The Etiology and Treatment of Albuminuria and Eclampsia Gravidarum.

being thesis as candidate for the degree of Doctor of Medicine.

by

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Case 1.

Eclampsia and Death.

Mary Chalmers, ætat 18. unmarried. primipara. admitted 12.30 p.m. 13. Sept. 1892.

History. Last unwell 28th Nov. 1891. In February May & June she had a slight red-coloured discharge from the vagina. There was a recurrence of this in July. At the beginning of August great swelling of the legs appeared and a fortnight before admission there was swelling also of the hands and feet especially during the night.

At the same time she began gradually to have diminished vision until on admission she could not recognise friends nor read nor count fingers 1½ feet away. She suffered from a severe head- & face-ache - chiefly on the right side of the face and across the forehead. Three days ago while speaking to a friend her Eyes became for a few seconds fixed & glaring.

Examination. The legs were very dropsical - face & hands puffed and swollen. Eyes suffused & somewhat injected. Pupils widely dilated but responding to the stimulus of light. Severe headache. Memory of dates & various things in connexion with the pregnancy much impaired. She had a few pains

the day before admission.

Abdominally - uterine tumour twice, head low down.

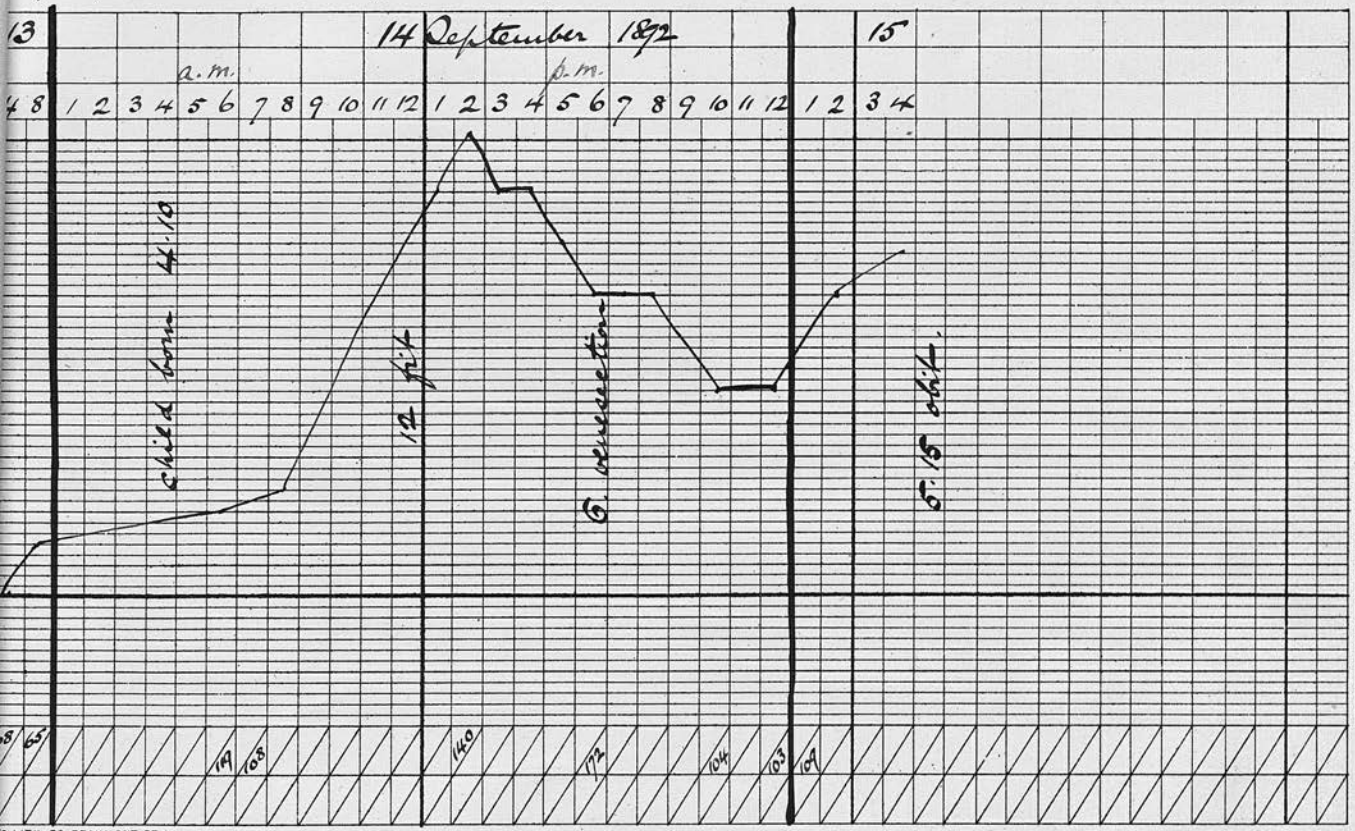
Per vaginam - condition of colpitis gravidarum. Vulva small. os not dilated. Labia majora somewhat swollen

Urine. Sp. gr. 1008. Albumen 5·3 grs ad $\frac{3}{j}$.

Treatment. An enema was immediately administered which produced 3 motions. Strictly milk diet. Calomel gr $\overline{iv}$ ē Jalapine gr v produced 1 motion. At 8 p.m. Potass. Acet. gr $\overline{xxx}$ ē Am. Brom gr $\overline{xx}$ was administered but immediately vomited. The loss of eyesight and headache were worse. She was put into a hot vapour bath for an hour which produced profuse perspiration Chloral hydrate ē Am. Brom āā gr $\overline{xxx}$ per rectum. A mustard & linseed poultice was then applied to the loins and this was continued alternating every hour with fomentations of Inf. Digitalis all night. Between 10 p.m. & midnight Croton Oil mij and Pulv. Elaterii Co gr v were exhibited but had no further effect than to produce the most violent vomiting. 28 oz of urine were passed during the first 12 hours she was in Hospital. At midnight the membranes ruptured during an attack of severe vomiting.

September 14th. From 1.30 to 4.30 a.m.

Mary Chalmers Age 18 Disease Eclampsia Index Nº



9 LITH. 52, BEAUMONT ST W.

the patient was kept under chloroform.
Chloral Hydrate & Am Brom āā ʒ xx
frequently administered per rectum
but often rejected.
At 3 am. the os was fully dilated and
the head quickly descended on to the
perineum. The application of forceps
was attempted but the head was lying
obliquely & the forceps rotated backwards
so they were taken off.
At 4.30 am. the child was born, followed
in 10 minutes by the placenta. At 9.30
8 oz of urine were drawn off by the
Catheter. She was very restless, turning
her head from side to side and throwing
her arms about.
12 noon. An eclamptic fit lasting
nearly 3 minutes. Chloral & Bromide
āā ʒ xx administered by mouth.
Hypodermic injection of Pilocarpine nit ʒ 1/6 twice.
Hot air followed by hot vapour bath for two
hours. Digitalis fomentations to the loins.
4.40. 6 oz urine drawn off and
Pot. Acet. ʒ ss administered. During
the afternoon she was very restless &
sometimes kept in bed with difficulty.
She drank Considerable quantities of
milk. Comatose but answered when
spoken to. Pulse very rapid and
feeble. Temperature 105°7 to 107°7.

5 p.m. Venesection of the median basilic vein was performed. 3viij of blood being drawn off. This was followed by collapse the pulse going up to 172 & very feeble. 3j brandy given by sips and a hypodermic injection of Ether. She continued comatose & very restless. The face was not so puffed - oedema of the legs entirely disappeared. Fed every hour alternately with milk & Valentine's Extract

8.45. 9½ oz of urine drawn off.

Midnight. patient much brighter & spoke quite rationally, though very much excited & restless. Pulse improved. Chloral & Bromide āā gr xx exhibited. Bowels moved & urine passed in bed.

<u>September 15th.</u> 2 a.m. very restless & excited.

3.15. practically unconscious, cared not be roused. Skin perfectly dry. Antipyrin gr x.

4.0. Vapour bath & pilocarpine gr ¼ hypodermically. Collapsed & brought out of bath. Breathing became very noisy and pulse extremely weak and rapid. There was no evidence of any perspiration induced by the various applications she had after the fit. The breathing gradually became laboured and the patient sank and died at 5.15 a.m.

Post Mortem Report by Dr Robert Muir.

There was very marked hydro pericardium. The heart, beyond showing a slight hypertrophy of the left ventricle - thickness of wall in some places being fully 5/8" - was quite normal. The intima of the aorta & the endocardium were not blood stained.

Lungs greatly congested, especially posteriorly & slightly oedematous, otherwise normal

Liver somewhat enlarged & soft, of a somewhat bright yellow colour with lines of congestion & a number of minute scattered haemorrhages.

micro. Exam^n showed extensive fatty & granular disintegration of the liver cells, with small haemorrhages here & there.

Spleen. slightly enlarged, of a dark colour & somewhat soft but not at all diffluent.

Kidneys. Both swollen & tense. Capsule stripped with great readiness. The cortex was greatly swollen & anaemic, almost white, whilst the medulla was congested.

micro. Exam^n. showed very marked cloudy swelling & Early Catarrhal changes. The tubules were very markedly swollen & the cortex was very anaemic. Malpighian bodies fairly normal.

The condition was extremely acute & intense & quite sufficient to cause death. No signs of previous disease. No micro-organisms could be detected in any of the organs.

Case II

Eclampsia and Death.

Mrs Naining, æt. 35. primipara. admitted 3rd October 1892 at 12.40 pm.

Said to be pregnant between 7 + 8 months.

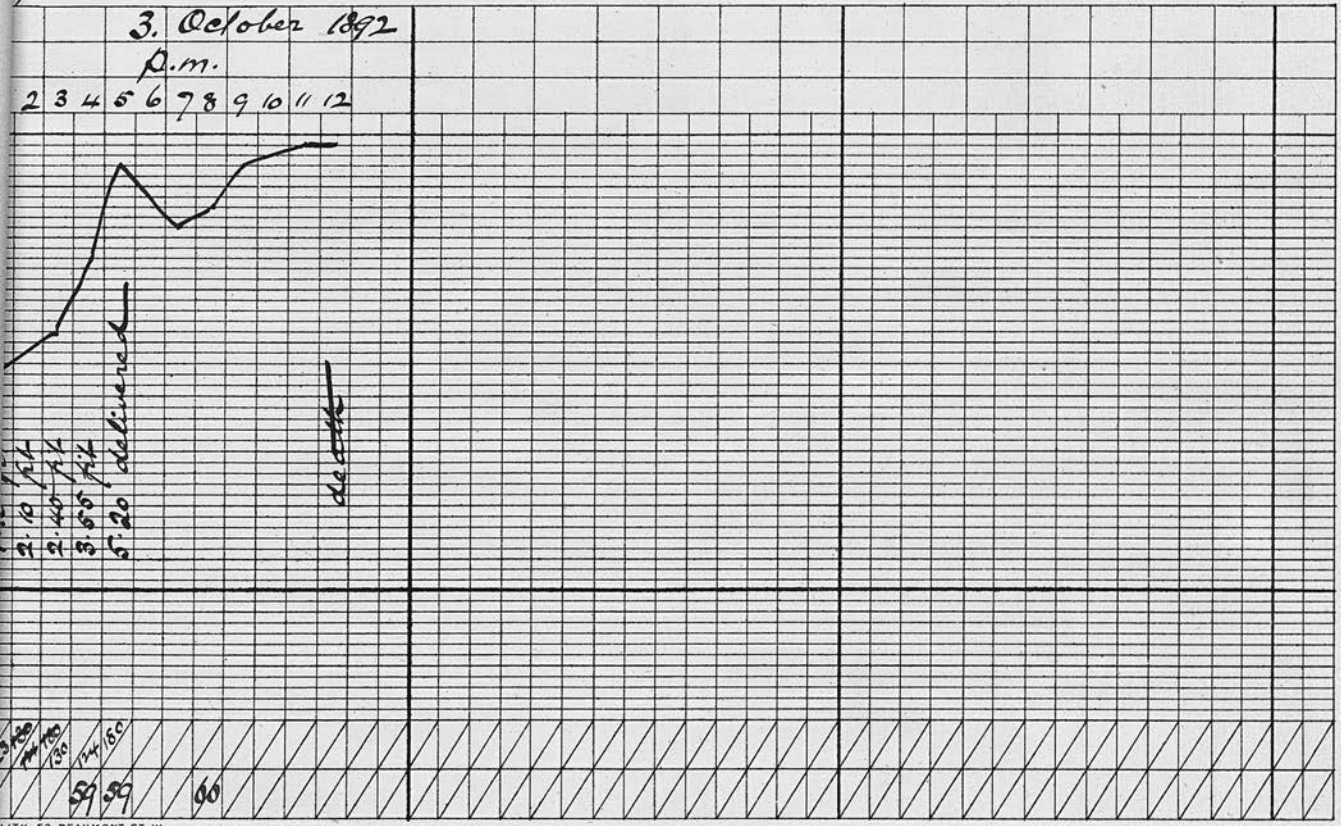
History. Morning sickness all through pregnancy accompanied by sickness in the evening. For last few weeks headache, frontal and occipital. - swelling of feet + face - some loss of memory + stupidity. Eyesight not affected. More sick than usual on the previous night. Went to bed and awoke at 1.45 a.m. in a fit. Became unconscious. Doctor called at 3 a.m. Bromide + chloral were given by mouth. The dose was vomited and repeated again. She never recovered consciousness and from 2 a.m to 12.40 p.m. she had 12 fits in all.

On admission - face swollen œdematous congested + blue. Pupils contracted. Legs swollen. Unconscious with stertorous breathing. 3iss urine was drawn off - on heating it became solid.

Uterus reached 2 fingers breadths above the umbilicus. Os not dilated. Head presenting. An enema was given which produced 2 big motions. Also Croton Oil mij

Fit at 1.10 p.m. At 1.30 mustard and linseed poultices applied to the loins. Hot bottles in wet flannel placed

Mrs Haining Age 35. Disease Eclampsia Index No.



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all round the patient. 3iv blood drawn off by venesection. Began to dilate the os by fingers.
Fits at 2.10 & 2.40. At 3 digitalis fomentations replaced poultices on loins.
The os was very rigid & dilated slowly by means of the fingers. At 5.20 the os was deemed large enough for delivery.
The child was delivered by bipolar version.
The head was delayed but was extracted by the combined Prague & Smellie siezures.
At 6.30 it was discovered that the hot water bottles had caused considerable burns on the skin of the legs & buttocks.
The fomentations had produced the same effect on the loins.
The patient remained comatose and though she had no fits after delivery she never regained consciousness. Nutrient Enemata were given at 7 & 8 p.m. & a hypodermic injection of ether at 9.15.
The breathing became more sterterous, the pulse flickering feeble & inconstant.
She rapidly sank & died at midnight.
The child was a female - dead.
Post mortem the temperature rose to 107°.7 at 12.30 a.m. and fell to 102°.4 at 1.15.
There was no post mortem examination.

Case III.

Albuminuria with subsequent Pyelitis and Cystitis.

Bella Walker, æt. 22. unmarried. primipara. admitted 19th October 1892 at 11. a.m.

Patient was last unwell in January. For the last few weeks before admission she had great swelling of the legs + feet. For about a month she had suffered from severe frontal headache, + had noticed that her hands were often stiff. She had no loss of sight and her memory was perfectly clear.

On admission. Legs very œdematous extending right up the thighs + the abdomen also. Abdominal tumour large. Fœtal heart heard half way between umbiliens + left anterior superior spine of ilium. She had had pains since 9 a.m.

Per vaginam — os admitted 2 fingers easily. A large enema was administered.

At 3.20 p.m. she passed 6 ℥ of urine
sp. gr. 1034. alb. 13 p.c. ad ℥j
urea 5½ p.c. ad ℥j. Both serum albumen + serum globulin were present.

At this time the os uteri had a diameter of 2 inches.

Croton oil ♏ij followed by Calomel gr v

was administered & the patient put into the hot air bath for an hour. Profuse perspiration & 1 small motion followed. At 5 p.m. the os was fully dilated & the head well down in the pelvic cavity so the membranes were artificially ruptured. Child delivered by forceps at 6.15 p.m. In the evening she had 2 doses of a mixture of ℞ Digitalis, Sp. Aeth. Nitrosi, with Decoct. Scoparii. She had a large watery stool passing urine at the same time. Strictly milk diet was prescribed.

At midnight 7oz of urine were drawn off by catheter & found to contain a large quantity of albumen.

Puerperium.

1 day. 12.15 a.m. hot air bath for an hour.
1.30. Liq. Ammn. Acet. forh 3ij & Digitalis fomentations to the abdomen.
9 a.m. Liq. Ammn. Acet. forh 3ij & Digitalis fomentations to the loins.
At mid day 20 oz of urine were drawn off. Sp gr 1020. urea 5½ps ad 3ij. albumen less than gr 6 ad 3ij.
2.45 p.m. passed 15 oz urine
6. p.m. 35 oz drawn off by catheter. Sp gr. 1010. urea gr 4 ad 3ij. albumen only traces.

Altogether in 6 hours she passed 70 oz.

The temperature was 99°F. The œdema was disappearing from the hands & face & she was sweating profusely. Five watery motions.

2 day. Progressing favourably. Œdema entirely disappeared from hands & Eyelids. She passed 118 oz of urine which contained only traces of albumen.

3 day. Urine passed during the day amounted to 92 oz — albumen gr 8 ad ℥j.
At 5 p.m. she had a rigor & complained of headache. Temperature 101°F.
The breasts were hard & tense. They were rubbed with Olive Oil, some milk drawn off, & limb smeared with belladonna & glycerine applied.
Œdema disappeared from the legs.

4 day. Breasts still hard & tense.
Temperature never above 100°F.
Urine 68 oz. Sp. gr. 1027. Albumen — traces.
8 p.m. Liq. Ammn. Acet. fort ℥j.

5 day. Temperature rose to 100·8 F. and patient complained of pain in right flank & right iliac region. Turpentine stupes were applied & the mixture of Digitalis, Sp. Æth. Nit. & Scoparium resumed. Urine 42 oz.
Sp. gr. 1030. albumen gr 2½ ad ℥j.
Large doses of Henry's solution were given.

7 day. morning temperature 101·8.

Severe pain in right flank & iliac region. Urine contained large quantities of pus with tailed & cylindrical epithelial cells. Sp. gr. 1030. albumen gr. 5·7 ad ℥j. A large fomentation was applied and Liq. Ammn. Acet. Joss ℥j. The temperature fell rapidly & at 6 p.m. was 98·4 – the pain being very much less.

8 day. Urine 24 oz containing albumen pus urates & epithelial cells. Sp. gr. 1037. Slight pleurisy in right side.

9 day. Temperature normal. Urine 26 oz. Albumen gr. 2·6 ad ℥j. pus & urates.

10 day. Discovered that patient had scarlatina when a child followed by inflammation of the kidneys. Chronic Bright's disease since

11. 12 & 13 days. Temperature & pulse normal. Urine still contains albumen pus & urates.

14 day. Temperature rose to 100·2° F & pulse 96. Patient was conveyed in an ambulance waggon to the Royal Infirmary where she was received in Ward XXV under the charge of Professor Grainger Stewart.

Case IV.

Eclampsia with Porro-Caesarian Section.

Mrs Bowie. æt. 20, primipara of Trafalgar Lane, Leith. admitted 9.35 p.m. 21st October 1892.

Had always been strong & healthy. At no time during the latter months of gestation were there any indications to raise suspicion in the minds of the patient or her relatives. On the day of admission she suffered from slight headache & a feeling of dullness but there was no appearance of oedema. She was attended by a midwife.

At 5. a.m. on the 21st she commenced to vomit & this continued for some time during the day.

At 5 p.m. Convulsive fits set in & Dr Tod of Leith was called in - his advice being that the patient should be taken to Hospital at once.

Prior to removal from her home there had been 6 convulsive seizures, on the way to Hospital there had been 3 in the cab & she was found in one by the resident on her arrival.

Condition on admission. She appeared a strong, well-built woman. Her face was cyanosed, the fit just passing off. There was no appearance of any

œdema either of Eyelids hands or lower limbs; she was perfectly insensible to touch light or sound & remained Comatose throughout. The abdominal tumour did not appear to be more than usually tense or prominent. It seemed to contain a foetus of 8½ or 9 months size, & this corresponded with the statements of the relatives.
Immediately on admission Croton Oil mᵢᵢ was placed on the back of the tongue, a hypodermic injection of Pilocarpine nitrate gr ¼ was given & the hot air bath administered.
Meanwhile Dr Halliday Croom was informed.
The pilocarpine & hot air bath induced an immediate & copious perspiration & the air bath was continued for 20 minutes the temperature of the patient being carefully watched. As the patient remained Cyanosed & there were indications of further impending Convulsions she was put under the influence of an anæsthetic & this was continued without intermission but the dose was increased on any indication of an approaching fit.
At 10.10 p.m. she had another Convulsion - the temperature was now 101° & the pulse 130. Urine 3ᵢᵢ muddy &

highly-colored was drawn off by the catheter. and this on examination indicated the presence of a very large amount of albumen - the precipitate being as much as 2/3 the bulk of the urine.

A <u>Vaginal Examination</u> was now made. The vagina was very short & narrow - its capacity extremely small. The foetal head appeared well down in the pelvis. The cervix was not drawn up and the os was closed only admitting the tip of one finger and with difficulty allowing the passage of the fingers to the internal os. The cervix was hard & firm & had little of the soft character one expects in a parous cervix.

The os did not appear capable of admitting the fingers for the purpose of inducing dilatation.

Dr Halliday Croom arrived & examined the patient. Up to this time the Croton oil had produced no effect & an enema was administered but was not followed by any evacuation. (This has been the experience in all these cases, although the oil was freshly ordered, & seems to have been the unexceptional result in previous cases)

fits occurred at 10.15. 10.20. 10.27. 11.16. 11.17 11.20. 11.25. 11.30. 11.35. 11.40. 11.45 and 11.50.

On a further vaginal examination the condition of the parts was found to be unchanged. It was impossible to do more than with difficulty insert one finger into the os. The patient remaining comatose, the fits succeeding each other at intervals of 5 minutes, & the patient being Evidently in articulo mortis the advisability of performing Cæsarian section was considered with the hope of saving mother & child, rather than merely waiting passively till the patient was dead & then extracting the foetus.

At 11.30 Dr Croom again attempted to dilate the cervix with the fingers but found this impossible.

Dr Milne Murray who was present then repeated the experiment but failed to get more than one finger in. He then inserted Hegar's dilators seriatim but this failed in producing any result other than rupturing the membranes.

At midnight the patient's temperature was 102°7. The only hope for her evidently lay in active measures

adopted instanter & she was prepared for operation. This was performed with the assistance of Dr Murray & Dr Haultain. Every antiseptic precaution was observed & the patient was fully anesthetised. The abdomen was opened in the middle line & the surface of the uterus exposed. The placenta was recognised as being attached to the anterior wall so that it lay in the line of the incision. This was cut through & the placenta & child rapidly extracted, & the walls of the uterus grasped & drawn out of the abdominal wound. The child was soon resuscitated & continued to do well until removal from Hospital. It was a healthy male at about 8½ months.
The uterus was firmly grasped & a piece of elastic tubing applied to its neck preventing any further hemorhage. The amount of bleeding had been very little more than in a case of normal labour. It had been intended to perform the simple Cæsarian section & replace the uterus but this was deemed inadvisable & the Porro operation was completed. The peritoneal surface was carefully stitched to the stump of the

uterus & this was held in position by the abdominal needles & the abdominal wound was carefully closed. During the course of the operation whilst the patient was fully anaesthetised there had been no recurrence of fits & the patient now appeared rather less cyanosed & the pulse, although rapid, seemed better. The patient was replaced in bed at 1 a.m. 22nd October. Dr Croom & Dr Murray shortly thereafter left.
At 1.30 the Eyes were noticed to be fixed in divergent strabismus & the breathing was somewhat noisy.
1.55. Pulse 150. temperature 102°.6 F.
2.40. Fit much worse than any of the preceding. Chloroform was again administered. The patient's face became exceedingly oedematous & purple & remained so.
A rectal injection of Chloral & Bromide āā ℈ xv, Valentines meat juice, & Brandy āā ℥j was given but rejected immediately. Hypodermic injections of chloral & bromide were given at short intervals.
3. Hot air bath for a short time but produced no Effect in perspiration
3.10. Pilocarpine ℈ 1/10 hypodermically was injected & was again followed

by copious perspiration which continued to flow freely.

3.45. Rectal injection similar to the preceding was retained.

4. Temperature 104°.6. pulse 160. 3vii urine drawn off by catheter.

4.30. Enema of Liq. Ammon. Acetat.

5. Temperature 105°.2. pulse 156 irregular.

5.30. Temperature 105°.6. Between 4 + 5.30 a copious frothy salivation exuded from the mouth

6. Temperature 105°.2

6.15 patient expired. About 3j of thick discoloured urine was drawn off.

Twelve hours afterwards the abdominal wound was opened. The surfaces had become adherent throughout the Entire extent & depth. There was a slight amount of serous exudation tinged with blood into the peritoneal cavity. The kidneys were extracted & sent to be Examined but no further post-mortem examination was performed.

Pathological Report by Dr Robert Muir.

Naked Eye examination.

Organ is somewhat swollen & tense. Capsule strips with great readiness. Cortex regular & slightly swollen.

The interlobular arteries are greatly congested whilst the parenchyma between is anaemic, of a pale yellow colour & much swollen. The medulla is congested.

micro. Exam^{n}.

The tubules are much swollen pressing upon the capillaries between. The Epithelium is in a condition of extreme cloudy swelling going on to catarrh. The Malpighian bodies are much swollen distending their capsule but shows no other change.

Condition. Extensive cloudy swelling & early acute catarrhal nephritis. Uterus practically normal.

The four cases detailed above occurred during my quarter's residency as House-Physician at the Edinburgh Royal Maternity and Simpson Memorial Hospital and the accounts are copied from the records of the Hospital by the kind permission of Dr Halliday Croom.

They will serve as an introduction to a discussion on the Etiology and Treatment of Albuminuria & Eclampsia Gravidarum.

The question of Albuminuria will be first separately taken up and Eclampsia discussed in the second half of the paper.

Albuminuria Gravidarum.

Albuminuria Gravidarum.

The urine in normal pregnancy undergoes notable changes. The quantity secreted is increased in amount. This is chiefly due to the excessive excretion of water. At the commencement of gestation the quantity of solids found in the urine is diminished and consequently with this increase of water we get a diminution of the specific gravity. The diminution of the amount of solids is due to lessened quantities of phosphates, sulphates, urea & uric acid, but the diminution is relative rather than absolute. Most probably the total amount of these substances excreted in the 24 hours is Equal to that in the non-gravid state & may be even greater. The only normal substance which seems to be relatively increased in quantity is chloride. The acidity is well-marked the urine rarely having an alkaline reaction.

The most notable fact however is that in the urine of pregnancy there is often found albumen. About this question of the albuminuria of pregnancy much discussion has taken place and chiefly in its connection with Eclampsia gravidarum.

Looking to the various results of examinations that have been published there cannot be any doubt that in a considerable proportion of women who pass through pregnancy & labour there is albuminuria. The frequency of this condition is given in very varying numbers by different authors. Several writers on the Continent estimate the frequency as 20 per. cent. and some even at 50 per. cent. But the former figure is the one more usually given. Thus[1] Blot, Litzman, Petit & Hypolitte regard the frequency as being over 20 per. cent. of women during or just after labour and during the 9th month before the onset of labour about 14 per. cent. [2] Lautos of Buda Pesth gives the frequency as 60 per. cent. in 600 puerperae and 18 per. cent. of 70 pregnant women. He considers it to be a valuable diagnostic sign of pregnancy. On the other hand most British & American observers put the frequency at a much lower rate than this - 2 or 4 [3] per. cent being numbers much more frequently found.

[1] A Manual of Midwifery by A.L. Galabin (1893) p. 316.
[2] British Medical Journal. 1889. vol. 1. p. 87.
[3] British Medical Journal 1891. vol. 2. p. 679.

Possibly the Continental observers have used more delicate tests and they consequently discovered the presence of albumen which was in insufficient quantity to give a reaction with heat & Nitric Acid - the test most frequently used in this Country.
But whatever the proportion be it must be granted that albuminuria does occur frequently in pregnancy and it is a usual accompaniment of Eclampsia.

Since the discovery of the association of albuminuria with eclampsia by Lever of Guy's Hospital in 1842 the origin of the albuminuria of pregnancy has been a much-debated question. Many theories have been brought forward to account for it and we propose to Examine some of them.

1. The first to be brought forward - by Lever himself - was the theory that the presence of albumen was due to mechanical causes and this still finds many supporters. It is stated that the gravid uterus exerts pressure on the renal arteries and veins. This supposition is supported by several facts. In the first place albuminuria is more frequent in primiparae and in them it is explained by the

greater resistance offered by the tense abdominal walls causing increased tension in the abdominal cavity.
Similarly in cases of twins & hydramnios where there is a proportional increase of the frequency of albuminuria we have this increased pressure. And we have still further an example of venous stasis produced by pressure in the case of edema and varicose veins of the lower extremities.
Others, notably ① Halbertsma & ② Löhlein, have argued that the pressure is exerted not so much on the renal vessels as on the ureters & the neck of the bladder. Löhlein made post-mortem Examinations in 32 cases of Eclampsia and found in 8, or 25 per cent., dilatation of one or both ureters.
The arguments brought forward in support of the mechanical theory are strong but are considerably weakened by the following considerations.
1. We often have albuminuria by the 3rd or 4th month or even earlier & in these cases it cannot be due to pressure on the renal vessels
2. The albuminuria often disappears

① A System of Obstetric Medicine & Surgery. by R. & J. Barnes. (1884.) p. 397.
② Galabin. op. cit. p. 315.

under treatment by general - not local-
means whilst the mechanical conditions
remain the same or are even Exaggerated.
3. Albuminuria occasionaly occurs in
multiparae who have escaped the
condition during their first pregnancy.
4. The kidneys and their vessels are
peculiarly protected by their position
from the effects of pressure exerted
by the growing uterus. They lie in the
recesses of the lumbo-dorsal region,
protected by the spinal column, and
the uterus grows forwards instead of
exerting its pressure backwards.
5. In a few cases it has been shown
that with the intra uterine death of the
foetus the albuminuria disappears
although the mechanical conditions
remain the same.
6. And lastly women who have large
ovarian cysts very seldom suffer
from albuminuria & then only when
the tension is much greater than is
usual in pregnancy.
These considerations considerably lessen
the importance of mechanical pressure
in pregnancy as a cause of albuminuria
but they do not altogether abolish it
The facts concerning priniparity, toxins

~~Barnes op cit p. 400.~~

& hydramnios still require Explanation and we may accept the fact of increased pressure acting as an accessory cause of albuminuria.

2. Vesical catarrh which is occasionally present in pregnancy must be held to account for a certain number of cases. In this connection Barnes' view of the cause of many cases of albuminuria may be noted. [1] He points out that in pregnancy it is easy to observe that there is hyperemia & a catarrhal condition of the mucous membrane of the vagina & cervix. This leads to the shedding of Epithelial scales and an exudation of muco-albuminous fluid. From this he infers that we have the same condition of things present in the tubules of the kidney for they are under the same condition of hyperemia Further their functional activity is much greater than that of the cells lining the mucous membrane of the cervix & any increased blood supply would lead to larger results. But there seems to be no reason why the same reasoning should not apply to Every mucous membrane in the body and an intestinal or bronchial Catarh would arise under similar

1. Barnes. op. cit. p. 400

conditions. Although ingenious we think this theory is insufficient to account for more than a very few cases of albuminuria.

3. Reflex nerve mechanism has been called on to account for this condition. Tyler Smith suggested that albuminuria "may depend upon Sympathetic irritation of the kidneys ~~of the kidneys~~ by the gravid uterus, Similar with the irritation of the salivary glands, the mammae, the thyroid &c." Undoubtedly there is a close nervous connection between the kidneys & the pelvic organs as shown by the sudden copious secretions of urine by hysterical women but there seems to be no explanation in this theory of the presence in the urine of the abnormal constituent albumen which is the point at issue.

Having cleared the ground a little by these examinations it would be well to Enquire into the nature of albuminuria in general.
Albuminuria is most frequently found associated with Bright's disease & in this connection it has been Studied most.

O. Barnes. op. cit. p. 403.

At the present day it is recognised that albumen may be found in the urine arising in one of three different ways. These are called
1. Parenchymatous 2. Vascular & 3 Haematogenous sources of origin.

The Parenchymatous theory ascribes the albuminuria to inflammatory changes in the epithelium of the tubules, which must give rise to albuminous products in the urine. In addition & more particularly by the shedding of epithelium the basement membrane is laid bare & permits the direct transudation of albumen from the blood vessels into the tubules. When albuminuria is produced in this way then there is necessarily an accompanying nephritis.

The Vascular theory is to the effect that when albuminuria occurs the seat of transudation is in the Malpighian tuft of the kidney. © Nussbaum's experiments on frogs practically settle this question in the affirmative and in the majority of cases, except in acute tubal nephritis, we may hold that albumen finds its way into the tubules by means

© Lectures on Bright's Disease. R. Saundby. (1889). p. 18.

of the glomerular tuft. In cases of venous obstruction due to pressure on renal veins, kidneys or ureters, or due to backward pressure in cardiac lung & liver disease &c, there occurs oedema of the whole organ & we get a direct transudation of albumen from the blood vessels & lymph spaces into the tubules but we have seen that it is unlikely that this is able to account for more than a few of the cases of albuminuria gravidarum. If the albumen then generally transudes by means of the glomerular tuft, what is the cause of this condition whereby the foreign substance albumen is permitted to pass? Are we to suppose that in all cases of albuminuria & Eclampsia gravidarum there is present a nephritis? An inflammation of the kidney structure by affecting either the tubules or glomeruli would immediately account for the presence of albumen, and this explanation has been and still is accepted by many as the correct one. For many years after the discovery of the association of albuminuria by Lever the majority of obstetricians held this opinion

and the condition was spoken of as Bright's disease occurring in pregnancy. It is of course quite natural that a patient suffering from chronic Bright's disease who becomes pregnant should still continue to excrete albumen in the urine but we are dealing with cases in which no previous disease of the kidneys has been present. Are we to suppose that in all these cases of albuminuria & Eclampsia we are dealing with an actual nephritis arising during the course of pregnancy? Some writers answer unhesitatingly in the affirmative. Galabin[1] says "there is abundant evidence that in the albuminuria of pregnancy, when notable in degree, there is generally actual nephritis" In a discussion on Puerperal Eclampsia in the Obstetrical Section of the British Medical Association at Bournemouth in 1891 he leaves no doubt that in his opinion in albuminuria & Eclampsia there is an actual nephritis. He says[2] "those who suffer from convulsions are commonly not known to have Bright's disease until either premonitory

1. Galabin. op. cit. p. 315.
2. British Medical Journal. 1891. vol. 2. p 679.

signs of Eclampsia or actual convulsions appear & therefore may be presumed to suffer from a recent attack of kidney disorder". Further on he describes the character of the "form of nephritis associated with Eclampsia" as being especially severe in the diminution of the excretion of solids &c.

Dr Sonthey in a clinical lecture reported in the Lancet[1] describes the condition as "pregnancy nephritis"

This theory then of an actual nephritis has not been wanting in able advocates & still has many adherents but we think the facts of the case are very much against them. The arguments in its support are that during life there is albuminuria & after death various conditions are found in the kidneys. If it be claimed that a patient who passes albumen in the urine has necessarily got nephritis there is no further discussion but we shall attempt to show immediately that the two are not coinclusive.

As regards the conditions found post mortem in fatal cases of eclampsia we shall have more to say later on but in the meantime

1. Lancet. 1883. vol. 1. p. 47.

it may be said that the post mortem changes in the kidneys are very trivial in a large majority of cases and there is no Evidence that the patients who recover suffer from the same changes. The complete recovery which takes place in the great majority of cases is an argument strongly opposed to this doctrine. Quite a number of women who suffer from eclampsia in their first pregnancy have no further trouble in subsequent pregnancies and are not subject to nephritis in any form.

In connection with Vascular theories of the origin of albuminuria the researches of Mahomed may be studied and they throw important light on the subject. His paper is Entitled "The Etiology of Brights Disease and the Prealbuminuric stage" but it is really an investigation into some of the conditions which precede and accompany albuminuria. The Experiments were conducted on cases of Convalescents from the exanthemata, gouty subjects, parturient & puerperal women. He discovered that the pulse of acute Brights disease like that of chronic was a pulse of high tension. There

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① Trans. Medical & Chirurgical Soc. of London. 2nd series. vol 39. pp. 197-220

is a similar condition of pulse in the exanthems, Erysipelas & pregnancy and this led him to suspect that the vascular condition caused the albuminuria & not vice versa. In Scarlet fever albuminuria is almost always preceded by constipation and less frequently, chill. This leads to some effete material being retained in the blood" which by disturbing the relation between the blood & the tissues interferes with capillary circulation & produces high tension." The albuminuria which occurs is not inflammatory. It is a general blood poisoning in which the kidneys are affected along with other organs, notably those of excretion. There is a similar condition to the kidneys in the stomach & duodenum & probably through the whole intestinal tract. By analogy the sweat glands are probably affected in the same way. In convalescence from the Exanthemata the patient is excreting as rapidly as possible a quantity of effete matter & one of the three excretory functions is suddenly arrested - by constipation or chill to the skin. Coincidently there is a rise in tension - the poisoned blood cannot take

up more effete matters, therefore, it loses its affinity for the tissues, & the two remaining organs of Excretion have to do extra work. The kidney receives extra blood supply under high pressure. This is not inflammation. The first indication is the presence of Crystalloids in the urine - then albumen. It seems that only under a certain degree of pressure do crystalloids pass - if the pressure is increased they cease & the Colloid albumen appears. If the pressure be still greater the minute vessels rupture & blood appears. The quantity of urine is invariably diminished.

He says that in the large proportion of pregnant women there is high tension - in none is there low tension or dicrotism. During the first stage of labour there is invariably high tension. It decreases gradually after labour & requires from 7 to 21 days to get normal. There is high blood tension because the mothers blood is charged with effete materials for she has to discharge the excretory matters of the foetus. Her blood is thus in a manner poisoned & does not bear a normal relation to the tissues

while the organs of excretion have to do increased work under increased pressure. Therefore if constipation or chill occurs albuminuria is a very probable result.

Mahomeds conclusions were —

1. Before any kidney change or albuminuria there is high tension due to noxious materials in the blood such as Lead, alcohol, uric acid, scarlet fever poison &c or else to sudden chill.
2. If sufficiently severe hæmoglobin & other blood crystalloids appear in the urine before albumen
3. If allowed to continue albumen is subsequently found & Bright's disease ensues.
4. If checked before albumen appears or immediately after by purge or otherwise the high tension & crystalloids disappear.

These observations of Mahomed are of great value & require careful consideration as applied to the pregnant condition. The changes produced by normal pregnancy on the state of blood pressure, the heart & vessels are well marked. The increased quantity of blood & its

① op. cit. p. 198.

② see infra under "Eclampsia."

hydraemic condition necessarily tax the heart to greater exertion. Thus it is found that the number of beats per minute is increased by 5 or 10 over the non pregnant condition & in addition the left ventricle soon becomes hypertrophied from the extra strain thrown upon it. The vessels show the effect of the strain by the peripheral capillaries becoming engorged & the stellate veins on the thighs increase in number & size. Many women suffer from varicose veins & haemorrhoids early during pregnancy & as this often occurs in the early months it cannot be accounted for by the pressure of the enlarged organ but is due to the increased blood tension.[1] Observations with the sphygmograph show that from a very early period in pregnancy the blood pressure is increased.
Sir W.H. Broadbent in his book on "The Pulse" quotes pregnancy as one of the causes of high tension.
These facts all strongly support Mahomed's thesis but before coming to any conclusion regarding the albuminuria of pregnancy it is necessary to take into consideration

[1] Barnes. op. cit. p. 209.

the 3rd group of causes which are nowadays regarded as causing albuminuria in general.

Since the days of Bright himself there have always been some who maintained that albuminuria is due to changes in the blood & that the only part which the kidney plays is the elimination of this constituent as a deleterious substance. Thus, according to the Hæmatogenous doctrine, albuminuria is on all fours with a glycosuria. Any excess of sugar in the blood passes off at once by means of the kidney & in doing so sometimes gives rise to a nephritis. In the same manner any foreign or useless albumen present in the blood is eliminated by the kidney & in the process the irritating qualities of the albumen give rise more frequently to a nephritis & that to a more severe degree. Thus the albumen is not a consequence of the nephritis but the nephritis is caused by the elimination of the foreign urinary constituent albumen. The chief supporter of this theory at the present day is Professor Semmola of Naples and as we think it may throw considerable light on the

quaestio vexata of the origin of the albuminuria of pregnancy & as it has received so little support in this country we propose to give a short outline of Semmola's views.

An account of his experimental & clinical work from 1850 to 1883 is found in a paper entitled "Nouvelles Recherches Expérimentales et cliniques sur la Maladie de Bright" which was presented to the Académie de Médecine of Paris & published in the "Archives de Physiologie" in 1884. Shorter papers have since appeared in the Bulletin de l'Académie de Médecine down to 1892.* From the title of the paper it will be seen that he deals exclusively with the question of Bright's disease but his remarks as to the etiology of albuminuria have a wider application & are of great importance relative to the albuminuria of pregnancy.

His first paper was published in Naples in 1850. At this time, as indeed since then, the theory that albuminuria & Bright's disease were due strictly to renal lesions was hardly called in question. By experimenting clinically with various diets Semmola found that

* The latest work of Semmola (1895) is abstracted in the British Medical Journal 1895. Feb. 23. Epitome art. 162

[1] 1. the quantity of albumen eliminated by the urine in Bright's disease in 24 hours has a constant relation to the quality of the food. Other things being Equal the quantity of albumen secreted was four times greater on an Exclusively meat diet than on a diet completely non-azotised. and
2. The quantity of albumen Eliminated under the influence of food is greatest during digestion.
This led him to think that there ought to be a relation between albuminuria & the Composition of the blood as he could not suppose that the morbid condition of the kidneys varied with such facility and in the different hours of the day. He then arrived at the following conclusions from clinical work
1 That albuminuria can take place without a renal lesion & that in Bright's disease it precedes the lesions of the kidneys.
2. That the albumen eliminated by the urine is in a certain relation with the Composition of the blood which consists in the fact that certain albuminoids not being destroyed (brûlés)

[1] O. op. cit p. 288.

& transformed into urea water & carbonic acid are eliminated by the kidneys as being useless material.
Further researches led to a paper before the Académie de Médecine at Paris in 1861 when he laid the following results before the body
©1. The albumen of different cases of albuminuria is not the same, either as regards coagulability or its reaction to acids, magnesium sulphate & other salts
2. The albumen in cases of Symptomatic albuminuria - i.e. albumen passed in cases of heart or liver disease &c - is allied to caseiform albumen while that of true Bright's disease is more like white of Egg.
3. That the alteration of the blood in the albuminuria of Bright's disease consists in the presence of a non-assimilable albumen unable by its molecular composition to contribute to the maintenance & repair of the tissues & consequently leads to its elimination as a substance foreign to the body.
Further he shewed that diet which has such a profound influence over

© op. cit. p. 291

the albumen passed by a patient suffering from Bright's disease has little or no influence on the quantity passed by those suffering from Symptomatic albuminuria.
Thus it will be seen that Denmola had come to the conclusion that the essential factor of Bright's disease is an alteration in the albuminoids of the blood & since then he has constantly directed experimental & clinical work to investigate what are the differential characters & the source of origin of these albuminoids & to show that this dyscrasic condition is the cause of the renal process.
For a long time he tried to devise a chemical test whereby the albumen found in the urine of Bright's disease could be differentiated from all others but though some general ideas were formed according to the density & retractility of the precipitate he could get no definite guide.
He considers that the chemical changes undergone by the albuminoids supplied by the food form an endless chain constantly changing by hydration, molecular transformation & combination with other constituents

of the blood-stream and that when we speak of the albumins globulins & syntonins these are only links in the chain bound together by an indefinite series of intermediate forms. Consequently Semmola turned his attention to the consideration of other characters of the albuminoids of the blood & chiefly to the question of their diffusibility. By 1881 he had formulated by experiment the conclusions that

1. the albuminoids of the blood in the albuminuria of Bright's disease are more or less completely diffusible according to the more or less advanced stage of the disease & to the smaller or greater quantity of albumen eliminated by the urine.
2. that in the serum of healthy people or of patients suffering from symptomatic albuminuria the albuminoids are diffusible only to a very slight degree & this small proportion of diffusibility has no relation with the quantity of albumen passed by the kidneys.

We come now to his most important contribution which was made, as

D. op. cit. p. 299

stated above, to the Académie in 1883.
He aimed to prove that
1. In healthy individuals who present transitory ("physiological" or "cyclical") albuminuria the blood serum always contains a greater quantity of diffusible albumens than that of healthy individuals who are not albuminuric & that the quantity is always in proportion to the quantity eliminated by the kidneys.
2. In all the cases of albuminuria which occur in the course of dyscrasic diseases the serum contains a greater quantity of diffusible albumens than in health.
3. In the cases of albuminuria due to changes in pressure on the renal circulation the albuminoids of the blood which diffuse do not vary from the proportion in health.
4. The blood serum of patients attacked by albuminuria in convalescence from scarlet fever contains a great quantity of diffusible albumens.
He gives two interesting clinical cases showing the various changes in the blood serum in albuminuria before during & after treatment & these

O. op. cit. p. 300

agree with his propositions.
The presence of an excess of diffusible albuminoids in the blood is called by Pennuola - hyperalbuminose. This may arise in the first place by an excessive introduction of albumen into the body by means of the food. If more be introduced than can possibly be dealt with by the various appropriate agencies of the body there necessarily arises a condition of "hyperalbuminose absolue". But the class of cases called "hyperalbuminose relative" is more to be studied in connection with our subject.
One is carried naturally to the consideration of how the albumens are dealt with in the body & what it is which effects those chemico-molecular changes in their constitution which enables them to fulfil their function of administering to the various tissues - what it is that leads "à l'accomplissement de son voyage biologique".
In clinical investigation one is immediately struck by the frequency with which albuminuria is produced by the influence of causes which affect the cutaneous surface & above all by the action of wet & cold and this

leads to the supposition that the cutaneous functions constitute one of the most important organic functions in the elaboration of the albuminoids. Several other well known facts support this theory strongly. Many patients suffering from cutaneous diseases such as eczema & psoriasis when cured of this condition by local remedies become attacked with albuminuria. Demmola has records of 55 such cases. Further by covering the skin of animals with an impermeable coating albuminuria is almost always produced. Again atmospheric influences such as moisture & cold affect in a notable degree the condition of patients suffering from albuminuria & very often the results of this influence can be seen in the daily amount of albumen passed. In these patients also at an advanced stage there can be noted an atrophy of the skin in all its elements and a smoothness & pallor which shew its implication in a striking degree. From these facts & from experiments on coating dogs Demmola concludes that there is a constant relation between the 3 terms

① 1 the degree of activity of the
cutaneous functions,
2 the quantity of dialysable albumen-
-oids in the blood stream and
3 the appearance of albumen in
the urine.
Another most important point is made
in showing the non dependence of
albuminuria on a kidney lesion by
the fact that in these cases albumen is
also excreted by other emunctories.
Albumen is constantly present in the
bile of patients suffering from Bright's
disease. Faccond in a note to his
translation of Graves' lectures states
that is found in the faeces. The
sweat + saliva contain it also.
These facts strongly bear out the
suggestion of Semmola that the
primary cause of albuminuria is the
presence of diffusible albumens in
the blood. Along with the other
considerations mentioned they suggest
that albuminuria is very comparable
to glycosuria "② L'albuminurie, dans
ce cas, constitue tout simplement
un acte d'épuration organique auquel
les reins contribuent en première ligne
Sans qu'il y ait aucun besoin d'une

① op. cit p. 317. ② p. 321

altération épithéliale pour réaliser cette élimination d'albumine." Thus Semmola considers that failure in the metabolism of the skin is the first link in the chain of the causation of albuminuria. Along with this there are probably altered functions of the liver & nervous system but the skin supplies the predominating factor.

Next we come to consider the causation of the renal lesions in cases of Bright's disease. Semmola regards them as being "Un fait secondaire et même la conséquence nécessaire de l'irritation fonctionnelle que l'appareil rénal doit subir pour éliminer l'albumine devenue inassimilable et en conséquence inutile au maintein des fonctions de l'économie vivante." The albumen is a foreign substance to the kidney - as much as, though in a different degree, uric acid cantharides or turpentine - & its passage must cause deleterious results. To test the truth of this supposition Semmola conducted 6 experiments on dogs - injecting a solution of white of Egg to reproduce the condition of the presence of an

© op. cit. p. 428

unassimilable albumen in the blood stream. This method is chosen in preference to any other method of producing albuminuria such as ligature of vessels or section of nerves as these procedures introduce other elements. In this he followed Claude Bernard who had previously made similar experiments[1]. The animals were bled to the Extent of the proposed quantity to be injected & the injections were subcutaneous to Ensure their slow absorption. The general results of his carefully carried out experiments & autopsies are as follows[2]

1. Albumen can cross the renal filter without any previous alteration in the histological elements of the kidneys and without causing during its passage any consequence

2. If the passage persist the first effect is hyperaemia with intra glomerular haemorhage & haemorhage into & between the tubules - the capsule is distended by a mass after boiling and sometimes it is simply lifted up & seems separated from the glomerule by an

1. British Medical Journal. 1891. Epitome Jan. 3
2. op. cit. p. 450.

empty space. There is considerable migration of leucocytes without any alteration of the epithelium. Hyaline casts are present in the urine. These are the first steps of an inflammatory process (un travail inflammatoire) in connection with the functional effort.

3. If the functional effort persist more than 6 or 8 days - above all with quantities of albumen injected of a gramme for each 1000 grammes of animal the slow inflammatory process increases with cloudy swelling of the tubular epithelium fatty degeneration, epithelial necrosis & thickening of the intertubular connective tissue.

4. The histological alterations of the kidney persist for some time after the injections have ceased without causing the continuation of the albuminuria.

5. With the elimination of albumen by the kidneys there is always albuminocholia - i.e. the elimination of a certain quantity of albumen with the bile.

This rapid resumé will serve to give a general idea of Semmola's theory of the production of albuminuria & Bright's disease. The steps of the

process are 1. some interference with the metabolic activity of the skin & other glands. 2. the consequent presence of unassimilable albumens in the blood. 3 the elimination of these by the kidney and 4 the production of nephritis. In connection with the presence of these albumens in the blood Demmola proves it to be correct by bleeding his patients & finding that their blood does contain an excess of albumens which diffuse and further by injecting these albumens into the veins of dogs he produces in them an albuminuria proportionate to the amount of albumen injected ①
Further, seeing that this loss of albumen to the economy should of necessity lead to a diminished excretion of urea he experimented & found that the diminution in the excretion of urea by patients suffering from Bright's disease is very marked in the earliest stages & is proportionate to the loss of albumen & this loss is not compensated by the presence of other nitrogenous products such as creatin.

① op. cit. p. 293.

In like manner all his propositions are supported by a wealth of clinical & experimental work which is very convincing to an unbiassed reader.

In this discussion of the question of albuminuria in general it will be seen that we have paid most attention to the researches of Mahomed and Dennmola because we believe that it is to them we shall have to look for the most plausible explanation of the albuminuria of pregnancy. It is to be regretted that we have no published Examinations of the condition of the blood in albuminuria gravidarum quâ the presence of diffusible albumens but the great frequency of complete recovery, the condition of the kidney found post mortem varying from quite normal to conditions of considerable change lead us to study Dennmola's views very particularly in relation to our subject. And the recognised high blood tension of pregnancy with the increased work thrown on the kidney of eliminating the Excrementitious matters of 2 organisms

give the data on which Mahomed bases an albuminuria in general. In the first place if accepted they permit us to dispense with the idea that in every case of albuminuria gravidarum there is necessarily present a nephritis. This will be the more acceptable because the presence of albumen in the urine is otherwise hardly to be satisfactorily accounted for. Further they would explain how it is that in a certain number of cases the disease is followed by chronic albuminuria and the presence on post mortem Examination of various changes in the kidney structure.

The most important post mortem examinations have been made by Braun. These were in cases of Eclampsia but in the great majority of them we may presume albuminuria to have been present & that to a considerable extent. The results of his Examinations of those cases in which the kidney was affected are summarised by Barnes©. "Braun distinguishes 3 degrees of disease of the kidney. First stage: hyperæmia, capsule easily removed, plexus of veins on

© Barnes. op. cit. p. 395.

surface dilated & full of blood. The cortical substance is brownish red; the pyramidal masses are also hyperaemic, injection striped. The epithelium of the tubuli is not essentially altered but is easily separable. The tubuli filled with coagulated or fluid exudation sometimes contain blood corpuscles.

In the second stage, that of exudation & commencing fatty metamorphosis, the cortical substance is of a dull yellow, the striped vascular ramifications & red spots in it disappear. Between glomeruli & capsule ~~lies~~ lies a thick stratum of firm exudation of granular structure, showing fat droplets. The interior of the epithelial cells of the tubuli is, in extreme cases filled with fat droplets, becomes turbid & at last the cells themselves are decomposed into aggregations of granules.

The third stage, that of retrogression & dissolution of the glandular substance (atrophy), the kidney becomes smaller, the surface is uneven and tuberculated."

Some observers such as Depaul state that in the autopsies they have made

the kidneys were perfectly healthy or simply congested. Braun only found the above conditions in one out of every 7 cases. These results agree remarkably with Professor Semmola's views.
We have in the majority of cases albuminuria without any Evidence of nephritis & in those cases in which nephritis occurs the steps are almost identical with those produced experimentally by him by the injection of white of Egg into dogs.
The part which atmospheric influences play in the production of albuminuria gravidarum has long been recognised but has received no adequate Explanation. Lusk says① "Convulsions may occur epidemically in consequence of atmospheric conditions which probably interfere with the functions of the skin & thus indirectly increase the labour thrown upon the kidneys. Fordyce Barker② refers to this in discussing Eclampsia. He saw 3 cases in one day & 3 on another day of the same week. It is supported to a certain extent by the records of cases in the Edinburgh Maternity

① The Science & Art of Midwifery. W.T. Lusk 1892. p. 577
② The Puerperal Diseases. Fordyce Barker. 1874. p. 112

Hospital. During the quarter of my residency & the succeeding quarter 8 cases of albuminuria or Eclampsia are given, of 3 of whom no record of the residence has been kept. Of the other 5, 3 came from Leith and 2 from Dumbiedykes Road.

By accepting Denmold's views these cases are easily explained by the supposition that under the influence of various winds damp & cold the metabolism of the skin is interfered with & we have the consequent hyperalbuminaemia & albuminuria.

With regard to Mahomed's theory of a toxaemia & increased blood pressure there is the curious fact that Continental observers, who have found albumen in the urine of 20 per. cent. of women during or just after labour, only found the percentage to be 14 during the 9th month of pregnancy. This is Explained by Galabin① by the presence of contractions of the uterus which cause an increase in the blood pressure. During a pain the flow of blood through the uterus is greatly limited - the arterial blood fails to find

① Galabin. op. cit. p 315

admission & a large quantity of venous blood is squeezed out of the uterus - the 2 factors causing a considerable rise in pressure.

How far we may reconcile the two theories of Mahomed & Semmola and construct a single one out of them is a matter of no great moment. D^r Alexander Haig[1] supplies a very thoughtful & suggestive study in his paper "On the connecting link between the High Tension pulse & albuminuria" in the British Medical Journal (vide 1890. vol. 1. p 65). He believes that the presence of uric acid in the blood causes arterial contraction & this by lessening the supply of the skin & the liver brings about the changes which Semmola reports. In another paper[2] he says "It is easy to see in the large & active nitrogenous metabolism of this period a condition corresponding to gouty hypernutrition & entailing some retention of uric acid which must from time to time find its way into the blood." This theory is extremely interesting & may lead to considerable results but the chemistry & pathology of uric acid in the blood is insufficiently

1. British Medical Journal 1889. vol. 1. p 290

advanced to permit of any conclusions being drawn as yet. Beyond accepting Haig's suggestion that the high blood tension of pregnancy must cause an interference with the cutaneous circulation & thus increase the Effect of any cause acting on the skin glands we prefer to take the two theories as they stand as being capable of explaining a great deal in the causation of albuminuria gravidarum & to leave the question of their interdependence for the time.

Without having any knowledge of Semmola's work Gübler① had suggested a theory of <u>Super-albuminosis</u> to Explain the albuminuria of pregnancy. He held that the mother produced more albumen than ordinarily & that the foetus could not consume it, Consequently the excess must accumulate in the blood & be eliminated by the kidneys causing as it passes irritation of the kidney structure. This hypothesis must give place to Semmola's more scientific theory but it is interesting as having run on somewhat the same lines.

① "De L'albuminurie puerpérale" Paris 1890 by Madame E. Walker-Bruère. p. 26.

Within recent years it has been suggested that the albuminuria and eclampsia of pregnancy have a bacterial origin. Dr E. Blanc[1] of Lyons in the Archiv. de Tocologie of March & April 1889 stated that he had discovered micrococci in the kidneys & urine of women suffering from this condition. He failed to find the organisms in the blood. Cultures of these micrococci were made & injected into pregnant rabbits causing albuminuria convulsions & death. Blanc thinks that the presence of the microbes & their products constitutes a zymotic disease & that the albuminuria is merely a symptom of this. This theory has received the support of Doléris & Jaure & the partial assent of Galabin. They trace the entry of the organism to an endometritis.[2] It is not to be denied that these microbes may be found in the urine & bodies of patients who have died from albuminuria & eclampsia but control experiments[3] have succeeded in

① Quoted by Galabin. Brit. Med. Journ. 1891. vol 2. p 679
② British Medical Journal 1893. vol 1. Epit. art 74
③ " " " " " " " 97

demonstrating them to be present also in the urine of perfectly healthy pregnant women. The occasional epidemic character of the disease lends some support to the hypothesis but many other facts are directly opposed to its acceptance. The greater frequency of albuminuria & eclampsia in primiparae and plural births is inexplicable on it & endometritis is a comparatively rare disease in primiparae. The good effects of simple treatment & the cessation of albuminuria on the intra uterine death of the foetus are alike facts that cannot be explained by it. Altogether, in the meantime at least, the theory has very few supporters & little to fall back on in the way of facts & data.

Recapitulating what has been said as to the causation of albuminuria in pregnancy we think the following may be regarded as the chief causes of its occurrence.

1. By the pressure of the growing uterus upon the neck of the bladder, the ureters the kidney vessels or the kidneys themselves. This theory will undoubtedly account for a certain

small proportion of cases though not for so many as its advocates suppose. It probably acts chiefly however in the cases of primiparae twins + hydramnios as accessory to the other factors following.

2. Vesical catarrh will explain the occurrence in a few cases.

3. Anything affecting the maternal organism which leads to an exaggeration of the normally increased pulse tension or leads to an increase of Excrementitious substances in the blood may give rise to albuminuria. Such circumstances arise from interference with the digestive processes especially constipation or any interference with the excretory functions of the skin by chill or otherwise. This subject will be more fully entered into in discussing eclampsia. The condition of multiple pregnancy by increasing the amount of excrementitious substances in the mother's blood will favour the development of albuminuria under slighter causes than in a single pregnancy

4. Any interference with the metabolism of the skin + liver will bring about albuminuria by interfering with the normal changes undergone by the

albuminoids. This theory is not asyet accepted by the great majority of medical writers but we believe that much more attention will be paid to it in the future than it has hitherto Enjoyed.

The skin has always been looked upon as a purely excretory organ but to us it is more than probable that this is only a small part of the important function it plays in the economy of the body. In this connection we may refer to the recent Harveian Oration on "Modern Developments of Harvey's work" by Dr Lauder Brunton.© He says "We do not yet know whether the secretion of sweat which is usually looked upon as the sole function of the skin bears really really the relationship to cutaneous activity which the secretion of bile bears to the functions of the liver." Much work in this direction has been done of recent years. The treatment of myxoedema by the injection of thyroid juice or ingestion of the gland opened the way by showing that a gland with no excretory duct may have important relations to the blood stream & the general economy. Similarly the glycolytic function of the

© British Medical Journal 1894. vol 2. p 853.

pancreas which takes place independently of the products of its activity secreted by the pancreatic duct shows in its case an important function which has hitherto been overlooked. Interference with this function is now considered one of the chief causes of Glycosuria, in the same way as we regard interference with the internal metabolism of the skin as causing albuminuria. Brunton further says "It is obvious that if this idea be at all correct a complete revolution will be required in the views we have been accustomed to entertain regarding the action of many medicines. In the case of purgatives & diaphoretics, for Example, we have looked mainly at the secretions poured out after their administration, whereas it may be that the main part of the benefit they produce is not by the substances liberated through the secretions they cause, but returned from the intestine & skin into the circulating blood." Now that more attention is being paid to this aspect of disease & therapeutics Semmola's views of the functions of the cutaneous

glands will gain in importance to the great gain we believe of the treatment of albuminuria in general & that of pregnancy in particular. They give very precise indications of the directions for treatment and it will be seen that the empirical methods which have been useful lend themselves readily to an explanation if these hypotheses be accepted.

The treatment of albuminuria gravidarum becomes of considerable importance when the complications which may supervene are considered. The loss of albumen if in any considerable amount is in itself a source of danger to the maternal organism. but other & more serious dangers may arise. The chief of these & the one which always presents itself to the mind on finding albumen in the urine of a pregnant woman is eclampsia. Puerperal convulsions may arise in pregnancy or labour without any preceding albuminuria but in the majority of cases - 84 per cent - this

(1). A text book of Obstetrics by Dr. J. Winckel translated by J. Clifton Edgar. 1890. p. 693

condition precedes the development of the convulsive seizures. On the other hand in the majority of cases of albuminuria eclampsia does not supervene. Various authors put the frequency at proportions varying from 10 to 50 per. cent. Fifty years ago when the association between the two conditions was first discovered it was held that they were invariably present together. Fuller knowledge has led to considerable alteration in this opinion & the discovery of cases in which eclampsia occurs without a trace of preceding albuminuria or any premonitory symptoms settles the question of albuminuria being the sole cause of the convulsions. What the precise connection between the two is we shall discuss later on – in the meantime we shall regard albuminuria as a distinct disease which may or may not be accompained by eclampsia. However the ever present possibility of its coming on gives to the treatment of the albuminuria considerable importance.

Abortion or premature labour is an accident to which albuminuria frequently tends. Possibly the insufficiency of nutrition in the mother's blood or the excess of

poisonous elements in it may lead to this condition. The exact frequency with which it occurs is difficult to ascertain but it is recognised by all obstetricians as a complication which is much to be dreaded. Similarly intrauterine death of the foetus may occur under the same circumstances.

Serous effusions are among the commonest symptoms of albuminuria & these when in any considerable amount are a source of considerable danger. The swelling of the vulva introduces a serious element at the time of delivery. Hydropericardium. hydrothorax, ascites, effusions into the lungs or brain are all to be dreaded & when they occur they become sources of grave trouble.

The possibility of permanent disease of the kidneys can never be lost sight of. We have seen that the constant passage of albumen causes an irritation which may be trifling but if continued is apt to give rise to structural changes which become permanent. A chronic nephritis may arise in this way or if such a condition does not supervene many patients are liable at each successive pregnancy to the dangers of a fresh

attack of albuminuria & in time a chronic disease may be set up.

Paralyses of various kinds arise in connection with albuminuria gravidarum. Cerebral apoplexy may occur during pregnancy but more probably during labour & may cause death. Or the patient may have one or several smaller bleedings which leave her more or less paralysed for life. A case of this kind occurred in my own practice in April 1893. The patient suffered from albuminuria & oedema during her 11th pregnancy. The labour occurred without any complication but on the 2nd & 4th days of the puerperium she had slight attacks of right hemiplegia which left her with permanent weakness in the affected parts. Paraplegia is a not uncommon accompaniment of labour in such cases. Similarly aphasia & aphonia occasionally happen.

Among the most notable changes which may complicate albuminuria are those affecting the Eye & Ear. The eye frequently shows haemorrhages & white spots - a condition known as albuminuric retinitis - atrophy of the optic disc, paralysis of accomodation &c. A favourable

prognosis can be given in the majority of cases but some lead to permanent impairment of vision.

Deafness due to swelling of the Eustachian tubes or local hæmorrhages not unfrequently occurs & this condition though partly recovered from is likely to be increased with each successive pregnancy.

Add to these the various serious hæmorrhages which occasionally happen such as epistaxis, pulmonary apoplexy & post partum hæmorrhage and it will be seen that the complications which may arise in cases of albuminuria are very serious & cause us to take up the question of its treatment as a most important subject.

Treatment of Albuminuria Gravidarum.

When any notable amount of albumin-uria is present during pregnancy the first thing to be done is to place the patient on a strictly milk diet. This was prominently emphasised first by Tarnier in 1875 and in 1880 he published a paper "De l'efficacité du régime lacté dans l'albuminurie des femmes enceintes" still further insisting on its great importance.

The substitution of milk for a mixed diet benefits the patient in many ways. Pennuola has shown that the albumen of milk is the form that requires least elaboration by the skin and if the metabolism of its glands be at fault this defect is to a certain extent counterbalanced. Dr Haig[1] has ingeniously suggested that this is due to the fact that milk is really the product of a skin gland. Milk diminishes as much as possible the formation of toxic products. It contains nothing which may be toxic. The toxaemia in this way is not being constantly increased as is possible on a mixed diet. The blood is further

1. British Medical Journal 1889. vol. 1. p. 290

diluted & its toxaemic condition rendered less intense by the dilution which is a necessary consequence of the ingestion of a sufficient quantity of milk to maintain good nourishment. Tarnier[1] even gives milk by means of a stomach tube in severe cases with threatened eclampsia to attain this dilution. The large quantity of water contained in it also acts as a diuretic & leads to the excretion of some of the toxic substances present in the blood.
For all these reasons milk diet is to be strongly recommended & whether our theories of its action be correct or not it is of undoubted service in the treatment of this condition.
In very severe cases the food should consist exclusively of milk but in less serious conditions it may be combined with starchy materials such as corn flour sago arrowroot &c.

Another line of treatment, directed to act on the skin, should always be combined with this. Following the suggestion that the condition was due to kidney disease baths intended to bring the skin into action as an alternative excretory organ have

[1] "Traitement de l'éclampsie Puerperale" Paris 1893 by M. Bernheim p. 70

long been used. Wrickel[1] says that the best method is to give daily a hot bath at 100°F & to wrap the patient afterwards in a hot blanket & this will cause diaphoresis for 2 hours. He says "this treatment enables the gravida to go to term without injury to the child." Or the use of the hot air bath for 20 minutes - daily in severe cases, twice a week in milder ones - will do equally well. These measures are better than Turkish baths taken away from home which are never quite free from danger.
The diaphoresis produced in this way undoubtedly does service by the elimination of excretory products from the blood & by relieving the overtaxed kidneys of some of their work.
But remembering what we have said in discussing Semmola's views of albuminuria it would seem that it is more than probable that a considerable - if not the main - part of the utility of this method is to cause an increased action in the metabolic activity of the skin whereby the albuminoids are enabled to undergo their normal changes. Some[2]

1. Wrickel. op. cit. p. 595.
2. Bernheim op. cit p. 68

writers have objected to the production of diaphoresis on the ground that the blood serum is in this way concentrated & the relative toxicity of the blood increased. But it is more probable that the action of the baths fully compensates for this by the increase of what we may call the "internal metabolism" of the skin and if milk diet is being given the fluidity of the blood will be fully kept up.

The importance of these two measures — milk & baths — cannot be too much insisted upon. By their means alone many cases of albuminuria in the early stage can be completely relieved and the pregnancy go on to term without any further complication.

Many other measures however are to be taken as accessory & often necessary in the management of such cases.

The impoverished condition of the blood in many cases requires the use of Iron to maintain its proper functions. The anaemia hydraemia of normal pregnancy are considerably increased. Almost all cases are benefited by its administration to a certain extent.

The use of diaphoretics such as Acetate of Ammonia has been advocated

& is distinctly of benefit but the baths supply the same action in a much more satisfactory & efficient way. The use of pilocarpine from its depressing action on the heart & its liability to produce pulmonary congestion cannot be recommended.

A copious daily evacuation of the bowels by means of saline laxatives must be produced. Waste products from the blood can be carried off in this way & the blood tension is markedly relieved. In severe cases this channel of elimination can be still further utilised by the exhibition of hydragogue cathartics.

The practice of giving diuretics such as Acetate of Potassium which may be irritating is hardly to be recommended. Water is the best diuretic in albuminuria & if the patient is on milk diet a sufficient quantity of this will be absorbed to flush the kidneys without any additional drug.

So far then we have recommended milk diet, baths, Iron & laxatives. With these must be Enjoined a strictly physiological life on the part of the patient. The body should be

enclosed in flannel from head to toe to avoid any possibility of chill to the surface of the skin. There must be no exposure to cold or damp & no fatigue from household duties or otherwise on the part of the patient. All sources of emotional excitement should be as far as possible removed. Absolute rest for a time is very beneficial and no long period of fasting must be allowed. All the rules for the management of a normal pregnancy must be followed carefully. Moderate exercise - not to the point of fatigue - will be very useful if not otherwise contraindicated.

The use of digitalis is recommended by Barnes[1] in cases where there is excess of blood tension but if it is used it must be in small doses & careful watch kept for any slowing of the heart's action. We think its use can be omitted in the great majority of cases.

These measures are applied to ordinary cases of a considerable proportion of albumen in the urine. Other measures must be applied in very severe cases & when there are premonitory signs of

[1] Barnes. op. cit. p. 409

serious complications. These consist of venesection & cupping and as a last resort the induction of premature labour.

Venesection in albuminuria & Eclampsia is undoubtedly a questio vexata of modern obstetrics. Winckel[1] says he has long given up its use in both conditions. Jordyce Barker[2] & Barnes[3] & many others however consider it of great value in extreme cases more especially as a prophylactic against the occurrence of Convulsions. This question we shall consider later & in the meantime we shall discuss its relations to the albuminuric state. Obviously a venesection will relieve the blood of a certain amount of toxic matters but the proportion of blood withdrawn being so small compared with the rest of the blood we cannot assume that this is its chief action. More probably the undoubted benefit which follows in some cases is due to its effect in lowering the blood pressure - thus diminishing the high tension which according to Mahomed is the

1. Winckel. op. cit. p. 596
2. Jordyce Barker op. cit. p. 80
3. Barnes. op. cit. p. 409

chief cause of the passage of albumen. In this connection a most interesting case has been recently published by Dr John Williams.© The patient had suffered from albuminuria & eclampsia in her first pregnancy & albuminuria in her second and premature labour was induced in each case with the death of the child. In her 3rd pregnancy she again became albuminuric in the 7th month. The albumen amounted to one fourth. She was bled this time to 8 ounces. "Relief followed immediately. The distress ceased, the turgescence of the face vanished & in 24 hours albumen had entirely disappeared from the urine". This was repeated 3 times at intervals of a week & in each case was followed by a like gratifying result.

Venesection we may conclude is beneficial in a certain - not large - proportion of cases where the indications are high tension & heart failure but it would be unwise to use this measure in the case of weak women & it should always be done with caution.

Along with it Cupping of the loins may be tried in cases of a great

© The Practitioner. January 1895 p. 1.

quantity of albumen. In this way the congested state of the kidneys may be relieved – a measure which would be beneficial on any theory of albuminuria.

The last measure that calls for consideration is the <u>induction of premature labour</u>. The advisability of this procedure can only arise in very extreme cases. Opinion is again very much divided on this point. Wickel[1] considers the practice "obsolete" but on the other hand several authorities strongly recommend it as giving the best chance both for mother & child. Barnes[1] Lusk & Galabin[1] are all in favour of it in the presence of grave symptoms – such as serious damage to the eye paralysis heart failure &c. In these cases many patients may be saved from becoming the victims of chronic Bright's disease or permanent paralysis blindness or deafness & in individual cases the operation is not only justifiable but necessary. Each case must be considered on its own merits

1. Opera cit. pp. 596. 409. 578 318

Eclampsia Gravidarum.

Puerperal eclampsia is characterised by the occurrence of epileptiform convulsions. The similarity between these convulsions and the uraemic fits of Bright's disease was first pointed out by Frerichs in 1851. In the former disease there is albuminuria generally present & anasarca and the idea naturally arose that eclampsia results from the association of Bright's disease with pregnancy. Puerperal convulsions came to be regarded as having the same causal connections as the convulsions met with in certain cases of Bright's disease and like them were put down as being due to the retention of urea in the blood. Frerich's words are quoted by Dusk[1]: "The eclampsia occurs only in pregnant women suffering with Bright's disease & it bears to the latter the same causal relation as convulsions & coma in Bright's disease in general; it is the result of the uraemic intoxication, with which also in its mode of manifestation it agrees."

To this theory Carl Braun gave his valuable support & for many years the two conditions were regarded as being identical.

During an attack of eclampsia there is

[1] Dusk. op. cit. p 571

a lessened secretion of urea by the kidneys. This fact has been proved often & by none more conclusively than Dr Herman in his series of carefully recorded cases placed before the Obstetrical Society of London. In all the 12 cases he examined the excretion of nitrogenous matter was absolutely diminished and in most the percentage was diminished also. Does it necessarily follow that there is an increased quantity of urea in the blood? And would the condition of uræmia cause convulsions?

Winckel[2] expresses himself strongly to the effect that there is no excess of urea in the blood or important organs. He says "In many cases - we have noted several in our clinic - absolutely no retention of urea could be found in the most important organs, especially in the liver & the muscles; on the contrary these contained less urea than ordinarily; further in those cases of eclampsia which recovered, the amount of nitrogen excreted in the urine was only equal to the minimum quantity excreted in a state of absolute hunger."

But others again are equally decided in

1. British Medical Journal 1891. vol 2. p 72
2. Winckel op cit. p. 688

affirming that urea is found in the blood in excessive proportion in the albuminuria & Eclampsia of gravidae. Barnes[1] considers the fact to be well-attested & says that Gegenbaur and George Harley were amongst the first to prove it. Barnes himself found urea & uric acid in the blood of a patient whom he had bled. Similarly most writers believe that during eclampsia the quantity of urea in the blood is increased & we may provisionally accept this conclusion. For, as regards the immediate point at issue, the mere presence of urea in the blood is of slight importance unless it can be proved that this would bring about convulsions. This has been long disputed & many experimenters have been at work in connection with it. Claude Bernard[2] injected large doses of urea into the veins of animals & failed to produce convulsions & many experimenters following him have failed to produce toxic phenomena either in this way or by causing the animals to ingest quantities of urea with their food. Grehant & Quinquaud[3] produced

1. Barnes. op. cit. p. 401. 2. p. 401.
3. Saundby. op. cit. p. 75

convulsions in dogs by injecting urea but the quantity required was from $\frac{1}{100}$th to $\frac{1}{30}$th of the body-weight and in man this same proportion would necessitate a minimum of 1½ lbs. The largest quantity of urea recovered from the blood of a uræmic person has been 1½ oz & therefore only $\frac{1}{16}$th of the requisite minimum amount. Apart from experiments we have the valuable evidence of patients suffering from uterine cancer in whom the ureters are invaded & there is necessarily produced urinary suppression & yet in these cases of true uræmia convulsions do not occur. The theory then that puerperal convulsions are due solely to the presence of urea in the blood must be abandoned.

Another phase was given to this theory by the explanation that it was the carbonate of ammonia developed by the oxidation of urea in the blood that caused the convulsions. To this both Frerichs & Carl Braun brought important evidence. Braun states[1] "Eclampsia parturientium is commonly the result of uræmic intoxication arising from Bright's disease and produced

1. Fordyce Barker. op. cit. p. 106.

that urea decomposed into ammonium carbonate.

Further Petroff's[1] experiment show that the intravenous injection of ammonium carbonate, even when the ureters were tied, produced only short convulsions with no further bad effects & that the same effect was produced by carbonate of Sodium.

In true cases of ammoniaemia such as arise from absorption of decomposed urine from the bladder the symptoms are altogether different from those of eclampsia[2]

The theory then that puerperal convulsions are due either to the presence of urea or of its product ammonium carbonate in the blood falls to the ground.

At the same time the condition of the blood must be considered as a factor of primary importance in seeking for an explanation & into the consideration of this we propose to enter

Take first the condition of things we find physiologically - i-e. in this connection, in a normal pregnancy.

1. Wrickel op. cit. p. 688
2. Jaksch quoted by Barnes op. cit. p. 401

The total quantity of blood in the organism is increased, more especially in the second half of pregnancy. This is a physiological necessity as the uterus, which is a very vascular organ, undergoes a great increase in size & the mother's blood has also to nourish the foetus through the placenta. This increase has been experimentally proved by Spiegelberg[1] in the case of bitches.

Along with this increase in the total quantity the specific gravity is notably decreased, always 3 or 4 degrees and sometimes as much as 6. This is due to the relative increase of water. In the non gravida the proportion of water is 791 to 1000 & according to Regnault 817 to 1000 in the two latter months but this increase is marked all through the period of gestation. This hydraemic condition is of considerable importance in the discussion of the causation of the Convulsions.

The number of red cells in the blood notably diminishes & the average fall is approximately 25 per. cent. - this is most marked at the latter end of pregnancy.

The amount of fibrin diminishes

1. Lusk op. cit. p. 89

materially during the first 6 months but after that it increases in quantity, & along with the diminished amount of fibrin we have a decrease in the quantity of albumen.

As also the excrementitious matters of the foetus must be carried off by the mothers blood stream it will be seen that the blood undergoes considerable changes in a normal pregnancy. It is[1] "in greater volume, more watery, diluted, deficient in the more vital qualities, overcharged with Excrementitious matters. It is a relative anaemia".

What further changes does the blood undergo in a case of eclampsia? The changes in the blood in various conditions, notably the so called uraemia of Bright's disease & Eclampsia, have been the subject in late years of various experimental researches by Feltz & Ritter, Bouchard, Lepine and Tarnier & Chambrelent.

Feltz & Ritter[2] led the way by a series of experiments in 1881 directed to show the results of the injection of fresh urine or its various constituents into the

1. Barnes op. cit. p. 208
2. Saundby op. cit p. 76

blood stream. They proved
1. that the intravenous injection of fresh urine causes convulsions coma & death
2. These results are independent of the increased pressure produced by the injection or of the organic constituents
3. The inorganic substances injected separately produced the same symptoms as the urine itself & that of these the Potassium salts showed the most powerful toxic action.
Further they shewed that while the urine of healthy people is toxic that of certain patients is not.
Bouchard[1] in 1885 dissociated seven substances in the blood having different physiological actions on rabbits. These are found in the blood in health but are not present in fixed proportion. He says that these various toxic substances in the blood have four sources
1. The products of tissue metamorphosis.
2. Toxic materials produced by secretory organs such as bile + saliva and absorbed by the blood.
3. Food derivatives especially salts of potassium
4. The products of intestinal putrefaction

1. Bernheim op. cit. p. 20

absorbed by the blood.
Experimenting in the same way Tarnier & Chambrelent[1] presented to the Société de Biologie in 1892 in a "Note relative à la recherche de la toxicité du serum sanguin dans deux cas d'éclampsie puerperale" a valuable contribution to the condition of the blood in eclampsia. They found
1. That the toxicity of the blood serum is considerably increased in the case of Eclampsia
2. This toxicity is in inverse proportion to the toxicity of the urine from the same cases.

Tarnier argues from this that eclampsia represents a true poisoning of the blood.[2] In a paper in the "Journal des Sages-Femmes" January 1st 1894 he repeats his proposition & maintains that the blood of an eclamptic is absolutely poisonous.

Doléris[3] again in 1886 extracted a crystalloid substance from the serum of Eclamptics which caused toxic effects when injected into rabbits & caused lesions having a close

1. Bernheim op. cit. p. 18
2. British Medical Journal. 1894. vol 1. Epit. art 153
3. Bernheim. op. cit p. 17

resemblance to Eclampsia.
In the face of these researches we must conclude that – whatever the cause may be – the blood of eclamptics is poisonous & we have to deal with a condition of toxæmia.
This theory has been held almost from the beginning of scientific researches into the nature of Eclampsia. Sir J.Y. Simpson wrote in 1852 in an article in the Edinburgh Monthly Journal of Medical Science – "And it may be that the premonitory oedema, headaches &c and the actual convulsions themselves ..... and the albuminuria are simultaneous or successive effects of some one common central cause – viz. a pathological state of the blood, to the occurrence of which pregnancy in some way peculiarly predisposes, probably from various acts of secretion nutrition & depuration being vastly increased & altered by the conditions of utero-gestation." His belief has been entertained by almost all philosophical thinkers on the subject & the above quoted researches place the theory on firmly established ground.

9. The Collected works of Sir J.Y. Simpson. Edited by J. Watt Black. vol. 1. p. 299.

The next question that arises is — what are the substances present in the blood stream which cause this excess of toxicity?

Several suggestions have been made that the toxaemia arises from the retention in the blood of various substances normally eliminated by the urine.

We have already discussed the theories that it is due to the presence of urea and of ammonium carbonate but have seen that neither of these is able to explain the origin of the convulsions.

Schottin[1] and Fleischer[2] both suggested that the toxic substances present in the blood are the <u>extractive materials</u> of the urine. Fleischer proved that the injection of the substances into animals caused toxic ~~substances~~ symptoms but there is far less chemical evidence of their presence in excessive amount in the blood & their dangerous character if there than there is of urea which we have seen already can be discounted. Possibly further researches may show that they are of importance but in the meantime we cannot accept them as being the sole cause of the <u>toxaemia</u>.

① Walker-Brière op. cit. p. 36

②. Wrickel. op. cit. p 589

In this connection we may mention the theory of Stumpf[1] – that convulsions are due to the presence in the blood of acetone or some allied body. He found sugar present in the urine of many eclamptic patients. From this he suggested that by an abnormal process of decomposition some such substance as acetone may be formed in the blood, as is supposed to be the case in diabetic coma. This acetone by irritation during its excretion may produce a nephritis and from irritation of the brain produces coma & convulsions. Very little experimental evidence is given in favour of this suggestion & the pathology of diabetic coma is not sufficiently advanced to allow us to argue from it in the case of puerperal convulsions, especially as sugar is not by any means universally present in eclampsia.

The most comprehensive of these theories of retention of urinary products is that it is the retention of the urine as a whole – uræmia – which causes the toxæmia. This finds many supporters & many facts make strongly in its favour.

In the large majority of cases of Eclampsia the amount of urine excreted is greatly diminished. The total quantity eliminated is one of the most important prognostic

[1] Winckel. op. cit p 690

signs. If the quantity diminishes danger is always to be feared & in all cases that recover the quantity of urine excreted is on the increase. This is a much more important point than the quantity of albumen which is eliminated.

In this connection it may be mentioned that in the experiments of Tarnier and Chambrelent quoted above a third patient was afterwards examined.[1] She urinated more than the other two & though the toxicity of the serum was increased over the normal it was not so great as that of the first two cases.

Seeing then this relation of quantity of urine & danger to the patient it may naturally be supposed that the retained constituents of the urine form a primary cause of the toxemia.

We have seen above that there is probably an increase in the quantity of urea in the blood. Other observers have found uric acid present in the blood also. Although these substances cannot, we believe, of themselves satisfactorily account for the convulsions they indicate that the kidney is overpowered & that some at least of the

1. Bernheim op. cit. p 18

Constituents of the urine are retained.

Uræmia is the theory of Peters in France & Barnes in England. Barnes[1] aptly calls it the result of a kidney "strike". We have seen that in albuminuria - a condition which precedes 8⅘ percent of cases of Eclampsia - we have by the constant passage of albumen across the renal filter a more or less considerable amount of irritation set up. This may not mean an actual inflammation but the functional efforts of the kidney must be considerably handicapped - especially seeing that it is generally in the cases of severe albuminuria that eclampsia arises.

Taking all these facts into consideration we think it must be granted that the presence of some constituents of the urine in the blood must be taken as a part of the truth. What the particular substance or substances may be we are not entitled to say.

But this is not the whole of the case. The quantity of urine is not greatly diminished in some cases & in the premonitory stages when headache. vertigo dyspepsia &c are present there may be no diminution of urine at all.

[1] British Medical Journal. 1891. Vol 2. p 987

Taking Bouchard's four sources of toxic products in the blood we see that the toxaemia in pregnancy may develope in other ways.

The products of tissue metamorphosis which form his first group are eminently at work here. The mother's organism ~~it~~ in all its parts undergoes extreme changes in metabolism. To provide nourishment for the foetus more food has to be elaborated giving a corresponding increase in excretory products and in addition the mother has to eliminate the excretory products of tissue metamorphosis in the foetus. It is interesting to note here that with the death of the child during pregnancy the danger to the mother is much lessened.①

2. Various secretory organs such as the salivary glands & liver are often functionally at fault as shown by excessive salivation & occasional jaundice along with various alterations in structure (Tarnier.) & the absorption of products from these may add their quota. The deficient action of the skin which we regard as an all important factor in the production of albuminuria

① British Medical Journal 1893. vol 1. Epit ark 74 (Fehling)

must lead to the retention of some of its excretory products.

3 Similarly in the pregnant woman, as in any other, constipation will give rise to the absorption of the products of intestinal putrefaction; and constipation is a not uncommon accompaniment of pregnancy.

4. Also food is often more difficult of digestion owing to mechanical & functional interference.

And so it is possible that an increase of toxic products may come from any one of these four groups under any departure from a physiological pregnancy.

We think therefore that even the term uricaemia is too small to supply the true explanation of the presence of these toxic products in the blood and we shall be content simply to maintain that in the majority of the cases of eclampsia there is a toxaemia.

Winckel[1] accurately sums it up by saying "There are not only very great differences in the degree of intoxication, but probably also various poisons, or, at least, one poison arising in different ways in the body of the pregnant woman which may be the cause of this severe disease"

1. Winckel op. cit. p 591

This toxaemia then is an auto-intoxication produced by exaggerated production of toxines or their imperfect elimination or both & we may assume that it is a condition which is present in the great majority of cases of eclampsia.

Having settled this preliminary point we come now to consider some further theories that have been submitted to account for the occurrence of convulsions.

When it had been seen that the theories of urea or ammonium Carbonate in the blood could not be accepted as the causation of puerperal convulsions the explanation known as the Traube-Rosenstein theory was brought forward & for long received as a more scientific & plausible exposition of the condition. Traube suggested the explanation in the uraemic convulsions of Bright's disease and Rosenstein adapted it to the case of puerperal eclampsia. Rosenstein's paper "Die Pathologie und Therapie der Nieren-krankheiten" ① was published in Berlin in 1863. In accordance with the theories then in vogue he admits that frequent Congestion of the kidneys as a result of

① Fordyce Barker. Op. cit p 107

mechanical pressure in pregnancy causes albuminuria & casts & often diminished secretion of urine. At the same time in the majority of cases the patient is hydremic & dropsical. Further he states that in the majority of cases the convulsions occur during or after parturition & thus the parturition & the consequent disturbances of the circulation have great influence in their development. He discounts the theory of uremia by saying that there is no evidence of its presence in these cases & that in pregnant women suffering from nephritis no convulsions have occurred. Moreover there are frequent cases of convulsions without albuminuria. In view of these facts & the great reflex nervous excitability of pregnant women - especially primiparae - combined with the condition of the blood & its tendency to transudation, and further the frequent occurrence of oedema & anemia of the brain in autopsies Rosenstein concludes in regarding eclampsia as a phenomenon attending the alteration of the circulation within the brain. "For under the influence of parturition through the action of the entire muscular System an enormous pressure is exerted on the aortic circulation which in the presence of a dilute serum

and acting upon the finest arterial vessels occasions ædema & secondary anæmia of the brain & thus may call forth convulsions."[1]

Thus it will be seen that the theory is a purely mechanical one – the convulsions being due to ædema & acute anæmia of the brain – and that the immediate cause is the muscular contractions of labour.

It is an attractive explanation & contains many elements that are true but it is insufficient & inadequate.

In the first place not all cases of puerperal convulsions occur during or after labour. General statistics tell us that the proportion of cases before during & after labour is 1:2:1 and so Rosenstein's explanation would fail to account for at least a quarter of the cases. Further in these statistics we do not get an analysis of individual cases. Probably in many of those said to occur during labour the parturition was premature & the convulsions may have been the exciting cause of the labour – not vice versa. Braxton Hicks[2] has shown that during a convulsion the uterus participates in the general muscular

1. Jordyce Barker. op. cit. p. 108.
2. "The Behaviour of the Uterus in Puerperal Eclampsia" Trans. Lond. Obst. Soc. 1883 p. 122

spasm & it may in some cases pass into a firmer contracted condition for 10 or 15 minutes so that often labour may be immediately brought on & carried through.

So we must consent to the fact that quite a number of cases occur during pregnancy in the absence of pains.

Further under these purely mechanical conditions it would be difficult to see why eclampsia is not much more common during labour than it is. And since the same cause of oedema is acting all over the body we should expect to find that convulsions would be most frequent in those cases with most extensive oedema & dropsy but this is not always the case.

Again the results of post mortem examinations do not corroborate the theory. We should expect to find in all cases oedema anaemia & flattening of the convolutions of the brain. Löhlein[1] only found this condition in 1 out of 19 examinations and as a general rule the brain conditions found are - beyond the high degree of cortical anaemia - insignificant

These objections are fatal to a cerebral source of origin due to purely mechanical

[1] Lusk op. cit. p. 575

causes & the Rosenstein theory must be abandoned.

Angus Macdonald[1] in 1878 published an account of 2 cases with post mortem examinations in which he brought forward a theory allied to Rosenstein's but more feasible. He stated that purely toxaemic theories such as that of Frerichs are upset by the beneficial effect of a slight blood letting. Purely mechanical theories give no Explanation of cases occurring independently of dropsy & renal disease.
He contended that the essential pathology was irritation of the vasomotor centres in the medulla oblongata originating from impure blood circulating in vasomotor centres or reflexly from impure blood circulating through the tissues. This causes a general contraction of arteries through the body. In the brain it leads to extreme anaemia of the central parts & an engorging of the peripheral portions. The central anaemia caused the fits. the peripheral congestion the pain and coma. Generally the source of irritation is excretory matters in the blood but any powerful peripheral irritation

1. Trans. Obst. Soc. Edinburgh. vol IX. p. 194

might give rise to it. This accounts, according to Macdonald, for the cases with no renal disease or only trifling albuminuria. In his two cases he found the meninges congested & the venous sinuses filled with blood while the deeper layers of the brain were markedly anaemic & the ventricles filled with serum. These observations are very important & seem to us to come much nearer the truth than any that had preceded them.

An explanation of puerperal convulsions of a purely <u>reflex neurotic</u> character was given by Jaukenhaeuser[1] of Jena. Seeing that eclamptic attacks follow various sources of external irritation as pressure of the foetal head on the cervix, digital examination, emotional causes &c he maintained that the nerves & not the vascular system was the starting point of the convulsions. Further he stated that he had demonstrated a direct connection by means of the sympathetic nerve between the nerves of the uterus & the renal ganglia. In this case he regards the albuminuria as being due also to reflex irritation.

1. Jordyce Barker. op. cit. p. 111

This explanation of albuminuria we have dealt with above & have not seen any reason to accept it. The other part of the theory - relating to the actual occurrence of the convulsions is much more likely & we believe contains a part of the truth.

Gathering together the known elements of puerperal convulsions we think it must be admitted that eclampsia has no uniform etiology any more than a uniform clinical history.
We regard it as being caused by the concomitant action of three elements
1. First of all we have the normal <u>increased excitability of the nervous system</u> during pregnancy. The anaemia & hydraemia which are constantly present lead to imperfect nutrition of the central nervous system. In this condition things that would otherwise have only a slight or no effect on the nervous elements are followed by serious results. Barnes[©] well illustrates this by the analogy of the strychnised frog. If a full toxic dose of strychnia be introduced into the circulation the frog if absolutely undisturbed will lie quite

© Barnes. op. cit. p. 386

motionless. But any slight irritation such as a prick or a shake of the table will provoke fits which may prove fatal under a dose which would be innocuous if the animal were left undisturbed. So it is in puerperal eclampsia. The anaemia & hydraemia lead to a highly irritable condition of the nervous system. Fits may be brought on by slight exciting causes such as vaginal examination, labour pains, the passage of a catheter or any manipulation of the patient which would otherwise be perfectly harmless. Any sudden emotion as joy or fear or grief may have the same effect. Pregnant women are particularly prone to diseases of a similar nature. The vomiting of pregnancy may itself be regarded as a convulsive seizure - when occurring within normal bounds an essentially conservative one but if excessive constituting a real danger.

2. The second factor at work is the abnormally <u>increased vascular tension</u>. A pulse of high tension is characteristic of pregnancy & we have seen that in albuminuria which precedes 8⅓ percent of Eclampsia cases this is considerably increased. Macdonald

suggested that this is caused by irritation of the vasomotor centres by toxic products circulating in the blood. However produced high tension is a clinical fact in eclampsia which has been well-attested by all.

Several factors may occur to increase the normally heightened tension of pregnancy. A chill by constricting the blood vessels of the skin - one of the commonest causes of albuminuria - will affect this. Similarly constipation or any plethora will bear a part in its causation. The high tension & arterial contraction produced are characteristic of many convulsive disorders. Passing over the uraemic convulsions of Bright's disease we have the condition of the arteries in epilepsy - an attack of which presents such close resemblances to an eclamptic fit. Sir Wm. Broadbent in speaking of Epilepsy says ① "I look upon convulsive attacks, when they occur in connection with an infrequent pulse, as a result of cerebral anaemia, produced in exactly the same way as the convulsions after great haemorhage".

Seeing that this contraction of cerebral arteries & consequent anaemia

① "The Pulse." by W.H. Broadbent p. 120

is sufficient to cause the convulsions of Epilepsy in a person of otherwise good health it is all the more likely to lead to convulsions from slight causes in a condition of the nervous system which we have just described as being present in patients suffering from eclampsia.

3. The third factor we have already discussed in detail – it is the toxæmia. This is probably in the majority of cases the most important factor. We have seen how it may arise from the increased production of toxic products & their retention. It greatly aggravates the heightened nervous excitability by imperfect nutrition and increases the vascular tension by irritation of the vasomotor centres.

In many cases toxæmia must be regarded as the immediate exciting cause of the convulsion. It is conceivable that the nervous system can perform its normal functions under a certain amount of strain from imperfect nourishment by an impoverished blood but an advancing toxæmia would render this more & more difficult & when the toxic condition reaches a certain extent

no further element is needed to cause an outbreak of uncontrolled nervous energy such as a typical Eclamptic fit.

But probably most often we have in addition some element acting as an exciting cause. This is borne out by the fact that half the cases, according to general statistics occur during the process of parturition. The labour pains themselves may be the immediate cause of such an increase in the already exaggerated vascular tension & excessive nervous excitability as to produce the explosion. Excessive distension of the uterus or retention of urine may act in like manner. In the same way anything that interferes with normal parturition & brings about a laborious labour may act as the exciting cause. During pregnancy a fit of indigestion or constipation a moral shock or fatigue or excitement may have the same result. Briefly anything which will increase the action of any one of the three elements above may act as an exciting cause of the particular fit.

What is the relation of the actual convulsions to albuminuria? In discussing the latter subject we saw that eclampsia in 84 per. cent. of cases is preceded by albuminuria & further that in the majority of cases of albuminuria eclampsia does not supervene.

We think the relation can best be expressed by saying that the causes of albuminuria are sometimes such as to be able to produce further effects in the way of convulsions.

If we compare what we have regarded as the causal elements of the two conditions we shall find many things in common. High vascular tension is characteristic of both. In discussing albuminuria we laid much stress on the imperfect action of the skin as regards its internal metabolism in addition to its excretory function. These two functions probably go together & when one is at fault most probably the other varies directly in the same way. So that with the production of inassimilable albumens & albuminuria on the one hand we showed (at the retention of excretory products on the other - one of the causes of the toxaemia of Eclampsia

Similarly the passage of albumen & the high blood tension in the former condition lead to changes ~~in~~ of the kidney of a temporary nature at least & if carried on to a certain extent will bring about a diminished secretion of urine & lead to a condition of uræmia - another element in the causation of Eclamptic toxæmia. Indigestion, defective action of the intestinal glands will act in the same way in each of the two conditions. So we see that the causes of albuminuria acting in greater degree or in excessive amount may bring about the condition of things found in eclampsia.

But we have still to Explain a most important group of eclampsia cases - those which are not preceded by any albuminuria. Braxton Hicks in 1866 in a paper entitled "A Contribution to the Pathology of Puerperal Eclampsia" was the first to draw attention to this class of cases. He gives four and typifies them by taking the case of a woman "approaching the full period of pregnancy apparently in perfect health, without œdema, without albumen in the urine, being suddenly seized with

O. Trans. Obst. Soc. London. vol 8. p. 323

an epileptiform attack. After a certain time has elapsed albumen is noted in the urine, at first in small quantities, shortly in profusion; then blood globules, waxy & epithelium casts are found in it. At this time the urine becomes scanty, of high specific gravity with very high coloured crystals of lithic acid in considerable quantity. The case is now one of acute desquamative nephritis".

The theory then held was that all eclamptic fits were the result of uraemia. He shows that this explanation cannot be accepted in these cases as there are no antecedent signs of uraemia present. He holds that one of 3 modes of explanation must be accepted.

"Either 1. The convulsions themselves are the cause of the nephritis

2. The nephritis & the convulsions are produced by the same cause. Eg. some detrimental ingredient circulating in the blood irritating both cerebro spinal system & other organs at the same time or

3 That the highly congested state of the venous system as is produced by the spasm of the glottis in Eclampsia is able to produce the kidney complication" He concluded that the

then state of obstetric knowledge would not allow him to decide which of these was the true explanation.

Reading albuminuria for nephritis we venture to believe that the second explanation is in the majority of cases the true one. The same causes which have produced the eclampsia further act in producing the albuminuria. Looking upon high vascular tension & nerve tension & toxaemia as the causes of Eclamptic fits there is no necessity that these conditions shared first have produced a condition of albuminuria. We may have any one or all of them at work without any passage of albumen in the urine and we think that now that uraemia & nephritis may be given up as the cause of Every Case of Eclamptic Convulsions there is no difficulty in seeing this. But when these conditions are of such intensity as to produce a convulsive outbreak & further when they are aggravated by the actual occurrence of a fit they will in all likelihood produce such changes as to occasion the passage of albumen in the urine.

There are still some cases that are neither preceded nor followed by albuminuria to account for. These are admitted to be of very rare occurrence & perhaps their frequency in statistics would be considerably lessened if a more careful & detailed Examination of the urine were systematically made. But under the conditions brought about by pregnancy in certain women we cannot be surprised that convulsions should occasionally arise. A highly neurotic individual placed under the circumstances of high vascular & nervous tension with Emotional influences strongly at work as in primiparity illegitimacy &c may exhibit these symptoms without the necessity for any great amount of toxaemia. Jordyce Barker says [1] "I believe that we meet with convulsions developed by emotional causes unassociated with any anatomical ~~reason~~ lesion, except so far as the general system is modified by the condition of pregnancy, precisely like in all respects those associated with albuminuria & uraemia". Some writers have even classed this group by itself under the name of

[1] Jordyce Barker op. cit. p. 105

"Hysterical Eclampsia"[1] or "Reflex Eclampsia". Others again. Eg. Sir John Williams[2] explain some cases as being the only expression during lifetime of epilepsy in the patient - the attack being brought on under the peculiar exciting conditions present.
But we prefer to bring these cases into line with the others by putting them down as due to the vascular and nervous elements alone in a patient strongly predisposed to abnormalities of the nervous system. In the treatment of these cases these elements must be remembered & remedies directed accordingly relying chiefly on sedatives.

1. Trans. Obst Soc. London. 1866. p. 332 (Braxton Hicks)
2. Practitioner. January 1895. p. 6

Treatment of Eclampsia Gravidarum.

It will be admitted by all that the most important phase of the treatment of eclampsia is the prophylactic treatment. The convulsions themselves are so often attended by disastrous consequences that all efforts must be made to avert them in cases where we have any premonitory warning.

The most important premonitory symptom is albuminuria & the treatment of this condition detailed above forms the prophylactic treatment of eclampsia in cases where it is found. In addition other measures must be employed if signs show that the convulsions are imminent. Such are rapidly increasing amblyopia, sudden losses of consciousness, vertigo, severe hemicrania, flashes of light before the eyes, sounds of ringing in the ears &. If these occur during pregnancy they are to be met by an increased attention to the details of the treatment of albuminuria, & by the exhibition of such drugs as chloral & bromide of potassium to soothe the excitable nervous system. By means of these measures it may be possible to continue the pregnancy until such

time as the child is viable.
The question of the induction of premature labour may arise at this stage. Under very grave conditions it may become an absolute ~~ne~~ necessity. When the patient is suffering from severe albuminuria with oedema dyspnoea pyrexia blindness or paralysis & all the above measures of relief have proved unavailing it becomes the duty of the obstetrician to terminate the pregnancy as quickly as possible. In this way the mother's life may be preserved or she may be saved from permanent paralysis or injury to the Eye or kidneys. At the same time Every precaution must be taken to prevent the measures carried on from bringing about a convulsive outbreak & to this end Every manipulation must be performed with the patient deeply under the influence of chloroform.

In cases not preceded by albuminuria there are sometimes no premonitory warnings whatever & of course no prophylactic treatment can be undertaken. But Even though there be no albuminuria the cerebral symptoms may supply evidence of a warning character & under these circumstances the rules as to sedatives

purgatives & and induction of premature labour as a last resort must apply.

When the premonitory symptoms are present during labour almost all authorities are agreed that Everything possible must be done to expedite its progress & in the same way all manipulations must be carried on with the patient deeply anaesthetised.

The actual treatment of the Convulsions is a question which has evoked very different opinions from various authorities. Barnes is very decided "The principles of treatment flow logically from the obvious etiology of the affection. In the whole range of medicine there is probably no case in which the disease so clearly dictates the treatment." And yet to the measures which he strongly advocates - bleeding induction of premature labour & - no less an authority than Winckel gives a direct negative

We propose to consider in turn the various measures that have been employed in the treatment of the Convulsions

O. British Medical Journal. 1891 vol 2 p 988

1. Probably the most ancient of all methods is that of Venesection. Before the days of chloroform anaesthesia it was almost always employed. Barnes says ① "It is undoubtedly the most powerful & prompt resource at command for lowering the high vascular tension - a primary cause of the eclampsia" Lusk writes ② "The special advantage of venesection lies in the rapidity of its action; incidentally it favours absorption & renders the patient more susceptible to the influence of other remedies." It forms therefore naturally the first step in the treatment of Convulsions." Jardyce Barker argued in favour of its use. Whilst Galabin reserves it for Extreme cases where all other means have failed, or for Extreme venous congestion of the lungs Winckel has abandoned its use altogether. Examples might be multiplied in this way of authorities who have praised or condemned the practice.

It cannot be maintained that bleeding acts beneficially by extracting along with the blood a quantity of toxines

① Barnes - Op. cit. p. 410

② Lusk Op. cit. p. 579

because the proportion of blood removed to that left behind is very small. Its supporters have advocated its use mainly on the ground that it lessens the vascular tension which is so greatly increased. Undoubtedly this is a very beneficial effect & it does tend to check the convulsions for a time or render them less severe. But its effect is very evanescent. The effused serum is quickly absorbed & makes the blood pressure as great as before while the quality of the blood now circulating is proportionally deteriorated in quality. And further if cerebral anaemia be regarded as the cause of the convulsions it would seem to be distinctly contra-indicated. In the face of these facts & of other methods of treatment venesection must be relegated from the first rank & take place as a measure to be used only under extreme circumstances or when no other means are available.

2. Although bleeding as a means of lowering the blood pressure cannot be generally recommended the Employment of <u>Purgatives</u> for the same & other reasons receives the support of all. When the patient is conscious any

hydragogue cathartic such as Jalapine may be given but if she be in an unconscious condition it is better to give elaterine in butter or 2 drops of croton oil. By active purgation the arterial tension is lowered without the danger of weakening the patient so much as by venesection. Further than this it may remove a local exciting cause of the convulsion by getting rid of an accumulation of fecal matter in the bowel. But possibly its most important action is the removal from the system of some of the various toxic products circulating in the blood. The relief that follows these measures is often seen in a striking degree. The sensory phenomena disappear & the nervous system is calmed.

In addition to purgation other measures aimed at the elimination of poisons & the lowering of blood pressure must be used. These were described under the treatment of albuminuria & when once eclampsia has declared itself they must be carried out with renewed vigilance. Hot air or hot vapour baths to bring the skin into action should be used immediately. These can be combined with the

administration of Liquor Ammoniae Acetatis or any diaphoretic.
For a like result the hypodermic injection of pilocarpine is strongly recommended by some authors. It produces a profuse perspiration but as its use is attended by a depressing effect on the heart & tendency to pulmonary oedema its general use cannot be recommended. Further in comatose patients the profuse salivation attending it is not without danger as the secretion may asphyxiate the patient by getting into the larynx & trachea. Still, where it is impossible to give baths such as described & under favourable individual circumstances pilocarpine may be used.
Besides bringing into greater action the bowels & skin to relieve the blood tension & diminish the toxaemia it is advisable as soon as possible to re establish the suspended action of the kidneys. If the patient can swallow, considerable quantities of milk may be given as described under the treatment of albuminuria & Tarnier even gives milk by means of the stomach tube in unconscious patients to dilute the toxaemic blood & act as a diuretic.

Under these circumstances weak hot tea is a most admirable and un-irritating diuretic & the patient may be permitted to take as much as she likes. In unconscious patients or where there is much vomiting digitalis fomentations to the abdomen & loins form the best means of introducing this drug into the system.

3. By far the most useful remedy is the administration of <u>chloroform</u>. Since its introduction the treatment of eclampsia has been revolutionised and the method of bleeding has been almost entirely superceded. As soon as possible after the first fit the patient is placed partly under its influence and when there is any sign of another convulsion coming on the anaesthetic is given to the full surgical extent. Afterwards the patient is allowed to come partly "out", the anaesthetist being always ready to push the drug on any sign of an approaching paroxysm. In this way the chloroform may be given for hours without danger & this should be done so long as the patient shows signs of the possibility of further convulsions.
By this means the arterial tension is

lowered, the face becomes less engorged & the breathing less stertorous. The reflex excitability of the nervous system is lowered or almost abolished & as the patient is unconscious she is subject to no exciting cause due to perception or emotion. It shortens the attack of each individual fit & given in the way described above it often averts a fit or certainly diminishes its intensity. Further it permits of our carrying out any manipulation that may be necessary without running the danger of causing an outbreak. Many indications are in this way prefilled & chloroform must be regarded as one of the most useful means at our disposal

Acting in a manner closely allied to chloroform is the use of <u>Chloral</u>, introduced into the treatment of eclampsia in 1869. Winckel[1] seems to regard it as even more important than the former. Whenever an attack has occurred he gives 1 to 2 gm. per Enema & puts the patient under chloroform until the chloral shall have had time to act. Further after each fit he again gives 1 gm by the rectum & is <u>not afraid</u> of giving Even 12 gm or more

1. Winckel. op. cit. p. 696

in the course of a day. He quotes a mortality of only 7 cases out of 92 under this treatment alone. In this country chloral is usually given more cautiously & not in such large quantities. 30 grains alone with the same quantity of bromide of Potassium are given in one or two doses per rectum & it is found that when the patient is fully under its influence the administration of chloroform can be intermitted or the quantity required lessened. If necessary the dose of chloral & bromide may be repeated in a couple of hours but any further dose would be considered unsafe.

Morphine is often exhibited for the same reasons as chloral. Jordyce Barker© preferred it to the latter but since then (1874) with greater experience of the new drug the concensus of opinion seems to be in its favour. Being given hypodermically we can be surer of the action of morphia than that of chloral given per rectum. It is sometimes given in heroic doses - gr j at a time & even as much as gr iij in the course of a day. But seeing the excellent results that

© Jordyce Barker. op. cit. p 117

are obtained by the chloral treatment there seems to be no necessity to have recourse to the more dangerous drug.

Nitrite of Amyl & Nitroglycerine have also been given with a view of relaxing the muscular spasm of a fit. Robert Barnes[1] recommended nitrite of amyl in his Lumleian Lectures of 1873 & a successful case treated by nitroglycerine was reported in the British Medical Journal for 1882. It might be thought that by relaxing the contracted arterioles of the brain we should do away with one of the primary causes of the fit. But the high tension which culminates in a convulsion is a condition which has lasted for a long time in the majority of cases and, as in nephritis & uraemic convulsions, these remedies have not been found to have the beneficial results we might à priori have expected.

Veratrum viride is a drug which is extensively used in America.[2] It was recommended first in the American Journal of Obstetrics in 1871 by Dr H. Jeam of Brooklyn. It is claimed that

1. Barnes op. cit. p. 411
2. Lusk op. cit. p. 579

the drug impairs the sensibility of the raso-motor nerves & causes the blood vessels to lose their power of Contraction. It also causes perspiration. The drug has been little used in this country & much more experience will be required before it can replace well-tried remedies.

Of all sedatives chloroform and chloral take rank as the best & others should only be used under Exceptional circumstances.

4. The most recent proposal in the treatment of eclampsia is the hypodermic injection of salt solution. This procedure was proposed in a paper read before the Obstetrical Society of Jance by Porak & Bernheim & further details of the method & its results are given in a paper by Bernheim entitled "Traitement de L'éclampsie Puerpérale Et En particulier par les injections sous-cutanées d'eau salée". (Paris 1893). He maintains that the only sound pathological doctrine of Eclampsia is to regard it as a toxaemia. Accepting Tarnier's teaching that treatment should be directed to dilute the blood serum & promote diuresis he maintains that the method of

doing this by introducing milk through a stomach tube is not only difficult but is also too slow in its action. In many cases, & these the most serious, it is difficult to introduce the tube & maintain it in position. Consequently he proposed to introduce subcutaneously a considerable quantity of salt solution for the same purpose. This method had already been employed in cases of hemorrhage cholera & various poisonings but the object in these cases was different. To the questions as to whether the injections have a diuretic effect he answers© that they increase the blood pressure and diminish the velocity of the current, & that the kidney secretion is in direct proportion to the blood pressure and in inverse proportion to the velocity of the current. A litre of water containing 7 to 7·5 g of sodium chloride, sterilised or boiled, at a temperature of 37·5 to 38°C is introduced into the cellular tissue of the buttock by any aseptic apparatus. Twenty minutes is taken to introduce the fluid which may be all in one buttock or in the two. There is generally a swelling at the sight of injection

© op. cit p. 82

which lasts for about half an hour - the operation is accompanied by no pain & followed by no ill effects whatever.
He then gives the clinical results of 14 cases. Six of these with Convulsions were treated by milk alone - all recovered, a good prognosis having been given because the daily quantity of urine amounted to 20 oz or more. The other 8 were 7 cases of eclampsia & 1 of uraemic coma. & no other treatment than the subcutaneous injection was adopted. In the eclampsia cases there was little or no urine. In all 8 the injections increased or reestablished the urinary secretion. In the 7 eclampsia cases the attacks ceased more or less quickly after one or two injections. Two died. One of these was recovering but was taken from the Hospital by her friends and brought back next day in a moribund condition. In the second the treatment was only commenced very late when the patient was already moribund.
If the 6 who were treated by milk diet had been injected it is only reasonable to suppose that they would have recovered as they did & so Bernheim claims that the mortality from this treatment is only 2 out of 14 or 14.3 per cent.

This treatment has also been advocated by Grasson.[1] The results are certainly remarkable & although the number of cases in which it has been tried is very small it is sufficient to warrant a further trial of the remedy. It will be seen that Bernheim holds that the sole cause of the eclamptic convulsions is the toxæmia & that his treatment is even directed to increase the blood pressure - an element which we have considered to be a primary cause of the convulsions. But putting aside the possibility of our theory of eclampsia being incorrect or of Bernheim's theory of the action of the injections being incorrect it would seem that in severe cases with urinary suppression this method has strong claims for at least a fair trial & we shall hope to see further results of it published.

5. The Obstetric Treatment of Eclampsia.
When convulsions break out during pregnancy the immediate induction of labour is a question which admits of some doubt but must always be taken into consideration. Winckel[2] considers

1. British Medical Journal 1893. vol 2. Epit. art 8
2. Winckel. op. cit. p. 596

the practice "obsolete" because it is irritating to the mother & dangerous to the child. But most authorities submit that in many cases it is a measure not only justifiable but absolutely necessary. Often the question is settled for us as the convulsions themselves bring on labour pains and then the case must be judged according to the rules applied to eclampsia during labour. In cases which may be considered as mild - i.e. where there are only a few fits at considerable intervals & where there is no great degree of coma between them, it may be wise to trust alone to measures such as we have described, hoping to counteract the conditions immediately causing the convulsions or in the expectation that labour will supervene spontaneously. But if the case be at all severe, and especially remembering that fits before labour are those most frequently followed by serious results, such measures alone will not suffice & every thing must be done to place the patient as soon as possible beyond danger.

Galabin[1] recommends the immediate puncture of the membranes.[1] "This at

1. Galabin. op. cit. p. 328

once takes off some of the reflex irritation by diminishing the tension of the uterus. In some cases I have found this suffice to stop the fits. while labour has not come on for a day or so. If the fits continue & labour does not progress, the os should be dilated by hydrostatic bags. Chloroform being given meanwhile". But when once it has been decided to empty the uterus it must be admitted that the quickest method compatible with the mother's safety should be adopted. All manipulations of any kind should be performed with the patient deeply under chloroform. In this condition it is possible by introducing first one then two then three fingers into the cervix to dilate it sufficiently in 2 or 3 hours to admit of turning or forceps as may seem to be most advisable. The labour is brought to an immediate termination & the patient placed in the best condition of safety possible.

When the convulsions break out during labour all authorities are agreed that everything possible compatible with the mother's safety should be done to hasten delivery. This will include

dilatation of the os in the first stage by means of Barnes' bags or the finger & the early use of forceps or turning. Such measures as incisions of the cervix & accouchement forcé are inadmissable.

A procedure has been recommended by Löhlein[1] & by Dr Routh[2] of placing the patient in the semi prone or knee elbow position. Dr Routh adopted the latter means to replace the cord which had prolapsed in a case of eclampsia. The procedure not only replaced the cord but all convulsions ceased from that moment. The object of the manoeuvre is to take away pressure from the kidneys or their vessels & in this or some other way it seems to have been attended by success in some cases. In many the assumption of the knee elbow position would be an impossibility but the semi prone may be tried.

It will be seen that in the fourth case detailed above all such measures were tried without avail & the cervix refused to dilate even under the influence of Hegar's dilators. The patient had

① Lusk op. cit. p. 598
② Trans. Obst. Soc. London. 1883. p. 126.

convulsive seizures every 6 or 7 minutes & under the circumstances it was decided to perform Cesarian section as a last resort in attempting to save the lives of the mother & child. The operation was successfully performed & the patient had no further fit for 2 hours 40 minutes. A very severe convulsion then took place & the patient had no further fit but died in 3½ hours.

In the interests of the child the operation was eminently successful as there is little doubt that under the conditions in which it was placed a delivery alive per vias naturales was impossible. The mother was considered moribund at the time of operating.

Experience of this treatment of eclampsia is very limited. Halbertsma[D] gave to the Berlin Congress in 1890 two cases successful both as regards mother & child. & he stated that the operation had already been done under similar circumstances 6 times in Holland and in only one did the mother die - she being moribund at the time of operation. The operations failed to set up any fresh convulsions & promptly stopped

D. British Medical Journal. 1890. Supplement Dec 6

the eclampsia. He regards complete cessation of urine in an unfavourable case as the indication for the operation and no patient should be allowed to die undelivered.

This is a measure that could only be recommended under extreme circumstances as in the case detailed above but the success that has attended it renders it justifiable in such cases.

When convulsions first occur after delivery as in Case I the measures to be used are similar to those already spoken of but of course the absence of pregnancy or labour does away with certain complications. Milk diet, depletives & baths and sedatives are the measures to be employed.