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SPONTANEOUS ABORTION.

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CONTENTS.

CHAPTER I.

CHAPTER II.

CHAPTER III.

CHAPTER IV.

CHAPTER V.

CHAPTER VI.

CHAPTER VII.

CHAPTER VIII.

CHAPTER XI.

CHAPTER X

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 opinicns. 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 writ-

ing 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 Baby-

lonian 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 writ-

ten about 500 B.C. In this condition the fetus dies or abortion

takes place with a great discharge of blood.

Hipprocrates, 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 purg-

atives, a too large opening in the uterus and an insufficient

development of the uterus. Hipprocrates 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), Hipprocrates 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 Find-
ley (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 some-
time 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 vol-
umes. Aetius gave a description of the signs of abortion which
were unmistakably taken from Soranus. He also quoted Hipproc-
rates 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. Berd advised copious
venesection before the seventh month as the most import-
ant 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 vagin-
al 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 comdemned 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 sedentery 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 pregnacy.

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 cere-
mony 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 she and the child from evil. The gypsies
of Serbia perform a ceremonial dance with magic incantat-
ions to protect the pregnant woman and her unborn child
from harm.

The Bribri Indians place great restrict-
ions 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.

Taugsig (112) gives some additional interest-
ing 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, Prcniparni to drive away Kanva, the embryo-eating
demon.

Many strange customs have arisen in connect-
ion with the dispostion 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 Hungar-
ians and Rumanians in the region of Siebenbuergen 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 literat-
ure 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 mean-
ings 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 pre-
mature 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, Churchhill (19),
in 1846, defined abortion in this manner, "If it occur
before the sixth month, it is called an abortion, subse-
quent to this period, premature labour".(p.177). Lusk (65)
in 1887, gave a lengthy definition in which he differentiat-
ed between abortion, miscarriage or inmature 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 desig-
nate 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 of/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).

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 variat-
ion 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 defect-
ive 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 mast 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 plasm 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 expuls-

ion of the products of conception in cases of habitual abort-

ion, 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. Profess-

or 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 occas-

ions.

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 develop-
ment, 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 damag-
ing 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, polyphydramnios 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 preg-
nancy. 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 signifi-
cance 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 subin-

volution, 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 amnii, 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 dis-integration and absorption of the placenta, membranes and decidua by vitamin E starvation. This work has been corrobor-ated by the work of Urner (115) in the same field of research. The latter found by histological study that vitamin E deprivat-ion 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 preg-nancy, 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
Tranquilli-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 condit-
ions 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 abort-
ion. 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, tet-
any, 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 dis-function is an insufficiency of corpus luteum. Wolf (128) expresses practically the same belief. The substance, progestin, 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 toweard the determinat-
ion 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 menstration, 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 thyroid-
ectomy tends to prolong pregnancy. On the other hand,
Johnson (57) does not agree as to the role of hyperthyroid-
ism in pregnancy. He believes many women with hyperthyroid-
ism 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 abort-
ion, 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 dis-
eases 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 infect-
ion 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 pneumoccus.
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 inocculating 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 inocculated 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 experiemental 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 inocculated 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.- absorp-
tion of embryos with nodulation of the uterus the only remain-
ing sign of pregnancy; (2) second rabit- 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 manifest-
ions of the same process, differing only by reason of the
site of the lesion, the degree of the damage and the virul-
ence 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 abort-
ion 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 investigat-
ors, Simpson and Fraizer (104), encountered five cases of
Brucella abortus infection in women who have repeatedly abort-
ed. 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 consider-
able 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 pre-
disposition 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 defiency 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 (121), Huntington (54) / 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, inter-
ruption of the pregnancy is the rule." (p.110).

He also expresses the opinion that other intestin-
al 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 subse-
quent 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 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 pre-

mature 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) <u>Secondary or Exciting Causes.</u>

      (1) <u>Physical Trauma.</u>- 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 precipit- ate 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 pathol-
ogy 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 be-
gins. 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 under-
going 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 evidenc-
ed 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 post-
partum shows a diminution in size and an advancement in the
organization of thombosed 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 complete-

ly 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 trans-
lucence 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. Mummi-
fication 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 grotes-
queness; 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 extreme-
ly 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.708.)

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 agglutin-
ation 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 consider-
able 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 consider-
able 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 character-
istic 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 use 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 expell-

ed followed later by the placenta as in delivery at term.

(Modus Partus)." (p.128).

Taussig (112) states, "Where pregnancy has advanc-

ed 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 ovisac 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 Churchhill (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). Churchhill (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 intermiittent and
laborlike in character, but some patients may have a continu-
ous aching in the sacral region rather than rhythmical ab-
dominal cramps.

The expulsion of a part of the whole of the
ovum and decidua is another clinical sign of abortion mention-
ed 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 sub-
sequent 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. Consequent-
ly, 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 notice-
able.

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 abort-
ion 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 consider-

able 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 medico-
legal 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 abnormalit-
ies 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 disfunction,
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 in-
fection. 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 abort-
ion, 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 progress-
ive 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 disdover 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 decidual tissue 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-shap-
ed 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° to 103°, whereas
it is the rule in tubal abortion for the thermometer to
register only 99.5° to 100°. 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 hemorr-
hage. The differential diagnosis will occasionally be imposs-
ible 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 con-
fined 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 neighbor-
hood 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 consist-
ency. 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 hemorr-
hage 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 preg-
nancy, 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 protrud-
ing 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 examinat-
ion 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.

Occurence- Missed abortion is not rare in occurence 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 ovisac 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 re-
tention, 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 abort-
ion. 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 sluggish-

ness of uterine contractions.

(2) Molar Pregnancy.- Three types of molar pregnancy are

described by Taussig (112); (a) 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)<u>Carneous or Blood Mole</u>.- 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 abort-
ion, 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 stri-
ations, 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 distin-
guishing 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 tuberose mole is expell-
ed 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 remain-
der 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 decidual
covering of the sac has the firm consistency and brownish
color seem 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 inter-
villous 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 examinat-
ion 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 tuberose 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 gradully 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 insert-
ions 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 tuberose 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 condit-
ion has been given the term destruierender blasemole or mola
destruens.

Findley (37) describes the microscopic appear-
ance 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 relat-
ion 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 vacueles 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 diffi-
cult. 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 pres-
ence 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 abort-
ion is one of the most common and important complications of abort-
ion. 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 infect-
ions 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 import-
ant differentiations must be made:(1) The differentiation be-
tween clean and infected cases; and (2) the differentiation
between infection limited to the uterus and extrauterine infect-
ion.

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°C. (100°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 abort-
ion become generalized. He designates an infected abortion
case as one in which the temperature is 101° F. or above on
two successive days, including the day of admission.Like-
wise, 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 ovisac 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 sever-
ity of the infection can be ascertained from the study of the
hemogram, noting the proportion of young neutrophiles 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 import-
ance.

Mention is made by Taussig (112) of the
Ruge- Philipp virulence test . Bacteria are grown in defibrin-
ated 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 in-
fection 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 periton-
eum 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 infect-
ion to spread beyond the confines of the uterus. Early dissemin-
ation of the infection is allowed, due to the increased vacular-
ity of the uterus, and the corresponding increase in the size
of the lymphatic channels. Infected thrombic 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 septicemia, 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 gonorrhea. 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 out-
come 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:"Unilater-
al 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 thatmight 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.)

<u>Preconceptional Treatment</u>- 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 hypothyroid-

ism. 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 giv-
ing 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 retro-
verted uterus during pregnancy is believed by Plass (88) to in-
crease 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 benefit-ed by ureteral dilatation.

Secondary anemia may have a deleterous 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 conser-

vative treatment. Taussig (112) has attempted to correlate

the active and conservative methods . He states, "The quest-

ion 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 conservat-

ive 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 in-
tact, we should adopt a waiting policy, merely giving medi-
cines to stimulate uterine contractions. Even in less ad-
vanced 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 contract-
ions, 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 o.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 recommend-
ed 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 occasion-
al occurrence of gangrene of the extremities following over-
dosage 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 necess-
ary.

Operative evacuation of the uterus is advis-
ed 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 follow-
ing 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 hemorr-

hage and the ovum, or at least the placenta, is retained.

(3) <u>Incomplete Abortion</u>.- 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 operat-

ive 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 neighborhing 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 confine-
ment 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 ad-
nexal 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 Emmet 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 instru-

ment, 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 premanent-
ly 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 infect-
ions 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 repeat-
edly found that only by longer observation of the case can
we with certainly exclude the possibility of such a complicat-
ion. 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 abort-
ion, 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 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 intrauterine 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 (87) 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 transfus-
ions 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 combinat-
ion 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
$38^{\circ}C.(100.4^{\circ}F.)$ 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 per-
iod 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°C.
(100.4°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 viabil-
ity 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 abort-
ion.

TUBAL: Detachment, partial or complete of an ovum implant-
ed 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, charact-
erized 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 re-

tention 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 dispens-

sary 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 termin-
ation 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 oc-
curred 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 associat-
ion.

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 question-
ing 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 absorp-
tion 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, depend-

ing upon the sensitiveness of the woman to tactile or kin-

esthetic impressions, the vigor of the childs 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 INFECTIONAL, 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 spontan-

eous effort at respiration. We can distinguish between

antepartun and intrapartum death. Stander classifies still-

born children that die antepartum as "dead-born".

WEEK OF DEVELOPMENT: See Duration of Pregnancy.

END OF QUOTATION.

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