Original Articles.

MEDICAL TREATMENT IN DIPHTHERIA.¹

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In a brief consideration of the medical treatment in diphtheria, which I have attempted at the request of your President, by way of introducing a general discussion on that subject, I will ask your attention to the more serious questions relating to that disease as they have presented themselves clinically in an experience of twenty years, during the latter part of which period my colleagues and myself at the Boston City Hospital have had under our charge annually a very large number of cases, many of them of the worst description.

While the recently proclaimed success of the treatment of diphtheria by the antitoxin may almost render it superfluous further to discuss the plodding methods by which we have so long struggled with this disease, still it may not be unprofitable to defer an opinion as to the rôle in therapeutics which this great discovery is destined to play, and by a study of past results to form an estimate of the many dangers which this new agent will be expected to overcome.

From 1880 to 1889, 1,300 cases of diphtheria entered the hospital; and in more recent years the admissions have been 300 or 400 annually. About one-third have required tracheotomy or intubation, and the great mortality in cases of respiratory obstruction is practically uninfluenced by any medical treatment hitherto at our command. Exclusive of those cases which have needed surgical interference, the death-rate in those requiring medical treatment alone has been 25 per cent.; nearly double that rate, however, for the whole series.

Without entering into the details which explain the terrible fatality of diphtheria in all communities where it is endemic, as during the last fifty years it has become in most of the large cities of Northern Europe and America, it may be said in brief that the disease often makes fatal headway before its character is recognized; and that the absence of coöperation on the part of most of the subjects, owing to their tender years, throws special difficulties in the way of successful treatment by the measures heretofore adopted. The simple injection of a fluid will, of course, entirely do away with this latter difficulty.

Passing by the milder forms of tonsillar diphtheria, which get well under almost any treatment, in the severer types, with extensive faucial, nasal or tracheal exudate and glandular swellings, there is a threefold danger to life, namely, through septic exhaustion, tracheal obstruction, and the various complications and sequels, of which the most serious are broncho-pneumonia, acute nephritis and toxic paralysis. Dysphagia may, from the outset, cause grave difficulty in nutrition.

What then are our means of contending with or averting these conditions? Can we prevent septic absorption or overcome profound sepsis after it has developed? Can we stop the extension of membrane to the larynx, trachea or bronchi? Can we ward off pneumonia, acute nephritis or paralysis? Or can we cure these complications when they arise?

The answer to most of these questions must, in the light of past experience, be negative; and so it will be

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in the future with regard to many cases coming late to treatment. With a disease sometimes so treacherous and virulent, and at others so mild as to escape notice, it is useless to dogmatize about this or that special therapeutic measure which may, from time to time in a limited number of cases, be attended by favorable results above the average.

Until the present year those physicians whose experience and observation have been the most extensive were unable to claim any great degree of success in contending with the worst types of diphtheria. In spite of the most assiduous efforts, its ravages have remained practically unchecked. Many bad cases, and some which appear almost hopeless, respond to the general and special measures which are adopted, but we have had no confidence in such a successful result.

The indications for treatment are clear, and point to such measures as will save and maintain the strength of the patient, with the discriminating use of those local applications which tend to check or neutralize toxic absorption and to prevent invasion of the respiratory tract.

In the maintenance of the strength which so rapidly fails in this disease, not only is the ingestion of a sufficient quantity of easily digested food essential, in a shape which can be best swallowed, but the wasting of the vital forces by too much painful and exhausting treatment must be avoided. Vierordt in his "Medical Diagnosis" says, "In diphtheria immediate death may follow an effort to examine the throat."

Tincture of the chloride of iron, oxygen and alcohol, in large doses, have met with professional approval to correct toxemia and to sustain the flagging heart. They are doubtless serviceable in many cases *not* of the most septic type, but in the latter, absolutely ineffectual. The same is true of strychnia, strophanthus and digitalis. Internal antiseptic drugs have not proved beneficial.

Early difficulty in swallowing may be the result of simple pain or of paralysis. Regurgitation through the nose attends the latter condition, and may occur in the first week. Care must then be exercised in the administration of food and medicines, both on account of the distress which the patient experiences in his efforts at deglutition, and the danger of strangling, or of broncho-pneumonia from the entrance of food into the air-passages, the so-called deglutition-pneumonia. Choking may be fatal as in the following instance reported to the Clinical Society of London by Dr. White last February: A patient with diphtheritic paralysis, while drinking a cup of tea, was seized with cough, spasm and dyspnea. He died, and at the autopsy an ounce and a half of tea was found in the bronchial tubes. There was no other cause for the sudden death.

Nutritive enemata may partially obviate this difficulty in the adult, but they are seldom well retained by young children. Systematic feeding by a soft catheter passed through the nostril into the gullet sometimes saves life. I have seen recovery in the case of a child with complete faucial paralysis who for four weeks could be fed in no other way. Dr. W. A. Morrison, at the Suffolk District Society last year, related several cases successfully treated in this manner.

LOCAL TREATMENT.

In the use of topical sprays or lotions, it must be asked, Have we any agent on which we can depend to arrest the disease or to prevent the extension of mem-

brane to dangerous localities? It is not improbable that success would oftener attend our efforts in this direction if cases were seen at an earlier stage, but in those which have already become malignant, in which the membrane spreads with great rapidity, nothing at our command has thus far been able to avert septicæmia or croup with any degree of certainty whatever.

In the use of local remedies there is great room for choice and for individual judgment as to the mode and frequency of their application. Their effect upon the patient must be carefully observed, the amount of pain which they cause and the degree of fatigue which follows. Great exhaustion not uncommonly ensues in patients whose hearts are already weakened, therefore it is evident that in such cases, especially with young and frightened children, it is best to make the intervals less frequent and to use the milder and less painful cleansing agents. Physicians have recommended an almost constant spraying and swabbing of the nose and fauces, every half-hour, day and night. Such zealous measures, except for very brief periods, exhaust the child and wear out the nurses. Force is objectionable, but its judicious use may be necessary in young subjects. In patients with pallid countenance and feeble pulse, no treatment which obliges them to sit up is permissible. Irrigation with the douche bag can be resorted to in the recumbent position. Sleep, fresh air and an abundance of drinking-water are of the first importance. Plain or medicated steam, so often used for impending croup, is of doubtful benefit and the heat is uncomfortable.

Of the many detergent and antiseptic remedies for cleansing and sterilizing the nose and fauces, I will mention but few, as, one after another, the more powerful and painful agents have been generally abandoned as useless or harmful. Mild carbolized sprays, such as Dobell's, lime-water, warm alkaline solutions, chlorine-water, and peroxide of hydrogen, may be used, the latter in a ten- or fifteen-volume solution, or stronger, once or twice daily for a few days for the removal of membrane. It has a perceptible effect upon the exudate, but is sometimes painful, and I think its prolonged use is more irritating than the other substances mentioned. Its germicidal effect must be considered, and in this respect I have also thought swabbing twice a day with corrosive sublimate, 1 to 5,000 or 10,000, valuable. Mercurial poisoning may occur. This is an objection to the free use of corrosive sublimate inhalations from the steam atomizer. A saturated solution of boracic acid is often used. Cocaine mitigates the pain of local applications.

With these measures we see many bad throats, and a few of the worst clear up and recover, even after a moderate degree of sepsis has developed, and most certainly the employment of active antiseptic measures in a prudent manner, is and always will be a requisite in the management of the throat affection in diphtheria, not only with reference to the Klebs-Löffler bacillus, but also to the streptococci and staphylococci which add so much to the danger. But they do not reach far enough.

The disinfection of the nose is most difficult, both on account of pain, when forcible spraying is resorted to in the swollen and almost impervious condition of the nostrils, and from the inflammation of the frontal sinuses and middle ear caused by too zealous attempts to cleanse the nasal passages by the douche or atomizer. Therefore, I have formed the opinion that, in young

children especially, the blandest fluids, at a warm temperature, by the force of their own gravity only, should be used in the nose. Adults may use the warm saline douche, or a very weak solution of peroxide of hydrogen, cautiously.

Again, we may see the throat clear up satisfactorily and the glands subside while the disease is making insidious progress in the windpipe and bronchi. Then the expulsion of a "tree" of ramifying membrane sometimes gives warning of the end, for in such extensive involvement of the bronchial tubes recovery is a rare event.

Broncho-pneumonia and nephritis we cannot prevent, and they occur in a large proportion of cases. The nephritis, being of an acute infectious type, tends to recovery in those cases which survive the general malady, but convalescence is often slow and albuminuria may persist for many months. There is danger of exacerbations from errors of diet, fatigue, or undue exposure.

In a few septic cases there is an uncontrollable hemorrhagic oozing from the mucous membrane of the mouth, nose or pharynx, and rarely petechiæ occur. I have never seen one of these cases recover.

Special difficulties sometimes arise in the management of diphtheritic paralyses. I have already alluded to the early deglutition symptoms which may complicate bad cases, and in the same way there may be, in the first week, dangerous impairment of the cardiac function, probably pneumogastric in origin, since frequent vomiting is an attendant symptom. No doubt, too, the heart is the seat of septic invasion, which causes degeneration of the myocardium, in most cases of diphtheria. In a series of several hundred cases, a German writer (Hoppe-Seyler) found cardiac symptoms in one-half, and manifest fatty changes at most of the autopsies.

The effect of the diphtheritic toxines, however, in causing paralyses, is not usually a sudden one, but gradual and cumulative, after the active manifestations of the disease have ceased. Different sets of muscles may be invaded in turn according to no apparent rule. It is then that the persistence of a rapid, feeble pulse and a pallid face, excite apprehension of heart failure, and indicate the necessity of absolute repose and the utmost care to avert a fatal issue. A galloping rhythm, from asynchronous contraction of the ventricles, sometimes gives warning before the heart's action becomes rapid. Recovery is slow and there is often continued precordial pain and oppression. Such patients should be watched until the knee-jerk returns. I have recently observed a case for several weeks in which the muscles of the throat, legs, arms and eyes were involved, as well as the heart and respiration. It has not seemed to me that the usual cardiac tonics, such as digitalis and strophanthus, or even strychnia, are of much avail in this state. Alcoholic stimulants by the mouth, rectum, or subcutaneously have been of service in some cases of repeated collapse due to this condition, and the electric battery may be tried. Free elimination of the toxines, however, through the skin, bowels and kidneys, is quite as important as urging the heart and nervous centres to increased action.

In a former paper (1893) relating to the advantages to be derived from the opening of the New Hospital for Contagious Diseases, I ventured to say that it was not too much to expect that improved methods, especi-

ally as applied to the early stage of diphtheria, would result in a greater proportion of recoveries. We were not then aware of the extent of the antitoxin experiments which were going on in France and in Germany. In spite of the skepticism engendered by previous sero-therapeutic failures, and the commercial competition which the new remedy has excited, the evidence presented by Roux, Behring and others is so detailed and complete that a general feeling of hope and belief has arisen that the enormous mortality from diphtheria will soon be a thing of the past.

[NOTE.—During the last two months the mortality in 100 cases treated at the City Hospital by the antitoxic serum has been 14 per cent. These cases were mostly in the service of Dr. Withington and were of severe type.]

MEDICAL TREATMENT OF DIPHTHERIA.¹

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of Children, Harvard University.

In discussing the treatment of diphtheria the first question that presents itself is whether we shall treat it at all, or whether we shall decide that it is too dangerous, and shall therefore abandon it entirely to men without practice and without families, that is to say, give up the treatment of one of the most serious diseases known, to young men without experience. If this is really necessary it must be done; and if it is unfortunate for diphtheria patients, so much the worse for them. But in forming such a decision, which I think is a wrong one, we should be governed by reason and not by panic, that is to say, not by blind, unreasoning fear. If by study of the means by which contagion is spread, we can learn to take intelligent measures against it, and render it safe to go from diphtheria anywhere; then we are able to widen our sphere of usefulness and perform a duty which we owe to those who trust us with their health and lives.

Every one knows that under some circumstances diphtheria can be carried by mediate contagion. Of course, clothing or hands may be infected by contact with the patient; and there is positive evidence that clothing once infected may under suitable conditions retain the poison for a long time. On the other hand, there is, so far as I know, no evidence whatever that it floats about in the air, while there is certainly much evidence to the contrary. It is impossible for me to give all the evidence, much of it forgotten, that during a long service in the diphtheria wards has crystallized this belief into my mind; and it is not the intention of this paper to go beyond personal experience. I might cite cases of tonsillitis that have been sent to the City Hospital with the diagnosis of diphtheria, and have, of course, been admitted to the diphtheria service. After a proper period of observation very many such cases have been decided not to be diphtheria and have been discharged without contracting it, although breathing the air of the ward for days.

On one occasion last winter having made a two hours' visit, accompanied by two internes, a nurse and seven students — ten in all beside myself — an ample number to stir up whatever dust might be free, — I went directly to the laboratory without going into the open air, and had cultures made from my

pantaloon. New pantaloons were worn on this occasion in order that they might not be filled with street dust. These cultures were made from cotton that had been rubbed over the lower part of the leg, especial attention being paid to the inner surface where it slides on the boot. These cultures were examined by Dr. Wright with great care and with negative result so far as the diphtheria bacillus is concerned. I do not mean that there are no diphtheria bacilli on the floor. I know² that there are — sheets, etc., must occasionally touch the floor; but for a single severe practical test as to the danger of carrying contagion from the ward, this appears satisfactory. On another occasion I had my moustache examined — I think by Dr. Cumston — after spending a long time in personally examining nearly every throat in the wards. Numerous streptococci were found but no diphtheria bacilli. One would expect these results from the way in which these bacilli will often adhere to definite places for weeks, without invading neighboring parts. Thus they will be found on the tonsil but not in the nose, or *vice versa*, or membrane will remain in the larynx visible with the aid of the laryngoscope for long periods, during which the bacilli are not found elsewhere.

In order at once to illustrate the immunity with which the air of these wards can be breathed so long as contact is avoided, and to show what can be accomplished with the aid of antiseptics, let me report two cases.

Last winter a woman was admitted with supposed pseudo-diphtheria — a case that I shall not report in a collection of pseudo-diphtherias that I am making, because of a possible doubt as to the diagnosis. She had a syphilitic eruption, alopecia, and warts on the vulva. There was a mucous patch under the tongue; and while the appearance of the throat was that of diphtheria in the opinion of the admitting physician and of several of my colleagues as well as of myself, yet as the bacilli of diphtheria were never found, there might be a doubt in the minds of some who had not seen her. The day after admission this woman was delivered of a child in the ward. Dr. Stevens, the senior interne, attended to the confinement, giving a corrosive vaginal douche (1 to 1,000) before and after birth, and cleaning his hands with soap and water, then corrosive sublimate, and then permanganate of potash followed by oxalic acid. Of course, he paid particular attention to his nails. He must have had recently infected hands, as he had done several intubations within a short time; but his precautions were sufficient, for numerous cultures from the vagina at various times afterward, failed to show the presence of diphtheria bacilli. The woman stayed in the ward, and was attended by diphtheria nurses, who always corroded the hands before touching her. She wore an antiseptic pad. The baby was nursed by the mother, and cultures from its mouth and nose were always negative. That this might be done safely, the child was kept in a basket and never touched by the mother, while the breast was disinfected with corrosive sublimate before each nursing. Had I thought that the mother had true diphtheria, and had I not known that she had syphilis, I should probably have taken a different course on her account.

Another woman, with true diphtheria complicated with lobar pneumonia, was delivered in the ward at

¹ Read before Boston Society for Medical Improvement, November 26, 1894.

² Wright: *Centralblatt für Bacteriologie*, 1894.