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# Eclampsia and pre eclamptic conditions

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Every year in the United States twenty five hundred women lose their lives as a result of eclampsia, a condition that under the proper care can be averted.

In 1924 H. Hinselmann[1] made a careful study of all statistics published up to that time and concluded that eclampsia occurs once in every 253.7 women entering a lying-in hospital, or 0.39 percent; and in private practice one in every 1816.6 deliveries or 0.05 percent. Williams[2] states that eclampsia occurs about once in every 500 labors, while in lying-in hospitals the incidence is about one in every 130 deliveries.

H. Hinselmann[1] has estimated that with the world's population 1,702 millions of people and the yearly birth rate at approximately 56 millions, the total number of eclamptic patients is approximately 64,570 every year.

In taking Williams figures, namely one in 500, it would mean that of the 56 millions born every year the mothers of 110,000 babies developed eclampsia. Of these throughout the world close to 25 percent are fatal. This means 27,500 mothers over the world die each year due to eclampsia.

Frankel[3] estimates that approximately 17,000 women die in the United States every year as a result of child birth. Of these one fourth, or 4,000---4,500, are due to toxemias of pregnancy. Then of these about 60 percent are due to eclampsia each year in the United States. Burns[4] in 1926 gave this figure as the annual maternal mortality due to eclampsia.

Eclampsia is a term used to signify an acute toxemia during the later half of pregnancy or early puerperium, which is usually associated with clonic and tonic convulsions, followed by varying

degrees of coma. The word"usually" is used as eclampsia can be considered as a definite entity without the presence of any convulsions. Also it must be remembered that all convulsions occurring during pregnancy should not be considered as eclampsia, as it is conceivable that they may be of epileptic, hysterical or meningeal in origin. Also within the toxemias there may be convulsions associated with uremia or acute yellow atrophy.

The term "eclampsia" has been in use for a long time and was derived from a Greek word meaning a shining froth or flash. It was first used by Hippocrates to denote a fever of sudden onset. It has gradually come down to its present meaning.

To correctly classify, determine the etiology of, and successfully treat the toxemias of pregnancy has been, and still is, one of the most important problems in obstetrics.

The greatest drawback in studying clinical material on the toxemias of pregnancy is the lack of a uniform method of classifying the various types. This makes it difficult to compare the work and results of various investigators. Kellogg[5] of Boston makes a very good suggestion when he states that a committee of representatives of the obstetrical socities meet with a view to establish a working index or classification, tentative at first and changeable at each yearly meeting. By this means there could be "a cooperative mode of study in every great obstetric center."

There are at present several useful classifications of the toxemias of pregnancy. Of these two are listed below.

Williams in his text-book classification: (a) pernicious vomiting, (b) acute yellow atrophy of the liver, (c) nephritic toxemia, (d) pre-eclamptic toxemia, (e) eclampsia, and (f) presumable toxemias.

DeLee[6] in his classification groups them as follows: (a) hyperemesis, (b) ptalism,(c) gingivitis, (d) eclampsia and allied conditions including eclampsia, eclampsia reflectorica, acute toxemia(eclampsia

without convulsions), and nephritic eclampsia, (e) kidney of pragnancy and (f) acute yellow atrophy of the liver.

The difficult problem in classifying of cases is the differentiating of "pre-eclamptic" and "nephritic" toxemias. Acute yellow atrophy of the liver, true eclampsia, and vomiting of pregnancy seem to be well defined entities and are usually recognizable.

In this paper I intend to deal with eclampsia only in an effort to bring out its etiology, symptoms, and treatment. By this knowledge and considering "pre-eclamptic toxemia" as "pre-eclampsia", or a stage in the development of eclampsia, such cases can be diagnosed and treated early enough to prevent that most dreaded complication of pregnancy.

Eclampsia may occur during pregnancy, labor, or puerperium. If a patient develops convulsions before labor it is called ante-partum eclampsia, if during labor it is designated intrapartum eclampsia, and during puerperium it is spoken of as post-partum eclampsia. Also the term intercurrent eclampsia is used to designate the type where the convulsions occur before full term has been reached, she recovers, and normal labor follows.

The incidence of the first three types varies considerable, but it is generally considered that it occurs more frequently before and during labor. Antepartum eclampsia probably occurs in about one half the cases of eclampsia.

Eclampsia usually occurs during the latter third of pregnancy. However cases have been observed in the first half of pregnancy with characteristic laboratory and autopsy findings. The cases of convulsions reported several weeks after delivery are probably of some other origin such as epilepsy, hysteria, or meningitis.

Eclampsia may occur at any age in which a woman may become pregnant, however there is more prevalence of the disease between the ages of 21 and 25 with most of them before 30 years of age.

This may be due to the fact that more primiparae fall within these age levels than multiparae. Eclampsia occurs about eight times more frequently amoung primiparae than multiparae.

It has been stated by several investigators that cold weather is a predisposing factor to eclampsia. This however probably is not a cause but tends to promote convulsions due to its effect on the excretory functions of the body and the retention of the body toxins.

It seems that the disease confers a relative immunity in subsequent pregnancies. Williams[2] states, "In my experience, a woman who has had eclampsia is less disposed to the disease in future pregnancies, than one who has never had it."

H. Hinselmann[2] in collectingall available statistics concluded that in 10,000 cases of eclampsia, recurrence in subsequent pregnancies were noted in 192.

In 1843 Lever[7] demonstrated that the urine of eclamptic patients contained albumin. This led to the theory that kidney lesions were always associated with eclampsia. Traube and Rosenstein[8] regarded the kidney changes as resulting from pressure of the pregnant uterus on the renal veins. Later Schroeder and Ingerslev[8] reported cases of eclampsia without albumin in the urine so that the uremic origin of eclamptic convulsions had to be abandoned.

Williams[2] says that the kidney usually shows lesions of degeneration of the epithelium of the convoluted tubules. However the renal changes are generally considered as a secondary change or result and not the primary or cause of the condition. The prompt return of the urine to normal in patients recovering from eclampsia is an indication that the renal changes are relatively trifling.

The peripheral necrosis of the liver lobule is generally considered the characteristic lesion of eclampsia. Lesions may be found by the autopsy of a patient dying from eclampsia in the liver, kidneys, heart, and brain, but as Williams[2] states the only characteristic and

constant findings are in the liver.

Eclampsia has been called the "Disease of the Theories" because of its many theories regarding its etiology. It has been said that it is due to (1) an overloaded state, (2) increased content of urea in the blood stream, (3) auto-intoxication, (4) fetal elements, (5) metabolic products, (6) placental products, (7) bacterial invasion, (8) endocrine disturbances, (9) biological reactions, (10) alterations in maternal metabolism, (11) mammary toxemias, (12) diet, (13) amniotic fluid, (14) physical chemical changes.

I will only attempt to briefly discuss some of these etiological factors.

Auto-intoxication:-- It is believed that the blood of a normal pregnant woman is less toxic and the urine more toxic than that of an eclamptic woman. Lash and Welker[9] compared the two blood sera by a series of injections into rabbits intraperitoneally but they found no evidence of any increased toxicity of the blood serum proteins in the eclamptic blood.

Two types of toxins must be considered however to produce such symptoms; first those substances usually present in the body in definite proportions and the varying of the proportions causes the symptoms, such as sodium calcium, potassium, and magnesium; second, the toxins which may be a substance foreign to the body such as the split products of proteins. As an example of these there are tyramine, histamine, and ergotamine. A condition as the first would probably have no effect on animals as in Lash and Welker's experiment. However the second group would be ruled out quite fairly with such data as they obtained.

Fetal Elements:-- Veit[8] in 1902 was the first to advance the theory that fetal elements free in the blood stream and not sufficiently neutralized causes the condition of eclampsia. He called these fetal, elements, such as chorionic villi and fetal ectoderm, "syncytio-toxins."

and the normally formed antibody for them "syncytiolysin". He believed that eclampsia occurred when there was an excess of syncytiotoxin. This was based on finding that rabbits injected intraperitoneally with an emulsion of human placenta developed albuminuria and later died.

Veit's suggestion has probably been better theorized by Hull and Rohdenberg[10] in 1914 who believe these fetal elements in the maternal circulation are autolysed with the resulting formation of an excess of leucin. Leucin injures the hepatic vessels causing thrombosis cloudy swelling, necrosis and even autolysis of the liver cells, thereby giving the pathological picture of eclampsia. These however are both theories and neither have any definite foundation to prove such a theory.

Fetal Metabolic Products:-- The continued observation ofmany cases of eclampsia in which the fetus died before delivery and the symptoms of eclampsia cleared up, no doubt brought forth the theory that the condition is fetal in origin and perhaps due to metabolic products of the living fetus.

However the occurrence of intercurrent eclampsia in which complete cure occurs without delivery speaks against such a theory. Also there are many cases reported in which eclampsia was present and the mother did not bear a fetus but had a hydatidiform mole.

The presence of eclampsia in cases of hydatidiform mole rules out fetal metabolic products as an origin but seems to not as definite argument against it being placental in origin.

Placental Products.-- Some investigators believe that infarction of the placenta gives off a toxin which is absorbed by the mother and the liver cells are broken down by this toxin. The symptoms of eclampsia then are due to the absorption of these broken down cells.

This theory seems partially defeated by the fact that in many

cases of placental infarction the symptoms of eclampsia never develop. For example in chorionic nephritis there is usually abundant infarct formation in the placenta and yet eclampsia is a rare complication.

Williams[2] states that placental infarcts when present in cases of eclampsia should be regarded as accidental findings, or secondary to the toxemic condition, and not as its cause.

Bacterial Invasion:-- Bacterial origin of eclampsia was suggested in 1884 by Delare and Rodet[8] but it has long since been dropped, However it has been brought forward that eclampsia is always associated with some focal infection. It is reasonable however to consider that such chronic sepsis lowers the kidney and liver function and thereby tends to precipitate an eclamptic condition.

Endocrine Disturbances:-- There have been many attempts to associate eclampsia with endocrine disturbance due to changes occurring in these glands during pregnancy, but the experimental data recorded is not sufficient to draw any definite conclusions.

Biological Reactions:-- There are theories dealing with vagoconstriction due to anaphylactic reaction from fetal origin or diet. It is known from data that women subject to vagal changes are prone to eclampsia, but there is nothing conclusive recorded to show this is the basis of eclamptic development.

Mammary Toxemias:-- Some believe the toxin causing eclampsia originates from the mammary glands of the mother. Sellheim[8] carried his belief so far as to amputate the breasts from a patient suffering from a severe eclampsia. Healy and Kastle "stated that they could produce eclampsia experimentally by injecting into guinea pigs small quantities of colostrum from cows suffering from parturient paresis. However parturient paresis has been shown to be quite different than eclampsia.

Diet:-- Tweedy in 1913[8] suggested that ordinary food becomes poisonous during pregnancy and may give rise to eclampsia. He was led to this belief by the fact that women who partake of food even in small

quantities, often had a recurrence of the convulsions. Tweedy reasons that the antibodies in whole blood not only guard against bacteria, but also against products of digestion which may have entered the blood stream. He holds that the antibodies are stimulated by an antigen, which is present in colostrum, and that they have to hyperfunction, as it were, during pregnancy, as they are called upon to neutralize the foreign protein which gains access to the maternal blood stream from the ovum. Should the maternal antibodies be unable to handle the food particles coming from the diet, as well as the protein coming from the fetus, the result may be serious and the patient develops eclampsia. He explains post partum eclampsia on the theory that the mother's intestine contained food at the time when the convulsion developed.

Sellheim[8] writes that eclampsia is more common in those who live on an animal diet, than in vegetarians. During the world war the incidence of eclampsia fell, and this was attributed to the lack of protein and fat in the diet. Ruiz-Contretas[8] argues that since eclampsia occurs less frequently among the poor than the well-to-do patients, and since the incidence was less during the war, when there was a shortage of food, particularly in meat and eggs, the cause of eclampsia must be sought in the diet.

To sum up the part the diet plays in development of eclampsia it can be considered that if toxin enters the blood stream by chorionic villi in blood sinuses or from placental infarcts, and accompanied by excess of food, toxemia results.

Oedema:-- Oedema ofthe brain is believed by some to be the cause of eclampsia, and explain it by saying the blood vessels become more permeable during pregnancy. These man (Widal[12] and Straus[13]) say that with oedema actual anemia of the brain produced eclampsia. They lay great stress on watching the increase of weight during gestation, and if it becomes in excess of normal limits to consider it a danger

signal.

In summing up the etiology of eclampsia it may be well to quote Williams[2]; "It is evident that the cause of eclampsia has not been discovered and that the peace of mind of all concerned would have been increased, had many of the so-called contributors never written, or at least had withheld their contributions sufficiently long to subject them to ordinary self criticism."

The prominent symptom of eclampsia is usually the convulsion. There may be signs of the oncoming convulsion as a warning signal, but occasionally it occurs, like a bolt from a clear sky", in women who seem to have been in perfect health. The first sign of the convulsion is a fixed expression of the eyes. The eyes then soon begin to roll from side to side. The twitching of the muscles usually starts around the mouth and then spreads over the face causing the entire face to become distorted. From the face the muscular contractions rapidly spread to the arms and body. The contractions are usually clonic in character, but the patient may have tonic contraction causing a complete rigidity of the body. The face usually becomes flushed and the patient foams at the mouth. In rapid opening and closing of the mouth the tongue may be severed or badly traumatised. The convulsion may last from a few seconds to a couple of minutes. During this time the patient is unconscious and after the contractions have ceased she passes into a coma that lasts for a shorter or longer period.

The number of convulsions vary in various cases. They may be from one or two in mild cases up to a hundred in severe cases. The interval between each convulsion is lessened after each succeeding convulsion.

As a rule the arterial pressure is greatly increased during the attack, the systolic pressure going over 200 millimeters of mercury.

The pulse is usually full and bounding in the less severe cases, while in the more severe it becomes weaker and more rapid.

The temperature may rise but usually is normal. Cases have been reported with temperatures of 104-5° F. Williams[2] speaks of a fatal case that went as high as 109.5° F. just before death. The high temperature is of very serious prognostic import. If the convulsions cease the temperature usually is back to normal by 24 hours. If the temperature stays up for more than 24 hours it is bad in prognosis as it is an indication of puerperal infection.

Antepartum eclampsia may terminate in several ways. The patient may go into labor and deliver a premature fetus or the patient may die undelivered. On the other hand the patient may recover from the attack and go on to full term at which time she may deliver a dead and macerated fetus or a living child. In the latter case it is called intercurrent eclampsia.

In the treatment of eclampsia the ideal thing is to be able to recognize the condition before convulsions occur or in other words during the pre-eclamptic stage. This requires the presence of prenatalnatal care which is in itself an important factor in preventing the occurrence of eclampsia, as well as in reducing the maternal mortality from it.

Rice[14], in a statistical study of over 42,000 deliveries showed that in patients who had received pre-natal care the incidence of eclampsia was only one in 1652 cases as compared with the general incidence of one in every 253.7 deliveries in lying-in hospitals, as indicated in the first of this paper.

H. J. Stander[8] of John Hopkins University states, "It is evident that a great deal can be done by careful pre-natal study of all pregnant women wherever this is possible. The frequent routine examination of the blood pressure, of the urine and of the patient's general condition, undoubtedly leads to the early recognition of a pre-eclamptic state or an eclampsia that may be pending."

Williams[2] is a strong believer in prophylaxis. He advises frequent and routine examinations of the urine and taking of the blood pressure. In normal cases of pregnancy he says these examinations should be made once in four weeks during the first six months, and every two weeks during the last three months of pregnancy. Also the patient should be cautioned to notify the physician when ever she suffers from headache, disturbance of vision, or edema.

The occurrence of albumin associated with casts, sudden increase in blood pressure, sudden appearance of amaurosis, blurring of the vision, and pain in the epigastrium are all considered by Williams to be danger signals of eclampsia. He believes that an excreation of more than three grams of albumin in twenty four hours or a blood pressure above 160 mm. of mercury is indicative of a serious condition.

The eye findings in these patients is an interesting field for investigation. Cheny[15] made fundus examinations in a large series of cases of toxemias at the Boston Lying-in Hospital and feels that routine examinations are of value.

According to Hirsch[8], the most common eye ground findings are detachment or edema of the retina, choked disc and inflammation of the choroid. He considers the prognosis of these conditions more favorable in pregnant than in non-pregnant women. He says that serious visual disturbances may develop, and yet the eye grounds may appear normal. He believes that the amaurosis in such cases is due to a disturbance in the visual centers of the brain.

Traymann[8] reports a case with asymmetric hypertrophy of the hypophysis and thinks that the asymmetry of the sella tursica or perhaps hyperemia of one half of the hypophysis may be the cause of the lemianopsia observed. He advocates paying more attention to the eyes during pregnancy, as amaurosis may be the first sign of an impending toxemia.

There are at present three general lines of treatment for patients showing these shgns of pre-eclampsia. These are (1) Radical treatment,

(2) Conservative treatment, and (3) a combination of radical and conservative. The radical treatment calls for a Caesarian section or prompt delivery, the conservativ is entirely medical in an effort to carry the patient through to full term before delivery, and the middle line treatment utilizes the conservative treatment until it becomes evident that such treatment is of no value and active intervention is necessary.

It is difficult to outline the treatment of pre-eclampsia as at times it may extend into eclampsia, so it will be necessary for me to deal with the two conditions.

H. J. Stander[8] of John Hopkins Hospital very well outlined the course for a patient carrying through the two conditions.

DISPENSARY

"1. Patients must be sent to the hospital whenever they show:

a. Systolic pressure of 150 or more and albumin;

b. Undue rise in diastolic pressure;

c. Any one of the above symptoms associated with severe headache, epigastric pain, or pronounced edema;

d. Sudden amaurosis, even if none of the conditions mentioned above are present.

2. Patients with increasing blood pressure and definite trace of albumin must visit the dispensary twice a week. If they do not follow directions, Social Service must visit them promptly.

WARD SERVICE Toxemias

1. In moderately sick patients when the albumin does not fall to below 1 gram per liter within a week, or when the general condition is not satisfactory, the induction of labor should be seriously considered.

2. Very ill patients will probably have induction of labor sooner immediate induction when amaurosis develops suddenly, either with or without epigastric pain. In primiparae with a rigid cervix, Caesarian section may be considered.

Eclampsia

1. Upon admission. Patients with frank eclampsia are:

a. To be placed in a quiet darkened room and to be disturbed as little as possible;

b. To have special nurse continuously until definitely out of coma;

c. To have one fourth grain morphia by hypodermic immediately;

d. To be catheterized, examined medically and obstetrically and bled for 200 cc. under nitrous oxide anaesthesia if conscious. The venesection is done only when it is necessary to obtain a blood specimen for research work;

e. To be placed on one side with foot of bed elevated so long as coma persists. Mucus to be swabbed from pharynx as it collects;

f. To have water freely when conscious. If patient cannot drink on account of coma or lack of desire, the intravenous administration of 500 cc. of 5% glucose solution should be considered;

g. Not to be delivered until cervix is fully dilated. Then by the simplest operative means, unless spontaneous delivery seems imminent;

h. No chloroform to be used;

i. Notify the chemical assistants as soon as patient is admitted, so that the necessary observations can be made."

Themore conservative means has only been employed in the last ten or fifteen years and from the recorded results in literature the mortality has been greatly reduced. The best results have been obtained with the combination as there are cases which will not respond to medical care and the uterus must be emptied by the appropriate means.

In order to reduce the high blood pressure some men have used veratrum viride which produces a rapid fall in blood pressure as well as in pulse rate. Stevens[16] advocates the injection of 1 cc. as soon as the patient is seen, but considers it dangerous except in presence of a high blood pressure. He reports a series of 25 cases with the

maternal mortality of 16 per cent.

Bourne[17] is a believer in the use of veratrum viride to control the blood pressure and advocates graduating the dose according to the height of the blood pressure, giving 1 cc. when the pressure is 190 mm. or above, and 0.25 cc. when it is between 140 and 155 mm.

Williams[8] however, treated every other case with veratrum viride and the alternate case by the usual method, and found that the results were practically identical. Consequently, it did no great harm and occasionally produced an alarming fall in pressure. It is doubtful whether such a fall in pressure is really beneficial and it should always be borne in mind that a high blood pressure may be a protective mechanism.

Venesection has been used in cases of toxic origin for hundreds of years so likewise it is employed in eclampsia and pre-eclampsia for reducing blood pressure and diluting what toxin might be in the blood stream. However it must be remembered, as above, that the high blood pressure may be a protective mechanism.

Mussey suggested the use of ammonium chloride to reduce the edema, if present, and lower blood pressure by it causing a prompt diuresis. He warns that although there is usually little or no increase in the blood urea, ammonium chloride should not be used without a previous determination of the blood urea content and the alkali reserve, as these may become markedly increased following the use of the drug.

Hockenbichler[8] showed that the rays from the quartz light lower the blood pressure and also decrease any existing acidosis. Kermauner[8] believes the rays good effect may be due to their action on the vessel spasm of the kidneys, brain, or skin. The number of cases reported is too small to draw any definite conclusions as to its efficiency. However its application is simple and apparently harmless so further test may be tried to enlighten the true clinical value of them.

The intra-cranial pressure may be relieved by lumbar puncture or by trephining. Voron and Mantalin[8] reported three cases in which the usual treatment of sedatives and eliminants had failed. They obtained a clear fluid under normal pressure, and its removal brought on marked improvement in the nervous symptoms, visual disturbances and headaches.

Willoch[8] uses sub-occipital trephining for both diagnostic and therapeutic reasons. He withdraws as high as 58 cc. of fluid and measures the tension. He found an increase in pressure in all his eclamptic patients except one. In over 50% of his cases the blood pressure fell after the puncture and in 38% diuresis was produced. He recommends it for pre-eclamptic patients as well as in eclamptic.

Miller and Martinez[19] have used liver extract or "heparmone" in the treatment of eclampsia and from their results it may be well to try it in pre-eclamptic patients.

They write" If perchance the liver has a certain neutralizing function, which could be conserved by the addition of liver substance, however given, it would make little or no difference regarding the nature or source of the toxic agent of eclampsia provided the vital capacity of the liver could be increased at will to meet the emergencies of the situation. With this thought as a background we began the use of heparmone in the treatment of pre-eclamptic and eclamptic cases."

They report 43 consecutive eclamptic cases so treated with a maternal mortality of 6.9 per cent. If such results are obtained in a larger number of cases the treatment will certainly be warranted.

Lazard[20], Rucker[21], and Dieckmann[22] report very good results in the treatment of pre-eclampsia and eclampsia with intravenous administration of magnesium sulphate. They have treated a large series of cases and advocate its use.

Stander[8] considers the results of such treatment as encouraging

but warns that its use in too concentrated a solution or too large an amount may cause liver lesions or even death. He believes the intramuscular administration the safer procedure.

A great deal has been written about diet in the treatment of and prophylaxis in eclampsia. Attention was focused on the amount and type of food the eclamptic patient received, when it was learned that a marked reduction in the incidence of eclampsia had occurred during the war, at a time when the women were receiving less food than normally and when the diet consisted mainly of carbohydrates.

Tweedy[23] and his co-workers believe that the diet may even function as an etiological agent in the production of eclampsia, and consequently lay particular stress on the kind and amount of food that patients should receive.

In his method of treatment when eclampsia has developed he has lowered his mortality to the lowest on the British Isles. The method consists primarily in starvation, gastric lavage, bowel lavage, morphia, injection of sodium bicarbonate under the breast and close observation to prevent drowning or other accidents. The patient receives nothing but water for several days and if there is no improvement Caesarean section is preformed. The gastric lavage is continued until the water returns clear, when 2 ℥ of magnesium sulphate solution are left in the stomach. The bowel lavage is given with the patient on her left side with the tube inserted 18 inches into the bowel. Sodium bicarbonate, 1 gram to one pint, is used until the bowels are clear and then one pint of the solution is left in the bowel. Recently they have omitted the use of morphia and their average maternal mortality is about 10%.

As seen by these various forms of treatment it is apparent that once eclampsia has set in there is no satisfactory way of combating it. However if better pre-natal care is given patients and if every physician taking charge of an obstetrical case is on the close look-

out for signs and symptoms developing much can be done in preventing the development of eclampsia.

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