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THE CURATIVE TREATMENT OF ECLAMPSIA—
A CRITICAL REVIEW

by

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This paper is not meant to be an elaborate critical review of all known methods of treatment of eclampsia or of all the literature on the subject. The main object is to evaluate the changes in treatment which have taken place in recent years. It cannot be claimed that the aetiology of eclampsia has been discovered. Until such time the treatment is and will be only symptomatic and empirical.

An excellent historical review of the treatment of eclampsia is obtainable in Deickmann's "Toxaemias of Pregnancy". From it one could gather the different lines of treatment with changing decades and the varying results. Controversies have

raged over 100 years regarding the best method of treatment of eclampsia. However, the dawn of the twentieth century saw the choice narrowing down to the conservative versus the radical line of treatment—the former meaning primarily medical management, and the latter, immediate emptying of the uterus by surgical procedures. The chief protagonists of the medical management were Tweedy of Rotunda and Stroganoff of Russia. Macpherson in 1901 stated in New York, "When a convulsion occurs let us empty the uterus without delay". His maternal mortality from caesarean section in eclampsia was however 44 per cent, and, by

1918, he had reversed his treatment completely and adopted the Stroganoff method.

It is not proposed to go into the details of Tweedy's and Stroganoff's methods, as they are well known, but only to bring out the principles involved in their management. Both Tweedy and Stroganoff believed in sedation to control convulsions and in complete non-interference with pregnancy. Tweedy believed, in addition, in the role of certain toxins in the causation of these convulsions and hence advocated elimination by stomach-wash, purgatives and bowel wash. Between the two, Stroganoff obtained much the better results and his treatment came to stay. The main disadvantages of the Rotunda treatment were the bowel washes, stomach washes and purgations. The frequent handling of the patient produced more convulsions in spite of sedatives.

Stroganoff described his methods in various publications — (1901 - 1923 - 1924 - 1926 - 1930 - 1934 - 1935.) He pinned his faith in the administration of sedatives, morphia parenterally and chloral hydrate per rectum, on a planned time schedule so that the patient was under the influence of the sedatives for 24 to 48 hours. He took particular care to diminish to the minimum all forms of external stimuli to the patient. The results of his treatment were reported by Stroganoff to the 13th International Congress in Paris in 1900. By 1901 he presented 103 cases of eclampsia with a mortality rate of 5.3 per cent. Stroganoff consistently reported improving results and his method came to be used all

over the world. The maternal mortality declined, although many mothers still died. In an effort to reduce the maternal mortality rate still further, in 1928 Stroganoff induced labour by artificial rupture of membranes in cases not responding to sedatives, while some brave ones resorted to caesarean section to empty the uterus. Stroganoff and Davidovitch reported in 1937: "We should like to note with satisfaction that caesarean section — an operation which deforms a normally built woman and threatens her with severe consequences—is scarcely ever used as a means of fighting eclampsia. We have conducted the treatment of over 1,000 cases of eclampsia without resorting to it." They also claimed that eclampsia had been conquered and due treatment could reduce its mortality to below 0.5 per cent for initial cases and to 2.5 to 4 per cent for advanced and infected cases. Few, if any obstetricians have obtained the excellent results of Stroganoff using his method. Stander studied Stroganoff's statistics (1929) and discovered that 70 per cent of these eclamptics had their first convulsion in the hospital and of these 50 per cent had only one convulsion. While none will take away the credit due to Stroganoff, it must be plainly stated that the results of any particular line of treatment for eclampsia necessarily depends upon the severity of the disease. The time interval from the onset of fits to the start of treatment, and the number of fits prior to the same, along with any other complications are important factors in the prognosis of eclampsia. The results obtained by any line of treatment on cases who developed a

convulsion in hospital cannot be compared to those on cases brought into the hospital after hours of repeated convulsions. Obstetricians have accepted the principles of management enunciated by Stroganoff and Tweedy and the later developments in its management have been mainly in the varieties of drugs used to obtain sedation and the control of the complications. Each clinic has worked out its own technique and though very few clinics use the original Stroganoff regime, the fundamental principles remain the same.

The recent advent of various drugs which help sedation and hypotensives to control the blood pressure has modified the treatment of eclampsia. It is therefore, proposed to discuss the treatment under the following heads: (1) General management. (2) Sedative line of treatment. (3) Hypotensive management. (4) Obstetric management.

General Management

Even from the very early times the general management in the treatment of eclampsia played a very important role in its prognosis. In 1896 Tweedy drew special attention to it and he was soon reinforced by Stroganoff. All patients ought to be nursed in a quiet dark room; all attendants, medical and nursing, should wear noiseless shoes, and handling of the patients should be reduced to the minimum. Examination of the patients must be gentle and quick and done only after the patient is under the effect of a sedative. Thus external stimuli to the patient could be reduced. The throat should be kept clear of mucus; raising the foot

of the bed or lowering the head will help postural drainage of the upper respiratory tract. In some cases with a lot of secretions, suction will help. Oxygen should be at hand and all measures to treat asphyxia should be available. Careful nursing attention to prevent injury during a fit is imperative. At times asphyxia may set in. Heroic measures like tracheotomy are seldom necessary to save an eclamptic from an asphyxial death, though a few cases have been reported where it has been done. Chloroform inhalations to stop convulsions adopted by Stroganoff are not recommended.

Fluid Balance and Diuresis

One of the most important details in the management is the proper maintenance of fluid balance and a good urinary output. It was the custom in the 19th and the early 20th centuries to restrict very rigidly the amount of fluid taken by these patients. Sodium and chloride balance studies have demonstrated that the major portion of the weight gain in toxæmic patients is due to the retention of water. Deickmann and others have proved the existence of abnormal retention of sodium and chlorides in toxæmia. The abnormal retention is most likely to occur when urinary output is low. The water and electrolyte balance (sodium, potassium and chlorides) is controlled primarily by hormones from the posterior lobe of the pituitary gland and the cortex of the adrenal gland. These hormones are brought into play when excessive amounts of water or electrolyte are ingested or when the levels in the

body become abnormal. Ingestion of sufficient amount of water will ensure in many a toxæmic patient a reasonable urinary output.

The intravenous infusion of isotonic saline was employed by Grooves in 1901. In 1920 several papers appeared advocating the use of intravenous injections of hypertonic glucose solutions with the object of (a) producing diuresis; (b) relieving cerebral tension; (c) providing energy; (d) combating acidosis. Various concentrations have been used. Ellinger (1920) recommended 25 per cent solution; Hoffmann 15 per cent solution; Titus (1920) a 20 per cent solution. The 20 per cent solution has been widely used.

Titus and Hoffman reported that they were able to reduce the maternal mortality from 29 per cent to 15 per cent. Deickmann believes that the reduction of mortality in eclampsia in the last 25 years must be attributed in a great part to the parenteral injection of hypertonic glucose solution. "Our treatment is based on the use of large amounts of hypertonic glucose solution and it is to this that we attribute not only our favourable results but also our ability to control convulsions with small amounts of magnesium sulphate", wrote Deickmann (1941). He usually gives 1,000 cc. of a 20 per cent solution and repeats it if necessary two or three times a day and is satisfied that it produces good diuresis. However Bouckaert and Coll (1936) and Muylder and Reul (1949) found that hypertonic glucose solution diminished urinary secretion which the latter attributed to diminished capillary filtration. Intravenous hyper-

tonic glucose infusions have been and are being widely used in Great Britain and particularly in U.S.A. It has not many adherents in Europe and has many critics in the United States (De Alvarez 1950, De Alvarez and Richards, 1952).

Since 1938 administration of a 20 - 25 per cent solution of glucose intravenously has been a routine with us. We have not given it in such large amounts as Deickmann but we limit ourselves to not more than 1,000 ml. in 24 hours. Since this treatment has been combined with sedation and other lines of treatment, it is not possible to say that improvement in the results noticed is due to the hypertonic glucose alone. But we are convinced of its usefulness in maintaining reasonable diuresis. We have found no difference in the recurrence rate of fits in patients treated with or without hypertonic glucose. We believe it is a very useful adjuvant in the treatment of eclampsia. Many authorities recommend the use of calcium gluconate, vitamin B₁, vitamin C parenterally. We have used these drugs but are not convinced of their necessity as a routine measure, unless there are some special indications.

Antibiotics

Since 1951 we have been using as a routine penicillin prophylactically in all cases of eclampsia with satisfactory results to combat the danger of infection.

Sedatives

A very large number of sedative drugs have been used in the treat-

ment of eclampsia. The aim of sedation is to diminish the patient's perception to stimuli and thus reduce the recurrence of fits.

Morphia

Perhaps till recently morphia was the one sedative most frequently used in toxæmia. It forms the main drug in the Stroganoff treatment of eclampsia. The usual dose is $\frac{1}{4}$ grain intramuscularly to be repeated not earlier than 2 - 3 hours, and not more than 2 grains to be given in 24 hours. The morphine routine is a simple one and is the main line of Maberly Smith, Tweedy and Stroganoff. Most clinicians believe that morphine depresses urinary secretion, and Brown, Hodges and Bradbury (1950) have reported that it decreased glomerular filtration and increased tubular reabsorption. But De Alvarez (1950) Alvarez and Richards (1952) state that when it is administered by the intravenous route to toxæmic patients, it exerts a diuretic action. Varying claims have been made as to the efficacy of morphine treatment. In Bradford, Theobald using morphine reported a mortality rate of 5.6 per cent in 71 patients so treated.

Stroganoff combined morphia with chloral hydrate and most obstetricians combine morphine with other drugs in the management of eclampsia.

Chloral Hydrate

This is, in addition to morphine, one of the most essential parts of the Stroganoff regime. If the patient is conscious, 3 gm. by mouth are given in milk. If unconscious, it is given in

100 ml. of sterile water per rectum. In all cases it is repeated every 6 hours, and the dose is decreased to 2 gms. Chloral hydrate is a powerful cardiac depressant. As mentioned before, using morphia and chloral hydrate, Stroganoff reduced his maternal mortality to 2 per cent. Many reports are available using Stroganoff regime. But in none were so excellent results obtained. We have used morphia, chloral hydrate and potassium bromide according to a modified Stroganoff regime. In a series of 434 cases, using morphine and chloral hydrate and bromide, we had a maternal mortality of 18.6 per cent with a recurrence rate of fits of 46 per cent. Subodh Mitra (1957) reported a mortality rate of 19 per cent in a series of 701 cases treated from October 1944 to 1954, on the lines of Stroganoff.

Paraldehyde

Paraldehyde may be given by mouth, rectum or by intramuscular injections. When given by rectum it is diluted in olive oil. The suggested dose is 0.5 ml. per kg. body weight. 30 to 40 mls. of paraldehyde diluted with olive oil may be given per rectum and repeated in smaller amounts in 6 - 8 hours. It is a safe hypnotic drug. But its place in the treatment of eclampsia is limited because of the difficulty in its administration.

We have used paraldehyde as intramuscular injection — the dosage has been usually on an average 7 mls. given intramuscularly and repeated every 6 hours with smaller amounts 5 - 6 mls. The response has been

varied and it is difficult to adjust the dosage. It could not be proved that paraldehyde was superior to morphia. We have used morphia and paraldehyde in combination alternating in a large number of cases. Nor then could we prove that the combination was more useful than morphia or paraldehyde alone. We have stopped since 1951 using either paraldehyde or morphia as a routine in the management of eclampsia. In a series of 204 cases so treated the maternal mortality rate was 19.5 per cent and the incidence of recurrence of fits 41.6 per cent.

Magnesium Sulphate

This drug depresses the central nervous system and has a curare like peripheral action. Winkler, Hoff and Smith state that magnesium sulphate injected intravenously into normal patients causes peripheral vaso-dilatation and a sudden fall in blood pressure. It does not alter the cardiac rate. The respirations decrease in number. The drug has no diuretic effect and does not alter the intracranial pressure. The respiratory depression occurs only after the disappearance of tendon reflexes. Dorsett in 1926 used 15 mls. of a 25 per cent solution intramuscularly. Deickmann injects 12 mls. of a 50 per cent solution intravenously and 6 mls. are given after each convulsion until a total of 20 gms. is given. In 1929 Deickmann and Dorsett compiled a series of 186 cases of eclampsia treated on these lines with a mortality rate of 7 per cent. Eastman (1950) injects 10 cc. of a 50 per cent solution of magnesium sulphate and 10 cc. every 4 hours for the first 24

hours. If the knee jerks are absent the drug is withheld. He has given as much as 70 mls. of a 50 per cent solution in 24 hours.

Lazard (1927) introduced the intravenous route and injected 20 cc. of a 20 per cent solution until the convulsions ceased entirely. McNeile (1934) used a similar technique and claimed a maternal mortality of 13 per cent in 259 patients. Stroganoff and Davidovitch (1927) impressed by the results of American workers substituted magnesium sulphate for chloral hydrate in the treatment of 200 cases of eclampsia with a mortality rate of 3 per cent. They came to the conclusion that the drug "could be dangerous and was no more efficient than chloral hydrate".

It must be realised that while the results obtained are encouraging it is usually combined with other forms of treatment. We have not used magnesium sulphate alone in the treatment of eclampsia, but 105 cases were treated with morphia and magnesium sulphate. Morphia, $\frac{1}{4}$ grain, and 10 c.c. of a 25 per cent solution of magnesium sulphate intramuscularly was alternated every 4 hours. The average recurrence rate of fits was 36 per cent and the maternal mortality 11.6 per cent. This combination did give better results than morphia, chloral hydrate and paraldehyde combinations. Only in a few cases did we use it intravenously. One of the main disadvantages is the formation of abscesses at the site of injections in some of these cases.

Barbiturates

They produce sleep, muscular relaxation and lowering of blood pres-

sure. They have a marked inhibitory influence on certain medullary and midbrain centres. Each patient must be individualised and it is safer to give small amounts at frequent intervals than large amounts. Many reports are available on the use of barbiturates in eclampsia. The chief barbiturate employed is sodium luminal either by mouth or intramuscularly (0.3 gms.), barbitol sodium (Nembutal), phenobarbitone (0.3 gms), sodium amytal either by mouth, by rectum or intravenously.

Good results have been reported by the use of these drugs. It would appear that sodium amytal is the better sedative. But its use is not entirely without danger.

Basal Narcotics

Two only of the basal narcotics will be discussed here: tribromethanol and sodium thiopentone. Their actions have been investigated by Macintosh and Pratt (1940). They both depress the respiration and lower the blood pressure and the cerebrospinal fluid pressure. Tribromethanol is excreted by the kidneys and if greatly exceeded in therapeutic dosage it produces anuria. Thiopentone is detoxicated in the liver and excreted by the kidneys. In spite of some disadvantages, basal narcotics have been used extensively in the management of eclampsia. These drugs produce deep sedation, lower the blood pressure and are rapid in action.

Bromethol (Tribromethanol)

The use of this drug as an anti-convulsant was first applied to the

treatment of tetanus and subsequently to eclampsia. The first comprehensive study of eclampsia patients treated by Bromethol was presented by Dewar and Morris (1947). Dewar and Morris employed 0.0875 mls. of concentrated Bromethol solution per kg. of body weight. This was made up with tap water at 40° C. to a 3 per cent solution which was administered with a catheter per rectum after it had been tested with Congo red. They recommended a second dose if necessary after 3 hours, but never earlier than 3 hours, and recommended not more than 3 doses in 24 hours. Campbell and Burton (1952) advocated a standard dose of 5.5 mls. of Bromethol in 223 mls. of water, the dose for a patient weighing 63 kg. and with this Morris (1954) is in agreement. Dewar and Morris (1947) treated on these lines 45 cases with 2 deaths. They however performed caesarean section if the cervix was not ripe as they considered that 'early termination of pregnancy even in the apparently mild case seems desirable.' More recently Morris (1954) has shown that Dewar had treated a further 39 cases with a maternal mortality of 2.5 per cent and a foetal death rate of 15.7 per cent and a recurrence rate of fits of 7.7 per cent. Kellar (1950) has reported 40 cases using Bromethol without a single death. Madhavan and Rao (1955) reported on 130 cases with a mortality rate of 5.4 per cent. Their dosage was 4.5 mls. of Bromethol in 250 mls. of water. It is not repeated earlier than four hours and only in a few cases a third instillation was required. At this hospital 80 cases

were treated on these lines with a mortality rate of 6.5 per cent. With this line of treatment it is possible to keep maternal mortality rate within 5—6 per cent. There is no doubt that Bromethol is an extremely useful drug in the management of eclampsia. It helps to control convulsions in 80 per cent of cases; but the difficulties in the administration of the drug are numerous. This form of treatment is often messy and if the patient is in labour it becomes much more so. Pulmonary oedema is a contraindication for the use of this drug. We are quite impressed with its use in the management of eclampsia; particularly is it useful when the patient has to be transported some distance to the hospital.

Sodium Thiopentone (Pentothal)

Lloyd in 1947 stated, "When I see an eclamptic patient who is liable to have a fit, I immediately flatten her with an injection of Pentothal." Pentothal has since been used by many obstetricians and in 1952 Macintosh commended it as admirable first-aid management. O'Donel Brown was the first to use this drug as a routine procedure through an intravenous drip. The initial dose was 0.5 gm. of Pentothal in 10 mls. of distilled water injected fairly quickly. To one litre of 10 per cent dextrose was added 3 gms. of Pentothal and one litre of this solution was delivered in 24 hours. Whenever restlessness occurred a further 0.05 gm. of Pentothal (2 mls.) was injected through the tubing from a syringe containing 0.5 gm. in 20 mls. On these lines he treated 18 cases and lost one mother.

Before his untimely death he treated 26 cases and reported a 7.6 per cent mortality using this method.

Krishna Menon (1953) treated on the very same lines 75 cases. Though the incidence of recurrence of fits fell to 9.5 per cent the maternal mortality rate was 16.5 per cent. While Pentothal may be the best drug for the control of convulsions, it did not in any way help to diminish the maternal mortality.

One of the most important disadvantages of Pentothal is the extremely careful watch that has to be kept by a doctor over the patient. Respirations have to be carefully watched; restlessness has to be controlled by repeated injections of 2 mls. of Pentothal from a syringe containing 0.5 gm. in 20 cc. of distilled water into the rubber tubing. The recovery period is likely to be complicated by a severe degree of distressing mental confusion. I cannot but repeat the comment I then made on the treatment. "While Pentothal may be best drug in the control of convulsions, it has not helped in any way to bring down maternal mortality . . . I am constrained to admit that the results obtained have not been commensurate with the stress and strain gone through". However for the immediate control of convulsions Pentothal 0.5 gm. in 20 cc. of sterile water is ideal. As Lloyd puts it, "it flattens the patient." There is no doubt that it is a first class first-aid management.

Of all the sedatives used few have stood the test of time—morphia, magnesium sulphate, Bromethol and sodium thiopentone. However with the development of antenatal care

and efficient treatment of pre-eclampsia, the incidence of eclampsia fell so sharply that in the highly advanced areas it has become a rarity; and when any case occurs it is mainly in a patient who is having some antenatal care. These fits could in the vast majority of cases be controlled either by morphia, Bromethol or sodium thiopentone. In vast areas of Asia where there are no facilities for antenatal care, eclampsia still constitutes a major obstetrical problem. And we would grasp at anything which will help us in reducing maternal mortality. When therefore phenothiazine derivatives were synthesized in 1950 and their pharmacological properties established, it was with no small enthusiasm that these derivatives were given a trial in the treatment of eclampsia. In December, 1950, chlorpromazine (Largactil) was synthesized by Charpentier in France. In 1951 Laboritt and Huguenard used it for their technique of artificial hibernation. There are few drugs in modern medicine to which so many properties have been attributed. Among its important properties are: (a) ability to lower body temperature — hypothermia; (b) potentiating the action of other drugs; (c) hypotensive action; (d) narcosis; (e) anti-shock property. In 1953 Aoustin used it in the treatment of eclampsia for the first time. Grasser and his colleagues reported its use in one case of eclampsia. In the same year Baccaglioni reported another case. In November, 1953, Prof. Schmidt Elmendorff gave his experiences of the modified Stroganoff regime using chlorpromazine, diethazine and phenobarbitone in

the treatment of eclampsia. In July 1955 Subodh Mitra reported briefly his results in a series of 46 cases of eclampsia with chlorpromazine and promethazine. Encouraged by his results he treated a series of 133 cases and in 1957 published his results. The maternal mortality rate was 4.5 per cent. In July, 1955, he concluded "that it is still too early to draw any conclusions from these data but this small series suggest that eclamptic patients are very susceptible to the action of chlorpromazine". By 1957 he was convinced of their usefulness.

Menon (1956) reported his results in a series of 75 cases using phenothiazine derivatives. In the first 25 cases he tried a modified Stroganoff regime using chlorpromazine, promethazine and phenobarbitone. As he was not satisfied with the sedation obtained and the maternal mortality rate was still 8 per cent, he changed the line of treatment. But during the course of treatment he was struck by the absence of any pulmonary complications, the general satisfactory appearance of the patient, the control of the blood pressure and the good urinary output. He therefore modified his treatment as follows: On admission all patients are given 25 mgms. of Largactil and 100 mgm. of Pethidine in 20 ml. of 5 per cent glucose intravenously. 50 mgm. of Largactil and 50 mgm. of Diparcol (diethazine) intramuscularly are given at the same time. Soon after, a drip containing 200 mgm. of Pethidine in 1000 ml. of 20 per cent dextrose is set up and is run through slowly depending upon the condition of the patient. If she is restless she

is controlled by running the drip faster and then slowing down the rate. Not more than 1000 ml. of 20 per cent dextrose and 300 mgm. of Pethidine are given in 24 hours. Diparcol 50 mgm. and Largactil 50 mgm. are given every 4 hours alternately for 48 hours. Blood pressure, respiration and urinary output and pulse are recorded and the sedation is continued on these lines for 48 hours. If the patient is in active labour the membranes are ruptured artificially if the head is engaged and the cervix effaced. If the fits cannot be controlled within 8—10 hours of treatment and the patient is not in labour, the cervix is closed and un-effaced and the head is unengaged, a lower segment caesarean section is done under local anaesthesia — Menon (1956). Vaginal delivery is helped in the second stage by outlet forceps application. He treated 50 cases on these lines. The overall recurrence rate of fits was 10.2 per cent and only one mother was lost. From July 1955 upto the end of December, 1957, 296 cases of eclampsia have been treated on these lines. Eight mothers were lost in this series with a mortality rate of 2.6 per cent.

The following relevant observations are made:

(1) In 60 per cent of cases there was satisfactory drop in the blood pressure occurring during treatment and before delivery. (2) In 95 per cent of cases good urinary output was maintained. (3) The incidence of recurrence of fits in this series of 296 cases was 20.6 per cent which compares unfavourably with Bromethol and sodium thiopentone. In the first series of 50 cases the recurrence rate was only 10.2 per cent. It is observed that the increased incidence of recurrence in this large series is mainly due to two factors. (a) If a reasonable time interval is not available from the time of start of treatment to the onset of labour, the sedation is not deep enough to prevent convulsions. If 3—4 hours interval is obtained the incidence of recurrence of fits would be very much reduced. But unfortunately most of these cases are brought from outside after hours of convulsions and labour pains start within a short time of the commencement of treatment. (b) Frequent changes in the nursing and medical attendants are associated with increased recurrence of fits. (4) The incidence of pulmonary oedema is reduced to a minimum. In a previous series of 1150 cases treated between 1938 and 1950 of which 147 died, pulmonary complications were found in 40 per cent, and in 29.5 per cent of cases pulmonary oedema. It is remarkable that in this series it was found only in 4 cases. (5) Hyperpyrexia: In 25.3 per cent of fatal cases in the series referred to, hyperpyrexia was found as a terminal event. In this series only 3 cases had hyperpyrexia. This could be attributed to hypothermic action of chlorpromazine. (6) Minimum incidence of post-eclamptic psychosis. (7) The absence of shock in those delivered by caesarean section and vaginally.

It is concluded that a combination of chlorpromazine diethazine and pethidine is a very satisfactory form of conservative therapy and this, combined with a judicious use of caesarean section in cases not responding to treatment, has helped in

reducing maternal mortality to levels never before obtained. This reduction in maternal mortality with this line of treatment is mainly due to the minimum incidence of pulmonary oedema, hyperpyrexia and shock which account for a majority of deaths in eclampsia. It is emphasized that control of convulsions alone is not enough to improve the maternal mortality rate in eclampsia.

Hypotensive Management

A state of hypertension is said to predispose to eclamptic convulsions. The occurrence of eclamptic convulsion is usually preceded by sudden rise in blood pressure and it was therefore thought that the reduction in blood pressure may be useful in the management of eclampsia. Under the influence of hypotensive agents the blood pressure would drop, cerebral tension would be decreased and the convulsions should cease. To bring about this result the hypotensive agent used should not only be rapid in its action but enduring in its effect. It should be harmless to the mother and the foetus and should have no unpleasant side-effects. Various hypotensive agents have been used in the management of eclampsia. But very few obstetricians have used hypotensives only in its management.

Spinal Blockade

Paramour (1930) advised spinal anaesthesia many years ago. Lull and Hingson (1945) and Lund (1951) observed that eclamptic patients did well when anaesthetised

with continuous caudal anaesthesia. The blood pressure drops and a good urinary output is maintained. Lund described in detail his technique and very satisfactory results were reported by him. These methods of treatment were approved by Sofian (1953). However one cannot but emphasise the difficulty in administration and sometimes the operation may fail. The cases reported treated on these lines are not large and no justifiable conclusions can be drawn from such results. We have never used this method in the treatment of eclampsia. In any case it cannot be recommended as a routine in places where eclampsia is common.

Ganglion Blocking Drugs

Penny and Shackleton (1951) reported one case in which eclampsia uncontrollable by barbiturates and chloroform subsided completely following a continuous administration over a period of 12 hours of 60 mgm. of hexamethonium bromide. In French and Italian journals favourable reports of its use in eclampsia have appeared. Campbell and Burton (1952) mentioned another case. These compounds produce hypotensive effect through a neurogenic mechanism exerted at the ganglionic level. Morris (1953) has shown that its use on pregnant mothers is attended by danger to the foetus. (Post-partum paralytic ileus). Stern (1954) comments that they are unlikely to meet the general approval.

Veratrum Veride

Veratrum was introduced into medicine by Osgood in 1835. In 1857

Parker treated one case of eclampsia. For a long time this drug fell into disrepute because of its unpleasant side-reactions. But the recent purified alkaloid — Protoveratrum and Veratrone — which are said to produce only very minimal side reaction has brought the drug once again to the forefront. This drug has been widely employed in the United States and Europe. Beginning with Bryant and Fleming (1940) who reported a maternal mortality rate of 1.6 per cent using Veratrone, a number of papers have been published favourably reporting on its use in eclamptics. Irwing (1947) from Boston lying-in-hospital using Veratrone reported favourable results. Garber, Asali, Kistner and Prystowsky (1950) used Veratrone in the treatment of 196 cases of eclampsia with a mortality rate of 1.5 per cent. The preparation used was Veratrone (Parke Davis & Co.), the usual intramuscular dose being 0.2 ml. Asali (1950) has worked out a technique for the intravenous administration of 0.2 mls. per hour in dilution with 5 per cent dextrose. Stern and Barnett 1954 employed it in the treatment of 80 eclamptics with a 2.5 per cent mortality rate. They give 0.6 mls. of the drug intramuscularly and repeated the drug every $\frac{1}{2}$ hour until the systolic blood pressure fell below 120 mm. of Hg. and the pulse rate to 60 per minute. No more Veratrone was given unless the blood pressure rose over 150 mm. of Hg. and if the pulse rate was not less than 60 per minute. Reports on this drug are very favourable. But unfortunately side-effects like nausea, vomiting, urticaria and

sudden collapse are not uncommon.

More recently new preparations of Veratrone have been introduced. Protoveratrone is one such. Krupp, Pierrie, Jacobs (1954) report favourably on this drug. Stern and Barnett (1954) after evaluating the methods employed in the treatment of eclampsia in 1718 cases concluded that hypotensive treatment gave better results than sedative lines in the treatment of eclamptics.

We have not used hypotensives alone in the treatment of eclampsia. Our experiences with Veratrone are confined to the early years of 1938—1940, when Veratrone was used in conjunction with a sedative. When bad side-effects were noticed, Veratrone was given up and we have not employed it on any large scale. It is pertinent here to point out that severe eclampsia can occur with normal blood pressure though hypertension is commonly met with. It is also noticed that fits can persist in spite of the control of blood pressure. In a series of 1460 cases (1938-1957) there were 220 cases of eclampsia with blood pressure not exceeding 140 mm. of Hg. systolic and where the fits persisted. Therefore it is but reasonable to conclude that while control of blood pressure will help in the management, too much should not be expected from this treatment alone. It is a useful adjuvant.

Along with sedatives we have used Apresoline (Ciba) to control the blood pressure in 24 cases. In 14, 20 mgm. of the drug was given intravenously and in 10 intramuscularly. Following the intravenous administration there is a rapid and marked fall of both systolic and

diastolic pressures. But this fall is maintained only for 4—5 hours. We have also used Serpasil (Ciba) to control the blood pressure. 5—7 mgm. of Serpasil have been given intravenously in 22 cases. We observed that the blood pressure took some time to drop — in 40 per cent of cases the fall was delayed beyond one hour. In 3 cases no fall was observed and the duration of the lowered pressure was only 2—3 hours. The drug is slow and uncertain in its action and the impression from a small series is that it is not a suitable hypotensive in the management of eclampsia. Further trials are proceeding and we reserve our opinion till these trials are over.

Obstetric Management

For a long time it was thought that termination of pregnancy by emptying the uterus as quickly as possible would improve the prognosis in eclampsia. On this was based the radical method which fell into disrepute owing to the heavy maternal mortality rate. Any form of forced delivery has long stood condemned and few will deny that it is best so. The question at the present stage is whether termination of pregnancy has any place in the management of eclampsia and if so by what method—caesarean section or artificial rupture of membranes to induce labour.

Stroganoff in 1928 added to his conservative therapy the termination of pregnancy by artificial rupture of membranes, where the fits persisted and could not be controlled by sedation in the antepartum eclamptic. He reported improved results. Since

1938 we have adopted artificial rupture of membranes as a routine in all eclamptics whose fits could not be controlled by sedation. We treated from 1938 to 1950 on these lines, viz. sedation combined with artificial rupture of membranes, 1150 cases with an average mortality rate of 15 per cent. Caesarean section was never done unless there was a specific indication like pelvic disproportion. Vaginal delivery was helped by outlet forceps, if necessary. But in no circumstances was a difficult vaginal delivery attempted. This was the main principle of obstetric management. According to Williams, the condition in which patients suffer least due to lack of medical attention is eclampsia. Eastman (1950) refers to cases of eclampsia in Chinese women who have survived after days of convulsions resulting in spontaneous labour and survival. "By writing these facts" writes Eastman "I do not mean to advocate a policy of therapeutic nihilism in eclampsia, but wish simply to recall that this disease, like many others showed a strong tendency to spontaneous abatement provided the patient is not killed by obstetric trauma". Quoting the figures from John Hopkins Hospital, Eastman concludes "the immediate treatment of eclampsia today then is not concerned with the question of obstetric interference but is simply a matter of determining the particular form of conservative therapy which is to be employed." Greenhill (1947) opined that if there is one thing that is settled in the treatment of eclampsia it is that caesarean section routinely performed, leads to the highest maternal mortality, while

Deickmann (1950) remarks that caesarean section is performed if there is cephalo-pelvic disproportion or if the eclampsia is severe and the cervix is closed and uneffaced. Morris and Dewar (1947) during the trials with Bromethol in eclampsia recommended caesarean section in cases where prompt uterine response to artificial rupture of membranes was unlikely as judged by the nature of the cervix on vaginal examination. Everyone of us has observed the improvement that follows delivery in pre-eclampsia and eclampsia. That postpartum eclampsia does occur is no argument against this improvement. Many an obstetrician has however written often warning against caesarean section in eclampsia. From a previous study of 1150 cases (Menon 1955) two important factors stand out: (1) antepartum eclampsia has the maximum maternal mortality — 17.5 per cent as against 6.5 per cent for intrapartum and 9.3 per cent for post-partum; (2) in uncontrolled cases the longer the time interval between the onset of convulsions and delivery the worse the prognosis. Thus there will seem to be a case for termination of pregnancy in antepartum eclampsia not responding to treatment (Menon: 1953, 1955). Termination of pregnancy by artificial rupture of membranes may be resorted to in cases where response to induction will be quick but in those with closed cervixes and unengaged heads there may be a long latent period which may be detrimental to the final outcome. Hence the question of caesarean section in these cases is worthy of consideration.

Caesarean section for eclampsia stood condemned from the early years of the century but those were the days when lower segment caesarean section was in its infancy and anaesthesia undeveloped. Based on the above principles, since 1953, so far 42 caesarean sections have been done on eclamptics in whom the conservative treatment failed to control the convulsions. Only one mother was lost in this group but the death is not attributable to the section. I do not think that caesarean section under the circumstances detailed above adds to the inherent risks to the mother from eclampsia (Menon: 1955, 1957). It is well recognised that in the management of eclampsia, if any treatment adopted enhances the inherent risk to the mother from eclampsia that treatment must be avoided. Based on this the value of caesarean section will stand or fall.

Lower segment caesarean section under local anaesthesia is the method of choice. It may be pointed out here that out of 42 patients who had caesarean section done for eclampsia, 13 have already come back and delivered vaginally of live healthy, mature babies with no maternal complications.

So far no mention has been made of the foetus. It is accepted that foetal mortality is high in eclampsia, 30 - 60 per cent, the main reason being the toxæmia itself, the sedatives used and prematurity. However with present lines of management, it could be kept within 15 - 25 per cent.

From all these published records it would appear that no single method can claim to be the best method. It

must be repeated that any evaluation of results of different methods of treatment of eclampsia should be based on comparison of results on similar cases. In many advanced countries most of the cases are booked ones or perhaps there has been a fit or two prior to treatment. Such mild cases can be usually controlled by any method. The real test for any method should be the really severe cases, and mortality figures for this particular group should be compared with the different lines of treatment adopted. It is for this statistical study of similar cases treated on different lines that the London Committee's classification is useful. It forms the basis for grouping every case into mild and severe ones.

From the results published one has to conclude that a combination of the sedative and hypotensive drugs should form the main line of treatment of an eclamptic. Hypertonic glucose intravenously is exceedingly useful. Prophylactic antibiotic therapy is essential. Nothing can replace efficient and intelligent nursing. Proper obstetric management is equally important. From our experience we are not now prepared to leave the pregnancy alone. If convulsions cannot be controlled by sedatives and hypotensives in 8-10 hours, artificial rupture of membranes, if cervix is effaced and quick response to induction is evident or caesarean section in patients with closed uneffaced cervixes are recommended. Among the sedatives used we are now partial to the phenothiazine, diethazine and pethidine combination

for the very obvious reason that in the phenothiazine derivatives we have drugs which are sedative, potentiating, anti-shock, hypotensive and hypothermic and what is most important they reduce the incidence of the three fatal complications — shock, hyperpyrexia and pulmonary oedema to the minimum. A combination of this form of conservative therapy with a judicious employment of caesarean section has helped to reduce our maternal mortality to less than 3 per cent in 296 cases from July 1955 to December 1957 — the lowest mortality during the last 25 years.

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