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Myoma of uterus complicated by pregnancy, labor and puerperium

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MYOMA OF UTERUS COMPLICATED BY

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By

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SENIOR THESIS

The University of Nebraska

College of Medicine

Omaha, Nebraska

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Course of Myoma in Puerperium

INTRODUCTION

The mutual reactions of fibroid tumors of the uterus and childbearing are considered by authors dealing with these subjects more commonly from the point of view of how the course of pregnancy, labor, and lying-in period is affected by the fibroid than from that of how the fibroid is affected by the process of childbearing. This is natural, for abnormalities in labor or in either of the other two divisions of the process are often conditions of urgency, and necessitate operation which can be compactly put on record as completed events, whereas the results to the fibroid are often not as striking. It is, however, important that the behavior of fibroids in this connection should be carefully studied, so that a knowledge of the modifications in their life history which may be expected to be produced by the presence of an ovum may be founded on facts and be of value in forming the prognosis of any case, and in deciding upon the best line of treatment. For this purpose it is necessary, except in instances where some acute change in the tumor takes place, to have a patient under observation for a somewhat long period.

In the case of hospital patients this is not, as a
rule, easy, and the opportunities of one individual
are too few for him to do more than add a small contri-
bution to our knowledge on the subject. Hence, I have
written my thesis from material obtained in a rapid
and cursory review of the literature involving a large
bibliography.

Speaking in general terms, it may be said that the
fibroid shares in the changes which affect the uterine
muscle while this is developing in pregnancy and, also,
while it is undergoing involution. This statement may
in certain cases comprise all that is to be said. Of-
ten, however, the tumor comes under other influences,
very commonly mechanical, which considerably modify the
simple lines of this course. Very much depends on
whether it grows on the inner or outer surface of the
uterine wall; if it is interstitial; and if it lies a-
bove or below the level of the pelvic brim.

The circulation of blood and lymph in and around
the tumor may be interfered with by many conditions
such as torsion of the pedicle of a subperitoneal
growth; or, more often, the compression during labor
of an interstitial tumor located between the fetus and
the pelvic wall; or the sudden change from the copius
blood-supply of pregnancy to the starvation brought

about during and after labor by the contraction of the
blood vessels of the uterus in general, by thrombosis,
and by the compression of the vessels in the capsule
of the tumor caused by uterine retraction.

The brief sketch of the life history of fibromyoma
of the uterus is introduced to lead up to the consider-
ation of another phase of the subject. It would seem
a priori, that every line of investigation had been
thoroughly studied. The etiology of the myoma; its
frequency; its growth and degeneration; prognosis;
treatment, medical and surgical, have all been subject-
ed to exhaustive research.

The pendulum of thought swung from the gynecologic
to the obstetric viewpoint and led to investigations
regarding the influence of fibromyoma of the uterus
upon sterility and the various complications incident
to pregnancy and labor. Abortion and premature labor;
malpresentation of the infant; placenta praevia; and
post-partum hemorrhage, are some of the recognized
complications. Dystocia, often demanding artificial
and surgical methods of delivery, has received careful
consideration. When to operate, how to operate, having
in mind the interests of two lives, have been questions
of vital importance to gynecologic and obstetric surgeons.

It would seem indeed that every pertinent line of

thought had been so thoroughly worked over that it was worn threadbare; yet one field of investigation has received but scant cultivation, and it is in that which I wish to write my thesis. Withdraw consideration of the effect of the tumor upon pregnancy, labor, and the puerperium, and reverse the lever of thought to take up the study of the effect of pregnancy and the puerperium upon the tumor. This will lead to the recognition not only of the nutritional changes in the fibromyoma, both physiologic and pathologic - dependent upon changes in the maternal organism as a result of pregnancy, but also to the occurrence of gangrene and suppuration - the dangers of which are greatly enhanced by the complication of pregnancy. The developmental and retrogressive changes of pregnancy and puerperium respectively exert a marked influence upon the growth and decay of tumor life.

HISTORY

For many years careful obstetricians, consulting gynecologists, and general surgeons have witnessed the disappearance, in many instances, of uterine fibroids during the course of pregnancy; absorption had taken place beyond a doubt. They have also witnessed pressure symptoms due to rapidly growing fibroids during the course of pregnancy. Again, many have been the cases in which suppuration has occurred, and patients have died as a result of septic conditions, the source of which at the present time could have been reached and treated with success. There are, perhaps, few conditions that have given the family physicion so much anxiety as those of fibroid, in which the patient becomes pregnant. On the other hand, there is perhaps no class of cases that has given the abdominal surgeon so much cause for thought as the cases of fibroids in which there has been a marked reluctance on the part of the patient to submit to an operation, and yet in which there is sudden enlargement with suspicion of pregnancy, such as existed in a series of cases, reported by Vanderveer (114).

In 1885, Gusserow (43) wrote that prior to 1880, abortion occurred in 21 percent of cases of pregnancy complicating fibroids. Pozzi (90) said the percentage

was 6, while Chahbazian gave his findings, as spontaneous, 13 per cent. The abortion is far more likely to occur in submucous, than either the interstitial, or subserous variey of tumor, according to Pozzi.

Previous to the advent of abdominal surgery and of aseptic midwifery the management of pregnancy complicating fibroids was almost unfortunate. Of 228 cases of fibroids complicated by labor by Gusserow (44), more than one half of the mothers and two-thirds of the children died. The assumption that many of these deaths may have been due to meddlesome interference on the part of the obstetrician is contradicted by Susserot's (109) carefully compiled tables. Among 147 such cases collected by him, 78 mothers died. Of the 61 mothers requiring manual or instrumental aid, 33 died. The remaining 45 deaths were, therefore, among the 86 cases not interfered with. The labors allowed to go to a natural termination were undoubtedly those in which there was the least hinderance to delivery, and yet they ended fatally as did those subjected to delay, injury, and sepsis (97).

In 1887, Lafours' (63) statistics of 300 cases delivered by the natural passage is a maternal mortality of 25 to 55 per cent, and for the children 77 per cent.

In the statistics collected by Stavely (104) in

1894 there are 597 cases in which no interference occurred before labor. Of these 220, or 37 per cent, died. The reduction in the mortality is owing to improvement in technique during the ten years since Gusserow's (44) report. Among the 307 cases reported as having aborted, the death rate was 12 per cent.

Leopold (64) in 1895 lauds myomectomy and quotes statistics. It will be recognized at once that this operation endeavors to remove the tumor and leave the fetus to be delivered at term. Leopold gives by this operation, for the ten years from 1884 to 1894, a maternal mortality of 17.4 per cent, and 37.13 per cent for the children.

Stavely (104) collected 33 cases of myomectomy which show a maternal mortality of 24.25 per cent, or 8 deaths in 33 cases; and reports that since 1889, 17 cases had been reported with a mortality of 11.75 per cent, showing that with improved methods of operating the operation was becoming less dangerous.

Carsten's 516 cases, with hysterectomy in 48 per cent before the child was viable, indicates how general hysterectomy was prior to 1909. The case was considered simply one of fibroids. Lobenstein's report of 100 cases with 75 per cent going to term, with absolutely spontaneous labor, shows a vivid contrast for the 1910

management of such cases (76). Troell's (113) cases
resulted in spontaneous deliveries in 68 per cent;
Pinard's figures are almost equally as valuable as an
object lesson, 65 per cent being delivered with no un-
toward development (76).

Doteris and Chartier, at the meeting of the Ana-
tomical Society in 1904, showed a fibroid uterus con-
taining a fetus 7.5 cm. in length. There were three
fibroids in the uterine wall, and on section all of
them revealed a hard, pearly emi-fluctuating, i.e. ne-
crobiotic central portion. A very similar specimen
was presented by Mr. Bland-Sutton in his "Essays on
Hysterectomy" (111). Bland-Sutton in his essays claim-
ed that degeneration of fibroid during and as a result
of pregnancy is a common occurrence. Pain and tender-
ness go hand in hand with this condition. "This degen-
eration", he said, "is known as red degeneration" (82).

Fairbairn and Williamson (31) in 1905 reported
cases in which necrobiotic fibroids had been removed
from women recently delivered.

In 1911, Paddock said, "In delivery, tumors situ-
ated low down in the uterus are no doubt frequently in-
jured." The submucous fibroids may also cause a great
deal of trouble at this time. He said it was not un-
usual for a tumor which has been severely pressed on in

delivery, or which has been injured in delivery to be followed by infection and serious consequences. Cases are on record where submucous fibroids have presented in front of the head of the child and have been mistaken for the latter; also, where following delivery a sloughing submucous fibroid has presented at the external os (83).

Murray (77), in 1914, advanced a theory that color of a red degenerated fibroid was due to the hemolytic action of lipoids. The unpleasant odor which is usually given off is due to the presence of amines derived from disintegrating muscle fiber.

Very little was written on myoma of the uterus complicated by pregnancy between the years 1914 and 1920. However, Schiller (101) in 1918 wrote a paper on "Red Degeneration of fibroids during and following Pregnancy", in which he presented a case of unusual interest. He advised rest in bed or expectant treatment for the milder cases. In the acute cases where urgency is produced by rapid enlargement, fever, and toxemia, abdominal section was advised. The choice of myomectomy or hysterectomy should be left up to the surgeon.

In 1923, Maury (73) presented a paper on the "Symptoms of Red Degeneration", in which he pointed out that red degeneration of a fibroid associated with

pregnancy may bring about the clinical picture of an "acute abdomen".

Sneed (103) reported in 1925 that 13 per cent of fibromyomas undergo some form of degeneration and calcification. His studies show that little evidence exists that any benign degeneration of myofibromas produce toxic effect on the other organs.

In a paper on "Myomectomy and Its Relation to Pregnancy", written in 1920, Brindeau concludes; When pregnancy occurs in a woman with fibromata this pregnancy generally takes a normal course, even when one can imagine trouble. In certain cases surgical intervention is indicated (violent pains, rapid hypertrophy of the fibroma, troubles from compression, torsion of the pedicle, impaction of a pelvic tumor). The abdomen being opened one can do a myomectomy in most cases. This gives excellent results for the mother and fetus (4 per cent mortality and 90 per cent continuation of pregnancy(11).

Burger reported a series of 431 myomectomies gathered from the literature by Bohler in 1932, showing a maternal mortality of 2.5 per cent, and undisturbed continuation of the pregnancy in 80 per cent of the cases. Of these 431 fibromas, 19 only were intraligamental (12).

Studdiford, in 1935, in his paper on "Pregnancy of Fibromyomatous Uterus", (108) points out; the chief dangers to cases with fibroids during the antipartum period is that of early interruption of the pregnancy, and the onset of acute degenerative changes in the tumors. He also points out that the necessity for operative intervention because of degenerative changes in fibroids during pregnancy is rare. He states, in few instances only, Cesarean section amd myomectomy may prove practical.

Greenhill (40), in 1935, advises to treat mild cases of necrosis expectantly. He warns against operation, even though the fibroid be infected, until the acute symptoms have subsided and the patient has developed her local and general immunities.

INCIDENCE

The frequency of pregnancy complicating fibroids is a matter difficult to determine, but it is by no means rare as one reads through the literature (4).

It is, also, difficult to determine the frequency of fibroids in pregnancy, for small fibroids are so commonly encountered that no note is made of them (5). However, the various writers encountered in a review of the literature on this subject have estimated the proportions of combined pregnancy and myomas as follows:

Author	Per cent of Combined Pregnancy and Myomas	Cases Studied
Campbell(13)-------------0.45 per cent		32,870
Craigin and Ryder(29)----0.45 " "		20,000
Eisaman(29)--------------0.30 " "		23,541
Emge(30)-----------------1.30 " "		6,263
Mosher(76)---------------0.60 " "		14,000
Palack(29)---------------0.85 " "		7,000
Pierson(87)--------------0.80 " "		30,000
Pinard(76)---------------0.70 " "		31,000
Schauta(30)--------------0.70 " "		100,000
Watson(119)--------------1.30 " "		

The average age of the patients studied was thirty-five years, the extremes being nineteen and forty-three years. Forty-six per cent of these patients were primigravids; this immediately placed many in that much-discussed and worrisome category of "Elderly Primiparas".

Lynch (68) called attention to the fact that fibroids are most numerous in the fifth decade, while pregnancy is most common in the third. The twenty

years between may allow for many developments, which are necessarily interdependent.

The incidence of myoma in 32,870 pregnant women, as Dr. Campbell has pointed out (13), was 0.43 per cent, or 142 tumors were diagnosed. Sixty of the 142 tumors were so small as not to be considered of clinical importance, while in 82 cases of myomas gave rise to complications during pregnancy, labor, or the puerperium. Fifty-eight of these cases occurred in the colored race and 24 in the white; and 52 were primiparas and 30 multiparas. The following table shows the age incidence:

	Primiparas	Multiparas
35 Years or over	19	10
30-35 Years	5	7
20-30 Years	23	12
Under 20 Years	5	1
	52	30

In 79 of the 82 cases, the records showed that 71 were married and 8 single. Fifty-two of the 82, or 63 per cent, were pregnant for the first time; and only 18 women of the series had living children.

The above figures show that two-thirds of the tumors occurred in the colored race. There was a tendency for the tumor to be discovered at any time after twenty years of age; however, it may occur at an earlier age. The foregoing statistics show the extreme age limits with a tendency for the fibroid to develop at a

relatively advanced age both in primiparas and multi-
paras. Then, too, as the series shows, a woman between
the ages of fifteen and twenty-five years is more apt
to conceive than to develop fibroids; from twenty-five
to thirty-five years of age the liability to both preg-
nancy and fibroids is greater; whereas between the ages
of thirty-five and forty-five years, the liability to
myoma is greatly increased and that to pregnancy de-
creased. One writer has pointed out that a barren
uterus is more prone to the development of fibroids
than one which has fulfilled its complete function by
going through the hypertrophic and the involutionary
changes of a gestation; the relative preponderance in
the number of primiparas in this series would seem to
justify such a statement.

ETIOLOGY

The etiology is unknown, as are factors causing the development of the tumor. Heredity may be a factor; fibroids often occur in mother and daughter. Race plays a part, since the incidence of fibroids is much higher in women with negro blood than in Caucasions. Lack of uterine development may be a factor, since fibroids very often develop in women with immature uteri. Sterility has been advanced as a cause, but more likely it is due to a lack of the development of the uterus than that it is the actual cause of the tumor. Advocates of this theory argue that fibroids are relatively common in virgins, because the uterus has been denied opportunity to become pregnant and thus to hypertrophy in its physiologic manner. They cite in support of this theory the high percentage of fibroids seen in nuns and other women in religious orders. The opponents of this view state that tubal inflammation is the common cause of sterility and that if sterility per se caused fibroid formation, surgeons would commonly find well developed fibroids in older women with long-standing inflammations, which they do not.

After careful investigation of the subject, Kelly and Cullen (57) express the opinion "that the uterus must have something to do, and that if it is not kept

relatively busy as a result of frequent pregnancies,
it may tend to show its activity in another direction,
namely in the formation of myomata".

There is a common factor favoring both sterility
and fibroids. Many apparently valid arguments support
this view. Thus, sterility is a common complaint in
women with underdeveloped pelvic organs; fibroids of-
ten are found in older women with such tissues; studies
of sterility in women having fibroids often show that
sterility long antedated the fibroid development. The
fact that women in ecclesiastical orders often have
fibroids may also be used to support this theory, since
these women as a rule never have been personally inter-
ested in men or marriage, and often a group in whom in-
fantile or pubescent uteri are common findings.

More recent investigators have sought to establish
a relationship between hyperactivity of ovarian secre-
tions and fibroid formation. The argument states that,
in undeveloped uteri, certain groups of uterine muscle
cells can be so activated by the stimulus of ovarian
hormones that they proliferate and become fibroid nod-
ules, especially in areas with temporarily impaired
circulation. While there is no proof to substantiate
this theory, it is a fact that many women with uterine
fibroids have   ovaries studded with developing

follicles and other evidence of ovarian activity. Persistent and macroscopic lutein formation also is usually noted. Daniel and Bares, in 1924, found such formations in the ovaries of 18 consecutive fibroid cases and felt that the amount of lutein formation was directly proportional to the size of the fibroids. While this may be, the fact remains that hormones of the anterior pituitary body are seldom demonstable in either the blood or urine of women with rapidly growing fibroids. Menstruation may have a bearing, more likely as a stimulant to growth than as the actual cause of the tumor. Apes, the only mammal other than the human that menstruates, do not have fibroids. (68)

HISTOGENESIS

The histogeny of these tumors is likewise uncertain. Few longer believe that they develop from uterine muscle, as was claimed by Virchow. The theory of Opitz that they develop from connective tissue by a process of metaplasia cannot so readily be dismissed, because embryologically both the uterine musculature and connective tissue develop from the undifferentiated process of the mesenchyme. Later in life, by metaplasia, fibroids could develop from undifferentiated cells. Cohnheim's theory that they develop from undifferentiated cell rests is supported by some pathologists and by some surgeons who, recognizing certain similarities between fibromyoma and adenoma of the thyroid, hold that both arise from embryonic rests. Others have sought their origin in the external covering of blood vessels, a theory first advanced by Roesger and later supported by Gottschalk, Kleinwachter, Pilliet and others. The theory has received no substantiation by Cullen after careful study of a very large series of cases. (68)

HISTOLOGY

A myoma is a neoplasm composed of either non- striated or striated muscle.

The parenchyma of the leiomyoma consists of non-striated muscle cells - overlapping fusiform elements with long rod-like nuclei. They lie closely packed into bands which run in various directions and are separated from adjacent bands by a variable quantity of more or less vascular fibrous connective tissue. The pure leiomyoma, in which the amount of stroma is minimal, occurrs principally in the female genital tract, the urinary tract, the gastrointestinal canal, the skin, and sometimes in the vein.

A much more common type is the fibromyoma, a leiomyoma containing a large amount of connective tissue; it should be remembered, however, that no matter how great the quantity of this material, muscle is still the primary constituent of the growth. This, Delafield and Prudden (22a) believe, because the younger is the neoplasm the smaller is the proportion of connective tissue, very recent growths being made up almost entirely of muscle. Since these tumors, then, are myomata, the term, myofibroma, should not be applied to them, though it often is.

The muscle cells in a myoma, as well as their nuclei, vary considerably in shape; both may be long and slender or short and plump, the latter form prevailing especially in more rapidly growing tumors, wherein mitotic figures may perhaps be discovered as additional evidence of rapid proliferation. Myoglin fibrils are demonstrable frequently presenting considerable variation in size and arrangement.

Fibromyomata may occur wherever smooth tissue exists, but are most commonly found in the uterus, where they are often called fibroids, from their resemblance to the fibroma; here they are not uncommonly multiple. They have been found also in the wall of the gastrointestinal canal and in the kidney, bladder, and skin, while a certain proportion of the hypertrophies of the prostate are sometimes regarded as leiomyomata of the interstitial muscle of that gland.

As a rule, they grow slowly and are benign, but, especially in the uterus, they may be large enough to lead to serious disturbance or even to threaten life, without being malignant. In this situation, too, they may become edematous by reason of some disturbance in their circulation and, owing to their poor blood supply, not infrequently degenerate, forming cysts or undergoing gangrene; hyaline degeneration and calcification

are not rare.

While leiomyomata are usually benign, as has already been said, a few instances are on record in which rapidly growing invasive and metastasizing neoplasms of this type have been found in the uterus, gastro-intestinal canal, bladder, etc.

Simple fibromata of uterus are almost unknown, the so-called fibromata being, in most cases, myomata or fibromyomata.

Myomata - these tumors, whose characteristic structural elements are smooth muscle cells, are the most common of uterine tumors and, while frequently of little practical importance, sometimes have serious consequences. They are especially common in negresses. They are most frequently composed of both muscular and fibrous tissue - fibromyomata - but the relative amount of the two kinds of tissue is subject to great variation. Myomata are most apt to occur after puberty, during the period of sexual maturity. They may be single or multiple, small or of enormous size; they are usually sharply circumscribed, whitish or pink, dense and hard, or sometimes soft, and on section present interlacing bands or irregular masses of glistening tissue. Their usual situation is in connection with the body of the uterus, but they may occur in the cer-

vix or in the folds of the broad ligaments. According
to their position, subserous, submucous, and intramur-
al (interstitial) forms may be distinguished.

The subserous myomata, often multiple, grow from
the outer layers of the uterus in the form of little
nodules. As they increase in size they may become se-
parated from the uterine wall and remain attached only
by a narrow pedicle or by a little connective tissue;
or they may be entirely free from uterine connections,
having formed new attachments to the adjacent or even
more distant organs ("wandering" fibroids). They may
work their way between folds of the broad ligaments un-
til they are some distance from their point of origin.
The tumors may become very large, but still remain firm-
ly attached to the uterus; this organ may then be drawn
upward, the cervix and vagina being elongated and nar-
rowed. The traction may be so great that the body of
the uterus is entirely separated from the cervix. The
bladder may also be drawn upward. Subserous myomata of
considerable size may interfere but slightly with the
function of the uterus.

The submucous myomata grow from the inner muscular
layers of the uterine wall; most frequently in the fun-
dus. They may project into the uterine cavity and re-
main sessile or become pedunculated; the uterus dilates

with the growth of the tumor, and its wall may become
thickened. The submucous myomata are usually single,
although there may exist at the same time subserous and
intraparietal tumors. They are frequently soft, and if
of large size and polypoid in form, may be extruded
through the cervix and, in rare instances, drag down
the fundus of the uterus, producing inversion. The
mucous membrane covering them may be atrophied or hy-
peremic, with dilated blood vessels, and may thus give
rise to severe and repeated hemorrhages. In some cases
the pedicle of a tumor is destroyed and growth is spon-
taneously expelled. Submucous polypi are especially
vulnerable to changes in circulation producing hemor-
rhage, necrosis, and subsequent infection of the growth.

The intramural myomata grow in the substance of
the uterine wall, but, if they attain large size, usu-
ally project beneath the serous or the mucous coat.
They are found in every part of the uterus, but are
most frequent in the posterior wall.

The uterine musculature about a myoma is circum-
ferentially arranged and lamellated. Except where the
nutrient vessels enter the growth, only a tenuous con-
nection exists; hence, fibroids readily shell out of
their "capsule".

The shape of the uterus is altered in a great var-

iety of ways by the presence of these tumors; its cavity is narrowed, dilated, or misshapen; it under goes flexion or version. The tumors may sink downward and become fixed in Douglas' cul-de-sac.

Myomata may undergo a variety of secondary alterations. A varying amount of interstitial edema may alter the size and consistence of the growth. The muscle fibers may undergo fatty degeneration, and the tumor may then diminish in size, or may even, it is said, be entirely destroyed. Degeneration of fibromyomata occurs most commonly in the puerperium as a result of the sudden cutting off of the blood supply. The most common degeneration is hyaline, which primarily affects the connective tissue growth, converting it into a structureless, faintly stained, glassy matrix (red, if stained with Van Gieson), between, the widely separated muscle fibers appear. Later, from lack of nutrition, the muscles also disappear. Calcification or ossification may occur, converting a part or the whole of the tumor into a stony mass. The intramural and submucous myomata may give rise to profuse hemorrhages; they may suppurate and become gangrenous.

Aseptic necrosis of myomata produces the so-called carneous fibroid, which on cross-section appears beefy, soft to semifluid, and in color from bright pink to

deep red or violaceous. The histological details grad-
ually disappear, a granular, diffusely staining debris
marking the final stage.

Sometimes the tumors or circumscribed portions of
them are very vascular, constituting the telangiectatic
or cavernous variety. These tumors, which possess some
of the characters of erectile tissue, may show sudden
change in size from variation in the amount of blood
which they contain. Larger and smaller cysts may devel-
op within these tumors - fibrocystic tumors. These may
be multiple and may communicate; they may be filled
with a clear or bloody fluid. These cystic myomata
sometimes reach an immense size and fill the abdominal
cavity. The cysts may be lined with ciliated epithe-
lium, although this is the great exception. The major-
ity of cystic cavities develop from aseptic necrosis
of the tumor tissue, due to lack of blood supply, and,
therefore, posses no epithelial lining.

Myomata of the cervix are moderately rare. They
may grow as polypi beneath the mucous coat, produce en-
largement of the anterior or posterior lips, develop
subperitoneally, elevating the uterus completely out
of the pelvis, or grow outward into the abdominal cavity.

Myomata of the uterus, either subserous, intrapar-
ietal, or submucous, containing glandular structure of

the type of those in the uterine mucosa, are of occasional occurrence. These glandular myomata or adenomyomata are occasionally directly connected with the uterine mucous membrane, but are sometimes so distant and so entirely separated from it as to justify the conjecture that they are derived from some embryonal abnormality associated with the development of the Wolffian body. The embryonal rests are most commonly located at the tubal angles (von Rechlinghausen). Adenomyomata rarely have a well-defined capsule and, therefore, can not be "shelled out" as can fibromyomata.

Myomata evidence themselves mainly by an increase in size of the uterus and by producing hemorrhage (meno- and metrorrhagia). Pressure effects occurr more often from small tumors in the pelvis or from impacted or sub-peritoneal growths than from large growths which rise into the peritoneal cavity. The mucous membrane over-lapping submucouse tumors is usually thin and atrophic, but the neighboring mucosa, where not pressed upon, is usually hypertrophic. There is some evidence that myomata are due to excessive ovarian stimulation, which likewise produces the uterine hemorrhage commonly ascribed to the influence of the fibroid.

During the puerperium, fibroids are vulnerable to

infection and often undergo degeneration.

Malignant myomata - Certain very cellular myomata have been know to produce metastases and evince an infiltrating growth. They may show no histological evidence of malignancy. Fortunately these tumors are rare. (22a)

Von Recklinghausen's description of adenomyoma of the uterus in 1896, first focused attention upon the wide distribution of uterine mucosa. His assumption that the lesions could be ascribed to remnants of the Wolffian-duct, though still held, has not obtained acceptance as a general explanation. Cullen somewhat later offered the explanation that such growths were displaced portions of the endometrium itself. (22a)

According to Lynch (68), the muscle cells are grouped into longitudinal and transverse muscle bands, bound together by varying amounts of connective tissue. The muscle arrangement is not as orderly as that seen in the wall of the normal uterus. In the smaller tumors, it presents as more or less circular masses of irregular shape and unequal size; in the larger tumors, much of the muscle tissue is interlacing and very frequently is arranged in whorls. Whorl formation also characterizes tumors composed chiefly of fibrous tissue. A varying degree of edema and hyaline degeneration

is present in all older tumors.

The larger tumors are surrounded by a loosely woven layer of connective tissue, which clearly demarcates the fibroid from its uterine bed. This capsule is a product of growth, consequently it is poorly marked in smaller tumors. The meshes of the capsule contain many thin-walled blood vessels and lymphatics, which give small anastomotic branches to the periphery of the larger tumors. The chief blood-vessel supply of the tumor is obtained from one or two small blood vessels which spring from radial or peripheral branches of the uterine arcuate arteries. They pierce the capsule and divide into a number of arterial trees which penetrate the entire tumor. The blood vessels usually are not readily seen on cut sections of the tumor. To the naked eye, the circulation seems most inadequate for proper nourishment of a rapidly growing tumor. There are few vessels in the center of the fibroid. The lymph supply is similar to that of the blood vessels. The larger lymphatic vessels pierce the capsule, together with the arteries which they closely follow, but without a definite perivascular arrangement. There is also a canal system of lymphatics in the fine spider-web type of connective tissue that unites the tumor and the inner sides of its capsule. Nerves have been demon-

strated in fibroids.

Rarely one finds fibroids which contain many fair-
ly large-sized thin-walled blood vessels scattered at
short distances from each other and in fairly regular
spacing throughout the entire tumor. These are the
telangiectatic fibroids.

The uterine muscle which surrounds the tumor varies
considerably in appearance and accords with the size
and location of the fibroid. The larger interstitial
tumors are surrounded by muscle cells so hypertrophied
that they could be confused with those of the uterine
wall of a well-advanced pregnancy. On the contrary,
the muscle cells surmounting a pedunculated tumor which
has been extruded from the uterus present only as a
thin filmy layer, sometimes so attenuated as to be un-
recognizable. In general, the muscular hypertrophy is
an example of work hypertrophy. (68)

On section, the fibroids give a sense of almost
cartilaginous hardness. When cut through, the peri-
pheries of the mass retract so that the cut surface is
bulging. The surface presents a dull-white, glistening
appearance, broken by darker areas which outline the de-
finite whorls. The capsule retracts with the margins
of the tumor and presents, in contrast, dark red in
color from the blood which has escaped from its clearly

seen meshes.

Histologically, the smooth muscle cells of the tumor resemble those found in the normal uterus. They may vary considerably, however. Sometimes the cells are long and thin and contain very thin, fairly long nuclei; in other cases, the cells are short and thick with short, oval nuclei. These varistions in shape depend largely upon the rapidity of the tumor's growth. The slowest growing cells are usually the most slender. Nuclear activity is not seen with ordinary staining methods; the tumor grows too slowly. In very rapidly growing tumors, if the nuclei show mitotic figures, the growth must be suspected of malignancy. (68)

Stevens (107) presents a very interesting histologic study of a tumor he operated in 1909. The tumor on section after preservation whole in 10 per cent formalin in normal saline solution presented a remarkable appearance. All the veins in the capsule were thrombosed, and thrombi being shown to be old by their microscopic appearances. Between the capsule and the fibroid was a layer of coagulated fluid exudate, whose thickness varied from 1/8 in. to 1 1/2 in., thickest part being at the upper end of the tumor, corresponding with the seat of the pain. This exudate must be presumed to be an acute condition, the result of the

universal thrombosis of the veins in the capsule. The
tumor itself showed many large areas of necrobiosis
with their usual red color and histological staining
reactions. It has been before suggested that throm-
bosis of veins in the capsule is a cause of necrobio-
sis, but this is such an extreme condition that it was
deemed worthy of notice. No cultures were made from
the tumor, but no organisms could be found in sections
stained by Gram's method. There is no satisfactory
cause to be suggested for this widespread thrombosis
of vessels.

GROWTH OF UTERINE MYOMA

A. In Non-pregnant Uterus

Fibroids usually grow only during the menstrual life and remain stationary or atrophy after the menopause. As a rule, the growth is slow and steady, and the tumors containing the most fibrous tissue develop more slowly than those with much muscle. Yet there are so many exceptions to this rule that any opinion as to how long the tumor has existed, or how much and quickly it will grow in the future, if left undisturbed, should be expressed with the very greatest caution. Some fibroids may not change size during six or seven years' observation, while other tumors of apparently equal size and consistency may grow to large size quickly, even in only a few series of cases reported during the years when abdominal surgery was undertaken for only the gravest indications and when, in consequence, fibroids were kept under observation until they became very troublesome. Schorler, in Schroder's Clinic in Berlin, followed 18 cases for five years for a fibromyoma to attain to the size of a man's fist, and fifteen years for it to become as large as a man's head. Kleinwachter, however, a few years later, when reviewing his own 35 cases, felt that Schorler was dealing with tumors of unusually slow growth. This is in ac-

cord with most of the more recent observations.

Reeb (93) reported a case in which small fibroma-
tous nodules, the size of a cherry, were observed and
had developed into large fibromas necessitating opera-
tion because of bladder disturbance in no more than
four years and three months.

Menstruation rarely affects the size of fibroids
unless they are the site of degenerative processes or
are adenomyomas, which then become congested and swol-
len. In certain degenerative processes, fibroids ra-
pidly increase in size as a result of edema.

Fibroids are usually multiple and of varying size.
Less than two per cent of fibroids are said to be sin-
gle. In some instances, the uterus is completely rid-
dled with tumors ranging from the size of a pea to that
of a baseball or larger. Uteri have been reported with
extremely large numbers of fibroids. Bland found 94
in one uterus, and Bland-Sutton recorded a case with
120 fibroids ranging from the size of a pea to that of
an egg. Such large numbers are unusual. In the major-
ity of cases, a uterus contains less than ten tumors.

The tumors vary greatly in size and may range from
microscopic particles to masses completely filling both
the pelvis and abdomen, although such large tumors are
rarely seen today; they are recognized and removed in

their early stages. Yet enormous fibroids have been reported, even though none have reached the size attained by the ovarian tumors. Large fibroids are usually cystic and, clinically, are often mistaken for ovarian cystomas. (68)

Little is known regarding the etiology of fibromyoma of the uterus except that the growth of the neoplasm is associated with sexual maturity. The monthly engorgement of the uterine vascular system favors development, while the cessation of the menstrual function encourages degenerative changes. Fibromyoma rarely develops before puberty or after the menopause. Not only does the tumor cause sterility, but sterility favors the development of the neoplasm. (35)

The point of origin as well as the origin itself, of fibromyoma is a subject of dispute. Virchow (117) located it in the smooth muscle tissue of the uterine wall. Others place the beginning of the growth in the blood-vessels of the uterus - the tortuous arterioles. Arteries supplying the growth usually show hyperplasia of the middle coat, often in a state of waxy degeneration. (35)

Obliteration of the arteries is of common occurrence and lends strength to the theory that the main cause of the development of the neoplasm is endarter-

itis obliterans. Fibromyomata are composed essentially
of the same structures as the uterus itself, viz.:
Muscular bundles and fibrous tissue.

The bundles of muscular fibers are formed into
spherical lobes joined by connective tissue. This in-
terlobular connective tissue forms a frame work which
binds the different lobes together and envelops the
growth as a whole with a capsule of variable thickness.
This capsule may be tightly adherent to the subjacent
tumor or it may have a loose attachment. The lymphatic
and blood currents circulate within the capsule and in
the interlobular connective tissue. The vessels of the
capsule proper give off secondary branches, these anas-
tomose with other vessels and form interlobular net-
works - some branches penetrating the lobes. The cen-
ter of each lobe receives a small blood supply compared
with that of the peripheral portions of neoplasm. As a
rule, fibromyomata are not well vascularized. (35)

The rapidity of the growth and the size of fibromyo-
mata vary within wide limits. Tumors may cease to grow;
may remain stationary; may decrease in size or disappear;
may be cast off from the uterine attachment; or may un-
dergo degenerative changes. Starting as inter stitial
tumors they may produce uniform emlargement of the ut-
erus; or working to other surfaces they may become sub-

mucous or subperitoneal. The base of the attachment
may become reduced to a small pedicle containing the
nutrient artery. A case is mentioned by Kelly (57),
which demonstrated the peculiar behavior of these tumors.
In 1869, Dr. Washington Altee examined a patient and
made a diagram of a large interstitial fibroid. The
uterus was then the size of a seven months pregnancy,
uniformly enlarged, and the uterine sound entered the
cavity eight or nine inches. Twenty-five years later,
Dr. Kelly operated and removed a fibroid weighing fifty-
nine pounds attached by a narrow pedicle to a small
uterus which had been crowded to the pelvic floor.

About two-thirds of all fibromyomata show non-
malignant degenerative changes after the occurrence of
the menopause. The frequent coexistence of fibrous
changes with hyaline degeneration is attributable to
faulty nutrition. Areas of hyaline degeneration some-
times liquefy and break down. If such liquefaction be
extensive and accompanied by fusion of different foci,
a large cyst will be formed with irregularly shaped
wall. Again, hyaline degeneration may undergo fatty
changes with extensive central necrosis.

Edematus and cystic degeneration are considered
the result of interference of the return circulation.

Parts of the tumor, or the whole tumor, become soft
and fluctuant owing to serous fluid imprisoned within
enormously delated lymph channels. The ultimate result
may be the formation of a thin-walled cyst traversed by
fibrous bands which are the remains of obliterated
blood-vessels. Edema is frequently the forerunner of
gangrene. (35)

Myxomatous degeneration is allied to edematous and
is characterized by the effusion of mucous material be-
tween the muscular bundles and proliferation of round
cells in the connective tissue.

Tumors devitalized on account of deficient blood
supply, and which have already become the seat of some
form of degeneration, are prone to undergo calcareous
changes. The calcareous infiltration may begin in the
center or in the periphery of the growth. Calcification
is regarded as a conservative process by means of which
a degenerated mass is converted into innocous body. (35)

Necrotic changes are among the most frequent and
dangerous complications of fibromyoma. Efforts at se-
paration and expulsion of submucous growths are liable
to be followed by sloughing of the tumor. A neoplasm
undergoing necrotic changes may be infected by putre-
factive germs. Micro-organisms may reach subperitoneal
tumors by way of the intestinal tract. Diminished

vitality of the tissue due to pressure or to adhesions
of the bowel to the tumor favors the penetration of
bacteria. The appendix may adhere and produce suppura-
tion or gangrene of the tumor. Interstitial tumors may
be infected from the bowel or from the uterine mucosa.
Infection by means of the circulation is brought about
through the agency of septic emboli. (35)

Pain is a marked symptom of the occurrence in some
forms of degeneration of the fibromyoma, having been met
with, according to Noble (79), in two-thirds of the ne-
crotic, three fifths of the cystic, and one-third of the
myxomatous degenerations.

B. In Pregnant Uterus

Many clinicians believe that certain fibroids enlarge or actually grow more tapidly during pregnancy. Others contend that pregnancy does not exert such an influence (Bell, Scipiodes, Koster, Katz, Walther, Benner, and Young). Borner's studies have produced evidence that fibroids migrate toward the surface during the progressive enlargement of the uterus, and since their size is rarely determined before pregnancy, it is difficult to determine whether such tumors become more apparent because of a change in position, whether they enlarge temporarily in response to local changes, or whether they actually grow (Windeyer). Whatever the explanation, the f act remain that certain fibroids of the uterus enlarge rapidly during pregnany. (30)

The mechanism involved in the enlargement of fibroids in pregnancy has been explained on several bases. Williams, DeLee, Heimo, Polak, Lockyer, Vandescal, and Lynch, Frank, and Cragin add to this the factor of hyperplasia. The stimulus of pregnancy and an increased blood supply are favored by Reed, Ashton, Bland-Sutton, and Giles, and Sheddan. Herman, Bandler, Graves, and Gragin consider the enlargement, particularly in pure myomas, as a purely functional response

in which the tumor shares the growth of the parent tissue (uterus). In this connection, however, Ferguson points out that certain tumors enlarge beyond a reasonable fulfillment of the potentialities of pregnancy. In general, many observers accept the view that the enlargement of these tumors is a concomitant of pregnancy. (Green, Stevens, Clark and Norris, Karsner, Edgor, Anspach, Thompson, Theron, Goldstein, Holmes, Litzenberg, Harries, and Cameron) That most of these neoplasms rapidly regress during the involutionary period of the uterus is an established fact. It is interesting that in subsequent pregnancies, not all of these tumors shwo the same tendency to enlarge which may be the result of vascular and cellular damage produced during the first incolution. The complete disappearance of fibroids after pregnancy has been observed by Lynch, Watson, Pouey, Barnes, and Bublitschenko, although Bland considers highly improbable. Whether the enlargement of fibromyomas during pregnancy is actually due to the functional response or results from an increased vascularity which invites hypertrophy, hyperplasia, and edema, remains, therefore, an open question. Involution of these tumors can be readily explained on either basis. (30)

There is no evidence that pregnancy alters the

character of the cellular components of these neoplasma,
for sarcomatous degeneration as a result of pregnancy
is known. McLean's radical stand that these tumors
should be removed immediately upon diagnosis because
"the fibroid of today may be a sarcoma later" is not
tenable. (30)

A survey of Emge's own material leads us to be-
lieve that only few of these tumors reach a consider-
able size during pregnancy. Although some of them were
discovered early in pregnancy, he could not determine
how much they had enlarged up to the time of discovery,
nor could he estimate their primary growth rate. He
was unable, therefore, to say to what extent pregnancy
actually influenced the enlargement of these tumors.
However, he was under the impression that the tumors
which actually increased in size while under his obser-
vation did so in a ratio equal to the enlargement of
the uterus. He was convinced, also, that most fibroids,
with the exception of some pedunculated tumors, regress
very materially during the puerperium, some to a very
insignificant size and others to a point where, some
months after delivery, they no longer can be felt. His
observations left him with the impression that in sub-
sequent pregnancies fibroids often fail to enlarge, or
that the degree of enlargement is considerably less

than that of the first gestation. (30)

As to the mechanism of enlargement, they studied tumors removed at various periods of pregnancy. Venous stosis, edema, both intercellular and intracellular, and progressive, hyaline degeneration became more evident with the advancement of pregnancy, but apparently did not progress materially after the seventh lunar month although degeneration beyond hyaline changes may continue. Hypertrophy is confined to muscle fibers and reaches its hieght somewhere between the fourth and sixth months. The apparent increased size in connective tissue elements seen in some tumors is due to intercellular edema. Vacualization of cells is, therefore, commonly observed. That an actual hyperplasia is responsible for this increase could not be determined by him. He doubts, however, that the enlargement of fibromyomas during pregnancy, because of the subsequent and rapid regression, signifies a true growth phenomenon. Emge is inclined to believe that it is a temporary response, due partly to functional hypertrophy of muscle cells and partly to increased vascularity. He believes, also, that Borner's theory of tumor migration deserves serious consideration in this connection. (30)

C. Physiological Changes

1. In Normal Structure of Pregnant Uterus

The first appreciable alteration observed in the
structure of the normal uterus as a result of impreg-
nation is increased vascularity accompanied by increas-
ed growth. The progressive enlargement of the organ
during the first half of gestation is due to hyper-
trophy and hyperplasia of the smooth muscular element.
During the second half, distention of the uterus is an
additional factor in promoting enlargement. The con-
nective tissue between the muscular fibers is not only
augmented by proliferation but is also thickened by
serous infiltration. White cells in great numbers es-
cape from the engorged blood vessels and a nutritive
energy is awakened which borders upon inflammatory ac-
tion. The final result of this developmental activity
is to build up tissue and increase the size of the or-
gan enormously. The length of the virgin uterus is a-
bout 7 cm.; that of the full term gravid organ about
35 cm. The weight of the former is 43 grams; that of
the latter about 1,000 grams. Equally striking as the
constructive phenomena of pregnancy is the destructive
phenomena of the puerperium. In five or six weeks after
the expulsion of the full term product of gestation,
retrograde changes affect the reduction of the uterus

to almost its original size and weight. Nearly 1,000
grams of highly vitalized tissue is devitalized and
eliminated. This process of involution consists of de-
generative changes - granular and fatty - o f the uter-
ine structures. The albumen of the muscle cell is to a
great extent converted into peptome and discharged with
the urine. In addition to the process of involution,
permanent contraction and diminished blood supply act
as factors in reducing the size of the uterus.(35)

2. In Fibroma of Pregnant Uterus

It has been for a long time and still is, a matter
of common observation that pregnancy inaugurates cer-
tain changes in fibromyoma of the uterus. The tumor
increases in size; it changes position; it undergoes
alterations of shape and consistency during pregnancy,
while it diminishes rapidly in volume and may disappear
during the puerperium. Being composed of the same his-
tologic elements as the normal uterine structure it
participates in the same physiologic changes that occur
in that organ during gestation - nutritional growth of
the muscular and connective tissue elements with serous
infiltration of the latter. The muscular fibers are hy-
pertrophied, multiply themselves, and the process does
not go on without a certain degree of inflammation which
is accompanied by an aggregation of white cells in the

intermuscular spaces(117). Although the uterine struc-
ture proper of the gravid uterus are engorged with
blood a complicating fibromyoma receives an insuffici-
ent blood supply. The nutrient vessels do not enlarge,
as a rule, to any appreciable extent; they are sur-
rounded by thick fibrous walls and are deprived of the
elastic coat. The hyperplastic middle coat is frequent-
ly found in a state of waxy degeneration. Changes in
the arteries may exist to the extent of obliteration.
The primary capsular network of blood-vessels exhibits
increased vascularity while the deeper lobes of the tu-
mor will be found deprived of the blood to the degree
of exsanguination. The result is degeneration of a large
number of muscular bundles and the absence of red glob-
ules in some of the arterioles.

The increase in volume of the neoplasm during preg-
nancy is not so much due to hypertrophy and hyperplasia
of the muscular fibers as to rapid proliferation of the
fibrous element and especially to serous infiltration
or edema. Gusserow first demonstrated that a true
growth of the tumor is relatively rare and that the
occasional enormously large increase in size is due to
the increased amount of fluids in the tissue. Owing to
this increased fluidity the consistency of the tumor
will naturally decfease and we find those growths which

take on a rapid increase of volume are soft and apparently fluctuating. This softening is nearly always due to serous infiltration of the connective tissue and rarely to myxomatous or cystic degeneration(16).

The actual increase of the muscular element is witnessed principally in the interstitial type of fibromyoma except, as pointed out by Arnheim (2), in those interstitial growths which are encapsulated by a firm, rigid, and poorly vascularized capsule. The more intimate the union of the growth with the uterus, the more it will partake of these physiologic processes, and the closer the structure of the tumor approaches to that of the organ the more pronounced will the changes be.

The influence exerted by the physiologic changes of pregnancy is observed not only in the increased growth of the tumor and its softer consistency, but also in the alteration of its shape. The general tendency of the neoplasm is to adapt itself to the growth of the uterus and to become flattened and elongated. Olshausen (81) has recently called attention to the flattening of the tumor during pregnancy. A tumor that had presented all the appearances of a globular growth will apparently disappear by pressure of the increased volume of the uterus forcing the neoplasm to assume a flattened shape difficult to recognize. After birth

the tumor quickly resumes its original shape.

This beneficient alteration of the form and position of the tumor is demonstrated most strikingly and most happily in those growths situated within the true pelvis. Tumors which had blocked the true pelvis during the early months of gestation and which had threatened to become incarcerated below the promontory of the pelvis, and which apparently had presented an insurmountable obstacle to delivery per vias naturales have softened, flattened, and elongated. The rising of the gravid uterus into the abdominal cavity aided by the changes of shape and consistency of the neoplasm; by the intermittent painless contraction of the uterus, and later by true labor pains, carries with it the growth which is eventually lifted above the superior strait. Lusk (67) and Jewett (53), in their respective textbooks of obstetrics, describe a physiologic rearrangement of the muscualr fibers during pregnancy and labor by which they are drawn up from the lower passive segment of the uterus to the upper active portion. If this be correct the change will assist materially in the elevation of the tumor.

Involution of the fibromyoma takes place during the puerperium as well as involution of the uterus. Enormous growth during pregnancy is followed by equally

striking decreases in size of the neoplasm. The shape
changes again to assume that which existed before the
advent of the gestational growth; the location of the
tumor alters to its original position; the structure
hardens to the tumor; the contraction of the organ,
and the diminished vascularity. Exaggerated degrees
of such changes may lead to absolute disappearance of
the growth.(35)

D. As Affected by Pregnancy

1. Nutrituve Changes

It is a matter of common observation that fibroids grow in pregnancy in practically all cases. The rate of growth varies from the smallest perceptible amount to the degree reached in tumors described as having increased from the size of a fist in the second or third month, to one which at the sixth month caused the uterus to be as large as it should be normally at term. Dakin has had the opportunity of watching a patient who before she became pregnant had no recognisable tumor, but who, before she reached the end of her pregnancy, had a mass measuring 7 inches in length by $4\frac{1}{2}$ inches in breadth and 3 to 4 inches in thickness as it lay between the back of the child and the examining hand.(19)

It appears doubtful whether the growth is most active in the earlier or the later months. Von Strauch (118) is of decided opinion that the first three or four months are the most important period in this respect, and he considers that this is due to the blood-supply being suddenly increased beyond the needs of the ovum. In the later months his experience as that the tumor does not grow as a rule. Indeed, in some cases he has seen it shrink, and he ascribes this to the appropriation by the fetus of the greater part of the

nutrient material of the uterine blood. Other authors
do not entirely agree with this statement as to time.
It is an important matter, for it we could assume with
certainty that a fibroid would not grow after say the
fifth month, we could decide what course to pursue in
the case of a tumor which by the end of that month had
reached a large size, but still not a size which would
endanger either the woman's life or the successful ter-
mination of pregnancy. But we cannot assume this with
safety, and the possibility of further increase in the
tumor must be a weighty argument in deciding the line
of treatment to adopt. (19)

In some cases, probably in most, the growth is
mainly a true hypertrophy, of similar nature to that
which is undertaken by the proper muscle of the uterus;
in others the increase in size is due to edema. In the
former class the hypertrophy of the myoma cells is more
marked than that of the proper muscle cells. Doran (25)
has dealt with this change in a paper in the Obstetrical
Transactions, where he gives two drawings illustrating
the hypertrophy, and the relations of connective tissue
in the tumor to the muscle cells. He says that "the
proportion between the muscle cells in the normal tis-
sue and in the new growth was maintained" in his case,
that is to say, the myoma cells were larger with some-

times myxomatous changes, but his view is not that of
other observers. Doran's case was one of pure myoma,
but fibromyomata undergo similar changes as regards
their muscle cells. (19)

2. Changes in Shape

These tumors, if observed carefully during preg-
nancy, are nearly always found to undergo a notable
flattening. This is probably due to the increase in
area of the uterine surface, and the adaptability of t...
the softening mass to its widening base. After labor
the fibroid again becomes a definite and probably a
prominent lump on the uterine surface. (19)

3. Locomotive Changes

In a very large majority of instances in which the
pelvic cavity is occupied by a fibroid, even if it
grows from the lower uterine segment, and in a still
larger proportion where the tumor is situated in the
upper part of the uterus, there will be a readjustment
of the mass before the end of pregnancy, and the pelvis
canal will be made free for the passage of the fetus.
Although this is not the place to discuss the treatment
of fibroids in pregnancy, it is obvious that it is of
the greatest importance to remember this tendency when
the question of operating on a fibroid which seems like-
ly to obstruct labor, is being considered, in the earli-

er months(19). A striking instance of this adjustment
is recorded by Von Strauch(81). A woman who had a myo-
ma filling the whole of the true pelvis and raising the
uterus at the second month of pregnancy so high that
the cervix was above the level of the symphsis, and
could be reached only with great difficulty on vaginal
examination, had on three occasions, during the two
following months marked symptoms of incarcerations -
severe vomiting and attacks of pain in abdomen. In
spite of these indications, he did nothing in the way
of attempting to raise the tumor out of the pelvis.
At the end of the fourth month the tumor had begun to
move upwards. This upward movement was completed and
the child's head was able to sink into the pelvis brim.
Labor was unobstructed. On examination soon after
birth the fibroid could not be recognised; but four
months later it was found as a tumor of the size of an
apple growing from the posterior wall near the fundus.
Olshausen (81) relates a similar case.

Kelley (55) says the fibroids occupy three posi-
tions as to the uterus - on the fundus, on the sides
of the uterus, and on the cervix.

Tumor on the fundus may descend during pregnancy
either by lengthening of the pedicle, or the other por-
tion of the uterus, growing rapidly at the expense of

the fibrous part, may roll over into the pelvis. It
is also claimed that interstitial fibroids of the fundus
will descend during pregnancy by a splitting process and
some to be situated in the cervix itself. On the other
hand it is positively known that a tumor which before
pregnancy is low in the uterine wall may come to be ab-
solutely on top at the completion of pregnancy. (55)

Reeb reports fibromata in the lower part of the
body of the uterus or in the cervix sometimes rise
during the last few days of pregnancy or during labor.
The author recently reported a case in which this oc-
curred. In this article he reports two cases in which
several fibromatous nodules changed their position with
regard to each other during the early months of preg-
nancy, the change being due to hypertrophy of the nor-
mal parts of the uterus between the tumors. During
pregnancy, the middle and upper parts of the uterus in-
crease in size more rapidly than the lower part, so
that even in the early stages fibromata in the upper
part of the uterus move upward while those in the lower
part remain in the same position. This change in the
relative position of fibromatous nodules may help in
the diagnosis of pregnancy in a fibromatous uterus.

In another case reported by the author a different
kind of displacement of fibromatous nodules was brought

about by torsion of the uterus from right to left of
more than 90 degrees. During a series of examinations,
four of five fibromata passed from right to left. The
author explains the torsion by the assumption that the
fibroma originally on the left was larger and higher
up than the others. The greatest hypertrophy of the
uterus therefore took place on the right side which did
not contain any tumors. At about the fifth month, the
growing uterus encountered a resistance on the right
and turned toward the direction of least resistance,
that is, toward the anterior wall of the abdomen. The
rotation, thus begun, continued until it reached more
than 90 degrees and brought the fibromata in the lower
posterior part of the pelvis, where they could not at
first be palpated, into a position where their presence
could be diagnosed. (92)

E. As Affected by Labor

1. Nutritive Changes

Fibroid tumors situated in the lower part of the uterus which fail to rise above the pelvis brim in pregnancy, or early in labor, and past which the fetal head has to be dragged or forced, are very likely, unless they are polypoid, to be injured to such a degree that degenerative, and in some instances necrotic, changes subsequently take place in them.

It is asserted by some observers, notably by Hammerschlag, that traumatism is not a necessary factor in such changes, but that they take place soon after labor in the absence of any injury of a mechanical kind. This cannot be anything like the rule, for every obstetrical physician must remember numbers of cases in his practice where a fibroid has passed through labor and suffered no hurt, nor shown any sign afterwards of any change.

Dakin (19) reports a case which is a good example of what a fibroid will stand. The patient had had a pediculated fibroid removed 8 years before; and when he first saw her she had been married 3 years and gave the following history. Labor had been induced at the 8th month after first pregnancy for a fibroid growth which lay below the brim and threatened to cause ob-

struction in labor. It was found at labor to be attach-
ed as low down as the internal os. It gave rise to
great obstruction even at this month, and the head was
very forcibly dragged past it. The child died soon af-
ter birth, presumably from injury to its nerve centers.
The mother nearly died from septicemia. The tumor was
not expelled, and remained as before in spite of its
rough handling. In the following year she again became
pregnant, and it was decided to induce abortion on ac-
count of the tumor. The year after there was another
pregnancy which was ended by an abortion ascribed to in-
fluenza. Both of these abortions took place at the
third month.

Not many months after this she again became preg-
nant. Dakin saw her first when she was $6\frac{1}{2}$ months ad-
vanced in that state. On examination he found that
there was a fibroid the size of a Jafia orange at the left
cornu. There was a distinct thickening of the uterine
wall in the right side of the uterus just above the brim.
This had an ill-defined upper limit and could be made
out to extend interiorly into the pelvis. On bimanual
examination the thickening, which was, of course, the
fibroid previously observed, was found to end inter-
iorly at about the level of the internal os, and it
gave the impression of a mass of two or three inches

in thickness, occupying a considerable space in the pelvic cavity. On examination a month later he found that the fibroid at the left cornu was almost imperceptible, but could still be felt as a flattish, fairly soft mass lying over the child's breech. Of the mass lower down in the right uterine wall there was hardly a trace. There could be no doubt that the right course was to let the pregnancy go to term. Labor took place at the proper time, and was perfectly normal. The lower fibroid was not perceptible. On being seen 3 weeks after labor the fibroid above was found to be very distinct and mainly subserous, and there was again the somewhat ill-defined tumor to be felt low down in the right wall of the uterus. Since then there has been no pregnancy, and the patient has not been in any way made conscious of the fibroids.

The softening and flattening which occur during pregnancy prevent damage to a large number of those tumors which remain in the pelvis, but if the growth is a large one it is very likely to be compressed and bruised in spite of these changes, and degenerative processes of some kind may be started. These will be more properly described in the section on puerperium. (19)

2. Locomotive Changes

Alterations of position of fibroids during labor

are common. In most cases, though not so often as in
pregnancy, a fibroid, especially if it be subserous or
interstitial, will rise above the brim in time to be out
of the way of the advancing head if it has anything like
a chance. That is to say, unless its implantation is so
low down - and this is most likely when the tumor is in
the posterior wall - that it is imprisoned effectually
by the presenting part of the child, the upward tract-
ile force of the retracting uterus, combined with the
plasticity of the tumor itself - which enables it to be
squeezed out of the pelvic cavity like so much putty,
or like fluid in a bladder - will gradually, or in some
cases suddenly, raise it above the brim of the pelvis
and out of harm's way.

Olshausen (81) records an instructive case of this
kind. In a woman near the end of her first pregnancy
he found a tumor the size of a child's head bulging the
posterior vaginal wall forward, and pushing the cervix
high up on the left. He made an attempt at reposition
under anaesthesia, but was unsuccessful. Reposition
was again unsuccessfully attempted. After 24 hours'
pains with early rupture of the membranes, the os slow-
ly dilated and moved towards the middle of the pelvis.
With more pains the tumor withdrew itself entirely out
of the pelvis and labor ended spontaneously. The tumor

gave rise to no trouble in the puerperium.

It will be remembered that there is some possibility of intraperitoneal hemorrhage if, by the considerable change of position required in such a case, vascular adhesions of the uterus to surrounding parts are torn. The tumor may also be damaged and afterwards slough. And a fibroid which has suppurated during pregnancy has been ruptured with fatal consequences during labor. (Krugenberg,19)

F. Pathologic Changes in Fibroma

Complicated by Pregnancy

In the brief reference already made to the life history of fibromyoma of the uterus it is recognized that in conditions outside of the influence of pregnancy, the neoplasm is subject to various pathologic changes, and frequent as are those changes ordinarily the occurrence of pregnancy in a fibromyomatous uterus imparts extra liabilities. Nutritional effects leading up to necrosis and suppuration have been recognized by pathologists and surgeons, but little consideration has been bestowed upon the subject from the standpoint of the co-existence of pregnancy. It is only in recent literature that one can find mention of it as an obstetric complication. Particularly worthy of notice is the inaugural thesis of M. George Erger, published at Paris in 1907. He has collected the reports of twenty-three cases of suppuration of fibromyomata in pregnant or puerperal uteri and made them the basis of careful study.

During pregnancy the poor vascularization of the neoplasm is further impaired by arteriosclerosis, waxy degeneration,and thrombosis of the blood-vessles. Marked exsanguination may terminate in gangrene, while edematous and cystic changes may result from interference with the return circulation. Red degeneration of fi-

bromyoma has been met with under other conditions but the best examples are observed in tumors associated with pregnancy. Bland-Sutton (110) has witnessed during the course of gestation the complicating fibromyoma assume a deep red or mahogany tint. In the early stages the color is observed in streaks, but as gestation advances the alteration of color permeated the whole tumor. Occasionally, even in the mid-period of pregnancy, this necrotic change may be so extreme that the central part of the neoplasm is reduced to a red pulp. The red color is not caused by increase of the muscular elements of the fibromyoma but to blood pigment diffused through the necrotic tissues of the tumor. Pain and tenderness are marked clinical features of red degeneration of fibromyoma complicating pregnancy. Complications arising during the course of pregnancy associated with fibromyoma of the uterus may be accidental as well as nutritional. They may originate from mechanical causes as when incarceration of the growth within the true pelvis is followed by pressure effect and necrosis of the tumor or of the surrounding soft parts.

Torsion of the pedicle may produce hemorrhage within the fibromyoma leading to the formation of cystic spaces. Fatty degeneration, suppuration, and softening, with central necrosis and sudden disturbance

of nutrition follows. Accompanying these changes will be stasis of the lymphatic circulation with dilation of the lymph channels. Gradual mechanical atrophy of the tissues combined with diminished nutrition frequently leads to fatty degeneration. Torsion of the pedicle of a fibromyoma may also cause interperitoneal hemorrhage and collapse. Acute abdominal pains added to the clinical picture would simulate closely the symptoms of ruptured ectopic gestation. Increased vascularity of the surface of a subperitoneal fibromyoma may lead to a rupture of superficial vein and fatal intraperitoneal hemorrhage.

Schenk (100) removed a fibromyoma at the fifth month of uterogestation on account of severe symptoms, and found the growth degenerated in various parts. In his opinion the rapid growth of the neoplasm during pregnancy had caused a stretching of the capsule and diminished blood supply to the tumor.

J. D. Malcolm (71) removed a fibroid uterus seven weeks after premature labor and found a grayish white slough within the central portion. The condition he said was unique. It did not seem to be the ordinary sloughing due to infection from the uterine mucosa. The growth was so close to the uterine cavity that contamination from that source would inevitably have in-

duced an ordinary putrid slough of the whole tumor and death of the patient, as the neoplasm extended as near to the peritoneum as to the mucous surface. The large number of muscle cells and greater contractility of the outer portion of the growth suggested that the central part had been subjected to considerable pressure, and that this, together with the diminution of the vascular supply caused by the involution of the uterus, afforded the most satisfactory explanation of the sloughing of the central part of the growth. According to this view the sloughing was aseptic and it is possible the dead tissue might have been slowly absorbed.

Nussbaum (80) claims that the irritation of the fibromyomata causes inflammatory processes of the decidua and placenta which is manifested by increased secretion. A true hydrorrhoea gravidarum may result. Proliferation of the chorionic villi with small warty or polyp-like excresences produces intimate adhesions of the placenta with submucous fibromyomata. He has experienced great difficulty in removal of the placenta and this is one of the chief causes of adherent placenta and retention of debris with attendant hemorrhage after child-birth. He points out that putrefaction of these growths is especially liable to take place when manual detachment of the placenta is necessary, even under strict aseptic precautions.

Central hemorrhage may result from torsion of the
tumor or of the pedicle and from physiologic flatten-
ing and change of shape of the neoplasm. But undoubt-
edly the most common cause of hemorrhage within the fi-
brmyoma is uterine contraction. Gusserow doubts whether
extravasations of blood take place before birth.
Schultz (102) reported a case of total necrosis of an
intramural fibromyoma caused by rupture of the nutrient
blood-vessels during contractions of the uterus in the
course of a miscarriage. Krugenberg (60) met with a
case of sloughing and suppuration of an interstitial
fibromyoma at the fourth month of gestation attribu-
table to hemorrhage between the neoplasm and its cap-
sule brought on by the act of defacation.

Suppuration of fibromyoma may occur in the central
or deeper lobules of the tumor or in the periphery di-
rectly beneath the capsule.

1. Beginning in the center of the tumor. The di-
minished blood supply and low degree of vitality of the
deeper lobes are so marked that nothing but the existence
of an aseptic field prevents suppuration. If the tissue
be invaded by pathogenic microbes an excellent culture
medium exists without phagocytic protection. The tis-
sues break down into circumscribed purulent collections
the pus appearing in the middle of necrotic cavities.

The walls of the pus collections are formed by tissues
possessing greater power of resistance. The limit of
the dead and living structure is marked by an inflamma-
tory zone with numerous phagocytes. Deep seated suppur-
ation may involve any part of the tumor or one or more
of its lobes. In some cases the suppuration is not
circumscribed.

2. Suppuration under the capsule. The periphery
of the fibromyoma, that portion in contact with the
capsule, receives a more liberal blood supply and is
therefore composed of vigorous tissue capable of offer-
ing resistance to pathogenic germs. The capsule itself
being composed of dense fibrous tissue also combats the
action of pus producing organisms. Suppuration of the
loose cellular tissue separating the fibromyoma from
the capsule tends to the formation of a liquid around
the tumor in which it is bathed and which isolates the
growth from the surrounding substance. The pus may be
confined within the tumor, giving rise to augmentation
in size of the growth and of the uterus; it may escape
by rupture of the cyst wall into the peritoneal cavity,
or it may discharge into the uterus and escape per vaginum.

Olshausen (81) reported a case in which the capsule
of the tumor suppurated, broke through the broad lig-
ament and later, under the influence of labor pains,

ruptured into the abdominal cavity causing fatal peritonitis.

Adhesions of the tumor to the abdominal wall may permit escape of the abscess contents externally. Neugebauer(78) reported a case in which three months after the birth of the fifth infant a fibromyoma suppurated and opened spontaneously upon the surface below the umbilicus. By discharge and curettage through the artifical opening about twenty-five ounces of debris were removed during a period of six months. Suppuration ceased and the wound healed.

Suppuration follows abortion, miscarriage, premature and full term labor. On the other hand, the process may excite uterine contraction and be the cause of the expulsion of the product of conception at any period of uterogestation.

Infection of fibromyoma is the most common cause of suppuration. Contributing factors, diminishing the power of resistance to invasion and action of germs, are the low vitality of the neoplasm, deficient blood supply of the deeper parts, degenerative changes, and extravasations of blood within the growth.

Streptococcus, staphylococcus, and gonococcus prove active agents of infection.

Gatti (38) reported two cases of suppuration of

the central portions of fibroid tumors of the uterus in
which bacteriologic examinations of the pus revealed the
staphylococcus. Hartman and Mignot (49) recovered a
special anaerobic bacillus. The source of infection
has been attributed to the general circulation, but
others have contended that this is impossible except
by means of septic emboli.

Adhesions of the bowel or of the diseased appendix
to the tumor may bring about infection of the growth
from the intestinal tract. Suppuration of the uterine
appendages is able to furnish the source of entrance of
pathogenic germs.

In the vast majority of cases the location of en-
trance of pathogenic germs is the uterine mucosa. The
frequency with which labor occurring in women with fi-
broid tumors of the uterus is complicated by malpre-
sentations, placenta praevia, etc., renders them more
liable to infection. Dystocia is often met with in
these cases involving the necessity for artificial aid,
forceps, or version, and such interference is a well re-
cognized factor of infection. Pathogenic organisms
producing septic endometritis are conveyed to the fi-
bromyoma by way of the lymphatic circulation. Septic
phlebitis may implicate the neoplasm through the blood-
vessels. Other conditions contributing to suppuration

have been referred to in the alteration of the blood
supply; degenerations and hemorrhages into the tumor
resulting from uterine contraction.

Abortion and miscarriage are frequently incomplete
when occurring in the fibromyomatous uterus, and the
retained fragments of placental tissue or membranes add
to the liability of infection.

Symptoms of suppuration in fibromyoma of the uterus
during and after the termination of pregnancy are mani-
fested by increase in volume of the tumor, abdominal
pains, fever, accelerated pulse, vomiting and diarrhoea.

The pain is localized in the tumor; it is of vari-
able intensity, ceasing at intervals and at other times
being acute. The intensity of the pains depends upon
the degree of peritoneal involvement. Sudden and severe
pain with symptoms of collapse is indicative of acute
peritonitis. Pain of moderate degree relieved by recum-
bence would suggest deep seated suppuration, when accom-
panied by septic symptoms. Fever of variable severity
is nearly always present. It may assume a typhoid
type, or it may be erratic with exacerbations preceded
or not by chilly sensations or rigors. When peritoneal
reaction is slight, producing adhesions, it is said that
the temperature is irregular. No temperature rise is
claimed to exist when a purulent collection has suc-
ceeded to aseptic necrosis.

COMPLICATIONS ARISING AS RESULT OF
PREGNANCY AND LABOR

A. Edema

Fibroids, whether interstitial, subserous, or sub-
mucous, are frequently found to become adematous during
pregnancy; and, further, there may be spaces in the
tissue filled with serum, or in some cases with brown-
ish fluid containing red corpuscles and lymph cells
(Kaltenbach, 81). In a few instances, Delaris (23) has
found extravasations of blood in the tumor. He says
that where this occurs there is a good deal of pain,
especially if the affected areas go on to suppuration,
but that mere edema, however rapidly it develops, gives
rise to no pain.

The softening brought about by the edema is a very
fortunate happening, for a tumor situated in the pelvic
cavity is by this change able to adapt itself during
labor to what available space there may be, and thus
allow a living child to be born where there seemed to
be no chance of the head being able to get past the
obstruction. (19)

Katz (54) claims a favorable pregnancy-linked
change is edema, in other words, a softening of consis-
tency, which is, for instance, lacking entirely in ovar-
ian tumors. This is important, in many cases, for the
differential diagnosis with all its consequences with

regard to therapy and prognosis.   Owing to it, a myoma
seldom occasions dystocia.

The edema of the myoma bears in itself the germ of
degenerative changes, which may become serious compli-
cations, namely, necrosis, infection, and suppuration.(54)

Galabin (37) presents a case in which the patient
was four and one half months pregnant.   Two tumors were
felt in the abdomen; that on the left side was diagnosed
as fundus uteri containing fetus, loud souffle was heard
over it.   That on the right side was about double the
size of the other and much softer.   Fluctuation and
slight fluid thrill were felt over it.   It was gener-
ally slient to auscultation.   Under observation the
size of the tumor doubled in three weeks.   The tumor
was displacing the cervix to left and was likely to ob-
struct labor.   The uterus and tumor were removed by
Baer's method of hysterectomy, the pedicle being drop-
ped.   The tumor proved to be an edematous fibroid, not
even fibro-cystic.

B. Necrosis

It is very rare for necrosis of the tumor to take place during pregnancy, according to a statement made by Fry in 1904, but cases in which the tumor was breaking down in the center are described by Machenradt (69) and by Hammarschlag (46).

The frequent association of this degenerative process with pregnancy had been pointed out by Mr. Bland-Sutton and by Dr. Fairbairn, the latter asserting that "pregnancy, quite apart from the accidents of labor and the puerperium, has some influence in the causation of this necrotic process". Dr. Fairbairn's figures show that 40 per cent of necrobiotic fibroids are associated with pregnancy, and Mr. Bland-Sutton considers this association to exist in one half of the cases. (111)

Mr. Alban Doran wrote that pain was a well-recognised symptom indicating necrotic changes in a fibro-myoma of the uterus. He referred to a case that he had observed where the uterus reached to a little above the pubis and had felt painful for about eight months, but there had been no hemorrhage or discharge of any kind. Necrotic fibroid was therefore diagnosed, as, in sarcoma of the uterus, which is also a painful form of tumor, discharge is an early symptom. (111)

Sampson (98), whose work on the vascularity of

fibroids is preëminent, has demonstrated striking features of the fibroids in the pregnant uterus. Fibroids generally have but one nutrient artery but there may be collateral anastomosis, and the venous supply is considerably poorer than that of the surrounding myometrium. The rythmic contractions of the uterus in the puerperium tend to evolve the tumor in the direction of the least resistance, thus freeing the mass from its bed and interrupting or constricting its arterial and venous channels. This leads to red degeneration, necrosis, or liquefaction of the tumor substance. Generally this is an aseptic process. However, infection may have been introduced by manipulation or by means of an ascending thrombophlebitis demonstrable in serial sections.

Of the tumors removed at operation in 29 patients having myomectomy with Cesarean section, 20, or 69 per cent, were found to contain red degeneration, necrosis, and liquefaction. (98)

Paramore (85) states that red degeneration of fibroids is much more common in pregnant than in non-pregnant women. It causes a toxemia (as shown by its effect on the temperature and pulse); it causes pain; and it causes an enlargement of the tumor. Pregnancy is a powerfully exciting cause.

Out of 40 specimens which Bland-Sutton examined

26 were associated with pregnant women (7). Kelly and
Cullen, in théir work on myomata of the uterus, a study
confined for the most part to the non-pregnant, seem
scarcely to have met the condition (57). The toxemia
has been attributed to an infection by pyogenic organ-
isms (staphylococcus). But Lorrain, Smith, and Shaw,
who out of four cases found this organism in two, con-
clude, "that the bacterial infection is secondary to the
occurrence of the thrombosis" (85). Bland-Sutton is
also of the opinion "that microbic infection of red fi-
broids is a sequence and not a cause of the change",
and that "micro-organisms are rarely found in red fi-
broids". He believes the condition is due "to mechani-
cal interference with the circulation".

Whether a toxemia - using that word in its widest
sense - is present in all cases of red degeneration is
not known. Everybody seems agreed that the tumors be-
come enlarged and tender. "Fever", says Bland-Sutton,
"is not a common symptom, but it occurs". The patients,
however, as is plain from reported cases, often become
profoundly ill. "When a pregnant woman complains of a-
cute pelvic pain," says Bland-Sutton, "and the presence
of a uterine fibroid is unsuspected, then grave errors
of diagnosis happen and occasionally unnecessary opera-
tions are performed". Paramore suggests that when fever

is observed only a slight rise of temperature is found.
In a case that he reported the highest temperature re-
corded whilst the patient was in the hospital was 100.6
degrees. The fever, apparently, is usually slight, com-
parable with the fever observed after many operation,
due to the absorption of blood or its products, and
aseptic in type. But that this is toxemia cannot be
gainsaid. It is a mild toxemia, but still a toxemia.
The presence of micro-organisms is adventitious; the
toxemia Paramore refers to is not due to them; they
occasionally complicate the condition which it is de-
sirable to contemplate in its purest form.

The cause of this change is interesting. What we
have to explain is the swelling; the dilatation of blood-
vessels; the diffusion and hemolysis of blood. Para-
more believes Bland-Sutton is right - that the change
is due to a mechanical interference with the circula-
tion. Such an interference may arise in two ways; (1)
it may occur as the result of persistent and spasmodic
contraction of the uterine musculature enclosing a fi-
broid, or (2) it may occur through general increase of
pressure in the abdomen, as in pregnant women.

That increase of pressure is a causal factory in
the red degeneration of fibroids is indicated by the
much more frequent occurrence of the change in the preg-

nant state. The intro-abdominal pressure as Paramore
has shown, is raised in pregnancy, and this increase
influences the blood flow through the abdominal organs.
The arterial pressure is raised, but the capillaries
are more compressed. The venous return, at least from
some parts, is impeded, as shown, for example, by the
bluish discoloration of the vagina.

Jolts and fars must necessarily cause considerable
variations in the intro-abdominal pressure; to meet them
the tonic contraction of the body wall musculature is
increased, so that the average pressure is raised. They
may perahps act by causing a kinking of the veins in
pedunculated fibroids; or, if they stimulate the uterine
musculature to contract, this contraction may obstruct
the return blood from such parts. Such an interference
must cause a turgescence, a dilation of the vessels,
and a swelling of the tumor; the further obstruction
and compression of the tumor, in the presence of a
raised arterial pressure, causes a rupture of capillar-
ies, an effusion of blood, a more marked swelling and
pain. The blood rapidly hemolyses and pigments the
tissues, whilst its products entering the blood stream
cause that elevation of the temperature and rapidity of
the pulse with which everyone is familiar. When such
fibroids are left, the toxemia subsides, as a case
Paramore reported show. (85)

Maury (73) says the symptoms caused by red degeneration vary much in severity in different cases. It is probable that the condition may exist without symptoms. In others, there may be a little pain and tenderness which under appropriate treatment soon subsides or there may be a condition of chronic toxemia and sapremia resulting from the absorption of amine-like bodies or poisons resulting from secondary saprophytic invasion. Again there are the fulminant cases resembling ruptures, ectopic pregnancy, acute appendicities, or torsion of a pedunculated tumor. In these cases, there is sudden onset, acute pain, marked tenderness, rise in temperature, increased leucocytosis, and vomiting.

Red degeneration of a fibroid associated with pregnancy may bring about the clinical picture of an "acute abdomen". (73)

Sneed reported in 1925 that 13 per cent of fibromyomas undergo some form of degeneration and calcification. His studies show that little evidence on the other organs. (103)

Pierson (86) says that fibromyomata may undergo degeneration and necrosis in the puerperium. They may slough into the uterine cavity and become infected.

Windeyer, in his paper on "Fibroids and Pregnancy", writes, "red degeneration or necrobiosis is spoken of

by some writers as being a common complication in pregnancy, but as far as his experience has gone, it was practically never seen". He reports that out of 32,000 cases of confinement, only one myomectomy was performed for a degenerative process in a fibroid occurring during pregnancy. Windeyer states that red degeneration is an exceptionally rare condition in New South Wales (120).

Campbell, in 1933, reported degenerative changes in 75 per cent of myomas removed from the gravid uteri in contradistinction of 7.8 per cent from non-pregnant uteri. (13)

C. CALCIFICATION

Fuge (36) reported a case of calcified myoma during pregnancy, parturition, and puerperium which is very unique.

Calcified myomas are mostly interstitial. The calcification is usually the outcome of a necrosis. It was observed in Fuge's case that the best vascularized part of necrotic myomas underwent the most pronounced calcification. The calcified myomas are very poorly vascularized and thus, it is quite clear that they are not subject to changes during pregnancy, like the other myomas. Also, the danger of infection during the puerperium is less great, for the hard shell affords protection against infectious exciters coming from the outside. It was, therefore, signs of incipient necrosis or suppuration of other myomas possibly present that were watched for in Fuge's case. The differential diagnosis between these and puerperal fever is not always easy. Winter (36), having made a special study of this diagnosis, mentions as the chief symptoms, metrorrhagias, pains, and signs of intoxication. Fever is not necessarily present. Since fever, but none of the other enlarged not sensitive, the case was treated like a puerpal sepsis, and it probably was one favored by the

delayed involution of the uterus due to the myoma.

Mahon believes that necrotic fibromata become absorbed or calcified after delivery without causing symptoms. (70)

D. Hemorrhage

According to Mosher (76), the conditions to be feared in the third stage of labor are: first, hemorrhage, and later, sepsis. Hemorrhage may be immediate, postpartum, or later in puerperium.

Katz (54) pointed out the danger of postpartum and secondary puerperal hemorrhage, associated with the atony of a myomatous uterus, especially in the case of multiple myomas. Fatal hemorrhage of this kind have been observed. If the usual means of hemostasis are futile, only a total hysterectomy saves the situation.

Hamant and Hartemann (45) described a case in which torsion of a fibroid in gregnant uterus was the cause of the bursting of a vein in the fibroid producing internal hemorrhage.

In a case of "Rupture of the Pedicle of a Uterine Fibroma During the Puerperium", reported by Palliez and Gernez (83), hemorrhage was a very serious complication.

E. Torsion of Pedicle

Torsion of the pedicle of a subserous fibroid during pregnancy has been met with in only a few cases; but when it happens it gives rise to serious peritonitic changes, and interstitial hemorrhage(19). (See two cases quoted by Olshausen.(81))

Katz (54) states that there are many factors in a pregnant myomatous uterus that work towards torsion: the weight of a fundic myoma, for instance, favors axial torsion of the uterus itself, and the softened condition of the cervix favors pedicle torsion of a subserosal myoma as, for that matter, of any abdominal tumor at all. Also, changes in the mutual orientation favor torsion, for instance, if the uterus alone ascends, while a subserosal myoma remains in the closer quarters of the small pelvis. All torsions are characterized by a clinical picture of peritoneal reactions. The situation is clarified by laparotomy.

Hamant, and Hartemann report a case of "Torsion of a Large Fibroma During Pregnancy", in which the fibroma was present in the woman before marriage, causing the sensations of weight. It had probably lapsed into Douglas' pouch and could, therefore, not be discovered. When the woman became pregnant, it started to grow and ascended into the abdominal cavity. For unknown reasons,

or rather, under the mere impulse of this growth and
movement, the twisting began gradually, each advance
being accompanied by a painful crisis, because the ped-
icle was rather thick and short. This also favored
circulartory disturbances. One of these was the burst-
ing of a vein and internal hemorrhage. The resorption
of the blood again accasioned pains and thermic reaction.(45)

F. Expulsion of Pediculated Submucous Fibroid

Submucous fibroids which were in the way have been expelled by the advancing head, and this has happened occasionally in the case of tumors which have become polypoid and the stalk has yielded to such an extent as to allow the polypus to come down to the vulva. The stalk has then been cut through or has given way. Submucous fibroids nearly always cause abortion even when, which is very rare, pregnancy has occurred in a uterus which contains one; so the expulsion of a pediculated fibroid during labor is not a common occurrence. Cases have been recorded where inversion of the uterus during or immediately after the third stage of labor has happened, with immediate detachment, spontaneous or artificial. It is conceivable that in some cases where inversion has taken place the state of affairs might not be recognised, and the fibroid might be allowed to slough away, as it undoubtedly would do, with probably fatal result to the woman, during the puerperium. (19)

Dakin has recorded a case of expulsion of a fibroid in labor. There is no doubt that many fibroids in the lower uterine segment, owing to their exposure to pressure and traction during labor, become loosened in their capsules to a varying degree, for, as is well known, such tumors are not infrequently extruded in the lying-in period. (19)

TABLE I

Complications of fibroids arising as result of Pregnancy and Labor

AUTHOR	DURATION of PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
Stevens(107)	?	Thrombosis and Necrosis	Hysterectomy	Uninterrupted Recovery
Blake-Aldrich(107)	Early	Necrosis	Myomectomy	Term Normal
Eisaman(29)	Early	Necrosis	Myomectomy	Abortion – two weeks later
Eisaman(29)	7 months	Necrosis	Hysterectomy	Uninterrupted Recovery
Sampson(98) (20 cases)	Late	Necrosis and Liquefaction	Myomectomy and Cesarean Section	Uninterrupted Recovery
V ineberg(116)	17 days	Large interstitial fibroid	Myomectomy	Term. Dead macerated fetus
Benner(5)	3 months	Necrosis	Myomectomy	Term. Normal
Benner(5)	Term	Necrosis	Cesarean Section Myomectomy	Term Normal
Grosse(41)	4 months	Large fibroid compressing neighboring organs	Hysterectomy	Uninterrupted Recovery

AUTHOR	DURATION OF PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
Totta(112)	2-3 months	Necrosis	Hysterectomy	Uninterrupted Recovery
Maury(73)	4 months	Necrosis	Myomectomy	
Vanderveer(114)	4 months	Cystic Degeneration	Hysterectomy	Uninterrupted Recovery
Vanderveer(114)	4 months	Large Multiple	Hysterectomy	Stormy Recovery
Taylor(111)	7½ inch fetus aborted	Necrosis	Hysterectomy	
Purslow(91)	3 months	Necrosis	Hysterectomy	Uninterrupted Recovery
D orsett(27)	6 weeks	Necrosis	Hysterectomy	
Galabin(37)	4½ months	Large edematous fibroid	Hysterectomy	Rapid Recovery
Davis(22)	8 weeks	Necrosis	Myomectomy	Term. Normal
Basham(4)	2 months	Multiple fibroids	Myomectomy	Term. Normal
Yarros(122)	7 months	Large fibroid Pressure symptoms	Hysterectomy	

AUTHOR	DURATION OF PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
Bonifield(9)	4 months	Large fibroid Pressure symptoms	Hysterectomy	Rapid recovery
Duvillier(28)	10 weeks	Necrosis	Hysterectomy	Favorable recovery
Planeuf(88)	Early	Multiple Myoma Pressure symptoms	Myomectomy	Cesarean Section at term-good recovery
McMurtry(75) 6 cases	Early	Fibroids complicated by pregnancy	Myomectomies	All recovered
Ford(33)	8 months	Necrosis	Expelled spontaneously 6 months P.P.	Breech-healthy child-good recovery
Ford(33)	Early abortion	Necrosis	Curreted away as much as could be reached	Died in few days
Ford(33)	2-3 months	Large fibroid		Term-normaL-decrease in size of tumor
Ford(33)	5 months	Large impacted fibroid-Pressure symptoms	Manual dislodgement	Term. Normal

AUTHOR	DURATION OF PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
Ford(33)	4 months	Large impacted fibroid-causing bladder symptoms	Hysterectomy	Good recovery
B ourman(10)	4 months	Large fibromyoma-Pressure symptoms	Hysterectomy	Excellent recovery
Frank(34)	4 months	Necrosis	Myomectomy	Term. Normal
Bland(7)	5 months	Necrosis	Myomectomy	Term. Normal
Bland(7)	6 months	Necrosis	Myomectomy	Forceps delivery
Bland(7)	6 months	3 tumors Necrosis	Multiple myomectomy	Aborted twin pregnancy
Harris(47)	6 months	Large fibroid	Myomectomy	Abortion 24 hours Subsequent pregnancy and normal delivery
Harris(47)	Early	Sessile fibroid	Myomectomy	Abortion
Harris(47)	4 months	Large fibroid	Myomectomy	Term. Normal
Kosmak(58)	5 months	Necrosis	Myomectomy	Term. Normal
Kosmak	7 months	Necrosis	Myomectomy	Term. Normal

AUTHOR	DURATION OF PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
McLlray(74)	12 weeks	Necrosis	Myomectomy	Cesarean Section at term
Bonifield(8)	5 months	Large fibroid	Hysterectomy	Good recovery
Bonifield(8)	Term	Large fibroid	Cesarean Section later Pan-hysterectomy	Prompt Recovery
Bonifield(8)	4 months	Large fibroid	Myomectomy	Still-born-7$\frac{1}{2}$ months
B onifield(8)	3 months	Large multinodular	Hysterectomy	
Schiller(101)	5 months	Necrosis	Myomectomy	Term. Normal
Worge(121)	3 months	Large fibroid	Myomectomy	Term Normal
Ladin(62)	4 months	Cystic fibroid	Myomectomy	Term. Normal
Ladin(62)	2 months	Pedunculated	Myomectomy	Term. Normal
Ladin(62)	2 months	Multiple myoma	Myomectomy	Continuing with pregnancy several months later
Ladin (62)	3$\frac{1}{2}$ months	Multiple myoma	Hysterectomy	Died
Godlewski(39)	3 months	Necrosis	Myomectomy	Abortion in 30 days

AUTHOR	DURATION OF PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
Papin and Mahon(84)	2 months	6 tumors Necrosis	Multiple Myomectomy	Abortion in 24 hours
Hartemann(48)	8 months	Necrosis	Incised tumor	Term-forceps
Palliez and Gernez(83)	8 months	Ruptured pedi- cle-Hemorrhage Necrosis	Myomectomy	Dead fetus Good recovery
Heffernan(50)	2 months	Large fibroid Retroverted uterus	Uterine Suspension	Term-mid-forceps Myomectomy $3\frac{1}{2}$ months P.P.
Samuel(99)	Term	Calcification	Cesarean Section Hysterectomy	Recovery - good
Devrainge and Arviset(24)	$3\frac{1}{2}$ months	Enormous ses- sile fibroid	Myomectomy	Term Good recovery
Liebman(65)	6 months	Necrosis	Myomectomy	Term-normal Bilaterla Crural Thrombosis 6 weeks later
Liebman(65)	3 months	Necrosis	Myomectomy	Term. Normal
Liebman(65)	4 months	Large fibroid	Myomectomy	Term. Normal
Liebman(65)	3 months	Large fibroid	Myomectomy	Term. Normal

AUTHOR	DURATION OF PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
Liebman (65)	3 Months	Large fibroid	Myomectomy	Abortion
Fuge (36)	Term	Calcification		Spontaneous Delivery
Campbell (13) (4 cases)	Early	Necrosis	Myomectomy	Term Normal
Campbell (13)	Early	Torsion and Necrosis	Myomectomy	Term Normal
Hamant and Hartemann(45)	6 Weeks	Torsion Rupture of Fibroid Hemorrhage	Myomectomy	Abortion 3rd day P.O.
Burger(12)	3 Months	Torsion Necrosis	Myomectomy	Continuation of Pregnancy
Lacomme (61)	4 Months	Large Fibroid Pressure Symptoms	Roentgen Ray Therapy	Term Normal
Lacomme	3 Months	Large Fibroid Pressure Systoms	Roentgen Ray Therapy	Term Normal
Fry (35)	Term	Necrosis	Pt.too weak to stand shock of operation	Died

AUTHOR	DURATION OF PREGNANCY	COMPLICATION OF FIBROID	TREATMENT	RESULT
Fry	Term	Necrosis	Hysterectomy	Recovery
Fry	Premature 7 Months	Necrosis	Antiseptic Intrauterine douches and general support- ing treatment	Gradual Recovery
Benner (5)	Term	Necrosis	C.Section Hysterectomy	Recovery

100 Cases Reviewed

60 Cases of Necrosis	60%
2 Cases Cystic Degeneration	2%
24 Cases Large rapidly growing and Edematous	24%
2 Cases Pedunculated	2%
3 Cases Torsion and Hemmorrhage	3%
2 Cases Sessile	2%
2 Cases Calcification	2%
5 Cases Multiple of Fibroids	5%
	100%

COURSE OF MYOMA IN PUERPERIUM

A. Nutritive Changes

If a fibroid tumor survives the strain of labor without injury, the usual course it adopts is to undergo involution along with the normal muscle fibers of the uterus to such a degree as will bring it down to its bulk before pregnancy. In some cases the tumor is found to have become smaller than it was before pregnancy; and if this process is repeated on several successive occasions, the fibroid may shrink to a quite unimportant size; or it may even disappear, at all events in a clinical sense. (19)

Involution - Pouey (89) reports one case of large fibroma which had not prevented ten normal pregnancies; the fibroma growing smaller with advancing years.

Subinvolution - Watson (119) observed that subinvolution of fibroids after parturition was common when the fibroids were left in situ. He states that in his experience this was usual, although it is generally thought that they atrophy. Many of the patients, who prior to pregnancy had been symptomless, were operated upon months later because of pelvic distress and large fibroids were removed; pregnancy acts, therefore, as a permanent stimulus to the growth of fibroids.

B. Absorption

There are also well-established instances of fibroids disappearing after a single pregnancy. Doran, in a paper in the Obstetrical Transactions (26), cites 37 cases of disappearance, more or less complete, of fibroids, and of these, 13 occurred in connection with pregnancy.

As regards the mode of absorption, partial or complete, it seems at least probable that the myoma cells undergo the same process of involution as the normal cells. It has been stated by many authors that disappearance is brought about by fatty degeneration; but this opinion is not supported by any weight of evidence (Gusserow, 43). It was no doubt suggested in analogy with the fatty degeneration which was supposed to occur in normal involution - a degeneration which is now known to be limited to cases in which some pathological change, usually inflammatory, has affected the uterine muscle. The normal process of involution has been described by Helme (52). He found that although there was some indication of degeneration, partly fatty, in the connective tissue, there was none in the muscle cells, these latter probably disappearing by simple atrophy, i.e., a kind of solution. Many cases have been recorded, however, in which very definite degeneration has taken place in fibroids during the lying-in period.

Hammarschlag (46) asserts from the observation of a
series of cases in his own practice that a myoma under-
goes, in the lying-in period, distinct changes which
often lead to necrosis. He considers that these are
brought about by the sudden cessation of the very free
blood-supply which exists in pregnancy. The fibroid
has, during pregnancy, become a large tumor which de-
mands a large supply of nutrient material. Then, immed-
iately after labor, the retraction of the uterine muscle
surrounding the capsule and of the capsule itself cuts
off this supply; the arteries thrombose and calcify;
extravasations occur and the tissues necrose, and they
sometimes suppurate in places. He fully describes four
cases illustrating this. He believes that these changes
occur apart from injury, or from any perimetritis over
the tumor. In this he differs from Gusserow (43), who
considers such changes, with the fatty degeneration and
pus-formation described by others, as due to traumatism
in labor. Gusserow (43) describes the usual change as
consisting in the formation of a cavernous structure
owing to shrinking of the muscle-cells from the con-
taining framework of connective tissue. The spaces
thus formed are found to be filled with serum. The
final stage is a kind of cirrhosis. It will be seen
that this process is not very far removed from the

normal mode of involution. He quotes Gebhard on this point, and agrees with him.

It will be noticed on referring to Hammarschlag's article (46) that most of his cases had some complication such as great pain in the abdomen, or free bleeding, and the tumors were removed on these accounts; so they must not be considered as material on which large generalizations can be made. Although, therefore, we may admit that diminished nutrition is caused in the way he describes it, we must remember how many cases go through not only one, but many labors, without suffering any of the changes he believes to be so common.

According to Campbell (13), absorption from a degenerating tumor is likely to produce a picture of severe infection beginning one or two weeks after delivery. This may be introduced with a chill, high fever, abdominal pain and tendernedd, scant lochis, and cachexia. A few grayish, gelatin-like fragments of tumor may be found in the lochia. These symptoms may continue at length with prostration and anemia until the tumor has sloughed free from its attachments or has been extruded through the crevix, permitting manual removal, which is a fortunate outcome not always to be expected.

C. Locomotive Changes

Expulsion of the tumor during the puerperium is not
at all uncommon. Dakin has met with two cases; one in
which the tumor was expelled spontaneously four days
after labor, and one where the fibroid presented at the
external os on the 15th day of lying-in, and was removed.
Both tumors were of about the same size - that of an o-
range,- and both were flattened to a thickness of about
one inch. Herman describes a case in which the tumor
presented on the 10th day at the external os, and was
removed three weeks afterwards. When such partially
separated tumors exist, attention is usually called to
them by hemorrhage. The tumor has in a large propor-
tion of instances been found to be partially gangrenous,
and the patient in a good many cases has died of septicemia.

On reviewing the facts which have been accumulated
on the result of the coincidence of pregnancy with fi-
broid tumors of the uterus, one is brought to think
that the tumor is not apt to suffer so often or so se-
verely in labor as might be expected, considering the
somewhat imperfect vascular supply and the disturbances
which must take place in it owing to the diminution of
the total quantity of blood entering the uterus as a
result of the ending of pregnancy, and considering also
the compression and dragging that must, in most cases,
take place during labor.

It would appear from the results of large numbers
of observations that a pregnancy complicated in this
way will in almost all cases go to term, and that the
tumor will survive the stress of labor and the starva-
tion of the puerperium with impunity. Olshausen's case
of spontaneous reposition during the late stage of la-
bor is very striking in this respect. At the same time
there are bound to be cases in which labor is brought
to a standstill by a deep-lying fibroid, and the tumor,
if it cannot be removed from the path must be evaded by
Cesarean section. (19)

TABLE II

Complications of Fibroids arising as result of Puerperium

AUTHOR	PUERPERIUM	COMPLICATION OF FIBROID	TREATMENT	RESULT
Ladin (62)	Puerperium	Necrosis	Hysterectomy	
Ladin	Puerperium	Necrosis	Hysterectomy	Recovery
Campbell 8 Cases	Puerperium	Necrosis	Hysterectomy	Recovery

Of the 10 cases reviewed, necrosis occurred in each
instance, and in each case hysterectomy was advised and performed

TREATMENT

Pozzi, in 1896, wrote that, pregnancy gives a live-
ly impetus to the development of fibrous tumors, and
often causes their edematous softening. The treatment
depends upon the nature of the symptoms and the seat of
the tumor. If it is a pediculated or sessile subserous
fibroma of the fundus, we may hope that it will not in-
terfere with the course of pregnancy. If there is dan-
ger of inflammation or the transformation of the tumor
into a fibrocyst, there is also a hope that it will
disappear during the uterine involution, and we may,
therefore, pursue the expectant treatment. (90)

According to Kelley (55), in 1896, a tumor of the
lower portions of the uterus demands surgical interfer-
ence at sometime of the pregnancy. It may undergo a
softening and become flattened so as to allow the child
to be delivered, but the pressure to which it is sub-
jected is apt to cause a sloughing. Treatment divides
itself into two stages; that before viability of the
fetus, and that in which the child is viable. Under
the first is the endeavor to repose a pelvic tumor by
genupectoral position or under an anaesthetic. This is
certainly to be advised if practicable, and the patient
can be kept under observation and be gotten ready for
operation at a moments notice. Artificial abortion is

to be condemned, unless it is utterly impossible to get the consent of the patient for a more radical operation. A fibroid of the cervix or a pedunculated submucous one may be enucleated per vaginam at any stage of the pregnancy with little serious danger or abortion or of loss of blood at term.

If the tumor is situated above the cervix, two operations stand paramount; myomectomy and hysterectomy.

In a report of "Three Cases of Uterine Fibroids complicated by Pregnancy", in 1896, Rosenwasser believed that each case should be considered on its own merits and should be managed in accordance with the bests interests of the mother and, where possible, also of the child.

If the fetus must be sacrificed the choice lies between abortion and hysterectomy. Rosenwasser believed the latter to be less dangerous than the former. He believed that accidents attending hysterectomy were more controllable than were the complications of an abortion, in which hemorrhage might become fatal from inability of the uterine muscle to contract, or the fibroid might slough and lead to sepsis. (97)

Two years later Coe (15) wrote, "Should the tumor not be discovered until the latter half of pregnancy, it would seem better, in the absence of serious pres-

sure-symptoms, to wait until near full term, and then to perform a Cesarean section, followed by supervaginal amputation, subject, of course, to wishes of the patient.

The abdominal is preferable to the vaginal route for the exterpation of the pregnant fibroid uterus. (15)

Ford (33), in 1900, said, a fibroid tumor of the uterus does not necessarily imperil life. Its position, its size, and the rapidity of its growth are factors that must be taken into account when advising as to what treatment, if any, is necessary. Complications that arise because of pressure symptoms, or because of hemorrhage, or from degenerative changes often demand radical measure.

A small fibroid in the top of the womb may remain for years without doing any special harm; whereas a growth of some size on the side or base of the uterus might give serious trouble. Again, the same small fibroid embedded in the body of the uterus and projecting into its cavity so that its capsule is ruptured, may cause such troublesome and persistent hemorrhage as to warrant hysterectomy. A soft myoma may give no pain, and yet increase in size so rapidly as to endanger the life of the patient, which would warrant a myomectomy or hysterectomy. (33)

Cumston advocated myomectomy, in 1901, by abdominal

incision during pregnancy for large subserous or inter-
stitial fibroids of the corpus uteri, whether they be
in either case pedunculated or not. As far as Cumston
was able to determine, no definite rules could be for-
mulated at that time as to the indications for abdom-
inal section in these cases, for the very simple rea-
son that every instance is a law unto itself and, there-
fore, each one requires the weighty consideration of
the surgeon. (18)

Routh and Spencer agreed that Mr. Malcolm's method
of removal of fibroid tumor during pregnancy by abdom-
inal section in 1904 was correct. However, they believ-
ed that during puerperium all sloughing or extruding
fibroids should be removed per vaginam, and if other
intramural fibroids were infected, death could only be
averted by pan-hysterectomy. (71)

Mr. Doran observed that in 1870 no operation would
have been performed, and in that case it was not impro-
bable that the necrosed fibroid would have been expell-
ed through the vagina. Had it been discharged in its
entirety, the true condition would have been recognis-
ed, but if it had come away slowly and piecemeal in dis-
charges, without the doctor's knowledge, the case might
have been described as an instance of "Absorption of a
Fibroid". (71)

While indiscriminate operation in uterine fibromyomata associated with pregnancy was not advised by McMurtry (75), the mortality of this condition unaided was so great as to justify an extension of the field of operative treatment, both myomectomy and hysteromyomectomy.

In the acute cases where urgency is produced by rapid enlargment, fever, and toxemia, Schiller (1918) advises abdominal section. Whether myomectomy of hysterectomy should be selected depends on the surgeon and condition present. Often the operation, on account of the uncertainty of the symptoms, possibly without suspicion, even of the presence of the tumor, will have to be done without a definite diagnosis. (101)

Guggisberg (1921) advocates operative measures at once when the necrosis of a myoma is suspected. Sudden development of pain and symptoms of peritonitis with known myomotosis of the uterus calls at once for surgical intervention, but with more chronic onset each case has to be decided for itself. In any event, the necrotic myoma must be removed at once after delivery.(42)

Mosher (1926) says all tumors injured during labor, or showing marked signs of degeneration, should be at once removed. (76)

The case to be treated by myomectomy is one with torsion of subserous fibroid, with necrosis, or a

prolapse of subserous fibroids in the pelvis, or an anterior fibroid forcing the uterus into antiflexion, and likely to cause abortion. Myomectomy, which Lynch (1926) calls "a surgical curiosity", limited certainly to a narrow field, should only be considered as a conservative measure in young patients. (68)

No interstitial fibroid with pregnancy should be removed by myomectomy, nor one which involves an opening through to the membranes. Statistics vary as to abortion following myomectomy. No single surgeon has sufficient experience to make his individual findings valuable, according to Mosher (76). However, as Marshall (72) says, myomectomy, even if it is followed by abortion, leaves the patient with her uterus for possible future pregnancy.

Vandescal (1928) admits that myomectomy is indicated in certain cases, these being as follows (115):

1. When the fibroid is large and is diagnosed early during the pregnancy, before the third month, and when the swelling of the tumor is easily distinguishable from that of the uterus. By performing myomectomy at this time all possibility of complications is avoided, during both the pregnancy and the labor.

2. At any time during the pregnancy when unmistakable signs of necrobiosis of the fibroid appear. Ne-

crobiosis is indicated by the tumor becoming acutely
painful and frequently softer in consistency. This is
often preceded by hypertrophy of the fibroid, and at the
same time there are signs of peritoneal reactions such
as vomiting, abdominal rigidity, and a weak pulse.

3. When there is torsion of the pedicle of the tumor, the symptoms of this occurrence being severe and
lasting pain accompanied by the symptoms of peritoneal
reaction mentioned above.

4. When the fibroid causes pressure on the neighboring organs, the chief of these being the bowel (occlusion), the ureter (hydronephrosis, pyelonephritis,
or anuria), the urethra (retention of urine), and the
veins in the pelvis, causing edema or thrombo-phlebitis.

According to Vandescal, with the exception of the
foregoing, there are no indications to justify a myomectomy during a pregnancy, although it is admitted
that such an operation may be successful in other cases.

As for the operative technique, the main points
for consideration are as follows:

1. General anaesthesia is preferable to spinal
anaesthesia, the reason being that in the latter the
contractions of the womb are not suppressed, and are
even exaggerated.

2. The tumor should be decapsulated by a single

incision running over its summit, and not removed by a circular incision around its base. This allows easier decapsulation of the tumor, and, also, easier closing of the peritoneaum afterwards.

3. All bleeding must be carefully stopped. The best method to employ is to understitch the bleeding point with thick catgut; this must be tied loosely to avoid cutting through the tissue.

4. No drainage should be employed.

5. Morphine should be given in large doses during the three days following operation; Vandescal gives 1/6 grain every six hours. (115)

According to Godlewski (1929), the enucleation of a fibroma does not prevent the renewed formation of fibrous tumors. It is in fact very rare for a localized fibroma not to be associated with disseminated fibrous lesions in the uterine wall. During a pregnancy, any of these fibrous foci may undergo hypertrophy, transient or, at least, curable. Two or three months after the delivery, no trace of fibrous exuberance can be palpated. Nevertheless, the fibrous lesions persist and in some cases, manifest themselves after years, by hemorrhages, indicating hysterectomy. (39)

Brindeau (1929) says, "many surgeons do not approve of myomectomy during pregnancy" yet he himself believes

that if they could be convinced that it is benign both
as to enucleation of the tumors as well as for the con-
tinuation of pregnancy, many patients would avoid hys-
terectomy. (11)

Brindeau (1929) writes: "Contraindications to oper-
ation concern only the state of the myoma itself; infec-
tion at the moment of intervention; elevation of tempera-
ture with rupture of membranes; fetid condition of the
contents, putrefaction of the fibroma; coexistence of
peritonitis. In these cases, hysterectomy is certainly
indicated. There is, also, the impossibility of assur-
ing hemostasis or predicting the presence of placenta
praevia on the same face as the uterine myoma. (11)

Benner (1930) was convinced that treatment of fi-
broids, both in pregnancy and in labor, should be con-
servative. Myomectomy during pregnancy may be perfor-
med on account of degeneration, torsion, impaction, or
large size of the fibroid, but indications calling for
this operation do not occur very often. (5)

Heffernan (1930) reported a case of retroverted
myomatous uterus during pregnancy in which he did a
suspension at 2 months. At that time the tumor was as
large as a grapefruit. The patient went to term and
had a mid-forceps delivery. A myomectomy was performed
at $3\frac{1}{2}$ months postpartum. Heffernan did not give ergot

and pituitrin as per usual for fear of necrosis of the
tumor. (50)

Katz (1930) gives very definite indications for
active therapy. Except under definite indications
(necrosis, suppuration, torsion, incarceration) the
therapy is expectative. The active therapy is conser-
vative with regard to pregnancy and uterus. The res-
trictions fefer to intramural myomas, whose conserva-
tive enucleation would leave large wound cavities which
require suturing. Also, Cesarean section for myomatous
dystocic indications should be followed by amputation,
under certain circumstances even by total hysterectomy.
All these operations should, as a rule, be performed
by the abdominal route, as, for that matter, the Cesar-
ean section, especially if the bag of waters is rup-
tured and the fluid gone. The vaginal operations should
be reserved for pedicled or otherwise easy myomas, pro-
vided the surgeon has experience in operating vaginally.
Enucleation and conservation of the uterus after Cesar-
ean section is perhaps permissable in a young and other-
wise healthy woman, if the node is unique and easily
accessible. Also, the complications in the third stage
and during the puerperium require partial or total
hysterectomy, whether vaginal or abdominal, depends
upon the situation. If the myoma remains inert during

the puerperium, there is no indication for any subsequent treatment whatsoever. Nor must pregnancy be avoided. (54)

Katz believes, if a woman with a myoma conceives and can be launched safely through pregnancy and childbirth, the ultimate sacrifice of an inferior organ is not too heavy a price. It is by all means preferable to leaving the uterus in a condition which renders a possible next pregnancy a vital hazard, as by enucleation and suture. (54)

Planeuf (1930) advocated the practice of myomectomy during pregnancy in the presence of pain, aseptic necrosis, compression of the bladder and rectum, torsion of the pedicle, for incarcerated retroversion of myomatous uterus. (88)

Lacomme (1931) reported two cases of Roentgen ray therapy for fibroids of the uterus during pregnancy with parturition at term. These cases are of special interest to both the gynecologists and the obstetricians. (61)

Mahon (1933) strongly condemns radiotherapy for fibromata during pregnancy as it is dangerous to fetus and itself favors necrosis. He characterizes abortion as a foolish procedure as **it** saves the pathological lesion and destroys the normal pregnancy. He states that

if any intervention is to be undertaken, it should be surgery. The only operations to be considered are hysterectomy and myomectomy. Hysterectomy has a mortality of 2.5 per cent and sacrifices both baby and uterus. Myomectomy allows continuation of the pregnancy, but has a mortality of from 15 to 25 per cent. He states that, according to his experience, medical management with bed rest and the application of ice has no mortality.

Mahon concludes with the statement that the majority of women with symptoms of necrosis of fibroids during myomectomy and hysterectomy should be done during pregnancy only when there are menacing symptoms such as those due to torsion of a pedunculated fibroid or threatened rupture of the uterus. (70)

Danforth (1934) believes that myomectomy during pregnancy is, in most cases, unwise. He prefers to leave the tumor and deal with the situation presented by the pregnancy and the fibroid on its merits at term. Attempts to enucleate growths from the wall of the pregnant uterus are often accompanied by severe bleeding which is difficult to control. A deep-seated tumor, if removal is attempted, involves the risk of opening the uterine cavity. Conservation during pregnancy is the safest course. (21)

Myomectomy during pregnancy, in spite of successful operations, should be reversed, Eisaman (1934) believes, for those cases with a history of past abortions and should be performed, if possible, after the third or fourth month when the placenta is will formed. The danger of later uterine rupture through the myomectomy scar offers an academic objection to operation, but, in view ot the many patients safely delivered after myomectomy, the number of such accidents must be small. (29)

Rhemann (1935) believes fibroids should be operated during pregnancy if symptoms occurr, even if an abortion should follow it, as the patient can again become pregnant. Fibroids which are cervical should be removed, because these endanger the pregnancy and frequently necessitate removal of the uterus. If, during the puerperium, fibroids undergo necrosis and infection, an operation should be performed. Women who have myomectomies during pregnancy should be delivered in a hospital. (95)

Greenhill (1935) says, treat a mild case of necrosis expectantly. Postpone operation, even though the fibroid is infected, until the acute symptoms have subsided and the patient has developed her local and general immunities. (40)

Studdiford (1935) declares the necessity for operative intervention because of degenerative changes in fibroids during pregnancy is rare. Cases with large fibroids, usually in elderly women, are best treated with Cesarean section and hysterectomy, if carried to term. These patients are fortunate to have reached term and are not likely to carry another pregnancy this far.

In few instances, Cesarean section and myomectomy may prove practical. (108)

CONCLUSION

The frequency of pregnancy complicating fibroids
is .72 per cent. The average age of the patients stu-
died was thirty-five years; the extremes being nineteen
and forty-three years. Forty-six per cent of these pa-
tients were primigravids.

Kross (1921), from a large series of experiments
on rats and a review of the literature, concludes that
pregnancy of itself does not necessarily alter tumor
growth rates. (59)

Litzenberg (1923) believes that there is a rapid
increase in the size of myoma during pregnancy, especi-
ally of the interstitial variety, and believes that
they decrease in size during the puerperium. (66)

Emge (1934) believed that the tumors which actual-
ly increased in size while under his observation, did
so at a rate equal to the enlargement of the uterus.
He was convinced, also, that most fibroids, with the
exception of some pedunculated tumors, regress very
materially during the puerperium, some to very insig-
nificant size and others to a point where, some months
after delivery, they no longer can be felt.

His observations left him with the impression that
in subsequent pregnancies, fibroids often fail to en-
large, or that the degree of enlargement is consider-

ably less than that of the first gestation. (30)

Below is a table of the various complications of
fibroids encountered during pregnancy, labor, and puer-
perium, as reported in 100 cases taken from the liter-
ature. Necrosis and rapidly-growing (edematous) tumors
were the most frequently encountered complications.

100 cases reviewed

60	cases	of	Necrosis	60%
2	"	"	Cystic Degeneration	2%
24	"	"	Large, Rapidly-growing and Edematous	24%
2	"	"	Pedunculated	2%
3	"	"	Torsion and Hemorrhage	3%
2	"	"	Sessile	2%
2	"	"	Calcification	2%
5	"	"	Multiplicity of Fibroids	5%
				100%

From the 100 cases reviewed, a very interesting
observation is made, as shown in the table below. Most
tumor complications arise early in pregnancy, i.e.,
from two to four months.

Duration of Pregnancy	Cases
17 days.	1
6 weeks.	2
2-3 months	19
$3\frac{1}{2}$-$4\frac{1}{2}$ months	16
5 months	5
6 months	4
7 months	5
8 months	3
Term	7
Early (Probably 2-3 months).	16
Late (Probably 5-7 months)	20
Unknown	2
	100

It is quite generally-agreed that the pathology of myoma in pregnancy will be indicated by pain, hemorrhage, or signs of degeneration. Rise of temperature, or high leucocytosis, being evidence of the latter.

If the tumor be situated at the brim, so as to constitute absolute, or even relative dystocia, and becoming subject to great trauma, operation is to be considered, either by myomectomy or hysterectomy, according to the condition encountered. Abortion is not to be considered as an expedient in case of a pregnancy complicating fibroids on account of increased risk of hemorrhage, traumatic injury, and septic infection.

Most authors agree that myomectomy during pregnancy is indicated in the presence of pain, aseptic necrosis, compression of the bladder and rectum, torsion of the pedicle, for incarcerated retroversion of myomatous uterus.

Statistics have proven that myomectomy is a safer operation than hysterectomy in non-pregnant uteri. It would seem to be a simple surgical axiom that the same principle should be applied to fibroids in pregnant uteri to avoid additional complications attendent on pregnancy, labor and the puerperium. The only exceptions are in cases of pregnant women of advanced years, who are anxious to be delivered at full term and, rather

than submit to myomectomy and possible abortion, are willing to go through with the uncertainities, risks, and dangers that the expectant plan entails.

No doubt Cesarean section is done in many instances without ptoper indications.

The great majority of cases of fibroids in conjunction with pregnancy run a favorable course, after the immediate danger of postpartum hemorrhage. The tumor rapidly diminishes in size, and in some instances has seemed to disappear, or become so small as to be no longer palpable.

Each case must in every instance be individualized and the result is dependent on the judgment and skill of the operator.

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