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Eclampsia with emphasis on treatment

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ECLAMPSIA WITH
EMPHASIS ON TREATMENT

by

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INTRODUCTION

Definition

The word eclampsia is derived from the Greek word ἔκλαμψις which means a shining forth or a flash. Hippocrates used it to denote a fever of sudden onset, and Gehler, a German writer, used the word at the end of the 18th century and undoubtedly introduced it into our modern medical literature.

As we use the word today, it signifies an entity representing clinically - as the occurrence of convulsions and/or coma in a pregnant or recently delivered woman if associated with an increased blood pressure, albuminuria, or edema; pathologically - the presence in the liver of periportal hemorrhages and necrosis, of anemic infarcts, or thrombosis of the portal vein or its branches in a pregnant or recently delivered woman if associated before death with any or all of the symptoms or signs previously described. (25) Generally convulsions and eclampsia are considered as synonymous terms, but such a view is not correct, inasmuch as a number of well authenticated cases of eclampsia without convulsions are recorded. (73) Other toxemic conditions occasionally occur in obstetrical practice which are likewise accompanied by convulsions or coma. These will

be discussed under the differential diagnosis which will be described later.

Types

Since eclampsia may occur during the pregnancy, labor, or puerperium there are different names applied to each one to denote when it took place. If it occurs before the patient has reached term, is followed by recovery, with normal labor subsequently it is called "intercurrent eclampsia." If the patient is not in labor it is called "antepartum," if it supervenes during labor it is called "intrapartum," and if during the puerperium, "postpartum eclampsia." Generally speaking one-half of all cases of eclampsia are of the antepartum type and the other two forms, intrapartum and postpartum, are approximately of equal frequency.(30)

Dieckmann further classifies the above into two types:

1. Eclampsia, characterized by excessive weight gain and/or edema, albuminuria, hypertension, and the various cerebral, visual, gastrointestinal, and renal symptoms and signs--the so-called "wet eclampsia",
2. Hypertensive encephalopathy characterized

by hypertension, albuminuria, and little or no edema--the so-called "dry eclampsia".(25)

Incidence

Eclampsia usually occurs during the last trimester of pregnancy, but the disease has been observed as early as the sixteenth week. It also has been reported as occurring weeks and even months following delivery. The writer believes it is very doubtful whether convulsions appearing three days or more after parturition can be considered due to postpartum eclampsia, but are convulsions most likely due to hysteria, epilepsy, menengitis, etc.

Most authors are in accord with the statement that eclampsia tends to occur in groups of cases, after long intervals without a case.(10,16,19,20,85) This may be due to certain predisposing factors which will be taken up later.

Dieckmann, in a comprehensive study, has shown that the incidence varies considerably throughout the world. Incidence varies from 0.0% in Alaska and Australia to 2.85% in Algiers, Africa, and 7.2% in Charlotte, North Carolina. The mean incident for the world is 1.0%, for the United States 0.66%, and for the British Isles 1.13%.(25) This is in accord with Davis' investigation. (20)

The incidence is higher in primipara than multipara, the ratio being 3-4/1; is higher in diabetic than the non-diabetic; higher in multiple than single pregnancy; higher in the colored race than the white race and higher in hydramnois. Guerriero, of New Orleans, found in his study of 220 cases the ratio of white to black to be 2.2/1.(34) While Arnell reached the conclusion, after studying 142 cases, that there is no inherent racial variation effective in influencing either susceptibility to or severity of the disease.(2) To the writer, it seems the colored race would have a higher incidence due to their disregard of the ordinary laws of hygiene, and the casual manner in which they accept their pregnancies.

ETIOLOGY

Predisposing Factors

From the very beginning, there has always been a belief that the incidence and severity of eclampsia varies according to the weather and the time of the year. The time of the year in which there is the highest incidence is debatable but most authors agree that it is in the early spring months.(16,20,25,91) It is generally stated that this seasonal character is dependent on the increased irritability of the vasomotors and the vegetative nervous system during spring. It is also possible that during spring the activity of the glands of internal secretion are increased.(40) Eclampsia occurs with an abrupt change in weather - hot to cold or vice versa, that is abrupt change tensifies the toxemias. These changes in weather aren't the cause of eclampsia, but in susceptible patients these sudden alterations may cause disturbances in the water balance, acid-base equilibrium, and vascular system which result in tensifying the hypertension, edema, oliguria, etc. until convulsions and coma occur.(18) Many authors have proven that there is some correlation, especially in the United States, between eclampsia, high average

temperature, a small range of temperature, and a high measure of rainfall.(18,20,25,91)

During World War I a decided decrease in its incidence was noticed in Central Europe, and many writers have attempted to explain the fact on a dietary basis. During the war the women received a relatively low percent of protein and fat, with a corresponding increase in carbohydrate.(24) This is just the opposite viewpoint of Arnell, who maintains a low protein diet as a predisposing factor.(2) It must be remembered that eclampsia occurs much more frequently in primipara than in multipara, and it is possible that a change in the ratio of primipara to multipara might have taken place during the war. Multiple pregnancies are also viewed as predisposing factors and occur five times more frequently than in normal pregnancies. Shanter observed that most of his cases of eclampsia occurred about thirty years of age and that the age of predelection is between twenty-one and twenty-five years of age.(79) But this is not strange if one remembers that the majority of first pregnancies fall between the ages of nineteen and twenty-four years and that the incidence is higher in primipara than multipara.

Theories

Eclampsia can be truly called the "disease of theories". As early as the 17th century, when eclampsia was explained as a nervous disorder, till today, new theories have become advanced, regarding its etiology. While it is impractical to discuss all theories advanced, certain of them will be considered in detail.

Nervous Disorders:

1. In 1829, Harrison and Lever believed the disorder due to injury inflicted upon the uterine nerves. He thought it due to too rapid and forcible dilatation of the cervix uteri, or tincae or vagina in which some of the nervous fibrils were so suddenly elongated as to become fretted, unduly stretched or perhaps actually torn if not broken.(52,37)

2. According to Ramsbotham, in 1844, the proximate cause was due to pressure on the brain which was produced by the rupture of a cerebral vessel, by serious exudation into the ventricles or by simple congestion of the cerebral vessels themselves. The affection originating most commonly in some deranged state of the uterus itself, that is an irritation being propagated from the uterus to the brain.(70)

3. Dr. Rigby, in 1844, thought the exciting cause due to irritation arising from the presence of the fetus in the uterus of passages or from a state of irritation thus produced continuing after labor. He thought the predisposing factors to be pressure on the abdominal aorta, uterine contractions, constipation, retention of urine, injuries to the head, cerebral disease and mental excitement.(74)

4. Burns believed the disorder was caused by uterine contractions and sometimes "a neglected state of the bowels". He believed that the sympathetic irritation was almost invariably accompanied by an affection of the vascular system. This produced a great determination to the head which aggravated the evil and became the chief source of danger.(11)

5. According to Locock, in 1844, the immediate cause was often very obscure. An end state of the vessels of the brain appeared to him as the proximate cause. At times the brain appeared to him to be under the influences of distant irritation, such as the uterus or digestive organs. From this he reached the conclusion that attacks were due to a loaded or disordered stomach, undigestible food, straining of labor pains and even the disturbance of rush of blood to the head caused by the earlier uterine contractions.(53)

6. Tyler Smith attempted to demonstrate, in 1850, that puerperal convulsions were on a purely excitomotor phenomenon. He believed convulsions occured when the spinal marrow had been acted upon by an excited condition of its incident nerves coming from the uterine organs. Such excitement depending of labor, pregnancy or the puerperal state. While the spinal marrow remains under the influence of these stimuli, convulsions may arise from two series of causes:

a) those acting directly on the spinal marrow, or centric causes such as:
   1. loss of blood
   2. pressure from congestion, infusion, etc.
   3. asphyxia from closure of the glottis
   4. emotion, and those affecting the extremeties of the incident nerves, or

b) eccentric causes such as:
   1. irritation of uterine incident nerves
   2. irritation of incident spinal nerves of the rectum
   3. irritation of incident gastric fibers of the pneumogastric nerve
   4. irritation of the vesical branches and those of the surface of the body.(81)

7. Madden, in 1874, thought the disorder due to the state of the uterus during gestation, the condition of nervous susceptibility, the interference with the renal function, the cerebro-spinal congestion, and the irritation of the same by the circulation of the vitiated blood producing a direct toxic effect. They all combined to produce such a hyperesthetic or irritable condition of the excito-motor nerve substance as to need only the addition of the uterine irritation to cause the pent-up nerve force to burst into uncontrollable action producing eclampsia.(55)

8. Fordyce Barker refers to the work of Frankenhauser, of Jena, "On the Nerves of the Uterus," in which he says is demonstrated a direct communication between the nerves of the uterus and the renal ganglia. Frankenhauser believes that the sudden occurrence of eclamptic attachs following all external sources of irritation (as pressure of the fetal head upon the cervix, digital examination, etc.) and emotional causes, goes to prove that the nervous system and not the vascular is the starting point of puerperal convulsions.(4)

Kidney disorders:

1. Elliot, in 1873, instead of suspecting the

brain studied the kidneys. He noticed pregnancy as the special excitor in many cases of albuminuria and materially developing morbid conditions in many chronic cases in which they might possibly have remained latent for a much longer period. He believed albuminuria of pregnancy entailed a special liability to some dangers such as convulsions and mania.(35) Simpson had stated approximately the same in 1848.(91) Elliot is the first author, in my knowledged, who had foresite enough to say: "The pathology of the blood remains comapratively unexplored, and the relation of that fluid, and of the nervous system itself, to the proximate cause of the convulsions, as well as the influence of other toxemic conditions, offer wide fields for exploration."(35)

3. Hunter, 1943, is a believer in the arteriolar spasm theory. He bases his theory on the work of Goldblatt. Goldblatt's work on the kidney showed a striking similarity between the findings in the experimental animals after moderate clamping of the renal artery and the finding in an early pre-eclamptic state. We all know that a marked dilatation occurs in the ureter and pelvis during pregnancy, even as early as the tenth week. Whether this is secondary

to hormonal action or caused by pressure of the enlarging uterus upon the pelvic ureter is not of importance in this discussion. The fact that there is dilatation of the entire ureter and that the maximum dilatation occurs in the renal pelvis are important in that this dilatation may compress the kidney medulla and thus increase the intrarenal pressure with resulting tissue ischemia.(43)

3. Dienst, 1902, is under the impression that eclampsia is produced by toxins which originate in body of the fetus. This assumption is supported by the observations of various authors where the mother suffers only from albuminuria while the newborn presents a genuine picture of eclampsia. We know that eclamptic attacks disappear in most cases directly after the child is born. All the above favor the assumption that the source of the toxins of eclampsia is found in the fetus. A study of the blood of the mother as well as the infant, in cases of eclampsia, shows that the protein substances of the blood are increased. The source of this pathological increase of proteins in the blood is not definitely known. The forementioned considerations lead to the assumption that protein substances produced by the

fetus produce the exlampsia in the organism of the mother. The pathological increase of fetal protein substances in the blood of the mother is based not on an excessive production but a decreased elimination of the fetal metabolic substances by the organism of the mother. The decreased secretory efficiency of the mother's organism is the basis of the retention and accummulation of the fetal metabolic products in the body of the mother. Eclampsia is most frequently found in women suffering from some renal affection and supports the view expressed above.(26)

It is generally believed that death of the fetus in utero during eclampsia is followed by a cure and in patients who give birth to living children the toxemia disappears shortly after delivery. Some authors state that the condition doesn't always clear up following the death of the fetus in utero.(38, 57) Against this theory is that no metabolic product or poison has been definitely isolated in a women suffering from eclampsia. Other authors state that because eclampsia can occur in patients with a hydatidiform mole, the fetus cannot be regarded as the cause of the disease. (6,80)

Auto Intoxication:

1. Riviere advanced the theory that eclampsia

was caused by a toxin in the circulating blood of the mother. He believed the blood of the eclamptic women to be more poisonous than that of a normal person and their urine less toxic than normal.(75) So far, no satifactory evidence has been adduced to prove the existence of a toxin in the blood of eclamptic women. The writer believes it is resonable to assume that eclampsia is caused by an unidentified toxin. Since pathological changes are produced in the liver, the kidneys, the circulation and occasionally the uterus, as is the case in toxic separation of the normally implanted placenta, it is equally logical to assume that this toxin is transported in the blood stream.

Fetal Elements:

1. Veit, in 1902, believed that fragments of chorionic villi and fetal ectoderm entered the maternal circulation, acting as a poison which he called syncytiotoxin. He believed that this was neutralized by an antibody, syncytiolysin, which was normally present and when the toxin exceeded the antibody then eclampsia developed.(93)

2. Hull and Rohdenberg, in 1914, said that when an excess of fetal elements was thrown into the maternal circulation blood autolysis took place. This caused

the formation of luecine which inturn injured the hepatic vessels giving the characteristic pattern of pathology which will be described later.(42)

Placenta Theories:

1. At the end of the 19th century, this was the most widely excepted theory of them all. Numerous experiments with placenta and with placenta extracts have been conducted with the hope of finding the causative factor or factors. It has been noted that the toxemias of pregnancy are manytimes associated with infarction of the placenta and Young used this to explain his theory of placental autolysis as the causative factor.

Young and Miller believe the placenta degeneration is due to altered blood supply and that the absorption of the placenta toxin occurs through the portion of the placenta attached to the uterine wall. The toxin in turn causes a break down of the liver cells and possibly other cells, and it is the absorption of these broken down cells that cause eclampsia. (98) Williams, on the other hand, states the placenta infarcts when present in cases of eclampsia should be regarded as accidental findings or as secondary to the toxemic condition and not as its cause.(93)

Many experiments have been tried in which large quantities of placental ferment have been injected into the blood stream without its development. In chronic nephritis, there is usually extensive placenta infarcts, and yet eclampsia is rarely associated with that disease.

Infectious Theory:

1. It wasn't until 1844, that the first bacterial origin of eclampsia was proposed by Dilon and Rodet. Since that time various bacteria in the blood and urine of eclamptic women have been reported. Today, however, the general consenses of opinion is that no real proof has been adduced in favor of a bacterial origin of the disease.(27)

Endocrine Disorders:

1. Hoffbauer, in 1912, stated that in the pathogenesis of eclampsia and hyperemesis a dominating role is played by the hypophysis and suprarenals. This statement is based on the pathological changes in these structures clearly pointing to an increased secretory activity. In humans, there exist individual differences in reference to the sensitiveness towards adrenlin and hypophysin. It has been demonstrated experimentally that the kidney vessels are most sensitive

to adrenalin and that the vessels of the liver react highly intensively towards adrenalin. Weichowski has found that adrenalin has selective action on the cerebral vessels. Naturally this vascular constriction leads to an insufficiency of the corresponding organ. The insufficiency is relative and disappears after some time, but it may lead to severe consequences and may become absolute; this holds especially true for the brain. (40)

2. During a normal pregnancy the thyroid gland hypertrophies. Lang and his associates have suggested that failure on the part of the thyroid gland to hypertrophy may lead to toxemia of pregnancy. (49)

3. Williams and Wallis are of the impression that hyperactivity of the corpus luteum is the cause of eclampsia. They have noted that sometimes there is an overproduction of the substances which escapes into the blood stream and causes vomiting of pregnancy or eclampsia. They base their theory on the excess cholesterol in the blood during pregnancy, especially about the fourth month when the corpus luteum is most active. In eclampsia hypercholesterolemia is very marked, and they have proven that injections of corpus luteum extracts increase the cholesterol content of

the blood. They say the increased cholesterol content is due to an attempt to neutralize the toxic substances which come from the corpus luteum. They alhave shown by animal infection methods, that the corpus luteum contains a chemical compound which can produce lesions in animals quite similar to those encountered in eclampsia.(94)

Edema:

1. Traube and Rosenstein, in 1864, first proposed the theory that edema and anemia of the brain were the etiological factors in the production of eclampsia.(90) Zangemeister believes eclampsia is caused by edema of the brain with water. He states the blood vessels become more premeable during pregnancy, so that water accumulates in the brain tissue causing the extravascular pressure to increase and the intravascular pressure to decrease. This results in a decreased blood supply to the brain which causes insufficient oxygenation and nutrition of the brain cells, so that anemic areas result. If the process continues it leads to areas of necrosis and it is the development of these areas of necrosis that cause the tonic and clonic muscle contractions.(98)

Dietary Disorders:

1. Solomans suggested that the food becomes poisonous during pregnancy gives rise to eclampsia. He attempted to explain postpartum eclampsia on the theory that the mother's intestine contains food at the time when convulsions occur. He believed that the antibodies in the blood not only protect against bacteria but also guard against products of digestion which may have entered the blood. Eclampsia develops whenever the maternal antibodies are unable to handle the food particles coming from the diet, as well as the protein coming from the fetus.(83)

PATHOLOGY

Autopsy upon eclamptic patients usually reveal the presence of peripheral necrosis of the liver. This is the most characteristic lesion of eclampsia. Most authors regard areas of necrosis involving the periphery of the individual lobules and the portal spaces as characteristic of the disease.(6,8,15,20,30) Fahr describes the liver of eclampsia as presenting typical changes localized in the periphery of the lobules and characterized by thrombofibrin in the portal capillaries, or capillary stasis, the formation of blood spaces and hemorrhages with cell destruction.(32)

However, the periportal hemorrhages and necrosis which are given as the pathogomonic lesion of eclampsia have been found in a few pregnant patients who have had none of the clinical findings of eclampsia. This periportal lesion, however, is peculiar to pregnancy. Furthermore, patients who die ten days or more after the convulsive seizures have normal livers. The most reasonable explanation is that convulsions and coma can occur in the following types:

1. Eclampsia encephalopathy--"dry eclamptic"
2. Eclampsia--"wet eclamptic" (see introduction)

Another almost constant lesion of eclampsia is found in the kidney. Here the lesion is generall that of degeneration of the epithelium of the convoluted tubules.(32) Prutz believes the kidney lesions play a secondary part in the production of the disease as they are for the most part too slight to be of great significance.(68) Most authors agree that the kidney pathology is more the result then the cause of eclampsia (see etiology). Fahr summarizes the pathology of the kidney as:

1. swelling of the glonerular loops,
2. albuminous degeneration of the epithelium,
3. degenerative changes in the arterioles,
4. thrombotic lesions in the vessels, especially the glomerular capillaries, and
5. hemoglobin cylinders.(80)

Schwarz found similar changes and he believes the changes in the glomeruli are of chief interest and seem to play the predominent part in the kidney lesions.(77)

Although most cases of eclampsia present renal changes, it does not seem that they are characteristic of the disease or are of great significance.

Schmorl believes that degenerative changes in the myocardium are the most constant lesions and most characteristic is petechial hemorrhages into the

myocardium.(76)

Edema, hyperemia, anemia, thrombosis and softening of the brain have been reported.(7) Raso found that cerebral hemorrhage or anemia, with flattening of the convolutions, and serous effusions associated with punctiform extravasations of blood into the cortex and mesencephalon as characteristic of the brain changes in eclampsia.(71)

Wessman distinquishes three stages of retinal envolvement:

> Stage 1--characterized by edema of the papilla, the adjacent retina, and the macula with venous congestion,
>
> Stage 2--characterized by hemorrhage and white spots and
>
> Stage 3--characterized by considerable increase of the above with an arrangement in the form of a star around the macula.(95)

Ophthalmoscopic lesions are usually associated with an increase in blood pressure readings which exceed 200 mm. in sixty per cent of the cases and the highest blood pressure readings are obtained in cases with complicating detachment of the retina.

One must not forget ophthalmoscopic examinations are of value if pathological changes are found, but normal findings do not rule out the gravity of the toxemia.

Many authors found the ureters are often enlarged and dilated in eclampsia.(51,54) Recent observations show that one or both ureters are generally dilated in normal pregnancy so such a condition is in no way characteristic of eclampsia.(85)

Chemical changes:

Marked maternal metabolic changes are always associated with normal pregnancy and it is natural to suppose that similar disturbances may play a role in the development of eclampsia. Hence, a great deal of work has been done on the chemical findings in the urine and blood in eclamptic women. Studies of the urine have only shown the following facts:

1. the urea nitrogen is lowered and the ammonia nitrogen is raised,
2. decreased chloride excretion,
3. acetonuria, and
4. albuminuria.

Most authors agree that non-protein nitrogen and urea nitrogen of the blood are not increased in eclampsia.(8,43,60) If nitrogenous retention does develop, it is usually late in the disease and due to the injury to the kidneys produced by the eclamptic state or some factor dependent on the attack. The pathology has already been discussed.(43,60)

It is universally agreed that eclampsia is associated with a low blood calcium. However, one must remember that during the latter months of pregnancy there is normally a slight diminution in the blood calcium. In pregnancy, there is an increased use of calcium due to the requirements of the growing fetus and perhaps because of a special property of the cells of the pregnant women.(85) Stander noticed a decrease in the calcium to phosphorous ratio, and believes it is due to an increase in blood phosphorous rather than calcium decrease.(85)

We all know there is a definite increase in the total lipids in the blood stream during pregnancy and these findings are identical in eclamptic patients.

Eufinger has shown that there is an alteration of the protein fractions of the serum during normal pregnancy. The ratio of albumin to globulin decreasing from 2.6 in normal pregnant women to 0.81 in women at term whereas the euglobulin and fribrinogen both increased as term was approached. He found that in eclampsia the albumin to globulin ration decreased further averaging 0.21.(31) These are the same findings as Dienst who found increased fibrin content in some cases being ten to twelve times that of normal values. (26)

It is universally accepted that in eclampsia there is a decrease in the carbon dioxide combining power below that seen at term in a normal pregnancy. It is not unusual to see values below thirty volumes per cent. Davis found that severe eclampsia is associated with a true acidosis, due to an uncompensated alkali deficit, the pH of the blood averaging 7.04.(20) This is due to an increase in organic acids in the blood.

Since hypertension is one of the outstanding characteristics of eclampsia, many attempts have been made to show it is due to a toxin in the blood streams which acts as vasoconstrictor bodies on the vessel walls. The isolation of a toxin in the circulating blood has so far been unsuccessful.

SYMPTOMS AND SIGNS

Eclampsia occurs most commonly in the last trimester of pregnancy. Primiparity, multiple pregnancy and hydramnios are important predisposing factors. It is generally admitted that two-thirds of all cases and upwards occur in primiparous women. The disease is five to six times more frequent in twin than in single pregnancies and four to five times more frequent when the pregnancy is complicated by hydramnios.

The patient may feel quite well and be performing her household duties as usual when all of a sudden she will complain of a sharp epigastric pain, severe headache, disturbed vision or actual amaurosis. Fortunately, the symptoms are more often developed slowly producing a preeclamptic stage. It is probable that eclampsia and preeclampsia are the one and the same disturbance, the difference being one of degree only.

The first symptom, as recorded most often, appeared to be headache, which may have been present over periods of weeks. Frequently dizziness was recorded as the first symptom and occasionally visual disturbances. More common than these latter two, but less frequent than headache, was edema of the feet,

ankles and sometimes of other parts of the body. Epigastric pain ranked close to headache as the first symptom in colored individuals, while convulsions, as the first symptom occurred frequently in the white race. Occasionally the first symptom was coma, dyspnea or vomiting. Hypertension may have been present before the subjective symptoms.(89)

Of all the different classifications of symptoms and signs which have been suggested, I believe Dieckmann's to be the best. It is as follows:

1. Non-convulsive Toxemia -- Preeclampsia
   (a) edema (weight), proteinuria, hypertension
   (b) cerebral symptoms and signs--headache, dizziness, restlessness, amnesia, increased pulse and respiratory rate and fever
   (c) visual symptoms--diplopia, scotoma, decrease in vision and amaurosis
   (d) gastrointestinal disturbances--epigastric pain, vomiting, jaundice
   (e) renal disturbances--oliguria, anuria, hematuria

2. Convulsive Toxemia -- Eclampsia
   (a) convulsions--coma(25)

Edema

As early as the beginning of the 18th century, Dr. Hamilton reported that puerperal eclampsia was often preceded by anasarca, and, in 1874, Madden stated that puerperal eclampsia was preceded by edema of the

upper extremities, face and eyelids.(35,55) Edema is usually the outstanding feature of the disease and the face may become so edematous as to be almost unrecognizable while the legs and feet present a deep pitting edema.

Slight pitting edema of the ankles is a common finding in late pregnancy and is due in great part to an increased venous pressure caused by pressure of the uterus on the common iliac veins. Edema of the legs or any other part of the body is abnormal and should be interpreted as a danger signal. The condition is toxic.(61)

The various primary and secondary factors which may be concerned in the formation of edema in pre-eclampsia and eclampsia are:

1. decreased colloid osomotic or oncotic pressure of the serum proteins,
2. increased permeability of the capillary walls and
3. increased capillary pressure:
   (A) contributory factors are--
      (a) decreased tissue pressure
      (b) increased concentration of proteins in the tissue fluids

(c) warm environment

(d) impaired elimination of water or sodium chloride or an excessive ingestion of either or both

(e) abnormal hormone metabolism(18)

Edema is likely to occur with a serum protein concentration of less than 5.5 plus or minus 0.3 gm. per cent, or a serum albumin concentration of less than 2.5 plus or minus 0.2 gm. per cent. Such a low concentration is usually associated with a colloid osmotic pressure of less than twenty centimeters of water.(23) The average serum protein concentration for normal individuals is 7.5 plus or minus 0.51 gm. per cent, with a range of from 6 to 8.3 gm. per cent. Dieckmann found the average serum protein concentration in normal pregnant patients to be 6.5 gm. per cent.(23) He and his associates found that the colloid osmotic pressure is 28.7 centimeters of water in normal pregnant patients at term, 24.9 centimeters in toxemic patients with edema and 26.5 centimeters in those without edema.(23) Many factors are concerned in the formation and disappearance of edema. The consensus of opinion is that edema is likely to occur if the

oncotic pressure is less than twenty centimeters and likely to disappear if the pressure exceeds this figure.(23,25) These figures indicate that the cause of the edema in most of the preeclamptic and eclamptic patients is not due to a hypoproteinemia.(23) These authors have believed for many years that the edema was not due to a hypoproteinemia. They have repeatedly stated that a marked blood dilution occurred preceding clinical improvement associated with an average decrease of 14 per cent in the serum protein concentration in preeclampsia and 25 per cent in eclampsia, and that the diuresis, disappearance of the edema, negative sodium chloride and water balance and greatest weight loss occurred when the serum protein concentration was the lowest.(23)

That pregnancy has a very definite effect on capillary permeability and water balance is exemplified by studies of two pregnant patients with diabetes insipidus who, despite their polyuria, showed gains in weight and developed peritibial edema and a mild hypertension. Their serum protein concentrations were 6.5 and 5.5 gm. per cent, respectively, at the height of the edema.(23)

Hypertension

Hypertension is usually always present but we

occasionally see an eclamptic whose pressure is around 140/110--usually it will run around 200/170. Hypertension seen in eclampsia is probably a compensatory factor of the body in its attempt to excrete urine, chloride and toxins through the already "damaged kidneys".(59)

Weight

Many patients have abnormal gains in weight, which can only be due to retained water, long before they have demonstrable edema. Therefore, the wise doctor should calculate the weekly or monthly gain at each examination. It is universally agreed that a weight gain should not exceed 300 gm. per week; the total gain not to exceed 8 Kg.(23,63)

Proteinuria

The usual qualitative tests reveal no protein in the urine of normal pregnant patients but a quantitative determination will yield 0 to 0.3 gm./24 hours. If a quantitative test for protein is positive it should always suggest the possibility of an early toxemia.(23) A persistent 24 hour excretion of 5.0 gm. or more warrants interruption of the pregnancy in the interest of both fetus and mother.(25)

Albumin forms the greater part of the protein

found in the urine and the loss is rarely sufficient to cause a hypoproteinuria.(25)

Urinary Sediment

The Addis count indicates that the number of casts erythrocytes, leucocytes and epithelial cells is slightly increased in normal pregnancy and increased even more in the toxemias.(25)

Cerebral, visual, gastrointestinal disturbances, headache, dizziness, increased pulse and respiratory rate, fever, diplopia, etc. are all due to cerebral anemia which may be caused by an edema of the brain or a marked vascular spasm. The epigastric pain is a local symptom and may be due to increased intestinal peristalsis or to the subcapsular liver hemorrhage.(25)

Convulsions and Coma

These are due not only to cerebral anemia, resulting from edema in most cases, but also to arteriolar spasm in other cases.(17)

In the severe fulminating type convulsions take place soon after the appearance of the first symptom. The patient's eyes become fixed and the pupils are usually widely dilated. Soon muscle twitching appears about the mouth, spreads over the entire face and finally the whole body is undergoing clonic and tonic

convulsions. They may last a few seconds to minutes and are followed by periods of coma which last minutes to an hour or more. During the convulsion the the breathing becomes stertorous, the face becomes congested, and the patient may foam at the mouth. It is very unusual for a patient to die during the first convulsion and coma, although there are such cases on record.(20) Occasionally the patient may come out of the convulsions fairly clear being able to respond almost immediatily. The patient may have from 1-100 such attachs and the greater the number of attacks the less time between convulsions. They may become so frequent that the patient never recovers consciousness and she dies while in this state.(20)

Regardless of how severe the symptoms may be the patient usually begins to improve immediately following the delivery. This has lead to much speculation in theories which I have already discussed earlier in this paper. Often the patient goes into labor and is delivered while still having convulsions. Then the convulsions stop immediately or become less frequent ultimately cease and complete recovery follows. Unfortunately in some patients this isn't the case, and the patient may die within an hour after the appearance

of the first convulsion while others may die as late as a few days after the cessation of the convulsion. These deaths are usually do to edema of the brain, lungs, or aspiration pneumonia. Some authors claim an uncompensated acidosis plays a major role in sudden deaths, occuring shortly after a convulsion.(20,63)

COMPLICATIONS, DIAGNOSIS and PROGNOSIS

Fortunately eclampsia, even though it is like an "atomic bomb" in its active stage, rarely leaves any complication if the patient recovers from this active stage.

Patients differ as to whether cerebral or visual symptoms predominate in eclampsia--the later is more serious. Complete blindness, developing early in the disease, may be associated with severe edema of the retina to complete detachment of the retina. The loss of sight may be abrupt and, although the recovery is over a period of days, there is rarely any permanent decrease in visual acuity.(25)

McClellan, Strayhorn and Densen after studing thirty patients (follow up ranged from six months to thirteen years) reached the conclusion that eclampsia does not predispose to hypertension in any undue proportion nor to a chronic glomerulonephritis.(58) The writer believes further observation would be required before any definite conclusion could be drawn from their series.

On the other hand, Dieckmann and Brnon have summarized the literature on this subject and found an average incidence of 27 per cent hypertension and 19

per cent chronic nephritis subsequent to attacks of eclampsia.(22)

Diagnosis

Except for the possibility of confusion with nephropathies, the recognition of eclampsia usually offer no difficulty. In contrast with nephropathies (glomerulonephritis, pyelonephritis, the nephroses, and the congenital anomalies of the urinary tract) in pregnancy there is no retention of urea or of non-protein nitrogen. The uric acid of the blood, the fibrinogen and cholesterol may be elevated.(39) It might be confuseded with acute poisoning from strychnine, phosphorus, or nitrobenzal but such instances are extremely rare, and careful inquiry into the patient's history should eliminate any errors. Other conditions which should be borne in mind whenever convulsions or coma appear during pregnancy, labor, or the puerperium, and must be excluded before a positive diagnosis can be made are:

1. epilepsy,
2. meningitis,
3. gumma of the brain,
4. neoplastic growths of the brain,
5. acute yellow atrophy of liver, and

6. hysteria.(46)

However, it is important to remember that one is much more likely to make a diagnosis of eclampsia too frequently than to overlook the disease. Convulsions occurring later than the third day of the puerperium are rarely a manifestation of postpartum eclampsia, and such a diagnosis is permissible only when characteristic changes in the blood pressure and urine are demonstrable. Very occasionally an accurate clinical diagnosis cannot be made and the nature of the attack must remain in doubt unless the patient comes to autopsy.(85)

Prognosis

Naturally the prognosis will depend upon the type of patient, being much more favorable when she is seen immediately after the convulsion than in neglected cases which are sent to the hospital as the last resort. It also will vary according to the degree of severity, that is whether its mild or severe. Eden has classified eclampsia as to mild or severe, and designates as severe any case of eclampsia showing two or more of the following:

1. prolong coma,
2. pulse rate above 120,
3. temperature 103 degrees farenheit or higher,
4.

4. blood pressure above 200 millimeters systolic,
5. more than ten convulsions,
6. 10 grams or more of albumin/liter of urine, and
7. absence of edema.(29)

There is considerable discrepancy of opinion concerning the relative prognosis in primiparious and multiparious women. Stander found the disorder to be twice as dangerous in the multiparious women.(85) This is in accord with Plass who found the mortality rate among the multipara to be 14.3 per cent and in the primipara to be 8.5 per cent.(66) Olshausen believes there is no difference in the two groups(62) and his contention is borne out by Eden's figures which show a mortality rate of 22.9 per cent and 27.4 per cent, respectively.(29) However, Douglass and Lynn are of the opinion the more severe character of the disease in multiparae is likewise indicated by the lower infant survival rate, and the fact that the convulsions tend to develop before the beginning of the last trimester of pregnancy.(28)

In all probability, the prognosis is more severe in multipara than primipara. The writer bases his

belief on the statistics, on the work of Douglass and Lynn and on the fact that in young women the disease is ordinarly not complicated by preexisting cardiovascular or renal disease, and the prognosis should therefore be more favorable.

During the period of extensive radical treatment the prognosis was more gloomy in the ante and intrapartum eclampsia than in the postpartum type. Since the advent of conservative treatment the death rate in the former has become gradually decreased, while that of the latter has remained stationary until today they are of approximately the same prognostic value.

TREATMENT

History

Prior to 1870 the treatment eclampsia consisted mainly in venesection, sedatives, cold packs or baths, but no obstetric interference. From 1870 to 1890 the treatment was still expectant, and narcosis, diaphoresis and pilocarpine played a great part, while venesection was more or less abandoned. Later in this period (1870-90) the teaching was to effect the promptest possible delivery, by means of accouchement forc'e or instrumental dilation of the cervix. The average maternal mortality during this period was over 30 per cent. After 1890, there was a great trend towards vaginal cesarean section to be performed as soon as possible after the first convulsion. From then on radical treatment of eclampsia was generally followed until today in which there are three schools of thought:

1. conservative -- pregnancy is terminated only after the eclampsia is well controlled and for the purpose of preventing recurrance of the entire acute toxic state.

2. radical -- pregnancy is terminated as soon after the first convulsion as possible, for the express purpose of stopping the convulsions.
3. middle-line -- this treatment expectant until it becomes evident that conservative measures are of no avail, and radical intervention is then resorted to.

Dr. Blundell, in 1828, advocated four principles of treatment. First, and of greatest importance, venesection and to bleed as much as the patient may safely bear. Second in importance was a thouough evacuation of the alimentary canal. Third, generally find symptoms of cerebral efflux of blood; hence, the importance of complete refrigeration of the head. And fourth, delivery if one can do it gently otherwise leave it to nature.(7)

W. Tyler Smith, in 1846, was also a believer in venesection and recommended blood-letting in fullness of the vascular system as the most powerful sedative of spinal action that we possess. He believed it to be the grand remedy in the simpler forms of convulsions, where the disease depended upon the stimula- of the spinal marrow by excess blood.(see theories)

However, Smith did not recommend venesection where the circulation was below par, and stated that a loss of blood under these conditions acted as a stimulant to the spinal marrow. In addition, cold water to the head and face in order to open the glottis and to relieve cerebral congestion, and avoidance of all emotional excitement, seemed to him of great importance. Ten years later he said, "Bleeding in this disease is curative in its action on the spinal marrow, preventative in its action upon the brain."(81) At no time did he state his maternal or fetal mortality but Radford, in 1856, used Smith's regime and stated he had a high maternal mortality.(69)

In 1859, Dr. Bullen treated eclampsia by chloroform enhalations and believed eclampsia had no immediate connection with the process of labor but was actually uremic convulsions.(7) Charles A. Lee, a follower of Bullen's treatment reported a case success fully treated by chloroform. He believed the congestion of the kidneys from mechanical pressure must be the cause of albuminuria, inasmuch as the condition is met with most frequently in primipara and disappears in two to three days at farthest after parturition. Lee believed the chloroform in the vast majority of cases was the best treatment.(50)

In 1870, Prof. H. S. Cheever of Michigan reported a case treated by evacuating the stomach, abstracting fifteen ounces of blood, giving five grams calomel and jalop, each, sponging of the entire body with warm vinegar and keeping the patient well under the influence of chloroform throughout. The baby was successfully delivered alive and the chloroform was stopped. In two and one-half hours the mother had another convulsion which terminated in death and he believed that if the chloroform had been kept up the mother no doubt would have lived.(17)

J. J. Philips, after a review of the literature, in 1870-71, reached the conclusion that the decrease in mortality was probably due to the less free depletion of blood that had been practiced. He believed the chief reliance should be placed on chloroform which prevented the occurrence or diminished the violence of paroxysms.(65) On the other hand, G. Swayne, in 1868, regreted the disuse of the lancet and objected to chloroform as a substitute for it.(87) Harvey Jewett was in accord with Philips and in 1871 reported prior to 1860 that he found ten recorded cases that were treated by copious and repeated bleeding, blisters, cold and opium. Out of the ten cases

thus treated seven died. Since that period he found six cases that were treated with chloroform and drastic cathartics, not one of the members were bled and all recovered.(47)

Dr. Robert Barnes, in his Lumleian lectures of 1873 believed: Pregnancy and labor required an extraordinary supply of nerve force which implies a corresponding organic development of the spinal cord. The provision of such nerve force implied a greatly augmented irritability of the nervous centers, rendering them more susceptible to emotional and peripheral impressions. The disturbance in nutrition, occasioned by pregnancy, almost always entailed some alteration of the blood which increased the irritability of the nervous centers. When the blood change is marked by albuminuria, a poisonous action of peculiar intensity is exerted upon the nervous centers, tending to produce eclampsia. Rational treatment must accord with two great factors in the production of such a disease. Namely, exalted nervous irritability and lowered or empoisoned conditions of the blood. His plan of treatment is as follows: Induction of labor where practicable, especially by puncturing the membranes and leaving the rest to nature; the induction of

anesthesia by chloroform; and when the patient can swallow in the intervals of fits, the giving of one-half drachm dose of chloral and then every three to four hours giving a like quantity of bromide, potassium or ammonium. Barnes says, "I'm one of those who think there is more harm than wisdom in the almost absolute disease of the lancet, but in this particular period I do not regret the disuse into which it is falling."(81) Fox was a strong follower of Barnes.(5)

Dr. Henry F. Campbell, in 1870, a believer in the theory of nervous disorders, stated the proximate cause of eclampsia to be central and peripheral irritation or exaggeration of reflex excitability. He thought the sole indication was to quiet and subdue the irritation. He especially advocated the use of opium and believed opium and its preparations were far superior than anything else for controlling irritation. Next to opium and superior to opium in many cases was blood letting as the sedative. He claimed that if it was not resorted to so frequently, venesection should at least be retained as one of the most reliable of all our alliances. While chloroform, chloral and bromides may all be considered with this as possessing one

common thereapeutic endowment--the power to subdue nervous irritation.(15)

Both Elliot, 1873, and Barker, 1874, were strong believers in the use of chloroform and their work can be summarized by saying: they thought chloroform was the most prompt and certain agent they possessed for moderating the violence and preventing the recurrence of the convulsions.(3,30)

Prenatal Care

As you have no doubt noticed nothing has been mentioned in the history of prenatal care. It is quite obvious that in the early treatment too little was known to provide adequate prenatal care. In reviewing the literature, the only article I found pertaining to prophylaxis was one by T. More Madden, in 1874, who said "treatment by him was especially prophylactic. His regime was as follows: cupping and fomentations over the loins to relieve the congestion in the kidneys, the free use of diluents and the continuous administration of mild diuretics especially colchicum in small and guarded doses, saline cathartics to help purify the blood and sedatives, such as, potassium bromide and belladonna for soothing the nervous irritability.(55) His treatment was greatly

inadequate.

Prenatal care is an important factor in preventing the occurrence of eclampsia, as well as in reducing its maternal mortality. Today almost everyone is agreed that the incidence of eclampsia has been markedly reduced during the past twenty years, by the rigid application of adequate prenatal care of the mother.(10,19,20,25,84) The frequent routine checking of the blood pressure, of the urine, weight increase and of the patient's general condition undoubtedly leads to the early recognition of a preeclamptic state or an eclampsia that may be pending.

The principle of prevention rather than treatment of the disease is particularly applicable to eclampsia. The prevention of serious preeclampsia and eclampsia is logically based upon measures to combat any undue gain in weight with retention of water and sodium, and continual vigilance to detect the first signs of toxemia--edema, albuminuria, increase in blood pressure, vomiting, headache and loss of appetite.

The recording of the weight and blood pressure, search for evidence of edema and examination of the urine should be carried out routinely at regular

visits, beginning with a complete physical examination as early in pregnancy as possible. Thus, those patients with essential hypertension and vascular-renal disease and the larger group of normal patients with edema are recognized early.(1,10,89)

Many patients have abnormal gains in weight, which can only be due to retained water, long before they have demonstrable edema. Therefore it is necessary for the practicing obstetrician to calculate the weekly or monthly gain at each examination and to be guided in his treatment by this information. It is generally agreed, the gain in weight should not exceed 300 gm. per week with the total gain not to exceed 8 kg. If the gain in weight exceeds this figure and also during the latter half of most pregnancies, the diet should be low in salt or even salt-free, and medicinal preparations containing sodium should not be used. These measures, together with sufficient rest, usually suffice to prevent the more severe forms of edema and preeclamptic toxemia.(10)

When mild toxemia is discovered, that is, when the systolic blood pressure is 130 mm. or more on two occasions, the patient should be carefully watched. If the systolic pressure is 140 mm. or more, or if

there is an increase in the systolic pressure of 40 mm. or more, even though the final systolic pressure is less than 140 mm., it must be regarded as abnormal and the patient should be seen at least once or twice per week. With each visit, she should bring a sample of the measured twenty-four hour urine output for quantitative albumin determination. The patient should be placed a 2000 caloric diet which is made up of 60 gm. protein, 30 gm. of fat and 400 gm. of carbohydrate with less than 1 gm. of sodium salt. The patient should have adequate rest at night with periods of rest during the day. Small doses of phenobarbital are often helpful, and if there is much edema ammonium chloride should be given in doses of 1 gm. 6-8 times per day.(25) If such treatment is begun early, it usually prevents further increase in the severity of the symptoms.

Marked edema is quite often the first sign of preeclampsia and in conjunction with the other signs is found in forty per cent of the mild preeclamptics and in sixty-six per cent of the severe. In contrast to essential hypertension, the figures are three per per cent and fourteen per cent, and in vascular-renal disease twenty-nine per cent and twenty-seven per cent

respectively. Slight pitting edema of the ankles is a common finding in late pregnancy and is due a great part to an increased venous pressure, caused by the pressure of the uterus on the common iliac veins. But edema of the legs or other parts of the body is abnormal.(25) However, E. Murray feels that the popular belief that edema with swelling of the ankles is due to pressure, and therefore of no import, is most dangerous as he believes the condition is toxic.(61) The writer finds in reviewing the literature that seventy-five per cent or more of the eclamptic patients have marked edema.

As stated before, an examination of the urine should be carried out routinely at regular visits, especially for the quantitative amount of albumin. Dieckmann has done much studying on the urine of pregnant and eclamptic women and the following is taken from his work. The usual qualitative tests reveal no protein in the urine of normal pregnant women, but a quantitative determination will yield 0 to 0.3 gm per twenty-four hours. If a positive quantitative test for protein is found, which should always suggest toxemia, the patient should be instructed to save the urine in a single container for

twenty-four hours, measure it and bring a small specimen to the doctor. Quantitative determinations for protein, chloride and non-protein-nitrogen should then be made. Dieckmann found the total excretion of protein per twenty-four hours is usually less than 1.0 gm. Generally speaking, as long as the proteinuria was less than 5.0 gms. per twenty-four hours, the patient should be observed at weekly intervals. However, he found in his studies the persistent excretion of more than 5.0 gms. indicated the need for hospitalization because fetal death in utero due to placental infarction quite often occurred in the arterial hypertensive patient and eclampsia was imminent in the preeclamptic. The determination of the chlorides should be used as a check on the patient's diet. The sodium chloride excretion must be less than 3 gms. per twenty-four hours to be of any value as a therapeutic measure in the treatment of edema and as a preventive against further increase in the blood pressure.(25)

He further found albumin to form the greater part of the protein found in the urine, and the amount and duration of the loss never sufficient in preeclampsia to cause a hypoproteinemia. However, in severe vascular-

renal disease, chronic glomerulonephritis, and nephrosis, the loss is quite often great enough and the duration of the disease is long enough to seriously lower the serum protein concentration of the blood.(25)

As been mentioned before, the Addis count indicates that the member of casts, erythrocytes, leukocytes, and epithelial cells is slightly increased in normal pregnancy and increased even more in eclampsia. The occurrence of an abnormal urine sediment indicates the need for repeated studies of the patient and a proper diagnosis of the disease. The occurrence for one week or more of erythrocytes should suggest acute glomerulonephritis, pyelonephritis, nephrolithiasis, tuberculosis or neoplasm.(25)

Today nearly all authors agree on the management of non-convulsive toxemia.(10,20,85) Dieckmann's, which is a good representative of them all, is as follows:

1. Examination
   (a) Ambulatory--weekly or semi-weekly
   (b) Hospital--patient is weighed and a twenty-four hour urine examination for volume, quantitative protein, and chloride, and three determinations of the blood pressure are made daily.

2. Hypertension
   (a) Relaxation--adequate rest at night and

one hour twice daily. As term is approached, more time may be spent in bed until all time is spent in bed.

(b) Sedation--phenobarbital 0.5-1.0 gr. or 0.03-0.06 gm. three times a day. Potassium bromide 0.6 gm. or 10 gr. three times a day. Sodium-luminal 5 gr. or 0.3 gm. 1-2 times per day, and may give subcutaneously in severe cases.

3. Elimination--soapsuds emena and mild laxative as needed.

4. Excessive gain in weight--a diet composed of vegetables, fruits, lean meats which must be broiled or boiled or roasted, eggs and 500 cc. of skimmed or buttermilk, no pie, cake, bread, butter, cream, gravy, soup or table salt.

5. Edema--a diet low in sodium and chloride. Watch weight (water balance) ammonium chloride in 1.0 gm. gelatin capsules is given 8 times per day for five days and repeated after five day interval. If symptoms of cardiac decompensation are present, limit the fluid intake to 500-1000 cc.

6. Oliguria or anuria--intravenous injection of 500-1000 cc. of a twenty per cent solution of glucose 2-3 times daily. Occasionally 500-800 cc. of a thirty per cent solution are necessary to produce a diuresis. If there is cardiac decompensation 100-200 cc. of a fifty per cent solution are used.

7. Proteinuria--determination of the twenty-four hour amount as a prognostic guide. No specific treatment.

8. Cerebral, visual and gastrointestinal symptoms--sedation. Intravenous glucose. Delivery.(25)

The writer believes if all the practicing obstetricians would follow such a plan of treatment as listed above the incidence of eclampsia would be so decreased

eclampsia would become one of the diseases of the past.

Some authors believe in restricting fluids to 1000 cc. per day even if cardiac decompensation isn't present. However, the writer agrees with Dieckmann. If one would only remember, a physiological diuresis is the best diuretic of them all, if cardiac decompensation is not present. Such a diuresis can be obtained by forcing fluids rather than by the restriction of fluids. The posterior pituitary secretes an antidiuretic hormone whose action is specifically on the kidney tubules causing them to reabsorb most of the water which passes through them. As long as this hormone is present in the blood stream, diuresis will not take place under normal conditions. But, this hormone can be stopped by forcing fluids. As one will recall, the osmotic pressure of the blood, extracellular spaces and cells mainly govern the water balance. By forcing fluids (water) the osmotic pressure is decreased accordingly in all three places. Soon the cells become so distended that they trip off a mechanism, which theoretically is located in the cell wall, which inhibits the secretion of the antidiuretic factor of the posterior pituitary. Thus diuresis is obtained. One must remember this isn't

a sudden diuretic and the patient is liable to gain weight at first, as some of the antidiuretic hormone is still present in the blood stream. As soon as this hormone is used up a physiological diuresis takes place with a remarkable decrease in weight. This early increase in weight can be counteracted by giving ammonium chloride, etc. as listed above.

If in spite of this above management or perhaps through lack of this management, the findings of severe preeclampsia develop, this term is reserved for those few cases in which eclampsia is imminent, hospitalization is clearly indicated. The symptoms and signs of preeclampsia which indicate hospitalization of the patient are:

1. systolic pressure of 170 mm. or more or an increase in systolic pressure of 40 mm. or more,
2. abnormal increase in weight with sudden increment of two or more pounds per week,
3. sudden marked edema, especially of the face or abdominal wall,
4. proteinuria of more than 5.0 gm. per twenty-four hours or concentration of 0.4 per cent or more (three plus test),

5. appearance of cerebral, visual or gastro-intestinal symptoms, or
6. hematuria or oliguria. (10)

In the hospital the twenty-four hour urine output should be measured daily and a specimen examined as explained above. The blood pressure should be recorded three times per day and a strict 2000 caloric salt-poor diet of 60 gm. of protein, 30 gm. of fat and 400 gm. of carbohydrate should be maintained. Other treatment should be the same as described above.

Even though the ultimate cause of preeclampsia and eclampsia is not known, it is known that there can be no eclampsia without the placenta, except for a short time postpartum. Therefore, it is obvious when toxemia is progressively sever, it may be desirable to empty the uterus and thus avoid the high mortality of eclampsia.

Dieckmann's indications for terminating the pregnancy are clear and logical and are based upon the duration of pregnancy, the condition of the cervix and the following two groups of signs:

Group A

1. The systolic blood pressure is constantly 170 mm. Hg. or shows a persistent daily

increase.

2. The proteinuria always exceeds 5.0 gms. per twenty-four hours or the qualitative test of the twenty-four hour urine is 3 plus.
3. The gain in weight exceeds 100 gms. per day.

Group B

1. The appearance of cerebral, visual or gastrointestinal symptoms.
2. The occurrence of hematuria, oliguria or anuria.
3. The appearance of jaundice.
4. The blood non-protein-nitrogen is 50 mg. per cent or more.
5. The pulse rate is 120 or more.
6. The appearance of cyanosis or edema of the lungs.
7. The blood shows an increasing concentration as indicated by an abnormally high or increasing hemoglobin, cell volume, serum protein concentration or specific gravity.(25)

If begun early enough, careful medical management

of the toxemic patient will usually prevent further increase in the severity of the symptoms and signs until the cervix is "ripe". By "ripe" is meant, that the cervix is effaced, soft and dilatable in the primipara or soft and partly dilated in the multipara as determined by vaginal examination and that labor can usually be successfully induced by the rupture of the membranes.

Dieckmann says that if uterine contractions have not begun in twelve hours under the above medical management 0.5 to 1.0 m. doses of pitocin should be given every thirty minutes until the contractions are occurring regularly at three to five minute intervals. However, one must remember pitocin is an extract of the posterior pituitary and may contain some of the antidiuretic hormone and produce an oliguria in a patient otherwise free of this sign. So it should be used with caution.

Warner Bump has made use of Dieckmann's two groups of signs for terminating pregnancy as follows:

1. Gestation of 26 weeks or less should be terminated if more than one of the above listed criteria are present or if there is no appreciable improvement after 7 days adequate treatment.

2. Gestation of 27-31 weeks should be treated medically until 32 weeks, unless

some group "B" signs develop or the group "A" signs persist despite treatment or increase in degree.

3. Gestation of 32-40 weeks, if group "B" signs are absent should be treated medically until the cervix is ripe when induction of labor will be successful. If group "A" signs increase in degree or if any of the group "B" signs appear, the pregnancy should be terminated by rupture of the membranes and/or the insertion of a bag or cesarean section if the cervix is uneffaced and closed.(10)

Dieckmann agrees with Bump in the methods used to induce labor and says, "The patient who does not respond to treatment or has been neglected is treated by rupture of the membranes and/or the insertion of a bag if the cervical canal is less than two centimeters long, or, if there is no effacement and dilatation, by cesarean section under local anesthesia.(25)

When convulsion do occur, that is true eclampsia, the danger to the patient becomes great and the considerations for treatment become somewhat paradoxical. If one remembers, eclampsia only occurs in the presence or very recent presence of living chorionic tissue, the obvious course is the removal of that tissue as soon as possible. All well and good but, on the other hand, the eclamptic patient is in a critical condition which brings about a staggering mortality from immediate

emptying of the uterus by such measures as accouchement force or cesarean section. Thus from this has developed the radical, conservative, and mid-line treatment.

Radical

The proponents of this method insist that the essential feature is to empty the uterus by operative means as soon after the first convulsion as possible. Until recently, radical treatment was the general method of treatment. Plass in reviewing the comparative results in over 10,000 cases reported in the literature, found that in patients treated radically the maternal mortality was 21.7 per cent while in those treated conservatively it was 11.1 per cent.(54)

Peterson recommended abdominal cesarean section in treatment of antepartum eclampsia and in 1914 reported 530 cases so treated with a maternal mortality of 23.4 per cent.(64) In 47 cesarean section operations for eclampsia in New Orleasn, between 1921-1926, the mortality was 41.5 per cent.(20) Stoekel also is a staunch believer in cesarean section treatment of eclampsia and reports a maternal mortality of 8.4 per cent in a series of 119 cases so treated.(86)

The writer is of the opinion radical treatment

is the worst possible management of eclampsia and feels that any fair minded obstetrician would reach the same conclusion after a thorough review of the literature.

Conservative and Middle-line

It is a known fact that the lowest maternal mortality is obtained in those patients who deliver relatively soon after the onset of the convulsions. Logically the proper treatment of eclampsia should aim at the emptying of the uterus by the safest means when the condition of the patient is sufficiently good to tolerate the procedure. Such a concept of treatment entails medical measures before any mechanical interference. This therapy consists of general care and rest, sedation and the production of diuresis. Water-retention and progressive renal shut-down cause cerebral edema, pulmonary edema, cardiac decompensation and circulatory collapse--thus diuresis is the most reliable sign of improvement.

Stroganoff has developed a conservative management which has given excellent results in his hands, as well as those of Irving, Anderes and Temple. His treatment is as follows:

1. Upon admission--
   (a) dark room with a minimum of noise

(b) special nurse
(c) examination or disturbance of patient only when absolutely necessary and then usually under chloroform
(d) .01-.02 gm. morphine hypodermically, while under chloroform narcosis; usually about 10-15 gm. of chloroform being employed.

2. One hours after admission--
(a) 1.5-2.5 gm. of chloral hydrate per rectum and 100 cc. normal salt solution and 100 cc. milk. Should the patient be conscious, the chloral hydrate can be administered without the use of chloroform, except where the patient has had one or more convulsions after admission; then about 10 gm. of the anesthetic are used with each dose of chloral hydrate.

3. Three hours after admission--
(a) .01-.02 gm. morphine hypodermically under 10-15 gm. chloroform.

4. Seven hours after admission--
(a) 1.5-2.5 gm. chloral hydrate, as above.

5. Thirteen hours after admission--
(a) 1.0-2.0 gm. chloral hydrate, as above.

6. Twenty-one hours after admission--
(a) 1.0-2.0 gm. chloral hydrate, as above.

7. After each convulsion--
(a) Oxygen is administered as quickly as possible. This is kept up until the breathing improves, usually about five minutes.

8. After three convulsions--
(a) Venesection of not more than 400 cc. is resorted to.

9. In case of frequent convulsions--
(a) chloroform and chloral hydrate to be used more energetically than outlined above.

10. No convulsions for twenty-four hours--

(a) If patient has been free from fits for twenty-four hours or longer after admission and has not yet been delivered, she should be given about 0.5 gm. chloral hydrate every eight hours for about three days.

11. Operative delivery is resorted to only when intervention becomes absolutely necessary for the sake of the child.(1,44,88)

Irving who is a believer in Stroganoff's routine follows his program exactly as outlined except he also has a plasmaphaeresis done as soon as the patient enters the hospital. (plasmaphaeresis will be discussed later) With this procedure he had a maternal death rate of 5.9 per cent and a fetal mortality of 41.2 per cent.(44) This is approximately the same mortality rate all users of Stroganoff's routine have been obtaining. The results of Stroganoff's treatment are poor only as far the fetal life is concerned.

Davis in commenting on Stroganoff's procedure states that chloroform produces central necrosis of the liver lobules and eclampsia is ofter associated with hepatic changes so that it doesn't seem logical to employ it in the treatment of this disease. Furthermore, venesection does not appear as any great benefit to Davis since the fall in blood pressure is usually only temporary. In order to dilute the toxins effectively, if this were possible, one would have to withdraw

1500 cc. or more of blood.(85)

Stander also has the same objections to Stroganoff's procedure and has modified it as follows:

1. Upon admission--
   (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 ¼ gr. morphine by hypodermic immediately.
   (d) To be catheterized, examined medically and obstetrically.
   (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 per cent glucose solution should be considered.
   (g) Not to be delivered until after cervix is fully dilated. Then by the simplest operative means, unless spontaneous delivery seems imminent.
   (h) No chloroform to be used.
   (i) The CO_2 combining power, sugar and uric acid are immediately determined on blood specimen taken. If indicated, the pH of the blood is measured. The CO_2 combining power must be determined at frequent intervals in order to detect, as early as possible, an impending severe acidosis.

2. One hour after admission--
   (a) If comatose, given 2 gm. of chloral hydrate in 100 cc. of normal salt solution, and the same quantity of milk per rectum. If conscious the chloral can be administered by mouth in 100 cc. of milk.

3. Three hours after admission--
   (a) ¼ gr. morphine hypodermically.

4. Seven hours after admission--
   (a) 2 gm. chloral hydrate, as above.

5. Thirteen hours after admission--
   (a) 1.5 gm. chloral hydrate, as above.

6. Twenty-one hours after admission--
   (a) 1.5 gm. chloral hydrate, as above.
   (b) While eclamptic patients are under treatment, the assistants and nurses must insist upon the greatest possible quiet.
   (c) Catharsis, sweating, or venesection in excess of 200 cc. must not be employed.

7. The CO_2 combining power and uric acid of the blood are determined at intervals, and if indications of an acidosis are found, the hydrogen ion concentration of the blood is also determined. In this way we know when a true acidosis becomes imminent or is present, and in this event anti-acidosis treatment in the form of sodium lactate or glucose and insulin is instituted.(85)

Review of the literature shows this method of treatment to have approximately the same maternal and fetal mortality as the method advised by Stroganoff. (41) It is the writer's opinion that either of these two methods are excellent forms of treatment and if followed religiously will meet with the same results in all hands of the obstetricians. However, because of the known ill effects chloroform has on the liver, the writer recommends Standers' treatment over Stroganoff's.

Williams', of Johns Hopkins Hospital, treatment is more or less a modification of both of the above listed plans. He advises treating the patient in a quiet, dark room, giving morphine gr. $\frac{1}{4}$, which is

repeated in an hour but no more than gr. ½ in twenty-four hours. If a second convulsion occurs, he bleeds to 1000cc. or until the blood pressure falls to 100 mm. irrespective of the pulse rate. A large amount of water should be given to drink if possible, or 500 cc. of a 5 per cent glucose injected into a vein which is repeated in twelve hours. The uterus is not emptied til the os is fully dilated but if the convulsions or coma continue and the cervix is dilated to 5 cm., then manual dilation is used and delivery effected. Williams believes cesarean section is distincly contra-indicated except when required for other conditions. He prefers ether or gas and oxygen for the anesthetic.(93)

Plass works under the assumption the essence of therapy revolves around the clinical observation that eclamptics generally do not have convulsions when the respirations are less than fourteen to sixteen per minute, and the deduction therefrom that there is some relationship between the respiratory exchange and the appearance of the convulsive episodes. Therefore, he recommends heavy sedation with a dosage solely regulated by the effect on the respiratory rate until the respirations are twelve per minute. He recommends morphine above all other depressants but advises the use of

chloral hydrate or magnesium sulfate parenterally to complement the morphine. Other forms of treatment employed by him are: hypertonic sugar solutions, as diuretic agents (dextrose to be preferred over sucrose), venesection, but its use should be limited to patients with full, bounding pulse and circulatory collapse must be kept in mind. His maternal mortality rate is 8.75 per cent and fetal mortality of 47.4 per cent.(66)

As the reader has no doubt noticed, the fetal mortality is high regardless of the treatment used and one should remember the prime object of any treatment is to save the mother. The writer feels that if this was generally practiced the maternal mortality would markedly decrease without the expense of too great an increase in the fetal mortality.

Inasmuch as there is specific therapy, Torpin, Richard, and Coppedge have developed a therapy based upon physiological and pharmacological aims at combating all of the deleterious effects noted. They recommended their "Five point treatment" and is as follows:

1. Two grams of magnesiums sulfate intravenously in sterile 10 per cent solution every hour as long as the systolic blood blood pressure is 160 mm. or more. Twenty grams in twenty-four hours may be necessary.

Stop mild convulsions by paraldehyde in 4-6 dram doses rectally. If severe, sodium phenobarbital solution is given intravenously only until controlled.

2. Adequate salt-free diet.

3. 3500 cc. of 5 per cent dextrose in sterile distilled water is given intravenously daily when the patient is in coma. Administration of oxygen and blood is used when indicated.

4. Absolute bed rest with the foot of the bed elevated and duodenal nasal tube with constant suction when the patient is comatose to prevent aspiration pneumonia.

5. When the condition improves or becomes stationary, induction of labor by rupture of membranes, if at term, or by catheter or bag insertion if earlier.

Their maternal mortality with such treatment runs 12.8 per cent and fetal mortality of 31 per cent.(89)

Treatment by Dieckmann takes into consideration these basic priniciples:

1. General--Constant observation. Retention catheter. The temperature, pulse and respiratory rate, blood pressure and urine volume should be determined every two hours until the patient is conscious. Oxygen is administered for marked cyanosis.

2. Convulsions--One or preferably more of the following drugs are used. Dieckmann used (a) and (b) antepartum and adds chloral after delivery.
   (a) Magnesium sulfate 50 per cent solution: 6 cc. intramuscularly and 2 cc. after each convulsion until controlled. Maximal amount is 20 cc. in twenty-four hours.

(b) Sodium luminal: subcutaneously 0.3 gm. (5 gr.) every 8-12 hours.
(c) Morphine sulfate 0.016 gm. (¼ gr.) every hour until convulsions cease or respirations become 12 per minute.
(d) Chloral hydrate 2 gm. (30 gr.) in 100 cc. starch water given by rectum every 6-12 hours.

3. Elimination--Soapsuds enema

4. Hypertension--Sedative, especially barbiturates and chloral hydrate

5. Renal and Cerebral Symptoms--The intravenous injection of from 500-1000 cc. of a 20 per cent glucose solution, 2-3 times daily given within 40-60 minutes. Sufficient glucose is injected to insure a urinary volume of at least 30 cc. per hour. A 30 per cent (500-1000 cc.) or 50 per cent (200-400 cc.) solution is used if an adequate output of urine cannot be produced with the 20 per cent or if symptoms and signs of pulmonary edema appear. Normal saline, Ringer's, bicarbonate solutions are contraindicated.

6. Pregnancy--If the patient is in labor, delivery must be hastened by rupture of the membranes or the use of a bag. If the patient is not in labor, we may, after a diuresis has been established, consider:
(a) Induction of labor, as described above or
(b) Cesarean section. This operative procedure should only be performed if the case is of the severe type or if cephalopelvic disproportion exists. Local anesthesia should be used and the environment must be suitable.

7. Diet--Nothing is given by mouth until the patient is conscious. As soon as the stomach is emptying itself, 50 cc. of a

> 10 per cent karo syrup solution is injected through a nasal tube and increased 50 cc. every hour up to the patient's tolerance (usually 300 cc.) and continued until the patient is conscious and able to take water and fruit juices by mouth. (24)

Warner Bump has treated eight antepartum eclamptics using the above procedure and his maternal and fetal death has been zero.(10) However, this small series cannot be taken as the true representative results of Dieckmann's treatment. But like the rest of the conservative and mid-line treatment, it has great advantage over any radical procedure.

As the reader has noticed, there is at the present time a tendency among most obstetricians to follow a course of treatment which is neither radical nor too conservative, that is the mid-line treatment. The treatment is expectant until it becomes evident that the conservative measures are of no avail and radical intervention is then resorted to.

Special Treatment

There are certain drugs and special therapies that have been recommended from time to time in the treatment of eclampsia and the main ones will be mentioned.

Veratrum Viride:

About one-half century ago, Reamy introduced veratrum viride in the treatment of eclampsia in order to

reduce the high blood pressure.(72) It was first used successfully in a case of postpartum eclampsia in 1859. For many years following this, it was used with fair results but then its use was gradually abandoned.(72) Bryant and Felming advise the use of veratrum viride to control the blood pressure. They base their dosage according to the height of the blood pressure, giving 1 cc. when it is 190 mm. or more and 0.25 cc. when its between 140 and 150 mm.(13,14)

Whitfield in 1940 administered veratrum viride in four cases of eclampsia along with a standard mid-line treatment and had no maternal deaths. However, one baby died after a difficult delivery due to a constriction band.(96) The series is too small to draw any conclusion and it is impossible to say that this seemingly decreased mortality both of mother and fetus was due to veratrum viride as a standard mid-line treatment was used with it.

The treatment with veratrum viride can be summarized by saying, fifty years ago veratrum viride was used frequently but at present is seldom used.

Venesection:

As was taken up in the history of treatment, venesection was one of the earliest treatments of eclampsia, However, venesection was one of the earliest treatments for many diseases, so it is no wonder that it was used for eclampsia too. For those authors advocating venesection, it was justified upon the supposition that it might serve to dilute or reduce the amount of "toxin" in the circulating blood stream and also acted as a means of reducing blood pressure. The theory of a toxin has never been proved and the decrease in blood pressure is usually only temporary.

Venesection is used less today than before, but the writer feels that in an individual case with an exceedingly high blood pressure, accompanied by irregular pulse and other signs of cardiac embarrassment, it is usually helpful and should be used, but with caution.

Autohemotherapy:

It has been proven that in cases of apoplectic stroke and cerebral hemorrhage resulting in aphasia, hemiplegia, etc., autohemotherapy has been amazingly successful. The value of such treatment appears to

lie in its hemostatic action and also in the fact that it stimulates reabsorption of the extravasated blood, thus reducing the cerebral compression.

In view of this action, Raso assumed that it appeared probably that autohemotherapy would have the same decompressive and beneficial effect in puerperal eclampsia. This he tried on three emergency cases and sums up the following:

1. In cases of advanced preganancy with albuminuria, especially if there is a hypertension, 10 cc. of blood should be injected prophylactically for a few days prior to parturition or when a premature delivery is anticipated.

2. During puerperium, albuminuria or nervous agitation without apparent cause are indications for preventive autohemotherapy.

3. If any previous attacks have occurred, regardless of the intensity or frequency, from 15 cc. to 20 cc. or even 30 cc. of blood should be injected immediately, preceded in extremely urgent cases by blood letting. In some cases, the injections should be repeated daily or on alternate days until recovery is complete or at least until the alarming symptoms have disappeared.(58)

He reported excellent results in all three cases in which he used autohemotherapy as treatment.(71) However, this is the same old story of too small a series in order to draw an accurate conclusion, and the writer doesn't recommend this to be used by the majority but only by

a selected few.

Plasmaphaeresis:

Excepting the assumption that eclampsia is caused by an unidentified toxin carried by the blood stream- plasmaphaeresis is a logical means of therapy. Irving, who has treated seventeen cases of eclampsia by this method, recommends it to be done as follows: "A liter of blood should be drawn from a vein at the elbow under sterile precautions into sodium citrate solution. It then should be centifuged for twenty minutes, which results in a clear layer of supernatant plasma, which is siphoned off and sicarded. Normal saline is then added to the corpuscles and they are gently diffused into it by rotating the bottle. After a second centrifugalization, the supernatant solution, in its turn, is siphoned off. The corpuscles are finally mixed with enough fresh salt solution to make a liter and reinfused into the patient."(44,55) Out of the seventeen cases this was tried on, only one mother died and eight babies died.

Like all the rest, the series isn't large enough to come to any conclusion, but does look like in selected individuals cared for by the best of obstetricians, it might play an important part.

Hormonal:

Studies of hormonal changes during pregnancy have indicated that preeclampsia and eclampsia in diabetic as in non-diabetic women are characteristically preceded by typical imbalance in the measurable hormones or hormonal products of the blood and urine. Smith, O., Smith, George, Watkins and Hurwitz found an abnormal rise in the chorionic gonadotropin of the serum four to eight weeks prior to any clinical signs. They state that this has been a less consistent finding than urinary evidence of changed metabolism of the placental steroids envolving a progressive deficiency of estrogen and progestin, and culminating in more rapid destruction of estrogen.(82)

Evan Shute also has found that in eclampsia the estrogen values in both blood and urine are low and upon this finding advocates the giving of estrogenic hormone as treatment.(80) This therapy should be more effective for preeclampsia than eclampsia, for prophylaxis than for therapy. Hence, it is necessary for the recognition of true preeclampsia in order to use this treatment correctly and to its best advantage.

McGee has used ephedrine in three cases of mild eclampsia and has reported success in all cases. No

other obstetrician has used ephedrine and the writer believes it has no place in the treatment of eclampsia. (59)

Thyroxin:

Kustner recommends, essentially upon the basis of four cases of eclampsia observed by him in the seventh month of pregnancy, the use of thyroxin for the purpose of influencing the eclampsia. He sees the principal action of the remedy in an increase of the basal metabolism and in a stimulation of diuresis. He assumes that the disturbed equilibrium of the endocrine glands in eclampsia may be regulated by the administration of thyroxin.(48) However, Hammerschlag says Kustner's success in his cases wasn't due to thyroxin but due to the death of the fetus.(36) Kustner says his success wasn't due to the death of the fetus as he has treated a large number of preeclamptics with thyroxin with good results and with the delivery of live babies.(48)

Parathyroid Extract:

Symptoms of calcium deficiency during pregnancy occur mostly in the middle trimester and increase in severity in the last trimester. Calcium deficiency is more prone to occur in the obese due to the fact

Calcium combines with neutral fat in the cells to form lipoids in which it is transported to its natural depots in the body. Symptoms of calcium deficiency are: increased fatigue, irritability, numbness, tingling of the hands and feet, muscle-cramps, insomnia and weakness. When occurring along with eclamptic symptoms, parathyroid extract in 1 cc. dosage should be given. In severe toxemias it is of no benefit chiefly because these patients are too sick to be benefited by physiological stimulation.(12)

Liver Therapy:

Matters, after an investigation of preeclamptic conditions in a large series of patients, resulted in the conclusion there might be some correlation between the epigastric pain of preeclampsia and the epigastric pain of pernicious anemia. He therefore decided to apply to preeclamptic and eclamptic states the liver hormone because it has been shown by Minot and Murphy that the toxemic state of pernicious anemia is completely eliminated by the administration of liver.(57) He reports one case of eclampsia treated with liver extract plus conservative treatment, so no conclusions can be drawn as yet.

Alkaline Therapy:

Dienst, in 1902, stated the low oxidation products

of metabolism increased with the decrease in the akalinity of the blood and the body juices. While in the presence of a higher alkalinity, these substances are better oxidized and are transformed into smaller molecules with greater solubility which is accompanied by an increase of osmotic pressure which in turn favors the excretion or elimination of fluid secretions. On the basis of the above, he recommended alkali therapy and said, "Alkali must be administered in large amounts in eclampsia." He used sodium bicarbonate by mouth and by emena and reported fair results.(26) However, one must remember that forty years ago, the mortality rate of eclampsia was extremely high, both maternal and fetal. At the present time very little sodium bicarbonate is used in the treatment of eclampsia.

Paraldehyde:

Douglass, Louis and Linn are of the belief that paraldehyde is the best for sedation in eclampsia. Their results on the whole have been so encouraging that they felt they should make a report although the total number of cases was small (48).(28) For purpose of comparison, these writers have tabulated forty-nine consecutive cases of eclampsia which received no

paraldehyde, but were in other respects treated the same, that is, mid-line treatment. The two series are quite comparable in that in each there were fifteen cases classified as severe eclampsia, in the paraldehyde group twenty were moderately severe and thirteen were mild; in the non-paraldehyde group these figures were twenty-six and eight respectively. In the paraldehyde group, twenty-four were antepartum, thirteen intrapartum, ten postpartum and one both intra and antepartum. In the non-paraldehyde group these figures were twenty-one, fifteen, twelve and one respectively.

In the non-paraldehyde group two-thirds continued to have convulsions in spite of vigorous sedation. The number of convulsions after beginning treatment were usually between one and ten. Comparing these figures with those of the paraldehyde group, one finds that when the writers first began to use the drug they were prone to give too small an initial dose and to delay repeating it as early as it should have been repeated. In this group one-fourth continued to have convulsions, however, the number of convulsions after beginning treatment were one to two. The remaining patients received

an adequate amount of paraldehyde and in this group the percentage was negative, no convulsions occurring after sedation had been obtained. The maternal mortality in the non-paraldehyde group was 14.29 per cent while in the paraldehyde group it was only 2.8 per cent, this death occurring from bronchopneumonia several days after delivery and recovery from eclampsia. The fetal mortality in the non-paraldehyde group was 28.58 per cent and in paraldehyde group 22.95 per cent. They recommended dosage as follows: 10 drams paraldehyde in 5-6 drams of olive or mineral oil rectally as soon after admission as possible. To repeat as necessary.(28)

The writer is of the opinion that paraldehyde in sufficient amounts will in most cases control the convulsions of eclampsia and permit the continuation of the conservative treatment for an indefinite period of time. Whether it will replace the other sedatives in importance is a matter of time.

SUMMARY

1. Convulsions and eclampsia should not be considered as synonymous terms, as eclampsia can occur without convulsions.

2. Eclampsia can be divided into four types depending upon when it occurs:

(a) intercurrent,

(b) antepartum,

(c) intrapartum and

(d) postpartum.

3. Generally speaking one-half of all cases of eclampsia are of the antepartum type and the other forms, intrapartum and postpartum, are approximately of equal frequency while intercurrent is extremely rare.

4. Incidence of eclampsia varies throughout the world. Varies from 0.0 per cent in Alaska and Australia to 3.85 per cent in Algiers, Africa and 7.2 per cent in Charlotte, North Carolina. The mean incident for the world is 1.0 per cent, for the United States 0.66 per cent and for the British Isle 1.13 per cent.

5. Incidence is higher in primipara than multipara, higher in diabetics than in non-diabetics, higher in multiple than single pregnancy, higher in the colored

than in the white race and higher in hydramnois. One is impressed by the advent of preeclamptic state with the first pregnancy, regardless of age; by the frequency with which it recurs in succeeding pregnancies and by its characteristic appearance in the last trimester.

6. Predisposing factors:

(a) occurs most frequently in spring months

(b) abrupt change in weather, that is, hot to cold or vice versa

(c) in the United States there is some correlation between eclampsia, high average temperature, a small range of temperature and a high measure of rainfall.

7. Eclampsia can be truly be called the "disease of theories". As early as the 17th century, when eclampsia was explained as a nervous disorder, till today, new theories have become advanced regarding its etiology. Today we know no more of the cause of eclampsia than we did forty years ago. However, it is reasonable to assume that eclampsia is caused by an unidentified toxin. Since pathological changes are produced in the liver, the kidney, the circulation and occasionally the uterus, as is the case in

toxic separation of the normally implanted placenta, it is equally logical to assume that the toxin is transported in the blood stream. The source of this assumed toxin is debatable.

8. Periportal hemorrhages and necrosis of the liver is the most characteristic lesion of eclampsia. Next in order is degeneration of the epithelium of the convoluted tubules of the kidney, although this is not of great significance.

9. The main findings in urine of eclamptic patients are:

(a) the urea nitrogen is decreased and ammonia nitrogen is increased,

(b) decreased chloride excretion,

(c) albuminuria, and an

(d) acetonuria.

10. The main characteristic findings of the blood in eclamptic patients are:

(a) low blood calcium,

(b) decrease in A/G ration, and

(c) decrease in CO_2 combining power.

11. Symptoms may appear suddenly or gradually; fortunately they usually come on gradually.

12. The first symptom, as recorded most often,

was headache; followed very closely by edema of the feet, ankles and sometimes of other parts of the body. However, any of the symptoms may appear first.

13. Edema is usually the outstanding feature of the disease and is found in forty per cent of the mild preeclamptics and in sixty-six per cent of the severe.

14. In eclampsia, the loss of albumin is rarely sufficient to cause a hypoproteinemia.

15. It is probably eclampsia and preeclampsia are the one and same disturbance, the difference being one of degree only.

16. It is very rare for a patient to die during the first convulsion and coma.

17. Regardless of how severe the symptoms may be, the patient usually begins to improve immediately following the delivery.

18. Death may be delayed as late as a few days after the cessation of the last convulsion and coma.

19. Eclampsia, even though it is like an "atomic bomb" in its active stage, rarely leaves any complications if the patient recovers from the active stage. However, Dieckmann and Brnon found an average incidence

twenty-seven per cent hypertension and nineteen per cent chronic nephritis subsequent to attacks of eclampsia.

20. Except for the possibility of confusion with nephropathies, the diagnosis of preeclampsia and eclampsia usually offers no difficult.

21. Convulsions occurring later than the third day of the puerperium are rarely a manifestation of postpartum eclampsia and such a diagnosis is permissible only when characteristic changes in the blood pressure and urine are demonstrable.

22. Naturally the prognosis will depend upon the type of patient, being much more favorable when she is seen immediately after the convulsion than in neglected cases which are sent to the hospital as the last resort. In all probability, the prognosis is more severe in multipara than primipara.

23. Prior to 1870, the treatment of eclampsia consisted of venesection, sedatives, cold packs or baths but no obstetric interference. From 1820 to 1890 narcosis, diapharesis and pilocarpine played a great part, while venesection was more or less abandoned. After 1890, there was a trend towards vaginal cesarean section to be performed as soon as

possible after the first convulsion and from then on radical treatment was followed until today in which there are three shcools of thought:

(a) conservative,

(b) radical and

(c) middle-line.

24. The incidence of eclampsia has been markedly reduced during the past twenty years by the rigid application of adequate prenatal care.

25. The frequent routine of checking the blood pressure, of the urine, weight increase, and the patient's general condition undoubtedly leads to the early recognition of a preeclamptic or an eclampsia that may be pending.

26. Many times the patient will have gain in weight before having demonstrable edema.

27. The gain in weight should not exceed 300 gm. per week ($\frac{1}{2}$ pound) with the total not to exceed 8 kg. ($17\frac{1}{2}$ pounds).

28. If the systolic pressure is 140 mm. or more, or if there is an increase in the systolic pressure of 40 mm. or more, even though the final systolic pressure is less than 140 mm., it must be regarded as abnormal and the patient should be seen at least

once or twice per week.

29. If a positive quantitative test for protein is found in the urine, one should always suspect a toxemia. As long as the proteinuria is less than 5.0 gm. per twenty-four hours, the patient should be examined at weekly intervals, but the persistent excretion of more than 5.0 gm. indicates the need for hospitalization.

30. The restriction of fluids in the absence of cardiac decompensation is debatable and the writer is against such a policy.

31. The symptoms and signs of preeclampsia which indicate hospitalization of the patient are:

(a) systolic pressure of 170 mm. or more or an increase in systolic pressure of 40 mm. or more,

(b) abnormal increase in weight with sudden increment of two or more pounds per week,

(c) sudden marked edema, especially of the face or abdominal wall,

(d) proteinuria, as listed above,

(e) appearance of cerebral, visual or gastrointestinal symptoms, or

(f) hematuria or oliguria.

32. If begun early enough, careful medical management of the toxemic patient will usually prevent further increase in the severity of the symptoms and signs until the cervix is "ripe" and the patient can be delivered.

33. Eclampsia only occurs in the presence, or very recent presence, of living chorionic tissue.

34. Radical treatment is the worst possible management of eclampsia with a maternal death rate that averages 21.7 per cent.

35. The proper treatment of eclampsia should aim at the emptying of the uterus by the safest means when the condition of the patient is sufficiently good to tolerate the procedure, that is, conservative treatment. Or if the patient doesn't respond to medical treatment, or has been neglected, the membranes should be ruptured and/or the insertion of a bag if the cervical canal is less than 2 cm. long, or, if there is no effacement and dilatation, by cesarean section under local anesthesia.

36. By making use of the conservative and midline treatment, the maternal mortality has been reduced to average 5.9 per cent but a fetal mortality

of 41.2 per cent. The writer recommends this method of treatment as in all methods of treatment the fetal mortality is approximately the same.

37. Because of the known ill effects chloroform has on the liver, the writer recommends Stander's conservative treatment over Stroganoff's conservative treatment.

38. There has been certain drugs and special therapies that have been recommended from time to time but the writer advises their use only by a selective group and not to be used by the ordinary obstetrician.

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