Buchanan (A.)

OBSERVATIONS

ON

MALIGNANT CHOLERA,

INTENDED TO ILLUSTRATE

THE NATURAL COURSE OF THE DISEASE,

THE NATURAL PROCESSES BY WHICH A SPONTANEOUS RECOVERY IS EFFECTED,

AND THE

MODE OF TREATMENT BEST ADAPTED TO SECOND
THE CURATIVE EFFORTS OF NATURE.

BY ANDREW BUCHANAN, M.D.

PROFESSOR OF THE INSTITUTES OF MEDICINE IN THE UNIVERSITY OF GLASGOW, ETC.

LONDON:

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TO

JAMES ADAIR LAWRIE, M.D.

PROFESSOR OF SURGERY IN THE ANDERSONIAN UNIVERSITY, AND FORMERLY PHYSICIAN TO THE CHOLERA HOSPITAL OF GLASGOW.

My Dear Lawrie,

It is not as a mere tribute of friendship that I inscribe these observations to you; although a friendship which has now lasted uninterruptedly for nearly thirty years, might well claim from me some more signal mark of the estimation in which I hold it. I inscribe them to you as having had extensive experience of the disease to which they relate, both in this country and abroad; and not only possessing a thorough knowledge of it in all its phases, but having yourself done much to elucidate its nature and improve the treatment of it. Your liberality, also, and courtesy, while you acted as physician to the Cholera Hospital of this city, demand acknowledgment on the part of the members of the Medical Profession: to whom every part of the institution was at all times freely accessible; and many of whom availed themselves of that privilege, not only from the city and neighbourhood, but from remote districts, and even from foreign countries. In this way you rendered a most important service both to them and to the public, by diffusing a correct knowledge of the new disease; and you rendered another service,

not less important, by publishing the results of your clinical observations and necroscopical researches, the latter of which I believe to have been unequalled in point of extent and minuteness.

When the Cholera was approaching this country in 1831, I associated myself with you and a few other medical friends, for the purpose of drawing up a complete history of the new epidemic, as it might show itself in our own city and neighbourhood; and, as far as we could, exploring its nature and the causes in which it originated. It was in the course of these investigations that I collected the facts which form the ground-work of the following memoir. I have arranged them in the order which seemed to me best adapted to illustrate their connection and mutual dependency. Many of the views which I take upon that subject are not dissimilar from those which you yourself entertain. I feel the more confidence in them on that account, and it is gratifying to me to be able to ascribe to the frequent intercourse I have the pleasure of holding with you, the similarity of our opinions upon this and many other topics of professional interest.

I remain,

My dear Lawrie,

With much esteem and best wishes,

Yours very truly,

A. BUCHANAN.

Glasgow, 13 Moore Place,
12*th October*, 1848.

PREFACE.

THE reader will find in the following pages a picture of the Malignant Cholera, as it showed itself in Glasgow in the year 1832, with reflections on the nature of the disease, and an account of the mode of treatment which the author found most successful in arresting or relieving it.

It is an unjust reproach which is often made to the members of the medical profession, with respect to Cholera, that they have learned nothing of it from the experience of the past—that they are now as ignorant as ever, both of the nature of the disease and of the method of curing it. So far from being totally ignorant of the nature of Cholera, the author has no hesitation in saying, that there are few acute diseases the nature of which is more thoroughly understood. Let any one, for instance, compare what we know of the succession and mutual dependence of the symptoms in Cholera, with what is known upon the same subjects in the most common forms of Fever, and he will be satisfied how much better we understand the nature of the deranged actions which constitute the disease in the former case, than in the latter. One object, indeed, which the author has in view in republishing the following memoir, is that he may be able to put it into the hands of his pupils in the University of Glasgow, to illustrate the utility of

the Humoral Pathology in explaining the phenomena of disease: as he has long been in the habit, in his Course of Lectures on the Institutes of Medicine, to refer at some length to the subject of Cholera, for the purpose of showing, that there can be no genuine system of Pathology, which does not derive its fundamental doctrines, as well from the altered condition of the Fluids of the body, as from the deranged structure and action of the Solids.

The second part of the accusation is as unfounded as the first,—that medical men are unacquainted with any rational or successful method of treatment in Cholera. It is most true, indeed, that there are not a few cases of this terrible disease which baffle our best directed efforts to control them; for just as there are external injuries so severe that surgery can be of no service, so there are internal diseases of such inherent virulence and malignity, that from the very first all the powers of life are laid prostrate by them, and all medicine is unavailing. But excluding such extreme cases, there is, still, an ample field for the exercise of the medical art. Past experience has made us acquainted with many remedies and modes of treatment in Cholera, which are worthy of our confidence; and which require only, as every good remedy does, the judicious adaptation of time and circumstances to render them useful. Experience has taught us, also, what is not less indispensable to be known for the successful treatment of every disease, not to estimate too highly the innumerable remedies and modes of practice which have been unwarrantably recommended, and which, on being fairly tried, have been found unworthy of reliance; many of those so recommended in Cholera having turned out to be absolutely injurious, while others merited

only the negative praise of being harmless, a character scarcely less condemnatory of them than the former, in a disease that leaves no time for trifling.

These observations were drawn up, and laid before the Medical Society of Glasgow, in November, 1832; and were thereafter published in the Glasgow Medical Journal in April, 1833. The author now republishes them, on being certainly informed, that this terrible Pestilence, which has been gradually advancing from the east, by nearly the same tract that it followed seventeen years ago, and which has now been some time hovering upon the British shores, has at length penetrated to the very centre of the kingdom. There is no disease which admits less of being treated *empirically* than Cholera. It presents such various phases, and demands such opposite remedies at different periods of its course, that it can only be treated successfully upon fixed principles; and these principles can only be established by a careful consideration of the physiological laws which govern the progress and terminations of the disease. The author, therefore, hopes that, by directing the attention of his medical brethren to these physiological laws at the present moment, he may render a service which will not be unacceptable to them, nor wholly useless to the public.

Glasgow, 13 Moore Place,
6th October, 1848.

OBSERVATIONS

ON

MALIGNANT CHOLERA.

The formidable Epidemic which has prevailed in this city during the last nine months* having engaged much of my time and attention, I propose to submit to your† consideration a few observations upon it. My opportunities of seeing and treating the disease in private have not been sufficiently numerous to afford scope for generalization or useful deductions, so that, if these observations possess any practical value, it is entirely owing to the unbounded opportunities which I have had of witnessing, at the Cholera Hospital of this city, the symptoms and course of the disease in the living, and the morbid appearances left behind in the dead.

I propose, in the first place, to delineate the natural course of the disease, by which I mean the order of succession which the symptoms observe, when allowed to proceed undisturbed by medicine, or other extrinsic agency. I shall, then, point out the phenomena which appear to me to throw most light upon the nature of the whole disease, and, in particular, to illustrate the causes of death upon the one hand, and of recovery on the

* From February till November, 1832.

† Glasgow Medical Society.

other. I shall, last of all, describe the mode of treatment which has appeared to me most useful in the several stages and varieties of the complaint, and offer a few remarks upon some of the remedies which have been most commonly employed.

I only premise that I wish to be understood to speak, solely, of the disease as it appeared at Glasgow, and, more especially, of the form which it assumed during the first five months of its prevalence, as I then gave to it a much more undivided attention than I have since been able to bestow. I consider this remark necessary, because the epidemic has certainly varied very much in character, in different parts of the country, and at different times in the same place.

I. An attack of malignant cholera is sometimes preceded by lassitude and other symptoms of general indisposition, but much more frequently a discharge from the bowels is the first circumstance that attracts the attention of the patient. The discharge is at first invariably of a feculent kind. It sometimes continues in this form during several days, and it can then only with difficulty be discriminated from an ordinary diarrhœa. In other cases, the feculent discharge passes off rapidly, in a few copious evacuations. As the fæces disappear, the liquid which has been considered characteristic of the disease, predominates in the discharges, and is at length evacuated without any admixture. This liquid has been aptly compared to thin gruel or to whey, with the broken curd swimming in it. The white flakes it contains vary much in quantity, and the liquid, accordingly, varies in consistence, and is more or less turbid. By filtering, the flakes are separated, and it becomes perfectly limpid, or with only a slight milky tinge. I have invariably

found the filtered liquid to contain albumen, coagulating either by heat or by nitric acid; and the flakes appeared to me to consist of albumen in the coagulated state. I have therefore frequently alluded to this liquid under the name of the albuminous discharge. It is only during a certain period that this discharge is observed in the pure state; at first it is mingled with fæces, and, in the latter stages of the disease, with blood or with bile. After the albuminous discharge has continued for a time, varying in length according to the severity of the disease and the quantity of serous fluids in the body of the patient, there is a temporary suspension of all evacuation from the bowels. It was during this suspension, or during the preceding albuminous discharge, that death took place in the worst cases. In severe, but protracted cases, when the discharges were renewed, they were, at first, or soon after, tinged with blood, which continued till death; for, although a few patients survived the passing of bloody stools, it was, in general, a mortal sign. In more benignant cases, the renewed discharges soon became tinged with bile, and, the bile becoming more abundant, continued in immense profusion till the termination of the disease—that is, till the death of the patient, or till the occurrence of a copious discharge of urine, which was the never-failing harbinger of complete convalescence.

The immense quantity of the discharges from the bowels, more especially of the albuminous and bilious discharges, will appear incredible to those who have not made it the subject of particular observation. Patients often described themselves as having passed whole gallons, and I believe, in many cases, without the slightest exaggeration. A strong middle-aged man was admitted into the cholera hospital on the morning of the 24th

April last. He had been taken ill the night previous. His skin was cold, clammy, and purple. He was nearly pulseless, and had the characteristic voice and expression of face. From the time of his admission till mid-day, he passed forty-seven ounces, by measure, of liquid, corresponding exactly to the description given above; and, according to the accounts received from himself and his friends, he had passed a much larger quantity previous to admission. After mid-day, the discharges were suspended, but they returned during the night, deeply tinged with blood, and continued till five next morning, when the patient died. They were not measured from their being passed involuntarily, but they were so profuse as to soak through the bedding, and collect upon the floor below. The bilious discharge is often not less remarkable in quantity. In the case of a man whom I attended, along with Dr. Perry, and who recovered, the amount of the bilious discharge in the last stage of the disease, was, I am sure, not less than that of the white discharge, in the case I have just related. In the notes which I have preserved of the examination of the body of a man named M'Kay, I find it stated, that "the bowels, both small and large, were enormously loaded with a dark bilious fluid, which had also been purged before death." This man was admitted from the Powder Magazine House of Refuge on the 6th of March, and died after he had just rallied from the first shock of the disease. The quantity of bile found in his bowels was so extraordinary as to attract the attention of all present. This was one of the first cases that led me to regard the bilious discharge as an essential, and probably a salutary part of the diseased actions in cholera. The observations I have since made induce me to think that, in cases in which venesection has not been practised,

the quantity of bile is nearly in direct proportion to the preceding albuminous discharge.

I have thus traced the history of the discharges from the bowels that take place in Malignant Cholera, as, these appear to me the most essential part of the disease. They succeed each other with the most remarkable regularity, and, being more uniformly observed than any other class of symptoms, they indicate with most precision the different periods of the disease. In sketching the history of the remaining symptoms, I shall avail myself of the marks thus afforded, by dividing the disease into three periods. In the first, the discharges are feculent; in the second, they are albuminous; and in the third, they are bilious. These periods I shall name, respectively, the Diarrhœal, the Leucorrhœal, and the Cholerrhœal periods of the disease: or simply the feculent, the albuminous, and the bilious periods: these names expressing the kind of discharge which occurs in each. A fourth period, the Hæmarrhœal, in which the discharges are bloody, is also observed in many cases, but it can scarcely be accounted a regular part of the disease. Perhaps, indeed, there are, in strict propriety, only two periods of the disease, the first marked by a preternatural exhalation from the gastro-intestinal membrane, the second by an increased bilious discharge. The first of these periods, however, admits of a very natural subdivision. When the gastro-intestinal exhalation is first poured out, it carries with it the feculent contents of the bowels; after the bowels are emptied of fæces, the exhalation appears in its pure state; and when the disease has been protracted till the exhaling vessels are drained of their serum, the exhalation consists, more or less, of red blood. Now, these discharges, although perhaps only denoting three different stages of

the same exhalent action, are, nevertheless, so easily distinguished from each other, and indicate differences so important in the condition of the sick, that I think they may usefully be made the foundation of a practical division of the disease into corresponding periods.

The changes that take place in the Circulation, in the Respiration, and in the function of Animal Heat, constitute a class of symptoms still more prominent, and not less important than those I have just described. Diminished vigour of the heart and arteries, and a reduction of the temperature of the body may be considered as constant concomitants of the first and second periods of the disease, except in the mildest cases. If these periods pass over without any notable feebleness of the pulse, we may, confidently, pronounce the disease to be free from danger. In bad cases there is often, from the commencement of the diarrhœal discharge, weakness in the action of the heart, and sometimes, before that time, if we may judge from the appearance of the patient. At all events, the pulse begins to sink soon after the commencement of the albuminous discharge; the sinking continues exactly in proportion as that discharge becomes more profuse, and too often goes on at once to a fatal termination without any attempt at reaction being made. In more favourable cases, after the pulse is no longer perceptible at the wrist, it is still felt to beat in the larger arteries, as the carotids and iliacs. The Collapse, as this condition of the sanguiferous system has been named, did not, for the most part, go farther in cases in which the circulation was afterwards restored. I have, however, seen cases, in which a perfect recovery was made, after the pulse had not only been imperceptible in any artery of the body, but could not even be distinguished in the region of the heart,

with the aid of the stethoscope. Complete re-establishment of the circulation has often taken place after the pulse had not been perceptible in the arm for twenty-four hours; and I remember one case where, although the patient ultimately died, the circulation was perfectly restored after there had been no pulse at the wrist for thirty-six hours. The return of warmth to the face, and a more distinct pulsation in the larger arteries, were the first indications that the circulation was beginning to be re-established. When the patient continued to improve, the pulse was at length felt fluttering at the wrist, and by degrees regained its natural strength. It rarely rose in frequency much above the natural standard, generally ranging from sixty to ninety; but there was very often an augmentation both of its strength and of its fulness. This state of the arterial pulse was always accompanied with an increased pulsation of the heart itself, often so great as to cause a visible elevation of the ribs. A more complete idea of this state of the circulation cannot be given than by comparing it to that observed in cases of Hypertrophy of the Heart. In all the symptoms derived from the state of the sanguiferous organs, the disease presented a most marked difference from common fever, to which it has been so often, but, as appears to me, most erroneously, compared. Not to mention other marks of discrimination, I can conceive no greater contrast, than between the small, feeble, and rapid pulse of Typhus, and the slow, full, and hard pulse in the advanced stages of Cholera.

Certain very remarkable conditions of the circulation were observed in the later periods of the disease, which, I believe, no British pathologist ever saw, or could, indeed, have conceived possible, before the eruption of the present epidemic. In many of the cases which

proved fatal, the circulation was not completely, but only partially, re-established. We had, then, the extraordinary spectacle of the heart and larger arteries acting, not only with full vigour, but with great violence, while the smaller arteries, although perfectly pervious, had no participation in that action. Thus, the heart itself, the iliacs, and carotids, often pulsated full and strong, while the pulse at the wrist or the ancle was only of natural strength, or was feeble, or even imperceptible. I recollect two fatal cases that occurred in the Hospital at the same time, in which this singular anomaly was observed. One of the patients was a stout plethoric young woman, the other a lad, who was attacked with cholera while convalescent from fever. In both, the action of the heart was so violent as to elevate the ribs by a visible stroke, and communicate to the hand the same impulse as in cases of hypertrophy, while the pulse at the wrist, instead of throbbing, as might have been expected, was, in the former patient, merely of natural strength, and, in the latter, very feeble, and at times imperceptible, with cold extremities.

The power of generating animal heat seemed to decline simultaneously with the pulse, although the actual reduction of the temperature of the body did not take place for some time after, sooner or later as the circumstances of the patient were more or less favourable to the physical subduction of heat. The coldness was often as complete as that of a dead body. The return of temperature to the face was, as I have already remarked, one of the earliest signs of the revival of the circulation, and was, in favourable cases, soon followed by the return of heat to the limbs. When the circulation became more than naturally strong, the heat surpassed the healthy standard, although not to the same

degree as in most febrile diseases. When the circulation was only imperfectly re-established, however violent the action of the heart, there was a tendency to coldness in the limbs.

The Respiration, in so far as it consists in the mere mechanical inhalation and expulsion of air from the lungs, seems to be one of the least affected of all the bodily functions. There can be no doubt, however, that the respiration is, in reality, deeply involved in the disease. The patient gasps for breath, and, although the air is inhaled and exhaled freely, he seems as if he were breathing an irrespirable atmosphere, as I believe to be virtually the case, the air inhaled being no longer capable of producing the necessary chemical changes on the blood.

Having thus described separately the two classes of symptoms, that impress the most peculiar character upon the disease, and mark the different periods of its course, a more cursory enumeration will suffice for the rest. The thirst is, from the very first, urgent, and the patients, even when deadly cold, desire only cold liquids, and refuse whatever is warm or of a stimulant quality. The tongue is at first little changed in appearance, or only coated with a whitish fur, and participates, with the rest of the interior of the mouth, in the general coldness; as the disease advances, it generally becomes dry and preternaturally red. The vomiting generally commences towards the end of the diarrhœal period, but is sometimes the very first symptom of the complaint; the matter vomited consists chiefly of the drink of the patient, although there is, sometimes, an admixture of morbid secretions from the stomach itself. The secretion of urine is almost completely suspended till the resolution of the disease, when it returns often in great

profusion. Perspiration, when it occurred very early, generally resolved the disease, but it seldom took place till the disease was far advanced; it was then cold and clammy, and scarcely less than a mortal symptom. The voice at an early period becomes weak, and in the depth of the disease, is totally lost, the patient being only able to articulate in whispers; as the circulation is re-established, the voice returns. The spasms of the voluntary muscles have not, by any means, been so formidable a symptom in the disease that has prevailed at Glasgow as they appear to have been at other places; they were generally confined to the calves of the legs, but often also occurred in the thighs, arms, and jaws; they attended the albuminous and bloody discharges, and generally subsided as the bile began to flow. The mind is generally desponding, although quite collected in the first half of the disease; in the second, there is often delirium, somnolence, or stupor. The muscular power was less impaired than might have been expected from the apparently lifeless condition of the patients, who, although incapable of any sustained exertion, could muster strength for a single effort, and thus sometimes sprang suddenly out of bed, when it was little expected of them. Death, in one or two instances, followed soon after these sudden exertions; but, upon the whole, I was disposed to think that there had been a good deal of exaggeration with respect to the danger of such exertions, or, even of allowing patients to sit upright, or to lift their heads from the pillow.

There is but one symptom that remains to be spoken of, and I have referred it to a separate place, as I shall have occasion hereafter to allude to it in particular. Soon after the disease commences, a discoloured circle is observed round the eyes. In many instances, indeed,

this circle has been the first symptom observed, the medical attendant having prognosticated from it, the discharges which subsequently came on. I shall afterwards show reasons for thinking, that though this symptom may precede the discharges, it probably does not occur till after the albuminous exhalation into the bowels has made considerable progress. The discoloration is soon followed by a hollowness of the eye, and as the disease advances, the eye becomes as much sunk as ever happens in the most protracted diseases. This sinking is found, on examination, to arise, not so much from any actual retrocession of the ball of the eye, as from the subsidence of the eyelids, owing to the collapse of the subjacent cellular membrane. A similar falling together of the cells of the subcutaneous cellular tissue, is also observed in other parts of the body, but varies in extent. It is very general all over the face, giving the peculiar expression of shrinking to the countenance. In fat subjects, however, as in plump children and young females, no sinking but that of the eyes can be observed, while, in persons having little fat, and especially in those above middle life, there is not only a collapse of the whole countenance, but the limbs shrink to a great degree, the skin of the fingers and hands appearing wrinkled, and as if too large for the parts invested by it.

The duration of the disease varied from a few hours to six or eight days. Among the patients that recovered, in some the disease did not extend beyond the diarrhœal period; if it advanced to the second period, the amount of the albuminous discharge determined both the degree of depression in the vital functions, and the amount of the subsequent discharge of bile: if, however, the patient had been freely bled early in the

disease, even though the albuminous discharge was profuse, and the collapse complete,—there was, nevertheless, on the revival of the circulation, either no bilious period, or only a very short one. The worst cases terminated fatally during the albuminous discharge, from five to twenty-four hours from the first attack, the heart never recovering from its depression. Most of the fatal cases, however, terminated after the patient had rallied a little, but while the circulation was only imperfectly re-established, bloody stools generally taking place before death; the period varied from about sixteen hours to several days. The patients to whom the disease proved fatal, after decidedly increased action of the heart had taken place, died from the 3d to the 8th day, generally with symptoms of congestion in the head or in the lungs.

The appearances observed in the dissection of persons dead of Cholera, have been exceedingly uniform. In the most rapidly fatal cases, where death took place before any restoration of the heart's action, the mucous membrane of the bowels was found pale, and as if bleached by maceration in the albuminous fluid which filled the cavity of the bowels. The most common seat of the disease was the small bowels, although frequently the same appearances were observed in the stomach. There was an immense accumulation of thick black blood in the heart, in the brain, and in all the larger veins, more especially in those nearest the heart; the same kind of blood was also found throughout the whole arterial system. The gall-bladder was distended to the uttermost with thick black bile, none of which had flowed into the bowels, although the gall ducts were perfectly pervious. When the patients survived till a later period, and especially if death did not take place

till the action of the heart was in some degree restored, the mucous membrane of the small bowels was no longer pale, but presented a minute injection of the capillaries with red blood, generally most conspicuous at the lower end of the ileum: the muciparous glands, both simple and compound, were generally enlarged: the fluid in the bowels was more or less bloody, and was also more or less tinged with bile; the state of the blood was the same. The appearances were more varied when death was deferred till the bilious stage; at the commencement of it, there was often, as in the case of M'Kay, quoted above, an enormous accumulation of bile in the bowels; at other times, the bowels contained a fluid variously discoloured from the intermixture of blood and bile; the mucous membrane of the bowels was often ulcerated or completely disorganized, the effects of the inflammatory attack it had undergone; there was the same accumulation of black blood about the heart as in the preceding periods of the disease.

In the above sketch, I have only given a place to those morbid appearances, which are so frequently or invariably observed, as to entitle us to conclude, that they are intimately connected with those diseased actions in which Cholera essentially consists. There are two appearances, which deserve to be more particularly mentioned, as being invariably present in whatever stage of the disease the patient dies. One of these is the black pitch-like blood already mentioned. The other is a rigid contraction of the voluntary muscles, which takes place after death. It is most remarkable in the hands, which are firmly clenched, and cannot be opened without much force. This appearance I never saw awanting, except in the body of a man who had undergone the process of saline injection during life.

It is often important, in enabling us to determine at once, from the inspection of the dead body, whether Cholera was the disease which occasioned death. I have seen difficult questions of diagnosis satisfactorily decided in this way, when, owing to the patient not being seen till an advanced period of the disease, the symptoms observed during life gave no ground for a certain judgment.

II. With respect to the nature and seat of Cholera, the opinions of physicians have been so various, and, upon the whole, so little satisfactory, that any observations I may make upon a subject so obscure, will naturally enough be received in a spirit of scepticism. I do not believe the disease to be a Gastro-enteritis, nor an inflammation of the muciparous glands of the bowels; for though, without doubt, the traces of those affections were very often conspicuous after death, yet they were often awanting in the worst cases, and when present, they were not proportionate in degree to the severity of the disease. Neither do I believe Cholera to consist in an inflammation of the great sympathetic nerve, or of the spinal cord, or of the brain, because dissection gave no countenance to those opinions. There are, however, lesions of the nervous system, which dissection cannot expose; how far such lesions may be concerned in the production of Cholera, is difficult to determine, and they are regarded by many as the true proximate cause of the disease. I can only oppose to that doctrine the proofs I am about to adduce, that Cholera is essentially a disease of the fluids of the body. I shall endeavour to show, that the principal symptoms admit of a satisfactory explanation from the obvious changes that take place in the constitution and qualities of the Blood; but

I shall at the same time bear in mind, that such is the intimate connection between the animal solids and fluids, that no disease can be referred exclusively to either of them: the solids cannot act without modifying the constitution of the fluids, and the fluids cannot be altered without involving the action of the solids.

To give a complete *Ratio Symptomatum* of Cholera is impossible, so long as we remain ignorant of the remote cause of the disease. Of the nature of that cause we know nothing, and of the mode in which it first acts upon the body we are equally ignorant. Most probably, however, the remote cause of cholera is a *miasmatic poison*, diffused through the atmosphere in certain situations, and received into the lungs by respiration. Whether, after entering the body, it mingles with the circulating fluids, and is carried, by a peculiar determination, to the gastro-intestinal membrane, in the same manner as we see certain poisons and medicinal substances carried to particular organs,—or whether it acts upon the gastro-intestinal membrane through the medium of the general nervous system, as other analogies might lead us to suppose, we cannot pretend to determine; but it is certain that the gastro-intestinal mucous membrane exhibits the first signs of a noxious impression having been made upon the body. These signs consist in a profuse discharge taking place from that membrane. Thus far this part of our subject is purely conjectural; the remaining part of it rests on a more solid foundation, for by observing the order in which the symptoms of the disease succeed to each other, and their comparative degrees of violence, we can ascertain, with considerable certainty, to what extent they are connected as cause and effect.

A preternatural exhalation from the gastro-intestinal

mucous membrane is, we have reason to believe, the first link in the chain of morbid actions in malignant cholera. The exhaled liquid excites to action the moving fibres of the bowels, the natural irritability of which seems, at the same time, to be augmented. The discharge from the bowels which ensues is at first feculent, but that arises simply from the presence of feculent matter in the bowels when the disease begins. As soon as the fæces have been evacuated, the gastro-intestinal exhalation appears in a pure state. The amount of this exhalation I have already adverted to. To estimate it by gallons, as many patients did, is not mere hyperbolical language. In a case narrated above, the amount of the exhaled fluid could not be less than eight or ten pints, exclusive of the fæces discharged at the commencement of the disease, and of the sanguineous and sanguineo-bilious discharges at the end of it. The amount of this fluid, then, sufficiently shows, that it cannot have proceeded from the vessels of the bowels alone, but that the whole sanguiferous system must have been drained of its serum to furnish an exhalation so profuse.* The same conclusion must be drawn from the changes that we are immediately to point out, as taking place in the blood itself, as the process of draining off its serum advances. And, lastly, the same conclusion is forced upon us by the chemical analysis of the exhalation itself; the liquid part of which, as I have already said, holds albumen in solution, while the flocks or thick parts of it approach to the nature of the same principle in the coagulated state; a change wrought

* If the antiquity of an opinion can add weight to it, Aretæus expressed the very same opinion as that above stated more than seventeen hundred years ago—"Cholera is a retrograde movement of the fluid in the whole body towards the gullet, the stomach, and the intestines."—*On the Causes and Signs of Acute Diseases, Book II. Chap. 5.*

upon it, most probably, by the glands and other exhalent apparatus of the bowels.

Some pathologists have thought the amount of the albuminous discharge sufficient to explain, upon the ordinary principle of evacuation, the debility of the whole system, that takes place as the discharge proceeds. This explanation, however, touches only the least part of the evil; for it is not so much the loss of fluids, as the change produced upon the fluids which remain, that causes the general disturbance of the bodily functions that ensues. The effect, which the loss of so large a quantity of its serous portion produces upon the mass of blood, will be best seen from the following sketch of the condition of the blood in the several periods of the disease.

Blood drawn during the diarrhœal period, is generally somewhat darker than natural, it coagulates with a separation of serum more or less abundant, and the coagulum, on exposure to the air, becomes florid on the surface. In mild cases, this state of the blood continues, also, during the leucorrhœal period. In general, however, during the whole leucorrhœal period, and often before the commencement of the pure albuminous discharge by which that period is characterized, blood drawn from the veins, is of an exceedingly dark colour, and of a thick viscid consistence; it coagulates without any separation of serum, or with only a very small quantity, and the coagulum, however long exposed to the air, retains its black colour on the surface. Blood nearly similar in all its qualities is found circulating in the arteries. This state of the blood continues till the circulation begins to be re-established, after which a totally different, and, in some respects, an opposite condition of the blood is observed. The serum of the

blood is now restored, and separates as usual on coagulation; and, it is remarkable, that, however soon after the circulation begins to revive, blood be drawn, the restoration of the serum is even then observed. The colour of the blood, as it issues from the veins, is now no longer black; it is sometimes nearly as florid as arterial blood, but, more frequently, it resembles very dark venous and florid arterial blood, imperfectly mingled together, and then the coagulum formed is of a marbled appearance, presenting, on a section being made of it, a striking resemblance to a slab of Jasper, owing to the intermixture of the streaks of dark and florid blood. This state of the blood prevails till the urine begins to flow, when, as may be presumed, the blood returns to its ordinary condition in the state of health.

It thus appears, that at the commencement of the disease, the blood does not deviate much from the natural state, but, that in proportion as the albuminous discharge flows from the bowels, the quantity of serum in the blood gradually diminishes; and, in consequence, the blood itself becomes blacker and thicker. It becomes, also, at the same time, incapable of being arterialized in passing through the lungs. It therefore passes in the black or undecarbonized state into the arterial system, and the symptoms of asphyxia ensue, just as when the blood ceases to be changed in the lungs from interrupted respiration. The important fact, that the blood is not arterialized in the lungs, and circulates through the arteries in the venous state, has been long known. The respiratory function, although apparently carried on with freedom, is, nevertheless, deeply implicated in the disease; the wonted changes, which the blood undergoes in the lungs, being no longer

effected, or only effected in an imperfect manner. To explain this well-established fact, it has been supposed, that the eighth pair of nerves is in a state of paralysis. This supposition, however, is altogether gratuitous, and only adopted as affording a convenient explanation of what otherwise seemed inexplicable. The altered constitution of the blood appears to me to be the true cause, why it no longer undergoes any change in the lungs. The mutual action, which it is the object of respiration to effect between the atmospheric air and the blood, appears to be purely chemical, and the interruption of that action must be sought for in chemical causes. Now, such causes of interruption are obvious. We know that the respiratory action is modified by altering the constitution of the air inhaled, as by diminishing or increasing the quantity of oxygen which it contains, or by mingling it with other gases; now, in the very same manner, is the respiratory action modified by altering the chemical constitution of the blood; for, as in every other instance of a mutual chemical action, the result will be affected by a change in the nature of either of the re-agents. I incline, therefore, to refer the interruption in the decarbonization of the blood that takes place in cholera to the chemical alteration in the venous blood sent to the lungs. We know that this blood is very different from common venous blood,—that it is blacker and of a thicker consistence, and forms a clot without any separation of serum. Now, upon blood thus destitute of serum, atmospheric air is not fitted to act. To take an illustration familiar to every chemist, we often see an energetic reaction take place between a metal and an acid mixed with water, while no reaction whatsoever occurs between the metal and the same acid destitute of water; now, in the very same

manner, while a mutual reaction takes place between atmospheric air and healthy blood containing serum, no reaction occurs between atmospheric air and blood destitute of serum. This conclusion, however, is not left to the uncertainty of abstract reasoning. It is established by observations made upon blood out of the body. We all know, that healthy blood left exposed to the action of the air, becomes arterialized upon the surface, but every one who has observed the pitch-like blood drawn in cases of cholera, knows, that however long such blood be exposed to the air, it never loses its black colour. Now, what can be the cause of this difference, except that the air which acts upon the blood in the former case is incapable of affecting it in the latter. The following experiment performed by my friend, Dr. Lawrie, and myself, places this subject in a still more striking point of view. On the evening of the 29th of April last, a man, admitted into the Cholera Hospital in the state of collapse, expressed a desire to be bled. He was gratified in his request, and about four ounces of blood were with difficulty procured from his arm. One half of this blood was received in a vessel containing serum, separated from the blood of a convalescent patient, and apparently healthy. The blood and serum were mixed together in nearly equal proportions, and the black colour of the former underwent no immediate change by the mixture. Upon standing, the whole coagulated, and the serum afterwards gradually separated, while the clot became florid upon the surface, exactly like healthy blood. The other half of the blood drawn, which was not mixed with the serum, had the usual characters of Cholera blood very strikingly marked. It was thick and black, coagulated without any separation of serum, and remained unchanged in colour by

exposure to the air. The patient died in eleven hours from the commencement of his illness.

Having thus pointed out the two great causes to which, in its early stages, the disease owes its virulence, viz., the profuseness of the albuminous discharge, and the consequent non-arterialization of the blood; the more pleasing task remains of explaining in what way the conservative powers of the constitution resist these causes of destruction, and often succeed, unassisted, in re-establishing health. The natural processes by which a spontaneous recovery from cholera is effected, are chiefly the three following, 1st, The re-absorption of serum from the cellular substance and great serous cavities, 2d, The absorption of fluids from without, and, 3d, The excretion of bile. The study of these natural processes is of the highest importance, that our artificial treatment may be adapted to promote them, or, at least, may offer no impediment to their progress.

The first of the conservative processes just enumerated, is the re-absorption of serum from the cellular tissue and the great serous cavities. The existence of this process, as well as its extent and universality, is evinced by the sudden extenuation of the body, the sinking of the eyes, the general collapse of the features of the face, the shrivelling of the hands, and the diminution of the bulk of the limbs, to which we have already particularly adverted, in describing the symptoms of the disease. There can be no doubt that these symptoms are occasioned by the activity of the absorbent vessels taking up the serous fluids, and thus causing a flaccidity of the cells of the cellular tissue all over the body. Now, this absorption appears to me to be the great means which nature employs to relieve herself from this disease. The absorbed serum being conveyed

to the blood-vessels, mingles with the circulating mass, and gradually restores the natural proportion of the constituents of the blood. That proportion being restored, the atmospheric air comes again to act upon the blood, and the brain and other nervous centres receiving arterialized blood, have their energy renewed, and speedily diffuse vigour throughout the system. Health may thus be at once re-established, if the absorption has been sufficiently plentiful, and no organic lesion has been produced in the bowels or other important organs, to occasion consecutive fever.

That the re-absorption of serum is no imaginary process, but one of actual occurrence in every case of the disease, where death does not take place in the collapse, is most satisfactorily shown by the fact, to which I have already adverted, and which I have had innumerable opportunities of verifying, that blood drawn from a patient, after the reaction has commenced, invariably separates into coagulum and serum. Now, whence has the serum come, since, undoubtedly, it was absent during the collapse? Whence—but from the source just indicated. In those cases, in which liquids were altogether denied to the patient, or given only in very sparing quantity, it could come from no other source, while, in other circumstances, it might also be, in part, absorbed from without.

Before quitting the subject of absorption, I may remark, that it was only the serous fluid, and never the adipose secretion that was re-absorbed, a circumstance in the process, that, if we consider the final cause of it, will not appear the least wonderful. Hence the shrinking of the limbs, puckering of the skin, and general extenuation of the body were most remarkable in elderly persons, and those in whom the subcutaneous fat was

least abundant, while, on the contrary, they were little observed in fat persons as in children and young females, in whom, after death, the cellular substance was often enormously loaded with fat. In the latter cases, there were, frequently, no traces of the absorbent process, but in the collapsed areola round the eye, where such traces were always most conspicuous, owing to the cellular substance in that situation containing serum alone, without fat. As the cellular substance of the scrotum is of the same kind as that under the eyelids, I made many observations to discover, whether the shrinking there were equally conspicuous, but without being able to arrive at any certain conclusion.

The absorption of liquids from without, probably, answers the same end as the re-absorption of serum, by diluting the mass of black blood. The urgent thirst, which is one of the most constant symptoms of the disease, points out the necessity of a free use of liquids; and the beneficial consequences which have attended the practice of not neglecting this salutary indication of nature, sufficiently evince, as appears to me, the utility of liquids absorbed from without, in effecting a resolution of the disease.

The excretion of bile is the last of the three processes, we mentioned as employed by Nature, to prevent the constitution from being oppressed by the black inarterializable blood, that fills the sanguiferous vessels. When the loss of fluids sustained has not been very great, in a person abounding in interstitial juices, the natural constitution of the blood may be at once restored by absorption alone; but, in severe cases, the absorbed fluid is insufficient for the purpose, however succulent the body of the patient, and however freely the cravings of nature for liquids have been gratified. There is still

an excess of black blood, from which the sanguiferous system can only be freed by an increased action of the liver separating from the blood an unusually great proportion of bile, and thus occasioning a bilious diarrhœa or bilious vomiting, which, as already described, are almost invariably attendant on the last stage of the disease. Were there no other arguments to prove, that one of the most important ends of the biliary secretion is to purify the blood from its black particles, I should consider it sufficiently established, as a physiological fact, by the uniformity with which, in this disease, a bilious diarrhœa succeeds to the pitchy state of the blood, by the quantity of bile being proportionate to the degree in which that state of the blood exists, and by the blood being gradually purified as the discharge of bile goes on. The only circumstances, in which I have known recovery take place from complete collapse, without the intervention of an increased bilious discharge, were, when free venesection had been practised at an early period of the disease. This exemption first attracted my attention in the cases of two young women, who were patients in the hospital about the end of March and beginning of April. They had both been freely bled at the commencement of the disease; both sunk into complete collapse, in one of them in particular, the motion of the heart and pulsation of the carotids were only discoverable at intervals, and yet both recovered without secondary fever or bilious diarrhœa. In such cases, the absence of the discharge of bile affords a still stronger proof of the doctrine I have been endeavouring to establish, than the profusion in which it is present in ordinary circumstances. The increasing unpopularity of blood-letting as a remedy, has, however, prevented me from observing a sufficient number of such

cases, to warrant me in considering as universal the exemption which occurred in the cases above mentioned.

The most mysterious part of the whole disease is that which accompanies the bilious discharge, and has received the names of the Reaction or Secondary Fever. The most common opinion is, that the excitement of the circulation and other anomalous symptoms which distinguish this part of the disease, are the consequences of an inflammatory affection of the bowels, of the brain, or of the lungs, which has taken place at a more early period. That such inflammations are very frequently present is most certain, and, it is reasonable to suppose, that when present they should produce the same symptoms of irritation which they are usually observed to occasion. There are, however, many strong objections to this opinion. The symptoms, which occur in the last stage of cholera, are totally different from those which occur in any common inflammatory or febrile disease; they are too uniform in character to admit of being referred to causes so diversified as the morbid appearances observed on dissection would lead us to suppose; and, lastly, there has been no regular correspondence between those morbid appearances, and the degree of vascular excitement observed during life. Sometimes, for instance, the sanguineous injection of the capillaries of the mucous surface of the bowels has been very great, when the reaction has been slight, and in cases where the reaction has been violent, the bowels and other important organs have not deviated much from the normal condition. It is, therefore, probable that the cause of the symptoms in question is one more constantly present, and of a kind so powerful, as to counterbalance all lesser causes of disturbance, and obscure the symptoms which, in ordinary circumstances, they

would have occasioned. Such a cause will, I think, when we come more perfectly to understand it, be recognised in the state of the circulation, and the condition of the blood connected with it.

The state of the circulation which occurs in the second stage of Cholera, is, in many respects, the very reverse of that which occurs in the first stage. In the first we find the pulse small, feeble, and rapid,—in the second it is full, strong, and generally slow, little more frequent or less so than natural. In the first stage the blood is destitute of serum,—in the second the serum is restored. In the first we find the blood circulating in the arteries in the venous or undecarbonized state,—in the second we find the blood circulating in the arterialized state, not only in the arteries, but also in the veins; sometimes we find the arterialized blood nearly pure, but much more frequently it is mingled, as I have already described, with streaks of very black blood.

To offer any explanation of this very extraordinary condition of the circulation, I do not pretend, but I hope to meet with indulgence, while I merely make a guess at its nature. For this purpose, I would beg to recall to mind the very singular fact so often observed in Cholera, that the circulation may continue to go on in the internal parts of the body, while it is completely arrested in the external parts. This is the state of the circulation that is observed invariably in the depth of the collapse, and for some time after the circulation has begun to be re-established. At this period, the absorption of serum is going on, and in proportion as the serum enters the blood-vessels, a larger and larger quantity of blood is restored to its natural constitution, and becomes capable of arterialization. Now, the blood, as it comes to be arterialized, at first only circulates inter-

nally. It has no access to the extreme vessels which go to the surface of the body, and to the excreting organs, which are still loaded with black blood, and have no participation in the circulation. In such circumstances, it is obvious that the blood cannot be disarterialized, that is to say, cannot return to the venous state. It must, therefore, circulate in the arterialized state in the veins, as we observe it actually to do. It must also circulate in the same state in the right cavities of the heart and the pulmonary arteries, and probably thus occasions the preternaturally forcible action of the heart, which is so common a symptom at this period of the disease. This state of the circulation, however, cannot long continue. The black blood in the remote vessels is constantly mingling with the red blood nearer the heart, and if the patient continue to improve, a larger and larger quantity of blood becomes fit for arterialization. The circulation is in proportion extended to the remote vessels, which at first beat only feebly, but gradually acquire force, and often as if struggling to overcome an obstruction, equal the heart itself in violence of action. In favourable cases, the extreme vessels are at length cleared of black blood, and the arterial blood then finding access to the excreting organs, the urine and other secretions are restored; the blood, in consequence, returns to the heart in the venous state, the preternatural excitation of that organ ceases, and health is speedily re-established. In more severe cases, again, when the quantity of black blood remaining in the circulation is very great, notwithstanding the efforts of the absorbent vessels to dilute the mass, and the activity of the liver discharging vast quantities of bile, the black blood at length predominates, and a secondary collapse is induced. This is, I

think, one of the most common of the fatal terminations of the disease in its second stage. It is, always, to be apprehended, when there is a disproportion between the force of the heart and that of the arterial pulse, and may be considered as almost inevitable when the action of the heart is violent, with a tendency to coldness of the extremities, and a feeble pulse. In other cases, the violent action of the heart, in which the arterial system fully participates, seems to be the chief cause of death, occasioning symptoms like those of oppressed brain.

An excess of black blood in the sanguiferous system is, according to the preceding views, the great cause of the danger and fatality of Cholera at every period of its progress. I am aware that the explanation I have endeavoured to give of the disease, will be thought by many to savour too much of Humoralism; but I am convinced, that here, as in many other instances, some of the exploded doctrines of the school of Boerhaave might, under the scrutiny of an improved chemistry, be advantageously revived, and that Pathology would lose nothing, if the exclusive Solidists of the present day would insist less on imperceptible lesions of tissue, and condescend to take the condition of the fluids of the body into account, in explaining the phenomena of disease.

III. In speaking of the Cure of Cholera, I shall, in the first place, explain the mode of treatment, which has appeared to me most useful, in the several stages of the disease.

Diarrhœal Period.—The treatment of cholera at this period does not differ much from that of an ordinary diarrhœa; with this exception, that we are, in a great measure, precluded from the employment of purgatives,

or even of laxatives, as the operation of these has been, repeatedly, known to hurry on the disease to the second stage. Opiates alone, or with a little calomel, or with tartar emetic or ipecacuanha; cordial diaphoretics; the pediluvium, or warm bath; and confinement to bed, or at least to the house, are our principal remedies. Venesection should also be added to the number. I am by no means an advocate for the indiscriminate employment of it, but I certainly would employ it in every case, in which the patient had blood to spare, and I judged it probable, that the disease would go on to the second stage. It is, therefore, by the circumstances on which that judgment is founded, that our practice must be directed.

Leucorrhœal Period.—At the commencement, and during the early part of this period, I would trust chiefly to the free use of opiates and to venesection, but I would not employ either of these remedies were the disease farther advanced. My decision on this important point of practice would be founded on the quantity of the albuminous discharge compared with the constitution of the patient, and on the degree of vigour of the pulse, which I have endeavoured to show, is, always, inversely proportionate to the profuseness of the discharge.

When the patient is not seen, till a profuse albuminous discharge has already taken place, the time for all active treatment is past. The injury to the constitution has been already done; we can no longer avert it, and our efforts must be directed, solely, to the reparation of it. How Nature repairs this injury, I have already endeavoured to explain, and I know of no other mode, in which it can be repaired. The situation of the patient is now very similar, in many respects, to that of an individual who has been wounded. No human care

can avert the division of the solid tissues which has already taken place, and every Surgeon who understands his profession will acknowledge, that he knows of no mode of treatment that can be of any avail, but that of allowing Nature to repair the injury done to the solids in her own way. In the same manner, in a person affected with Cholera, after the albuminous discharge has been profuse, the constitution of the circulating fluids has been already altered, and the injury thus inflicted Nature alone can rectify, all that the Physician can do being to assist the natural processes that are going forward, and at all events to abstain carefully from impeding them. With these views, the sick-room should be supplied with fresh, cool air; liquids should be assiduously supplied to every surface capable of absorbing them, and the patient should be allowed to remain at rest as little harassed as possible by officious treatment. When the body has become cold, we should carefully avoid applying heat in the dry form, as, for instance, by means of the hot air bath, because dry heat, in all its forms, is, in the highest degree, detrimental, causing evaporation from the skin, and thus, as it were, wringing out the last drops of moisture from the body of the patient; instead of applying dry heat, we should direct an assiduous application to be made to the surface, of cloths moistened with tepid water. After the temperature is restored, we should still keep the surface moist, by washing it from time to time with a sponge. The patient should be allowed drink in whatever quantity he desires it. The drink should be always cool, unless, which very rarely happens, the patient prefer it warm. The liquid which I have most frequently employed, and which I have found generally relished and retained upon the stomach, is that, which was at one

time known at the Cholera Hospital here, by the name of the *Mistura Albuminosa*. It is formed by beating up a raw egg with half-a-pint of milk, mingling them with about a pint and a half of water, and adding as much salt as gives the whole an agreeable taste. Instead of this mixture, whey, milk and water, weak chicken soup as recommended by Sydenham, or any similar animal decoction may be employed. These drinks contain all the elements necessary for the elaboration of healthy serum. When the stomach was very irritable, an aromatic infusion, as that of mace or of balm, or water seasoned with a little wine or spirits, sometimes, answered better. In cases where the irritability of the stomach was so great as to excite a suspicion of inflammation, it was sometimes necessary to restrict the quantity of liquid to be taken at a time; if, however, the vomiting were not incessant, but only occurred at intervals, I have generally found it occasion much less inconvenience than the ungratified longing for liquids. Copious enemata of warm milk, repeated as often as expelled, constitute another part of this treatment of the very highest importance, not only by supplying, an absorbible liquid, but by mitigating abdominal pains, and diluting acrid secretions.

Cholerrhœal Period.—During the greater part of this period, the treatment just described is to be continued. The milk enemata are, now, especially useful in lessening the acrimony of the bile, which I have seen so great as to excoriate the hips and thighs. As bile is spontaneously secreted in great abundance, in almost every case where the patient survives the collapse, it is seldom necessary to give any medicine to promote the discharge of bile. Small doses of calomel, or of blue pill, may however be given at the commencement of

the disease, but I could never persuade myself that any good effect was obtained from mercurials at a later period. Venesection is often required at this period, generally, to lessen the over-excitement of the central circulation. It ought, however, to be borne in mind in employing this remedy, that there is another source of danger not less to be apprehended, viz., that the florid blood of the central circulation be gradually overpowered by the black inarterializable blood coming from the remote vessels. It must be obvious, that if florid blood be drawn from a large vein, although the excitement of the circulation may be moderated, the chances of secondary collapse are increased. When, however, we open a small vein, more remote from the centre of the circulation, the blood drawn contains a larger proportion of black particles, and thus a double object is accomplished, for we both lessen the tension and excitement of the blood-vessels, and remove the black blood, which might be the cause of future danger. I have persuaded myself, that I have seen more benefit result from opening a vein of the foot at this period of the disease, than would have been effected by a bleeding practised in the ordinary way. I acknowledge the difficulty of forming any certain judgment on this matter, but I still incline to follow the practice, or, if circumstances permit, to apply as many leeches to the feet as may answer the purpose of a general bleeding.

The following are the principles on which the preceding mode of treatment is founded, or, to speak in medical language, the indications which it is calculated to fulfil. I shall merely enumerate them, without offering any remarks. They are, 1st, To check the diarrhœa and albuminous discharge; 2d, To diminish the quantity of black blood, destitute of serum, and inarterializable;

3d, To promote the re-absorption of serum; 4th, To supply liquids to all the surfaces of the body, capable of absorbing them; and, 5th, To promote the excretion of bile.

I shall conclude with offering a few remarks on some of the remedies which have obtained most celebrity in the treatment of cholera.

Opiates are the remedies most worthy of reliance at the commencement of the disease; from their power of suspending the organic actions of the system, they are successfully employed in checking the diarrhœal and albuminous discharges. The same power renders them, in a high degree, hurtful, in the later stages of the disease; they lull nature asleep when she should be exerting herself to rescue the patient, or, to speak without a metaphor, they suspend the action of the absorbents, and the excretion of bile, on which the recovery of the patient depends.

Bleeding, when practised at an early period, seems to be chiefly serviceable, by diminishing the quantity of black blood which would oppress the system at a more advanced stage of the disease. It is highly dangerous, when attempted after the pulse has begun to sink, as it has then been frequently found to induce an immediate and fatal collapse. It does not appear, even when performed early, to prevent the collapse, but it increases the chances of recovery from that state. If an attempt to obtain blood be made when the circulation is feeble, it will be most safely done when the patient is lying in the warm bath. When blood is drawn at a later period of the disease, the operation serves both to moderate the violent action of the heart, and to diminish the quantity of black blood; and, as I have remarked above, it appears to be the more useful, according as the

vessels, from which the blood is obtained, are smaller and more remote from the centre of the circulation.

Dr. Stevens' Saline Powders taken every hour, in a tumbler of water, have appeared to me highly useful, but I think it probable, that the liquid, in which the powders are dissolved, is the most important part of the remedy. The quantity of saline matter taken at once seems to be too great, and often excites vomiting.

Stimulants have appeared to me to tend only to inflame the stomach, and to be of no use in exciting the heart to a salutary action. They should never be used in larger quantities than to act as cordials to an irritable stomach. Employed on the principle on which they are used in typhus, they are worse than useless. The injection of spirits and other stimulant liquids into the bowels is still more highly pernicious, causing inflammation and ulceration of the colon and rectum, as was repeatedly ascertained by dissection.

Tobacco, Strychnia, Prussic Acid, Galvanism, Boiling Water, Firing the Spine, or applying the Cautery actual or potential to any other part of the body, I never saw of any use, nor do I think the employment of them supported by any rational views of the nature of the disease. Large doses of Calomel, or of Lead, internally, I never thought of use, and I have persuaded myself, that I have found both detrimental. Nature seems, indeed, to abhor all violent remedies in this disease; she herself effects a cure by slowly restoring the constitution of the liquids of the body, and she will not admit of any practice but that founded on her own principles.

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