# Remarks
ON
# THE CHOICE OF A DIURETIC.

BY

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In the treatment of a case of general oedema, from whatever cause, the question of how to remove the fluid most quickly by the use of remedies which stimulate the urinary secretion is, of course, a matter for immediate consideration. It is not, however, always easy for the medical practitioner to decide as to the exact kind of diuretic which is most likely to answer his purpose. He has a wide field for his choice. Diuretics are many in number, and fall roughly into groups which, although all working to the same end, reach it by very dissimilar means. Each class has its own method of exciting the urinary flow. Consequently, these remedies must not be prescribed thoughtlessly and at random, but must be carefully chosen with due regard to the state of the patient and the cause to which the oedematous swelling is owing.

In his treatment of the case the medical practitioner may proceed in several ways. He may gently stimulate the convoluted tubes of the kidney, and encourage osmosis by increasing the saline constituents of the blood by the use of the acetates, citrates, and tartrates of soda, potash, and ammonia. He may raise the blood pressure and hasten the circulation through the glomeruli of the kidney by the use of drugs which give vigour to the heart muscle and contract the peripheral vessels of the system generally. Or, again, he may employ drugs which have a stimulating effect upon the renal epithelial cells, such as diuretin and citrate of caffeine. Or, lastly, he may use more positive irritants to these cells, in cantharides, resin of copaiba, oil of juniper, etc.

In the dispersion of a general oedematous swelling the first point to consider is the cause of the serous infiltration. We have to decide whether the defective action of the kidneys is due to a temporary failure of function, owing to deficient driving power of the heart, or to organic disease in the kidney itself; for the means to be adopted will depend in a great measure upon which of these conditions it is with which we have to deal.

If we have to do with kidneys whose secreting power is impaired by acute parenchymatous nephritis, our chief anxiety should be to do no harm, for we may gravely increase the mischief by the heedless employment of stimulating diuretics. In such a case it is not only what we should do, but also what we should carefully avoid doing, that ought to exercise our minds. We must not fret a damaged organ in an attempt to stimulate secretion by the use of irritating remedies, which are bound to fail; nor should we try to flush the kidneys by large quantities of fluid which, as they are not able to excrete it, can only add to the transudation into the tissues.

Digitalis is justly regarded, when given with judgement, as a safe and efficient promoter of diuresis; but it is not to be depended upon under all circumstances. If the drug is to answer our expectations and do good service, the kidneys must be capable of responding to stimulation, however hampered they may be for the time. The remedy acts by causing contraction of the peripheral blood vessels—those of the kidney excepted—and increasing the force of the cardiac systole. It therefore raises the blood pressure generally, and forces more blood through the kidneys. But in renal disease the blood pressure is often raised already, and to raise it still further is to force upon diseased organs, which are already greatly overtasked, an amount of additional work which in their crippled state they cannot perform. Other drugs which belong to this group and have a similar action are strophanthus, convallaria, strychnine, and squill.

Caffeine, again, and diuretin have an action directly upon the secreting cells of the tubules and indirectly upon the renal vessels, which they are able in some measure to dilate; but to stimulate the epithelial secreting structure of the kidney in a case of acute renal dropsy when the cells are more or less seriously diseased is a course from which we have no reason to expect any satisfactory result. For the time, at any rate, the cells are unable to respond even to the ordinary call of every day. They cannot, therefore, answer to the spur; and the use of these remedies is calculated in such a case to lessen secretion instead of to augment it, and is almost certain to be followed by harm rather than good to the sufferer.

It is otherwise with the saline diuretics—the citrates, acetates and tartrates of soda, potash, and ammonia. These remedies increase the osmotic pressure of the blood and draw water from the tissues into the blood stream. They do not, therefore, irritate the kidneys, and may be used without fear even when the organs are acutely inflamed. It is important that when taken they should be well diluted, for their action upon the kidneys is thus rendered more certain; and it is useful to combine them with spirits of nitrous ether, which, on account of the nitrite of ethyl it contains, is a useful agent in causing dilatation of the afferent vessels of the kidney.

In cases, then, of renal dropsy, if the illness be acute, the saline diuretics are the only remedies of the kind which can be given without risk of further injury to the affected organs. That they may act with success it is of the highest importance to make sure that there is no obstruction to the portal circulation through the liver. A preliminary dose of blue pill followed by a liberal saline aperient is always advisable; and if during the course of the treatment the action of the remedies is found to be getting uncertain or ineffectual, especially if the arteria tension be high, a repetition of the dose will prove to be of service. In all cases a careful watch should be kept upon the work of the bowels, and their action should be encouraged by sufficient doses of a watery aperient every day or every other day, such as the compound jalap powder. To be effectual this powder must be ordered in adequate dose, and its action can be rendered more energetic by the addition of a grain or two of jalapine. In the treatment of adults elaterium is a useful remedy, but in early life its action is uncertain, and the jalap powder is to be preferred in the case of a child.

In considering the action of remedies which have direct influence in stimulating the renal secreting structures, we cannot leave out of account certain subsidiary measures which act indirectly by lightening the labours of the kidney, and make the action of diuretics more certain and easy. For instance, by promoting the activity of the skin, we relieve the overburdened kidneys of a part of their work. Little but water, however, is removed by the action of sudorifics, for of the nitrogenous refuse, which it is a prime duty of the kidney to discharge by means of the secreting epithelial cells, a very inconsiderable quantity can escape from the body by way of the skin. Still, removal of excessive fluid from the tissues is alone a source of great relief, and in the case of acute and subacute nephritis the persevering use of hot air baths is attended in most cases with the very best results. In place of the hot air bath we may use the blanket bath, in which the patient is wrapped in a sheet wrung out of tepid water and swathed in many blankets. This bath should be used continuously for several hours, and may be repeated every day. The remedial action of pilocarpine I have not found very satisfactory. A dose of gr. $\frac{1}{6}$ to $\frac{1}{3}$, given hypodermically, although no doubt a powerful diaphoretic, sometimes causes troublesome vomiting, and in most cases sets up excessive salivation, which is a source of great annoyance to the patient.

Another way of relieving the overburdened kidneys consists in a sparing use of the protein element in the food, for moderation in this respect will reduce the amount of nitrogenous waste which the crippled organs have to discharge. We do not by this means materially lessen the excretion of albumen, but we very decidedly lighten the work of the epithelial cells. The same precaution need not be taken with regard to albumen. The old notion that excess of albumen in the food increased the albuminuria has been shown to be incorrect. Many observers have proved by experiment that there is no correspondence between the quantity of albumen excreted by the kidneys and the amount of albumen contained in the food; indeed, it is incorrect to suppose that the degree of albuminuria can be taken as a trustworthy guide

to the excreting capacity of the kidney. In all acute cases, then, meat and meat extracts—articles in which the proportion of protein is high—should be avoided; instead, a diet should be ordered which consists mainly of milk, eggs (lightly cooked), farinaceous matters, and bread. Fat, in the shape of cream and fresh butter, may be allowed, but table salt is to be forbidden, for, unlike the citrates and acetates of the alkalis, this salt has no diuretic action, and is not easily eliminated by the kidneys. On this account bacon fat is not a desirable addition to the dietary, although the fat alone, without the added sodium chloride, would be unobjectionable. In the food generally as little salt as possible should be allowed, and it is advisable to have the bread used by the patient made for him without this ingredient.

It is a common practice in cases of acute renal dropsy to enforce an exclusive milk diet. This is advocated on the ground that the excess of fluid flushes the kidneys, and that the nutriment conveyed, being poor in protein, is sufficiently sustaining to the system without making too exacting demands upon the kidney cells. But it is useless to attempt to flush kidneys when, as in acute nephritis, they are already overburdened and cannot respond. Moreover, for a diet to be satisfactory in this, or indeed in any other, disease it must be readily digestible, and not prone to undergo unhealthy changes in the bowels. In neither of these respects does milk answer to our requirements. A comparatively small part of the curd can be digested, however carefully it may be manipulated so as to fit it to the powers of the weakened organs; for the more or less solid mass formed by the casein when coagulated in the stomach must offer a stubborn resistance to the action of the gastric juice and other agents of digestion. At the same time the undigested residue is very liable to undergo putrefactive changes in certain disordered conditions of the bowels. Moreover, the sameness of such a diet is a serious obstacle to its ready digestion. The stomach is as quick as the palate to resent this monotony, and the disgust excited by a repetition of the same food, meal after meal, is often sufficient to bring about its immediate rejection, or, if it be retained, to render its value in nutrition comparatively small. The incentive to healthy digestion is appetite; food taken unwillingly is rarely digested with ease. In almost all cases where the diet is confined entirely, or almost entirely, to milk, the large masses of curd which are discharged by the action of an aperient are a sufficient proof that comparatively little real nourishment has been derived by the patient from his food. It is, perhaps, no misfortune that this should be so, for if a patient who is condemned to such a diet were able to digest the enormous quantities of milk forced upon him by an energetic nurse, his assimilative powers would almost certainly fail him. His blood would be full of digested material which his tissues were not capable of taking up, and the extra work thus thrown upon the liver and other excretory organs, in their efforts to rid the system of all this unacceptable nutriment, would be likely to exert anything but a favourable influence upon the course of the illness. The beneficial results which sometimes seem to ensue from an exclusive milk diet are not improbably dependent upon moderation in the quantity prescribed, a liking by the patient himself for this form of nourishment, and the greatly reduced intake by this means of common salt, for milk contains no more than a grain and a half of sodium chloride to the ounce.

When the acuteness of the attack subsides and the complaint begins to settle down into a chronic course, we may venture discreetly to widen our choice of remedies and bring into use some of the special drugs which act directly upon the secretory apparatus. Of these the remedies which increase blood pressure and hasten the circulation through the kidneys are of more service at this stage than drugs which stimulate the secretory cells of the tubules. Therefore, if blood pressure be not unduly high, digitalis is to be preferred to diuretin and caffeine. The dose of digitalis should be small at first, and I greatly prefer the freshly-made infusion to the tincture. As a beginning, twenty drops of the infusion may be combined with thirty drops of spirits of nitre, and given in combination with the saline diuretic every three hours (in the case of an adult). If this agree well and be found to increase the secretion of urine, we may venture upon greater liberality in our dosage. This treatment is useful at all ages. Children bear digitalis well; but care must be taken that in early life the dose is not pushed to an immoderate degree. Twenty drops to half a drachm of the infusion, repeated every four hours, will usually be found to produce all the good effects which we look for in the drug. It is important, too, not to give the remedy too long at a time without a break. Digitalis is a cumulative drug, the action of which persists for some time after its administration has ceased. If continued too long without a pause, even a moderate dose may begin to produce signs of depression, shown by pallor, coldness of the extremities, and a feeling of faintness. If vomiting occur, it is a symptom which should always attract attention, and in a child, especially, is a reason for an immediate change in the treatment. In giving the remedy it is well to stop the medicine every few days for forty-eight hours or so. This plan anticipates the cumulative effect and causes no loss of time, for the action of the drug persists sufficiently in the intervals. Other diuretics may also be used which have a direct influence in contracting the efferent vessels of the kidney, such as squill and infusion of broom-tops; for it is a matter of common experience that the diuretics, like aperients, produce better results when used in combination than when given alone.

Our next step, as improvement advances, is cautiously to make use of remedies which have a stimulating effect upon the kidney cells, such as caffeine, diuretin,* spirits of juniper, and tincture of cantharides. It must be remembered, however, that this class of drug is only diuretic when given in moderate dose, for in large quantity it is apt to overstimulate the secreting structure and lessen the flow of urine, or even arrest it. It is best to begin with small doses, such as caffeine gr. ¼–j, according to age, diuretin gr. iij–vj, and spirits of juniper ♏ v–xv. Later the doses, if necessary, may be increased. Very many combinations of these remedies may be devised for the treatment of renal dropsy after the acute stage has passed off. All these should include a saline diuretic to increase osmosis, a mild stimulant to the renal cells, such as spirits of juniper, diuretin, or caffeine, and a member of the digitalis group, such as digitalis itself, strophanthus, squill, or the infusion of broom-tops—all drugs which quicken the flow of blood through the kidneys. It is well also, if chemical compatibility will allow of it, to include a proportion of spirits of nitre in the prescription in order to promote dilatation of the renal vessels. Combinations of this kind are found in the pharmacopoeias of every hospital. There may be differences in the choice of the several constituents, but the principle of combining variously acting diuretics is common to all. In the use of these remedies we must never forget that drugs which stimulate the renal cells—caffeine, diuretin, cantharides, and the essential oils, such as juniper and copaiba (resin)—can only be prescribed in dropsy from kidney disease with a good deal of caution. Even when the mischief is chronic the rule still applies. The use of these agents must always be tentative and sparing, and they must be regarded as of secondary importance, serving only as helps in the treatment to reinforce the action of such remedies as cause dilatation of renal vessels, and give an impulse to the general circulation.

At a later stage, if, as often happens, anaemia is a prominent symptom, iron is found to be of service. The perchloride and acetate are two salts which have a definite diuretic action, but it is well to use them at first in small doses. It may be noted that iron gives a black colour to a mixture containing digitalis. This may be corrected by the addition to each dose of a few drops of dilute phosphoric acid. If the perchloride be used, a combination of the three elements (the iron, the digitalis, and the phosphoric acid) forms a perfectly clear, amber-coloured solution; but if the acetate of iron be used instead of the perchloride, although the black colouring is removed, the iron is thrown down in the form of the insoluble phosphate of iron. If, then, the acetate be preferred, it is better to omit the digitalis from the prescription and combine the salt with the acetate of ammonia, giving 10 or 15 drops of liq. ferri acetatis with a drachm of liq. ammoniae acetatis to the dose. Should any sign of heart weakness be noticed,

* The action of diuretin upon the renal secreting cells has been disputed by some observers, who attribute its undoubted diuretic influence to its power of causing dilatation of the renal vessels. It is said also to promote the elimination through the kidneys of common salt.

a useful addition to this formula is liq.strychninae in doses of 1 to 5 minims according to the age. Whatever preparation of iron be used, it should be freely diluted and taken directly after food. It acts most efficiently if an aërated water be used to dilute the mixture. It will be found convenient to make up the dose with plain water to one teaspoonful, and order this quantity to be taken in a wineglassful of soda water or other simple gaseous fluid three times a day.

As the oedema subsides greater liberality may be allowed in the choice of foods, and chicken, white fish, and a little mutton—especially boiled mutton—can be taken with advantage.

When the general oedema is due to cardiac insufficiency, the kidneys being organically sound, we have greater freedom in our choice of remedies. The oedema is the consequence of temporary functional disability of the kidneys, for the circulation through them is for the time seriously obstructed owing to the turgid state of the whole venous system, and perhaps also to direct pressure upon the kidney itself by accumulated fluid in the peritoneal cavity. To effect the removal of this fluid it is necessary not only to stimulate the activity of the kidneys, but also to lighten the congestion and improve the general circulation by every means in our power. We must insist upon absolute rest to the body in order that the heart's action may not be hurried. We must be careful to regulate the diet so that the digestive powers, enfeebled as they are for the time, may not be overtaxed. The question of feeding is one which is too often left to the nurse in charge, to give food or withhold it at her discretion; but it is really one which requires, and should never fail to receive, the earnest attention of the medical attendant, for it is of urgent importance not to err on the side of excess. It is always advisable to order four small meals rather than three larger ones in the day. These may include mutton or chicken, fish, egg, and toast, or bread-and-butter. We should carefully regulate the quantity of fluid to be taken, especially of milk, and positively forbid starches cooked with milk, jams, and all the acid fruits, cooked or raw; for the fermentation of such foods in the alimentary canal only adds to the discomfort of the patient by filling his body with wind. We next proceed to act freely upon the bowels with aperients which encourage secretion into the intestine. By this means we draw water away from the tissues, and also relieve the pressure upon the kidney.

In our choice of a diuretic in a case of cardiac dropsy we must bear in mind that the cause of the oedema lies primarily in the chest, and not in the abdomen. and that remedies which act only upon the kidney are of little or no value unless combined with others which strengthen the action of the heart. We must remember, too, that when blood pressure is low drugs which tend to lower arterial tension still further are not only useless, but become an actual source of danger. We turn, then, to the list of cardiac tonics—of remedies which increase the vigour of the heart's movements, and moderate undue rapidity of action. Under their influence the heart contracts with greater energy; the diastolic pause is lengthened so as to allow of more complete unloading of the large venous trunks, and more blood is forced through the kidneys. Digitalis, strophanthus, convallaria, squill, and some other drugs act in this way, but digitalis, as a rule, is the most highly prized. In two or three days after beginning its use the blood pressure rises, the pulse becomes fuller and more regular, and there is copious diuresis. This improvement is especially noticeable in cases where there is dilatation of the left side of the heart with mitral insufficiency, a feeble irregular pulse, and, as a consequence of low arterial pressure, a scanty secretion of urine. Unless mitral regurgitation be present the influence of the remedy in promoting an increased flow of urine is but small; and if the heart is already acting strongly and the pulse is full, regular, and equal, without signs of mitral leakage, digitalis is not required, and if given may probably prove hurtful. Under such conditions the urinary secretion is normally free; and as a rule we may take the amount of urine passed as a fair guide to the probable usefulness of the remedy. Therefore, if secretion be already of normal amount, and the pulse be regular and full, digitalis should not be included in the prescription Instead we should give diuretin combined with an infusion of broom-tops. It may be remarked that a feeble irregular pulse is not in itself a sufficient sign that digitalis is required. The effect of the drug, if given too continuously or in too large a dose, is to make the pulse very rapid and very weak, and to lessen the renal secretion. In all cases, therefore, where these symptoms are observed it is well to inquire as to what treatment, if any, has been adopted before we venture upon the use of this remedy. It may well be that digitalis has already been given in excess and ought at once to be replaced by strychnine and stimulants. So, also, if there be great dilatation of the *right* side of the heart with tricuspid regurgitation, digitalis should be given with caution, for by heightening the vigour of contraction of the right ventricle we run the risk of increasing dangerously the leakage backwards into the overcharged systemic veins. Again, in cases of early aortic regurgitation digitalis is a dangerous drug to employ, but at a later stage when mitral incompetence has become established its use is followed by very satisfactory results. There is one other point which may be noted: digitalis acts not only upon the heart but also upon the coats of the peripheral vessels of the general system causing them to contract. They therefore offer increased resistance to the driving force of the heart. If the heart be gravely degenerated, as in the fatty heart which is common in elderly persons, or in the acute degeneration of the heart which is often seen in cases of chronic heart disease at all ages, this resistance may be so great that the cardiac contractions are unequal to the effort of driving the blood through the narrowed peripheral vessels, and the heart stops beating. A sudden cardiac failure from this cause, then, may be directly promoted by the very means which we adopt in the hope of preventing it.

If we desire to obtain the tonic influence of digitalis upon the heart walls without causing a corresponding contraction of the peripheral vessels, we can neutralize its effect upon the latter by combining each dose of the remedy with a proportion (20, 30, or more drops) of the spirits of nitrous ether, which has the property of causing dilatation of the small vessels both of the kidney and the general system. Or we may make use of another cardiac tonic—the tincture of strophanthus. This drug, although it acts upon the heart like digitalis, has much less power of causing contraction of the peripheral vessels.

Although as a cardiac tonic digitalis is the remedy we value most, its efficacy as a diuretic may be further enhanced by giving it in combination with other drugs which promote diuresis by different means. A conjunction with drugs which have a special action upon the renal epithelial cells is usually attended with the best results, for in cardiac dropsy the cells are healthy, and capable, therefore, of responding to stimulation. The citrate of caffeine is perhaps the most useful of these drugs in ordinary cases. This remedy, like digitalis itself, has the power of compensating for valvular insufficiency and improving the rhythm of the heart, and it has also its own special endowment of stimulating the kidney cells of the tubules. The combination is further strengthened by the addition of sweet spirits of nitre, as dilator of the afferent vessels of the kidney, in doses of 30 to 60 drops. In giving this combination it is best to prescribe the digitalis alone or in conjunction with the nitrous ether for two or three days before adding the caffeine. as digitalis requires to be taken several days before its effects become noticeable. The dose of caffeine should be moderate (grains ij to iij two or three times a day), as stimulation of the epithelial cells of the kidney should always be looked upon as a temporary measure which is not to be abused, and may do harm if carried to excess.

The infusion of broom-tops is another safe remedy which may be usefully combined with digitalis. It contains sparteine, an alkaloid which has an action upon the heart similar to that of caffeine, and also contracts the efferent vessels of the kidneys. An ounce of the infusion given in conjunction with a drachm of infusion of digitalis, 30 to 60 drops of spirits of nitrous ether and 60 to 90 drops of the acetate of ammonia solution, is a diuretic of great value both in cardiac dropsy and in that which results from renal disease after the acute stage is at an end. Nitrous ether is one of our most valuable diuretics and can be included in most combinations; but it is incompatible with diuretin and the salicylates, and also with antipyrin and any drug containing tannin. Its good effects

are perhaps most noticeable when given in combination with acetate of potash, digitalis, and squill. Diuretin, again, is a remedy which we could ill spare. It is most useful in cases where digitalis has failed to bring relief or could not be taken without unpleasant effects. The drug has little or no action upon the cardiac muscle and appears to exert its influence as a diuretic quite apart from any increase of the blood pressure. It may therefore be given without misgivings when blood pressure is high and when, as a consequence, digitalis and other cardiac tonics are not desirable remedies. Diuretin has been found of especial value in cases of acute cardiac dropsy where the symptoms appear very suddenly. It may be usefully combined with infusion of broom-tops and small doses of tincture of strophanthus.

Some cases of cardiac dropsy resist treatment with extreme obstinacy. Although the diet may be arranged carefully both as to quantity and quality and the bowels kept regular and free, the patient seems to be unable to respond satisfactorily to any treatment, and meets every fresh combination of diuretic remedies with the same disappointing insensibility. When progress seems thus at a standstill, there are two drugs, either of which will often bring about a welcome change in the situation. One of these is tincture of cantharides. I look upon this remedy as one of our most useful means of promoting diuresis in cardiac dropsy. Its action is upon the secreting cells of the tubules, and the effects manifest themselves very quickly. I have often seen a formidable quantity of fluid disappear in the course of a few days under the influence of this remedy, although all previous treatment had failed to make any impression upon the complaint. The dose may be 2 or 3 to 10 minims, according to the age, given several times a day. The tincture can be used in combination with any other remedy, and may be usefully added to a mixture containing caffeine, tincture of strophanthus, and spirits of nitre.

The other remedy which in obstinate cases can often be given with conspicuous success is mercury. Either calomel or blue pill may be employed, but I prefer the latter. This remedy is well known as a useful addition to digitalis and squill when these drugs are prescribed for their diuretic action, but it is when given alone that the effects of blue pill are most strikingly manifested. The cases which are best fitted for this treatment must be chosen with care. The drug seems to have an action complementary to that of digitalis, and to prove most efficient in cases where the latter has failed to increase materially the urinary secretion. It may therefore be regarded as belonging to the same group as diuretin and caffeine. Mercury is to be avoided if renal disease be present, and when given should not be pressed if diuresis do not result in the course of three or at the most four days, for it is in such cases that the system may possibly be unfavourably affected by the treatment. I have given blue pill in doses of 3 grains three times a day in many cases, both to young people of 10 or 12 years of age and also to the adult, and have found it to be very well borne and produce free secretion; but when diuresis has been fully established I have made it a rule to discontinue the mercury and replace it with a mixture of caffeine and spirits of nitre with infusion of broom-tops. If the mercurial be continued too long we run the risk of setting up stomatitis; and in any case it is wise while the remedy is being taken to wash out the mouth several times a day with a suitable antiseptic solution. The drug is supposed to act by increasing the formation of urea, which is well known to have a powerful diuretic action, or possibly it may directly stimulate the renal cells. The mercurial treatment should be reserved for cases which have proved obdurate to other methods, and it is fortunately in just such patients that the most successful results have been observed.



THE International Exposition of Food, Brewing, Wines, Liqueurs, and the Industries relating thereto, with a section of medico-pharmaceutical hygiene, is to be held at Antwerp this year. The exposition will be open from September to November. It is under the patronage of Her Royal Highness the Countess of Flanders.

# ON SOME POINTS CONNECTED WITH THE SERUM TREATMENT OF DIPHTHERIA.*

BY

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THE serum treatment of diphtheria has now been in the hands of the profession for so long a period—namely, upwards of sixteen years—that it may possibly be a matter of surprise to some that it should be chosen as the subject for discussion now. I understand, however, that there are special reasons for this choice. Hitherto, in London at any rate, the serum treatment of diphtheria amongst the poor has been almost entirely confined to hospital practice. Partly because the medical practitioner knows that if he notifies a poor person to be suffering from diphtheria, the patient will speedily be removed to hospital, there to receive appropriate treatment, and partly because, even if he wishes to make use of serum before the removal of the patient, he is deterred by the expense of the remedy, it is rarely that a patient is treated with antitoxin before he is removed to hospital. There is no doubt that any considerable delay in the employment of antitoxin in the treatment of diphtheria is highly detrimental to the interests of the patient. In order, therefore, that the poor patient may be subjected to the most efficacious treatment at the earliest possible moment, even before removal to hospital, the Local Government Board on August 15th last issued an Order sanctioning the provision by the councils of the metropolitan boroughs of a temporary supply of diphtheria antitoxin. I understand that the City of Westminster is proposing to avail itself of this Order and to supply medical men residing in that city with antitoxin for use in suitable cases. This action of the public health authority may result in forcing the serum treatment of diphtheria upon the notice of some who have not up to the present been practically concerned with it. In complying with the request of the Executive Committee of your Division to read this paper I take the opportunity of bringing forward certain points connected with the antitoxin treatment which do not appear to be generally known.

I wish, in the first place, to make it quite clear that I am myself most firmly convinced of the value of antitoxin in the treatment of diphtheria. I have had an extensive experience of the disease reaching back to eight years before the discovery of the serum method, and I regard the antitoxic serum as a specific. But at the same time I am of opinion that there are certain limits to its use, and what they are I shall presently indicate. Another point I am also quite decided upon, and that is the importance of early treatment. As I am so certain upon these two points it may be said to me that the only limit to the use of antitoxin is the limit of dosage—that if a person is suffering from diphtheria, or is suspected to be suffering from diphtheria, he should have antitoxin. That is a view I myself held some years ago, but a more extensive experience has led me to modify it. I think that the most convenient course I can take in this paper is, first, to give the reasons for the modification which I have deemed it desirable to make in my opinion and therefore in my practice, and, secondly, to point out in what these modifications of practice consist.

### *Serum Sickness.*

Immediately after the introduction of the serum treatment of diphtheria in 1894 it was observed that in a certain number of the patients treated symptoms appeared of such a nature as very rarely indeed occurred in diphtheria cases not treated with serum. It soon became clear that these symptoms were due to the serum. As serum treatment was extended to other diseases—such as tetanus, streptococcal infection, and enteric fever—it was found that the symptoms alluded to were not due to the antitoxic or antimicrobic principle in the serum, but to the serum itself. Serum from a horse which had not been immunized against any disease was found to produce these

* A paper read before the Westminster Division of the Metropolitan Counties Branch of the British Medical Association.