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PREGNANCY AND TUBERCULOSIS

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SENIOR THESIS 1936
INTRODUCTION

The literature continues to yield its contributions to the perennial problem of the relation of pregnancy and tuberculosis. As usually presented, the question is, "Does pregnancy have any effect, deleterious or otherwise, upon a tuberculous process concurrently present in the female body?" The present data as revealed in the periodicals, which attempt to settle opinion, indicate the problem is still unanswered.

From a brief survey, one is impressed by the apparent lack of definition of subject matter. Most writers are inclined to lump their writings under pregnancy, yet wander from its limits. To the mother, pregnancy, labor, and the puerperium are three distinct events. Consecutive, yes, but physiologically decidedly defined.

In trying to "pigeon hole" the whole problem, pregnancy is too often assumed to act as a constant in its influence on the tuberculous. Who would not criticize such a statement in regard to bodily economy in the pregnant non-tuberculous?

Again, one is chagrined to find the "specialist" in each condition holding divergent views. Stranger still, these views are the opposite of those which they might well be expected to hold.

In the following paper, no attempt is made at originality. The bulk of the matter is taken from articles of the various contributors. Fortunately, no conclusions are required. However, the writer hopes some value may be re-
turned to the reader, by a logical presentation of the material by which one can in some measure evaluate the subject.

---G. T. A.
HISTORY

1. General

There is no doubt but that tuberculosis was recognized several hundred years B.C. Hippocrates, about 460 B.C. gave a rather definite and fairly vivid description of it, and about 30 B.C. Colsus describes three different varieties: the atrophic, the cachetic, and ulcerative. (1) Hippocrates referred to tuberculosis as "the greatest and most dangerous disease and one that proved fatal to the greatest number." Aristotle mentions that the Greeks believed that the disease was contagious. (2)

Some writers consider that Moses had a practical knowledge of tuberculosis when he said to the children of Israel (about 1500 B.C.), "I will even appoint over you terror, consumption, and burning ague, that shall consume the eyes", and again, he threatens them, "The Lord shall smite thee with consumption." (1)

Galen (150 A.D.) considered all pulmonary conditions as ulcerations, with the exception of lobar pneumonia. The ulcerations of the lungs were treated as surface ulcers, but he did recommend that all persons of this affliction live in high altitudes. He also specified bed rest, restricted conversation, and restraint of cough. (3) It was in 1655 that Thomas Sydenham revived Hippocratic methods of observation and experience. He was the founder of epidemiology and advocated fresh air and horseback riding for consumptives. (4)

Sylvius in 1695 was the first to indicate any
connection between tubercular nodes and pulmonary phthisis. Morgagni, in 1771, was first to regard the disease as infectious and taught that it was dangerous to perform autopsies on tuberculous patients. Stack, in 1785, gave the first accurate description of miliary tuberculosis and up until 1800, phthisis was thought to be antecedent by scrofulous glands. The disease was not recognized in any other organs but the lungs until about 1793 by Baillie. Laennec, in 1819, described the pathology and physical signs of the various stages of the disease, and was the originator of the stethoscope by which more accurate auscultatory findings were made possible. Klencke, in 1843, made the first successful inoculation of a rabbit with tuberculosis by intravenous injection.(2)

Some of the theories immediately antedating the discovery of the causative agent in tuberculosis were most ingenious. Williams, in 1857, in a consideration of the theories present at that time refers to the tubercle as, "A degraded condition of the nutritive material from which old textures are removed and new ones formed; and differing from plasma not so much in kind, as in degree of vitality, and capacity of organization." "A peculiar irritability of the lungs must occasion inflammation in them, and that, as the plasma is deficient in healthy fibrin, and the tissues wanting in their normal formative power, the materials which should have been appropriated, fail to be organized and degenerate in tuberculous matter."(5)

Aufrecht (1881) and Baumgarten (1883) independently
of Koch, described bacilli in the centers of tubercles, but did not prove that they were the infective and active agents.\(^{(2)}\)

Robert Koch's original paper as delivered in Berlin (1882) was of tremendous significance. Although many justly renowned men were never completely won to Koch's work, it was in this paper that he published his four famous postulates, and his work was so well planned and convincingly beyond doubt that the concept of tuberculosis immediately gave rise to a new field in medicine.\(^{(6)}(7)\) Krause has more romantically said, "Such work as his converted incense-burning priests to sure-eyed ministers of health.\(^{(8)}\)

American physicians gave a cool reception to Koch's work. Some receptive minds, such as Trudeau, further inquired into the matter and added further information. Doctor Trudeau published his first work in 1885, and established the first sanatorium for the treatment of tuberculosis at Saranac Lake in 1884.\(^{(9)}\) The first like establishment founded in the old world was due to the zeal of Philip, in Edinburg, in 1887.\(^{(10)}\)

The vast amount of investigation, research, and public education which followed such beginnings is well known. Within thirty years (1900-1930) tuberculosis was claiming less than half the victims from a population one-third greater than formerly.\(^{(11)}\)

2. Specific History

In reviewing the literature of pregnancy in the tuberculous it is interesting to note that since the time of Hippocrates, pregnancy was believed, for many years, to exert a favorable influence on tuberculosis. This was probably due to the tendency of the patients to increase in weight in
the first trimester. According to De Lee when pregnancy occurs in the tuberculous woman, very frequently, even in those cases in which pregnancy ultimately exerts an unfavorable influence, no deleterious results occur, or at least become manifest, during the early months of gestation. (12)

A somewhat dissenting note is given by Ernst Horn, in an exceedingly interesting paper written in 1804. (13) Horn laid stress upon the fact that the weakening periods in the puerperal state are often indicative of true consumption. Among the causes that predispose to phthisis in the puerperium and during pregnancy, he mentions weak digestion, incessant vomiting, diarrhea, poor or insufficient food, unpleasant disposition, and worry over the coming addition to the family. He discusses the likely signs and advocates, weaning the newborn and outlines a quite rational treatment for phthisis.

Warren (1857) in a prize essay written on pregnancy and tuberculosis, by argument and citation of numerous authorities and statistics sought to prove:

1. "There is an inequality in the relations which men and women sustain to phthisis; the former being less liable to it than the latter".

2. "This inequality depends upon certain differences of configuration which are plain, palpable and conspicuous".

3. "An examination of phthisical statistics should show that the difference in the relative mortality of the two is plain, palpable and conspicuous as their original dissimilarity of constitution and predisposition".

4. "An examination of statistics proves that it is not a
settled fact that more females are destroyed by this malady, and that there is a positive approximation towards equality in the effects of phthisis upon the two sexes. This approximation towards equality shows the operation of some great equalizing cause, by which a certain amount of protection is secured to the female system, that makes up for its greater original susceptibility and affects the general result in the manner alluded to above. Pregnancy complies with all the conditions which the cause demands for its operation, and it is fair to attribute the protecting, preventing, and equalizing effect to its influence upon the female system".(5)

Grisolle (1850) called attention to his beliefs that pregnancy was deleterious to the tuberculous.(14) However, Stone, in an incomplete examination of the literature in 1871, could find but two men who rejected the belief that pregnancy is unfavorable to the deposit of tubercles. To quote, "The authorities accepting the theory of antagonism between pregnancy and tuberculosis being too numerous to mention.(15)

The controversy became more pronounced when Labert, in 1872 observed that there was an increased death rate in pregnant women. Ruehle, in 1873, was the first to explain that there might be an apparent arrest of disease early in pregnancy, only to be followed by a fatal termination soon after the birth of the baby. He further observed that the oftener pregnancies occur and the shorter the interval between them, the surer it is to be fatal.(14)

Though the majority of opinion changed to the belief that pregnancy was deleterious to tuberculous women, the question has never been satisfactorily answered.
INCIDENCE, FERTILITY AND DIAGNOSIS

1. Incidence

Tuberculosis complicated by pregnancy is admittedly common, but statistics and figures of authenticity are exceedingly scarce. In one of the German obstetrical clinics 150 cases were reported in eighteen years. In another, 26 cases in 4000 pregnancies. Contrast this dearth of material with the known prevalence of tuberculosis and that most are sexually active and one is forced to conclude that most cases escape notice. (16)

In 1913 Bacon stated that 32,000 tuberculous women became pregnant annually in the United States and that 44,000 to 48,000 women of childbearing age die of tuberculosis every year. (17) According to Norris, 25 percent of the latter have reached the puerperal state, or 11,000 to 12,000 tuberculous pregnant women die annually. (2)

Brachman from his work estimated that 1 percent of apparently healthy young adults have tuberculosis. (18) Floyd speaks of 5 percent of all cases of pregnancy as being complicated by tuberculosis of the lungs, and that of these about 1 percent or one-fifth are active. (19)

In 1400 consecutive entries into the obstetrical department at Johns Hopkins, 134 were adjudged tuberculous. No classification as to age, color, decade of disease, or type of constitution was made. Yet this number corresponded closely to the rate of tuberculosis as reported by Baltimore's practicing physicians, which is in all probability definitely below actual figures, but is interesting in that this shows
no increase in gestation. However, with all the reports it will probably be conceded that figures gathered from the actual experience of anyone man or group are not in themselves conclusive. (20)

2. Fertility

Due to the frequency with which pregnancy occurs in the tuberculous, many observers have been led to believe that people so affected are unusually fruitful and that as a result of the disease the sexual appetite is increased. In 1924, Kacprazak studied the mating of 9,855 persons, which resulted in 49,031 pregnancies. Considering the duration of life, he found that there was a greater fertility among the tuberculous than the non-tuberculous individuals, no matter whether one or both parents were affected. (21)

Other writers have contradicted the existence of increased fertility. Instead, prominence has been directed to other conditions resulting from tuberculosis. Wilkes says an increased sex desire is erroneous. Instead, there is a condition of hyper-excitability or nervous tension. The patient has very little else to think about. An undue prominence has been given to a few individual cases. In general, Wilkes concludes, ability is diminished in proportion to the amount of debility of the patient. It is probably greater in amount than in other debilitating diseases. (22)

Matthews and Bryant in a study of obstetrical and gynecological histories of 1000 women discharged from Trudeau sanatorium have also obtained some information on this problem. Of the group, 484 answered satisfactorily enough to make possible some conclusions. Their Trudeau women had
hardly more than half as many pregnancies during marriages lasting fifteen years and losses occurred at two times the normal rate. (23)

White in his practice at a health resort has commented on the frequency of pregnancy in the tuberculous. He thinks this is due chiefly to an increased sex desire resulting from an inactive life, high caloric diet and slightly elevated temperature. (24)

Tuberculosis itself is essentially a disease due to faulty hygiene; the latter is the most common among the ignorant and poor, a class in whom fertility is notorious. Although fertility among the poor is probably the result of ignorance regarding the methods of contraception, the fact remains that pregnancy and tuberculosis frequently exist together.

3. Diagnosis

It is not intended in this writing to furnish the details of diagnosis of either pregnancy or tuberculosis. These are presumably familiar to most practicing physicians. Early diagnosis is of double importance in these coexisting processes if treatment is to be of utmost value, no matter the therapeutic beliefs of the attendant.

It is becoming more and more evident that a complete medical knowledge of the pregnant woman's condition is essential. She should be regarded as a sick woman, or perhaps it would be better to express it in this way. Facing, as she does, risks over and above those of her non-pregnant sister, every effort should be made to see that she is organically sound. It cannot be too strongly emphasized that the careful
examination of the lungs is as important as similar examination of the heart and kidneys. This is the most certain means of obtaining information of importance relative to the lungs. Thus exposure to tuberculosis in the family, a past history of hemoptysis, pleurisy, or fistula in ano, point strongly to the presence of a pulmonary lesion. Keeping in mind the fact that the examination of lungs in women with such a history is often inconclusive, one should not assume that in the event of a negative or doubtful examination, this woman can be passed as normal. These danger signals are of utmost value, and if heeded will often enable the physician to take cognizance of symptoms developing during the course of pregnancy which he might otherwise ascribe to the pregnancy. (25)

The diagnosis of pregnancy during the early weeks is not always easy and especially is this so in the tuberculous. The suppression of menstruation may be attributed to the tuberculous condition. Slight pulmonary hemorrhage may be regarded as vicarious menstruation. It may be two or three months before the physicians awakens to the fact that he is dealing with pregnancy complicating a newly developed active tuberculosis. (26)

The menstrual period cannot be depended upon, since many tuberculous women are irregular and miss one or several periods without significance. The symptoms of nausea and vomiting and other digestive disturbances are not diagnostic, because many women who are slightly toxic from the infection may have these symptoms. White calls attention to two early indications. First, as early as the fifth or sixth week there
can be felt on the anterior wall of the uterus a soft spot which pits on pressure as does the edematous leg. The second is the test as described by Bullock, which in brief is as follows: In the pregnant woman an artificial acetonuria is found, after eight or nine hours fasting following a meal rich in fat, while in the non-pregnant woman at least forty eight hours are required to produce this condition.(24)

Many other points are of value in diagnosis, both of pregnancy and tuberculosis. In spite of the difficulties encountered at times, diagnosis is chiefly dependent upon awareness to the possibilities. Brachman advises an X-ray of the chest of all pregnant women irrespective of the presence or absence of symptoms or abnormal physical signs.(27)
1. Influence of tuberculosis on pregnancy

The question of sexual desire and fertility in the tuberculous has already been discussed. There is little doubt but that tuberculous women are quite as likely to conceive as is the normal woman, unless there is tuberculous involvement of pelvic organs and resultant blocking of the passages. After conception has taken place, the tuberculosis has little influence on the course of the pregnancy per se. As the result of excessive coughing, progressive anemia, or hyperpyrexia; abortion or premature labor may occasionally occur, but this is comparatively infrequent. The tuberculous gravida is probably especially prone to develop such complications as renal disturbances and gastric disorders. (2) Ferguson has reported toxemias in the high proportion of 14.5 percent. (28) As has been stated, in advanced cases, abortion or miscarriage occasionally occurs, and this is especially likely to take place just before a lethal termination of the disease, and in the event of laryngeal involvement. There is some basis for the thought that the tuberculous patient is more likely to have a post-partum hemorrhage. Matthews and Bryant report an incidence of 13 percent in 484 pregnancies. (23) Ferguson also supports this figure which is about six times the normal incidence. (28)

2. Influence of tuberculosis on the child

One cannot discuss the influence of tuberculosis on pregnancy without some reference to the child. Evidence of placental infection with tubercle organisms is quite readily found. (29) True cases of congenital tuberculosis
are more uncommon. Warthin, in 1907, in a review of the literature could find only five well substantiated cases.\(^{(30)}\)
Since that time the condition has been reported quite frequently. Baldwin, Petroff, and Gardener stated that 60 cases were to be found in the literature in 1928.\(^{(31)}\) It is to be emphasized then, that congenital tuberculosis does occur occasionally in man, the condition being so rare, however, that for practical purposes it need not receive serious consideration.

The question as to whether or not the children of a tuberculous mother exhibit a greater or lesser susceptibility to this form of infection is of much greater importance, and is, unfortunately, still an unsettled problem. Formerly, it was thought that of the 10,000 children under five years of age who die annually in the United States of tuberculosis, 7,500 or 75 percent were born of tuberculous mothers.\(^{(17)}\) Parry thought 50 percent of the children born of tuberculous mothers died during the early months.\(^{(32)}\) Trembley thought these offspring weak and displaying a tendency to tuberculosis.\(^{(33)}\)

Modern data seems to concur only to a limited extent. Other causes of such a high mortality in the children of tuberculous mothers have been pointed out. The death or invalidism of the family leading to inadequate care and the fact that the mortality of bottle fed babies is notoriously high.\(^{(2)}\) In other words, it does not seem probable that tuberculosis exerts any specific action on the infant other than would be produced by any other weakening condition. In one study of 579 children born of tuberculous mothers, 556
were alive; 501 being of average health or above, 55 were below par, and only nine were suspected of tuberculosis. (23)

3. Influence of pregnancy on tuberculosis

In order to understand the relations occurring between the two conditions, one must first look to the non tuberculous parturient in order to discover those processes most likely to influence tuberculosis. Some dissention occurs over the classification of the uncomplicated pregnancy. De Lee believes that though pregnancy and labor should be a normal function, that they seldom are. (12) Most men regard pregnancy as a normal physiologic state in which extraordinary demands are made on the patient's metabolism, but for which the organism is usually prepared to make necessary adjustment.

These excessive demands are reflected in various ways. Calcium, iron and iodine metabolism is increased. There is a hypertrophy of the parathyroids reflecting the drain of calcium. A pregnant woman's basal metabolic rate during the later months is 30 percent higher than that of the non-pregnant woman. There is a relative deficiency of liver glycogen which is most marked in the early weeks. The renal threshold for sugar is lowered, with a resulting glycosuria. The capacity of the kidneys declines progressively during the last twelve weeks, with the result that every woman definitely drops toward the toxemic level of urine volume during the latter part of gestation. As to the blood, there is a diminution of red blood corpuscles and an augmentation of fibrin and of water content with about normal albumin.
There is a definite increase of cholesterol and a decrease of lipase in the blood stream. An encroachment on the cardiac reserve is always demonstrable in pregnancy. The entire circulation is upset, the pulse is quickened, and the blood pressure raised. The physical changes induced by pregnancy are calculated not only to stimulate metabolic activity, tax glandular functions and burden the eliminative mechanism, but to increase the rate of respiration. (28)(12)(2)

To determine the influence of these physiologic changes upon the woman with pulmonary tuberculosis has been the object of many studies. Through these some advance has been made, in many instances the results are inconclusive. Some of the factors involved are the following:

1. More or less vomiting occurs in 50 percent of pregnant women. This is especially likely to occur in neurotic subjects and during the early months of pregnancy. When violent straining occurs, the blood pressure is raised and unusual pressure is exerted upon the lung tissue. All who have studied pulmonary tuberculosis agree that the phthisical patient requires an abundance of nutritious food. If sufficient food cannot be taken or assimilation is interfered with there is naturally a general loss of resistance. (34)

2. Norris believes that the circulatory changes have little influence upon the tuberculous other than as a part of the general resistance. (2)

3. In the later months of pregnancy, when the basal metabolic rate is most increased and an increased respiratory rate is expected, Brachman has shown that advancing pregnancy
results in the elevation of the diaphragm similar to that following a phrenic nerve crushing. The rapid increase of disease following labor may be due to the subsequent lowering of the diaphragm. (28)

4. The question of demineralization has been given much consideration. There is at times a change in the calcium, potassium ration the pregnant tuberculous woman in the form of a calcium deficiency, which according to bio-physical interpretation, means an increased activity of the tissues. This has been pointed out as making the patient more susceptible to injurious influences. In an effort to supply calcium to the growing fetus some observers even cite instances in which they have noticed the absorption of calcium to take place from areas of healed tuberculosis in the lungs with consequent reactivation of the lesions. Stewart and Percival state that the calcium demand in pregnancy increases from .006 grams per day in the early months, to .6 grams at term. Tuberculosis itself may also be accompanied by a calcium deficiency thus making necessary compensation more difficult. (34) (35)

5. It has long been pointed out that in pregnancy a condition of anergy is present, as shown in both weakened, and reduced frequency of positive reactions to tuberculin. The number of reactions is reduced 50 percent. Since the same lowered reactivity and absence of allergy is shown in the exanthems, influenza, cachexias and severe tuberculosis when the patient's immunity is waning, it is cited as a definite proof of a decreased resistance to the tuberculous in-
fection. The interpretation of these conditions of decreased reactivity to tuberculin which are brought on as a result of some complicating condition such as here mentioned as meaning decreased resistance to tuberculosis seems to be well established. It must not be confused with the desensitization that comes on as the patient develops a greater tolerance for bacillary protein during the course of the disease, which at times may approach complete or almost complete desensitization.\(^{35}\)(36)

6. It has been pointed out that the lipase content of the blood serum during pregnancy is lowered, reducing the lipolytic effect on the waxes of the bacillus and diminishing one of the natural anti-bacillary actions of the body. This effect, of course, is largely theoretical and difficult to prove.\(^{35}\)

7. The increase of cholesterol which appears in the blood during pregnancy has been cited a favorable to the development of bacilli. Tuberculous guinea pigs in which an increase in blood cholesterol was produced by feeding have been reported to show a more rapid dissemination and especially a wider spread of caseation than that of control animals. Other experiments have failed to confirm these results.\(^{35}\)

The periods of labor and the puerperium are consecutive periods of the reproductive cycle, but strictly speaking are not part of pregnancy. Fraught with more danger to the non-tuberculous mother than pregnancy, these events are likewise of great importance in the tuberculous gravida. Here a definite basis for the exacerbations, which so frequently
occur can be determined. (37)

The patient has already undergone the strain of pregnancy, with or without deleterious results. The straining and increased blood pressure incident to labor may be sufficient to break down partially healed lesions, converting closed lesions to open ones. The actual physical exhaustion following a difficult labor is also a contributing factor. The excessive loss of blood with resultant anemia leads to loss of vitality. The lungs which have been compressed during the later months are suddenly released. The giving of an inhalation anesthetic may result in aspiration of organisms to healthy lung tissue. (2)(34)

The puerperium, then, is the period in which most untoward effects occur. In addition to the points above, Robinson points out that pregnancy is a period of anabolism or building up, while the puerperium is a period of katabolism involving rapid tissue atrophy, autolysis, and absorption. This if applied to an active tuberculous focus would be disastrous. (38) Again, all authorities agree as to the harm in permitting lactation, another insult to the mother's vitality and as will be pointed out later is of utmost danger as a source of infection to the child. (39)

However, various writers who have taken care of their tuberculous mothers, to eliminate the dangers of labor and the puerperium, have come to some startling conclusions. Jennings and Mariette after an extensive study of 470 cases conclude that pregnancy does not have a marked effect on the progress of pulmonary tuberculosis. In fact their evidence
is striking that the phenomena are independent of one another. (40) Ornstein and Kovnet were surprised, in their series of cases at Sea View hospital to find the death rate of the pregnant tuberculous and the non-pregnant tuberculous were almost the same. The pregnant group had a death rate of 36 percent in contrast with 33 percent of the non-pregnant group. Where as the death rate was slightly increased, there was a marked difference in the unimproved group. Here pregnant females showed 18 percent unimproved compared with 31 percent in the non-pregnant group. They were satisfied that the bad prognosis did not depend on pregnancy but on the character of the pulmonary tuberculosis. (41)

Barnes and Barnes in another sanatorium study found that, of the 56 ex-patients of the Rhode Island State sanatorium with positive sputum who are known to have had children during or since sanatorium residence 31 percent were living, while of all tuberculous ex-patients, only 26 percent were alive. In their series of 410 pregnancies they suggest that pregnancy in itself had a harmful influence, if at all, only in a small percentage of cases. (42)

Marshall is in agreement after a survey of his work, of a study of 309 non-pregnant and 203 pregnant tuberculous women, found that in the "dormant or healed" cases 2 percent of the non-pregnant died, while only 1 percent of the pregnant died with in a year. In the advanced cases 46 percent of the non-pregnant died, compared with a 37 percent mortality in the pregnant. (39) Fossner has done an enormous amount of work in this field and also concluded that there is insuf-
ficient evidence to say pregnancy is harmful to the tuberculous. Hill also concludes from her public health survey in Detroit that pregnancy had little bearing on pulmonary tuberculosis.

In spite of the inconclusive results which have been obtained, it is known that pregnancy does make excessive demands upon the woman's metabolism. Whether the woman can compensate for this load differs with the social and mental status of the individual. It is because of this fact that pregnancy, in a general way, is concluded by most to exert an unfavorable influence on pulmonary tuberculosis. This is the explanation of the tuberculous lesion which is called to attention by the additional strain of pregnancy, which leads to a decompensation of the "anti-tuberculosis mechanisms". In view of the careful observations from the nation's tuberculosis sanatoria, one must conclude that the previous unconditional views must return to more conservative opinions.
TREATMENT AND PROGNOSIS

1. Prophylaxis

In the preceding pages mention was made of the small number of cases of tuberculosis which are recognized in the pregnant woman. From all the results which have been gathered in order to determine the general incidence of tuberculosis one must agree that a very small group of pregnant tuberculous women demand attention. These may be divided into two groups: cases of known tuberculosis, and those developing tubercular symptoms during pregnancy. Of these groups only those cases of known tuberculosis are amendable to prophylactic treatment.

Many authorities believe that tuberculous individuals should not marry. This of course must be somewhat determined by the nature, type, and stage of disease. Also, both parties should be aware of any tuberculous condition of the other, and advised accordingly. In many states concealment of such facts before marriage is grounds for annulment. That the healthy individual who marries a tuberculous person runs some risk of contracting the disease is well known, the risk varying with the lesion and the intelligence of the contracting parties. Ferguson speaks of marriage, with postponed pregnancy, as being a therapeutic factor in improving tuberculous women. Ward, has also collected evidence to show the risks of matrimony. He found that the tuberculosis patient lost nothing by marriage alone. However, pregnancy and parturition was likely to make her worse.

The chief danger to the tuberculous woman, then, is
pregnancy and her safest plan, regardless of the nature of her lesion, is to avoid conception. Yet each case must be individualized. Certain quiescent cases in intelligent individuals, especially desirous of having a child, and able to secure proper treatment and supervision, may make conception justifiable. If one or two children are living at the time the woman becomes infected or seeks advice, conception best be advised against. (2)

Unfortunately, despite painstaking study, no one is as yet able to determine with certainty which case will bear pregnancy and the puerperium well, and which will fare badly. No positive prognosis can, therefore, be given in the case of an individual patient. At times, even those cases that appear most favorable will result disastrously and occasional cases in which conception has been countenanced, strict hygienic measures must be enforced, and the woman kept under close observation and examined at frequent intervals by an experienced internist.

2. First Trimester

As a matter of fact, the physician is frequently not consulted regarding the advisability of either marriage or conception. This is especially true of the ignorant classes, and even the intelligent are as yet not sufficiently educated on this point. If pregnancy has taken place, all tuberculous women should be subject to a rigid hygienic and dietary treatment. This should be instituted as soon as tuberculosis is diagnosed, but is especially important if pregnancy occurs. The pregnant tuberculosis woman needs every possible aid in
combating her infection. She should therefore, be placed under the care of a physician who understands this special form of treatment. (2) Too often there is not a satisfactory association between the experienced internist and the obstetrician. Many writers have deplored this situation and though recent years have brought some improvement, much more is to be accomplished. (20)(34)(38)

**A. Abortion**

The most important point to be decided is, shall the uterus be emptied. This controversy is the basis of most disagreement in the care of the pregnant tuberculous. In a specialty of medicine in which the success of treatment has made such rapid strides as in tuberculosis during the last twenty-five years, the prognosis in the face of any complication is subject to change. For many years, there were two distinct views. The so-called "German view" which counseled unconditional interruption; and the so-called "French view" which held that pregnancy exerted no harmful influence on the tuberculous. The former was favored in this country and twenty-five years ago, the coexistence of tuberculosis and pregnancy was considered so disastrous that a pregnant tuberculous woman was almost invariably advised to have the pregnancy terminated.

Parry, writing in 1914, speaks of the universal opinion of physicians as to the danger of tuberculosis in pregnancy and the commonly fatal ending within a few months following delivery. (32) Lobenstein, in this period, urged interruption in all cases where possible. (45) Norris, advised interruption up to five months. (46) Biggs, also advised inter-
ruption. (47) A little later, Mosher, makes almost the first
dissenting move in a plea against unconditional abortion and
states physicians should study each case individually. (48)
The prognosis in tuberculosis has become vastly more favor-
able, likewise the care given the pregnant woman has changed
immeasurably in her favor. It is interesting to note that
Norris, as quoted above in a recent article in collaboration
with Murphy, in speaking of present treatment says, "When
properly cared for, the mortality rate of the pregnant and
non-pregnant tuberculous are not so far apart." (49)

Abortion statistics are confusing as it is stated
as beneficial in percentages running from 20 to 90 percent.
Winter, quotes figures as high as 87 percent beneficial. (50)
Von Bardeleben quotes figures to show that 50 percent ben-
efit was a maximum figure in his series. (2) Ingram in a re-
cent analysis of his work states that in 35 cases, 62.9 per-
cent were improved, 17.4 were unimproved and 20 percent were
dead. (51)

However, in order to justify the interruption of
pregnancy one must be convinced of the danger of pregnancy
and its effect on the tuberculous woman. As stated previous-
ly there seems to be little specific damage from the preg-
nancy other than a problem of increased metabolic demands on
a diseased individual. Also data gathered from the large
sanatoria indicate that under proper influence and care that
there is sufficient evidence to show that the mortality rates
of pregnant and non-pregnant tuberculous are practically the
same. This has resulted in a gradually prevailing belief that
therapeutic abortion is neither so frequently necessary nor so efficacious in checking the tuberculous process as it was once thought to be.

Adair, in a recent article, says his personal experience leads him to believe that though pregnancy per se may have no effect on the tuberculous process, there are, nevertheless associated and complicating conditions which do add to the risk of the patient. He concludes with, "Premature termination is not indicated in uncomplicated tuberculosis. Obstetrical complications may arise, however, which necessitate the termination of pregnancy". (52) In another article, Whitacre and Adair state that, "Whether or not a therapeutic abortion is to be done depends not only upon the reaction of the woman to the tuberculosis, but also on the way in which she reacts to the pregnancy. If a woman with latent or active tuberculosis is definitely disturbed by pregnancy in the early months, it is our opinion abortion should be done before symptoms such as anorexia, nausea, and vomiting have reduced her vitality. After the early months the pregnancy seems to act more as a stimulus to the well being of the woman, and there is practically never any indication for the termination of pregnancy because of tuberculosis." (43)

Robinson reports material based upon the 200 answers received to a questionnaire drawn from an obstetrician's point of view and submitted to a number of recognized specialists in tuberculosis in the United Kingdom, Ireland, Africa, America, Australia, Canada, China, France, and Switzerland. The consensus of opinion appears to be that in a small min-
ority of cases of active disease, in early pregnancy, the operation may have a definite value and the indications are three in number: 1. An early active lesion when discovered early in pregnancy. 2. Re-activation of quiescent lesions early in pregnancy. 3. The association of mild tuberculosis with some obstetric complication reducing the resistance of the patient. (38)

Pottinger in a recent article states that the course of the tuberculosis complicated by pregnancy is not sufficiently constant and regular to permit the establishment of definite rules to guide future action. Some of the many variables pointed out are: 1. Character of the lesion, and extent and age of lesion. 2. General and specific resistance. 3. Primiparae or Multiparae. 5. Attitude of the patient. With these variables in mind, Pottinger considers interrupting patients unable to get themselves good care if the pregnancy is discovered by three months, if the disease is active. If proper care can be arranged and the patient apparently has good resistance and provided the lesion is not extensive, she may usually carry the child with safety. (35)

Strassnie states that every pregnant tuberculous woman should be placed under the most favorable conditions possible. If this is done, many will support the pregnancy and come to term in a relatively satisfactory condition. In extensive rapidly developing cases, with fever, fatality closely coincides with delivery. One is tempted to interrupt the pregnancy but nothing seems to be less certain than the benefit of such a course. (53) Riddick is of the same opinion. (54)
Taussig, who has recently written a most excellent volume on abortion, quotes numerous authorities and adds his own opinion, that interruption is generally not regarded as justifiable in latent cases of tuberculosis. While there is no absolute guarantee that a latent case will not from time to time flare up in a more active form, this will happen but rarely when the patient has been kept under close observation, and prophylactic rest and prompt treatment instituted on the first evidence of suspicious symptoms. Moreover, the abortion will in itself at times have an unfavorable influence on a latent tuberculous lesion. The apical form is generally conceded to be more benign and hence amenable to treatment, so that in such lesions, abortion should not be performed. The bulk of evidence, however, points to a definite value of therapeutic abortion in active or progressive cases of tuberculosis. Also in two-thirds or more of these cases, will diminish the harmful effects of the pregnancy on the tubercular process. (50)

If such is the case, interruption is a problem which must be decided by the attending physician after a thorough understanding of the individual patient and her problems. In making any decision, it is of greatest importance to have consultation with the experienced internist.

Every patient should be under a strict regime while the foregoing points are evaluated and the patient is under observation. If termination is deemed advisable, some writers believe sanatorium care for two to four weeks advisable. (26) The type of procedure to be followed is of slight importance as long as the operation is performed by an experienced ob-
stetrician in a well equipped hospital. Some prefer the vaginal, others the abdominal route. Recent work shows the applicability of X-ray in this capacity. (50) (19) Sterilization is also a problem to be decided upon, and most writers hold that routine sterilization unjustifiable. This of course should be guided by the presence of living children, type of lesion, extent, age, and desires of the patient. Inhalation anesthetics are adjudged harmful and experience is necessary in this matter. Of upmost importance, however, is the need for prolonged post-operative care. (2)

3. Second and Third Trimesters.

Evidence is undisputed that if abortion is done early, it is less dangerous and the final result is more favorable than if done late. Winter found that, while 87 percent of 167 cases aborted between the second and fourth months showed improvement, only 51 percent of 99 abortions between the fifth and seventh month and only 25 percent of 36 inductions of labor from the eighth to tenth month showed favorable reactions. (50)

As most writers concur, little is to be gained of any procedure to induce abortion, after the third month. It seems well established that the best course, is to place the prospective mother under sanatorium care. Bacon, 1913, first spoke of the lack of obstetrical facilities in the sanatoria for the tuberculous. (17) Hill, speaks of the improvement of conditions up to 1928, when 81 percent have been equipped for maternity work. (25) Since that time still more improvement has occurred. Sellers is concerned with another aspect of the
problem, in that he says, "Conservatively speaking 90 percent of pregnant tuberculous women, cannot or will not submit to hospitalization. (55) These considerations must be met in the first trimester and are one factor in favor of therapeutic abortion. However, as has been previously quoted, the results of sanatorium treatment of the pregnant tuberculous are remarkable.

Of particular value are the procedures for the immobilization of one or both lungs. These may be done early in pregnancy, just prior to, or immediately post-partum, as indicated, and are of tremendous importance. It is not unusual to find a gradual improvement in the tuberculous condition during the last trimester, without special procedures. This has been explained by Brachman, as due to the elevation of the diaphragm, by the enlarging uterus. (27) By such means every effort has been made to have the mother in as good condition possible for her delivery.

4. Labor

Attention has been previously directed to the dangers of labor for the patient suffering from pulmonary tuberculosis. To recapitulate, chief among these are muscular exertion, exhaustion, increased and sudden changes in blood pressure, the possibility of breaking down healed or partially healed pulmonary lesions, resulting in the liberation of virulent tubercle bacilli into the blood stream, edema of the lungs, and the squeezing out of organisms into the general circulation from the placental cite, and hemoptysis. Post-partum hemorrhage occurs in 13 percent. (23)(28) and is thought to be due to the as-
thenis condition of the woman following delivery. With these dangers in mind, the general conditions of labor and delivery can readily be formulated. The delivery should be conducted with two ends in view, the birth of a living child, and the expenditure of as little physical exertion and strain on the part of the mother as possible. If the general condition is weakened, labor is slower and the second stage is likely to be prolonged. If so, forceps are advisable to facilitate delivery. Induction of premature labor is seldom indicated unless some obstetrical complication exists. Furthermore these patients should not be permitted to go beyond term.(2)(52)

A. Cesarean Section

This operation, with spinal anesthesia maybe indicated as a life saving measure for the mother or child. In this instance it may save the child when the mother is moribund. Again reports have indicated its value when labor pains have been the cause of hemoptysis. Favorable results have also followed Cesarean Section done because of pulmonary edema. Morris, with excellent results, advises it only in desperate cases. Others advise Section upon like indications in the non-tuberculous and think it valuable as combining sterilization and delivery in one operation, when sterilization is deemed advisable.(52)(2)

5. Puerperium.

The break in the regular hygienic regime incident to labor should be as short a one as possible. Afterwards every effort should be directed toward improving the patients general condition and maintaining her resistive powers. If
pneumothorax has been instituted this should be repeated un-
til deemed advisable to re-inflate the lungs. Duryea has
published an exceedingly interesting case, showing the value
of collapse therapy instituted post-partum, to maintain the
effect gained from pneumothorax and fixation of the diaphram
late in pregnancy.(56)

Case Report

Mrs P.P., age 26, part-Hawaiian singer and dancer, im-
m ediately upon her return from a two year singing and dancing
tour, she presented herself on September 19, 1930, complain-
ing of sore throat of eight weeks' duration. Six weeks pre-
viously she had been obliged to stop her singing but still
appeared on the stage twice daily in a dancing act, until
four weeks previously, when she embarked from Australia for
her home in Honolulu.

The family history was completely negative for tuber-
culosis; the patient had always been well and strong, had
been married eight years, and had had two living children,
since dead, (cause unknown).

Past History: No operations, no illnesses until
March, 1930, when, in India, the patient had sudden severe
chill, high fever, cough and expectoration, and pain in the
chest. A diagnosis of bronchopneumonia was made at that time,
but because of illness throughout the entire company, the
patient kept at work. After one week of acute illness, she
was fairly comfortable but still had a cough and slight ex-
pectoration.

Present Illness: The patient dates her present ill-
ness eight weeks prior to September 19, 1930, with the onset of a sore throat, dysphagia and partial aphonia, which prevented her singing. Since September, 1930, she has had increasing cough and expectoration, mucopurulent in character, malaise and night sweats.

Physical Examination: General appearance; well developed, poorly nourished Hawaiian female, apparently about seven months pregnant. She had the appearance of chronic illness, coughs incessantly, and is quite dyspnoic.

Head, Eyes, Ears, Nose: Normal

Neck: Slight visible and palpable enlargement of the anterior cervical chain of nodes on each side.

Chest: Symmetrical, well formed, full breasts. Drooping of right shoulder, with diminished respiratory movements on right side.

Heart: Rate 108, size and position apparently normal, no murmurs or irregularities.

Lungs: Right: Above the fourth rib anteriorly and seventh vertebral spine posteriorly there is marked impairment of resonance, and increased broncho-vesicular breath sounds with showers of medium moist rales everywhere.

Lungs: Left: Anteriorly, dullness sixth rib to third rib, with an area almost flat from the second rib to the clavicle. Posteriorly there are varying degrees of impaired resonance throughout. Voice transmission is markedly increased throughout this side. Medium moist rales are everywhere throughout the left chest, on quiet breathing as well as post-tussic.
Abdomen: Distended. Fundus of uterus just below the ensiform cartilage, fetal movements are seen and felt. Fetal heart was heard in lower right quadrant. Rate 180. No other masses or abnormalities felt.

Extremities: Normal, no clubbing of fingers.

Reflexes: Normal

Vaginal Examination: Cervix, stellate tear, external os admits one finger, Occiput of fetus palpitated in ROA position.

Larynx: There is swelling of both arytenoids, vocal chords visible, pale, approximate poorly, small ulceration, posterior third of right chord.

Laboratory: 3,800,000 red cells, 75 percent hemoglobin, white blood count, 7,200, with 78 percent lymphocytes, large mononuclears 2 percent, 20 percent polymorphonuclears. Red cell sedimentation rate 60 percent, two hours; urine normal. Wasserman and Kahn, negative. Sputum examination positive for tubercle bacilli, with many organisms to the microscopic field on two successive occasions.

Diagnosis: 1. Pulmonary tuberculosis far advanced. 2. Tuberculosis of the larynx. 3. Pregnancy six to seven months.

Treatment: Bilateral pneumothorax as a palliative measure was considered and treatments started on September 24, on both lungs simultaneously. Refills were given twice weekly on alternating sides until patients admission for confinement on December 8, 1930. Effective collapse was obtained on both sides as demonstrated radiographically and by the patients marked symptomatic improvement. Refills varied in amounts from 200 to 550 cc. At first a mobile media-
stinum presented a serious inconvenience, as, when a refill was given on the right, the left lung was pushed over until the visceral pleura was in contact with the parietal pleura. In all, 13 refills were given on the left side and 14 refills on the right side. On December 8, the patient went into labor and was delivered under gas anesthesia of a normal full term 6½ pound boy. The duration of the second stage was 40 minutes, and of anesthesia 10 minutes. Bleeding was only slight and there were no complications. During the anesthesia, the patient was exceedingly blue and respirations were thirty to forty per minute. Oxygen, twice the usual amount, was given with nitrous oxide. On December 10, under local anesthesia, a left phrenic exaeresis was done by Dr. F. F. Alsup and 35 cm. of nerve was avulsed. On December 18 the patient was readmitted to the hospital for the removal of the right phrenic nerve which was done under local anesthesia and 30 cm. removed.

The patient's weight at this time was 104½; just prior to the onset of labor the patient's weight was 120 pounds. Following the removal of the left phrenic nerve, the very slight cough and expectoration, which persisted even after her pneumothorax treatments disappeared, and the patient has been symptom-free ever since. There has been an average gain of 1½ pounds per week until February 2, 1931, when the patient's weight was 111½ pounds. At this time the patient was given a refill of 300cc. on the right side. She looked well, had no complaints to offer, except a slight hoarseness. The red-cell sedimentation rate is 32 percent in two hours. The treatment during this woman's illness was as follows: A strict sanatorium
regimen at home and complete vocal rest for the laryngeal condition, pneumothorax treatments, and phrenic exairesis bilateral post-partum. Removal of the baby from the tuberculous environment.

The post-partum period is the period in which past injury reveals itself and adequate protection for at least a six months period is advocated by all. (52)(38)(43)

A. Lactation

It is generally conceded that lactation exerts an unfavorable influence on the course of pulmonary tuberculosis. In all cases the child is removed from the mother and fed from the bottle. This is not only advantageous from the point of the mother's resistance, but protects the babe from possible infection from accidental contamination, such as occurs from infected fingers carrying the organisms to the child's mouth, either directly, or from infection of the nipples. (43)(40)(38) The question as to whether the mother's milk is likely to contain tubercle bacilli is of some theoretic interest. Morris has never been able to demonstrate the bacilli. (2) Other authors have found organisms in the breast milk quite frequently. (13) Thus it is undesirable to feed the infants with mother's milk, even if this be obtained by means of a breast pump.

6. Prognosis

The prognosis, then varies from good to bad, and it must always be approached with caution. The outlook in latent or arrested disease is not necessarily grave, though it may be so. The progressive cases give the worst outlook. The active case with proper treatment may bear the pregnancy
very well. Repeated pregnancies are deemed harmful by all, and ultimately lead to a complete break down in all cases.

However, the prognosis should be made upon an individual basis. The manner in which the patient reacts to the pregnancy is of major interest. General resistance, must be judged and due regard given to social, mental and economic status. The adequacy of possible treatment is of most importance. When such has been done, we may come to a realization that the problem is as yet unfinished, but that medical science can give the prospective tuberculous mother a vastly more favorable outlook.
SUMMARY

Tuberculosis has in some form been recognized since the time of Moses, 1500 B.C. The early Greek and Roman physicians had some notion of the disease and had some rational lines of treatment for the condition. The etiology was ascribed to many things before Koch, in his dramatic work, irrefutably established the acid-fast organisms as the responsible agent and named them tubercle bacilli.

The effect of pregnancy upon a coexisting tuberculous process has varied considerably in the minds of physicians during the past years. Hippocrates thought it beneficial. Others thought similarly until about 1875. At that time the opinion swung in the opposite direction.

It has been estimated that 11,000 to 12,000 tuberculous pregnant die annually. Tuberculous individuals do not have increased fertility according to present data. Instead, emphasis is placed upon the increased metabolism and hyperexcitability, and the incidence of this disease in the poor, a class in fertility is notorious.

Diagnosis of pregnancy in the tuberculous, or tuberculosis in the pregnant patient, is sometimes confusing. Of greatest importance is the necessity for being aware of either possibility and the bizarre symptoms and findings that are presented in these conditions.

Tuberculosis has little effect on pregnancy per se. The incidence of toxemias and post-partum hemorrhage is slightly high. Congenital tuberculosis does occur, but rarely. Other specific actions upon the infant seem limited to that which would be produced by any other weakening condition.
The factors occurring in pregnancy which have been alleged to exert specific effects on tuberculosis have been enumerated. As yet, experimental work has not given any conclusive results to these contentions. The fact that in the last trimester the rising uterus fixes the diaphragm, may explain the improvement seen at this period.

The injurious influences of labor have been called to attention, with the explanation of the high incidence of fatalities post-partum. Statistics gathered from the large sanatoria have been quoted to show that under adequate care pregnancy seems to alter a coexisting tuberculosis but little.

The manner of treating the pregnant tuberculous patient has been discussed, with the indications for abortion as submitted by many writers. The consensus of opinion being that therapeutic abortion is seldom indicated except in progressive, and active cases discovered early. Need for individualizing each case has been emphasized together with the value of sanatorium regime and collapse therapy as proven by the leading sanatoria, with statistics to show that by such treatment the mortality in the pregnant and non-pregnant tuberculous is very nearly the same. With the preceding it must be conceded that the prognosis for the tuberculous pregnant women has vastly improved.
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