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## Spontaneous abortion

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SPONTANEOUS ABORTION.

By

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TO THE

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## INTRODUCTION.

The subject of abortion has become a serious problem, world-wide in its scope. Those members of the medical profession who are interested in the preservation of maternal health are striving to conquer the ever increasing scourge of abortion. Medical science has been handicapped in its battle against disease by such factors as sentiment, mystery, emotional false precepts and religious prejudices. This is especially true in the subject of abortion.

Dickinson (32 ), in the preface to Taussig's (112) new volume on abortion, aptly expresses the solution to this age old problem. He states, "Learning the facts is the first step toward combating any evil, and by facing facts we may be forced effectively to develop what appears to be the only cure for this evil and its near relatives; namely, to foster sane sex life stayed on sound character and built in turn on fearless inquiry and wise education." (p. 9).

In the past two decades much has been written on the problem of abortion. The casual reader on this subject is dismayed and disheartened in an attempt to evaluate the enormous amount of material published in the current literature. He is confronted with such a bewildering diversity of opinion, in regard to all phases of the problem, that he is apt to be left with a hopeless confusion of ideas. However, the critical reader, after laborious effort, can readily appreciate the rea-

sons for such apparent conflict of opinions. By careful weighing of the evidence, he may be able to formulate a reasonable conception of the problem of abortion.

It is my purpose, in this thesis, to give a critical survey of the literature on the subject of spontaneous abortion and its related conditions. The problem of induced abortion, therapeutic or criminal, will not be discussed, except for a very few minor aspects which coincide with those of spontaneous abortion.

I acknowledge my indebtedness to Dr. F. J. Taussig, from whose new book, "Abortion, Spontaneous and Induced", I have quoted freely and at length.

## CHAPTER I.

HISTORICAL ASPECTS OF SPONTANEOUS ABORTION.

We know that spontaneous abortion in the human must be as old as the race itself, yet there is little mention of the condition in the history of ancient peoples.

In the Ebers Papyrus, according to McKay(74 ), were described medicaments to induce detachment or dispersion of the fetus from the womb. Although the exact date of the writing of this interesting old document is not definitely known, its approximate date is about 1553-1550 B.C. Taussig (112) has remarked that there was no interest manifested in the old Babylonian manuscripts concerning spontaneous abortion, but various factors which tend to prematurely interrupt pregnancy were given.

A description of a condition called "Patragani" was found by McKay (74 ) in an old Hindu book on medicine written about 500 B.C. In this condition the fetus dies or abortion takes place with a great discharge of blood.

Hippocrates, the Father of Medicine, is said by Taussig(112) to have been interested in spontaneous abortion, for he advanced theories concerning the causation of such an event. He made mention of such factors as; oppressive weather, external violence, fever, vomiting, abdominal pain, excessive or too little nourishment, bitter ingredients in food, drastic purgatives, a too large opening in the uterus and an insufficient development of the uterus. Hippocrates also had some conception

of the pathology of early abortion and pregnancy, for he examined the embryos expelled from the prostitutes of the city. He cited the reduction in the size of the breasts as a sign of fetal death. According to McKay (74), Hippocrates supposed abortion to be due to an excess of humour, and the treatment was directed toward drawing off this surplus by the administration of drugs and the use of pessaries.

In "De Medicini", written by Celsus, who lived about 53 B.C. to 7 A.D., McKay (74) found directions for the use of pessaries to produce the expulsion of a dead fetus. Another writer, Pliny, who lived from 23 A.D. to 79 A.D., was credited by McKay (74) to have given a list of plants in his "Historia Naturalis" which were supposed to arrest hemorrhage from the uterus, especially after abortion. Pliny is also said by Findley (36) to have stated that the menstrual discharge possessed pernicious properties which would be liable to cause a pregnant woman to abort, if she was touched with it, or if she stepped over it.

Pedanius Dioscorides, or Pedacius, lived sometime during the first century A.D. McKay (74) states that this writer gave a prescription in his "Materia Medica" for drugs which would expel the fetus prematurely from the uterus.

Soranus of Ephesus, who lived about 78 to 138 A.D., in a work on Gynecology, as referred to by McKay (74), described the methods of abortion in use at his time, and recommended the

third month of gestation as the most favorable time for abortion. Soranus is also credited with the first description of the use of the vaginal speculum, and the plugging of the vagina with sponges in severe hemorrhage from the uterus. He advocated the use of the finger as a curette in evacuating the uterus.

Galen, another prominent figure in the history of medicine, is credited by Taussig (112) as the first writer to mention abdominal pains, softening of the breasts, and uterine bleeding as the signs of fetal death.

Aetius, who wrote prolifically during the middle of the sixth century, compiled sixteen volumes on the subjects of medicine and surgery. McKay ( 74 ), however, does not credit Aetius as the original author of much of the contents of these volumes. Aetius gave a description of the signs of abortion which were unmistakably taken from Soranus. He also quoted Hippocrates on the subject of abortion. First mention of the use of the sponge tent for dilating the cervix was made by Aetius.

From the seventh century to the latter part of the seventeenth century there was little contribution to the knowledge of the subject of abortion. It was during that period the mid-wives maintained a position of great importance in the handling of pregnancy and its related conditions, much to the detriment of the science of Obstetrics.

Samuel Bard ( 7 ), in 1817, and John Burns ( 17 ), in 1837, were two writers of that period who strongly advocated

copious venesection in abortion. Bard advised copious venesection before the seventh month as the most important means of controlling hemorrhage in abortion, but after the seventh month he stated that great care must be used for the mother may have already lost a copious quantity of blood. Burns of Glasgow stated, "Bleeding prevents the womb from being oppressed," Burns did not recommend digital removal of the fetus and placenta. He advised plugging of the vagina with a large piece of soft cloth, dipped in oil and wrung out gently, for the control of hemorrhage in abortion.

Meigs (75) in 1838 stated, "Abortion may be caused by the death of the embryo; by disease of the secundines; by sudden violent movements of the blood, causing the effusion of that fluid behind the placenta; by direct violence, or by the discharge of the water of the amnion." (p.122). He stressed the usage of the vaginal tamponade for control of hemorrhage and administered internally such preparations as dilute aromatic sulphuric acid and acetate of lead with opium.

In 1843 Dewees is said by Taussig(112) to have designed a wire crotchet for the removal of the ovum.. However, in 1864, Hodge condemned the wire crotchet of Dewees as too dangerous and substituted in its place a blunt ~~ovum~~ forceps which could be slowly revolved within

the uterus to loosen the placenta before an attempt at extraction was made. He deplored artificial assistance in cases of retained placenta and preferred to wait for the uterine contraction to expel the retained portions. In Germany in 1862 Hegar advised against active treatment in abortion, particularly in those cases with fever. However, in 1887 Dührssen advocated emptying of the uterus in all cases of abortion.

Taussig (112) also states that conservatism was the accepted principle in the treatment of abortion up until about 1890. During the first decade of the twentieth century active treatment was widely employed in incomplete abortion. The result of this wide-spread acceptance of operative interference was an increase in the morbidity and mortality rate in abortion due to perforation, peritonitis and septicemia.

Winter (126), in 1911, showed that evacuation of the uterus could only be accomplished by conservative measures without the risk of spreading infection or traumatizing the pelvic organs.

#### RACIAL ASPECTS OF ABORTION.

Taussig (112) maintains there exists some indications of a certain degree of racial predisposition to spontaneous abortion. The Chinese women of the lower classes row for long periods of time upon the rivers with

only rare instances of abortion. In contradiction are the women of the wealthy Chinese classes who, by virtue of their sedentary life induced by the practice of binding their feet, apparently have but slight resistance to abortion.

It is said that the women of New Zealand, parts of Australia and East India abort readily. Abortion and premature labor occurs very frequently among those races which employ some type of abdominal massage during pregnancy. This custom prevails especially among some tribes of Mexico and in Java,

Persian women often ride for long distances astride horses without apparent ill effects upon their pregnancy.

An increased frequency of abortion in Tunis and Turkey may be attributed to the custom of taking very hot baths and rough handling of pregnancy.

#### CUSTOMS AND SUPERSTITIONS.

Folk lore contains many varied means which were employed to frighten away the spirits or demons which haunted the pregnant women. Findley (36) gives the following interesting accounts of such customs and superstitions.

The pregnant women of ancient Rome sacrificed flowers to Juno in the wood at the foot of Esquiline Hill in order that she would provide a means to prevent



miscarriage. Religious ceremonies were performed and amulets worn to ward off miscarriages. Pliny testified to the preventative qualities of the amulet stones, and the Talmud referred also to certain amulet stones for the prevention of abortion.

Bechu-Metiana, the demon of trouble and plague who was the personification of the souls of women who died in childbirth; and whose specialty was the induction of abortions; was the terror of the women of Nias. In defense against this demon the women offered sacrifices to their god, Adu Sawowo, and armed themselves with knives.

The Talmudists had a superstition which stated that the suffering of a "holy man" could prevent others from sickness and death. In The Talmud is a passage which is as follows, "our Rabbi suffered from toothache for thirteen years, during which time not a single lying-in woman died in Israel, neither was there any miscarriage." (p.39).

The Russian ancients feared the evil eye or "glas". In the event that the evil eye became fastened upon a pregnant woman, some harm would come to her and the child.

There is a legend which states that the inhabitants of an island of the Philippine group feared a devil who had a gland of oil beneath his arms which enabled him to fly wherever he wished; he had claws and a long

black, soft, and glossy tongue; with his claws and tongue he was reputed to tear the child from the mother's womb and devour it.

Another flying demon, known as Kan Kamiak, was greatly feared by the women of Borneo, for it was said he would enter the mother's body and hinder or render impossible the birth of the child.

The female miscarriage demon of the Anonites, or natives of the province of Anam of French Cochin-China, was known as Con Ranh. It was believed that he assumed the human form and had the power to destroy the child in its mother's womb. An interesting incantation and ceremony based upon the principle of magic and hypnotism was used to drive the demon away. So very great was the fear of Con Ranh that the mention of the name was avoided in the presence of pregnant women.

The pregnant women among the Kambedjaner were advised not to leave anything made of tamarinder wood in the home of a married man, for the ghost of the wood, Priai, would swallow their unborn children.

The pregnant gypsy women of Siebenburgen carry on their naked bodies a bag which contains red hair from the beard or head of a man, and it is believed that this charm protects <sup>her</sup> she and the child from evil. The gypsies of Serbia perform a ceremonial dance with magic incantations to protect the pregnant woman and her unborn child from harm.

The Bribri Indians place great restrictions on the pregnant woman, and particularly on one who miscarries or gives birth to a stillborn baby. In that event, no one may attend her; she is fed by means of long sticks; and it is believed everything she touches is a source of grave danger.

Bantu tribes believe that if the secretions of childbirth, and particularly those of miscarriage, should contaminate an attendant the whole country would be ruined by drowth and burning winds.

Even in Greece today the women fear Neraiden, who dwells in poplar trees, wells and flowing waters, and who is reputed to bring harm to pregnant women. For protection against the evil influence of Neraiden, these women wear amulets.

Englemann ( 34 ) wrote telling of the custom in Old Calabor, where the pregnant woman is usually sent away to a quiet country place where she reaches the seventh month of pregnancy. There she lives quietly, away from the hustle and excitement of the town as well as out of the way of witchcraft. Englemann ( 34 ) also cites a novel custom among the Esthonians, which consists of the weekly changing of shoes among pregnant women to throw the devil off the track.

Taussig (112) gives some additional interesting customs and superstitions among ancient and primitive peoples in regard to abortion. The Atharva-Veda of ancient India gave a magical incantation to be spoken to the goddess, Pracniparni to drive away Kanva, the embryo-eating demon.

Many strange customs have arisen in connection with the disposition of the aborted embryo. The Jews buried their abortion embryos after careful examination was made to determine the sex for the purpose of ritual. The natives of the Murray Islands dry the aborted embryo and hang it in the wind. Sometimes its body is painted. The Siamese believed that evil magic might be worked with an abortion embryo. To prevent such a disaster, they took the embryo to a priest who put it in a pot and pronounced an incantation before he threw it in a river. The Hungarians and Rumanians in the region of Siebenbuerger cut off the little finger of the left hand of the aborted embryo and placed it in the foundation of a new building with the belief that it would ward off lightning, and the person who performed the amputation could thereafter see in the dark and be made invisible.

## CHAPTER II.

## DEFINITIONS AND CLASSIFICATIONS.

There has been little uniformity in the past in the use of such terms as miscarriage, abortion and premature birth. Because of this fact, the literature contained a confusing application of terms.

Taussig (112) has observed that in the development of our language words which had once been clear and well defined tend to be given special meanings as time goes on with a resultant confusion in the expression of our ideas. He cites as an example the word, abortus; from the Latin verb aboriri, which meant "something that had been detached from its site." (p.21). The word abortus, when it was used in reference to the embryo, signified that events had brought about its premature expulsion.

In order to demonstrate the confusion in the use of the term abortion, the following definitions are given. Taussig quoted from Boorde (12), who in 1547, in the Brevearie of Health, wrote, "abhorsion is when a woman is delyvered of her chylde before her tyme." (p.21). In 1823 Dewees (31) defined the term as follows, "Abortion is the expulsion of a child before the usual period of pregnancy, and especially before that in which

it is strong enough and sufficiently developed to live after birth."(p.584). A short time later, Churchill (19 ), in 1846, defined abortion in this manner, "If it occur before the sixth month, it is called an abortion, subsequent to this period, premature labour".(p.177). Lusk (65) in 1887, gave a lengthy definition in which he differentiated between abortion, miscarriage or immature delivery, and premature delivery. To quote Lusk, "When pregnancy is interrupted, during the first three months, by uterine contractions leading to the expulsion of the ovum, the term abortion is used; in the fourth, fifth, sixth and seventh months, i.e., from the formation of the placenta to the time the child becomes viable, it is proper to speak of the accident as immature delivery, or miscarriage; and finally, a confinement occurring from the twenty-eighth week, the earliest period of viability, to the thirty-eighth week, when the fetus possesses every indication of maturity, is distinguished as premature delivery."(p.305).

The terms "abortion" and "miscarriage" were used synonymously for a time. However, they gradually came to assume differentiated meanings, as the definition by Lusk signified. Then the terms came into an entirely different usage and the word abortion was employed to designate criminal interference with pregnancy. This usage still persists among the laity while the term miscarriage

continues to be construed as a spontaneous expulsion of the ovum.

In an effort to clarify and give a more exact definition<sup>of</sup>/related terms used in scientific medical discussion of the subject of abortion, Taussig (112) has formulated certain definitions and classifications which I am following in this thesis. I present at this time his definition of abortion. The reader is referred to the Glossary of Terms for definitions of the various types of abortion.

"Abortion: The detachment or expulsion, or a combination of both, of the pre-viable ovum." (112).  
For the definition of pre-viable see the Glossary of Terms.

Reinberger and Russell (90) gave the following classification of abortion in the form of a table. To quote:

1. Spontaneous: Onset without apparent cause.
2. Induced: History of abortifacient or instrumentation.
3. Complete: Definite history of pregnancy with passage of products of conception. No evidence of uterine activity or bleeding.
4. Incomplete: Definite history of pregnancy with passage of some part of the products of conception. Evidence of uterine activity and bleeding.

5. Febrile: Elevation of temperature on admission with or without active signs of infection.

6. Afebrile: No elevation of temperature or active signs of infection on admission.

7. The presence of fever on admission, rather than later, as a guide seems more logical for classification, particularly for those who invade the uterus as a routine.

8. Late Septic: History of abortion with considerable lapse of time before admission to the hospital. Evidence of blood loss or the presence of extra-uterine infection such as parametritis, thrombo-phlebitis, peritonitis and bacteremia. End quote.(p.1528.)

I prefer the classification of abortion as given by Taussig (112), for it is particularly concise. However, because the subject of abortion is so broad, I am limiting the scope of this thesis to include only Spontaneous Uterine Abortion and its various types, namely; Threatened Abortion, Inevitable Abortion, Incomplete Abortion, Complete Abortion, Septic Abortion, and Missed Abortion. (See Glossary of Terms).



### CHAPTER III.

#### ETIOLOGY OF SPONTANEOUS ABORTION.

The concept of the etiological factors in spontaneous abortion has undergone a marked change in the past two decades. We may credit these changes, not to an ingress of new factors, but to the tireless efforts of the physiologist, the biological chemist, the statistician, and the practicing physician or obstetrician in a correlated endeavor to render the science of medicine a more exact art. The causative factors in spontaneous abortion present a problem of extreme complexity. This is due to the fact that so many factors may bring about separation and expulsion of the products of conception before the period of viability.

In 1817 Samuel Bard (7) wrote, "The causes of miscarriage, abortion, or premature labor, may be reduced to the death of the foetus, a separation of the ovum from the womb; the cessation of the healthy action of gestation, and the accession of the muscular contraction of the womb." (p. 122). The problem is not as simple as Bard phrased it, for today we recognize so many more factors which were not even thought of a mere twenty years ago. Moreover, the diagnosis of the cause of abortion may be extremely difficult in some instances, due to the combination of factors which may operate.

Churchhill (19), in 1846, presented a very

comprehensive classification of the causes of abortion which were recognized and accepted at that time. He divided these causes into two general groups, maternal and ovuline. Whitehead (120) in 1854 also divided the causes into two general groups, predisposing and exciting or immediate causes. Another writer, Lusk (65), in 1887 recognized that fetal death usually precedes and leads to disease of the chorion.

In the discussion of the etiological factors in spontaneous abortion I have adopted the classification given by Taussig (112). Although there are many different classifications offered in various texts on Obstetrics, and in various articles in the current literature, I believe the following classification lends itself to a more comprehensive and concise study of the problem.

#### CLASSIFICATION OF ETIOLOGICAL FACTORS IN SPONTANEOUS ABORTION.

(From Taussig).

##### A. Primary or Fundamental causes.

##### I. Ovulogenic:

- (1) Fetal
- (2) Placental

##### II. Maternal

- (1) Constitutional Factors
- (2) Endocrine Disturbances
- (3) Infections
- (4) Pelvic Pathology

(5) General Diseases

(6) Chemical and Physical Agents.

(7) Operative Procedures

B. Secondary or Exciting Causes.

(1) Physical Trauma

(2) Thermic Irritation

(3) Psychic Trauma

A. Primary or Fundamental Causes.

I. Ovulogenic:

(1) Fetal.- A relatively new concept in the etiology of spontaneous abortion has been set forth by Mall (68) and Streeter (108). These two investigators, in their work on early abortion ova, have demonstrated the frequency of incompatibility between male and female sex cells which renders the impregnated ovum incapable of normal development. Whitehouse (121) likewise is of the opinion that incompatibility of the male and female sex cells, in the absence of local uterine pathology, may be a cause of abortion. Another writer, Vignes (116) believes that not every egg is capable of fertilization, and hence not every abortion is pathologic. He states there is a variation in the fertility among different races of people, and there is a possibility of some individuals being biologically incompatible.

Rock (97) has formed the opinion that the causes of sterility and abortion are synonymous, and that

both conditions must be regarded from the viewpoint of diminished fertility of different degrees. For this reason, he stresses the importance of study of not only the products of conception, but also a careful examination of the parents.

It has been the experience of Taussig (112) in early spontaneous abortions that arrested development of the ovum, leading to its death in the first few weeks of development, was one of the most common findings. Frequently he found no visible fetus in the ovisac, or else a vesicle in the place of the embryo. His findings corroborate the observations of some embryologists, His (51) and Mall (69) in particular, that the majority of the ova aborted during the second and third months of gestation present some abnormality.

Another recent theory in the causation of spontaneous abortion has been advanced by Macomber (66), and it has since been corroborated by other investigators. I refer to the theory of "defective germ plasm." In a series of fifty-three cases of abortion, Macomber (66) found that abortion is twice as frequent when the fertility is low as when it is presumably average or above. In the series mentioned, the factors producing abortion were associated in seventeen cases with low fertility in the male; with low fertility in the female in fifteen cases; and in the remaining twenty-one cases the cause of abortion was ostensibly

uterine in origin. To this factor of lowered fertility, Macomber ( 66 ) has applied the term, "defective germ plasm", which may either be maternal or paternal in origin. Huntington ( 54 ), in an analysis of one hundred and four consecutive cases of abortion, made an unqualified diagnosis of defective germ plasm in eighty-two of the abortions. The products of conception were examined by Streeter. Huntington further states, "It is possible that focal infection, faulty endocrines, fatigue or other poisons may play a role in the creation of spermatozoa capable of impregnating the ovum but lacking the vitality to bring the egg to full development." (p.41). Another writer, Morse ( 78 ), believes that a lowered vitality of the spermatozoa may be due to an acute toxemia induced by alcohol, lead, phosphorus or arsenic, and may produce premature death and expulsion of the ovum. Wolf ( 128 ), in his volume on endocrinology recently published, also favors the theory of defective germ plasm in "idiopathic" abortion. He has observed the occurrence of this phenomenon most frequently in women with hypo-ovarian function.

Streeter ( 108 ) states the description of defective germ plasm is upon the basis of behaviour, rather than upon any characteristic histologic appearance. Taussig ( 112 ) quotes Streeter in a personal discussion on the subject, "At times the trophoblast is defective, at times the inner cell mass may be defective and sometimes the fault lies in both of them. At the start there is merely cell division of

the impregnated ovum without growth. A certain portion of the cell mass then separates out into the trophoblast and the fate of the two becomes distinct. The trophoblast makes its own blood supply and connective tissue in which the embryo does not directly participate. As to the relative frequency of defects in the trophoblast and embryo, accurate data is not available. All varieties and degrees of defect may occur, sometimes caudal, sometimes at the head end. If the building materials are good then the egg is good. In such cases endocrine influences should not be powerful enough to disturb normal development. In defective germ plasma preconceptional factors are probably more important than postconceptional. Trophoblast defects are fewer in number and less important than embryonal defects. If one-half the trophoblast is good it should suffice for the embryo."(p.95).

The question of the more frequent occurrence of abortion in male fetuses has aroused comment on the part of several investigators. Lehmann (63) states male fetuses in abortion are in preponderance, and that many women abort only with male fetuses and carry the females to term. Another writer, Riddle (95), has advanced the theory that the greater vitamin and metabolic requirements of the male is the cause of the higher abortion rate in male fetuses. On the other hand, Kirstein (60) is of the belief that a hereditary factor operates in such cases and renders the male fetus more readily killed by external influences. Taussig (112)

has suggested that the hormone environment of the male fetus in the mother results in the production of antitesticular substance antagonistic to the fetus, for the fetus acts as a foreign body.

In a careful histologic study of pathologic spermatozoa, Moench ( 77 ) noted many abnormalities in the sperm head. He suggests that perhaps the cause of some of the spontaneous abortions are due to such abnormalities in the male germ cell, for he found an increased frequency of abortions in the wives of men who had abnormal spermatozoa of more than average percentage. Moench raises a question as to the advisability of attempting to prevent the expulsion of the products of conception in cases of habitual abortion, for there is a frequent occurrence of abnormalities in such offspring. On the other hand, Mall ( 69 ) believes the external influences to be the causative factors in the production of pathological ova, and not anatomical or physiological defects in the spermatozoa or ovum. Professor Arthur Robinson ( 96 ) differs with Mall, for it is his opinion that the pathological lesions encountered are due to inherent abnormal physiological attributes in the gene. Although the weight of evidence gives more support to the theory of Mall than to that of Robinson, we may eventually find that both factors may be concerned on different occasions.

Saunders ( 99 ) reported two cases of repeated

abortions in which examination of the fathers' semen showed an increased number of abnormal spermatozoa with decreased vitality. Although both wives were normal, the two husbands were found to have pathology in their genital tracts. One of the men had a non-venereal Vesiculo-Prostatitis and the other had a non-venereal Prostatitis. Under treatment the infections in both men were eradicated, and somewhat later, both wives conceived and progressed to full term pregnancies.

There are various external factors existent which may lead to fetal death and abortion. Taussig (112) states that certain external factors, infections, toxic, chemical or physical in nature, may be associated with relatively minor disturbances in the mother. He further states, "While the fetus, in the early months of its development, possesses a certain immunity to various maternal infections, these may at times be transmitted through the placenta and lead to fetal death. The same applies to the passage of certain chemical substances, such as carbon dioxide, chloroform, phosphorous and mercury, and toxins, such as diphtheria and tetanus, which, without appreciably damaging the mother, may in rare cases be responsible for fetal death. Hyperpyrexia and lightning may at times have a similar lethal effect." (p.97).

Included by Morse (78) are the following causes of fetal death; a lowering of the temperature surrounding the fetus, a deficiency of the oxygen supply to



the fetus, polyhydramnios and oligohydramnios.

Nuernberger ( 80 ) is said by Taussig (112) to list other causes of fetal death due to certain metabolic deficiencies, absence of oxygen, albumen, fat, carbohydrates, mineral salts and maternal hormones.

A cause of premature labor, but which may result in late abortion, is given by Taussig (112) as multiple pregnancy. This is particularly true if there is a polyhydramnios or three or more fetuses.

(2) Placental Causes.- Considerable difficulty may be encountered in differentiating in many cases between those conditions which produce fetal death, whether ovular or placental in origin.

It was noted by Rhodes ( 94 ) that abortion most frequently occurred during the second and third months of pregnancy, or the period of placental development.

It is the opinion of Morse ( 78 ) that hyperplasia of the endometrium and polypoid formation of the decidua predispose to abortion. He is inclined to question the significance of evidences of endometritis, for the infection may have followed the abortion, rather than act as a factor in its production.

Hemorrhagic lesions of the placenta are given consideration as a cause of abortion by McNalley and Dieckman ( 73 ). These men reported a case of abortion in a pregnancy

of thirteen weeks duration. An examination of the placenta revealed infarction due to cutting off of the maternal blood supply to the chorionic villi. As a result, fetal death ensued because of deficient nutrition and oxygenation. Morse ( 78 ) and Henkel ( 48 ) are of the opinion that endarteritis of the vessels of the chorionic villi are also responsible for fetal death in some instances.

Lesions of the chorion, according to Whitehouse (121 ), are frequently coexistent with diseased ova. This statement is in accord with the findings of Mall ( 69 ). He attaches great importance to the condition of the endometrium itself as a significant factor in pregnancy. If the endometrium is hypertrophic, as in fibroids or subinvolution, or if it has been subject to chronic inflammation, there is a defective response to lutein stimulation and the ovum develops in an abnormal manner. Also, Whitehouse believes it a reasonable assumption that, in the presence of defective physiological function of the decidua, there is also an abnormality in the interchange of nutrition in the chorio-decidual space.

Mall ( 69 ) came to the conclusion that a large percentage of "blighted ova" were due to factors in the trophoblast. He based his conclusions, in the examination of pathological ova, on such findings as; atrophic and irregular villi; a chorion which was either thin and transparent or thick and hemorrhagic; and an increase in the

amount of liquor amni, in which there was a granular deposit.

Placenta previa and premature separation of the placenta are said by Morse (78) to give rise to fetal death later in pregnancy. This observation is corroborated by the work of Rhenter and Pigeaud (93), who found placenta previa to be the cause of abortion in 15% of the cases in the gestation period of three to five months. They explain the abortion on the basis of changes in the decidua, in which there is a shrinking of the decidual mass over the cervix, exposing the villi and intervillous spaces, and the reflex action induced by the expulsion of the clots formed by hemorrhage, and the ultimate production of uterine contractions. Binder (8), in a series of eighty-four cases of placenta previa, found there was a history of one or more abortions in twenty-five. It is interesting that he lists previous abortions as a predisposing factor to placenta previa.

The role of placenta circumvallata in spontaneous abortion is given little mention in the literature. However, Hobbs and Rollins (52), in a series of seventy-nine cases with this placental abnormality, reported 43% of such cases terminated in abortion with the death of all the fetuses. Of those cases which aborted, only four terminated prior to the twentieth week, and the remainder were distributed evenly from the twentieth to the thirty-fourth week.

Abnormalities of the umbilical cord has been attributed as a cause of abortion by many writers. Browne of Edinburgh ( 15 ) believes the occurrence of true knots in the umbilical cord is rare. Torsion of the cord is found normally, but pathologic torsion is probably due to a thin cord with little or no Wharton's jelly, and there is little resistance to the exaggeration of normal torsion. Morse ( 78 ) holds the opinion that torsion of the cord is an occasional cause of fetal death and subsequent abortion. Another writer, King ( 58 ), reported a case of torsion of the cord, which, after careful investigation, he believed to be the chief cause of the death of the fetus. Taussig ( 112 ) suggests that, in many cases of twisted umbilical cord, a careful check-up will reveal the condition to have come about after the death of the fetus as a result of necrotic changes in the cord, with a resultant loss of elasticity and resistance to normal twisting mechanisms.

Dougal and Bride ( 33 ) reported a case of obstruction of the vessels of the umbilical cord. There were no syphilitic lesions in the fetus or placenta. Browne ( 15 ) states that fetal death is rarely due to syphilis of the cord, for the disease produces fetal death by direct effect on the fetus. A case of fetal death due to a localized constriction of the cord was also reported by King ( 58 ). He believed an obliterative inflammation of the

vessels of the cord to be the chief lesion. Browne (15) states he has seen three cases of fetal death due to ruptured varicosities of the cord.

Another cause of abortion mentioned frequently in the literature is the hydatidiform mole. It has been the observation of Taussig (112) that the majority of such cases rarely advance beyond the third month of pregnancy before there is fetal death and spontaneous expulsion of the ovisac and its grape-like appendages. He states, "Only if the area involved by the hydatid change is relatively small and not situated beneath the umbilical insertion, can the fetus continue to develop."(p.100.) Morse (78) and Watkins (119), as well as others, also mention hydatid changes in the chorion as a cause of abortion. However, the condition is not to be regarded as common, for Meyer and Mall (69) found only eight hydatidiform moles in 2,400 abortion specimens.

## II. Maternal Causes of Spontaneous Abortion.

(1) Constitutional Factors.- The problem of dietary insufficiencies in abortion is a comparatively new subject. One investigator, E.C.P. Williams (122), has observed the relationship of errors in carbohydrate metabolism to abortion. He studied a series of nineteen cases of pregnancy, each with a history of two or more abortions

or still-births and no live infants, and a second series of twenty non-pregnant women with a history of several abortions. Williams found no other obvious reasons for the tendency to abort, other than evidence of an endocrine imbalance, as manifested by a lowered tolerance for glucose in 90% of the cases. This observation suggested to the author that the reduction in glucose tolerance was not one merely related to pregnancy, but that it was one which was the result of a general condition, namely, a lack of balance of the ductless glands.

The role of vitamin deficiencies in abortion and sterility has been under investigation the past fifteen years. The work of Evans and Bishop (35) with the problem of vitamin E deficiency was first given mention in 1922. These investigators produced death of the embryo, with disintegration and absorption of the placenta, membranes and decidua by vitamin E starvation. This work has been corroborated by the work of Urner (115) in the same field of research. The latter found by histological study that vitamin E deprivation in the pregnant albino rat produced pathological changes as early as the tenth day, as evidenced by a deficiency of mesodermal formation and blood forming mechanism in the ectoplacenta. Vogt-Moeller (117) also confirmed the work of Evans and his co-worker. He reported two cases of pregnancy, with the history of repeated abortions, in which he

carried the pregnancies to full term, presumably by the administration of wheat-germ oil, a substance rich in the fat soluble vitamin E. Another writer, Shute (103), has reported that in 73% of a series of 44 cases of spontaneous abortion, serologic study revealed evidence in the blood serum of a deficiency of Vitamin E. Taussig (112) states, "In this country, where all the needed constituents for a balanced diet are obtainable, dietary deficiencies probably do not play a very great part in abortion, except in domestic animals." (p.102.)

Another factor in abortion is mentioned by Whitehouse (121), who has observed that as parity increases there is a progressive increase of the number of women who abort.

Another writer, Dengler (30), reported a case of fetal death and abortion at the third month in a woman of thirty-seven years. The patient carried a blood pressure of 195 systolic and 125 diastolic, but there were no urinary or blood findings indicative of nephritis. The placenta showed infarction on the basis of arteriosclerosis.

The possibility of incompatibility between blood groups of husband and wife as a cause of abortion has been given study by some Italian investigators. Paroli (82), and Franquilli-Leali(114) have studied the incompatibility of blood groups and have found a greater number of abortions in

those individuals with difference in blood groups. Taussig (112) suggests, however, that considerable more data is necessary before incompatibility in blood grouping can be accepted as a cause of abortion.

The question of uterine hyper-irritability as a cause of abortion is cited by Taussig (112). He states, "Experimental work has demonstrated that the irritability of the uterine muscle to mechanical, thermic and other forms of stimulation is greatly increased during pregnancy. The presence of this high degree of irritability under conditions of ordinary health shows an increase in some individuals to such a degree that the slightest trauma, nervous shock etc., brings about uterine contractions and leads to abortion. Individuals with excessive constitutional nervous irritability will usually show this in other ways, such as marked peristalsis of the intestine, increased urinary frequency, or twitching of the body." (p.102). Bland and Goldstein (10), in a study of pregnancy and parkinsonianism, have concluded that the incidence of abortion in pregnancy complicated by parkinsonianism is relatively the same as in the non-parkinsonian individual. Hirst (50) has mentioned that abortion is frequent in women afflicted with chorea, tetany, epilepsy or hysteria.

(2) Endocrine Disturbances.- Disturbances in the endocrine system, particularly pathology in the ovary,



pituitary and thyroid glands are frequently associated with early pregnancy and may, in some instances, lead to abortion.

The work of Parkes and Bellerby (81), on the effects of injection of the oestrous producing hormone, has done much to clarify the role of ovarian secretions in pregnancy and abortion. These investigators found the injection of sufficient amounts of oestrin in early pregnancy invariably caused the rapid disappearance of oestrous symptoms. The artificial production of such oestrous symptoms during pregnancy produced an incompatibility which culminated in abortion. The authors presented two suggestions for explanation of the above phenomena which are as follows:

(1) "It is possible that local disturbance of the uterus consequent upon the effort to assume an oestrous condition would render the position of the embryos untenable.

(2) Since the oestrous inhibiting function of the corpora lutea is over-ridden it is possible that the function relating to the maintenance of pregnancy is also suppressed." (P.154.)

It is the opinion of Taussig (112) that the factor of prime importance in abortion due to ovarian dysfunction is an insufficiency of corpus luteum. Wolf (128) expresses practically the same belief. The substance, progesterin, which has its source in the corpus luteum, aids

in the nidation of the ovum and the formation of the decidua, and it also renders the myometrium non-sensitive to stimulation by the posterior pituitary substance. On the other hand, estrin, or the primary follicle secretion, renders the myometrium sensitive to stimulation by the posterior pituitary substance, permitting contractions which may have something to do with the onset of labor. Krohn, Falls and Lachner (62 ) report considerable success with the use of the lutein hormone in the treatment of threatened and habitual abortions. It is also their conclusion that a large number of spontaneous abortions are due to a deficiency of the corpus luteum hormone.

The use of the female sex hormone test as an indication of the cessation of the action of gestation is becoming popularized. Spielman, Goldberger and Frank (106) conducted female sex hormone studies on a series of thirty-three pregnancy cases in which abortion was suspected or expected. The studies were directed toward the determination of the relationship between the female sex hormone of the blood and the prepituitary hormone of the urine, and the differentiation by means of hormone tests between fetal life and death. The Frank-Goldberger method was used in conducting the blood studies, and the Aschheim-Zondek and the Freidman tests were used in the urine studies. These investigators found the female sex hormone blood determination in their small series of cases to be 100% correct in the diagnosis of

fetal life or death. The test can likewise be used to determine in some degree an unbalance in the function of the ovarian hormones.

The role of the pituitary gland in abortion has been noted by many authors. The action of the posterior lobe substance has previously been mentioned in relation to synergism with estrin in its action. The anterior lobe of the pituitary gland has been called "the conductor of the endocrine orchestra" because of the powerful influence it exerts over the other endocrine glands of the body. Hypoplasia of the uterus is due indirectly to a deficiency in the secretion of a gonadotropic hormone from the anterior pituitary gland, according to Wolf (128). Taussig (112) states that conception does not readily occur in women with infantile uteri, and when pregnancy does take place, abortion is a frequent occurrence due to the small size of the uterus. It is the opinion of Shaw (102) that ill-development of the uterus, with the associated syndrome of hypoplasia genitalis, is one of the commonest causes of repeated abortions. He states the diagnosis can be made from the history of a late onset of puberty, irregular, scanty and painful menstruation, and the associated finding of a palpably small uterus. Usually these patients abort three or four times and then go on to term in their successive pregnancies.

Many authors have mentioned the relationship

of thyroid gland function to pregnancy. McConnell (72) believes that in thyroid disturbances the production of an excess of thyroxin usually prevents pregnancy, but if pregnancy does occur, it may result in abortion. Mayer (71) points out that experimental injection of thyroid extract has a tendency to produce abortion, while a thyroidectomy tends to prolong pregnancy. On the other hand, Johnson (57) does not agree as to the role of hyperthyroidism in pregnancy. He believes many women with hyperthyroidism conceive readily and carry their pregnancies to full term without disturbance. However, he states there is usually an acute exacerbation of hyperthyroidism about two weeks after delivery. There is some evidence to indicate that hyposecretion of the thyroid gland may likewise terminate pregnancy. Huntington (54) and Abruzzese( 1 ) have mentioned hypothyroidism as a cause of abortion.

At the present time there is little to be said on the relationship of the other endocrine glands in abortion, for there is no available data on the subject so far.

(3) Infections- It has long been recognized that certain acute infections in the mother would bring about fetal death and ultimate termination of pregnancy. Taussig (112) states that abortion is produced in about one-half of the pregnancies associated with small pox, scarlet

fever, typhoid fever, erysipelas, cholera, malaria and encephalitis, lethargica. Morse ( 78 ) points out that acute infectious diseases in the mother, such as influenza and pneumonia tend to bring about abortion. In general, the later in pregnancy such diseases occur, the more liable the patient is to abort. The primary factors in the production of fetal death is the toxemia and hyperpyrexia.

The subject of the relationship of focal infection as a factor in abortion has been investigated by many. In 1916 De Lee ( 29 ) reported three cases of still-birth in which the fetuses were macerated. From one fetus a pure culture of streptococcus was obtained, from a second fetus a pure culture of an anaerobic non-hemolytic streptococcus was taken, and the third fetus yielded a pure culture of pneumococcus. The first mother had a slight attack of pharyngitis, the second a history of a previous septic pregnancy, and the third had two attacks of gallbladder trouble during her pregnancy. These findings lead DeLee to believe that focal infection may be the cause of many abortions.

Curtis ( 22 ) produced experimental abortion in rabbits by inoculating them with fresh cultures of hemolytic streptococci obtained from three patients with a history of habitual abortions and active foci of infection. A control series of rabbits inoculated with other virulent bacteria did not show such a high degree of specificity.

Reith (91) cultured pleomorphic, anaerobic, faintly hemolytic streptococci from the tonsils and placenta of a woman with a history of repeated spontaneous abortions. Intravenous injection of the culture into four pregnant rabbits produced abortion, and in eight out of ten nonpregnant rabbits it produced uterine hemorrhage. Two other investigators, Nickel and Mussey (79), were able to produce experimental abortion in guinea pigs by the intravenous injection of strains of streptococcus viridans isolated from foci of infection in patients who had aborted. They concluded the abortion produced in the inoculated animals was due to elective localization and growth at the placental site.

Cornell (20) has noted the frequency with which patients with the history of abortions and stillbirths are subject to diseased tonsils, teeth, gallbladder or appendix. He feels that in certain cases a previous endometritis may harbor infective bacteria which gain access to the fetus directly through the placenta. Another writer, Talbot (111), is in accord with the opinion of Cornell on the role of chronic sepsis in abortion. He points out the evidences of inflammatory changes in the placenta which occur in patients with chronic sepsis.

Brown and Kincaid (16) reported a case of fetal death with maceration of the fetus, but there were no anomalies of the placenta and cord. A culture of the blood

from the fetal heart revealed a hemolytic streptococcus. The mother was clinically healthy, and previous cultures from her nose, throat and cervix were negative for streptococci. A culture of the urine showed no organisms. Inoculation of four pregnant rabbits resulted in : (1) first rabbit.- absorption of embryos with nodulation of the uterus the only remaining sign of pregnancy; (2) second rabbit- fetuses dead, cultures from amniotic fluid, broad ligament vein and blood from heart showed hemolytic streptococci; (3) third rabbit- fetuses living one week later, cultures from amniotic fluid and vein of broad ligament negative; and (4) fourth rabbit- given triple dose of culture, aborted 44 hours later with six dead fetuses, and direct smear of peritoneal fluid showed a streptococcus identical with the organism injected.

Talbot (110) states, "The evidence tends to show that such units as threatened miscarriage, miscarriage, antepartum hemorrhage and abruptio placenta are all manifestations of the same process, differing only by reason of the site of the lesion, the degree of the damage and the virulence of the bacteria causing the lesion." (p.317).

The problem of infection of the human with *Bacillus melitensis* and *Brucella abortus* as a cause of abortion has been a controversial subject. *Bacillus melitensis*, the organism producing Malta Fever, and *Brucella abortus*, the organism producing contagious abortion in cattle, have been

found to be identical, as stated by Taussig (112). De Forest (27) reported eleven cases of abortion in women which he believed to be identical with contagious abortion in cattle. Although no cultures were obtained, he stated the character of the vaginal discharge, and the pathologic changes in the fetus and placenta were characteristic. Two other investigators, Simpson and Fraizer (104), encountered five cases of *Brucella abortus* infection in women who have repeatedly aborted. All had been consumers of raw milk. These writers stated that Undulant Fever is no longer uncommon in man and there is evidence of widespread of the disease in the United States. Taussig (112) and Pearce (83), however, believe that the organism does not play an important part in the etiology of spontaneous abortion in the human.

Another subject which has received considerable attention concerning its role in spontaneous abortion is that of Syphilis. It is the opinion of many investigators today that the importance of Syphilis as a factor in abortion has been considerably over-rated. Whitehouse (121), in a study of 493 tertiary syphilitics, found the percentage of abortions was 37.3%, which did not differ from the percentage of 35.3% from all causes. It is his opinion, as well as that of Pye-Smith (89), that syphilis does not increase the predisposition to abort during the early months of pregnancy, but it does however, increase the incidence of premature labor and



stillbirth. Taussig (112) states, "While syphilis is undeniably the most important factor in the premature expulsion of a macerated fetus in the last three months of pregnancy, it is only in an exceptional case the cause of abortion in the first three months."(p.106).

Tuberculosis is said by Taussig (112) to be a rare cause of abortion before the period of viability, and then it is usually due to some acute flare-up leading to pneumonia. In a series of 164 cases of abortion, Royston (98) attributed five of them to tuberculosis in the mother, and two cases to tuberculosis in the husband. It is possible that in the latter two cases, a decreased vitality of the spermatozoa was the contributing cause of abortion.

According to McConnell (72), urinary infections frequently lead to abortion. This is especially true of pyelitis and nephritis. Royston (98) remarks that renal deficiency may interrupt pregnancy at any time. It is the opinion of Peckham (84) that over 90% of the toxemias manifesting themselves previous to the seventh lunar month are nephritic in origin. Marked deviation in blood chemistry in terms of non-protein nitrogen, uric acid and carbon dioxide combining power gave definite increase in fetal mortality percentage, according to his observations. The earlier in pregnancy toxemia signs developed, the less favorable was the prognosis for the child. Peckham states the outlook for the fetus in

low reserve kidney is fair, less favorable in preeclampsia, and still less favorable in chronic nephritis.

(4) Pelvic Pathology.- In the past, retrodisplacement of the uterus was given as a common cause of abortion. The present concensus of opinion, however, has somewhat altered this viewpoint. Although Williams (123) believes abortion to be common in pregnancies complicated by retrodisplacements, he gives no figures to support such a statement. Huntington (54), Taussig (112), Plass (88), and Danforth and Galloway (23) believe retrodisplacement of the uterus to be only an occasional cause of early abortion. Nevertheless, these clinicians recognize the danger of producing an abortion by attempts at correcting the displaced uterus during pregnancy, and they advise such attempts to be made in the interval between pregnancies. Dougal and Bride (33) reported a case of marked retrodisplacement of the uterus. They believed congestion caused by faulty position might account for the engorged decidua and hemorrhage into the placenta, which they found upon examination following the abortion.

The observations of Shaw (102), Whitehouse (54) (12), Huntington, Hendry (47) and many others tend to establish multiple fibromyomata of the uterus as a frequent cause of abortion. McConnell (72) states, "Fibroids do not as a rule impair or endanger pregnancy unless by their situation or size they rob the placenta of its needed

amount of oxygen and nourishment, or unless their location is such that a mechanical interference with fetal development ensues." (p.735.) Another writer, Pierson (86), ranks fibromyomata with the toxemias of pregnancy, syphilis and abnormal conditions of the cervix as one of the most important conditions producing abortion and premature labor.

An interesting and rare case of adenocarcinoma of the body of the uterus complicating pregnancy, with an abortion in the fourth month of gestation, was reported by Wallingford (118).

Shaw (102) has noted a group of cases in which repeated abortions have followed difficult instrumental deliveries with resultant severe lacerations of the cervix. The same observation has been made by Hendry (47), Dougal and Bride (33), Royston (98) and others. Cervical repair is indicated in such cases as prophylaxis against further abortions.

Royston (98), and Dougal and Bride (33) have also noted the occasional association of abortion with pelvic adhesions and adherent caesarean section scars.

(5) General Diseases.- Fetal mortality in appendicitis complicating pregnancy is high, according to Maes and his co-workers (67), due to the toxemia produced. The factors responsible for abortion in such instances are the fever and toxemia, the gastrointestinal disturbances,

reflex peritoneal irritation and direct extension of the infection, rather than appendectomy itself. Although the maternal mortality is highest among those who abort, it is due to the overwhelming infection and not because of the abortion. Taussig (112) states, "If the appendix lies over the brim of the pelvis and hence close to the uterus, interruption of the pregnancy is the rule." (p.110).

He also expresses the opinion that other intestinal conditions associated with marked peristalsis, such as acute intestinal obstruction, may bring about abortion during pregnancy.

Diseases of the liver and gallbladder have been ascribed by Taussig (112) to be an occasional etiological factor in abortion. He points out that, in the presence of cholelithiasis with colic, infection of the gall bladder or marked icterus, abortion may occur. In some cases he attributes the precipitation of the abortion to hyperpyrexia, and in others to the cholemia.

The relationship existing between pathology in the urinary tract and abortion is of interest. A case of repeated abortion due to infection of the kidney with echinococcus was reported by Gentili (41). Hunner (53) reported four cases of repeated abortions due to ureteral stricture. Ureteral dilations enabled all the patients to go to subsequent full term pregnancies with no difficulties. It is

Taussig's (112) opinion that bladder calculi do not precipitate abortion usually, but that urinary fistulae are often a cause of abortion when pregnancy occurs.

Diabetes as an etiological factor in abortion has long been recognized. In a study of 665 cases of diabetes complicated by pregnancy, Kramer (61) found the incidence of abortion to be increased in almost direct proportion to the severity of the diabetes. The fetal mortality was terrific, only 286 infants out of 665 survived. Two cases of severe diabetes complicating pregnancy are reported by Ill (55). This clinician, by careful dietary management and insulin therapy, carried both patients through pregnancy and normal deliveries.

(6) Chemical and Physical Agencies.- Lead is believed by Taussig (112) to be the most common chemical poison which produces abortion. In an experimental investigation of toxic abortion produced by chemical agents, Datnow (25) found that lead in sublethal doses produced a coagulation necrosis in the trophoblast in pregnant rabbits. He also observed that large doses of cadmium, selenium, acids and lead produced hemorrhage beneath the placenta in the spongiosa, throughout the entire uterus, and often in other organs, with abortion as the end result. It is the observation of Morse (78), that mercury, arsenic and phosphorous will sometimes produce abortion.

De Lee ( 28 ) and Taussig (112) as well as others agree that chronic alcoholism is a factor which predisposes to abortion. The deleterious effect may be manifested either in the ovum or the spermatozoa, or it may be as a result of associated renal conditions.

The role of nicotine in abortion is given mention by Taussig (112). He states, "Nicotine, if absorbed in large quantities by workers in tobacco factories, may tend to abortion but it is most improbable that cigarette smoking even to excess can lead to such an event." ( P.111 ).

It is the opinion of De Lee ( 28 ) that anaesthesia may have a lethal effect on the fetus if it is too prolonged, or attended with too great a cyanosis, particularly in the continuous nitrous oxide method. According to Davis ( 26 ), the use of chloroform anaesthesia is the most apt to produce fetal death by excessive injury to liver cells.

The abuse of the so-called oxytocic drugs such as ergot, cotton root, aloes, juniper, tansy, black hellebore, pennyroyal, quinine and cantharides is said by Davis ( 26 ) to "rarely disturb a healthy ovum in a healthy uterus." Taussig (112) believes such drugs are more apt to produce an effect in the second three months of pregnancy, if at all. If abortion occurs, it is because other predisposing factors are usually present.

Over dosage with irradiation is mentioned by

De Lee ( 28 ) and Taussig ( 112 ) as having a destructive effect upon the developing ovum. The former remarked it would be interesting to note if total sterility in X-Ray operators was preceded by a series of abortions in their wives. The analysis of results obtained by Linton, Marks and Smith ( 64 ), in the treatment of pregnant women by radium for various conditions leading to non-malignant uterine bleeding, tended to show that radium was harmful to pregnancy, and it frequently results in abortion or premature labors.

However, the patients studied were distinctly abnormal, and the abnormal uterine bleeding was a result of local, constitutional or endocrine pathology which might in itself lead to abortion.

(7) Operative Procedures.- The observations of De Lee ( 28 ) , Taussig ( 112 ), Davis ( 26 ) . and others tend to show that operative procedures during pregnancy, as a rule, do not produce abortion unless some predisposition already exists. Major abdominal operations, for the most part, can be performed safely if care is taken by the surgeon to be gentle. Fibroids have been removed from the pregnant uterus with no disastrous effect, but a slight operation on some distant organ, such as a tooth extraction has been known to precipitate abortion. Taussig ( 112 ) advises, however, that tooth extraction should be delayed until after the fourth month, and the procedure should be done under a short

gas anaesthesia.

(B) Secondary or Exciting Causes.

(1) Physical Trauma.- Avicenna ( 5 ), in the tenth century counseled that bathing and the lifting of heavy objects were frequent causes of abortion. It has been noted by many writers that trauma is most frequently given as a cause of abortion by the patient. Morse (78 ) believes the blow must have been applied directly over the uterus to produce abortion. Huntington ( 54 ) states trauma sufficient to cause rupture of the amniotic sac will precipitate a premature termination of the pregnancy.

The question of trauma as the cause of abortion, according to Taussig (112), is frequently raised in cases of litigation in an attempt to collect accident insurance. He stresses the importance of history and clinical findings in such cases, for an attempt at induction of abortion may have preceded the trauma.

Coitus is conceded by many clinicians to be an important factor in the etiology of abortion. Morse ( 78 ) made the observation that uterine irritability is variable in patients, and in some cases abortion may follow coitus or pelvic examinations.

Repeated sexual intercourse, according to A.Mayer ( 71 ), may disturb the normal metabolic relationship existing between the ovum and the corpus luteum.



In regard to nursing and its relation to abortion, Taussig (112) states, "Since there is a physiological connection between the act of nursing and the production of uterine contractions as is normally noted after delivery when the child is put at the breast, it happens at times that when a nursing mother becomes pregnant, the act of nursing will incite uterine contractions and lead to a loosening of the ovum from its uterine attachment ." (p.115.)

(2) Thermic Irritation.- Extremes of heat and cold are mentioned by Taussig (112) as secondary or exciting factors which may occasionally cause abortion. The application of heat or cold to the abdomen, or the use of hot vaginal douches during pregnancy may incite uterine contractions.

(3) Psychic Trauma.- In 1849, Robert Gooch (42) stated: "There is no doubt that passions and emotions of the mind sometimes destroy the child; but how an influence of this kind is communicated from the brain of the mother through the umbilical cord to the child, is not easily determined." (p.124). Whitehouse (121) advanced the possibility of inhibition of the corpus luteum through the network of nerve plexuses and ganglia which surround it as a mechanism in the production of abortion by nervous shock. Another writer, Davis (26), has suggested that the mechanism of abortion following emotional disturbances may be a

contraction of the uterine muscle which is analogous to that of the vesicle and rectal sphincters during involuntary, nervous urination and defecation. It is the opinion of Taussig (112) that women who are sensitive in nature, who have a low blood pressure, and who are prone to faint readily, are more apt to abort as a result of fright.

## CHAPTER IV.

PATHOLOGY OF ABORTION.

The discussion of the pathological anatomy in abortion is best considered under two distinct heads:

(1) Pathology of the Ovum.

(2) Pathology within the uterine cavity.

(a) Complete abortion without complications.

(b) Incomplete or retained abortion.

(1) Pathology of the ovum.

The exhaustive studies of abortion ova by Mall (68) has given rise to the observations and conclusions which I shall present in the following discussion of the pathology of the ovum.

Those embryos which show signs of maceration are not necessarily pathological, for their condition may be a result of post-mortem changes. Abnormal conditions within the uterus may kill an embryo without producing a monster or resulting in abortion immediately. Those embryos which die suddenly are usually aborted at once before maceration begins. However, if they do not die, and are retained for any length of time, they will grow irregularly.

The majority of pathological embryos are formed during the first seven weeks of pregnancy, and very few occur after the tenth week. Those pathological embryos which survive the second month will probably remain in utero until term is reached and give birth to monsters.

The study of pathological ova reveals embryos which are deformed, and structural changes in the chorion which are apparently associated with inflammatory processes in the uterus. "The villi are usually fibrous or are otherwise degenerated, the syncitium is atrophic or necrotic, and there is an excess of blood and mucus rich in leucocytes between the villi. These are also often invaded by syncytial cells and leucocytes. The picture indicates that the chorion is affected by an inflamed uterus, which naturally interferes with its nutrition." (p.227).

Mall classifies his series of pathological ova under the following headings:

Group I- Includes the vesicular forms. The umbilical vesicle is the main remnant of the embryonic mass. In some the amnion is formed and in others it is entirely destroyed.

Group II- The amnion, embryo and umbilical vesicle are absent. The chorion alone remains. Vesicular and solid moles may have their origin from this group.

Group III- The embryo has been destroyed after the amnion was formed. All stages of destruction of the embryo are represented, from a necrotic, granular mass to a vesicular ovum lined by the amnion with only the remains of a short stump of umbilical cord.

Group IV- The embryo is present, but it is more or less degenerated. If it is much degenerated it becomes a nodular

embryo of His or an amorphous embryo of Panum.

(2) Pathology within the uterine cavity.

(a) Complete abortion without complications.

In an extensive search of the literature, I was unable to find any material on the pathology of the simple post-abortive uterus. However, since we are primarily concerned with the regeneration of the uterine mucosa at the placental site, for the purpose of description we may assume the histological picture of the placental site in the post-abortive uterus to be essentially similar to that of the post-partum uterus at term. Minor variations may occur in the histological picture, such as the degree of fusion of the decidua capsularis and vera and variations in the compacta and spongiosa layers of the decidua basalis.

The following discussion is based upon the observations of Williams (124), who examined a large number of uteri amputated at various periods following delivery and throughout the puerperium.

The line of separation of the placenta and membranes is usually irregular. For the most part, the separation takes place generally in the spongiosa, but in some places the muscularis may be practically bare while in other places decidua may be thick.

In the specimens examined immediately following delivery of the placenta, the placental sites showed a

large number of compressed blood vessels, and large numbers of compressed glands in the spongy layer. There were the characteristic chorionic giant cells in the decidua basalis and the muscularis immediately beneath the placental site. Occasionally changes in the blood vessels were noted. These changes were manifested by a "replacement of the walls of certain arteries and veins by a thick zone of hyalin material, through which are scattered large faintly staining cells, with the eventual replacement of the endothelium by similar cells, which may completely or partially fill the lumen."(p.675. ) In some cases the vessels were thrombosed, while in others they contained fluid blood. These degenerative changes in the vessels are not necessarily associated with the terminal processes of pregnancy and their significance at the present is not understood.

The placental site on the first day postpartum appears macroscopically as a rounded, blood stained, ragged and nodular elevation of about 8 to 10 cm. in diameter, and projecting from 4 to 10 mm. above the surface of the rest of the uterine cavity. Microscopically, the histology is characterized by great numbers of distended vessels in the superficial portion of the decidua basalis which are undergoing thrombosis. The deepest portion of the basalis still retains its original structure and shows definite glands and a non-decidual stroma.

In examination of the placental site on the second day postpartum, there is found further thrombosis of arteries and veins and beginning organization, as evidenced by the invasion of fibroblasts. Considerable free blood is to be seen in the superficial layers, and there is a moderate leucocytic infiltration.

The placental site on the eighth day postpartum shows a diminution in size and an advancement in the organization of thrombosed vessels. Well developed endometrial tissue is present and it is apparently extending beneath the mass of thrombosed vessels.

The endometrium on the twelfth day has further extended beneath the mass of vessels. On the seventeenth day there is a thin layer of well regenerated mucosa covering the free surface of the placental site. There is a dense mass of tissue beneath the mucosa which consists of obliterated arteries, thrombosed and organized veins, and interposed tissue showing hyalin degeneration. The endometrium is well developed and is beginning to undermine the placental site.

The entire uterine cavity is almost filled by the placental site on the twentieth day. The endometrium shows further undermining of the mass of obliterated vessels, and there is beginning invasion of the placental site by narrow strands of endometrial tissue.

The placental site continues to grow progressively

smaller during the puerperium, and it has disappeared completely by about the end of the seventh week. Although the evidence is not conclusive, there is some basis for believing that the endometrium completely undermines the placental site and leads to its exfoliation. Examination of a placental site forty-eight days postpartum showed it to be represented by a tag of tissue projecting into the uterine cavity and attached by its base to the superficial portion of the endometrium. The endometrium showed complete regeneration.

In a summary of the discussion of the fate of the placental site in the normal puerperal woman, Williams (124) states: "- I feel that it has been made clear that six to seven weeks are required for its disappearance, and that it is not effected by absorption in situ, but rather by a process of exfoliation which is in great part brought about by the undermining of the placental site by the growth of the endometrial tissue. This is effected in part by extension and downgrowth of endometrium from the margins of the placental site, and partly by the development of endometrial tissue from the glands and stroma left in the depths of the decidua basalis after separation of the placenta." (p.694).

The following discussion is limited primarily to the pathological changes occurring in the fetus, placenta and uterus in the condition of retention of portions of the ovisac:



Changes in the Fetus.- In abortion during the early months of pregnancy, according to Taussig (112), the finding of pathological changes is infrequent except in those cases of blighted ova. He has observed rigor mortis in the period of three to six months.

In the series of pathological embryos studied at Carnegie Institute, Mall and Meyer (69) have noted certain fairly constant changes in the fetus. Maceration is usually present in a greater or lesser degree. During early postmortem changes the tissues of the fetus lose their translucence and appear whiter and denser. Later they become yellowish and frequently hemorrhagic. Some swelling and softening occurs, and bleb formation begins. The extremities begin to drop and develop curvatures as a result of tissue softening. The ocular margins become everted and irregular, and the lids may prematurely open if they are fused. The effects produced by retention in utero after death is not so much dependent upon the duration of the retention as it is upon the age of the fetus. The younger fetuses may be completely absorbed in a few weeks of retention, while the approximately mature fetuses may show merely varied degrees of maceration.

The fetus compressus is defined by Mall and Meyer (69) as follows: "A twin which has died early and become softened and compressed by a living well developed

companion." (p.92). Some of these fetuses are macerated and swollen, while others are shriveled and mummified. Mummification sometimes occurs in the presence of a large amount of liquor amni, probably as a result of chemical changes in the fluid. The fetus compressus shows considerable grotesqueness; the features are pointed, the mouth gaping, and the extremities distorted. Occasionally bleb formation occurs, and the skin may slough or roll up and fuse to form welts. Fusion of the extremities is not an uncommon finding.

Another pathological change in the fetus is described by Williams (123) : "In very exceptional instances, the foetus may be retained in utero for a long period, until the deposition of lime salts upon it converts it into what is known as a lithopedion. This phenomenon, though extremely rare in uterine pregnancy in human beings, is relatively common in the lower animals. In extra-uterine gestation, on the other hand, it is not of unusual occurrence." (p.703.)

The condition of spontaneous decapitation of the fetus with intact membranes, is attributed by Streeter (108) to be due to defective germ plasm. He has shown that defects in the germ-plasm of the fetus leads to the agglutination of the degenerated area of germ-plasm with the amnion, and the subsequent formation of amniotic adhesions and bands.

The Placenta.- The following description of pathological changes in the placenta is given by Taussig (112); "Where portions of the placenta have been retained we find considerable variation in the histologic picture. The epithelial covering of the chorionic villi frequently shows almost a proliferating tendency. While the Langhans cells are usually completely absorbed, the syncytium may form buds of considerable size that show normal staining qualities and a tendency to remain attached to and even slightly embedded in the mucosa. Occasionally the layer of Langhans cells remain alive and form small islands of ectoderm.

Quite characteristic of retained placental villi is the appearance of connective tissue surrounded by a layer of fibrinous blood clot. The epithelial covering may be completely absorbed, while the connective tissue, although losing all nuclear elements, can be recognized by its different staining qualities and retains its irregular, ovoid or sausage-shaped form within the blood clot. This hyalin degeneration of the villous stems and their branches presents a characteristic histologic picture. The chorionic vessels also show characteristic changes consisting of concentric proliferation of the intima with occasional round cell infiltration or hyalin degeneration of the vessel walls. No noteworthy pathologic changes occur in the membranes. They remain intact for considerable periods of time." (p.85-87).

Placental Polyp.- The pathology of placental polyps is given consideration by Taussig (112). "The relative frequency of placental polyp following abortion justifies more detailed pathologic consideration. The polyps vary in size from two to six centimeters in diameter, have a flattened or ovoid shape, and are attached by a broad base usually to the upper portion of the uterine body. In a few rare instances they may be as large as a man's fist. Their surface is covered by a light brown fibrinous layer and their center contains, for the most part, a dark red organized blood clot with some irregular placental tissue visible at the base where the polyp is attached. They often show concentric layers due to the agglutination of additional layers of coagulated blood. In this way the polyp sometimes grows larger and larger until it dilates the cervical canal and becomes visible at the external os." (p.87).

Post-abortive Edometritis.- Williams (123) states: "The presence of a remnant of decidua of any considerable size, which has failed to undergo the usual regressive changes, may act as an irritant upon the regenerating endometrium, giving rise to a hyperplasia which is designated as endometritis decidua postpartum or postabortum, according as it follows full-term labor or abortion. It usually interferes with the process of involution, and may lead to more or less hemorrhage." (p.1026).

The following discussion is presented verbatim from Taussig (112). "The most common pathological lesion following abortion is that of so-called post-abortive endometritis or subinvolution. In the gross examination of such a uterus we find a markedly thickened mucosa with a uterine wall that is also increased in size, and is softer and more hyperemic. The curette brings away considerable material varying in consistency from almost cartilaginous tissue to soft mucous particles. In the firmer pieces examined microscopically, we find degenerated chorion villi and plaques of decidua cells. In the softer particles we find uterine mucosa showing the typical corkscrew-like proliferation of the uterine glands. The uterine mucosa shows the marked round cell infiltration and hyperemia of a chronic infection. The decidual tissue shows a varying picture. In some areas it appears as an island of decidua cells, in other areas it is surrounded by or embedded in uterine mucosa. Often these cells show degenerative changes, becoming smaller, more spindle shaped and staining only faintly with a somewhat swollen nucleus. The round cell infiltration invades and separates these decidual bundles. In the presence of more active infection polynuclear leucocytes are present throughout the mucosa and the blood vessels are considerably increased in size and number.

The uterine wall histologically shows the typical picture of a subinvolution with some edema of the

fibro-muscular coat and numerous open blood vessels.

While careful search of the curetted parts will usually reveal a few islands of degenerated chorionic villi, it occasionally happened that only decidual elements are found, and, in a few instances, if considerable time has elapsed between the abortion and the curettage all histologic evidence of the preceding pregnancy may be absent. In such cases we see only the hyperplastic endometrium with chronic infection."( pp.89-92).

Syphilis.- According to Taussig (112) changes in the placenta due to syphilis are not pronounced before the twenty-fourth week of gestation. However, there may be a tendency toward club-shaped villi and obliterative endarteritis.

#### MECHANISM OF ABORTION.

The mechanism of abortion is classified by Taussig into two groups: (1) One-stage abortion, and (2) two-stage abortion. His description of the modus abortus is used as the basis of the following discussion:

(1) One-Stage Abortion:- As a rule, the one-stage abortion occurs during the first twelve weeks of pregnancy. The insecurity of the attachment of the ovisac to the uterine wall, due to the fact that the chorionic villi have not developed and penetrated the wall of the uterus, predisposes to a complete separation and expulsion of the ovisac with its decidual covering when uterine contractions arise.

Liquefaction necrosis of the decidua will further insure such an expulsion of an intact ovisac.

Previous intrauterine instrumentation renders the mechanism of one-stage abortion impossible, for there is usually retention of placental tissue in such instances. Not infrequently a portion of parietal decidua is retained in the typical one-stage abortion.

(2) Two-Stage Abortion.- In the discussion of the two-stage abortion, Taussig (112) refers to the four varieties described by Nurnberger (80): From Taussig.

"(1) The decidua capsularis tears off from the parietal decidua and the embryo is expelled in its capsularis sac with subsequent expulsion of the remaining parietal decidua.

(2) The embryo is expelled intact, covered by its membranes but with both capsular and parietal decidua remaining in the uterus and expelled later.

(3) The chorion has also been detached and the embryo is expelled in its amniotic sac.

(4) The membranes rupture, the embryo is expelled followed later by the placenta as in delivery at term. (Modus Partus)." (p.128).

Taussig (112) states, "where pregnancy has advanced beyond the twelfth week, it is extremely rare for the ovisac to be expelled intact." (p.127). He believes the expulsion

of the embryo in its amniotic sac to be very rare, and then usually it occurs between the twelfth and eighteenth week of pregnancy. The fourth type of abortion described previously is believed by Taussig (112) to occur most often in the period between the twentieth and the twenty-eighth week. This usually follows instrumental rupture of the sac or where the membranes are abnormally friable as a result of inflammatory changes.

#### Other Types of Abortion.

Three types of unusual abortion are described by Taussig (112) : (1) Cervical abortion; (2) Abortion through cervico-vaginal fistula; and (3) Vaginal abortion.

(1) Cervical Abortion.- In this condition the ovum becomes detached from its site in the uterus and is retained in the cervical canal for a considerable period of time. Such factors which may predispose to such a retention are: low amputation of the cervix, stenosis of the cervix by radium or cautery, and agglutination or partial atresia of the cervix. This type of abortion is characterized by the frequency of free bleeding and the absence of contraction pains. Evidence seems to indicate that the condition is not due to a primary attachment of the ovisac in the cervical canal.

(2) Abortion Through Cervico-Vaginal Fistula.- This condition is due apparently to an undilatable cervix, with subsequent rupture of the ovisac through the thinned out cervico-



vaginal junction.

(3) Vaginal Abortion.- It is extremely rare to find a stenosis of the vagina which prevents the expulsion of the ovum from the vagina. Such a condition is characterized by extreme hemorrhage as a rule.

## CHAPTER V.

### SIGNS AND SYMPTOMS OF ABORTIONS.

The signs and symptoms of an abortion are preceded by those of pregnancy. It is entirely obvious that to make a diagnosis of abortion, one should ascertain the existence of pregnancy.

The physician should give consideration to a history of amenorrhea, nausea and vomiting as well as look for the signs of pregnancy. The demonstration of breast changes, such as enlargement, and increased pigmentation about the areolae, are of importance. Pelvic examination will reveal a darkening of the vaginal mucosa, a softening of the cervix, and an enlargement of the uterus which are significant, according to Davis (26).

Additional information may be gained by the various pregnancy tests. The serological test for the presence of the female sex hormone, as devised by Frank and Goldberger (39), is of considerable value in the diagnosis of pregnancy. The Aschheim-Zondek reaction or the Freidman test for the presence of the female sex hormone in the urine as described by Taussig (112) is also of value. Stein (107) stresses the use of the roentgen ray in the diagnosis of pregnancy. Transabdominal pneumoperitoneum is of value in the determination of early pregnancy of five to ten weeks. X-Ray without pneumoperitoneum can be used to determine

pregnancy of midterm or later.

Abortion is heralded by certain symptoms and clinical signs, which may vary in different patients as to severity, but which are nevertheless present in some degree.

Uterine bleeding is the cardinal symptom in abortion. The onset of bleeding, in relation to pain in the pelvis, is conceded by Davis (26), Morse (78), Johnson (56), Taussig (112) and others, to be extremely variable. The hemorrhage may precede the uterine pains, it may occur synchronously, or it may follow the pains. The amount of bleeding is likewise variable. Davis (26) states the hemorrhage may be so slight as to appear as "spotting"; it may be a alarming and profuse hemorrhage; it may be retained in vagina and form large clots which are expelled from time to time; or it may be concealed entirely within the uterus. In 1846 Churchill (19) remarked that internal hemorrhage may be difficult to detect, but he mentioned the associated symptoms of shock, increased distention of the uterus, and increased pain in the pelvis as valuable signs of concealed hemorrhage.

Pain in the pelvis is another significant symptom associated with uterine bleeding during pregnancy. On the other hand, pain may be entirely absent, according to Davis (26). Churchill (19) noted that in cases of habitual

abortion, pain was often minimal or absent. It is pointed out by Davis (26 ) that often the pains are intermittent and laborlike in character, but some patients may have a continuous aching in the sacral region rather than rhythmical abdominal cramps.

The expulsion of a part of the whole of the ovum and decidua is another clinical sign of abortion mentioned by Davis (26 ). Only in rare instances are the uterine contents expelled suddenly without the prodromata of uterine bleeding and pain in the pelvis. The passage of large clots from the vagina should be thoroughly investigated . Morse ( 78) stresses the importance of the examination of such clots, for they may conceal the ovum.

The rupture of the amniotic sac and the subsequent expulsion of a watery discharge may occur, according to Taussig (112). However, such an incident usually occurs after uterine contractions have persisted for a considerable time. The fetus may or may not be expelled following rupture of the amniotic sac. It is characteristic, nevertheless, of an abortion in a pregnancy of four to six months duration, to have expulsion of the fetus.

#### Physical Signs.

Much importance to certain physical signs is given by Taussig (112). Much information can be gained by vaginal examination. Softening of the cervix is a usual finding, and there may be some dilatation of the external

cervical os. On the other hand, the cervix may be found to be closed. Occasionally a portion of the ovisac may be found protruding into the vaginal canal. The presence of Hegar's sign, a softening of the lower uterine segment characteristic of pregnancy, may be entirely absent or diminished. Consequently, there will be noted little difference in the consistency of the cervix and body of the uterus.

Further palpation of the uterus will give several observations of value described by Taussig (112). There may be noted a decrease in the angle of anteflexion of the uterus. One may detect a lessened compressibility of the uterus, firmer consistency, and an increased definition of outline. Evidence of uterine irritability may be noticeable.

As a rule the adnexa present no abnormalities. In an occasional patient with a thin abdominal wall, Taussig (112) has palpated the ovary enlarged by the corpus luteum of pregnancy.

It must be remembered that the stage of abortion determines in part the physical findings. As abortion progresses from the stage of threatening to inevitable, there is a progressive dilatation of the cervix.

## CHAPTER VI.

## DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS.

Diagnosis of the Abortion.

The importance of confirming the diagnosis of pregnancy has been stressed in Chapter V. One must also be certain he is dealing with an intra-uterine pregnancy rather than an ectopic gestation. A further discussion of this problem will be presented under the heading of Differential Diagnosis in this chapter.

The diagnosis of abortion, according to Morse (78), is made on the basis of the following : (1) A history of amenorrhea; (2) presence of slight or moderately profuse bleeding; (3) cramplike pains in the lower back and abdomen which may eventually become rhythmical in character; (4) cervix softened and with perhaps some dilatation; and (5) an enlarged uterus. Taussig (112) adds the finding of a uterus firm in consistency and distinctness of uterine outline. The examination of the material expelled from the uterus is stressed by many writers, notably Taussig (112), Morse (78), and Shaw (102). If one is fortunate enough to obtain a piece of the tissue expelled from the uterus, he should look for small pieces of chorion, the embryo itself, the decidua, or the ovisac. Taussig (112) describes the foregoing points and he also states the presence of

proliferating glandular tissue and decidua cells, as seen microscopically, are of value if present in sufficient number. The finding of chorionic villi and proliferating syncytium, and its identification microscopically, is extremely significant.

#### Diagnosis of the Stage of Abortion.

Because of the variation in prognosis and treatment, it is exceedingly important to diagnose the stage of abortion. These stages are five in number and are attended by distinctive signs and symptoms, as cited by Taussig (112). He states: "In general we speak of threatened abortion when definite symptoms have set in, but it is still possible that the expulsion of the ovum may be prevented. Inevitable abortion is the term applied when it is no longer possible to check the expulsion. Abortion is spoken of as incomplete when portions of the ovum are still left in the uterus. Complete abortion refers to the condition immediately after the expulsion of the ovum has been fully accomplished. Recent abortion is the condition several days after complete expulsion of the ovum."(p.143).

Threatened abortion.- In threatened abortion, according to Shaw(102), there are the usual pelvic signs of intrauterine pregnancy associated with vaginal hemorrhage. He believes that as a rule dilatation of the cervix is hardly ever found in this stage, and when it is present, it usually indicates the abortion is becoming inevitable. Taussig (112)

states there is also headache, backache, and an increased micturation. These symptoms may persist for a day or two, and are usually followed by vaginal bleeding and abdominal cramps.

Inevitable Abortion.- The differentiation between threatened abortion and inevitable abortion is more or less arbitrary.

Davis ( 26 ) states, "In this condition the threatening symptoms are as marked and so persistent that all hope of preventing the completion of abortion must be given up." (Vol.I.Chap.X,P.8.)

Rock ( 97 ) has adopted an attitude that abortion is inevitable when the hemorrhage is enough to soak five napkins in twenty-four hours; when the bleeding continues over a period of days too severe to permit continual recovery of the blood supply; when there are characteristic rhythmical sharp aching pains in the pelvis or low back which are not stopped by moderate doses of morphine; or when there is evidence of ruptured membranes. Taussig (112) has stated abortion can be usually considered inevitable in the presence of the following:

"(1) When the amount of blood lost is considerable or the bloody discharge prolonged for several weeks.

(2) When the pains become severe, occur at regular intervals, and are of a cramp-like character.

(3) When the cervix is dilated sufficiently to admit one finger.

(4) When there has been a watery discharge



indicative of a rupture of the membranes.

(5) When the fact of fetal death has been determined." (p.144). This author points out that cervical dilatation is of diagnostic value primarily in the primiparae. In the multiparae there may be considerable cervical dilatation without much significance. Although continuation of pregnancy is rare after hemorrhage which has been prolonged over a period of three weeks, consideration must be given to other factors before the abortion is termed inevitable.

Incomplete Abortion.- Taussig (112) refers to the difficulty encountered at times in the determination of complete expulsion of the products of conception. As a rule, hemorrhage ceases within a day or two following complete abortion. However, with the retention of placental tissue, the bleeding continues to be a bright red and clotted, with an increasingly foul odor to the discharge. Usually uterine contractions and pain in the back persist. The examination of expelled material is important and may reveal retention of parts of the ovisac.

The reaction of the uterus to ergot is cited by Taussig (112) as another aid in the diagnosis of incomplete abortion. He states, " Especially in abortion of the third month or more, we find that there is a noticeable increase in the strength and regularity of the painful uterine contractions within one hour after the ergot is administered if

there is material inside the cavity." (p.145.)

Pelvic examination can be made with caution and under aseptic conditions, according to Taussig (112). If there is sufficient cervical dilatation, the examiner may be able to feel fragments of retained placenta. The uterus is still abnormally enlarged and is less firm in consistency. He believes a curettage, when done in the hospital under aseptic conditions, is of value, in cases where there is a suspicion of retained material in the uterus. Rock (97) also confirms this opinion but he warns that great discretion should be used in electing curettage.

**Complete Abortion.**- This condition, as I have stated previously, refers to the complete expulsion of the products of conception. According to Rock ( 97 ), Morse ( 78 ), Taussig (112) and others, complete abortion is indicated by a cessation of bleeding, uterine pain and a regression of the signs and symptoms of pregnancy.

**Recent Abortion.**- The importance of a diagnosis of recent abortion, according to Taussig, is manifested from the medicolegal and therapeutic viewpoint. This is particularly true in cases where there is a question of criminal interference.

Digital examination, in recent abortion cases which have occurred from two to fourteen days previously, will reveal a blood-stained or brownish discharge, a patulous cervix and a variably enlarged uterus which is softer in consistency

than normal. Curettement will show the presence of chorionic villi or typical decidua as described in Chapter IV. on Pathology.

Diagnosis of the Cause of Abortion.

The diagnosis of the cause of abortion is frequently very difficult, and often no obvious cause can be determined. Examination of the fetus and placenta will often give the clue to the diagnosis. Macomber (66) and Huntington (54) are strong advocates of defective germ plasm as an etiological factor. Streeter (108) has shown that examination of the ovisac may confirm the presence of defective germ plasm. The inspection of the placenta, umbilical cord, membranes and fetus for the characteristic macroscopic and microscopic changes in syphilis is referred to by Whitehouse (121). The presence of placental abnormalities have been stressed by Hobbs and Rollins (52), Binder (8), Morse (78) and others.

The taking of a careful history, correlated with a thorough medical examination of the patient is stressed by Taussig (112). The examiner may find evidence of the presence of one of many factors, such as; heart disease, renal insufficiency, diabetes mellitus, endocrine dysfunction, or local pathology such as fibroids, retroversion or cervical lacerations.

The most important reason for determination

of the cause of abortion, according to Taussig (112), is the differentiation between spontaneous and induced or criminal abortion. Those abortions induced by instrumentation are either actually or potentially infected cases. Therefore, active treatment in such cases may tend to spread the infection. It may be exceedingly difficult to obtain an accurate history because of the moral implication involved. However, delay in seeking medical attention, sudden onset of profuse hemorrhage, the presence of fever early in the abortion, and evidence of trauma in the upper vagina or cervix should arouse suspicion of criminal interference.

#### Diagnosis of Fetal Death.

In the diagnosis of abortion, we are also concerned with the possibility of fetal death. This is especially important in the state of threatened abortion, since there is no logic in the prevention of the expulsion of a dead fetus. There are physical signs by which the diagnosis of fetal death may be ascertained. The cessation of the symptoms of pregnancy, according to Rhodes (94), especially in the presence of symptoms apparently due to absorption of toxic substances, point to fetal death. Taussig (112) and Morse (78) stress the failure of progressive enlargement of the uterus as a sign of fetal death.

The use of the pregnancy hormone test for the confirmation of fetal death is advocated by Taussig (112) as

a supplement to physical examination. The work of Spielman, Goldberger and Frank (106) on the hormone diagnosis of the viability of pregnancy gave some interesting and conclusive results. These investigators conducted female sex hormone studies on a series of thirty-three cases of pregnancy in which abortion was suspected or expected. In the use of the Aschheim-Zondek or the Freidman tests for the prepituitary hormone in the urine, they found the tests to be reliable in the indication of fetal death in only 50% of the cases. However, the use of the Frank-Goldberger technique for the determination of the female sex hormone in the blood was 100% correct as to the diagnosis of life or death of the fetus. They concluded, "the presence or absence of the hormones depends upon the degree of involution of the placenta and its attachment to the uterine wall." (p.268)

#### Differential Diagnosis.

It is essential to differentiate between abortion and certain other pelvic conditions which may simulate premature expulsion of the ovum from the uterine cavity. The most important of such conditions will be given consideration in the subsequent discussion.

(1) Tubal Abortion.- It is the opinion of Shaw (102) that ectopic gestation is often mistaken for threatened uterine abortion. The discussion of Taussig (112) on the differentiation between tubal abortion and uterine abortion is a veritable

classic and for this reason I present it verbatim.

Most difficult is the differentiation between tubal pregnancy, or, rather, tubal abortion, and intrauterine abortion, especially when the latter is associated with inflammatory trouble of the adnexa. It is a very common event to have a uterus curetted on the supposition that there is a post-abortive retention of the placenta, only to discover a little later that the correct diagnosis was extrauterine pregnancy. To keep from making such mistakes we must bear the following points in mind:

In the history of the case we are apt to have in a uterine abortion a longer period of complete amenorrhea before bleeding starts. Tubal abortion is more apt to occur between the fourth and the sixth week, whereas uterine abortion occurs with the greatest frequency between the eighth and twelfth week. In tubal abortion the onset of pains and bleeding is often attended by dizziness or even fainting, owing to the shock of intra-abdominal hemorrhage. Furthermore, the cramps or sudden stabs of violent pain are felt on the affected side, whereas in uterine abortion the cramps are directly in the hypogastrium, coming and going like menstrual pains or labor. Vomiting, due to peritoneal irritation, is more often found in tubal gestation.

The character of the bleeding is of some differential value. In tubal abortion, for instance, only

small fragments of decidua are expelled from the uterus; the bleeding is never active and often there is only a prolonged brownish discharge. In uterine abortions, on the other hand, there are apt to be many clots, a copious bleeding, and pieces of decidua or placental tissue expelled. Again, in tubal abortion bimanual examination reveals a slightly enlarged uterus with a one-sided oval or sausage-shaped mass, the size of a fist or even larger, extremely sensitive to pressure, rather boggy to the touch, semi-fluctuating, adherent; whereas in uterine abortion we have a more or less spherical, enlarged uterus, not sensitive, with perhaps a one-sided or double-sided mass of variable size depending on the amount of associated inflammatory trouble in the adnexa. If this inflammatory mass is sensitive, there are apt to be several degrees of fever,  $101^{\circ}$  to  $103^{\circ}$ , whereas it is the rule in tubal abortion for the thermometer to register only  $99.5^{\circ}$  to  $100^{\circ}$ . The pulse, on the other hand, is more often rapid in the latter condition, ranging between 100-130 in accordance with the extent of the internal hemorrhage. The differential diagnosis will occasionally be impossible until the patient has been under observation for some time.

Another trying element in the management of these cases is the unwillingness of the patient to be confined to her bed or go to a hospital for observation.

Wishing something done at once, she often hurries the physician into measures whose consequences are fatal to the patient. Many cases of tubal pregnancy are on record where a hurry-up diagnosis of retained placenta was made and the uterus emptied digitally or with a curette, only to have the patient collapse from internal hemorrhage and shock immediately afterward, and die before she could be taken to the hospital to be operated on.

The material expelled should be saved, and sectioned microscopically. The presence of chorionic villi or epithelium is proof of an intrauterine pregnancy, whereas, if decidua alone is found on examining many sections, one may be very suspicious of tubal pregnancy especially if a tender adnexal mass is present. In this connection we must remember that there are now on record in the neighborhood of one hundred cases of combined extrauterine and intrauterine pregnancy. Hence the possibility of such an event, in spite of its rarity, must be kept in mind in making a diagnosis." (pp.152-155).

(2) Myomata.— The presence of degenerating submucous or intramural myomata must be considered in the differential diagnosis of uterine abortion. Morse( 78 ) states there is usually a history of recurring menorrhagia. A positive biologic test of pregnancy will rule out fibroid tumor, but a negative reaction does not rule out a possible missed



abortion. If the physical and laboratory examinations are inconclusive, he advises observation of the patient to determine if the pelvic mass increases in size as characteristic of a developing pregnancy. According to Taussig (112), careful palpation in cases of fibroid tumors will reveal discernible irregularity of outline and consistency. He points out, however, that the diagnosis may be complicated by the presence of fibroids in a uterus during abortion.

(3) Cancer of the Uterus.— Another cause of uterine hemorrhage is cancer of the cervix and of the body of the uterus. Inspection of the cervix, states Taussig (112), will serve to differentiate cancer of that region. On the other hand, cancer of the body of the uterus must be differentiated mainly on the basis of history. Microscopic examination of the expelled material is not to be forgotten. It should be remembered that chorio-epithelioma occasionally arises after an abortion.

Wallingford (118) has reported a case of adenocarcinoma of the body of the uterus complicating pregnancy, in which an abortion occurred during the fourth month of gestation. However, such cases are rare during the childbearing age.

(4) Cervical Adenoma or Polyps - Attention is drawn by Morse (78) to the condition of cervical adenoma or polyps as a

cause of uterine bleeding. Active bleeding may result from physiologically increased vascularization of the pelvic organs, originating in a cervical adenoma or polyp protruding from the external os. Frequently the hemorrhage is noticed following coitus. A careful analysis of the patient's history and speculum examination of the cervix should exclude error in diagnosis.

(5) Irregular Menstruation of Functional Origin.- As pointed out by Taussig (112), it is not uncommon to find women who have an occurrence of periods of amenorrhea which may last from three to four months, and which may terminate with a bloody discharge, cramps and the expulsion of clots. The previous menstrual history and the absence of other signs of pregnancy should lead to the diagnosis.

(6) Membranous Dysmenorrhea.- A description of a condition of endometrial hyperplasia is given by Taussig (112). In membranous dysmenorrhea there are severe cramp-like pains which cease after expulsion of a uterine cast. The amount of bleeding is usually more than the average menstrual flow and there may be the passage of clots. In such cases there is no history of a preceding amenorrhea, but there is usually a story of previous occurrences at the menstrual period. The signs and symptoms of pregnancy are absent. An examination of the expelled material will reveal an absence of chorionic villi and decidua.

## CHAPTER VII.

## COMPLICATIONS OF SPONTANEOUS ABORTION.

Not infrequently spontaneous abortion is ~~attended~~ by various complications and sequelae. To discuss them all would be a task far beyond the limitations of this thesis. Consequently, a brief discussion of the most frequent and important conditions complicating or subsequent to abortion are to be given consideration here.

COMPLICATIONS.

(1) Missed Abortion.-The definition of the term "missed abortion" is given by Taussig (112) as follows: "Retention of the ovisac for longer than two months after the death of the fetus until it is expelled or removed from the uterus." (p.480.) The condition is best considered as a complication of abortion, and for that reason I have chosen to discuss it as such.

Etiology- The etiology of missed abortion, according to Von-Graefe (44), is a lack of irritability of the uterus, evidenced by a failure to contract as usual when the dead ovum acts as a foreign body. It is the opinion of Taussig (112) that due to the gradual changes which result in fetal death, and to the persistence of activity in the fetal membranes, and the possible sedative effect of modification of the endocrine secretions upon the uterus, the ovum fails to act as foreign body and stimulate the uterus to contractility.

The factors which bring about the ultimate expulsion of the retained ovum are obscure, but the ovarian follicle is probably concerned in the restoration of uterine irritability, for expulsion often occurs with the first return of menstruation.

Occurrence- Missed abortion is not rare in occurrence as Von-Graefe (44) believed. At least a tenth of Taussig's (112) cases in private practice for the past five years were classified as missed abortions.

Pathology- A description of the pathology of missed abortion is given by Taussig (112), from which the following is a brief summary:

"The placenta is usually hard, dried, shriveled and tough, and has a yellowish white color. Infarcts are numerous. Here and there are small subchorionic hemorrhage can be seen.

Histologically, we find in the placental areas, intervillous spaces fitted with partly hyalinized blood. The chorionic villi show mucous and hyalin degeneration, and the epithelium covering them is in part missing. In some areas, however, the syncytial covering is absolutely normal, and shows evidence of recent growth. Calcium deposits occur first in the surrounding layer of blood fibrin; later involving the tissues within the villi." (p.249).

"The decidua, which is amply nourished by maternal blood, retains its vitality for a long time. Here

and there we find areas of necrosis associated with partial detachment of the placenta from the uterine wall. The blood vessels of this decidual layer are greatly dilated. Where the retention of the ovum has extended over a period of months, we find a tendency of the endometrium to regenerate over a large area of the uterine cavity."(p250.)

Coming now to the changes in the amniotic cavity, we find that in many cases associated with the continued growth of the fetal membranes after embryonal death, there is a definite increase in the size of this cavity, and an early hydramnios.\*\*\*\*\*\* Even though in the early stages of retention, there is at times such an increase in amniotic fluid, it is universally true that in longer periods of retention, especially in pregnancies of over three months development, the absorption of amniotic fluid is so pronounced that the embryo is often directly compressed by the surrounding placenta. Sometimes only a few drops of fluid are present." (p.252.).

For a discussion of the pathology of the ovum see Chapter IV.

Symptoms. - The symptoms of missed abortion are said by Taussig (112) to at first resemble those of threatened abortion. A slight bloody discharge and perhaps a few cramp-like pains following shortly after fetal death are characteristic. There is usually a subsidence of symptoms after bed rest and

sedation. The irregular bleeding may continue and there is an absence of signs of pregnancy such as; fetal activity after the fourth month, or progressive increase in the size of the uterus. The duration of the amenorrhea is variable, according to Shaw (102), and it may last from one month to two years, terminating with the development of a brown discharge or the passage of a carneous mole.

Diagnosis. The diagnosis of missed abortion is easily made when there is a classical history, according to Shaw (102). However, Taussig (112) does not agree, and he states that in some cases, especially those women with moderately thick abdominal walls, it is difficult to demonstrate with any degree of accuracy slight changes in the size and consistency of the uterus. Moreover, certain cases will present further difficulties of diagnosis. Forster (38) reported a case of missed abortion at five months with a superimposed pregnancy which went to full term. I have previously mentioned the Frank-Goldberger pregnancy test as an aid in the diagnosis of fetal death.

Treatment.- Although there exists some difference of opinion as to the employment of active or expectant treatment in missed abortion, Taussig (112) and Morse (78), especially, believe the type of treatment should depend upon the duration of the retention and the mental attitude of the patient. The opinion of the latter is that, in the absence of fever,

mental disturbance, malaise, headache and loss of weight, there is no urgent indication for evacuation of the uterus. In such cases he observes the patient for one month. If spontaneous expulsion has not occurred at the end of that period, exploration and evacuation of the uterine cavity is indicated. If the cervix is soft, he uses Hegar or Goodell dilators; but if it is rigid and undilatable, he employs vaginal hysterotomy.

It has been the practice of Shaw (102) to insert three or four laminaria tents into the cervical canal. Abortion usually follows within 36 hours. He also suggests preliminary cervical dilatation, followed by the insertion of a small hydrostatic bag. Both methods he has found to be preferable to the immediate evacuation of the uterus, for the complication of shock and hemorrhage are rare.

The ineffectiveness of oxytocics such as ergot, quinine and pituitrin are pointed out by Taussig (112). He has found packing the lower uterine segment and cervical canal also ineffective in some cases due to the sluggishness of uterine contractions.

(2) Molar Pregnancy.— Three types of molar pregnancy are described by Taussig (112); <sup>(a)</sup> Carneous or blood mole, (b) Hematoma mole, and (c) Hydatidiform mole. These occur in certain types of missed abortion and are variations of pathological changes in the ovum.

(a) Carneous or Blood Mole.- The following description is quoted verbatim from Taussig (112):

"It occasionally happens that even though the entire fetal sac has been detached from its decidual bed, it is not at once expelled from the uterus, but is surrounded by a layer of blood which coagulates, forming a bloody, fibrinous mass. By repeated slight oozing of blood, this mass may increase in size until the coagulated blood is many times larger than the original fetal sac. Since this process takes place only in cases of missed abortion, where the embryo has succumbed in the first few weeks of pregnancy, it is not surprising that as a rule we do not find any embryo within the amniotic cavity, or at the most a vesicular or club-like form. In gross appearance such a blood mole has the isosceles triangular shape of the uterine cavity in which it has been lying for some time before its expulsion. With the exception of a few gray fibrinous striations, the color ordinarily will be a wine red with a tinge of brown in the areas of older bleeding. On cutting open the blood mole, we find in the center a small spherical cavity lined by amnio-chorion and containing a few drops of amniotic fluid. Chorionic villi are scanty and barely distinguishable. The clinical history of such a blood mole presents no distinguishing points from that of an ordinary missed abortion, except that it is limited to very early abortions.



There is considerable resemblance between these blood moles and the blood clots containing a small amniotic sac frequently encountered in tubal abortion." (pp.260-261.)

(b) Hematoma Mole.— The hematoma mole, according to Taussig (112), was described by Carl Breus in 1892 under the name of the "tuberous subchorial hematoma of the decidua." The same condition has often since been referred to as the Breus Mole.

In 1902, Hart ( 45) described five cases of "tuberose fleshy mole." He states:

"The most common form of tuberose mole is that of a thickened, fleshy- looking structure averaging 6 c.m. by 6 c.m. in diameter, and 1.5 c.m. in thickness. It is evidently placental in nature, with a rough shreddy aspect, the one attached to the uterus, the opposite surface being, of course, amniotic. The amnion is separable, as usual, from the chorion beneath.

The chorionic surface presents a very remarkable appearance, as it has on it a number of finger-tip-like projections, and these average from 5 to 6 in number. On section the structures seen are amnion, chorion, with the sub-chorionic projections already mentioned, whilst clotted blood makes up the main mass of the thickness, resting usually on a thin layer of serotina. The subchorionic projections contain blood-clot communicating with the

rest of the mass, but some of them may be empty. This form of specimen is, thus, early placenta minus the membranes attached to the edge. Sometimes the tuberoso mole is expelled as a pear-shaped mass made up of placenta and reflexa. When laid open a small fetus is often found; in the former variety it is less frequently present. The specimens are quite fresh as a rule, with no odour." (pp.479-480).

In an examination of eight Breus moles, Taussig (112) reported his findings as follows: " Depending somewhat upon the localization of the chorionic villi, we find two types of hematoma mole; one, in which the blood sacs assume a polypoid form projecting from all portions of the fetal membranes into the amniotic cavity; the other, in which the hematomata are broad based, crowded together in one portion of the sac in a hemispherical shape with the remainder of the membranes normal in contour. Between the hematomata, folds of chorio-amnion can be seen crowded together by the surrounding sacs. The blood in these sacs has a dark red color, and is for the most part clotted. At their base we find strands of fibrin, grayish brown in color. The decidua covering of the sac has the firm consistency and brownish color seen in all retained abortions.

Although the sac itself is the size of an orange or even larger, the amniotic cavity will be found to be almost entirely obliterated and containing about a half

teaspoonful of a fluid having a brownish sediment.

This sediment consists of old blood. Most peculiar are the pathological changes in the embryo. The term "cylinder embryo" has been applied to this form, because instead of the normal crescent curve, we find that the head, body and extremities are barely distinguishable in the amorphous cylindrical mass." (pp.262-263).

In a discussion of the microscopical anatomy of the tuberous mole, Hart (45) states: "On examination, the sections of two were found to include the structure from amnion to the large-celled layer of the basal serotina, so that the specimens had separated at the spongy layer. The parts shown are therefore amnion, chorion, villi and intervillous spaces, with the large celled serotinal layer.

The amnion and chorion are well preserved, and call for no special remark. The amnion is naturally a tough elastic membrane, and both are away from phagocytic action. The intervillous spaces are occupied with effused clotted blood, in which one can see scattered decidual cells and villi, both much altered, and recognisable more from their outline than from their structure.

A very important point is that at the sulcus bounding the base of the characteristic chorionic tuberosities, already described, one can see a choriobasal septum persisting, but with a curved outline, instead of the

normal straight one already described.

In the large-celled layer very evident changes are present. One can note villi in various stages of absorption, some with epithelium fairly intact, others with it completely absorbed, and only the core left. The most important feature is the blocking of the thin-walled sinuses, whose lumen are invariably blocked with organized connective tissue. With care they can be distinguished from villi, and some are especially easy to pick out, owing to their curved outline." (pp.484-486).

Taussig ( 112) found upon microscopical examination that the hematoma moles showed evidence of considerable vitality of the fetal membranes. The syncytium showed numerous well-staining buds indicative of recent cell division. The epithelium of the amnion was, for the most part, intact. In one of the moles he noted an inclusion growth of epithelium around small blood masses lying in the amniotic cavity. The decidua, to a great extent, was necrotic or in a state of necrobiosis. The blood vessels of the decidua were thrombosed, and there was no evidence of its active participation in the pathologic process. There was noted accumulations of blood in the intervillous spaces; a thinning out of the fetal membranes over this area, and a chorion lacking in villous projections at the same area.

The origin of the hematoma moles has been, and still is, a controversial subject. Breus ( 13) believed the decidua was primarily involved in the pathologic process, and

that the fetal membranes continued to grow after the death of the fetus. Hart ( 45 ), on the other hand, has summarized his theory as follows: "(1) There is an undue blocking of the serotinal sinuses in the large celled layer. This leads to (2) A slow engorgement of the intervillous circulation. This will bulge out the choriobasal septa, and as these tack down the chorion at definite points, the amnion and chorion will bulge up between. This produces the tuberoso swellings. (3) The embryo dies as the result of this interference with the circulation, and its death is 'secondary'. (4) The placenta becomes a thrombosed mass, and is retained a certain time before expulsion." (p.486).

The theory of origin of the hematoma mole advanced by Taussig ( 112 ) is as follows: "After the death of the fetus in the first or second month of gestation, the fetal membranes and the amniotic fluid increase in volume. Thus there arises a secondary hydramnios ovum. This growth continues up to a certain point. The ovum is retained. The amniotic fluid is then gradually absorbed and the ovum as a whole shrinks somewhat in size. By the negative pressure thus produced, folds, or invaginations, of the membranes arise which become filled with the blood circulating in the intervillous spaces. By continued absorption of the fluid, together with a certain degree of stretching of the membranes by the blood clots, we have the formation of the hematomata. In this process the insertions of the villous stems act as fixed points. If the stems

are close together a hemispherical or broad-based hematoma results; if far apart, a tuberoso or polypoid hematoma."(p.266.)

The clinical features of the hematoma mole are discussed by Hart (45). There are at first symptoms of early pregnancy, and then of threatened abortion during the second or third month. These subside, but there is a period of amenorrhea which persists until a mole is expelled from five to eighteen months after conception. There is also no progressive increase in the size of the uterus consistent with a developing pregnancy.

The diagnosis of a hematoma mole, according to Taussig (112), presents considerable difficulty because of the absence of symptoms, the relative smallness, and firm consistency of the uterus, and the prolonged amenorrhea.

The treatment of hematoma mole is considered by Taussig (112) to be essentially that of missed abortion. He does not consider active interference necessary as a rule.

(c) Hydatidiform Mole.-- The following discussion of the subject of hydatidiform mole is based upon the observations of Palmer Findley (37):

The cause of hydatidiform mole is not definitely known. Often vesicular degeneration of the placenta occurs in isolated areas, and for that reason it is frequently overlooked. It is possible that this type of molar pregnancy is more

frequent in occurrence than generally recognized.

The condition apparently occurs at all ages of the child-bearing period. It has been found as early as 13 years and as late as 55 years of age. However, the greatest number have been found to occur between the ages of 25 and 35 years.

Such conditions as syphilis, anemias, tuberculosis, and heart and kidney lesions, have been said to predispose to the development of the hydatidiform mole, but no proof has been advanced.

Although cystic degeneration of the ovaries has been advanced as a cause of vesicular mole, the condition is found so frequently with normal pregnancies that this theory is not acceptable.

The pathological anatomy of the hydatidiform mole is characterized by the formation of large, irregular clusters and chains of cysts. These may vary in size from microscopic dimensions to an inch in diameter. When the condition occurs during the early weeks of pregnancy, there may be an involvement of the entire chorion and no visible amnion or embryo. The vesicular mass assumes the contour of the uterine cavity, with the cystic villi closely packed together. If the disease has its onset at a later period of pregnancy, it may remain confined to limited areas of the placenta; and it may not interfere with the development of the fetus. If fetal death occurs, the mole may continue to develop. Characteristically, the

vesicles are oval or globular in shape; contain a thin, clear fluid; are semitranslucent and pale yellow in color; and they are attached to the chorion by a short, delicate pedicle. Occasionally the villi penetrate deep into the musculature of the uterus, and in some instances, they have even penetrated the entire uterine wall and into the parametrium. This condition has been given the term *destruierender blasemole* or *mola destruens*.

Findley (37) describes the microscopic appearance of the hydatidiform mole as follows : " The decidua is unusually thick, but otherwise there are no variations from the normal. The chorionic villi show characteristic changes. There is marked variation in the staining qualities of the connective tissue stroma. In advanced forms, in which there is complete degeneration of the connective tissue stroma, the central portion of the stroma fails to take a stain; the larger the villus, the fainter the stain. At the periphery of the villus, the stroma is seldom, if ever, lost and will always take a faint stain. There are also great variations in the staining qualities of the overlying epithelial structures, the deeper layers taking the stain more faintly. The connective tissue of the stroma is embryonic; the individual cells are elongated and present spindle shaped nuclei. Degeneration of the connective tissue cells is first noted in the indistinct outline of the body cell, giving way to granular substance beset with stellate cells,



containing a granular nucleus from which radiate fine fibrillar processes. Later all formed elements disappear, leaving irregular spaces filled with serous fluid. Concentric layers of connective tissue fibers always remain at the periphery of the villous stalk. Seldom, if ever, is there complete degeneration of all stroma substance. There is no mucus content in the villus as was first described by Virchow. Blood vessels are seldom recognized in the stroma of the large villi. Concurrent with the liquefaction of the connective tissue stroma is proliferation of the epithelial elements overlying the stroma. These changes in the ectodermal structure are of the highest significance, particularly in relation to malignant changes. In the small villi there is little change from the normal. As the villi enlarge, proliferation of the epithelial elements becomes more and more in evidence. Clumps and buds of protoplasmic bodies, containing irregular groups of nuclei, form at the distal end of the villi. These bodies take on a deep stain. Irregular vacuoles are formed in the clumps; the protoplasm is finely granular and takes a fainter stain than do the nuclei. Irregular protoplasmic nests may be seen in the connective tissue of the stroma, but this is not to be interpreted as evidence of malignancy. It is not an active invasion of the stroma as in the case of malignancy. Coagulation necrosis of the syncytium is found in advanced cases. Necrotic changes in the stroma and epithelial elements are proportionate to the disturbance in the maternal circulation, and it follows

that in partial moles, where there is little disturbance of the maternal circulation, the necrotic changes are seldom in evidence. As the villus distends with fluid, pressure necrosis of the overlying epithelial element becomes apparent."(P.3).

Hydatidiform moles show some tendency toward malignancy. However, the incidence of malignancy in these moles is estimated to be probably not more than 5%. There is no apparent relationship existing between the time a mole remains in utero and the frequency with which it undergoes malignant degeneration. The histologic changes are of little value in the judgment of malignant changes in the hydatidiform mole. The subsequent clinical events are the criteria for the determination of malignant degeneration.

Of the clinical signs of hydatidiform mole, the rate of growth of the uterus is the most characteristic. The enlargement of the uterus is all out of proportion to the period of gestation, and it may be even double the size of a normal pregnant uterus of the same period. Moreover, the rate of growth lacks uniformity. On the other hand, in rare cases the uterus may not be unduly enlarged, or it may be smaller than normal.

The presence of certain symptoms may suggest hydatid changes. Hemorrhage, as a rule, appears during the second or third month of pregnancy, but it may not occur before the sixth month. If there is recurrent hemorrhages weeks or months after the expulsion of the mole, malignancy should be

suspected and immediate investigation undertaken. A sign which is almost constant, and which is more of a suggestive sign, is the occurrence of a serosanguinous discharge. Pain in the pelvis and back may be present, but it is usually absent when no hemorrhage is manifest. Overdistention of the uterus may lead to excessive nausea and vomiting. Edema at an early period is common in hydatidiform mole. Not infrequently there is an albuminuria early in pregnancy. If the hydatid changes in the chorion are extensive, early fetal death and absorption occurs. In such instances there is an absence of the physical signs of the presence of a fetus.

Even in the presence of the foregoing signs and symptoms, the diagnosis of a hydatidiform mole may be difficult. As a rule, a positive diagnosis can only be made at the time the mole is expelled. A strongly positive Aschheim-Zondek reaction with a small amount of urine is found, due to the presence of excessive amounts of the anterior pituitary hormone.

Hydatidiform mole may be differentiated from hydramnios by the absence of hemorrhage and the presence of a fetus in the latter. In placenta previa there is no undue enlargement of the uterus, the presence of a fetus can be demonstrated, and the bleeding occurs in the last trimester of pregnancy.

The treatment of hydatidiform mole consists of evacuation of the uterus and curettage to remove all fragments.

The patient should be watched for a period of two years.

Any recurrence of hemorrhage following expulsion of the mole is an indication for exploratory curettage. The curetted scrapings from the uterus should be examined by a competent pathologist for evidence of malignant degeneration. If no proliferating chorionic elements are found upon microscopic examination, there is no necessity for amputation of the uterus.

The discussion of chorio-epithelioma malignum is outside the scope of this thesis. For a discussion of this condition, the reader is referred to a standard text of obstetrics or gynecology.

(3) Septic Abortion.— Let there be no doubt about it, septic abortion is one of the most common and important complications of abortion. It is the practice of Gellhorn (40) to consider every septic abortion to be criminal until the contrary has been proven. However, he concedes that a febrile incomplete abortion may occur spontaneously, either by way of the blood stream in acute infectious diseases, or by direct ascent from the vagina or cervix.

In the city of Cleveland during 1931, there were 151 puerperal deaths, according to Bolt (11). Of these, 50 were due to abortion. Sepsis was the primary cause in 70% of the cases. Adair (2) quoted statistics gathered by the Children's Bureau, in which 7,380 maternal deaths were analyzed. Septicemia accounted for 73% of the deaths following abortion, and constituted 45% of the total deaths from puerperal

septicemia.

In the discussion of septic abortion, two important differentiations must be made: (1) The differentiation between clean and infected cases; and (2) the differentiation between infection limited to the uterus and extrauterine infection.

Differentiation between clean and infected cases.-

Taussig (112) advises the differentiation between clean and infected, or potentially infected, cases. He maintains it is not good practice to classify cases as afebrile or febrile, since there are febrile cases which are not infected. Also, the absence of fever does not exclude the possibility of infection. This clinician designates septic abortion by the following rule: "If the temperature be over  $38^{\circ}\text{C}$ . ( $100^{\circ}\text{F}$ .) for more than twenty-four hours the case should be considered septic." (p.158.)

Another clinician, Blair (9), prefers to use the term "infected abortion" rather than "septic abortion." He maintains the latter term signifies the existence of a generalized septicemia, and that not all infections in abortion become generalized. He designates an infected abortion case as one in which the temperature is  $101^{\circ}\text{F}$ . or above on two successive days, including the day of admission. Likewise, Gordon (43) divided his cases into infected and non-infected. Those cases called infected had a temperature

above 101° F. rectally, or had the uterus interfered with.

The history of the patient is considered significant by Taussig (112). If there is a history of an attempt to induce an abortion by the patient, midwife or abortionist, the case must be considered septic or potentially infected because the possibility of infection is so great. Although such a history may be difficult to obtain, because of the moral implications, the diagnosis can usually be made on the basis of the early rupture of the membranes, early severe bleeding and evidence of trauma about the upper vagina or cervix.

Fever is present in varying degree, according to Gellhorn (40), and if it is high in proportion to the pulse rate, there is indication of the presence of a virulent infection. The rise in temperature which accompanies a retention of the ovum or blood clots in the cervix and vagina with putrefaction, according to Taussig (112), does not necessarily indicate uterine infection, if there is a temperature drop promptly after the discharge of the retained material.

The use of certain laboratory tests are recommended by Taussig (112) in the differentiation of infected and noninfected cases. He advocates a study of the blood picture, and bacteriological examination of the blood and the vaginal and uterine secretions. It is his belief that much valuable diagnostic and prognostic evidence can

be obtained from repeated Schilling hemograms. The severity of the infection can be ascertained from the study of the hemogram, noting the proportion of young neutrophils to the older polynuclear cells. By the comparison of repeated blood examinations, the progress of the infection can be visualized. These are significant in the cases of severe septic abortion, particularly, for they may serve as a guide to the advisability of operative interference.

Two investigators, Soule and Brown (105), found anaerobic streptococci in the vaginas of 40% of 103 normal patients. They concluded these bacteria are saprophytes in the vagina, but under certain conditions such as abortion or delivery they may cause severe infections. Taussig (112) believes the bacteriological examination of the secretions of the vagina and uterus are valuable aids in the diagnosis and management of septic abortion. The presence of organisms not normally present in these secretions is of utmost importance.

Mention is made by Taussig (112) of the Ruge-Philipp virulence test. Bacteria are grown in defibrinated blood of the patient. Careful diagnosis of the organisms present is most important, rather than the method of growth. The time consumed by the bacteriologist is often too long to make this study of much value to the clinician.

A discussion of the treatment of septic

abortion will be found under the proper heading in Chapter IX.

Differentiation Between Infection Limited to the Uterus and

Extra-uterine Infection.- Complications of septic abortion outside the uterus, according to Gellhorn (40 ), are indicated by chills and pain. These complications are such as; parametritis, pyosalpinx, thrombophlebitis, pelvic peritonitis and general peritonitis.

Watkins (119) states that postabortal infection originates within the uterus, nearly always at the placental site. The streptococcus is usually the invading organism, but the gonococcus may complicate the picture.

Taussig (112) gives three paths of extension of the infecting organisms beyond the uterus, which are:

- "(1) They may pass along the lymphatics to the cellular tissue of the broad ligament and pursue a subperitoneal path;
- (2) They may pass through the uterine wall, or by way of the tubes, to the peritoneum and involve first the pelvic peritoneum and later the general peritoneal cavity;
- (3) They may be carried along the uterine veins, producing a pelvic thrombophlebitis with extension later to other veins, or become scattered throughout the body in the form of a generalized bacteremia or pyemia." (p.203).

In a detailed study of the infective process, Watkins (119) gave a description which is the basis for the



following discussion:

The virulence of the infecting organism and the resistance of the patient, as in all acute infections, determines the severity of the course of infection.

A leucocytic barrier is formed about the placental site, which, if broken down, will allow the infection to spread beyond the confines of the uterus. Early dissemination of the infection is allowed, due to the increased vascularity of the uterus, and the corresponding increase in the size of the lymphatic channels. Infected thrombi of the blood vessels of the uterine wall and broad ligament are a frequent finding. Because of this, invasion of the blood stream by the infection, leading to a generalized septicæmia, occurs early.

The involvement of the cellular tissue by the infection produces the formation of exudates in the tissues which usually consist largely of flocculent serum. Ovarian abscess may occur occasionally and persist for a long period of time.

The condition in the Fallopian tubes is a perisalpingitis, rather than an endosalpingitis, except in those cases complicated by active gonorrhœa. Consequently, peritonitis from invasion of the peritoneal cavity through the lumen of the tube is not exceedingly common. Cul-de-sac abscesses are seen occasionally. They are probably due to direct extension of the infection through the cellular tissues. Perforation does

not occur in spontaneous abortion, except in some cases of incomplete abortion where operative interference is made.

For a more detailed and comprehensive study of septic abortion, the reader is referred to a standard text of Obstetrics.

(4) Fatal Hemorrhage.— Hemorrhage leading to a fatal outcome is given by Taussig (112) as a complication of abortion. He states: "The severity of bleeding has a fairly constant relation to the period of gestation in which abortion occurs. While severe hemorrhage is of more frequent occurrence than in full-time deliveries, fatal bleeding is less common." Such deaths should not occur, especially when transfusions are available.

(5) Gangrene of the Extremities.— Taussig (112) states: "Unilateral gangrene of the lower extremity is usual due to a septic thrombus. Symmetrical or bilateral gangrene is usually the result of an overdose of ergot."(p.242.)

## CHAPTER VIII.

## THE PREVENTION OF ABORTION.

The problem of control of abortion is one in which each individual physician should be interested. We are primarily concerned with the preservation of health, yet, according to Taussig (113), 600,000 to 700,000 abortions occur in this country each year, and the maternal mortality is from 7,000 to 10,000. These figures are approximations and include all types of abortion, spontaneous, therapeutic and criminally induced.

The approach to the problem of prophylaxis is stated by Taussig (113) as follows: "Fundamental to any plan for the reduction in the number of spontaneous abortions is a better understanding of the underlying causes of these abortions. Unfortunately our knowledge of this subject is very meagre. It is almost in inverse proportion to the number of theories that have been propounded by various writers. Yet it must be said that we are here and there justified in drawing conclusions and making certain definite recommendations as to preventive treatment. So far as possible the study of factors that might predispose to abortion and their correction should precede conception, since it occasionally happens that after pregnancy has begun corrective measures may be difficult or impossible to apply. On the other hand, it may also happen that the cause of the tendency to abortion is not evident until pregnancy starts. Hence we

divide the subject into preconceptional and postconceptional treatment." (p.110.)

Preconceptional Treatment- Since the confirmation of the work of Streeter (108) on the defective germ plasm theory of abortion, many writers, notably Taussig (113), Morse (78 ), Moench (77 ), and Huntington (54 ) have advocated an investigation of the male parent, as well as the mother, in an attempt to determine the etiological factor in abortion.

Abnormalities in the spermatozoon have been noted by Sanders (99) and Moench (77). The former was able to check two cases of repeated abortion by clearing up prostatic infection in the husbands. An empiric treatment is suggested by Taussig (113). He believes it advisable to clear up prostatic infections; to prescribe a diet rich in vitamin E one month before conception; and to give thyroid extract in cases of hypothyroidism. In the presence of signs of syphilis in the husband, antiluetic treatment is indicated.

The possibility of endocrine imbalance in the female must likewise be considered. Krohn (62 ), Falls (62 ) and Lachner (62) believe a large percentage of spontaneous abortions are due to a corpus luteum deficiency. They reported considerable success with substitution therapy in cases of habitual abortion. On the other hand, Shaw (102) has not been so successful with substitution therapy in cases of repeated abortions. The investigations of E.C.P. Williams (122) revealed a lowered glucose tolerance as

evidence of endocrine imbalance in a majority of his cases of repeated abortions. It is the opinion of Taussig (112) the giving of corpus luteum extract is of value, probably more so in the first few months of pregnancy, however, he advocates the correction of such conditions as thyroid deficiency and pituitary disfunction.

The work of Evans and Bishop (35 ), and Urner (115), particularly, has established the deficiency of Vitamin E as a factor in spontaneous abortion. Vogt-Moller (117) and Shute (103) reported success in several cases of habitual abortion by the administration of wheat-germ oil, a substance rich in vitamin E.

Much has been written on the relation of focal infection to spontaneous abortion. The work of De Lee ( 29 ), Cornell ( 20 ) and Curtis ( 22 ), especially, has indicated the desirability of clearing up foci of infection in cases of habitual abortion.

Pelvic pathology and its relation to abortion has long been recognized. The manual replacement of the retroverted uterus during pregnancy is believed by Plass ( 88 ) to increase the risk of precipitating abortion. However, Taussig (112), believes the procedure can be performed gently with safety. Replacement of the retrodisplaced uterus, however, is more readily and safely accomplished prior to conception. Cervical repair is recommended by Shaw (102) and Taussig ( 112 ) in cases with severe

cervical lacerations. In those cases with small infantile uteri the latter recommends the giving of pituitary extract, or the wearing of a stem pessary or both.

Hunner ( 53 ) has found that cases of repeated abortion with associated ureteral stricture are much benefited by ureteral dilatation.

Secondary anemia may have a deleterious effect on pregnancy, according to Royston ( 98 ). The correction of anemia should be undertaken. The importance of careful management of diabetes in pregnancy has been stressed by Kramer ( 61 ) and Ill ( 55 ).

In cases of repeated abortion, Morse ( 78 ) advises against pregnancy for a period of two years. During that period he advises a diet rich in calcium and vitamin content.

Postconceptional Treatment.- All the procedures recommended for the preconceptional period may apply following conception likewise. The administration of corpus luteum extract has been previously mentioned. Theelin, the follicular hormone of the ovary, according to Taussig ( 112 ), actually seems to predispose to abortion.

The injection of normal pregnancy serum to prevent abortion has been recommended by Sellheim ( 101 ). He injected 10 c.c. of the blood serum from normally pregnant women with negative Wassermann reactions, intra-

muscularly every fourteen days throughout the pregnancy.

The general opinion of many writers, particularly Morse ( 78 ) and Taussig (113), is that coitus during pregnancy may predispose to abortion. In some cases of abortion they recommend abstinence from sexual intercourse for the first three months, and in other cases it is prohibited throughout the duration of pregnancy. The correction of constipation is likewise recommended. Rest during the first four months of pregnancy is advised by Morse (78 ), particularly on those days when menstruation would normally occur. Some patients may have to remain in bed for the greater part of their pregnancy.

The treatment after bleeding or uterine contractions have begun is important, for in many cases the abortion may be warded off. Taussig (113) advises complete bed rest in such instances, and sedation by means of opiates or barbiturates. Elevation of the foot of the bed in the second trimester of pregnancy may be of value. In the case of a blighted ovum, abortion may occur in spite of efforts to prevent it.

## CHAPTER IX.

## THE TREATMENT OF ABORTION.

The treatment of abortion has been a controversial subject for a century and a quarter. Early in the nineteenth century John Burns ( 17 ) cautioned against active interference with the process of abortion. Dewees ( 31 ) fashioned a wire crotchet, previously mentioned, for use in extracting the ovum from the uterine cavity.

At the present time, there exists a controversy as to the type of treatment of the most value in abortion. On the one hand we have those clinicians who advocate active interference, and on the other hand are those advising conservative treatment. Taussig (112) has attempted to correlate the active and conservative methods . He states, "The question at issue, as I see it, is not whether active treatment is preferable to expectant or conservative treatment, but when active treatment is preferable and when expectant or conservative measures should be employed." (p.170).

The treatment of the various types of abortion will be discussed according to their stages and as to whether they are afebrile or febrile. The treatment of missed abortion and molar pregnancy has been discussed in Chapter VII under the proper subject headings.

TREATMENT OF UNINFECTED AND AFEBRILE ABORTION.

(1) Threatened Abortion.- In many cases, abortion can be averted and the pregnancy will go on to full term. When the symptoms of



uterine contraction and bleeding occur, Taussig (112) advises absolute bed rest. Hospitalization is preferred, but if the patient remains at home, a bed pan must be used. The patient must not be disturbed by the family or visitors. If there is no recurrence of fresh bleeding in five days, the patient may be allowed to sit up in bed. In another week she is allowed to be up and gradually assume her duties.

Johnson (56) advocates a low residue diet, increased fluid intake, and the regulation of the bowels with mineral oil or milk of magnesia. The avoidance of strong purgatives is stressed by Metzler.(76).

The medicinal treatment is placed secondary to absolute bed rest by Taussig (112). If there is lower abdominal pain and bleeding of moderate or severe character, he recommends morphine, gr.1/3 to 1/4, repeated every half hour until the pains cease or the respirations are reduced to 15 per minute. Morse (78) uses only 1/4 gr. of morphine every four hours. Hypodermic injection of dilaudid, gr. 1/32, every two to three hours for four doses is recommended by Taussig (112). He states this drug is effective in controlling uterine contractions, and it is less apt to produce constipation than the opiates. The use of the barbiturates as a sedative are also recommended.

(2) Inevitable Abortion- The question of when to institute

treatment directed toward hastening an abortion is discussed by Taussig (112) as follows:

"If the abortion can no longer be averted, our object must be to hasten its conclusion. Usually the cervix will be partially open at this time and undue delay might very well result in the entrance of vaginal organisms into the uterine cavity with resulting infection. Continued bleeding also makes the termination of the abortion a thing to be desired. In what way and when to assist the natural forces that proceed to the expulsion of the ovisac is a matter that requires deliberation. If the abortion occurs in the second trimester of pregnancy and the ovisac is intact, we should adopt a waiting policy, merely giving medicines to stimulate uterine contractions. Even in less advanced gestations, there is rarely need for undue hurry, and many cases can be terminated spontaneously by simple means." (p.172).

A few simple procedures to be tried first in inevitable abortion is recommended by Taussig (112). An ice cap is placed on the abdomen to stimulate uterine contractions, and a warm enema is given. Abortion may result from this procedure.

Taussig (112) does not consider the pituitary extracts effective in stimulating uterine contractions in pregnancies before the fourth month. It can be given with

benefit as an adjunct to quinine or ergot. Pearce (83 ) of Great Britain reports considerable success with the intrafundal injections of pituitrin. Johnson ( 56 ) prescribes 0.5 c.c. of pituitrin every half hour for six doses. At the completion of this course one drachm of fluid extract of ergot is given every four hours for four doses.

The use of quinine and ergot is recommended by Hendry ( 47 ) and Taussig (112). The latter believes that fluid extract of ergot given by mouth will occasionally deter expulsion of the ovum. If ergot is to be used, he recommends a maximum dose of 0.5 c.c., because of the occasional occurrence of gangrene of the extremities following overdosage of the drug. Hendry ( 47 ) particularly likes to use ergot and quinine in those cases where a portion of the ovum is protruding from the internal os.

Packing of the vagina with antiseptic gauze is advocated by Gordon (43 ) and Morse ( 78 ). The packing is removed in 18 to 24 hours and replaced if necessary.

Operative evacuation of the uterus is advised by Morse (78 ) in cases which do not respond to packing. The procedure is done under aseptic conditions. Digital separation of the ovum and extraction with ovum forceps is performed. Usually the uterus contracts sufficiently following the evacuation to control hemorrhage. If bleeding is

severe, the uterus is packed with gauze.

Taussig (112) prefers to use a waiting policy, at least in cases where there is no severe hemorrhage and the ovum, or at least the placenta, is retained.

(3) Incomplete Abortion.— The general concensus of opinion favors evacuation of the uterus by means of the finger, the ovum forceps, or the curette, in cases of afebrile incomplete abortion. Hirst (50), Williams (125) and King (59) agree that incomplete abortions after the second month of gestation may have the uterus properly cleaned out.

There are some clinicians who oppose operative removal of retained placental tissue. Blair (9) and Reinberger and Russell (90), in particular, believe routine operative procedures are not indicated except in the presence of alarming hemorrhage.

The choice of instruments in performing dilatation of the cervix and evacuation of the uterus is a controversial question. Percival (85) believes the Hegar dilator produces too much trauma to the cervix. He produces cervical dilatation by packing the cervix and vagina with one or two inch gauze soaked in an acriflavine emulsion. The pack is left in for 24 hours. Maxwell (70) also avoids the use of the Hegar dilator for the same reason, and prefers to use the laminaria tent. The use of the sharp curette is advocated by Hendry (47). Such clinicians as Morse (78),

Johnson ( 56), Maxwell ( 70) and Percival (85 ) prefer to separate the retained ovum or placental tissue by means of the gloved finger.

Taussig (112) has set forth some principles to be used as a guide in selection of the method for evacuation of the uterus. He bases his choice upon; (1) the period of gestation, (2) the degrees of dilatation of the cervix, and (3) the nature of the retained material. The cardinal principles for choice of procedure for evacuation of the uterus, as set forth by Taussig (112) are:

"(1) In earlier gestation where much cervical dilatation is unnecessary and difficult, instrumental evacuation is preferable. Before the third month the cervix is in danger of laceration, if stretched to admit the finger.

( 2) If in such gestations considerable material is still retained, the ovum forceps and blunt curette are safer, whereas if only placental remnants are retained, these can be more thoroughly removed by the large sharp or semi-sharp curette.

(3) If gestation is somewhat more advanced, the finger is a safer agent than instruments for loosening placental tissue, even though ovum forceps or a sponge stick is used for its removal.

(4) In gestations beyond the third month, the finger is always to be used as a guide, even if instruments are at times necessary as an adjunct for removing tissue.

(5) Where the cervix needs to be dilated, in the first two months of pregnancy, the ordinary graduated metal dilators are the simplest and best instruments. In later gestations a gauze pack in the lower uterine segment and cervical canal is safer and after the fourth month a small rubber bag dilator may be required." (pp.174-175).

Following dilatation and evacuation of the uterus, Johnson ( 56 ) keeps the uterus in contraction by the administration of ergot.

(4) Complete Abortion:- The difficulties of the diagnosis of complete abortion have been mentioned in Chapter V on diagnosis. Taussig ( 112 ) considers the economic and home factors in determining the type of treatment to be instituted. He states: "Where it is important that the patient assume her household duties promptly, curettage in a neighboring hospital has advantages. If a few days of waiting would make no difference to the patient, we can readily wait for the appearance of symptoms that necessitate intervention."(p.171).

The care of the patient following complete abortion, or abortions completed artificially, is emphasized by Taussig ( 112 ) and Metzler ( 76 ). The former advises rest in bed, preferably in a hospital. The length of the confinement is dependent upon the period of gestation at which the abortion occurred, and the presence or absence of complications. He sets an arbitrary rest period of five to ten days. It is

his experience that an abortion which occurs between the fourth and sixth month requires a longer period of convalescence. In such cases he recommends tight strapping of the breasts, administration of ergot and ice bags to the lower abdomen if necessary.

#### TREATMENT OF SEPTIC OR FEBRILE ABORTION.

The differentiation of clean and infected cases of abortion has been discussed earlier in this chapter. I have also previously mentioned that septic or febrile disturbances may occur in spontaneous abortion, although it is more common in induced abortion.

The importance of differentiation between infection limited to the uterus and extra uterine infection is stressed by Taussig (112). He states: "If on bimanual examination a definite thickening in the parametrial or adnexal regions can be felt, the assumption of an extrauterine infection must be made. \*\*\*\*\* In doubtful cases a second examination a few days later may give a definite answer. In all such cases, the principle should be "if doubtful, don't" - that is, don't pursue any active measures of treatment." (pp.175-176).

The choice of treatment in septic or febrile abortion is a question of debate among the clinicians in this country, as well as abroad. There are those who favor active treatment, and there are others who advocate conservatism in the treatment of septic abortion.

Active Treatment:- The arguments for active treatment of septic abortion are pointed out by Taussig (112). Active treatment is an easy path for the clinician to follow, for the patient is usually insistent upon something being done at once. Fever and bleeding often cease after evacuation of the uterus. The presence of necrotic tissue in the uterus undeniably makes a good culture medium for bacterial growth. Also, the removal of the infected material may lessen, in some instances, the danger of blood stream invasion by the infecting organisms.

Hirst ( 50 ) does not hesitate to evacuate the uterus, if it contains a large amount of putrefying decidua, even though the infection has spread to involve extrauterine structures. He does not believe in the use of the curette, and uses the ~~P~~unet forceps instead. Baer ( 6 ) is a trifle more conservative, for he evacuates the uterus only when there is no adnexal involvement. He prefers to perform digital separation and removal of the material with ovum forceps.

The active treatment is favored by Maxwell ( 70 ). He advises digital removal of retained material in infected cases. Following the evacuation, he gives a gentle intrauterine douche. Schwarz (100) also advocates prompt emptying of the uterus with the gloved finger, a dull instrument, or ovum forceps. The sharp curette is not used in his cases. He uses a uterine douche of 1:4000 potassium permanganate, under low pressure, following evacuation of the uterus.



Gellhorn (40) has adopted a mode of treatment which he believes to be a compromise between the principles of active and conservative treatment. He advocates strict conservatism in those cases with definite complications outside the uterus. Ovular remnants protruding from a dilated cervix are gently removed. If a severe hemorrhage occurs at any time during the first two days, the vagina is gently packed with iodoform gauze. The end of the gauze strip extends into the cervical canal. If on the third day there is no evidence of extra-uterine complications, the uterus is curetted irrespective of fever. The sharp curette is advocated, because less force than necessary with the blunt curette or finger is needed to dislodge placental fragments from the uterine wall. After evacuation, the uterus is kept contracted with ergot, and milk injections are continued until the fever has permanently disappeared.

Williams (125) cannot see much difference in the results obtained in the treatment of septic abortion, either operative or conservative, as long as the infection is limited to the uterus. When the infection has extended beyond the uterus, he believes the only treatment of choice is strict conservatism, except in the presence of severe and alarming hemorrhage.

Conservative or Expectant Active Treatment.- The conservative or expectant active treatment has gained popularity in recent

years. Taussig ((112)) expresses his defense of this mode of treatment as follows:

"In the vast majority of intrauterine infections the need for immediate intervention is not apparent. While bacteria may multiply, the patient's resistance to the infection is greatly increased as a rule by a few days of delay, and the encapsulation of the infectious material is furthered. The virulence of the organisms seem on the whole to be diminished by such a waiting policy. \*\*\*\*

The infection is often not at all in the ovisac but in the cervical wounds produced by the unskilled criminal interference, so that the evacuation of the uterus would be of no value. Furthermore, the universally recognized principle that all manipulations are to be avoided in the presence of extension of the infection beyond the uterus, would make a few days of delay an added advantage. It has been repeatedly found that only by longer observation of the case can we with certainty exclude the possibility of such a complication. Those favoring expectant treatment claim that the dangers of severe hemorrhage have been exaggerated, for this accident is of rare occurrence."(p.178.)

In an analysis of the results obtained by active and conservative treatment in febrile cases of abortion, Hillis ( 49) found that conservatism yielded better results than active therapy. He also noted that, if curettage was

not done in septic cases until a five day afebrile period was reached, the temperature was more likely to remain normal than in those cases operated before the end of that period. A five day rest period in the afebrile cases before curettement also tended to lessen the morbidity. In the presence of alarming hemorrhage he advocated evacuation of the uterus irrespective of fever. Metzler ( 76 ) likewise recommended an afebrile period of five to six days before operative interference is performed.

Adair ( 3 ) tries to avoid entering the uterine cavity in any febrile or potentially infected case. He points out that it is relatively safe to enter a uterus once, but to repeat the procedure a second time is extremely dangerous. Most of the fatal cases of sepsis he has seen were in patients in whom the uterus had been entered more than once. The uterus is emptied in practically all his cases after the temperature has been normal for three to five days. Watkins ( 119 ), Morse ( 78 ), and Darnall ( 24 ) advocate a five day afebrile period before entering the uterus.

Johnson ( 56 ) does not consider evacuation of the uterus until the temperature has been normal for three days. He uses an iodine sponge to swab the uterine cavity before digital removal of the retained material. The sponge is left in the cervical canal for 24 hours following emptying of the uterus.

There are some clinicians who do not favor entering the uterus in any case of septic abortion. Rock (97) does not believe the uterus should be invaded unless there is active and severe hemorrhage. Blair (9) recommends a strictly supportive treatment in infected cases. No intra-uterine manipulation is advocated by Gordon (43) if the temperature is more than 101° F. per rectum. He believes the mortality and morbidity are in direct ratio with the degree and frequency of uterine invasion. Witherspoon (127) found evidence of increased morbidity and mortality in the operative treatment of septic abortion. He urged strict conservatism when possible.

The following principles in the treatment of abortion are recommended by Taussig (112):

"(1) The diagnosis of extrauterine complications is of the utmost importance; so important that a few days of delay are preferable to taking the wrong steps; for under no circumstances should we employ active treatment evacuating the uterus in the presence of an extension of the infection beyond the uterus.

(2) The agent producing the least trauma should be chosen in septic abortion. Hence medication in the form of quinine, pituitrin or ergot is indicated wherever it might help as in cases of intact retained ovum or placenta, especially in the later months.

(3) A delay of five days in the evacuation of the uterus is almost always possible and does not harm the patient. During this interval many cases are terminated spontaneously and the remainder have a better opportunity to build up resistance to the infection. The temperature will often drop to normal. It is often advisable to wait even a few days longer.

(4) If the temperature has remained normal for three to five days, emptying the uterus will expedite recovery and usually do no harm.

(5) Digital removal, preferable in many cases of afebrile abortion, is to be avoided in febrile cases, except where the major portion of the placenta, in pregnancies of four to six months' gestation, is retained.

(6) Instrumental evacuation of the uterus can be safely done at this time but the minimum traction and the minimum trauma must be employed. Dilatation of the cervix is rarely necessary after the period of expectant treatment has elapsed.

(7) Wiping the uterine cavity with a tincture of iodine sponge, both before and after evacuation, reduces the chances of spreading infection.

(8) The sharp curette should rarely be employed in febrile abortion owing to increased danger of traumatism and risk of spreading infection.

(9) If profuse bleeding occurs, immediate evacuation of the uterus by the gentlest possible method is indicated, and

the blood loss promptly replaced by blood transfusion.

(10) In the presence of hemolytic or anaerobic streptococci we should advise longer delay in cleaning out the uterus and the minimum of manipulation. In the presence of Welch gas bacillus, however, a hysterectomy is sometimes necessary." (pp.183-184).

Certain adjuvants to the treatment of septic abortion are offered by various writers. Anspach ( 4 ) believes the use of intravenous mercurochrome and other intravenous antiseptics are of value, especially as adjuvants to other measures of treatment in septic abortion. Piper ( 37 ) and Gellhorn ( 40 ) do not believe the use of intravenous mercurochrome to be of value.

The use of antistreptococcic serum is advocated by Blair ( 9 ), Darnall ( 24 ), and Hendry ( 47 ). The rationale given for its use was that a large percentage of intrauterine infections are due to hemolytic strains of streptococci.

Blood transfusions are recommended by Taussig (112), Morse ( 78 ), Johnson ( 56 ) and others. The transfusions were usually given in small amounts, not more than 500 c.c. and repeated at intervals. The intravenous administration of normal saline solution is advocated by Blair ( 9 ) as a general supportive measure.

The intrauterine application of activated carbon is recommended by Carroll ( 18 ) as an adjuvant in the

treatment of septic incomplete abortion. He contends that the adsorptive power of the carbon, and the change from alkaline to acid medium, inhibits the growth of invading streptococci.

The use of intrauterine douches has been advocated by Brown ( 14). He uses a 1:1000 solution of potassium permanganate and gently irrigates the uterine cavity.

No mention has been made of the treatment of the extrauterine complications of septic abortion. Since this subject lies somewhat out of the realm of spontaneous abortion, it will not be discussed in this thesis.

## CHAPTER X.

## CONCLUSION.

The following conclusions are based upon the foregoing review of the literature on the subject of spontaneous abortion and its allied conditions:

(1) There exists a need for a standardization of terms used in the discussion of the subject of abortion.

(2) Although there are many known factors in the etiology of spontaneous abortion, some abortions occur for which no definite cause can be assigned.

(3) The preventive treatment of spontaneous abortion during the preconceptional and postconceptional periods should be stressed by the clinician.

(4) The choice of treatment in the uncomplicated spontaneous abortion should be determined by: the state of the abortion; the condition of the patient; the facilities available; and the skill of the clinician.

(5) The expectant-active treatment is the most widely accepted method of therapy in the septic abortion.



## GLOSSARY OF TERMS.

The following definitions of related terms used in the discussion of spontaneous abortion in this paper are taken from Taussig (112) pp.480-483.

**ABORTION:** The detachment or expulsion, or a combination of both, of the pre-viable ovum. (For definition of pre-viable, see proper head. )

**AFEBRILE:** An abortion in which there has been no rise of temperature, due to the abortion, higher than 38°C. (100.4°F.) for longer than twenty-four hours.

**ATTEMPTED:** Any case in which procedures have been employed to bring on an abortion, even though the patient may not have been actually pregnant.

**CERVICAL:** An abortion in which the ovisac has been retained within the cervical canal for a long period of time, usually several weeks or more.

**CRIMINAL:** Abortion produced or attempted by patient, or other person, contrary to the statutes of the particular state or country in which the act takes place; abortion without sanction of the law.

**EARLY:** Abortion that occurs before the fetus has attained the thirteenth week of development.

**FEBRILE:** Abortion in which there has been a rise of temperature, due to abortion, higher than  $38^{\circ}\text{C}$ .

( $100.4^{\circ}\text{F}$ .) for longer than twenty-four hours.

**HABITUAL:** Tendency to repeated abortion without intentional interference.

**INDUCED:** Intentional termination of pregnancy by abortion.

**INEVITABLE:** Stage in the interruption of a pre-viable pregnancy at which the termination by abortion can no longer be avoided.

**LATE:** Abortion that occurs after the fetus has attained the thirteenth week of development.

**LEGALIZED:** An induced abortion authorized under certain conditions by the laws of the country in which it is performed.

**MISSED:** Retention of the ovisac for longer than two months after the death of the fetus until it is expelled or removed from the uterus.

**SEPTIC:** An abortion in which the presence of fever, associated with leucocytosis and other signs of pelvic inflammation, justifies the assumption of a uterine infection.

**SPONTANEOUS:** Termination of pregnancy before viability without intentional interference.

**THERAPEUTIC:** Interruption of pregnancy before viability in order to conserve the life or health of the mother.

**THREATENED:** Disturbance of a pregnancy before viability, characterized usually by uterine contractions or bleeding, or both, that might terminate in an abortion.

**TUBAL:** Detachment, partial or complete of an ovum implanted in the Fallopian tube, associated with death of the embryo or fetus.

**UTERINE:** Extraction or expulsion of the pre-viable ovisac implanted in the uterus.

**ASCHHEIM-ZONDEK TEST:** Laboratory test in which the woman's urine is injected into infantile mice or rats to determine the diagnosis of pregnancy.

**BACTERIEMIA:** Blood-stream infection of septic origin, characterized by deposits of infectious material in various organs or tissues of the body forming an abscess or localized exudate.

**BLIGHTED OVUM:** An ovum which, through some inherent defect of the sex cells before impregnation, or through faulty implantation or nutrition after impregnation, fails to develop beyond a very early stage and dies.

**BLOOD MOLE:** A blighted ovum which is detached from the uterine wall and is retained in the uterine cavity,

surrounded by an extravasation of coagulated blood.

**BREUS MOLE:** A blighted ovum, associated with early hydramnios, characterized by numerous pedunculated or sessile hematomata and by prolonged intra-uterine retention for many months.

**CARNEOUS MOLE.** See Blood Mole.

**CONCEPTION:** Date of fruitful coitus; also used as a synonym for fertilization.

**DURATION OF PREGNANCY:** Considerable difficulty of definition arises because of the tendency to figure onset of pregnancy from the date of last menstruation, whereas the date of conception is usually about two weeks after the first day of last menstrual period. Most writers agree that the terminology should be similar to that used in stating the age of an individual. Just as a child, between the first and second birthday is in its second year, and after the second birthday is two years old, so a woman who has skipped one menstrual period may be said to be in the second month of her pregnancy, and at the conclusion of this second month may be termed "two months pregnant" or "two months along" (in the usual language of the dispensary patient.) Statistics on isolated coitus indicate a coital age of 269 days at birth, a menstrual age of 281 days.

On the other hand, the development of the child from an embryological standpoint should date from conception and can better be expressed in weeks of development. Thus, at the end of the second month of pregnancy the ovum may be said to have attained its sixth week of development.

**EMBRYO:** The impregnated ovum from the end of the second to the end of the fifth week of its development.

**FETUS:** Term applied to the child from the end of the fifth week of its development until its birth at the normal termination of pregnancy.

**FREIDMAN TEST:** Similar to the Aschheim-Zondek test except that mature oestrous (isolated) rabbits are employed instead of mice. The test is positive if ovulation is found to have occurred within 24-48 hours.

**HEMATOMA MOLE:** See Breus Mole.

**IMPREGNATION:** Entrance of sperm into ovum.

**INTERRUPTION OF PREGNANCY:** Euphemistic term, or synonym, used instead of "induced abortion," legal or illegal. It has a place, because in the lay mind the word "abortion" connotes criminal abortion and is long likely to carry this association.

**MISCARRIAGE:** Term applied by the laity to all abortions except those due to criminal intervention. Earlier medical usage limited the term to late abortions. In the present volume

(as in this paper) the word "miscarriage" has been avoided as far as possible because of its ambiguity, but in questioning patients "miscarriage" should be used in preference to "abortion", since the latter carries in the lay mind the implication of a criminal procedure.

**MODUS ABORTUS:** One-stage expulsion of the ovisac, with the fetus and placenta coming away together.

**MODUS PARTUS:** Two-stage expulsion of the ovisac, with the fetus expelled before the placenta, as in the mechanism of normal delivery.

**MOLAR PREGNANCY:** Abnormal pregnancy in which the embryo dies early in its development and becomes partly liquefied or mummified, while the placental tissues form a fleshy mass containing coagulated, partly fibrinous blood, or proliferating edematous villi.

**OVUM:** Term applied both to the unimpregnated sex cell of the ovary and to the same cell after its impregnation and during the first two weeks of its development.

**PLACENTAL POLYP:** Retained placental tissue still attached to the uterine wall with accumulated extravasations of fibrinated blood forming a pedunculated tumor projecting into the uterine cavity.

**POSTABORTIVE ENDOMETRITIS:** Subinvolution of the endometrium, associated with low-grade inflammation and incomplete absorption of decidual cells.

**PREMATURE BIRTH:** Expulsion of the child before the normal termination pregnancy but after the period when the child has become viable.

**PRE-VIABLE:** That period, of gestation during which the embryo or fetus is not yet capable of sustaining life, if expelled from the body of the mother.

While this period may be said to extend up to about the twenty-eighth week of fetal development, Stander claims that the duration of pregnancy as usually calculated is too inexact, and prefers that the definition of pre-viability be based on objective findings, such as the weight and length of the fetus. He recommends that any fetus under 1500 grams in weight and 35 centimeters in length be considered pre-viable. Since in some cases such a fetus will survive, these limitations seem a little too high. It would seem preferable, therefore, to reduce the figures to 1250 grams in weight and 32 centimeters in length. This would correspond to about the twenty-sixth week of development.

Before this period interruptions of pregnancy should be termed abortion; after this period and up to the normal conclusion of pregnancy the term premature birth should be applied. Cases of infants under 1250 grams in weight that survive are at present extremely rare.

**PYEMIA:** See Bacteriemia.

**•QUICKENING:** First movements of the child felt by the mother.

The time when quickening is first experienced varies from the fourteenth to the twentieth week of gestation, depending upon the sensitiveness of the woman to tactile or kinesthetic impressions, the vigor of the child's movements, and the experience of the woman through previous pregnancies.

**SEPTICEMIA:** Blood-stream infection in which the septic organisms are repeatedly found circulating in the blood.

**SEPTIC (OR INFECTIOUS, OR INFECTIVE) THROMBOPHLEBITIS:**

Blood-stream septic infection in which the organisms form clots in the veins at certain points with localized inflammation and partial or complete blocking of the lumen of the vessel.

**STILLBORN CHILD:** A viable child (i.e., over 1250 grams in weight or 32 centimeters in length) that dies without any spontaneous effort at respiration. We can distinguish between antepartum and intrapartum death. Stander classifies stillborn children that die antepartum as "dead-born".

**WEEK OF DEVELOPMENT:** See Duration of Pregnancy.

END OF QUOTATION.



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