Vomiting of pregnancy, especially that of hyperemesis gravidarum

Carl J. Baumgartner
University of Nebraska Medical Center
VOMITING OF PREGNANCY

ESPECIALLY THAT OF HYPEREMESIS GRAVIDARUM

Carl J. Baumgartner
The object of research is the benefit it may confer and not merely to know the truth (Robinson). I dare say that if there is no ultimate benefit that may be derived in the various activities of research, we are at a loss in furthering such investigations. It is our hope then, if we must place our time on investigation, to place it on such material grounds as might be developed into the utmost of importance to mankind in that particular field of endeavorance.

I have chosen then, in brief, to review the gradual developments in a particular condition found in the field of Obstetrics, namely that of excessive vomiting of pregnancy. A great deal of investigation has been done toward placing the underlying cause of this illness on a proper footing, but as yet it seems we are merely holding to ourselves such developments in the therapy thereof which at times confer considerable relief or even a cessation of symptoms. This does not satisfy our interests however in that we would care much to know its cause that we might handle it with impunity in view of a direct relationship to that underlying stimulus. Many theories have been advanced as to the cause of this excessive vomiting of pregnancy; treatments have been established toward such ultimate theories, and I dare say with good results;
but, with such varied theories and wide range of conducted therapies, we are left with that feeling of uncertainty that drives us deeper into its analysis, that our everlasting characteristic of inquisitiveness may in the end be satisfied. These theories will be mentioned later on under etiological factors.

The various forms of treatment that we administer to patients for vomiting in pregnancy vary in degree as the seriousness of the illness. It is apparent then that those with mild symptoms are more easily controlled than those of a more extreme nature. It is a pity then that the public are as yet not educated in the prophylactic sense of the disease. But what fault is it of theirs when many physicians today regard vomiting of a mild nature in the early months of pregnancy as a necessary evil thereof. Women thus, as they become pregnant, necessarily expect to experience early morning vomiting, and it is estimated that probably more than fifty percent do have that experience. L. A. Calkins (11) expresses this serious fault by saying, "The great difficulty is that women have been gradually trained over a period of centuries to the idea that vomiting is a necessary part and parcel of pregnancy and that there is nothing to do but grin and bear it until they get far enough along that it will automatically disappear". We can but express then with all seriousness
that, were these our patients educated to regard such vomiting with more seriousness and thus consult their doctor early, and then if this their doctor investigate the condition with all impunity as regards possible developments, it is but likely that the more serious degrees of vomiting of pregnancy will less frequently be experienced.

The ordinary type of nausea and vomiting that these women experience in the early weeks of gestation usually appears about the sixth week, and disappears spontaneously six to eight weeks later. When, however, this vomiting grows more frequent and severe, so that in extreme cases the woman is unable to retain any nutrition, not even water, the condition then becomes known as pernicious vomiting or hyperemesis gravidarum. W. T. McConnell(33) briefly outlines the developments of a true case of pernicious vomiting thusly: "Nausea and vomiting become so severe nothing is retained in the individual's stomach. The patient becomes dehydrated, emaciated, extremely neurotic, toxic and devitalized, the pulse rapid, the skin becomes dry and parched, the temperature somewhat elevated, the urine is scanty and concentrated, the intestine is inactive, and epigastric pain is usually quite severe". Williams(51) however states that in his experience, fever was absent in all of his fatal cases, and that the behavior of the pulse was not constant, since in some it soon became rapid and
thready while in others it was scarcely accelerated. It is known that in some individuals slight jaundice may develop, but this is regarded by most men as a terminal manifestation and thus considered one with serious prognosis. William J. Stevens(41) says of the disease (it being considered as truly a disease entity), "The case of true hyperemesis is one of uncontrollable and pernicious vomiting, sustained by a vicious circle -- a vomiting, starvation and acidosis cycle. When more than the once a day, early morning type of vomiting, then we are dealing with a pathological type and therefore must look for the etiology and successful means of combating the disease".

In my discussion, I do not wish to leave the conception that the condition of hyperemesis gravidarum is as the whole a quite prevalent disease. According to Pick(40), pernicious vomiting occurs about once in every thousand pregnant women. Williams is of the opinion that one in every seven hundred pregnant women are stricken with the disease thus including not only hospital cases as do Pick's figures but also attempting to include private patients. Williams(51) also states that among neurotic women of the upper classes in this country, he has encountered pernicious vomiting once in every hundred, meaning thus that the higher classes are more prone to the disease. Peckham (36) says in his article that women in
the upper walks of life are more prone to the disease, but
the negro women are by no means immune to it. Peckham also
believes that the age and parity are not predisposing factors.

Wilkins\(^{50}\) reports an interesting observation which
coincides with the previous statement. He reports a total of
fifty-one cases of pernicious vomiting from the University
Maternity Hospital of Michigan.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Cases</td>
<td>51</td>
</tr>
<tr>
<td>Average Age</td>
<td>25.5 Years</td>
</tr>
<tr>
<td>Youngest Patient</td>
<td>18   Years</td>
</tr>
<tr>
<td>Oldest Patient</td>
<td>39   Years</td>
</tr>
<tr>
<td>Primiparas</td>
<td>27</td>
</tr>
<tr>
<td>Multiparas</td>
<td>24</td>
</tr>
</tbody>
</table>

Now it so happens that the majority of the maternity patients
at this hospital are of illegitimate origin, but of these
fifty-one cases on observation, only four were illegitimate.

It has also become quite beknown to us that hyperemesis
gravidarum is much more prevalent in the United States and
France than in Germany and England, but for what reason we
are as yet as a loss to say. Bessesen\(^{9}\) states that it is
more common among American, French and Russian women than
among German women. From this we then conclude that the
etiological factor of hyperemesis gravidarum must explain
why German women are not prone to the disease. It is hardly possible that through tribal growth, German women have carried with them this tendency toward lessened susceptibility since we experience no such characteristic among women of German descent in this country -- that is, provided they carry our generalized American customs.

As regards history of the disease, it is reported that (20) Soranus of Ephesus observed the disease in the year 20 A.D. but Delorme in the nineteenth century first called attention to the danger of the affection. Simmond in 1813 was the first to interrupt pregnancy as a therapeutic measure in pernicious vomiting with good results. We have learned then that previous to a final stage therapeutic abortion has given definite and prompt recovery and we have thus for over one hundred years (11) been performing them and still doing it for lack of any other satisfactory treatment that is uniformly successful. Paul Dubois (20) presented a thesis on hyperemesis gravidarum in 1852 before the French Academy of Medicine which is still a classic. Charlotte Bronte, the author of Jane Eyre is said to have died of this disease in 1855. She was married for the first time one year previous in her late thirties.

In 1879 Duncan brought to our attention that pernicious vomiting of pregnancy was associated with definite liver
lesions. These lesions are apparently the same as those found in acute yellow atrophy with necrosis in the central portion of the liver lobule. Williams, Stone and Ewing were first to describe this characteristic lesion. It has also been reported that at times a marked fatty degeneration of the liver lobules may appear instead of hepatic necrosis. Stander (40) states that we should remember here, however, that starvation and dehydration alone may cause changes in the liver and we know that these very often have superimposed effects in pernicious vomiting. Williams (51) describes associated nephritic lesions which are degenerative in nature, and practically limited to the convoluted tubules. Since these conditions are found only at necropsy, he concludes that these pathological findings in the kidney may be only terminal developments.

ETIOLOGY

Many theories have been advanced as to the etiology of hyperemesis gravidarum, none of which have as yet become widely enough accepted to express any causal certainty. Its cause and treatment both have come under a great number of suggested bearings.

Charles D. Meigs (34) in his textbook on the Science and Art of Obstetrics of 1849 states that the disease early is regarded as a sympathetic disturbance of the stomach, but when the malady has attained so fearful a height, it becomes
itself the primary disorder and cannot correctly be explained but as an actual inflammation of the stomach and duodenum, with grave derangements of the circulation and secretions of the liver itself. Meigs here, no doubt, was considering causes complicated with vomiting throughout pregnancy and not the present day picture of vomiting terminating at about the end of the third month of gestation. Gunning S. Bedford(7) in his text of 1870 expresses it as sympathetic irritation and advises premature labor to save the mother.

In more recent years, judging from the various suggestions made as to the possible causes of pernicious vomiting, there have been classifications made as to the varied types of etiology. These are listed under the forms of reflex, neur-otic and toxemic. Under these headings many factors have been brought out as the exciting causes bringing about the excessive vomiting. We know thus that there must be some peculiar mechanism by which the stomach is stimulated toward expulsion of its contents during the first trimester of pregnancy. Under the reflex variety comes the suggestions of vagal irritation and highly sensitive sympathetic system. Scott S. Jones(27) states that in normal pregnancy we experience heightened nerve reflexes which may account for the various forms of reflex vomiting advanced. Kotz has found an over irritability of the vagus to be the underlying factor
in most cases of vomiting, while Leitz thinks that it is due to reflex psychic and toxic vagal stimulation, and that the vagal changes may be caused by disturbances of inner secretion. Bessesen(9) states that since increased reflex irritability causes an easier expulsion of gastric contents in the pregnant woman, then intercurrent pathology may give rise to this phenomenon more easily during the first three months of gestation than in a non-pregnant woman. Among such have been included abnormalities of the uterus, tumors, infections, traumata, functional and constitutional lesions or congenital affections of the digestive tract.

R. W. Keeton(28) suggests that in an average early pregnancy there occur sufficient changes in the pelves of the kidneys and in the ureters to act as powerful reflex stimuli on the vomiting mechanism. And since the conditions in the pelves and ureter are direct sequelae of pregnancy, this should be thoroughly considered as regards etiology. Remember also that chronic foci of infection tend to increase the reflex mechanism.

McConnell(33) lists the present day chief contributing factors as dietary indiscretions, neurotic disturbances, endocrine dysfunction, abnormalities of genital organs, constitutional disorders, biliary trouble, carbohydrate deficiency (actual or relative), unusual conditions of ovum as hydramnios, multiple pregnancies, abnormalities of the chorion and so forth.
Williams is of the opinion that neurotic type is the most frequent, that reflex is the least frequent, and toxic the most serious. Constance D'Arcy\(^{(16)}\) believes them to be all toxic and regrets very much that text books divide them into neurotic and toxemic. Nervous instability should be regarded as a symptom rather than a cause. I can give D'Arcy a great deal of credit in such a statement since as Williams states that most cases are neurotic, it will be the general tendency of the physician to treat most cases as such. And who is to say whether one case is toxemic or neurotic? Since most of them are regarded neurotic we will naturally give the odds to the neurotic form of treatment. Then, should there develop the unexpected toxemic form, we would be at a loss as we could no doubt have terminated the disease much earlier had we administered therapy on a toxemic basis to begin with.

Kaltenbach was one of the first to attempt to explain nausea and vomiting of pregnancy on a basis of neurosis. H. B. Atlee believes cases of pernicious vomiting to have a neurotic origin\(^{(6)}\).

There is no doubt in my mind that the nervous element may very easily play a part in exaggeration of the symptoms but it seems to me that it can hardly be the sole factor. James R. Goodall\(^{(19)}\) is of the opinion that it is doubtful whether even a true toxemia of pregnancy without an element
of neurosis superadded ever exists in the human race; he doubts also if ever a true neurotic vomiting of pregnancy occurs without a basic element of toxemia. Both Schwab and Lynch are true believers that a neurosis is the basis on which to explain most cases of vomiting of pregnancy. Brindeau is also a firm adherent of the hysteria theory for etiology of vomiting. Edward P. Allen (1) is of the opinion that most of them start with a neurotic basis.

Allen believes that the nervous element started the vomiting, which with the lack of food intake causes an increased flow of hydrochloric acid (1). This then causes an irritation of the nerve endings in the mucous lining of the stomach and so the vomiting continues. Due to the starvation and associated chemohistological changes that take place in the body, the glycogen reserve is used up and the patient begins digesting her own fats, and the case them becomes toxic.

W. C. Alvarez (2-3) demonstrated in pregnant animals a disturbance in normal intestinal gradients, namely reversal and inhibition of peristaltic rushes and slowing rate of travel of these waves. Reversal may conceivably be brought about by increase of metabolic activities of the muscles in the lower part of the bowel, an increase related in some way to increase in metabolic activity of the pelvic organs.
The Spanish obstetrician Vdaeta\(^{(26)}\) believes that there are toxins in the blood due to a variation in the characteristic complex of the albumin molecule in various individuals and cites reactions following blood transfusion. He makes the assumption that in some individuals the fetus has acquired the albumin characteristic of the father, which then being a foreign protein in reaction to the mother's albumin is thus responsible for toxaemias of pregnancy.

Haden and Guffy\(^{(4)}\) found a low sodium chloride content in the blood and regarded the condition as analogous to the vomiting of intestinal obstruction, and claim successful treatment with large doses of sodium chloride.

Artz\(^{(4)}\) has demonstrated low hydrochloric acid content by gastric analysis in pregnancy, and its absence in hyperemesis.

Calkins is of the opinion that the vomiting is due to a protein intoxication. Many authors are inclined to base the disease on a toxic basis. Williams also believes many to be on a toxic basis.

Levy\(^{(1926)}\) expresses the tendency to acidosis in pernicious vomiting which is regarded as a toxemia of pregnancy\(^{(31)}\). The toxin of pernicious vomiting produces definite destruction of the liver lobules. This destruction of the liver substances causes a derangement of carbohydrate metabolism and glycogen
storage. He also states that blood sugar and carbon dioxide combining powers are lowered and a state of acidosis is thus either imminent or present.

Levy-Solal\(^{(32)}\) later experimented to see whether women with pernicious vomiting were sensitive to placental extract. They found in the placenta of a vomiting woman an antigen which is reactivated by human serum and which when injected into a guinea pig developed shock. On further investigation they came to the conclusion that this antigen was not present in normal placentae early in pregnancy, and also not present in the placenta at term. They drew the conclusion then that a woman with pernicious vomiting was sensitive to placental extract which had the peculiar characteristic of causing this vicious circle of vomiting in the first three months, and that later in pregnancy this sensitiveness was overcome. Some authors have suggested toxins produced by the fetus as possible cause of excessive vomiting. Such possibilities make up the absorption theory which includes all absorption of toxic products from gestation, either ovum toxin, placental protein, fetal ectoderm or chorionic villi liberated into maternal blood stream. If then the supposititious antibody fails to neutralize them, a toxemia follows.

We know from the Abderhalden reaction that certain
placental elements are thrown out into circulation and this then suggests very much the possibility of Levy-Solal's work.

Krebs and Dieckmann \(^{(30)}\) suggest that in the neurotic and toxic vomiting group, there was a very definite relation between the degree of toxicity of the patient as evidenced by the clinical picture and the degree of functional impairment of the liver. They demonstrated then that by the Rosenthal liver function test they were able to obtain valuable information as to whether the case was neurotic in type or not. At either cause, vomiting, whether neurotic or toxaemic produces starvation which in turn leads to acidosis. This acidosis leads to further vomiting, starvation and a greater acidosis such that the vicious circle goes from bad to worse and ends in acute yellow atrophy of the liver and death unless this circle is broken.

Another popular theory is the endocrine theory which deals with defective hormone secretion from ovaries, pituitary gland, or suprarenals and thought to affect somehow the brain, kidneys and stomach.

Hirst, Carter \(^{(13)}\) and others attempted explanation through endocrine disturbances. Hirst \(^{(40)}\) argues that all women are absorbing corpus luteum substance constantly during her menstrual life, but at gestation this absorption ceases. The corpus luteum then increases in size until the third month
of gestation at which time it begins to become absorbed and decreases in size. It is during the period of increased size and cessation of absorption that vomiting of pregnancy appears, and ceases at about the time the corpus luteum begins to decrease in size. Hirst links these two phenomena together as the possible origin of vomiting and directs his treatment toward the unsupplied corpus luteum extract.

Sella\(^{(40)}\) considers an insufficient ovarian function to be the cause of excessive vomiting, while Silvestri, Rebaudi, Sergent and Rathey think that its cause may be found in insufficient adrenal and polyglandular activity.

Bessesen\(^{(9)}\) is a very firm believer in the lack of corpus luteum and is the author of a very illuminating and inspiring article published in 1928. I would like very much to go into considerable detail on his article as it does express quite fundamental evidence and threshes out the possible etiology by a process of elimination in a most convincing form.

Bessesen\(^{(9)}\) begins thus: Any theory which will explain the illness of hyperemesis gravidarum must explain why the disease is less common among German women than among women of other nationalities; it should also explain why some women vomit and others do not; why some suffer from pernicious vomiting and others from simple vomiting; why some with pernicious
vomiting have a high ammonia coefficient and others do not. The suggestion of Udaeta in Horn's article\(^{(26)}\) that there is a blood grouping variance can be refuted in that vomiting often occurs in cases of hydatiform mole where we have obviously no question of difference in blood grouping. The theories of villi free and floating in the blood stream, of toxic elements formed by the fetus, of difference in immunization and the like, do not seem logical as they do not explain why German women should not be susceptible to these as well as any other individual. So far as we know the ultimate result involves chiefly the digestive tract from a nutritional basis and the process of utilizing this food. This then involves the four physiological functions of ingestion, digestion, absorption and assimilation which may all or in part be impaired. The mother vomits continuously and thus does not ingest food; and if she does ingest food, she may not digest it; and if digested it may not be absorbed; and if absorbed, it may not properly be assimilated or at least not enough of it be assimilated.

Bessesen suggests that vomiting takes place in the first trimester of pregnancy since it is then that the most rapid rate of growth takes place -- in contradistinction with actual growth. It is at this time also that the process of differentiation of tissues takes place and therefore brings
forth greater stress on the mother. We know also that at this time the ovarian function is different than in later months.

As was stated before by Hirst, the corpus luteum is growing during the first trimester and begins to be absorbed at about the time vomiting ceases. Bessesen adds more evidence to this by referring to the vomiting of menstruation which often occurs about the time just preceding ovulation and at a time when a new corpus luteum is to be formed, so that this constitutes the time when we have a minimum of the absorption of corpus luteum into the blood stream. Since this then brings about the greatest stress in the menstrual cycle as regards ovulation we have vomiting at this time, much the same as we have vomiting of pregnancy when the least amount of corpus luteum is being absorbed. But why should this have particular selection among nations and women individually?

The liver we know is very susceptible to injury by carbohydrate deficiency and in starvation the first drawing is on the carbohydrate reserve so that of all necessity a degeneration occurs in the liver which we believe then may possibly be due to the starvation. Starvation also suggests itself in the finding of acetone in the urine and a high ammonia coefficient. Bessesen had considerable success with corpus luteum therapy early which speaks all the more in favor
of the condition. Many authors have received marked results with the use of thyroid extract, adrenalin, pituitrin, parathyroid or pancreas which the author explains on the similarity of endocrine functions.

Considering our assumption previously that the ultimate pathology was nutritional we must bring into relation the bearing of ovarian function with that of nutrition. But here we must bring into the picture the rapidly growing embryo with its process of differentiation of tissues, which on the whole would require a considerable amount of the ovarian function to balance the physiology of nutrition. This added burden then plus the lack of corpus luteum absorption throws the mother into an inanition much more rapidly than an ordinary starving non-pregnant woman. So now we have a mother taking in no food and attempting to arrange the building units of a rapidly growing fetus. It is easy then to see how such a condition could easily develop into quite serious straits. As regards the rapidity in growth of the embryo, Crossen\(^{(15)}\) states that at the end of the first month the ovum has increased in size ten thousand times, at the end of the second month seventy four times and at the end of the third month eleven times while in the last month only three-tenths the previous size. The actual increase is small but the changes caused by pregnancy are tremendous. The author also remarks that the uterus increases from fifty grams to one thousand
grams, and most of this increase takes place in the first three months.

H. T. Stander(39) has investigated into the respiratory quotient of the fetus at term and found that it was approximately unity, so we conclude from this that the fetus uses almost entirely carbohydrates for its energy requirements. This carbohydrate depletion plus the added depletion from starvation gives additional evidence for the degeneration seen in the liver.

We have had the experience that high acids produce increased peristalsis and since in pregnancy there is a lack of acids, we find decreased peristalsis and decreased emptying time. So now the stomach becomes very slow to empty and what food can be taken by mouth is then mostly emptied by reverse peristalsis. With this hyperemesis we have a lack of nutritional intake and also the added dehydration which makes up another complication. This then brings on a changed picture in the urine and we attempt prognosis thereby. The resultant then suggests that urine of low specific gravity and large output is indicative of a good prognosis while urine of high specific gravity and small output is severe. Water has always been a good diuretic, so it seems wise here that forcing of fluids would aid matters considerably. With starvation and dehydration so far advanced, the therapeutic use of corpus luteum
would no longer suffice.

Now then, how can we explain the early morning vomiting of pregnancy which is but the first appearance of a possible progressive one (simple vomiting if continued becomes pernicious vomiting)? We have explained that the fetus adds a marked strain on the mother's nutritional balance, it requiring considerable carbohydrates to carry on its growth and tissue differentiation. This process does not rest as we do during the night hours but continues its work regardless. However, during this time we are taking in no food and from dinner in the evening until breakfast in the morning is the longest interval wherein we go without food. May we explain then that this interval of time is enough to upset the nutritional balance and thus cause our early morning vomiting of pregnancy. If then the individual resources on themselves are low and the ovarian function is such that it is all utilized toward rapid growth and tissue differentiation of the fetus, we have a suggestion of the possible origin of pernicious vomiting.

So we can say that the reason some women have pernicious vomiting and others do not, including the German women, is possibly because they eat more often and plentifully, are more phlegmatic, or their digestive apparatus is more adaptable to absorption and assimilation through more effective
action of the ovaries at the time of early pregnancy. Bessesen finishes by saying that the variations in height of ammonia coefficient and degrees of ketosis is explained in that they depend on varying grades of starvation, dehydration and added drainage of maternal nutrition by the fetus.

I think that Bessesen has written a very convincing article, and whether right or wrong, should stimulate further investigation into its possibilities.

The theory of deranged metabolism notwithstanding its causative fundamentals has received considerable attention as the basis on which to place pernicious vomiting. Diekmann and Grossen (17) express it as a deranged metabolism of the maternal organism, especially that of carbohydrate metabolism.

Underhill, Rand, Stowe, Ewing (1910), Duncan and Harding, Hoffman, Given, Dodds and Titus, all have advanced the theory of carbohydrate deficiency (22, 50).

The theory of glycogen deficiency in the liver of the mother as the cause of vomiting of pregnancy was advanced by Harding and Duncan in 1919. At about the same time Titus brought forth the same theory independent of the suggestion of Harding and Duncan (21, 40). Their theory was based on the fact that cases of pernicious vomiting showed a ketonuria
and responded to rich carbohydrate diets.

As Stander (39) informed us, the respiratory quotient of the fetus at term is approximately unity and carbohydrate evidently the chief nutritional factor. Is it not possible then that an upset of carbohydrate metabolism may occur in the mother, and which in turn leads to incomplete oxidation of fatty acid, so that a ketonuria is evident? Further discussion in these metabolic activities will continue after we have considered more of the chemical changes accompanying this disease.

URINE AND BLOOD

Grogan (20) gives a description of urinary findings. The urine is scanty, highly colored, high in specific gravity, containing albumin, casts and sometimes blood, bile, acetone, diacetic acid, indican and even sugar. Urinary changes other than those caused by dehydration are an increased ammonia coefficient, decreased urea output and presence of ketone bodies. Williams was first to observe the high ammonia coefficient as evidence in the change of nitrogen partition and considered those with a coefficient of ten or over to be severely sick. Others have shown that it may be a result of simple starvation and Williams has endorsed it. It is here suggested that the presence of high ammonia coefficient may be used in differentiating the toxic form from the neurotic
the latter showing no evidence of increased ammonia coefficient.

As regards the urea output, Standen, Duncan and Moses believe it within normal limits. Dieckmann and Grossen have found a decrease in chlorides in urinary components\(^{(40)}\). Harding regards decreased chlorides in both urine and blood as indicative of dehydration.

In the blood we evidence more specific information. Many authors have found an increased non-protein nitrogen and uric acid. Some have found an increase in urea and others a decrease. Plass and his co-workers have studied out the partition of nitrogenous products and could find no significant changes in the protein factions in vomiting of pregnancy\(^{(40)}\).

In connection with the great controversy over carbohydrate deficiency in hyperemesis gravidarum, a great deal of attention has been paid to the blood sugar. Most authors have in their studies of cases of pernicious vomiting, found the blood sugar to be within normal limits. Titus\(^{(42,43)}\) and his co-workers however believe that we have a hypoglycemia and as was mentioned before, Titus believes this hypoglycemia to have an etiological bearing in the disease. Kermauner advances his belief that there is an abnormal sugar tolerance in a severe case of pernicious vomiting which also suggests a glycogen deficiency.
With a carbohydrate deficiency, we can explain the acetone bodies in that there is not enough carbohydrate or antikeotgenic substance to complete the oxidation of the fatty acids. We thus have a high ketogenic-antiketogenic ratio.

Many authors are of the opinion that the acid-base equilibrium is undisturbed in vomiting of pregnancy.

Crossen\(^{(15)}\) shows by the action in vomiting there is a tendency toward alkalosis. The hydrochloric acid of the stomach is formed from the carbonic acid and sodium chloride of the blood. The acid-carbonate radical combines with sodium to give sodium bicarbonate with the resulting increase in carbon dioxide. Normally the chloride ion is reabsorbed to be used again but if lost by vomiting, an excess sodium bicarbonate collects, thus tending toward an alkalosis.

But Thalhimer\(^{(43,31)}\) is of the opinion that an acidosis prevails, which evidently must overbalance the previously suggested alkalosis brought on by vomiting. Whether the acidosis is due to a primary disturbance of carbohydrate metabolism or some as yet unknown cause which initiates vomiting and thereby causes a starvation superimposing a starvation acidosis is immaterial. Thalhimer emphatically states that we do have an acidosis; and we do have starvation. The findings in the blood in severe cases of vomiting of
pregnancy indicate a lowered alkali reserve, and with acetone and diacetic acid in the urine, the combination indicates acidosis.

Albert W. Holman (25) in the following brings out a fair chemical summary of what takes place: "Early in the disease before the blood sugar has dropped, the glycogen (a colloidal polysaccharide synthesized from glucose by the body) which is normally stored in the liver has become depleted. During this time the fetus is drawing rapidly on the glucose of the maternal blood so that this approaching hypoglycemia must be combatted by the reconversion of glycogen into glucose and thus an ultimate depletion of glycogen in the liver. In order to restore the normal blood sugar, a normal amount of glycogen must again be stored in the liver. This then also accounts for the ketosis and acetonuria from the resultant incomplete metabolism of fat".

He continues, "In starvation with the still lowered blood sugar, the body fat becomes broken down and since the complete combustion of one molecule of fat requires one molecule of the monosaccharide, glucose, to furnish the oxygen needed to reduce the fat to carbon dioxide and water, and since there is not enough glucose intake to complete the combustion, we find the incomplete combustion products, aceto-acetic acid, beta-xybutyric acid and acetone."
"In normal metabolism the aceto-acetic acid is quickly oxidized to carbon dioxide and water and so is not excreted in the urine. There is however a definite quantitative relation between the amount of aceto-acetic acid that can be oxidized and the amount of dextrose which is being oxidized. For every molecule of dextrose oxidized, one molecule of aceto-acetic acid can be completely oxidized. But if there are more molecules of aceto-acetic acid to be oxidized than molecules of dextrose oxidized, a ketosis develops, and this then suggests the apparent condition we are dealing with here".

Scott S. Jones(27) believes that this diminution of glycogen is due to an unduly sensitive sympathetic nervous system (there being heightened nerve reflexes normally in pregnancy) because excitation of that system produces an excess of sugar in the blood at the expense of glycogen in the liver. This diminution of glycogen in the liver is then followed by vomiting.

Harding says that a drain on the maternal glucose begins at pregnancy and nausea and vomiting is an indication of beginning deficiency(41).

Slemen's analysis(44) of maternal and fetal bloods show that the nutritive exchange through the placenta is almost entirely of glycogen. Not only does the fetus require considerable glucose, but in addition the placenta stores glycogen
for the fetus until the fetal liver is able to take care of itself. The liver besides being a glycogen or sugar storing organ is also known to be a great detoxicating organ of the body. Now if the liver is depleted of its glycogen and focal necrosis appears, its capacity as a detoxicating organ is also reduced. This has been proven in an animal starved of carbohydrate which was killed by a smaller dose of poison than was required for a similar animal well fed.

Titus (44) points out that carbohydrate deficiency in pregnancy is of duofold origin: (1) the unexpected demand for glycogen on the part of the fetus and the enlarging uterus and (2) actual deficiency augmented in the presence of nausea and vomiting from lessened carbohydrate intake.

Titus and Dodds (45) give us the following data as regards the blood sugar values in several groups of cases of pernicious vomiting totaling forty in all.

<table>
<thead>
<tr>
<th>Blood Sugar 100 cc. Mg.</th>
<th>Below 80</th>
<th>80-100</th>
<th>100+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group II</td>
<td>18</td>
<td>11</td>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>Group III</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>12</td>
<td>3</td>
<td>40</td>
</tr>
</tbody>
</table>

The following chart expresses the variance of cases ranging in the normal value of 80-100 mg. per 100 cc. of blood.
\[
\begin{array}{ccccc}
\text{Cases} & 80-84 & 85-89 & 90-94 & 95-100 & \text{Total Cases} \\
\hline
\text{Cases} & 8 & 2 & 1 & 1 & 12 \\
\end{array}
\]

Then in the values below 80 mg. per 100 cc. blood.

\[
\begin{array}{cccccccc}
\text{Cases} & 20-29 & 30-39 & 40-49 & 50-59 & 60-69 & 70-79 & \text{Total} \\
\hline
\text{Group II} & 0 & 0 & 1 & 1 & 7 & 10 & 18 \\
\text{Group III} & 1 & 0 & 1 & 1 & 1 & 3 & 7 \\
\end{array}
\]

The authors in their investigations of these cases found that the lowest values of blood sugar were seen most often in the sickest patients.

In general as regards the etiology of pernicious vomiting, it appears that a metabolic disturbance, in particular that of carbohydrate metabolism plays a role in the different manifestations of this toxemia of the early half of gestation. The fundamental stimulus thereof, whether on an absorption basis, endocrine disturbance or direct deficiency or some as yet unbeknown stimulus cannot here be foretold.

**TREATMENT**

Before we begin discussing treatment in our cases of
excessive vomiting, let us be sure that we have given a thorough physical examination and eliminated all chronic or acute foci of infection, all gastrointestinal disorders or pelvic disorders which may in themselves be the exciting stimulus in the disease. An acute cervicitis should be treated when present. Try to correct a uterine displacement. Take care then of all possible pathology which may be regarded as predisposing factors.

Let us review first a few of the suggested forms of therapeusis advanced previous to our present day methods.

Tarnier once applied concentrated solution of Belladonna to the inferior segment of the uterine neck and vaginal walls with best results (5).

Eulenberg of Berlin (5) applied tincture of iodine to the os. He also had success with chloral hydrate, grains thirty morning and night by rectum. He also prescribed potassium bromide. S. C. Busey in 1878 used potassium bromide with decided and immediate relief. He gives thirty grains to one drachm dissolved in beef tea, to which brandy and laudanum may be added according to the condition of the patient. This is given in enemata every four hours.

Leeches (5) to the os have been used by Clay and other authors, but their propriety is doubted by Playfair. Dr.
Tilt claims that vomiting was promptly checked after a failure by ordinary means by placing a few leeches to the pit of the stomach although there were no signs of inflammation there and patient was not plethoric. Tilt says opium and morphia are the first remedies to be used.

Dr. Dubelski of Warsaw, in the nineteenth century sprayed the spine with an ether spray and obtained excellent results.

Campbell(5) of Augusta, Ga., called attention to rectal alimentation not only as a last resort but to supply nutrition. He did not use carbohydrates, but usually eight ounces of beef tea twice daily.

This then gives us an idea of the vague attempts at therapeusis carried out in earlier years. Some of them however parallel closely the suggested treatment of today which I shall now attempt to review.

Titus(44) groups his cases as mild, moderately severe and pernicious and treats them accordingly. The mild cases show more or less nausea with some vomiting; the moderately severe cases show the patient to be ill most of the day with persistent vomiting; but not necessarily in serious condition; while the serious or pernicious group present patients emaciated and dehydrated with beginning nephritis, acidosis or even jaundice. They are unable to retain food or water and are usually in desperate straits.
The mild cases are treated wholly on a dietetic basis. They should be told to eat often during the day and at definite intervals beginning before arising and ending at bed-time. Further advice is given to choose carbohydrate foods such as cooked fruits, dates and raisins, green vegetables, crackers and cookies, honey, sugar and deserts such as puddings, custards and ices. This regime then should suffice for the mild cases of vomiting of pregnancy.

In the moderately severe cases, Titus advises treatment to begin in the evening if possible by fasting a few hours, then only water by mouth until morning; then easily assimilated liquids at hourly intervals until the patient has fallen asleep at night. Thirty grains bromides plus ten grains chloral per rectum morning and evening are given following enemas; proctoclysis of glucose and soda; intravenous glucose immediately if vomiting doesn't cease. About the third day frequent small feedings of soft nourishment will be retained.

In the pernicious group then we give intravenous glucose immediately and repeated one to three times daily. Glucose by rectum and plenty of fluids.

Wilder and Sansum (44, 46) showed that glucose could be given at the rate of eight tenths grams per hour per kilogram of body weight without glycosuria. It is estimated that an average woman weighs from fifty to sixty kilograms so full dose
would be from fifty to sixty grams of glucose. But in order to make a standard dosage seventy-five grams has been taken as the initial dose, and subsequent doses of fifty grams.

Rules for dosage and administration of glucose can be found in DeLee's extract -- Practical Medicine Series on the paper of Titus and Dodds. The sum and substance of them are included in the following paragraph (16).

Glucose should be dissolved in distilled water instead of salt solution because we have in the past experienced unpleasant or even dangerous reactions with the latter. The solution should be a twenty-five percent solution, as a weak solution overloads the circulatory system too rapidly if therapeutic dose is given. And again it is thought to contribute also to reactions. A hypertonic solution also favors more rapid interchange of substances in tissues and blood stream; so toxins are diluted, edema lessened and sugar seized by tissues more rapidly. Do not forget that the glucose should be chemically pure.

Corpus luteum in moderately severe cases has proven a benefit. Hirst (40) has reported a large number of cases successfully treated with corpus luteum extract. Some men have found no success with the dry form but have with intravenous therapy. Bessesen (9) as we have experienced earlier in this paper is a firm believer especially in early cases, but
later when dehydration and starvation have set in he advises fluids and glucose therapy. Cornell(14) advises giving corpus luteum grains two, four times daily.

Carter(13) and others believe in treatment of excessive vomiting of pregnancy by ovarian extract.

Physical therapy offers exposure to ultra violet with favorable reports resulting(50).

Cary has administered the dessicated placenta in treating vomiting of pregnancy. Garnett believes there is a failure to produce antagonistic hormone against a toxemia and thus advises transfusion from post partum patients. Little success has been reported from this latter treatment(40).

It has been suggested by those authors believing in the theory of neurosis, that suggestive treatment and such individual treatment as that particular patient may require, to be of utmost importance in therapeusis of excessive vomiting.

Harding and Van Wyck(21) believe that the successful treatment of hyperemesis gravidarum depends upon the use of fluids. Schaick and Davis also report favorable results from the administration of large amounts of water. Van Wyck(47) states that in vomiting of pregnancy, the partial or complete lack of food plus the loss of fluids by vomiting causes an acute anhydremia with resulting rise in concentration of serum
protein. If then fluids are freely administered at this stage by the use of glucose, the blood concentration may be restored to normal. Suppose however that an acute anhydremia is allowed to carry on—then serum proteins are broken up and blood concentration may fall to normal or even below. Here we must make the addition of something to aid in regeneration of the serum protein. Larger amounts of glucose aid in protein regeneration in that it helps to save the nitrogen loss to the body. In severe cases transfusion would logically be indicated.

Thalheimer\(^{43}\) advocates the use of insulin in the treatment of vomiting of pregnancy. It is customary to give a protective dose of glucose with the insulin. It seems this combined therapy of insulin and glucose relieves the ketonuria and acidosis. Thalheimer believes that this combination breaks the cycle of acidosis by bringing back the power of oxidizing glucose and thus in turn retaining the power to fully burn the products of incomplete fat metabolism.

J. S. Brewer\(^{8}\) is also of the opinion that insulin is often indicated, especially if the concentration of the glucose is high and the rate of administration fairly rapid.

Stevens\(^{41}\) however says that insulin to the glucose causes glycogen stores to become depleted by its demand for glucose set up, and also because some glucose is converted into non-saccharine material. In toxemia of pregnancy, storage in liver
and not combustion of injected sugar, is the desired result. He thinks then that insulin is contraindicated except in accompanying diabetic or coma conditions.

Titus (44) remarks to insulin with glucose in this way, "To offer a homely simile, injection of glucose alone is like supplying fuel to a furnace which has burned low, and at the same time storing some in the fuel bin; whereas to add insulin to the glucose is like pouring kerosene on the coal to make it burn faster. If these views are correct, the use of insulin with intravenous injection of glucose is contraindicated in toxic vomiting of pregnancy and all other acidosis, because storage of sugar in the liver and not combustion in the muscles is the effect desired".

Keeton (28) quotes Loeser in saying that in severe cases the liver has lost its power of glycogenesis and that insulin restores it. But this defect is secondary as a result of liver damage. Insulin also increases gastric hunger contractions, sets aright the peristalsis and abolishes nausea consequent upon the intestinal antiperistalsis and duodenal dysfunction.

Calkins (12) and Andrews (4) have obtained a considerable number of good results from Litzenberg's form of treatment which I would like to relate here, "In the severe cases the patients are put to bed in a private room, given enough sodium
bromide to paralyze her vomiting reflex and then filled full of food. Nothing at all is given by mouth for the first twenty-four hours to allow the stomach to overcome its hyperexcitability. The lower bowel is cleaned by an enema, after which sixty grains of sodium bromide in two to three ounces of water is given with small catheter per rectum every six hours. Insist on the six hour schedule as it seems that the effect of the bromide in the early stages of treatment does not last much over six hours. Use a small catheter and small amount of water to diminish tendency toward expulsion of medication. If patient has found difficulty in retaining medication, elevate the foot of the bed sixteen to eighteen inches thus causing the bromide to go higher in the colon and remove the tendency to expulsion. Two hundred forty grains per day of the bromide is enough to more or less paralyze the vomiting reflex and patient becomes dopey at the end of twenty-four to thirty-six hours. We may begin feeding the patient at the end of twenty-four hours and rapidly increase the diet from 2500 to 3000 calories or more, mostly carbohydrates. Watch the patient carefully to determine when you can decrease the bromide dosage. Usually in two to three days it can be reduced to fifty grains; in two to three more days, forty grains; in two to three more days fifteen to twenty grains orally
three or four times daily and continue thus for a greater or less period of time depending on the rapidity of gain in weight. Give a high carbohydrate diet until we have a gain of from eight to ten pounds, at which time the proper diet of a pregnant woman can again be carried out. Plenty of fluids are given. The patient is able to take carbohydrates by mouth after the vomiting is stopped so that it is usually only necessary to give intravenous glucose a few times even in severe cases.

If during the course of the treatment a bromide rash appears, remember it is symptomless and rarely persists over two to three weeks in five percent of the cases. Bromide psychosis is only temporary and will clear up, although at the time it may become very alarming to the relatives.

Tashjian(42) states in his article on multiple neuritis following pernicious vomiting that patients with a long standing nutritional disturbance, especially during pregnancy, should be supplied with the anti-neurotic vitamin B.

So far we have experienced a wide variety of suggested treatment and no agreement has been made in this country or elsewhere as to the best method of treating these patients. Thalheimer emphasizes the fact that the relieving of the condition of acidosis in these patients is the extremely important aim. It is not however the only objective to be relieved by
treatment. It seems to Thalheimer that the best method of
treatment is to combine sedatives, give fluids and the proper
type of carbohydrate, and by colonic irrigations and gastric
lavage, do what we can to enable the body to eliminate what-
ever might have accumulated in its tissues. In addition we
should use whatever types of therapy that are necessary to
increase excretion through the kidneys, take the precaution
to see that there is no excess pressure in the central ner-
vous system, and if we will treat systematically any other
conditions that may arise, we might someday find out what is
the cause of these distressing complications of pregnancy.

We must remember however that apparently there are some
cases of pernicious vomiting which do not respond to glucose
or any other form of therapy, such that prompt evacuation of
the uterus is necessary. Fortunately however our present day
knowledge of therapy makes such cases of therapeutic abortion
very few in number.

Tashjian(42) brought out a possible complication of
hyperemesis gravidarum to be multiple neuritis. A list of the
possible complications include toxic multiple neuritis,
nephritis, Korsakoff's psychosis, esophageal stricture, ab-
ortion and most serious of all a premature ageing of the mother.
The fetus may also show defects or later liable to manifestations
of disorders of infancy (9).

Let us consider now the management of individual cases and their outcome as to the ultimate value of what has been discussed in our paper.

Case Number 1.

Mrs. E. F. is a white housewife aged twenty-five. She entered the hospital complaining of nausea, vomiting, weakness, blurring of vision, epigastric distress, loss of weight and fainting spells, while in the third month of pregnancy. She became nauseated and vomited after the first month of pregnancy and has been steadily becoming worse since. She vomited twelve to fifteen times daily on entrance and often awoke at night with the urge to vomit. In the hospital she was so weak she fainted several times on attempting to get up. The patient also experienced almost continuous frontal headaches; had blurring of vision and spots before her eyes for four weeks prior to entrance. She lost twenty pounds of weight since she began vomiting.

This is the patient's third pregnancy. Her first child was a still birth at term, and during this pregnancy she experienced three weeks of morning vomiting. Her second pregnancy terminated as miscarriage at three months, and with no morning sickness accompanying.
Patient while in the hospital vomited only two or three times in the first five days. She was very little dehydrated. She retained fluids pretty well.

Her treatment consisted of sodium luminal grains three by hypodermic every six hours; sodium bromide grains thirty in three ounces starch solution every eight hours by retention enema. A considerable amount of ten percent glucose in normal saline was given by proctolysis. Fluids were given frequently by mouth beginning second day. She was started on a fluid diet on the third day and gradually additions were made until she was on regular diet ascribed to pregnant women.

On the fifteenth day she was up and around, holding food and water quite well. No more danger was expected so she was dismissed with orders to have frequent check on conditions. She was given prescription of sodium luminal and sodium bromide which she was to take three times a day.

The fetus was carried until term without further complications.

Case Number 2.

Mrs. G. B., aged twenty-seven, white, American, housewife, came into the hospital December 7, 1930, complaining of excessive vomiting, weakness, and loss of weight. She was in her third month of pregnancy. Nausea and vomiting became
manifest about one week after time for next menstrual period. Some meals were kept down, and water was tolerated fairly well. Two weeks prior to entrance she began vomiting all by mouth and it is since then that loss of weight and weakness became pronounced. On admittance, the patient was almost prostrate.

One previous pregnancy was experienced with pernicious vomiting accompanying. She was at that time hospitalized to obtain recovery. At that time she also had swelling of feet and hands and a raised blood pressure, and patient states that before term the doctors had feared she would have convulsions.

Physical examination revealed a retroflexed uterus lying in the culdesac. This was thought to be a possible cause for vomiting, so she was made to lie on her abdomen and on the tenth day the uterus was in good position.

Her pulse ranged from ninety to one hundred; her blood pressure was 115/80. Blood sugar was one hundred twenty-three milligrams percent, and carbon dioxide combining power was forty-seven and three tenths volume percent. The urine was amber in color, acid, specific gravity of 1.022, a trace of albumin, and positive for acetone and diacetic.

Treatment consisted in correction of retroflexed uterus, almost continuous proctoclysis of ten percent glucose for a
few days, ten percent glucose intravenously and water one half ounce every fifteen minutes. Sodium luminal and chloral hydrate were given as sedatives. On third day she was started on orange juice and glucose orally and diet gradually worked up to ordinary diet of pregnant woman. Entire diet was high in carbohydrate value.

On the eighth day she was still slightly nauseated at times, but no vomiting. Improvement continued and patient was dismissed on the fifteenth day.

Case Number 3.

Mrs. A. B., aged twenty-two, white, Bohemian housewife entered hospital complaining of nausea and excessive vomiting. Her pulse ranged from ninety to one hundred ten. Urine was amber in color, specific gravity of 1.017, no albumin, sugar, acetone or diacetic. Blood sugar was one hundred sixteen milligrams percent, and carbon dioxide combining power forty three volumes percent. On physical examination the uterus was found to be retroverted and retroflexed. She was made to take the knee chest exercises three times a day and to lie on her abdomen almost continuously. Her condition was thought to be in a great part of a psychic nature, and not a true hyperemesis gravidarum. The treatment, however, was on the whole the same as those of true pernicious vomiting, starting with starvation and then a high carbohydrate diet. Within a
week her uterus was in normal position and vomiting ceased. Treatment consisted in glucose five percent, sodium citrate two percent in one thousand cubic centimeters solution by proctoclysis; also sodium bromide, grains thirty and chloral hydrate grains ten twice daily. One half ounce water was given every fifteen minutes. On the fourth day she was started on a soft diet such as cream of wheat, malted milk, albuminized orange juice and other high carbohydrate foods. Sedatives were discontinued on the seventh day. On the same day she began a more solid diet still mostly of carbohydrates. She was dismissed on the fourteenth day after vomiting had ceased for about a week and patient feeling relieved.

Case Number 4.

Mrs. V. J., aged twenty-eight, white, American housewife complaining of vomiting for last three or four days and unable to retain food. Patient was in second month of pregnancy. She had been feeling fine up to present condition. Physical examination revealed the uterus in normal position.

Patient gives history of hyperemesis in previous pregnancy with therapeutic abortion performed by local physician.

Patient's urine dark straw color, specific gravity 1.020, acid, two plus albumin, no sugar, acetone or diacetic. Blood pressure 120/80.

Treatment consisted of two thousand cubic centimeters
of ten percent glucose intravenously, S.S. enema morning and afternoon followed with thirty grains triple bromides and fifteen grains chloral hydrate in one hundred cubic centimeters of water. Nothing was given by mouth the first day; hourly feedings the second day. Five percent glucose was given by proctoclysis. On the second day insulin was given by hypodermic ten units two times on that day. Patient vomited but little while in the hospital and dismissed on the tenth day.

She was readmitted again one week later and sedation and glucose by hyperdermoclysis and proctoclysis carried out. Was not thought to be really excessive vomiting but rather of a neurotic element. Dismissed in two weeks after having ceased vomiting for some time.

Case Number 5. (41)

Primipara aged twenty. Six weeks after last period she began vomiting and stayed in bed. On the ninth week she came to hospital complaining of nausea and vomiting, abdominal soreness, dizziness and blurred vision. Treatment instituted was six small meals daily, high colonic irrigations, rectal glucose two to four times daily, and lactose by mouth. Under this treatment the patient failed to improve. On the twelfth week the patient was listless, anemic, emaciated and dehydrated. Acetone was found in the urine. Hemoglobin was seventy
percent, blood sugar was eighty-four percent and carbon dioxide combining power of fifty-four volume percent. She was placed on a dry carbohydrate diet, no fluids, nutrient enemas, glucose by mouth, and one thousand cubic centimeters ten percent glucose intravenously. Next day she was given one ampule corpus luteum extract by hypodermic twice daily for seven days. On the third day vomiting ceased and patient was given lemonade with glucose on request, grape fruit and such food as desired, no fluids. On the seventh day she retained eggnog and bovril. On the eighth day she was eating and not vomiting. On the ninth day she was out of bed. She was discharged on the eleventh day feeling well and weight of one hundred twenty-one pounds. On the twentieth day she weighed one hundred thirty four pounds or a gain of thirteen pounds in one week. Three months later she weighed one hundred seventy two pounds.

Case Number 6. (49)

Mrs. B., German, aged thirty-five, married sixteen years, mother of six children. On January first she was nauseated and felt weak but still up and about. Nausea grew worse and patient began vomiting frequently. Another physician was called, hospitalization was advised, diagnosis was made and thought to be intestinal flu and bronchitis. Urine normal
and leucocytosis of 10,800. Patient left hospital in one week slightly better. Two days later vomiting increased in frequency and severity without relation to food or fluid intake. Patient slept very little, ate very little for two weeks prior to my first visit. Vomited almost continuously. Eyes sunken and skin jaundiced, dyspnœic, nervous and weak. Pulse 120. Percussion of chest revealed no dullness but sibiland and sonorous rales heard. Rounded mass felt at level with upper edge of symphysis, which bimanually revealed a softened mass, symmetrical, insensitive and continuous with slightly softened cervix. Diagnosis of pregnancy complicated with pernicious vomiting was made.

Mrs. B. dreaded another pregnancy on diagnosis, denounced it, said she menstruated while at the hospital and just a couple of days before. Consultation agreed she was pregnant.

Treatment and prognosis. Patient was given no food by mouth until she ceased vomiting for twenty-four hours. Soap suds enemas were used to clean the bowel, followed by solution of sixty grains sodium bromide in twelve ounces of water every four hours by proctoclysis. Twenty-four hours later she ceased vomiting, slept several hours and felt much better. Forty-eight hours after treatment was begun, the dose of sodium bromide was reduced to forty grains every four hours in eight
ounces of water. She was then started on a diet of buttered toast and jelly by mouth and a cup of black tea. Fluids were given one and one-half hours after solid food. Sodium bromide dosage was reduced to twenty grains in four ounces of water every four hours and discontinued four days later. The ninth day she was up in bed. On the tenth day she was given a laxative by mouth. Patient ceased vomiting twenty-four hours after beginning treatment and no recurrence ensuing six weeks following. Pulse ranged from eighty-four to one hundred during treatment. Respiration averaged about twenty-two. Pregnancy progressed normally and patient delivered without complications.

CONCLUSION

In our cases we find a comparatively high percentage of cases which suggest a neurotic basis as the etiology of the disease. But as was stated before, it is a dangerous matter to consider most cases as neurotic and treat them as such. The three most popular theories are the endocrine theory, absorption theory and theory of deficient carbohydrate reserve. At any rate we must certainly experience some metabolic derangement which has a certain bearing on the digestive system. Our treatment then would apparently be most efficacious to combine sedatives, give fluids and the proper type of carbohydrates and by colonic irrigation and gastric lavage do what
we can to enable the body to eliminate whatever toxins might have accumulated in the tissues.

We can only regret that we have as yet found no definite etiology and specific treatment for pernicious vomiting, but with the progress being made we have the best of hopes for such knowledge in the near future. In the meantime, however, let us educate our patients to come early, and treat them symptomatically to the best of our knowledge.
BIBLIOGRAPHY

1) Allen, Edward P. -- Pernicious Vomiting -- Journal Oklahoma State Medical Association 18:209-211 (1925)


8) Brewer, J. S. -- Hyperemesis Gravidarum -- Southern Medical and Surgery -- 39: 689-692 (1927)


13) Carter, P. J. -- Vomiting of Pregnancy, its Causation and Treatment by Ovarian Extract -- American


17) Diekman, W. J. and R. J. Crossen -- Changes in Metabolism and Relation to Treatment of Vomiting of Pregnancy -- American Journal Obstetrics and Gynecology p.3 July '27


19) Goodall, James R. Toxemias of Pregnancy -- Canadian Medical Association Journal -- N. S. 24 (1931) p. 112-113


39) Stander, H. J. -- Toxemias of Pregnancy -- American


42) Tashjian, Souren -- Multiple Neuritis following Pernicious Vomiting of Pregnancy -- Northwest Medicine -- 28: 135-37


44) Titus, Paul -- Hyperemesis Gravidarum -- Journal American Medicine Association -- LXXXV 488-494 (1925)


