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THE CAUSATION AND TREATMENT OF OEDEMA*

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The causation of oedema is one of those problems which have given rise to acute controversy in physiological and pathological circles for generations. Even to-day the mechanism is in several ways obscure; the disciples of many opposing schools continue to produce experimental support for their individual theories, and at times controversy is accentuated by the invocation of national patriotism and personal honour.

Oedema is a physical sign indicating an excess of fluid in the tissue spaces. It is met with clinically as a condition calling for treatment chiefly in cases of cardiac failure and of renal disease, and because of the importance of these two conditions it is with them that this opening paper will be principally concerned.

For oedema to be present there must in every case be a greater passage of fluid into the tissue spaces than out of them, and it may be laid down as a primary rule that the problem can only be understood if attention is concentrated on the forces which are in action in the immediate region of the tissue spaces and the walls limiting them, and that the shifting of consideration to other fields such as the kidney, the heart, or other special tissues of the body can only create confusion.

The tissue spaces lie between numbers of living cells, and always contain a certain amount of fluid consisting of water, some crystalloids, and dissolved gases, with at most a very small trace of protein. The blood in the capillaries is separated from the fluid in the tissue spaces only by the extremely thin capillary wall, which permits fluid both to enter the tissue spaces and to return thence to the interior of the capillary. Also lying in immediate proximity to the tissue spaces are the terminations of the lymph channels, formed by completely closed tubes with extremely thin walls, affording little opposition to the passage of fluid. In normal conditions water with dissolved crystalloids and gases passes through the capillary wall into the tissue spaces, and is largely reabsorbed with CO₂ added to it and oxygen and glucose removed, while a certain amount of fluid passes from the tissue spaces into the lymphatics and travels ultimately up the lymphatic system. Blockage in the lymphatic system produces a form of oedema well known in certain pathological conditions but sufficiently rare to be outside the scope of the present discussion.

In order to understand the commonest forms of oedema we must confine our attention to the examination of those forces which regulate the passage of fluid backwards and forwards through the capillary wall, and however complex the problem of oedema may seem it must surely be admitted that these particular forces are now rather fully understood. Only two are of great im-

portance: (1) the intracapillary blood pressure; and (2) the colloid osmotic pressure of the plasma proteins.

It is possible to explain nearly every form of oedema on the assumption that the thin capillary wall acts as semi-permeable membrane permitting the free passage of crystalloids, of which the diffusible ions will arrange themselves on the two sides according to the fundamental laws laid down by Donnan. The intracapillary blood pressure is the great force which propels fluid through the capillary wall into the tissue spaces. This transudation is a natural process of constant occurrence in health. Exact knowledge of the subject is largely due to the work of Krogh, and more recently of Landis and Drinker. Landis has shown that as the blood passes from an arteriole to a venule through a capillary the pressure falls from 27 mm. of mercury to about 13 mm.

If we inquire what conditions can increase the intracapillary pressure and so tend to increase the amount of fluid passing into the tissue spaces, we immediately encounter certain important facts. We find, for example, that in conditions of high blood pressure in the general arterial system—that is, in cases of hypertension and many cases of nephritis—there is no corresponding increase in the capillary pressure, a fact which corresponds with beautiful precision with the well-known fact that hypertension often exists for years without the appearance of oedema. It is, indeed, when hypertension has produced cardiac failure that oedema appears; or again it is in cases of valvular disease of the heart with cardiac failure that we encounter oedema. The explanation appears simple: it is increase in intracapillary pressure coming from the venous end of the capillary which produces oedema in these circumstances. Here we need not necessarily suppose that there is any increased transudation of fluid through the capillary wall; the assumption that the normal return of fluid into the capillary is impeded is sufficient to account for the oedema.

Colloid Osmotic Pressure

We owe to Starling our knowledge of the importance of colloid osmotic pressure. It is nearly forty years since he demonstrated that the presence of proteins in the blood serum is responsible for the osmotic attraction of fluid from the connective tissue spaces back into the capillaries. The term "colloid osmotic pressure" has come into general use, and there is no need at present to enter into discussion of the exact nature of this force, beyond pointing out that it is due partly to the true osmotic pressure of the total colloids and partly to the unequal distribution of diffusible ions, or, in other words, to a Donnan effect.

The colloid osmotic pressure tends to counteract the intracapillary blood pressure, and is a constant drag on the passage of fluid through the capillary wall. At the arterial end of the capillary the blood pressure is sufficient

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to overcome this, and water and crystalloids pass through, but as one proceeds along the capillary towards its venous end this pressure becomes less and less, and concentration of the colloids leads to a steady increase in the reverse factor of osmosis. In this manner the transudation of fluid is first arrested, and later on there is an actual return flow from the tissue spaces into the capillaries. If for any reason the colloid osmotic pressure falls there will be both an increased tendency for fluid to pass out of the capillary and a greatly lessened force of attraction to drag fluid back from the tissue spaces.

Such a fall in colloid osmotic pressure is brought about if for any reason the proteins in the blood plasma are diminished. This occurs notably in those pathological states in which large amounts of protein escape into the urine. It does not matter whether one is confronted with a heavy albuminuria following acute nephritis, or whether the pathological condition falls into that group which some of us refer to as "nephrosis"; in any such circumstances the colloids of the blood will be diminished, and, albumin being many times more powerful as regards the osmotic pressure of its molecule than is globulin, it will follow that a relative diminution in the albumin of the plasma will have an even greater effect than if there is merely a lowering of the total serum proteins.

The importance in this conception of the role of the plasma proteins in regulating oedema has been recognized following the work of Albert Epstein of New York. It is true that by his experimental work Starling made himself the precursor of Epstein; it is also true that Bright, over a hundred years ago, suggested that albuminuria was the cause of oedema, but to Epstein must be given full credit for the present-day conception. There is still much controversy on this subject, but it is doubtful whether anyone conversant with the work of Krogh, of Govaerts, of E. H. Fishberg, or of Moore and van Slyke can remain sceptical as to the extreme significance of this factor. A number of observers, notably Leiter, Barker, and Kirk, have produced experimental oedema in animals by repeated bleeding followed in each instance by re-injection of the red cells in normal saline in such a manner that great depletion of the plasma proteins, without anaemia, has been produced. Bennett, Dodds, and Robertson were able some years ago to describe a series of cases in which a similar loss of serum proteins had occurred into the peritoneum, the stomach, and elsewhere in men, with oedema formation without evidence of any renal element being involved.

The Capillary Wall and Acute Nephritis

I have not yet referred to the importance of the capillary wall in the production of oedema; this omission has been deliberate. It is true that if the capillary wall is damaged the passage of fluid into the tissue spaces must be rendered easier, but this applies to the passage of fluid in both directions. On the other hand, increased permeability of the capillary wall may lead to loss of protein from the blood plasma, and so to a disturbance of the colloid osmotic balance. It is quite probable that in certain states, among which acute nephritis may be included, this factor is of some importance. Acute nephritis is, by its very nature, a disease which does not frequently come under the observation of any clinician, and writers such as Robert Platt have perhaps over-emphasized those examples of the condition in which extreme oedema has rapidly occurred without (so it is asserted) any appreciable diminution in the plasma proteins.

I can only say that, on the one hand, I have often been impressed by the frequency with which acute nephritis occurs without any appreciable appearance of oedema,

and that, on the other, I retain a vivid memory of the only large group of cases of acute nephritis ever seen by me. This latter group occurred during the war. The patients were healthy men in a battalion of infantry to which I acted as medical officer. In the years 1915 and 1916 there were periods when as many as ten men a day

Diagrams to represent the force regulating the passage of fluid between capillaries and tissue spaces. The blood pressure is represented by arrows within the vessel, plasma proteins are represented as minute globules.

had to be sent away from the front line with acute nephritis. The diagnosis was often made by the late Sergeant Needham, who, during our daily round of the trenches, would observe a man to be puffy under the eyes, and would call him down from the fire-step. On returning to the battalion aid post it would be demonstrated not only that the urine contained albumin, but that it was so full of albumin that, after boiling, the test tube could often be reversed without spilling. I have never seen such cases before or since, and they are quoted now to show that there is at any rate one group of cases of acute nephritis in which an immediate and tremendous loss of protein in the urine occurs.

The problem of the relative importance of the capillary wall in the production of oedema remains obscure. It is probable that in certain types of oedema, and particularly in urticaria, it is of great importance, but it is still more probable that in the two great groups of oedema encountered in cardiac failure and in renal disease the part played by the capillary wall is passive and unimportant.

The Importance of Sodium Chloride

The importance of salt in producing water retention in the tissues has been recognized by the medical profession for thirty years. At the beginning of the present century the late Professor F. Widal drew attention to the manner in which oedema can be influenced by the addition or withdrawal of salt from the diet. To this great physician we owe in large part the revival of interest in the chemical aspects of renal disease. It is, however, somewhat unfortunate that the conception of two functionally different types of pathological kidney—the one retaining nitrogenous substances and the other retaining salt and water—should have resulted from the researches of his followers, and become widespread. Not one, but a series of papers would have to be given in order to review all the work that has been done on this subject. Here it can only be said that the theory that nephritis creates a barrier to the passage of salt through the nephrons is no longer tenable.

But it remains true that salt is provocative of oedema through some property of holding water in the tissues. It must be borne in mind that salt possesses this property in cases of cardiac as well as of renal oedema, and it must further be borne in mind that the work of the late L. Blum has demonstrated that it is the sodium and not the chlorine ion which chiefly possesses this property.

Treatment of Oedema

The oedemas of cardiac and of renal origin are of such importance that it is not proposed to deal with the treatment of other types. Apart from cases in which there is local obstruction to a vein by thrombosis, adhesions, or pressure, right-sided heart failure provides the purest example of oedema due to increased pressure at the venous end of the capillaries. The regularity with which the relief of cardiac failure is followed by the disappearance of oedema is in itself very strong indirect evidence in favour of the theoretical considerations which have just been discussed.

Considering, in the first place, oedema of purely cardiac origin, we must recognize that a generalized oedema arising in this manner implies failure of the right side of the heart, and that this may occur with valvular disease, with a myocarditis of infective origin, or as the result of prolonged hypertension. Without discussing these groups individually, it may be said that any factor which diminishes the output of the right heart will necessarily tend to create congestion in the systemic venous circulation, and, conversely, it may be said that any treatment which tends to improve the output of the right ventricle

will tend to lead to an amelioration of such cardiac oedema. For these reasons prolonged rest is essential, and when factors such as auricular fibrillation are present digitalis is usually very valuable. Digitalis, of course, finds its most important indication in conditions of auricular fibrillation with right-sided cardiac failure, and in recent years many of us have found that the drug can most easily and effectively be given in the form of the powdered leaf. The one-grain pills of this preparation retain their potency even when kept for a long time, and make a very convenient medium for administration. When using this preparation one is relieved of anxiety as to the potency, as to the possibility of the drug being destroyed by other substances given with it, and of the danger of faulty measurement. It is usual to give at the outset from 6 to 10 grains to a patient of average size, and to reduce this gradually as the digitalis effect becomes evident.

In all cases of generalized oedema successful treatment demands a careful record of progress from day to day. It is very important to be able to judge at any time whether the oedema is waxing or waning. This can be accomplished either by the accurate weighing of the patient or by an accurate record of the water balance. Patients are often so ill, and good weighing apparatus is so expensive, that the former course is scarcely practicable; but estimation of the water balance is a relatively simple procedure, which should be carried out in all cases, both in private and in hospital. It is only necessary for the nurse or relative in charge of the case to keep an exact record of the amount of fluid taken by the patient, and to measure the volume of urine passed. The patient should be asked to pass urine just before the beginning of each official day—say at 8.30 a.m.—and this should be added to the urine of the previous day. It is well to place every patient on a fixed daily intake of fluid, which must include all fluids with the necessary allowance for the water contained in fruit, ice-cream, etc. A limit of 30 oz. daily can be imposed with no hardship; in severe cases of oedema this may be cut down to 25 oz., or even to 20 oz.; restriction below this point can only be obtained at the cost of considerable discomfort.

The next point of importance in the treatment of most generalized oedemas is that a salt-free diet should be imposed; salt must be forbidden at all meals, and the salt used in cooking must be eliminated. Bread is sometimes a difficulty, because ordinary baker's bread contains appreciable quantities of salt. Salt-free unleavened bread can now be readily obtained from Jewish caterers. The imposition of a salt-free diet implies a regime calling for considerable ingenuity if the diet is not to be unpalatable; the use of lemon juice and of sodium-free salt is a considerable help.

The Mercurial Diuretics

Reverting to the treatment of the oedema of cardiac failure: a salt-free diet having been imposed, the water balance correctly determined, and digitalis therapy pushed to the limits of its utility, it frequently happens that cardiac dropsy persists. A certain degree of improvement has been achieved, but the patient remains partially waterlogged. In such cases the new mercurial diuretics are often of great value. It is no exaggeration to say that these substances represent the greatest advance in the treatment of cardiac failure by drugs since the introduction of digitalis. It has been argued that to remove water from the tissues of a patient does nothing to improve his myocardium; it is very doubtful whether there is even academic justification for such a statement, but even if it were so no patient would hesitate to choose between lying in bed waterlogged with oedema and leading the life of an invalid who is able to get about a little and is free from superfluous water.

It is unnecessary here to enter into the mode of action of these diuretics, beyond saying that there is strong evidence to show that their main action is a direct stimulation of the kidney to secrete more urine, that there is no evidence as to any harmful cardiac effect, and that, in ordinary dosage, the renal effect is not dangerous. There were so many unfavourable reports concerning novasurol that numbers of clinicians were discouraged at the outset, and its use was largely abandoned. Concerning salyrgan experience tells a different tale. There are very few contraindications to its use, and it seems to be extremely safe. Its effect is enhanced when it is given in conjunction with ammonium chloride, 15 grains of which should be prescribed thrice daily for forty-eight hours previous to the injection, by the intravenous or intramuscular route, of 0.5 to 2 c.cm. of salyrgan.

A typical result is shown in the accompanying chart, which was obtained from a patient admitted to the Middlesex Hospital suffering from severe hypertensive cardiac failure with anasarca. Digitalis had been pushed for many weeks in the patient's home, but he remained completely bed-ridden and helpless. On admission he was placed on a salt-free diet, and fluids were restricted to 30 oz. daily. Ammonium chloride was administered, and after three days the first intravenous injection of salyrgan was given, and the chart shows how this and subsequent injections produced responses varying from 50 to 180 oz. of urine. The net result was that within three weeks over 50 pints of superfluous fluid had been removed from this patient, who was able to return home infinitely better than before.

Before leaving the subject of cardiac failure a word must be said concerning a somewhat rare but very important form of oedema—namely, the acute pulmonary oedema encountered in sudden left-sided ventricular failure. In cases of hypertension the hypertrophied heart will not infrequently, after years of favourable effort, suddenly give way. Such sudden cardiac collapse often manifests itself by pure left ventricular failure, a clinical syndrome characterized by attacks of cardiac asthma with paroxysms of dyspnoea often occurring at night, by dilatation of the left ventricle, and by the appearance of moist sounds at the bases of the lungs. In extreme cases there may be copious expectoration of pink, frothy sputum, and dyspnoea is often of extreme violence and terribly alarming to the patient and those around him. The recognition and treatment of such cases is important. Morphine and venesection are the sovereign remedies, the immediate application of which has often saved life in what is one of the most important medical emergencies occurring in general practice. It was recently my experience to see this condition in a patient in whom generalized vascular disease had produced thrombosis of many of the peripheral veins to such an extent that venesection was very difficult.

We were able, however, to open a vein after dissection, and the removal of 15 oz. of blood, together with the administration of morphine 1/4 grain, so revived the patient that he was able next day to describe a previous attack which had occurred during a cruise. On that occasion the ship's doctor had been unable to find the median basilic vein, but had pursued his efforts until he reached the artery. The patient was landed at the nearest port on the following day with a tourniquet round his arm, and made a good recovery, although to this day he is able to puzzle physicians who cannot find his radial pulse.

Renal Oedema

At least two, and probably three, varieties must be included under the heading of renal oedema. First it must be recognized that cases of chronic nephritis associated with high blood pressure often exhibit cardiac failure at the termination, and that this group sometimes

presents great difficulties of exact diagnosis and classification. Cardiac hypertrophy is usually present, but the systolic blood pressure may have fallen sufficiently to confuse matters, although the diastolic pressure is generally maintained at an abnormally high level. There is some albuminuria, but it may be impossible to decide whether this is the result of renal changes, or whether it is merely the slight albuminuria which accompanies the disordered renal circulation of

CHART I.—Effect of salyrgan on urinary output in cardiac failure with oedema. Fluid intake 30 oz. daily; 1 to 2 c.cm. of salyrgan given intravenously on days marked "S"; urinary output in ounces indicated by vertical columns; total diminution in pints of body fluid during treatment indicated by curve.

cardiac failure. It must be noted that actual renal failure tends to diminish rather than to increase oedema, because polyuria is one of the earliest and most striking effects of declining renal function, and will tend to drain off superfluous water from the tissues. In chronic nephritis with high blood pressure oedema is not infrequently of complex origin, being partly cardiac and partly renal.

True renal oedema is seen in the condition sometimes described as "nephrosis," and in those cases of undoubted nephritis characterized by what is sometimes known as "the nephrotic syndrome." In such cases there is long-standing albuminuria of considerable degree, with the result that the plasma proteins are greatly reduced and oedema appears. It would be out of place here to discuss at any length the conception of nephrosis, beyond saying that this envisages a group of patients in whom there is no rise of blood pressure, no change in the retinae, no history of haematuria, no nitrogen retention, no impaired renal function, nor any objective sign of disease of the kidneys beyond albuminuria, that this group exhibits lowering of the protein content of the blood, particularly as regards the albumin fraction, and that this diminution leads many of them to develop oedema. It is believed that these patients live for years, that many of them recover completely, that, if they die, it is usually from pneumococcal peritonitis or from some other generalized infection, and that the kidneys, when examined, show

glomeruli which are practically normal, with convoluted tubules exhibiting degenerative changes.

The original conception of Epstein, that these cases were not of primary renal origin, but represented some disorder of metabolism, has not been confirmed, and although it still remains impossible in many cases to demonstrate a glomerular lesion the general opinion to-day is that the albuminuria in nephrosis must represent an increased permeability, and so an abnormality of the glomeruli. On the other hand, the fundamental conception of Epstein that the oedema of these cases is the direct result of the leakage of albumin from the blood plasma has become more and more firmly established. As regards prognosis the problem remains most difficult; all of us who have had much experience have seen some of these patients, after a long course in which albuminuria and oedema were the sole manifestations, suddenly begin to develop hypertension and proceed to a uraemic termination. We do not know whether the cases were misdiagnosed as nephrosis at the outset and were really extremely subacute cases of glomerular nephritis, or whether, as believed by Volhard and Fahr, it is possible for chronic nephrosis to proceed to a condition in which there is sclerosis of the kidney. In this connexion it is notable that A. M. Fishberg, in his latest work, states that he has never seen an example of nephrotic contracted kidney.

CASE 1.—Male, aged 42. Albuminuria Six Years

	1929	1930	1931	1934
Urea	45	31	38	33
N.P.N.	41	30.6	29	31
Ca	10.0	9.8	8.6	10.9
Cholesterol	167	258	195	205
Alb.	4.4	2.74	2.6	4.1
Glob.	2.1	1.57	2.1	2.1
Fibr.	0.5	0.3	0.2	0.3
Blood pressure	90/135	90/150	108/178	105/150

CASE 2.—Female, aged 38. Oedema for Fifteen Years

	1932	1933	1934
Urea	28	19	33
N.P.N.	25	28	29
Cl	495	625	610
Ca	—	8.9	—
Phos.	—	3.3	3.2
Cholesterol	310	330	375
Alk. res.	59	52	—
Hb	14.9	14.7	17.0
Alb.	1.7	1.8	1.6
Glob.	1.8	1.9	1.9
Fibr.	0.5	0.4	0.6
Blood pressure	85/140	90/140	90/140

Nephrosis

Nephrosis is, in my experience, a rare disease. In collaboration with Professor E. C. Dodds I have been able to publish a description of several cases, together with post-mortem findings described by Professor S. L. Baker. My clinical experience includes two cases which have been under my observation for from three to five years, in one of which albuminuria has now been present for over six years, and in the other for over fifteen. Details of these cases are set out in the accompanying tables, from which it will be seen that there is no nitrogen retention in either

case, and that otherwise their chemistry exhibits the hypercholesterolaemia, the lowered calcium, and the decrease in plasma proteins characteristic of nephrosis. In the more chronic case there has never been any suggestion of hypertension, but in the shorter case the blood pressure figures have during later years been somewhat disquieting. At the same time this patient remains in apparently perfect health; he came to me showing nothing except a profuse albuminuria, which led to a progressive fall in the plasma proteins and ultimately to the appearance of oedema. The institution of a rigid salt-free diet and a cure of dechlorination at Evian cleared up the oedema. He has followed a salt-free diet for three years now, and when seen a few months ago was in excellent health, with only a persistent trace of albumin in the urine, and with plasma proteins which have returned almost to normal.

The other patient has been troubled with chronic oedema, waxing and waning in intensity for fifteen years. Albuminuria is always considerable, and the plasma proteins are continuously very low, the globulin figure being actually in excess of that for albumin. But she is able, by persisting with a salt-free diet, and with the occasional use of diuretics, to keep well enough to lead an ordinary sedentary life. Two years ago the oedema became much more severe in spite of these precautions. The administration of urea failed to relieve it. On my advice her doctor gave her several intravenous injections of salyrgan, with the result that the oedema completely disappeared, and she has remained practically free from it since.

Treatment of Nephrosis and Nephrotic Syndrome

The treatment of renal oedema in cases of nephrosis and of the nephrotic syndrome should aim at the removal of the increased permeability of the glomerular epithelium and replacement of the diminished plasma proteins. Unfortunately, we have no means of achieving either of these ends, although it is interesting to note that Hartmann, Senn, Nelson, and Perley have succeeded in removing the oedema in certain cases of nephrosis by repeated intravenous injections of strong solutions of gum acacia. On the other hand, the diet originally advocated by Epstein, which contains abundant proteins, especially those of vegetable origin, is strongly indicated in these cases, because not only is it necessary to supply sufficient material from which the body may produce new serum-albumin, but the absence of any tendency towards nitrogen retention makes it permissible to supply the blood with sufficient amino-acids to create the full quota of urea to act as a diuretic. A salt-free diet is essential, and the water intake should be limited to a figure compatible with comfort. Mild diuretics are desirable, and among these urea occupies an important place, and may be given either in capsules or dissolved in small quantities of lemonade during periods of increasing oedema. Thyroid extract has often been advocated, but my personal experience in this respect has been discouraging. Salyrgan is certainly of the utmost value whenever it is necessary to reduce oedema of crippling degree. It must never be forgotten that extensive oedema carries with it the constant risk of infection; anyone who has had the experience of seeing a patient suddenly develop pneumococcal peritonitis or a spreading cellulitis will understand the importance of reducing nephrotic oedema whenever it becomes extensive. If this cannot be done with salyrgan or by other medical means it may be necessary to resort to the use of Southey's tubes or to drain the oedema by incision over the malleoli.

Treatment of Acute and Subacute Glomerular Nephritis

Treatment in glomerular nephritis must be very different from that of nephrosis and the nephrotic syndrome. In acute cases the utmost possible degree of glomerular rest

must be sought for. The cause of the oedema is somewhat obscure; not only may it be a combination of increased intracapillary pressure and of lowered colloid osmotic pressure, but such factors as increased permeability of the capillary wall cannot be eliminated. Renal function is usually greatly disturbed, and there is nitrogen retention or great loss of the concentrating power of the kidney. In these cases the water intake must be carefully controlled, and the diet must not only be salt-free, but the treatment must consist of virtual starvation for as long a period as can be maintained without risk to the patient.

CHART II.—Blood analysis to show effect of starvation on blood urea in a case of acute nephritis.

The above diagram illustrates the effect of such treatment on a girl of 19, who was admitted to the Middlesex Hospital last December. On admission there was slight oedema in the form of puffiness below the eyes, and a considerable masked oedema manifested by an increase in weight of nearly a stone. The blood urea was over 200 mg., and the urinary output during the first week was below 10 oz. daily. Living on a water intake not exceeding 20 oz. and food limited to half an apple or some tiny pieces of orange daily, the blood urea was seen to fall rapidly to a very low level, and at the present time the patient appears perfectly normal, except that a trace of albumin is occasionally to be found in the urine.

The treatment of subacute and chronic nephritis with oedema is a matter of great difficulty. If cardiovascular change is minimal the therapeutic indications are closely similar to those in nephrosis; if, on the other hand, haematuria is recurrent and evidence of impairment of renal function marked, treatment must be directed towards these rather than towards the actual oedema. It would be out of place to discuss this further here, beyond emphasizing that oedema becomes a minor manifestation in such serious cases as these.

It cannot be laid down too strongly that, on the one hand, the syndrome to which the term "nephrosis" may properly be given demands treatment with a diet generous in protein, and that substances such as urea and salyrgan are not contraindicated in these circumstances; while, on the other hand, cases of undoubted nephritis with evidence of hypertension and impairment of renal function call for the greatest caution in the choice of the protein ration, require the avoidance of drugs which might stimulate the damaged kidney, and demand treatment calculated to remove infection and promote rest rather than merely to relieve oedema.

Summary

Oedema is a physical sign indicating an excess of fluid in the tissue spaces. Two great factors are chiefly responsible for the occurrence of oedema: (a) changes in the intracapillary blood pressure; and (b) lowering of the colloid osmotic pressure of the plasma proteins.

Increased permeability of the capillary wall is probably important in the production of oedema of the urticarial type; it is of possible importance in cases of acute nephritis. Sodium chloride is not a causal factor in the production of oedema, but is provocative of the condition, in that it tends to hold water in the tissue spaces rather than in the circulation; the sodium and not the chlorine ion is responsible.

As regards treatment, cardiac oedema demands prolonged rest, digitalis therapy in appropriate cases, a salt-free diet, and the employment of mercurial diuretics in resistant cases. In these, as in all cases of oedema, accurate record of the water balance is important. Acute pulmonary oedema tends to occur in cases of left-sided cardiac failure, and is an indication for venesection and the administration of morphine.

Renal oedema includes two and possibly three varieties: (a) the type seen in terminal cases of nephritis with hypertension; (b) the type seen in cases of "nephrosis" and the "nephrotic syndrome"; and (c) the type seen in cases of acute nephritis. The oedema of nephrosis and the nephrotic syndrome is due to loss of protein from the blood plasma, and calls for a diet which is salt-free and relatively rich in protein. Mercurial diuretics are not contraindicated in resistant cases. The oedema of glomerular nephritis requires very cautious treatment. In the acute phase virtual starvation is necessary; in chronic cases careful judgement is required for the accurate regulation of the protein in the diet, and the avoidance of anything that may further damage the kidney.

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The number of suicides in Germany in 1932—numbered 18,934, or 29.2 per 100,000 inhabitants, as compared with 28.8 in 1931, 23.3 in 1913, and 21.2 in 1891, when the German statistics for suicides were first compiled. The number of suicides per 100,000 inhabitants in 1932 was 41.6 for males and 17.4 for females, as compared with 35 for males and 11.7 for females in 1913. The most frequent form of suicide was hanging, which was noted in 42.7 per cent. of the cases. Next, after a long interval, came poisoning by gas (15.9 per cent.), shooting (13.2 per cent.), drowning (11.6 per cent.), other forms of poisoning (7.1 per cent.), and other causes (under 10 per cent.).