bleeding occur (25). Should the placental margin merely approach the internal os, the mechanism by which bleeding is produced may not be so clear. The mechanism is intimately bound up with the dilatation of the cervix and the formation of the lower uterine segment. As that portion of the cervix above the external os becomes pulled up to become incorporated in the lower portion of the uterine wall, it seems that there is bound to be a shift in the layers composing the wall in this area. The shift would be sufficient to cause detachment of the placenta should a portion of it be implanted in this region. How far upward from the internal os this shift occurs is a matter of conjecture. It is evident that the area occupied by the placenta is enlarged, but the placental growth is not in proportion.

In cases before onset of labor some feel that the separation is caused by the painless contractions of the uterus. If this be the case, the question is brought up as to why there is no premature separation of a normal placenta. It is known that toward the seventh month of

pregnancy, the Braxton-Hicks contractions become more and more active and the lower uterine segment begins to stretch and thin out (30). The placenta previa, as stated, being unable to stretch with the uterine wall, partially detaches in its lowermost portion with resultant bleeding. The uterine contractions may be further stimulated by blood clots in the cervix and the nervous shock to the patient caused by the hemorrhage. This causes further separation. Thus is set up a vicious circle which will terminate unfavorably. It may be that the painless contractions of the uterus can cause, in some cases, a partial separation of an abnormally implanted placenta. It seems plausible that the reason a normal placenta is not prematurely separated is due to the fact that the contraction does not cause a very great shift in the opposing layers of the fundus. However, in the abnormal placenta we also have to strongly consider the fact that the formation of the lower uterine segment causes a relatively great shift in the uterine and placental portions. This inevitably results in the detachment of the placenta. The separation may be increased by the Braxton-Hicks contractions.

DIAGNOSIS:- A painless, causeless uterine hemorrhage in the last three months of pregnancy usually enables a direct diagnosis of placenta previa to be

made, but the conclusion must be certified by other findings. Generally speaking, the more completely the placenta covers the region of the cervical os, the earlier in gestation will bleeding occur--Randall (31). It is rare to see a woman at full term or in the first stage of labor with a central placenta previa. In this latter instance the patient is apt to be a lateral, or at the most a marginal one. The location of the placenta naturally has a great deal to do with the severity of the hemorrhage. A complete placenta previa may announce itself with a hemorrhage of considerable amount. Fortunately it is rare that the initial hemorrhage proves fatal. The blood that is lost by these patients is characteristically bright red, although in the case of small hemorrhages enough blood may be retained in the vagina to cause the expulsion of clots at a later time. The bleeding from placenta previa may occur at any time and is often unrelated to any exertion. Not infrequently the patient awakens to find that bleeding has occurred.

In placenta previa the general condition of the patient will usually be commensurate with the amount of blood lost. Examination will show bright blood or blood-tinged serum coming from the introitus.

Abdominal Examination

A great deal may sometimes be learned from careful

palpation of the lower pole of the uterus from the abdomen--Kerr (32). Thickening of the lower segment of the uterus with the presenting part high above the brim of the pelvis is suggestive of placenta previa. It is in the variety of central placenta previa that these features are most pronounced. In the lateral or marginal varieties it may sometimes be possible, from abdominal palpation, to be able to determine a placenta previa by recognizing less resistance on one side when the head is presenting. By very gentle palpation it can be sometimes determined that over a certain area of the lower pole of the uterus the presenting head is less definitely felt. Unless labor has ensued, the abdomen will be soft. If labor has been initiated, the uterine contraction will be succeeded by the usual interval of relaxation. Palpation of the abdomen of patients with placenta previa will reveal a much higher percentage of abnormal positions and presentations. This may be considered as one of the suggestive diagnostic features. In the review of placenta previa by Findley (23), cephalic presentations were found in 687 (71.19 per cent) of 965 cases, breech presentations in 130 (13.48 per cent), transverse lies in 146 (15.13 per cent), and in 2 (0.2 per cent) the position of the baby was not known.

Depending upon the duration of the gestation and

the amount of placenta in the lower uterine segment, the presenting part is often not engaged and cannot be pushed into the pelvis. The fetal heart tones are usually present unless there has been a severe exsanguinating hemorrhage. The location of the uterine bruit is also of considerable help in the diagnosis of placenta previa. It is often possible, according to Bill (33), to trace this bruit into the lower uterine segment and across the symphysis pubis. If the placenta is normally situated, the uterine bruit is not often heard over the lower uterine segment.

Rectal Examination

Rectal examination frequently gives disappointingly little information in such cases. In those cases in which the presenting part is engaged and cervix effaced, the external os may be palpated and a sense of fulness detected in the region of the low-lying placenta. The examiner may encounter only a boggy mass on rectal examination for several reasons. These patients are often not in labor or even at term. The placenta prevents the presenting part from entering the pelvis. Breech presentations are not uncommon. Consequently the examiner is unable to map out accurately the relation of the cervix and presenting part to the placenta. However, examination through the rectum should always be performed.

If sufficiently accurate information can be obtained in this manner, the necessity for vaginal examination may not exist.

Vaginal Examination

Randall (31) believes that it is good policy to do a vaginal examination when the information obtained by rectal examination is inconclusive. This is particularly true in cases in which patients continue to bleed. It may be indicated when the history and abdomino-rectal examination would indicate that a greater portion of the placenta is in the lower part of the uterus.

Irving (34) believes that all patients who have bled at all in the second half of pregnancy should have a thorough vaginal examination under an anesthetic. Davis (22) states that the examination of the bleeding cases is fraught with danger. A simple examination for diagnosis may stir up a profuse hemorrhage necessitating further manipulation for its control. The patient who is referred to a hospital at the earliest sign of bleeding will rarely be jeopardized by the transportation, if she has not been previously examined. Irving (34) advocates that the general practitioner do no vaginal examination and further insure the patients recovery by refraining from packing the vagina for control of the hemorrhage.

The danger of examinations, especially vaginal, in

cases with bleeding in the later months of pregnancy, are several. During the examination further hemorrhage may be produced with its attending complications. The possibility of throwing the patient, premature or full-term, into labor must always be considered. The greatest danger of all is the introduction of an infection into the cervix or uterus with the possibility of sepsis and maternal death. A hard and fast rule should be that no vaginal examination should be attempted unless the patient is in a hospital and preparations are made to meet any emergency which may arise by the proper procedure.

Let us consider now the vaginal examination and what can be learned from it. Examination usually reveals a cervix that is quite soft and, in the majority of cases, to a certain extent dilated. In some cases of hemorrhage, the cervix may admit the finger and allow the examiner to locate the placenta. This may not be true of the placenta previa that frequently manifests itself several weeks before term, that is, in cases in which a large amount of the placenta is in the lower uterine segment. In such cases the cervix may be uneffaced and closed sufficiently not to admit a finger. One will have to rely on a fulness, or bogginess, felt in the lower uterine segment which holds the presenting part away from the examining fingers. Some speak of this finding as being a sensation

as if there were a flat sponge between the fetal head and the examining finger. Undoubtedly in certain cases digital examinations are helpful, especially if the vertex is the presenting part. If the fetus presents by the breech, the diagnostic signs mentioned are not so valuable or reliable. The presenting part will be palpated with difficulty in cases of central placenta previa and will become more easily felt the less the amount of placenta in the lower uterine segment. Often the extent of placenta previa can be ascertained without introducing the finger into the cervix. Randall (31) feels that one may be justified in exploring the cervix and the region of the interior of the uterus that can be reached. Certainly this is to be performed with the utmost care and only after preparations to meet any emergency have been perfected before hand. Due to the proximity of the placental circulation to the finger, unusually prominent pulsations may be evident. The possibility of a placenta previa membranacea must be kept in mind.

Kerr and Mackay (32) suggest a procedure which they have at times found helpful. Through the cervix a fairly large-sized Hegar's dilator is passed with very great care; when this is removed there is free bleeding if the placenta is previa (central or marginal). They have found however that in some cases the bleeding so produced has

been considerable. This procedure would be valueless in any hands except those of an expert, who, under the circumstances, might attempt such a manipulation.

DIFFERENTIAL DIAGNOSIS:- The signs and symptoms of placenta previa usually enable the accoucheur to make a direct diagnosis in patients with abnormal bleeding in the last trimester of pregnancy. The history and physical examination will usually add to the conclusion. However, there are conditions which may confuse the practitioner and make the diagnosis somewhat difficult.

The peculiar spongy, fibrous feel of the placental tissue may be simulated by several conditions. A firm blood clot or hemorrhage into the fetal membranes may feel like placental tissue. Thickened membranes or fetal hair matted with vernix caseosa may also produce the same impression. A monstrosity with exposed viscera, for example, anencephalus, may make the diagnosis difficult. It may be of interest to note that fetal abnormalities are somewhat more common than usual in cases of placenta previa. Greenhill (35) lists 15 cases found in the literature and adds 6 cases. He believes that the monsters associated with placenta previa are due to the faulty relation between the placenta and the fetus. This may give rise to arrests in development. In Irving's (21) study of 308 cases of placenta previa, it was found that fetal

abnormalities were somewhat more common than usual, there being one case each of hydrocephalus and anencephalus. In his clinic hydrocephalus ordinarily occurred once in every 581 deliveries and anencephalus once in every 470 deliveries. Murphy (36) found one case of hydrocephalus and spina bifida in 741 pregnancies. He found five malformed individuals per 1,000 of all births and eleven monsters per 1,000 births complicated by placenta previa. This is suggestive in that there may exist some causal relation between fetal malformations and placenta previa. However, he concludes that one condition is in no way responsible for the occurrence of the other.

Hemorrhage is the sign which brings an urgent call from the patient. The origin and cause of the hemorrhage, as well as the amount, must be ascertained by the obstetrician so that he may plan his treatment accordingly. The hemorrhage may be due to some cause or condition which would cause bleeding at any time, or it may be due to some condition peculiar or specific to pregnancy.

Cervical erosions, polyps, hemorrhoids, cervical carcinoma, intrauterine tumors, hematuria, etc., may give rise to signs of bleeding during pregnancy, as well as at any other time. Blood dyscrasias, such as thrombopenia, must also be excluded.

Conditions specific to pregnancy may offer some obstacle in the diagnosis and must be differentiated from placenta previa. Rarities, such as laceration of the circular sinus and bleeding from a vessel passing over the os from a velamentous insertion of the cord, must be considered. Other conditions that must be excluded are abortion and premature labor, normal dilatation of the cervix and cervical lacerations, rupture of the uterus, abruptio placenta, and possibly ectopic pregnancy.

The history and time element, for all practical purposes, will allow the exclusion of abortion and ectopic pregnancy. Premature labor will show the same signs and symptoms as a normal labor except that the patient has not reached full term. Normal cervical dilatation, accompanied by cervical laceration and hemorrhage, should be easily differentiated.

The diagnosis of rupture of the uterus is made from the findings on examination. Ruptura uteri usually occurs during labor and is characterized by the occurrence of sudden, acute abdominal pain, shock, and collapse. The uterine contractions cease. On vaginal examination bleeding is seen. Extreme movability or absence of the fetal presenting part may be found. In some cases the uterine wound may be felt with perhaps gut and omentum

which have prolapsed through it. Further diagnostic certainty is attained by the discovery upon abdominal palpation of emphysematous crackling and of a heart-shaped empty uterus. The uterus may be displaced to one side by a hematoma or by the fetus if it has been forced into the peritoneal cavity.

Abruptio placentae may superficially resemble ruptura uteri or placenta previa. If premature, extensive separation of the placenta occurs during advanced pregnancy or at the beginning of labor, it must be diagnosed immediately because of its sudden deadliness. The grave form of abruptio placentae is often characterized by sudden, severe vaginal hemorrhage. On the other hand bleeding may at first be entirely intrauterine (concealed hemorrhage). In this event the uterus increases more or less rapidly in size and becomes tender and boardlike upon palpation. Uterine pain, especially in the concealed type, is severe and continuous. It is usually more intense on one side of the uterus than on the other. The pain is commonly accompanied by uterine contractions. The uterine expulsive pains ordinarily increase in severity. This contrasts sharply with the cessation of such pains after rupture of the uterus. The pains in placenta previa ordinarily do not increase in intensity as much as in ablatio placentae. Shock is

often severe and the signs of acute anemia rapidly supervene.

If the bleeding is rapid and more or less concealed, abdominal palpation reveals a symmetrical, tender "board-like" uterus which is larger than normal. In some cases, however, the uterus is soft, of a "doughy" consistency. The child may be palpated with abnormal distinctness. No contraction ring or tense round ligaments can be felt. Violent fetal movements and changed heart sounds may be distinguished if the fetus is in danger. These signs cease after extensive or complete separation of the placenta. This is an indication of fetal asphyxia or death.

Upon vaginal examination, bleeding is ordinarily found to be present. The cervix is not dilated as much as the strength and duration of the uterine contractions would indicate. The presenting part of the fetus is distinctly felt and, when displaced upward, occasions increased bleeding which may be accompanied by the escape of clotted blood.

The diagnosis of abruptio placentae, therefore, is made by the occurrence of the following signs and symptoms: sudden vaginal bleeding accompanied by uterine tenderness and pain; alteration or abolition of fetal movements and sounds; the ligneous consistency and en-

largement of the uterus; and the presence of uterine contractions. The diagnosis is assisted by a history of trauma or toxemia.

As stated, in placenta previa, no local signs other than hemorrhage are usually present. However, local signs may be found, particularly if an ablatio is also present. This possibility must be borne in mind. Such a condition has been referred to by Browne (37) who described four such cases.

MORTALITY:- Placenta previa is a formidable complication, and annually sacrifices more mothers and children than appear in statistics. Muller (22), in 1877, quoted a maternal mortality of 40 per cent with expectant treatment. In 1911 McDonald (18) collected 8,625 cases and found that 7.22 per cent of the mothers and 55.5 per cent of the babies died. In 1921 Hitschman reported 6,438 cases, with 6.5 and 40 per cent mortalities respectively. DeLee, in reports gathered from twenty different parts of the world, found mortalities that ranged from 1 to 19 per cent for the mothers and 10 to 80 per cent for the babies. Irving (21) had an uncorrected maternal mortality of 7 per cent. Findley (23), in his series of 47,828 cases, divides the mortality into two periods--those prior to 1922 and those from 1922-1937. In 15,062 cases before 1922, the maternal mortality was 1,116 (7.74

per cent). The gross fetal mortality was 7,816 in 14,162 cases (55.61 per cent). In 32,766 cases from 1922-1937 the maternal mortality was 2,288 (6.98 per cent). The gross fetal mortality in 12,885 cases was 6,551 (50.84 per cent). In 2,063 cases of central placenta previa the maternal mortality was 220 (10.66 per cent); the gross fetal mortality was 806 in 2,040 cases (39.51 per cent). In 3,266 cases of marginal placenta previa the maternal mortality was 118 (3.62 per cent), and the fetal mortality 899 (27.52 per cent). In 2,096 cases of lateral placenta previa the maternal mortality was 88 (4.19 per cent) and the fetal mortality, 707 (33.73 per cent).

Most of the deaths are due to hemorrhage--ante-partum or post-partum (33)--sepsis, rupture of the uterus, and air embolism, in the order named (18). The ante-partum hemorrhage is caused by a partial separation of the placenta from the lower uterine segment. The woman may bleed to death in labor usually because her store of blood has been wasted during pregnancy. A patient with placenta previa is prone to post-partum hemorrhage for two distinct reasons: first, injury to the cervix and lower uterine segment brought about by manipulation necessary to extract the child from the birth canal; second, general atony of the patient or

shock resulting from previous loss of blood and the effect of this condition upon the contractile power of the uterine muscle. The lower uterine wall is thin and weak in muscle, which contracts tardily and closes imperfectly the large venous sinuses; also the contractions are unable to completely separate the placenta. Thus the natural post-partum hemostasis may not exist. If it were not for the fact that the uterine arteries enter the uterus higher up, thus being in the zone of contraction, many more women would bleed to death. Sepsis is invited by the close proximity of the placental site to the more or less infected vagina. Infection may be introduced by the hasty and many manipulations that may be necessary in the treatment. The previous loss of blood lowers the woman's resistance to any infection which is present or introduced. Rupture of the uterus is liable to occur as the uterine wall is much more thinned than usual. The efforts of the accoucheur may be too forcible; rupture may also occur from over-active uterine action. Air embolism, although rare, may occur because the uterine sinuses are so near the external air.

The fetal mortality is due to asphyxia through dislocation or compression of the placenta, tearing of the placenta and fetal hemorrhage. Prolapse of the cord with compression, and the shock from being used as a tampon

in the Braxton-Hicks treatment may be the cause of death. The child may also die from prematurity, pulmonary atelectasis, or shock from the trauma incident to rapid delivery.

INDIRECT PLACENTOGRAPHY

INTRODUCTION:- It is generally believed that the only way to make an accurate diagnosis of placenta previa is by a digital examination, through the cervix uteri, whereby the relation of the placenta to the cervical os can be determined. As has been stated, the abdominal examination may give some hint to the presence of the abnormal implantation of the placenta; in the main it is rather disappointing, as is the rectal examination. Even under the most careful and aseptic technique, the vaginal examination is fraught with more or less danger; the examination may produce uncontrolable hemorrhages or cause the patient to go into labor, often prematurely. It may endanger the patient's life by subsequent infection. Because of these dangers, the vaginal examination is often omitted. The study is confined to the history of the patient and abdomino-rectal palpation. The observation that the head fails to engage properly and cannot be impressed into the lower uterine segment may be made. These findings may lead to the correct diagnosis, but may leave considerable doubt as to the actual location of the placenta.

To prevent contamination of the vagina, to protect the life of the mother, and to obtain a living child, it

becomes a matter of the utmost importance to be able to diagnose this condition by a method which does not have the inherent dangers associated with the digital examination. Until the last few years, there has been very little if any work undertaken which would solve this problem. However, recently this phase of the management of placenta previa has been recognized as being of the utmost importance. Efforts have been made to refine the diagnostic procedure so as to enable the accoucheur to manage the case with the least possible danger to the mother and the child.

The latest aid in diagnosis to be used is, of course, the roentgenologic study of the pregnant woman. Heretofore, the x-ray has been used, although sporadically, in the study of the fetal skeleton so as to determine the position and presentation of the fetus, the presence or absence of any disproportion between the fetal body and the maternal pelvis, and the presence of multiple pregnancies or fetal abnormalities.

It wasn't until this decade that any continued attempt was made to determine the location of the placenta, in its relation to the uterus, by means of radiographic studies of the pregnant uterus. The basic idea was that the differences in densities of the placenta and the uterine wall would enable the roentgenologist to determine

the placental site. Later contrast media were used in an attempt to refine the technique. The latest refinement has been the use of indirect placentography.

It is the intention to show, in more or less chronological order, the development of the use of the x-ray in the study of the placental site. Specifically it will show the method, brought into prominence the last few years, by which cases of abnormal bleeding in the last trimester of pregnancy may be studied for the presence or absence of placenta previa.

Indirect placentography means nothing more than an attempt to define the placental site, especially by the use of contrast media, with the least danger to the mother and child.

DEVELOPMENT:- In 1927, Robins (38), while discussing the use of cystography in the study of pelvic lesions, showed that there were characteristic pressure changes on the form of the bladder in a variety of pelvic masses. He demonstrated that in pregnancy there was a typical crescentic pressure on the dome of the bladder. However, the case he demonstrated was that of a normal pregnancy. No further investigation was carried on in the field of obstetrics at that time.

Menees, Miller and Holly (39), in routine roentgenologic study of pregnancies, observed that there was

a difference in densities of fetal tissues and amniotic fluid. It was suggested that an artificial increase in the density of the amniotic fluid would aid in outlining the fetus. It was found that a water-soluble contrast medium could be injected into the amniotic sac with relatively little danger (40). They used a solution of strontium iodide and followed the injection by an x-ray film of the abdomen. They then proposed to outline, if possible, the site of implantation of the placenta. In 21 cases directly injected there were no injurious or toxic effects to the mother or fetus in normal pregnancies. It was believed that the method offered a precise means of locating the placenta in cases of silent bleeding. The procedure was not devoid of danger as, in a case of placenta previa at the sixth month, the fetus was expelled about thirty hours after injection.

In the meantime Staveley (41) pointed out that the placenta is not normally visible. However, the placenta might show calcified patches, which might be useful in the diagnosis of placenta previa. He assumed that if such patches are present in the fundus, no placenta previa is present. This finding, however, is not common as the calcareous granules often found in the placenta are seldom so grouped together as to present a definite shadow on the x-ray film.

Hewitt attempted to demonstrate or exclude placenta previa by x-ray examination, after making intrauterine injections of lipiodal (32). The findings were not constant or conclusive.

Thorotrast, intravenously, was tried in pregnant mice, thereafter examining them with x-ray. It was found that the drug was deposited in the placenta, but the animals were overdosed before a sufficient amount would produce shadows.

Kerr and Mackay (32) attempted to follow Menees procedure using strontium iodide, but with rather dire results--three premature dead fetuses. They then substituted Uroselectan B, which is non-toxic and non-irritant. This also had a tendency to terminate pregnancy prematurely.

Snow and Powell (42) were able to demonstrate the placenta in routine roentgenologic examination of the abdomen of pregnant women in a very high percentage of cases. No special technique was used. They believed that with a reasonable amount of technical accuracy in making the exposures, no difficulties would be encountered. It was observed that the placenta causes greater obstruction to roentgen rays than amniotic fluid because of tissues and blood. This, and the fact that the placental shadow fuses with that of the uterine wall,

enabled them to show the placental location. It was also observed that the fetal part pressing on the placenta showed a line of increased density appearing between. This was believed to be caused by greater penetrability by roentgen rays of the fat-containing sub-cutaneous tissues. That the use of contrast media might be of value in the diagnosis of placenta previa was suggested.

Ude, Weum and Urder (43) reported a case of placenta previa study by analysis of the usual anteroposterior film of the abdomen and pelvis. They supported the supposition that the roentgenologic findings in placenta previa permit the roentgenologic diagnosis of this condition without actual invasion of the uterine cavity. It was found helpful to inject a small quantity of sodium iodide in the bladder to aid in visualizing the bladder margins. Placenta previa was demonstrated by them in two additional cases. Friedman and MacDonald (44) reported two cases diagnosed as placenta previa by aid of the cystograms and substantiated at delivery.

Ude and Urner (45), after reporting the one case of central placenta previa diagnosed by cystograms and confirmed clinically, began an intensive study in this field. Patients with a normal pregnancy and patients with any abnormal bleeding of any character during the last trimester were studied. The x-ray interpretations

were correlated with clinical and operative findings. They reported 35 cases of abnormal bleeding. Fourteen cases were diagnosed as placenta previa and corroborated by clinical and operative findings in all cases but one in which a partial implantation was shown, but the findings at delivery were not recorded. None of the 21 remaining cases showed either clinical or operative findings of placenta previa. These authors described their technique in the use of cystograms and discussed anatomic relationships.

ROENTGENOLOGIC TECHNIQUE:- The radiographic procedure should be carried out on a table equipped with a Potter-Bucky diaphragm, and under circumstances permitting a rapid exposure. A catheter is inserted into the urinary bladder; the bladder is emptied; and about 40 c.c. of a 12.5 per cent solution of sodium iodide or other contrast media is instilled. The catheter is then withdrawn. Two details are stressed in this procedure: first, the amount of instilled solution should only be sufficient to outline the urinary bladder. It should not be sufficient to distend the bladder completely. Too great a pressure may be exerted against the uterus so as to produce difficulties in the analysis of the findings. The only call for instilling a contrast material is to demarcate the margin of the bladder. Any filling which

exceeds this would be of no additional value and might distort the findings. Second, the catheter should be withdrawn before making the roentgenogram. If it is left in the bladder, it may distort its margin to such an extent that the study may have to be considered unsatisfactory. Attempts to use air to distend the bladder instead of a contrast solution is less satisfactory than the method advocated. Although under careful control it may yield the same information.

The usual anteroposterior film is made immediately after withdrawal of the catheter. The tube is centered over the mid or lower abdomen just as is customary for study of the fetus in normal cases. It is thought best not to angle downward into the lesser pelvis because in doing so it would result in failure to clearly demonstrate the soft tissue space between the urinary bladder and the head of the fetus. It is preferable to use a large enough film to show the entire fetus. Other valuable information may be revealed from a study of the fetal structure or from the soft tissue shadows, such as the placenta, in the upper portion of the uterus. Exposure time should be the shortest consistent with the available equipment in order to reveal the maximum amount of detail without distortion from the motion of the fetus.

It is believed that a lateral film is of very little value to demonstrate placenta previa. It may, however, be of considerable indirect help if one can establish thereby the placental presence in the upper segment of the uterus. Thus, as was brought out by Snow and Powell (42), low implantation may be excluded.

Ude, et al, (46) later made additions to their technique as follows: Prepare the patient by administration of low colonic flushes in order to eliminate gas and fecal material from the rectum. Rectal distention will not always lead to error in diagnosis but may produce abnormal findings which closely simulate the positive picture. Fecal distention of the rectum probably constitutes the greatest hazard in the roentgenologic interpretation.

An abdominal compression band is used only to stabilize, not for compression. As stated before, the lateral film is of no additional value to demonstrate placenta previa. However, it will show the very interesting anterior protrusion of the bladder during the later stages of pregnancy.

Aurelius and Schulze applied this method in 23 cases with satisfactory results. They introduced, as an innovation, an oblique film of the lower abdominal region as a supplement to the procedure. In this way

they were able to diagnose one case of placenta previa centralis with the fetus in a transverse position, with one forearm presenting over the upper surface of the placenta. The linear shadow of increased radio-translucency first described by Snow and Powell (42) was of distinct service in this case in demarcating the outline of the fetal forearm. Ude, et al, (46) are under the impression that this line must represent the layer of vernix caseosa on the body surface of the fetus, since this is the ever present fatty substance which could give such a layer of decreased soft tissue density.

Williams suggests that the use of an erect radiograph also be made when feasible so as to obtain more pressure on the bladder (47). Hoffman (48) suggests the use of a portable unit in cases in which the patient is in rather difficult straits.

ANATOMIC RELATIONS AND ROENTGEN DIAGNOSIS:- The anatomic relations of the pregnant uterus to the adjacent structures constitute the basis for roentgenologic interpretation. Anteriorly, the uterus rests directly against the abdominal wall, generally displacing the intestinal loops and the omentum superiorly and posteriorly. The peritoneal cavity dips down between the lower uterine segment and the urinary bladder. The wall of the bladder is only a few millimeters in thickness, and is separated

from the lower uterine segment only by the two folds of peritoneum. In the roentgenogram the fold of peritoneum may be demonstrated as a narrow line of increased translucency. In the third trimester of pregnancy, the lower uterine segment is a comparatively thin-walled muscular tube, also measuring a few millimeters in thickness. The total thickness of the soft tissues normally lying between the inner wall of the gravid uterus and the lumen of the bladder scarcely exceeds one centimeter. On the roentgenogram this space normally appears to be only about six to eight millimeters in depth. If then the inner wall of the lower uterine segment can be demarcated, it should be possible to demonstrate any abnormal increase in the width of this area. For this factor, the presence of the fetal head in the lower uterine segment is an excellent landmark. Covered only by a very thin layer of soft tissue, the bones of the head give a very accurate demarcation of the inner wall of the uterus. This may be well demonstrated in control cases of normal pregnancies. It has been found that the presenting head invariably lies directly against the lower anterior wall of the uterus unless it is displaced upward by a solid mass. The displacement may be caused either by the placenta, blood clots from premature separation of the placenta, or from some abnormality of

the fetus or pelvis. Furthermore, this portion of the uterus produces a crescentic pressure deformity of the upper posterior surface of the urinary bladder. It is a careful analysis of the densities between the bladder margin and the skull of the fetus that is depended upon for the roentgenologic diagnosis of placenta previa. If a breech or transverse position is encountered, these findings probably cannot be established. In the absence of the head of the fetus from the lower uterine segment, the inner wall of the uterus cannot be accurately determined. It is, therefore, apparent that this study depends on the presentation of the head of the fetus.

The normal placenta varies from two to three centimeters in thickness. In low implantations the placenta has a tendency to be thinner than normal. It spreads out over a larger area because of the limited blood supply of the lower uterine segment. The shape of the placenta conforms to that of the uterine wall externally and to the pressure from the fetus and the amniotic fluid internally. Its outer margin is therefore convex and its inner margin concave. The concavity of the inner margin is especially evident when the rounded head of the fetus rests directly against it in the lower uterine segment. The demonstration of a mass of these characteristics interposed between the fetal head and the urinary bladder

constitutes the diagnostic picture.

The size and position of the presenting mass may allow one to express an opinion whether the implantation is central or partial in type. One must not be misled by blood clots from a premature separation of the placenta which may form a density closely simulating placenta previa.

Hundley, Walton, et al. (49) studied 27 cases. In ten a space, which varied from 1 to 2.5 cm. in diameter, was found between the shadow of the fetal head and the outline of the bladder. They could not demonstrate any placenta previa clinically in these ten cases and concluded that the findings, by this method, were not diagnostic of placenta previa. However, McIver (50) reported eight cases of placenta previa diagnosed by use of the cystogram and Hoffman (48) reported four cases correctly diagnosed.

Beck (51) using Ude and Urners' technique took x-ray films of 90 cases with bleeding the last trimester of pregnancy. Of these, 19 revealed the presence of breech or transverse presentation in which, as noted by Ude, this method is of little value. In the remaining 71 cases of last trimester bleeding examined by x-ray, the diagnosis was correct in 63 or 88.7 per cent and incorrect in 8 or 11.3 per cent. In the series were 17

cases of placenta previa. Of these the diagnosis was correct in 13, or 76.5 per cent, and incorrect in 4, or 23.5 per cent.

Of the 54 patients without placenta previa, the diagnosis was correct in 50, or 92.6 per cent, and incorrect in 4, or 7.4 per cent. Absence of placenta previa was therefore diagnosed in 92.6 per cent. Beck feels that the method is of great value in ruling out placenta previa. It should be used simply as an aid to the history and clinical findings.

McDowell (52), in nine cases of suspected placenta previa, diagnosed seven positive cases by the use of the cystogram.

Hall, Currin and Lynch (53) studied 40 cases of abnormal bleeding but, instead of using Ude's technique, injected 20 c.c. of Skiodan intravenously. Eighteen cases were without placenta previa; seven were placenta previa; five were breech presentations, and the remainder were controls of seven, eight, and nine months gestation. They felt that their studies were a success as they had one case of breech presentation of eight months gestation complicated by placenta previa, and uncomplicated breech presentations of seven, eight, and nine months gestation. The three uncomplicated cases showed the breech in close apposition with the bladder. That of the placenta previa

revealed a large space between the presenting part and the bladder.

Ude, Urner and Robbins (46) reported 44 cases of abnormal bleeding in 1938. Thirty-nine were found to be negative for placenta previa, four were diagnosed as central in type, and one of the partial variety. The clinical findings, with the observations at parturition, established only three cases of the central type of placenta previa, one of the partial type, and forty as negative. One error occurred in the roentgenologic diagnosis on the positive side, none on the negative. In the case of the positive error, the clinical findings were so predominantly against the roentgenologic diagnosis that the case was delivered by bag insertion with otherwise normal delivery.

Anderson (54) used the cystogram as an aid in diagnosing placenta previa in 22 cases of vaginal bleeding in the last trimester of pregnancy. Five cases of normal pregnancies were subjected to roentgenologic examination by the use of the cystogram, simply as a control. In ten cases, a positive diagnosis of placenta previa was made by x-ray and confirmed by subsequent clinical findings at either operation or delivery. Three cases revealed a negative x-ray report as well as negative clinical findings subsequently. One case, diagnosed as

positive by cystogram, at operation proved to be a normal implantation of the placenta. Two cases were proved negative by cystogram for placenta previa and were negative at the time of delivery. In both these cases bleeding was due to ablatio placenta. One case, referred for placenta previa and proved negative on x-ray and clinical findings, is interesting as it was found to be a case of pseudocyesis.

It can be seen, from the above discussion, that this refinement enables a diagnosis of placenta previa to be made with a high degree of accuracy. Its greatest value lies in diagnosis without contamination of the genital tract. It is not intended to be used as the sole means of diagnosis. The roentgenologic findings should be in agreement with the other findings.

The weak points are several. The method is of little value when there is an abnormal position and presentation. The cystogram is satisfactory only in the last trimester of pregnancy. This is due to the fact that in earlier pregnancy the head is floating above the brim of the pelvis. In that case no pressure is made on the bladder. In the presence of prematurity the fetal head is not large enough to fill the pelvis with the resulting unsatisfactory pictures.

SUMMARY

Placenta previa is the implantation of the placenta wholly or partially within the zone of dilatation of the uterus.

It occurs as one of three types; central, partial, or marginal, depending on the amount of placenta over the internal os.

It occurs approximately once in every 150 cases in hospital practice.

The etiology is not known but multiparity and endometritis seem to be contributing factors to its development.

A painless, causeless uterine hemorrhage in the last trimester of pregnancy is almost pathognomonic of placenta previa.

The diagnosis is made from the history and abdominorectal examination. Vaginal examination may aid in diagnosis if done in the proper manner in a hospital.

The maternal mortality is approximately 7 per cent. The fetal mortality is approximately 50 per cent.

Indirect placentography may be a valuable aid in diagnosis, but is not designed to be used as the only means of diagnosis.

BIBLIOGRAPHY

1. Leishman, W., System of Midwifery, p. 386, Philadelphia, H. C. Lea, 1875.

2. Rigby, E., A System of Midwifery, Philadelphia, Lea & Blanchard, 1851.

3. Cock, T. F., Manual of Obstetrics, New York, S. S. & W. Wood, 1853.

4. Mauriceau, Francis, Trans. by Hugh Chamberlen, Diseases of Women with Child, London, T. Cox & J. Clarke, 1752.

5. Lee, Rob't., Uterine Hemorrhage, Edinburgh Med. & Surg. J. 51: 381-389, 1839.

6. Renton, Rob't., History of Uterine Hemorrhage, Edinburgh Med. & Surg. J. 48: 243-248, 1837.

7. Dionis, Treatise of Midwifery, London, Publisher not known, 1719.

8. Smellie, Wm., Midwifery, London, New Sydenham Society, Vol. 1-3, 1876.

9. Glisan, R., Textbook of Modern Midwifery, Philadelphia, Blakison, 1881, p. 407.

10. Rigby, Edward, Essay on Uterine Hemorrhage, London, Joseph Johnson, 1775.

11. Baudelocque, J. L., Midwifery, abridgment of Heath's translation by W. P. Dewees, Phila., T. DeSilver, 1823, p. 246.

12. Denman, Thomas, Introduction to the Practice of Midwifery, Brattleborough Vt., Wm. Fessenden, 1807, pp. 109, 333-335.

13. Burns, John, Anatomy of the Gravid Uterus, New York, Collins & Perkins, 1809, pp. 79-81, 113-118.

14. Burns, John, Principles of Midwifery, Philadelphia, Hopkins & Earle, 1810, pp. 312-313.

15. Barnes, Rob't., Obstetrics, Medicine and Surgery, Philadelphia, Lea Bros. & Co., 1885.

16. Taylor, I. E., Placenta Previa, Albany, N. Y., Van Benthuysen's Steam Printing House, 1865.

17. Goodell, Wm., Concealed Accidental Hemorrhage of the Gravid Uterus, Am. J. Ob., 2: 281-346, 1870.

18. DeLee, J. B., Textbook of Obstetrics, Phila., W. B. Saunders Co., 1936.

19. Williams, Textbook of Obstetrics, N. Y., D. Appleton-Century Co., 1930.

20. Helwig, C. M., Placenta Previa and its Frequency in Private Practice, Northwest Med. 37:114-115, 1938.

21. Irving, F. C., A Study of 308 Cases of Placenta Previa, Am. J. Ob. & Gyn. 32: 36-50, 1936.

22. Davis, M. E., The Treatment of Placenta Previa, Am. J. Ob. & Gyn. 32: 518-527, 1936.

23. Findley, David, Management of Placenta Previa, Am. J. Ob. & Gyn. 36N2: 267-275, 1938.

24. Peckham, C. H., A Statistical Study of Placenta Previa at the Johns Hopkins Hospital, Am. J. Ob. & Gyn. 21: 39-51, 1931.

25. Morton, D. G., Anatomical Description of a Case of Marginal Placenta Previa, Am. J. Ob. & Gyn. 33: 547-559, 1937.

26. Solomons, B., and Canter, H. E., The Etiology of Placenta Previa, Surg., Gyn. and Ob. 54: 790, 1932.

27. Thompson, W. B., The Treatment of Placenta Previa, Bull. Johns Hopkins Hospital, 32: 228-233, 1921.

28. Goodall, J. R., Circumcrescent and Circumvallate Placentas, Am. J. Ob. and Gyn. 28: 707-722, 1934.

29. Titus, P. and Andrews, V. L., Frozen Section Through Uterus of a Woman Dying of Central Placenta Previa, Am. J. Ob. and Gyn. 7: 396-402, 1924.

30. Falls, F. H., The Use of Progestin in Obstetrical Complications, South. Med. J. 31: 558, 1938.

31. Randall, L. M., Antepartum Hemorrhage, The Surg. Clinics N. A. 18 No. 4: 1159-1174, 1938.

32. Kerr, J. M. M. & Mackay, W. G., The Diagnosis of Placenta Previa, Trans. Edinb. Ob. Soc. in Edinb. Med. J. 40 Pt. 2: 21, 1933.

33. Bill, A. H., Placenta Previa, Am. J. Ob. & Gyn. 21: 227-233, 1931.

34. Irving, F. C., Problems in Placenta Previa, Surg., Gyn. and Ob. 45: 834-839, 1927.

35. Greenhill, J. P., The Association of Fetal Monstrosities and Deformities with Placenta Previa, Surg., Gyn. and Ob. 36: 227-231, 1923.

36. Murphy, D. P., The Coincidence of Placenta Previa and Congenital Malformations, Am. J. Ob. & Gyn. 35: 653-657, 1938.

37. Browne, F. G., An Experimental Investigation into the Etiology of Accidental Hemorrhage, Trans. Ed. Obs. Soc. in Ed. Med. J. 33 Pt. 2: 151-168, 1926.

38. Robins, S. A., Cystography as an Aid in the Diagnosis of Pelvic Lesions in the Female, Am. J. Roent. 18: 546-550, 1927.

39. Menees, T. O., Miller, J. D. & Holly, L. E., Amniography, Preliminary Report, Am. J. Roent. 24: 363-366, 1930.

40. Campbell, A. M., Miller, J. D., Menees, T. O. & Holly, L. E., The Diagnostic Value of Radiopaque Contrast Media in Gynecology & Obstetrics, Am. J. Ob. & Gyn. 24: 542-552, 1932.

41. Staveley, D., Diagnosis of Pregnancy, Brit. Med. J., Pt. 1: 936-937, May 12, 1932.

42. Snow, W. & Powell, C. B., Roentgen Visualization of the Placenta, Am. J. Roent. 31: 37-40, 1934.

43. Ude, W. H., Weum, F. W., & Urner, J. A. Roentgenologic Diagnosis of Placenta Previa, Am. J. Roent. 31: 230-233, 1934.

44. Friedman, J. & MacDonald, D. O., Roentgen Ray Diagnosis of Placenta Previa, Canad. Med. Assoc. J. 32: 12-14, 1935.

45. Ude, W. H. & Urner, J. A., Roentgenologic Diagnosis of Placenta Previa, Am. J. Ob. & Gyn. 29: 667-679, 1935.

46. Ude, W. H., Urner, J. A. & Robbins, O. F., Roentgenologic Diagnosis of Placenta Previa, Am. J. Roent., 40: 37-42, 1938.

47. Williams, E. R., Urography in Pregnancy, Brit. J. Radio. 11: 202-210, 1938.

48. Hoffman, W. E., Uterine Hemorrhage in Late Pregnancy, South. Med. J. 29: 670-673, 1936.

49. Hundley, J. M., Walton, H. J. et al, Physiologic Changes Occurring in the Urinary Tract During Pregnancy, Am. J. Ob. & Gyn. 30: 631-632, 1935.

50. McIver, J., Use of the Cystogram in the Diagnosis of Placenta Previa, Tex. State J. Med., 32: 471-474, 1936.

51. Beck, A. C., & Light, F. P., X-ray Diagnosis of Placenta Previa, Am. J. Ob. & Gyn., 35: 1028-1031, 1938.

52. McDowell, J. F., Cystographic Diagnosis of Placenta Previa, Am. J. Ob. & Gyn. 33: 436-443, 1937.

53. Hall, S. C., Currin, F. W. & Lynch, F. J., The Diagnostic Value of X-ray in Placenta Previa, Am. J. Ob. & Gyn., 33: 625-631, 1937.

54. Anderson, H., Diagnosis of Placenta Previa by the Use of the Cystogram, Urol. & Cutan. Rev. 42: 577, 1938.