patient's complaint, I at once resolved to apply two galvanic batteries of the size of a shilling each, above the seat of mischief, immediately over the spine, in the manner advised in the former case. The aperients were continued, and Donovan's syrup of bark in half-drachm doses, with five minims of dilute hydrocyanic acid, P. L. 1836, was prescribed to be taken twice daily. On the seventh night she complained of a good deal of pain in the back. To take morphine hydrochlor. gr. ss. at bedtime. In the morning had passed a good night. Eschars forming, covered with a white powder. In twelve days they separated, and were then dressed with savine ointment.

From this day my patient became rapidly convalescent, and in a few weeks returned home quite well.

I could easily multiply cases of the good effects of counter-irritation judiciously applied. I do not attach much importance to the galvanic action produced by the apparatus, but merely recommend it as being an excellent substitute where the more formidable remedies, such as potassa fusa, moxæ, or the potential cautery, may be objected to on account of the suffering they entail, and which in some constitutions is an insuperable bar to their use.

Cheltenham, August 1849.

CONTRIBUTIONS TO THE PATHOLOGY AND TREATMENT OF CHOLERA.

By JAMES BIRD, A.M., M.D., formerly Surgeon of the European General Hospital at Bombay, and late Physician-General, Bombay Army.

(Continued from last Number, page 724.)

III. PARTICULAR SYMPTOMS ORIGINATING IN THE PERVERTED FUNCTION OF INDIVIDUAL ORGANS.

Gastro-enteric Discharges. In fever and common Cholera Morbus of the autumnal months, the discharges from the stomach and bowels consist of vitiated secretions of the abdominal viscera; but in the disease known under the name of *Asiatic Cholera*, running into the asphyxial form, the several gastro-enteric secretions are suspended, though there be copious intestinal discharges, consisting, according to the best chemical examination, of effused *blood plasma*, exuding from the capillaries after normal secretion has ceased. The occurrence of these discharges, which bear, as I have said, no relative ratio to the severity of the other symptoms, seems, however, secondary to the blood lesion, from which those abnormal changes in the respiratory, circulating, and nervous systems, which constitute the phenomena of Cholera, derive their origin. The vomiting was not so constant a symptom in the first stage of the disease as was the diarrhoea, but generally appeared with the development of the second stage. Both have been considered, by some observers, as curative efforts of the system, to relieve the congestion of the abdominal venous capillaries; but this opinion is irreconcilable with the beneficial therapeutic effect of astringents, in combination with medicines that allay irritation, to restrain the excessive intestinal exhalation

of Cholera fluid, containing, as Dr. Parkes and others have ascertained,¹ an abundance of alkaline chlorides, phosphates, and sulphates, and a certain proportion of albumen, along with masses of flocculent matter, considered by Andral to be *modified mucus*, but viewed by Parkes as *modified fibrine*, like what is exuded in the low organization taking place in the follicular deposit of typhoid fever. Masses of this exudation block up the biliary duct, and render viscid the biliary secretion, which is obstructed in its course, but is not altogether suspended. Boehm, who first completed the microscopic examination of these *cholera masses*, referred them all to changes in the epithelial coat,—an opinion which Dr. Parkes satisfactorily shows to be erroneous, there being no proof of the separation of the epithelium until after the death of the patient. *The stools contain a quantity not more considerable than is present in common diarrhœa, if even so much.* It is therefore evident, that the normal *gastro-enteric* secretion is suspended, and that the fluids exuding from the stomach and bowels contain portions of the blood constituents, some of which appear to be rather *altered in quality* than *increased in quantity*. The relation of these phenomena to the physical condition of the blood and its component elements, is an important link of investigation in the chain of effects, which binds together the progressive phenomena of Cholera; and though much has been already done, yet much remains to be effected by future investigators, to account for discrepancies of result, and establish the truth.

Physical and Chemical Condition of the Blood. In the epidemics of 1818 and 1819, both Europeans and Asiatics were generally bled when attacked by Cholera; but, though I frequently opened the temporal artery and jugular veins, in the worst collapsed cases which were then received into hospital, the blood was so viscid, black, and tar-like, that I seldom succeeded in obtaining any considerable quantity even while the patients were in the hot bath. In the earlier periods the blood flowed more freely from the veins of the arm, though it trickled down in a small, feeble stream, the central portion of which had a florid appearance, while the parts on either side were much darker. When left to coagulate, the clot was soft and loose, and its top covered sometimes by a thin, sily film. The cases in which this film appeared were chiefly of a gastric character, such as some Continental writers denominate *Cholera Sicca*, being accompanied by a slight degree of diarrhœa, but by much burning pain at the præcordia, great irritability of the stomach, sometimes vomiting of watery fluid, intense thirst, a small frequent pulse, and less diminution of animal heat than usually attends the more severe forms of the disease.

The alterations which the blood undergoes in composition are yet more important than its exterior character, in enabling us to judge of the general condition of the system in these attacks. Dr. Garrod's late communication on the Pathological Condition of the Blood in Cholera,² contains the results of former investigations, and what we have since learned on the same subject. All these analyses tend to show that the water of the blood is much diminished in quantity, and that there is a corresponding increase of the solid portion, especially of the albumen;

¹ LONDON JOURNAL OF MEDICINE, No. II, for February 1849, pp. 141 and 161.

² LONDON JOURNAL OF MEDICINE, No. V, for May 1849, p. 409.

that the diminution of its alkaline reaction is not due to the loss of salts, but to the impeded excretion of organic acids constantly formed in the system; that the fibrine undergoes changes of quality rather than of quantity; and that urea, in increased quantities, exists, but that the amount differs considerably in the different stages of the disease; being but small in the intense stage of collapse, increasing during reaction, and in excess when consecutive febrile symptoms occur. The relation of these changes to the ascertained nature of the *gastro-enteric discharges* must be manifest, viz., an increased secretion from the alimentary mucous membrane, of thick, white, mucaginous matter, much resembling pus, but probably consisting of modified fibrine, and generally accompanied by excessive intestinal exhalation of water from the blood, carrying with it a certain amount of salts, and causing the darker colour and more viscid state of the circulating fluid, which thus attains a maximum of specific gravity and tenacity, that render it unfit for healthy secretion and the ordinary vital operations of the system.

It may be necessary here to notice that disorganization of the blood corpuscles, which, according to the microscopic observations of Professor Webb of Calcutta, and of others, has been found existing in Cholera, and has been regarded by them as the cause of that loss of power in the blood which renders it incapable of absorbing oxygen, destroys its normal endosmotic power in the lungs, and gives rise to that paralysis of the pulmonary capillaries from which all the morbid changes observed in Cholera necessarily follow. Some further observations on this head are required to establish, or disprove, the truth of these conclusions; Dr. Gairdner having lately found that the microscopic appearances of the blood presented nothing unusual; and Dr. Garrod having seen only in one case, any abnormal appearance of the blood under the microscope.¹

Respiration and Circulation. Anxiety at the præcordia, and some degree of embarrassment in the pulmonary circulation, marked by yawning and sighing, seemed to attend the first and second stages; but in the *third* one, and period of full development, the respiration became quick and anxious, as if the lungs were imperfectly filled by the inspired air. Prior to 1839, I made no observations on the sounds of either the respiration, or of the heart; and, such being imperfect, I must here have recourse to Dr. Parkes's excellent and instructive remarks on this subject, the truth of them being established by the pathological anatomy of the disease. Slight dyspnoea, tightness, and oppression, were very usual symptoms in the sixty-nine fatal cases seen by Dr. Parkes. The average number of respirations was sometimes very great at a comparatively early period; the majority breathing from twenty to twenty-eight times in the minute, when first seen. The stethoscopic indications of change in the pulmonary organs connected with these symptoms, were, an evident lessening of the inspiratory murmur, which become shorter and bronchial in character, while the expiratory murmur became more lengthened and audible than usual. In several cases, muco-crepitant, mucous, or sonorous râles, were heard at times in one part or other of the chest.² Paralysis of the pulmonary air-cells, from loss of power in the blood to

¹ LONDON JOURNAL OF MEDICINE, vol. i. p. 428.

² Researches into the Pathology and Treatment of Asiatic Cholera. By F. A. Parkes, M.D. Lond. p. 67.

become arterialized, and increasing debility in the muscles of the glottis, and those which dilate the chest, by which normal respiration is brought to a close, will account for that *aphonia* which forms so remarkable a feature of some Cholera cases, where the patients cannot speak beyond a whisper.

Synchronous with, if not prior to, these abnormal changes of the respiratory movements, the arterial column of blood was found to be diminished, and the venous circulation proportionately obstructed. The impaired action of the heart was in constant ratio to the smallness, rapidity, or intermission, of the pulse at the wrist, which was generally increased in frequency, and very feeble.

Cyanosis, Diminution of Heat, and Cold Sweats. The blue tint of the skin, which was so general a symptom of the worst forms of the malady, had its origin in that imperfect sanguification by which the unoxygenated arterial blood is conveyed in a nearly venous state to the cutaneous capillaries, as manifested by the livid appearance of the extremities, and particularly the skin covered by the nails of the fingers and toes.

This pathological state of the cutaneous capillaries and their circulating fluid, admitting no longer of the usual union of oxygen and carbon, to maintain the animal heat at its normal standard, is followed by a diminution of it on the surface of the body, and a suspension of the natural sebaceous secretion from the skin, with a corresponding increased exhalation of watery vapour.

Præcordial Pain and Cramps. The painful sense of pressure at the præcordia, and the commencement of cramps, were most generally associated together in cases where the nervous energy was partially depressed, or in those where slight symptoms of reaction appeared. The most usual period of the appearance of these muscular spasms, was towards the end of the second stage, when there were present symptoms of irregular or defective innervation, with distinctly marked indications of venous congestion; but, as nervous irritability decreased, and the powers of life became paralyzed in the progress of the third stage, the cramps altogether ceased. The relation between them and the symptoms of *gastro-enteric* irritation seemed to be most intimate; and their severity was in constant ratio to the irritability of the intestinal mucous surface, and its efforts to expel the scanty flocculent stools which followed the more copious watery purging. These cramps chiefly attacked the superior and inferior extremities, and may be viewed as the result of reflex irritation acting on the cerebro-spinal axis.

IV. POST-MORTEM APPEARANCES AND PATHOLOGICAL ANATOMY.

Two very valuable and interesting memoirs on the anatomico-pathological appearances in Cholera have been lately given to the public: one of these, in the *Monthly Journal*, is by Dr. W. Gairdner, Pathologist to the Royal Infirmary of Edinburgh; the other, by M. Raikem, was communicated to the Belgian Academy of Medicine.¹ In the former, only slight allusion is made to the condition of the lungs and other thoracic viscera; and in the latter, several important points of investigation are but partially noticed. Many and varied opportunities, during the different years of Cholera prevailing in India, having occurred to

¹ For a translation of it, see LONDON JOURNAL OF MEDICINE, August 1849, p. 755.

me for correcting observations, and modifying opinions, on this subject, I shall here give several detailed post-mortem examinations, followed by a summary of pathological changes most usually present in the several modifications of the disease, in the hope that, at no very distant period, I may be enabled to present these in a tabular form, together with a more extended series of necroscopic examinations, collected from various sources.

ILLUSTRATION I. *Kaira, 20th March, 1820.* Peter Collis, an artilleryman, aged about 30 years, was admitted yesterday evening into hospital, in such a state of exhaustion that he could scarcely answer the questions put to him. The men who brought him to hospital, stated that he had been attacked by the disease an hour before admission, and that, during this time, he had been purged eight or nine times, and had passed nothing but water. Stomach irritable, features shrunk and hippocratic, skin cold, pulse frequent and feeble, violent cramps in the muscles of his legs and abdomen. According to the then Indian practice in Cholera, a vein was opened in the patient's arm, and the blood allowed to flow till ten ounces had been abstracted. The pulse became more feeble, and the cramps were not relieved. Twenty grains of calomel, and a draught containing forty drops of tincture of opium, and a drachm of aromatic spirit of ammonia, were then administered. The patient was put to bed, was well covered by blankets, had bottles of hot water applied to his feet and legs, and took, every half hour, a drachm of aromatic confection, with thirty drops of aromatic spirit of ammonia in two ounces of water. The purging and vomiting continued; and when I again saw him, about an hour and a half after his admission, he was pulseless, but had still slight cramps of the muscles. Was put into a very hot bath, which caused a temporary restoration of his pulse; but he continued to sink, and died this morning about 7 A.M., or little more than twelve hours from the time he was first attacked. A necroscopic examination of the body was made about eight hours after death.

General appearance. The skin of his face, neck, and back, was of a deep purple hue; and that of his hands and fingers shrunk and corrugated.

Head and spine. There was more than a normal quantity of blood in the large sinuses of the dura mater; the veins of the pia mater were turgid, red points in the white substance of the brain very numerous, and a considerable amount of fluid effused into the ventricles. On opening the spine, the ligamentous sheath of the *medulla spinalis* appeared distended with fluid; and on slitting it open, a considerable quantity of effused serum escaped.

Thorax. The lungs were of a deep purple hue, and emphysematous; the right auricle of the heart much distended by loosely coagulated blood, as were the two *venæ cavæ*.

Abdomen. The liver was of a deep purple hue generally, and in some places, particularly at its edge, quite black; there were several old adhesions between it and the diaphragm. The gall-bladder was distended by black ropy bile, which did not flow into the gall-duct even when the gall-bladder was squeezed forcibly; but on a silver probe being introduced into the duct, it passed readily, though this appeared to be obstructed by viscid mucous matter. The spleen was a little

larger than natural. The mucous membrane of the stomach, which contained the rice-water he had drank, shewed spots of red vascularity near the pyloric opening. A large quantity of white thick matter, resembling mucus, was found adhering to the mucous coat of the jejunum and ileum; which appeared, after this adhering matter had been removed, to be as red and vascular as if it had been prepared with fine injection. The bladder, which was contracted, contained no urine. The kidneys were pale and granulated.

ILLUSTRATION II. *Kaira, 4th July 1821.* Thomas Foster, an artilleryman, 27 years of age, was discharged from hospital on the morning of the 3rd July, cured of chronic hepatitis. The same evening he got drunk, and slept out all night in the open air, where he was exposed to the cold and wet of the season. Was admitted this morning with symptoms of the highly collapsed form of Cholera Morbus, and died seven hours after his admission, and thirteen hours after the appearance of the first symptom. A post-mortem examination was made three hours after death.

Chest. The lungs were emphysematous and crepitant.

Abdomen. The small intestines were externally of a vermillion tint; internally, the villous coat was a little more vascular than natural, and contained a large quantity of lactiform fluid. The large intestines were contracted. A slight contraction in the middle of the stomach formed this organ into two bags. The liver was of a livid brown colour, and in the first stage of schirrhosis; it presented thread-like white lines beneath the peritoneal coat, appearing like small ascarides imbedded in the glandular part. Old adhesions were found between the liver, spleen, and diaphragm. The gall-bladder was filled with dark green ropy bile.

Brain. The dura mater was adhering to the skull cap, but did not exhibit any appearance of congestion, which, however, the pia mater did. The lateral ventricles contained from four to five drachms of limpid fluid, and about one ounce of the same had been effused at the base of the brain.

ILLUSTRATION III. Serjeant-Major Tomlinson, of the horse artillery, aged 28 years, was taken ill about 6 A.M. on the morning of the 5th of July 1821. Was attacked by purging, soon succeeded by vomiting, and a considerable degree of languor and debility. The symptoms increasing in violence, he applied for medicine about 8 A.M., when twenty grains of calomel and a draught of laudanum were administered. The medicine was vomited soon after, but was repeated at 10 A.M., and with the same effect. As I myself was unwell, I requested Mr. Assistant-Surgeon Mack to see him at 1 A.M. The irritability of the stomach and bowels was then very great; the tongue white and loaded; thirst great; pulse 66, and rather full; accompanied by extreme languor. No fixed pain of any part. Mr. Mack bled him from the arm; ordered the calomel and draught to be repeated; applied a blister to the epigastrium; administered assafoetida enemata, with tincture of camphor and opium; after which remedies the vomiting was relieved, but the purging of rice-water-like stools continued unabated, and the pulse became weaker. Vertigo, with tinnitus aurium, cramps, and clammy perspirations, supervened; and all the symptoms becoming worse, he

died about 12 P.M., or eighteen hours from the attack. A necroscopic examination of the body was made ten hours after death.

Head. Firm adhesion of the dura mater to the skull. The vessels of the pia mater were a little more distended with blood than usual. The lateral ventricles of the brain, which were much enlarged, contained a little bloody serum. An ounce or more of the same fluid was found at the base of the brain.

Chest. Very extensive adhesions of the pleuræ on both sides to the front part of the ribs; the lungs not fully collapsed, and of a purple hue in some parts of the posterior surface. On cutting into their substance, a frothy bloody mucus flowed from the incision, as seen in pulmonary oedema.

Abdomen. The intestines had assumed a leaden colour. The liver, which was attached to the diaphragm, etc., by several old adhesions, though not much enlarged, seemed a coagulated mass of blood. The gall-bladder was filled with dark viscid bile. The other viscera were not examined.

REMARKS. The appearances after death in these two cases are, on the whole, analogous. A greater vascularity of the pia mater than natural, effusion of serum into the ventricles of the brain, red vascular patches in the villous coat of the intestines, and marks of congestion of blood in the liver, point out a similarity of disease, though somewhat modified by the accessory circumstances of each case. The frequent watery stools which accompanied the disease, the cold extremities, and the small feeble pulse, followed the accumulation of blood in the large internal vessels of the body, oppressing the vital powers, and impeding the action of the heart. In Tomlinson's case, the quantity of blood in the liver, and the blueish tinge in the villous coat of the intestines, indicated a greater degree of congestion than there was in Foster's. The adhesions of the pleuræ in the former instance, by impeding the action of the lungs, contributed to produce this effect; and the structure of the liver in the latter seemed unfavourable to the free transmission of blood; as the thready appearance of its peritoneal coat shewed that it was approaching that state which Ballie considers the first step in the progress towards the formation of schirrhus liver. The total absence of bile in the stools and intestines, arose probably from the viscid nature of that fluid, which became an obstacle to its egress from the gall-bladder.

ILLUSTRATION IV. Tannah Garrison, 15th September 1818. A peon of the Bazar establishment was brought yesterday, 2 P.M., in the last stage of Cholera, to the Native Hospital. He had been ill between eight or nine hours, and was in a state of extreme collapse, all arterial action having ceased. Died in the course of the night. A post-mortem examination of the body, seven hours after death, was made this morning.

Head. In removing the skull-cap, the vessels of the dura mater, which were lacerated, poured out a large quantity of dark venous blood; the veins of the pia mater were also very turgid, and indicated much congestion. On making a section of the brain, the red points in the medullary substance appeared very numerous; the amount of fluid in the lateral ventricles was small; the venæ magnæ Galeni were distended

by blood to the size of a common crow-quill; and the veins at the base of the brain were gorged with blood.

Thorax. The lungs were emphysematous, of a deep purple posteriorly, and exhibited some sanguineous engorgement. The pericardium being laid open, the right auricle and ventricle were relaxed, and filled by dark coagulated blood; left auricle empty, and left ventricle containing a small quantity of dark blood.

Abdomen. The intestines were greatly distended by flatus. The peritoneal coat of the stomach, at the pyloric end, was of an unnatural red tint; but on being laid open, the mucous coat seemed natural. The peritoneal coat of the duodenum, jejunum, and ileum, was generally abnormally red and vascular, but in parts of a dark purple. These intestines contained a small portion of dark mucous matter, streaked with blood, adhering to the villous coat. The mucous coat of the cæcum and colon was of a dark leaden colour. The liver seemed natural; but the gall-bladder was filled with black inspissated bile. The spleen presented nothing unusual.

The post-mortem appearances in the following illustrations were recorded by Dr. Morehead, now Professor of Medicine in the Grant Medical College at Bombay, and formerly my assistant at the European General Hospital.

ILLUSTRATION V. William Taylor, aged 39 years, a man of dissipated habits, and no fixed employment, admitted into hospital at 4 P.M. on the 19th of March 1840. Had passed many rice-water-like stools, and vomited frequently before admission; tongue white; countenance sunken; voice and pulse feeble; skin quite cold. Died eight hours after admission. A necroscopic examination of the body was made eight hours after.

Head. The vessels of the membranes were turgid with blood, and the substance of the brain was of a rosy tint, and presented numerous bloody points. There was a veil of serum on the upper surface of the brain, and about an ounce at the base of the skull.

Thorax. The lungs, moderately collapsed, were somewhat congested with blood at the posterior parts. The coronary vessels of the heart were turgid with blood; and the cavities, chiefly of the right side, were distended with dark fluid blood.

Abdomen. The omentum and peritoneal coat of all the intestines had a deep blush of redness. The stomach, which was much distended, filled the left hypochondriac and epigastric regions, and part of the right hypochondrium, pushing the liver within the arch of the ribs. The mucous coat of the stomach was much mammillated, thickened, and pale in colour. There was no distension of the intestines, and the mucous coat of the small ones was of a rosy tint, presenting well developed villousities, but no enlarged glands. The mucous coat of the colon was pale, and its follicles not apparent.

ILLUSTRATION VI. Simon Francis, seaman, aged 22 years, admitted at 5 P.M. on the 6th of April 1840. Had been passing frequent rice-water-like stools for more than an hour before admission, and had vomited several times; complained much of oppression at his chest, and pain in the epigastrium; countenance sunken; voice feeble; pulse scarcely perceptible; tongue white, and thirst urgent. Died in little more than nine hours from the commencement of the attack. A

necroscopic examination of the body was made twelve hours after death.

Head. The vessels of the membranes were turgid; and there was more than the usual quantity of effused serum in the ventricles and at the base of the brain. The substance of the brain was of a darker tint than usual, and presented many bloody points.

Thorax. The left lung was emphysematous, and the right one compressed by old adhesions. The venæ cavæ were filled with blood, but the heart was flaccid.

Abdomen. The peritoneal coat of the intestines had a light vermilion tint. The small intestines were filled with rice-water-like fluid. On these being laid open, the mucous coat at the end of the ileum was pale and studded with mucous glands, which stood in prominent relief, each white, and of the size of a mustard seed; the villi of the jejunum were distinct, and its mucous surface pale.

ILLUSTRATION VII. John Paget, aged 47 years, admitted at 2 A.M. the 9th of April 1840, after having been ill for about six hours with vomiting, purging of watery stools, and cramps. Countenance not much sunken; skin damp and cold; pulse feeble. The cramps and purging ceased about an hour and a half after his admission; his respiration became greatly oppressed in an hour afterwards; and death followed at 5 A.M. on the same day, or ten hours from the commencement of the attack. A necroscopic examination of the body, six hours after death, revealed the following appearances.

General Appearance. Body stout and fat.

Head. There was moderate turgescence of the membranes of the brain, and many dotted red points were visible on incision of its substance; but there was no veil of serum on its convex surface.

Thorax. The lungs were anteriorly emphysematous, and posteriorly œdematous; the heart was loaded with fat, and its right auricle filled with blood.

Abdomen. There was a very faint blush of redness on the peritoneal coat of the intestines; the omentum was loaded with fat; and the liver was pale.

ILLUSTRATION VIII. Lewis Simas, a pauper, aged 11 years, admitted the 16th of April 1840. Had been suffering from diarrhœa and vomiting for three days previous to admission; said that his abdomen was tender, and that he had been passing stools mixed with blood. Leeches to the abdomen, an opiate enema, and warm bath, were administered with relief: but on the 17th, he was severely attacked with vomiting and purging, and sank rapidly from collapse. A necroscopic examination of the body was made twelve hours after death.

General Appearances. Body of a slender form.

Head. There was much turgescence of the vessels of the membranes, and a very considerable amount of effused serum on the convex surface of the brain. The medullary substance was generally soft, and shewed many bloody points.

Thorax. The costal and pulmonary pleuræ were connected together by old adhesions, and the posterior part of both lungs was œdematous.

Abdomen. The liver was natural. The mucous coat of the stomach presented marbled red patches, but was firm in texture. The intestines

were somewhat distended, and their fluid contents were of a light grey colour. The patches of Peyer's glands, at the end of the ileum, were much developed. The mucous coat of the colon was of a light grey colour, and its follicles were not very distinct.

These individual illustrations of the anatomico-pathological appearances in Cholera, have been taken from cases of the disease as it appeared at various times in India. They were recorded without any preconceived notion or theory of the disease, likely to bias the mind in its observations; and having been detailed by different individuals (myself, and Dr. Morehead), must be allowed some weight, as the means of establishing or disproving questionable points of opinion on this head. They agree generally with the observations of M. Raikem, lately communicated to the Belgian Academy of Medicine; and do not bear out some of Dr. W. T. Gairdner's conclusions, "*that it is an error to conceive of congestion as an essential or universal condition in this disease.*" This remark is true, as it applies to the *liver, spleen, and kidneys*: the congested condition of the liver and kidneys being contingent on there having been little or no *exosmosis* from the intestinal exhalents and minute venous trunks of the portal vein. But, assuredly, *mechanical congestion* of other parts of the venous system, from the cessation of the endosmotic power of the lungs, is an essential condition of Cholera, and is manifested by the right side of the heart and *venæ cavæ* being loaded with blood, and by the cerebral veins and venous sinuses and vessels of the medulla spinalis being in the same state, greater or less, according to the smaller or greater amount of serous effusion that may have taken place from the vessels.

Post-mortem observations in Cholera cases are of acknowledged importance in studying the disease, in order to obtain a more exact knowledge of its nature, and an improved method of treatment: but, *pathological anatomy* not being *pathology*, if we would obtain a more comprehensive knowledge of the *series of morbid changes* which constitute this *most obscure if not incomprehensible* malady, we must study the *defects of the vital principle*, and the *diminished constitutional power of resistance against external agents, which precede and regulate* all the subsequent phenomena. It may be useful, however, and partly contribute to this most desirable investigation, as the foundation of a better therapeutic system, to give here a summary of the characteristic groups of morbid anatomical changes, in both solids and fluids, which distinguish Cholera from, or associate it with other diseases, to which it seems allied. The heads of this summary will be nearly those already given in Dr. Gairdner's valuable report referred to, with such emendations as seem necessary and are warranted by my own observation, and by the experience of others.

I. EFFECTS OF PREVIOUS DISEASE. The conclusion, that individuals of unsound constitution are not more liable to Cholera attacks than those in perfect health, requires a greater collection of anatomico-pathological facts, than that on which this statistical induction has been made, before its establishment can be admitted. It is in complete opposition to a well ascertained law of predisposition in this and other diseases—namely, that whatever has a tendency to render sanguification and nutrition defective, to pervert secretion and weaken the constitutional powers of

resistance to morbid causes, favours the production of Cholera collapse. Though many persons in perfect health were attacked by Cholera in 1818, under the strongly epidemic influence of the atmosphere then prevalent, yet the chief victims of the malady were the *aged, emaciated, and previously diseased*. The chronic lesions, found most influential in producing Cholera development, were those which impeded the due performance of the respiratory function; a conclusion fully borne out by the cases given in illustration.

II. CONDITION AND SECRETION OF THE INTESTINAL CANAL. M. Raikem's observations on this head, are confirmed by those made in India. Where the amount of watery purging had been least, the mucous intestinal surface was coated with a thick layer of white creamy matter, associated with much hyperæmia of the membrane, visible after the mucous or fibrinous exudation had been removed. Sometimes the stomach and intestines contained large quantities of this whitish creamy matter, occasionally tinged with blood. Andral considers the fluid, which constitutes the rice-water-like stools of Cholera, to be only mucus secreted in large quantities and modified in its qualities; in which opinion Dr. Gairdner coincides. But Dr. Parkes, with well considered grounds for opinion, is disposed to consider *all the flocculent matter of the true Cholera stool, cells, dark yellow granules, fibres, flakes, and amorphous matter, to be but modifications of the same substance, viz., fibrine*; and that though the corpuscles seen in these Cholera masses may be mucus, yet *these fibres and flakes, in all respects chemical and microscopical, resemble those seen in the so-called inflammatory exudation matter*; and it is in the highest degree probable, that they owe their origin to effused blood plasma, which assumes with great rapidity a low, ill-defined, and non-progressive organization.¹ It is in all respects similar to the follicular deposit of typhoid fever, being a *diphtheritic exudation*,² similar to what is formed on the pharynx and tonsils, in certain morbid conditions of the blood, when its fibrine has lost its natural firmness and vital cohesion. It sometimes appears as an exudation of the *submucous tissue*, distending the *solitary* and *Peyerian glands*, so as to elevate them in patches; which yield, on section, a milky liquid, analogous to that found in the intestines, and noticed both by Drs. Gairdner and Raikem. The latter observed, the exudation generally confined to the *glandulæ solitariae*, whose base was of a pearly white, and surrounded by a sort of areola of hyperæmiated arborescent vessels, with sometimes superficial ulceration at their summit. Dr. Gairdner describes the exudation as presenting itself in ecchymosed patches distinctly circumscribed, but of greater or less extent, and in tint varying from a claret colour or deepest purple to a greyish or leaden colour. The mucous membrane of the stomach and intestines was sometimes pale, but more frequently exhibited the scattered vascular portions in the sub-mucous cellular tissue, as already described.

III. LUNGS. The lungs were sometimes collapsed and almost natural; but more frequently *voluminous and emphysematous*; of a dark purple

¹ PARKES on the Intestinal Discharges in Cholera, LONDON JOURNAL OF MEDICINE for February 1849, before quoted.

² Edinburgh Monthly Journal for July 1849.

colour, and cedematous at the posterior parts; the right cavities of the heart and venæ cavæ greatly distended with blood, which Mr. Lizars, in thirteen cases, found in a state of fibrinous coagulum, and the left side of the heart containing only small quantities of the circulating fluid: appearances which do not certainly support M. Raikem's assertion, that there is no *asphyxia* or paralysis of the lungs in Cholera.

IV. GLANDULAR SECRETION. The glandular secretions, according to the incomplete investigations we yet possess on the subject, undergo alterations in quality, and are most probably diminished in quantity. The biliary secretion appears to be retained rather than suppressed; but, though apparently abundant in the gall bladder, it contains a large amount of mucous matter, and possibly morbid constituents; experiments being still requisite to determine this point. The gall-bladder has been found studded with highly-developed hyperæmiated vascular ramifications, and sometimes containing a large quantity of clear limpid fluid; indicating that its mucous coat is in the same low state of inflammatory organization as is met with in the intestinal mucous surface. The liver and spleen, however, have not presented the remarkable signs of active disease, met with among the anatomico-pathological appearances of *remittent fever*.

The state of the kidneys, in the Indian necroscopic examinations, was seldom attended to; but Dr. Gairdner's microscopic examinations of these organs are of the highest interest, more particularly when we connect his observations with the morbid state of the intestinal mucous surface as observed in Cholera. Dr. Gairdner says, *the kidneys, however, appeared in many cases to have undergone changes, the cortical substance being pale and turgid, and the tubuli uriniferi gorged with imperfectly developed epithelium, which was mostly loaded to an unusual extent with oleo-albuminous granules. A similar state of the kidneys occurs after scarlatina, and not unfrequently after typhus fever, and some other acute diseases.* This ascertained condition of the kidneys is, as it regards the condition of the blood, of the utmost importance in guiding us to a right understanding of the phenomena of Cholera. Dr. Garrod ascertained that the urea of the blood gradually increases in amount, from the cold stage to that of febrile reaction; and explains the phenomenon by supposing that, in intense and sudden collapse, the urinary excreting function and also the vital metamorphoses are diminished or suppressed, and therefore the formation of urea is likewise nearly suspended; but that when partial reaction ensues, and the vital changes take place with greater activity, urea must accumulate in the blood, if the function of the kidneys be not at the same time restored.

V. THE NERVOUS SYSTEM. The *spinal chord* was only examined by me in two cases, and in one only of these were the sympathetic ganglia, and substance of the medulla oblongata and medulla spinalis, noticed; they seemed somewhat more vascular than natural. Dr. Gairdner states that the sympathetic ganglia, and the pneumo-gastric nerves, were repeatedly examined; but nothing unusual, except, in a few cases, slight ecchymosis, was discovered. Well marked venous congestion of the substance of the brain, and of the cerebral membranes, was frequently present; in one case, softening of the cerebral substance; and, in most, copious serous effusion into the ventricles.

PATHOLOGICAL SUMMARY. Some further investigations on certain doubtful points, the chemical constituents of Cholera bile, and of the effused serosity into the brain and other cavities; more precise microscopic examinations of the state of the medulla oblongata, medulla spinalis, and ganglionic nerves; and a more extended series of chemical and microscopic observations on the conditions of the blood, its degrees of coagulation and fluidity, the tenacity of its fibrine, the ratio of its albumen and salts to the healthy standard and the appearance of the blood vesicles, seem yet necessary, before we can obtain a well established pathology and rational therapeutics of this disease. It is also of essential importance that authors state the stage of the disease, to which their observations refer. So far as our present investigations extend, they warrant us in adopting the following **CONCLUSIONS**.

1. That Cholera begins in a change by the blood, or morbid arrangement of its ultimate particles; by which a diminution or altered quality of its fibrine and normal ingredients takes place, impairing the formative and vital power of the circulating fluid.

2. That this altered condition of the blood, caused by unhealthy assimilation and improper food, *malarious influence*, damp ill-ventilated apartments, unhealthy exhalations from drains, and epidemic constitutions of the air, is generally manifested by certain low inflammatory exudations on the mucous surface of the stomach and intestines, accompanied by progressive, and sometimes sudden, loss of function in the nervous, respiratory, circulating, and secreting systems.

3. That the concatenation and succession of phenomena which mark the full development of a Cholera attack, consist of a depression of nervous power, a cessation of endosmotic function in the pulmonic cells, a state of congestion and arrest of the blood in the right cavities of the heart and veins, emphysema or œdema of the lungs, cyanosis and loss of animal heat, increased exosmotic exhalation from the mucous membrane of the alimentary canal and cutaneous surface, increasing carbonization of the blood and diminution of its quantity in the arterial system, suspension of the urinary secretion, and general *toxæmia*.

V. TREATMENT.

Cholera being, pathologically, a low inflammatory irritation of the mucous membrane of the alimentary canal, with deficiency of vital power in the blood to retain its fibrine in aggregation with the other elements, manifested generally by *premonitory diarrhœa*, consecutive cessation of endosmotic function in the pulmonic cells, and arrest of healthy fecal secretion, the indications of cure are:—1. To allay irritation of the stomach and intestines, check the unhealthy intestinal secretion, and restore the natural action of the skin. 2. To support the powers of the nervous system and heart, and prevent congestion in the lower part of the brain and spinal marrow during the development of the second stage. 3. To promote and restore the biliary and urinary functions so as to eliminate *toxæmic* elements from the blood. 4. To moderate the violence of reaction, subdue cerebral and abdominal complications, equalize the general circulation, and restore tone to the system.

If the premonitory symptoms of the first stage be attended to, and timely treatment of these be adopted, by allaying irritation of the

mucous surface of the alimentary canal, restraining the diarrhoea, and restoring healthy perspiration to the skin, the symptoms of the next two stages, or developed Cholera, may be generally prevented. If the stomach be oppressed and loaded by undigested contents, it will be sometimes useful to relieve it by an emetic of mustard and warm water, or one of sulphate of zinc; but caution in the administration of emetics seems necessary, lest they increase the intestinal irritation, and add to that nervous depression which precedes the development of Cholera. Purgative remedies are, for this reason, yet more to be avoided in *Choleroïd* diarrhoea, as I have known several individuals in India, who, on feeling oppressed and anxious under the indigestion and slight bowel derangements which precede Cholera, took nothing more than rhubarb, and were soon after attacked by symptoms of the second stage. Case II, which has been related, under the head of Cholera modifications, was of this kind. It is therefore advisable to fulfil the first indication by administering enemata of acetate of lead and tincture of opium,¹ giving a pill of sulphate of quinine and calomel combined with catechu or extract of logwood and a small proportion of opium, to be repeated every hour, or second hour, according to the urgency of the symptoms and the persistence of the diarrhoea. Under a conviction that *gastro-enteric inflammation*, in India, associated with *diarrhoea*, generally proceeded from *malaria*, and was an effect of the same diseased irritability, which gives rise to the phenomena of fever and Cholera, I employed, many years ago, the combination of quinine and calomel, in the treatment of this class of diseases, and with much advantage. The proportion of the quinine to the calomel given was greater or less, as the diarrhoea was more or less severe; but in many cases the calomel was omitted, and one grain of sulphate of iron and a quarter of a grain of opium to every four grains of sulphate of quinine, were beneficially substituted.

Dr. Cormack, of Putney, informs me that, acting on a suggestion which I made to him, now nearly twelve months ago, he has found the citrate of iron and quinine one of the most useful medicines which can be given in the *Cholérine*, now almost universal on the Surrey side of the river. In infantile cases the remittent type is commonly well marked; and in them, specially, the combination of this preparation with astringents is useful. In the severe spasmodic cases, with much intestinal irritation, Dr. Cormack has found the *camphor-chloroform mixture* of Messrs. Smith of signal advantage, in doses of from three to six minims,² repeated every two or three hours, according to the circumstances of the case. This medicine may be also usefully given in combination with the creasote mixture of the Edinburgh *Pharmacopœia*, to allay vomiting; and Dr. Cormack often combines the creasote mixture and camphor-chloroform mixture with catechu, or such other remedies as may be indicated. The administration of sulphate of quinine with camphor, in Cholera, has also been found useful by Dr. Lorimer, of the

¹ The French have found injections of nitrate of silver very efficacious; and though I have never used them in Cholera, I am disposed to recommend them, having found them useful in dysentery.

² *Edinburgh Monthly Journal* for November 1848; also, *LONDON JOURNAL OF MEDICINE*, for January 1849, p. 102.

Madras Medical Service ; and M. Duchesne-Duparc, at Paris, has been lately recommending the former as a *prophylactic*, or rather a *curative*, for the disease. It is, doubtless, of great efficacy in preventing the depressing effects of *Choleroïd* diarrhoea, and arresting the course of the disease. The patient should at the same time use a hot bath, at the temperature of 106° of Fahrenheit, be afterwards laid in bed, and have a large sinapism applied to the epigastrium. Milder cases do well under the use of sulphate of quinine and calomel pills ; but when muscular debility is a prominent symptom, and the action of the patient's heart feeble, he should be bathed in the horizontal posture on a bed, by wrapping him in a sheet wrung out of warm water, then covering him with several blankets after the hydropathic fashion, applying warming-pans of hot water till warm perspiration appears ; when the patient may be laid in a dry warm bed. The danger of such cases is from syncope being induced by over exertion or the upright posture while in the common warm bath, the evil consequences of which I often witnessed in the first epidemic Cholera seen by me in India, where people were scalded in the hot bath, without reflection that syncope, any way induced, proves fatal to the weak circulating system. Attention to the maintaining of the horizontal posture, the employment of enemata, and all freedom from exertion, is more necessary in the second stage than even the first. To fulfil the second indication, the patient should take the quinine, combined with any preparation of iron, camphor, and a small proportion of opium, along with a draught of bicarbonate and nitrate of potass dissolved in camphor mixture, with the addition of nitrous ether ; to be repeated every hour. Small quantities of brandy, or gin, in cold soda or potass water, may be given for drink ; and if the cramps of the extremities be severe, the limbs are to be *shampooed*, or bandaged in the manner recommended by Dr. French. Dry cupping at the base of the skull and cervical region, or the application of a large sinapism along the spine, and another on the epigastrium, will be useful in this stage of congestion, and also in the fully developed algide stage. Frictions of the limbs and chest with stimulating linaments, and the application of bags of hot sand, or bottles of hot water, to restore the animal heat, are of utility.

In making use of a combined tonic and stimulating mode of treatment, with diuretics to restore suppressed urinary secretion, we at once fulfil the second and third indications of the requisite treatment. The diuretics indeed may be advantageously used, in combination with the other remedies, from the beginning ; but their action becomes more a principle of treatment in the *second* and *third* stages, when *toxæmic* elements have accumulated in the system, and have to be eliminated. In modified pyrexial cases, their utility is strongly indicated, during the temporary reaction, when *uræa* is accumulating in the blood, destroying the nervous irritability of the heart and brain, and encouraging the venous congestion of these organs. It is in cases of this kind that a timely and judiciously employed bleeding from the arm, may be of service in relieving the oppression of the heart and equalizing the circulation : but when resolved on, it should be performed while the patient is in the recumbent posture, and in the wet *cumlie*, or sheet, wrung out of scalding water. We may sometimes dispense with the use of the latter, particularly when there are symptoms of considerable toni-

city in the circulation, and of local inflammatory action in any organ. Stephen Dewer's case (p. 719) was one of this kind, in which *gastro-intestinal* symptoms were predominant, accompanied by temporary abdominal spasms, pain at the epigastrium, and pulmonic oppression, head-ache, and irregular reaction; where the excitement of various organs, following previous congestion, might be viewed as a necessary condition of their restoration to health. In such cases, as in fever, we have to equalize the circulation by remedies that give tone to the nervous, and reduce phlogosis in the circulating system. The good effect of *general* and *local* bleeding will be manifest on reference to the report of the 4th of July, when relief from cramps, and diminution of pulse followed the former; and again, when on the 8th, complete removal of epigastric tenderness was produced by the latter. In the premonitory stage of the disease, where so much good can be effected by medicine, the removal of patients from low, damp, affected localities, to higher and drier situations, where they breathe a drier and purer air, will materially aid in effecting a cure: for whether it be the relatively altered electrical state of the air to the condition of the human body, that produces such beneficial results, the efficacy of the change, in such cases, is at *least* undoubted.

Reaction, or the fulfilment of the fourth indication, must be treated on the principles applicable to varieties of fever. In thus endeavouring to introduce a rational system for the treatment of Cholera, on clear pathological principles, I have abstained from noticing the greater or less success of particular remedies, and the applicability of them to modifications of the disease; contenting myself by giving this brief outline of the treatment, on which I may probably enlarge when the present article is reprinted and published in a separate form.

27, Hyde Park Square, 17th August, 1849.

P.S. Since writing the above, I had an opportunity, (on the 22nd August), of seeing three cases of the disease, under the care of Dr. Cormack. One, an infant, was in a state of collapse, and died on the following day; another infant, in the same house, was passing into the same state, and died on the 25th. The third patient was an adult woman, who had been brought very low by the vomiting and purging. The symptoms on the day on which I saw her were precisely those of a pernicious ague: the danger of collapse seemed imminent; and there was almost total suppression of urine. She was judiciously treated by diuretics, stimulants, and a mixture of the citrate of iron and quinine. She is now convalescent. Dr. Cormack has sent me a very full account of the post-mortem appearances in the first fatal case; from which it appears that the deficiency of blood in every part of the body was most striking. The lungs were œdematous; the liver and kidneys pale; and the spleen was natural in size and consistence.

27th August.