ORIGINAL COMMUNICATIONS.

CLINICAL NOTES ON CHOLERA.

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[Continued from page 335.]

II. HISTOLOGY AND CHEMISTRY OF THE EVACUATIONS.

11. *The Vomit.* Like the "rice-water" stools, the vomit in cholera usually consists of two distinct portions, viz.: a supernatant fluid and a sediment. The former has generally a low specific gravity, ranging from 1005 to 1010: this must chiefly depend on the large quantity of water imbibed in various forms during the agonising and incessant thirst of the collapse. To test paper, it most frequently exhibits an acid reaction, which, however, is sometimes neutral or alkaline; this is evidently governed, in the majority of cases, by the nature of the ingesta. Its various degrees of clearness and turbidity, and the nature and amount of the sediment are also regulated in great measure by the food, or its disintegrated elements, contained in the stomach. The application of the heat and nitric acid test often proves the presence of albumen, and sometimes to a comparatively large amount: this also is due, in most cases, to the nature of the food, but frequently it is co-existent with, and apparently dependent on, the presence of a large quantity of epithelium and mucus; more generally, from the copious dilution with water, the fluid is not coagulable. It is usually devoid of odour, further than a faintly mawkish smell: when a distinct odour exists, it is generally borrowed from some of the ingesta; e.g., whiskey or other stimulants: it is never foetid. Its colour is most frequently pinkish red, brownish, or steel grey; it varies, however, in different patients, and in the same patient at different periods of the same day; e.g., it was not uncommon to find a collapse patient vomit, in the course of twelve hours, large quantities of fluid having every shade of green, grey, yellow, brown and red. The causation of these colours is quite independent of fluid ingesta: I believe them to be all due to the presence of bile, which becomes variously modified in appearance by the contents or secretions of the stomach. In what such modification consists is a question mainly for the chemist to investigate. The comparative suddenness of these colour-metamorphoses is a good indication of the rapidity of the changes which are in progress in the gastro-intestinal mucous membrane. In rare instances, the vomit resembles, in appearance and in chemical and histological characters, the "rice-water" stools. The proof of the presence of bile, whether the colour of the vomit be pink or grey, I hold to be that, on the application of heat and addition of nitric acid, there is obtained either a greenish, greenish-yellow, pinkish, reddish or brownish colour: the latter three colours are readily convertible, by excess of acid and prolongation of heat, into the former, but never *vice versa*. This subject I have already more fully explained in the first article of this series: I have there hinted at the importance of bearing in mind the varied action of heat and acid on the vomit, which undoubtedly contains a greater or less amount of bile,—appreciable even to the eye in most cases, in examining the question of the presence of bile in the "rice-water" stools. It may naturally, by some, be supposed that the presence of such an amount of bile, and of bile frequently so altered in colour, as is usually found in the cholera vomit, must be indicative of some severe hepatic disorder of a functional character; it is, however, easily explicable on mechanical principles; the facts are quite consistent with the belief that the duodenum, and biliary reservoir and canals participate in the inverted action of the stomach during the violent retching and vomiting which are so prominent features of the earlier stages of cholera, and that comparatively healthy bile, which is thus thrown into the stomach, is there altered by its vitiated secretion or contents.

On allowing the vomit to stand a few days, as in the

stools, an oily scum generally collects on the surface, consisting, under the microscope, of oil globules entangling a few prismatic phosphates. In one or two cases, I have found floating on the surface irregular masses of various sizes, of solid fat, resembling pieces of tallow or lard. Under the microscope, they consist of fat vesicles or cells having central radiating crystalline masses of margaric acid. I have met with fat, in this and other forms, in the fæces of cholera: here, however, it is not so directly or evidently derivable from the food as it would *prima facie* appear to be in the vomit. Its occurrence in both these matters is interesting in connexion with the general subject of the presence of fat in fæces and other excretions, and the origin and causes thereof. The vomit-scum is sometimes of a semi-viscid, frothy character, having a pinkish or reddish-brown hue, and resembles exactly the ejecta of the stomach, abounding in *sarcina*, in some cases of chronic vomiting, etc. The analogy is further borne out by the fact that, in this scum, *sarcina Goodsirii* (or *ventriculi*) is met with in greater or less abundance. I have met with it in five out of ten cases, where severe vomiting constituted a symptom of the disease: in these cases, there did not appear to have been any previously existing chronic vomiting, dyspepsia, or gastric derangement of any kind. In a few of these instances the segments of the plant were very much altered in appearance and broken up; but, in most of them, numerous very perfect specimens could be detected. Its occurrence is interesting as showing the apparent proclivity of the gastro-intestinal mucous membrane in cholera to become the nidus for the growth and development of minute vegetable organisms; of this I have already spoken as noteworthy in connexion with the discussion of the fungus-theory, and the question, whether are certain vegetable and animal organisms or parasites to be regarded the cause or effect of cholera?

The sediment, or sometimes the greater part of the bulk of the first vomits, consists of food in process of digestion. It very frequently indeed happens that the cholera seizure supervenes more or less immediately on a full meal; hence it is not uncommon to find unaltered fragments of potato, cabbage, onions, barley, herrings, beef, etc., according to the nature of such meal. I have found, though it is probably a mere coincidence and not at all a causative phenomenon, cholera more frequently following a full and hastily swallowed meal of potatoes than any other kind of food; in cases, too, where they had been taken exceptionally as a delicacy and not employed habitually as articles of food. In the subsequent vomits, the sediment gradually decreases in quantity, and becomes more homogeneous in character; its consistence is thinner, pultaceous, and resembles bread and water finely ground together; and it generally possesses the same tint as the supernatant fluid. Under the microscope, we seldom fail to detect in abundance the ultimate tissues or elements of the various articles of food already enumerated. Some combination of the following substances is generally observed; the large round cells of the parenchyma of the potato, or onion—full of starch or chlorophylle grains, or empty—entire or collapsed, or altered in various ways; the smaller parenchymatous cells of the turnip or carrot; fragments of the epidermic tissue of the cabbage, onion, potato, barley, etc.: starch grains from bread, barley, the potato, etc., some forms of the same "annular bodies" which I have already described as occurring in the stools; fragments of vegetable spirals and vessels; isolated vegetable cells of various kinds altered by the process of digestion; portions of muscular fibre; sometimes the scales of fish; fatty and oily matters, the former in the shape of large dark globular bodies surrounded with setæ or spicula and resembling *echini* in general appearance; the latter, as minute oil-globules; occasionally some animal or vegetable parasites or organisms accidentally introduced *ab extra*, e.g., *sarcina Goodsirii*, or species of *acarus*. I have already adverted to the importance of studying these organisms, evidently foreign to the human body, with a view not so much to the discovery of the causation, as the effects, of the disease. I have also referred to the value of a microscopical

examination of the stools in certain cases, as throwing some light on the nature of the food. My remarks apply with double force to the vomit, in which the food is found frequently but little altered. On one occasion, in this way, I discovered that a patient had been eating fish, an interdicted article, which was not kept in the hospital: the fact was at first strenuously denied by both patient and nurse, but, on closer questioning, it appeared that a Findon haddock had been surreptitiously supplied by her husband when admitted to visit her. These statements are not restricted to the evacuations of cholera; they are even more properly applicable to the evacuations in many other diseases and sometimes even in health. I have more than once had occasion of late to make an histological examination of fæces and vomit, and of the *post mortem* contents of the stomach and intestines, for the purpose of ascertaining the nature of the food of patients; in one instance, in a medico-legal case (of poisoning), where the very unusual contents of the stomach of themselves indicated the mode and cause of death.

Intermingled with these elements of food, there usually occur more or less pavement epithelial scales, bands of mucus, mucous corpuscles, prismatic phosphates and crystals of chloride of sodium. When the stomach contains little or no food-*débris*, the vomit-sediment has a somewhat different character; it is comparatively small in amount, granulo-flocculent in character (if I may be allowed to use such a term), and its colour varies with that of the fluid portion, being most frequently, however, dark steel-grey or pinkish; it consists chiefly of mucous flocculi, which, under the microscope, are made up of masses of epithelium scales, few of them perfect in form or size, or normal as regards transparency, most of them, on the contrary, shrunk or atrophied, granular, hazy or dark coloured; the remainder of the field is occupied by dark molecular and granular matter. This epithelium I have found in greatest abundance in vomit having a flocculent sediment, and a greyish or blackish tint; in which case, it is exceedingly dark and granular. As the retching and vomiting, characteristic of the earlier stages of the disease, decrease in amount and severity, so does this epithelial or mucous sediment diminish.

On evaporating down the filtered fluid portion of the vomit, two crystalline matters at least are met with, sometimes in considerable quantity, as in the stools, viz.; triple phosphate and common salt; the preponderating salt, however, is the opposite of that in the stools, for here chloride of sodium exists in a much larger ratio than the phosphates; this, no doubt, is due to the fact of salt being abundantly used by the lower orders as a condiment, and sufficient time not having elapsed for absorption into the system.

I think I have noticed in the vomit, and indeed in all the cholera evacuations, on allowing them to stand for a few hours or days, a great proclivity to the growth of fungi in the form of mould; but, not having made this the subject of comparative experiment, I am scarcely in a position to say whether it is greater than in other decomposing animal fluids under similarly favourable circumstances, viz.; exposure to a moderate degree of temperature and moisture, etc.

The following cases will illustrate the changes in the vomit during the collapse and subsequent stages of the disease.

CASE I. M. R., aged 37, a married woman. Admitted in deep collapse: discharged, *recovered*, sixteen days after admission.

First day. First vomit immediately after admission: 3iii. It was of a pale greenish-yellow and whey-like; somewhat darker, but of similar appearance to the "rice water" stools; it was acid, albuminous, and had an odour of spirits. Floating on the surface was a little flocculent mucus. The sediment was copious, and consisted of oatmeal, which had been taken as food in the forenoon. Nitric acid increased the greenish-yellow tint. Under the microscope, appeared delicate bands and fibrillæ of mucus, pavement epithelium, a large quantity of starch granules, certain forms of "annular" bodies, fragments of muscular fibre, epidermis of barley and oats, hairs and isolated cells of vegetables taken as food, large globular fatty bodies, minute oil globules, com-

pound granular bodies, a few crystals of common salt, and a host of molecules and granules (food-*débris*).

CASE II. A. W., a girl, aged seven years and a half. Admitted in almost hopeless collapse: discharged, *recovered*, twenty-one days after admission.

Second day. First vomit: 3iii. It was very turbid, of a dirty greyish-brown, and acid. Nitric acid produced a greenish-yellow colour. The microscope revealed, in the scanty sediment, a quantity of epithelial scales, some of them perfect in form and transparent, others elongated, fusiform, and otherwise altered in shape, granular, hazy, and dark; numbers of minute *vibrios* in active motion, "annular" bodies, potato-cells and other elements of vegetable tissues, starch granules, oil globules and compound granular bodies. Second vomit, 3iii. It was of a dark iron-grey colour, very granular, turbid, and acid. Nitric acid and heat produced a greenish yellow colour. The sediment contained very large quantities of epithelium, altered as above described, but much darker and more granular; there were abundance of minute *vibrios* in a high state of activity, and dark compound granular masses.

Third day. The colour was a light bluish-grey. The vomit was very turbid, acid, and slightly albuminous. No reaction occurred with nitric acid.

CASE III. I. S., a girl, aged six years and a quarter. *Cholérine*. Admitted in mild collapse: discharged *recovered* in three days.

First day. The colour of the vomit was light brownish-yellow: the sediment occupied half its bulk, and resembled bran or oatmeal and water. The stool was acid and slightly albuminous. Nitric acid produced a greenish-yellow tint. The microscope detected, in the sediment, a quantity of starch granules and large dark globular bodies, apparently of a fatty nature, which seemed as if surrounded with setæ or spiculæ, and resembled microscopic *echini* or minute bristly insects; they were not affected by iodine or acids, but heat caused a deliquescence or collapse of the setæ, quite altering the appearance of the bodies. There were also pavement epithelium, chiefly elongated and shrunk, "annular" bodies, oil globules, fragments of vegetable tissue, dark amorphous granular matter and portions of an *acarus*. Heat and acid rendered evident a quantity of spicular phosphates.

CASE IV. A. F., a man, aged 48. Admitted in mild collapse: *died* in the consecutive fever, in seven days.

First day. The first vomit, 3x, was of a dark chocolate colour, and acid. The sediment amounted to one-third of the bulk. There was a frothy scum of a pinkish colour, which contained a large quantity of *sarcina Goodii*, chiefly incomplete, and in single segments, pavement epithelium, perfect and altered in various ways, starch, fragments of vegetables, and oil-globules.

In the fluid removed from the stomach after death, there was a considerable quantity of the spiculated echinus-like fatty bodies mentioned in Case III.

CASE V. A. S., a woman, aged 40. Admitted in advanced collapse; *died* in continued collapse, in eighteen and a half hours.

First day. The first vomit consisted chiefly of masses of potatoes, beef, cabbage, onions, barley, etc. (i. e., an undigested meal of beef, potatoes, and broth, but recently swallowed). Among the finer part of the sediment, the microscope detected hosts of the parenchymatous cells of the potato, onion, cabbage, carrot, and turnip; tubes, spiral vessels, single cells, uncoiled spirals, and fragments of the epidermis of the same plants; shreds of muscular fibre, echinus-like fatty bodies, starch and oil-globules. On the surface, several *acari* and fragments thereof were found floating.

The second vomit was of a lead grey colour: it also contained undigested food, besides a quantity of *sarcina*, cylindrical and pavement epithelium, mucus, and mucus-corpuscles.

The third vomit more resembled the first in colour, being of a dirty light pink. The fluid portion was acid and slightly albuminous; it gave a pink reaction with nitric or muriatic acid in the cold, but a greenish-yellow with

heat and nitric acid. Its sediment resembled bran and water.

Second day. The vomits were more of a brownish yellow tint. On the surface were found floating pieces of a light greenish yellow or whitish curdy matter, which appeared to be fatty in its nature, and to be derived originally from the food. Some of them were of large size, and resembled in external appearance pieces of boiled potato; others were more like lard or suet. Under the microscope, they consisted of vesicles containing centrally radiating crystalline masses of margaric acid. They dissolved into an oil on the application of heat; in this state, they were wholly taken up by ether. When dissolved by heat, and viewed under the microscope, nothing could be seen but oil-globules.

The thin whey-like fluid portion of the later vomits (largely diluted with the water swallowed), was of specific gravity 1004, acid, non-albuminous, and gave a greenish yellow reaction with heat and nitric acid.

CASE VI. M. F., a woman, aged 40. Admitted in deep collapse; died in the consecutive fever, in two days.

First day. The first vomit was not ejected in forcible gushes, and not induced nor aggravated by the copious imbibition of cold water. It was of a pale straw colour, resembling "rice water" stools in general appearance, somewhat viscid from mucous admixture, of specific gravity 1008, alkaline, highly albuminous, and had a strong odour of whiskey. It gave a greenish-yellow reaction with heat and nitric acid. The scanty, flocculent, whitish sediment resembled that of the "serous" stools, and consisted of mucus and mucus-corpuscles, epithelium, entire and shrivelled, and a few "annular" bodies and molecular *débris*.

The second vomit was of a dark brown colour, in quantity 3ij, alkaline, and albuminous; it gave a greenish yellow colour with heat and nitric acid. The sediment was dark coloured and scanty, and consisted also of epithelium, "annular bodies", mucus, and mucus-corpuscles.

CASE VII. J. M'G., a man, aged 45. Admitted in advanced collapse, and died in collapse the same evening, in eight hours and three quarters.

The first vomit was ejected in forcible gushes (sometimes spouted several feet), to the amount occasionally of a pint at a time. It was aggravated by fluid ingesta. The fluid portion was of a pinkish red; it was acid, and of specific gravity 1005. The sediment contained a large quantity of potatoes and beef, and other articles of food but recently consumed. Heat and nitric acid caused a very fugitive increase of the pink tint, which rapidly passed into greenish yellow. Nitric acid in the cold caused a deepening of the pink colour. There was a frothy scum of a pinkish tint, which contained *sarcina*, echinus-like fatty bodies, muscular fibre, potato-cells, dotted tubes, spiral vessels, ducts, and elongated cells from the parenchyma of the onion, etc. On evaporating down the fluid portion, a small quantity of common salt, and a large quantity of phosphates, in irregular crystals, were met with. Nitric acid caused the development of a beautiful crimson tint.

The second vomit was of a deeper pink colour, and of specific gravity 1010; it was acid and non-albuminous. Heat alone diminished the pink tint; heat and nitric acid produced a dark pink; and acid, in the cold, a light pink colour, which, however, soon faded on the continued application of heat, or on exposure to the air. The scanty sediment contained mucus and mucus-corpuscles, potato-cells, starch, muscular fibre, fatty bodies, oil-globules, and a quantity of vegetable *débris*, all having a chocolate tint.

CASE VIII. C. M., a woman, aged 34, admitted in collapse; died, in the acmé of the consecutive fever, in three days.

First day. The first vomit, 3x, was slightly turbid, of a deep grass green colour, and sp. gr. 1005 (from intermixture of water drank); it was acid, devoid of odour, and non-albuminous; it was decolorized by nitric acid, with or without heat; the sediment was granulo-flocculent, and contained mucus, starch, oil, epithelium, annular bodies, and vegetable *débris*, all tinged green.

The second vomit, 3vij, was light brownish-red, neutral, of

sp. gr. 1010, non-coagulable, and devoid of odour; with heat and nitric acid, it gave a brownish orange, which soon became greenish yellow; the sediment was light brownish yellow, granulo-flocculent, and contained oily and dark granular matter, but no epithelium nor annular bodies.

The third vomit, 3vi, was of a duller and darker brown, very turbid, of sp. gr. 1009, neutral; nitric acid, with or without heat, produced a faint brownish red colour, which passed into greenish yellow; the sediment was light brown, and contained annular bodies, compound granular and cellular bodies, and oily and mineral matter; on standing for forty-eight hours, a white opaque scum collected on the surface, consisting wholly of oil-globules.

The fourth vomit, 3ii, was of iron-grey colour, slightly acid, and had no particular odour; with heat and acid, it gave a brownish red, which slowly became greenish yellow; with nitric acid, in the cold, it gave a faint pink colour; the sediment was scanty, and contained epithelium, mucus-corpuscles, free epithelial nuclei, annular bodies, and vegetable *débris*.

The fifth vomit was of a greyish brown colour, sp. gr. 1002, neutral, had a strong smell of whiskey, and was non-albuminous; the sediment was lead grey in colour; heat and acid caused a pink colour, which slowly became greenish yellow.

Third day. The first vomit was neutral, of sp. gr. 1010, devoid of odour, and of the colour of ale; it gave a greenish yellow tint with heat and nitric acid.

The second vomit was of the colour of porter, and contained an admixture of porter and port wine; the reaction, with heat and nitric acid, exactly resembled that of pure diluted bile with the same acid, viz., in the test tube from below upwards, zones of pink, purple, blue, and green; with nitric acid, cold, the reaction was at once greenish yellow; the sediment contained prismatic phosphates, mucus-corpuscles, free epithelial nuclei, epithelial scales, annular bodies, compound granular bodies and pus (probably derived from muco-purulent sputa accidentally intermixed with the vomit).

III. *The urine.* Suppression of urine is a well-known prominent symptom of the collapse stage, reaction, and earlier part of the consecutive fever of cholera, and by some it is believed to be the cause of many of the worst symptoms of the latter, and even of the death by coma, which is one form of its fatal termination. Knowing the deleterious effects of the retention in the system of urea or other elements of urine, in other diseases, it becomes a matter of moment to determine the exact condition of the urine at various points of the progress of the disease, and to note carefully the co-existing symptoms, with a view to the discovery of any causal connexion. On the supposition that suppression of urine is the circumstance of all others to be dreaded in the consecutive fever, many cholera remedies are directed to the re-establishment of this secretion, and to the throwing off by the kidneys of an increased quantity of urea, *e. g.*, colchicum and diuretics. But the knowledge of the fact that, in experiments on the lower animals by some continental investigators, urea given as a poison has been repeatedly found comparatively innocuous, or at least far from possessing the highly dangerous qualities usually attributed to it, and the observation of the symptoms of cholera, have led me to look with suspicion on this belief in the specific effects of urine, or its individual elements, on the system in that disease. The so-called "consecutive fever" bears all the ordinary characters of typhus, of certain stages of which we well know both coma and suppression of urine to be common features,—as results of the disease. I have more than once seen retention, and probably even suppression, of urine for several days not followed by coma, nor indeed by any bad symptoms, and coma supervening though the urinary secretion was re-established in comparative abundance: the urea retained in the system, even in the case of complete suppression (or equally probably other poisonous elements of the urine), is eliminated by many other channels (*e. g.* by the skin, lungs, and stools), in the form of carbonate of ammonia,

into which it is decomposed: besides, the retention or suppression is usually of comparatively short duration, ranging from a few hours to several days. Under these circumstances, I am inclined to look on suppression of urine as merely one of the many effects of the collapse, and as having no essential or necessary connection with any of the phenomena of the fever.

In many cases, it is difficult to discover whether the urine is really suppressed, merely retained, or passed unconsciously. None may be voided separately, but a few drops may trickle in the bed; and I have frequently found indications of urea in the stools, which has led me to believe that a small quantity is often passed along with them, without the knowledge of the patient, especially in the case of females.

The urine in cholera differs materially in character, according to the period of the disease at which it is examined. That first passed after collapse,—i. e., during the reaction or earlier part of the fever stages, or that drawn off by the catheter during these periods, if retention merely, without absolute suppression, should exist,—has no peculiar or naked eye characters. It is usually more or less turbid, seldom high coloured, but of a pale amber colour, and has little if any odour, except a faintly mawkish smell. Its reaction with test-paper is, in almost all instances, acid; where it is not, there is generally some intermixture of decomposing pus, mucus, etc. Its specific gravity is comparatively low, ranging about 1010 to 1015: I have seldom noticed it above 1020. Heat and nitric acid almost invariably prove the presence of *albumen*. The same reagents generally develop a pinkish, blood red, or orange red colour, which, on the addition of more acid and the prolongation of heat, change through orange into a permanent brownish yellow, or perhaps into the original amber colour of the urine. In some cases, this reaction was very fugitive; in others, more permanent: the intensity and permanence of the colour appeared to depend chiefly on the period which elapsed between the voiding or withdrawal of the urine and its examination, and the stage of the disease at which it was so removed or voided, being greatest when the urine was fresh, and when passed soon after or during collapse. In other diseases, and in former days, such a reaction has been regarded as depending on the presence of purpurine or urrosacine (i. e., the colouring matter of the urine); but in cholera, and at the present day, it is looked upon as *biliary*. In the urine (removed from the bladder after death in the collapse stage) of two dogs, to which I succeeded in artificially communicating cholera*, the reaction with heat and nitric acid closely resembled that ordinarily given with pure bile or with fluids undoubtedly containing it in quantity, viz., an intense grass-green colour, which passed through dark bluish purple, purple, red, and orange, into a dull brownish red. These opposite views of the cause of this reaction may be reconciled to a certain extent in this way: the urinary and biliary pigments, as well as those of other fluids of the human body, are only now beginning to attract a proper amount of scientific attention; and, from the yet scanty results of experimental investigation, it appears possible, if not probable, that these two substances are similar or identical in character, or, though differing slightly in constitution, are traceable to a common origin. This as yet is almost matter of conjecture; but, were it a settled scientific point, it would satisfactorily explain the phenomena just referred to. A more important feature is the relative or absolute deficiency of *urea*. For its detection, I have been in the habit of employing the rough qualitative test of filtering and evaporating down the urine to from one-third to one-tenth of its bulk, and adding a few drops of nitric acid. This mode of procedure, though not very accurate, is probably sufficiently so for all ordinary practical purposes.

In the very scanty granular or flocculent sediment, little else is discoverable by the microscope than pavement epi-

thelium thrown off from parts of the urinary apparatus, intermixed sometimes with casts of the renal tubuli, transparent, granular, or oily, and a few prismatic phosphates. I have occasionally found also annular bodies, similar to those occurring in the stools, and oily matters of various kinds. Comparatively seldom in the first urine secreted, but more frequently in that passed in the later stages, urates, uric acid, oxalates, both dumb-bell and octahedral, blood, pus and exudation corpuscles, and spermatozoa, occur. All these I have seen repeatedly, with the exception of blood disks and spermatozoa. From the frequent presence in this urine of epithelium, and the occasional presence of renal casts, it has been deduced that a characteristic feature of cholera is a desquamation of the epithelial lining of the tubuli of the kidney—an assumption which facts do not seem fully to bear out. The casts I have seen in four out of twelve cases.

In the urine secreted when the renal functions begin to be duly re-established, the chief circumstances to be observed are the gradual disappearance of albumen and the biliary reaction with heat and nitric acid, and increase of the proportion of urea and of the density. The coagulability, as a general rule, disappears in from one to three days; sometimes it continues for weeks, either regularly decreasing in intensity, or intermitting and re-appearing to a variable extent and at irregular intervals. In rare cases, the urine first passed has been said to be non-coagulable, while that subsequently voided may be albuminous. The presence of albumen in the urine of cholera is usually supposed to depend on renal congestion, which, by producing a considerable degree of pressure on the *tubuli uriniferi* and Malpighian *glomeruli* causes a transudation of the serum of the blood, exactly as is the case when the renal veins are tied in animals, or when they are compressed by a tumour or the gravid uterus. It would appear that, as in the case of the liver, there is, during the later stages of cholera, a degree of compensatory action on the part of the kidney, whereby excess of urea is subsequently formed and excreted.

The urine of the consecutive fever and convalescence has no peculiar characters: it is still of comparatively low density, and somewhat small in quantity, acid, of an amber colour, clear, and devoid of sediment. Its appearance, as well as its chemical and histological characters, vary greatly from day to day, even in the same case: one day, I have found it high coloured, and containing beautiful sparkling crystals of uric acid; a second, turbid from a supersaturation with urate of ammonia; a third, having a copious sediment of phosphates or pus; and a fourth, having a mucous sediment, entangling a few oxalates. As in fever and other diseases, there is often a sudden and peculiar change in the characters of the urine coincident with a crisis, exacerbation, or other marked change of some stage of the disease, chiefly the typhoid stage. In these cases, the urine might be considered a critical discharge, were it not that its contents are not uniform, and it does not occur sufficiently often and regularly to be of any diagnostic value as such. I have noticed this phenomenon especially with uric acid and urate of ammonia. In the later stages, also, renal casts and epithelium are comparatively rare, while phosphates and urates are exceedingly common.

To examine the saline contents of the urine more narrowly, it is necessary to filter and evaporate to dryness, when one or more of the following substances will certainly be met with, viz., common salt, triple phosphate and urates, and perhaps uric acid and oxalate of lime. According to the rapidity of evaporation, the comparative freshness of the urine, the period of the disease at which it has been voided, and the reagents added, the forms these exhibit under the microscope are almost endless: e. g., urate of ammonia is found, both in its usual form of amorphous granular matter, and in that of large dark brown globular bodies, having a radiated crystalline texture; uric acid appears in an infinite variety of modifications of the rhombic prism; while phosphates occur as prisms of every shape and size, stars, plumes, crosses, etc.

* Vide Edinburgh Medical and Surgical Journal, April 1854: "On the Communicability of Cholera to the Lower Animals."

The following cases will illustrate some of the conditions of the urine above referred to, viz.:

CASE I. A. M., a married man, aged 52. *Cholérine*. Admitted in a state of mild collapse: discharged, *recovered*, in six days. Reaction was well marked, but there was no "consecutive fever."

Third day. The first urine passed was of specific gravity 1020, acid, slightly albuminous, and natural in colour. It became milky on the application of heat; and the further addition of nitric acid developed a dark brown colour, which changed almost immediately into a deep green, and then passed again into a brown. On standing, a copious flocculent precipitate was thrown down. The mucous sediment contained, under the microscope, transparent, granular, and oily renal casts; pavement epithelium, normal as well as elongated and shrunk; urates; mucus and mucus-corpuscles; and a few dumb-bell oxalates. After the lapse of a day, a number of needle and lozenge-shaped crystals of uric acid appeared among the mucous bands. On standing three days, a whitish greasy scum formed, containing a large quantity of prismatic phosphates, and a few broken irregular crystals of common salt. It contained urea.

Fourth day. The urine was of specific gravity 1015, and contained urea in abundance, besides uric acid, urate of ammonia, and compound granular bodies.

Fifth day. The urine was of specific gravity 1018. On the surface, there was a scum of uric acid, in irregular, striated, dark crystalline masses; the scanty sediment contained the same acid in beautiful pale yellow, lozenge-shaped crystals, pavement epithelium, and compound granular bodies.

Sixth day. The urine was of specific gravity 1018. Both scum and sediment contained a large number of uric acid crystals, while the latter also contained pus, mucus, and compound granular bodies.

CASE II. M. F., a girl, aged 16. *Cholérine*. Admitted in mild collapse: discharged, *recovered*, in five days. As in the last case, reaction was complete, but there was no subsequent fever.

Third day. The first urine passed was of specific gravity 1022; acid; loaded with urates; the sediment contained epithelium, renal casts, octahedral oxalates, pus, and compound granular bodies.

Fourth day. The urine was of specific gravity 1020, and acid. The mucous sediment contained pus, epithelium, urates, and a few oxalates.

CASE III. M. R., a married woman, aged 37. Admitted in collapse: passed through all the ordinary phases of the disease, and was discharged, *recovered*, in sixteen days.

Third day. *Fever* beginning. No urine was voided: 3 iii were removed by the catheter. It was very acid, turbid, and non-ammoniacal. Nitric acid developed an orange red, which quickly passed into blood red; this colour disappeared on the addition of excess of acid. On being filtered and boiled down to one-third of its bulk, and an equal quantity of nitric acid added, great effervescence, with the development of a pink colour, was produced, but no urea was detectable.

Fourth day. A drachm, removed by the catheter, had similar characters, but in a less marked degree.

Fifth day. Four drachms of urine, passed after the use of the hip bath, had a specific gravity 1015; it was very turbid, acid, and albuminous, and had a saccharine smell. Nitric acid, with or without the previous application of heat, according to its quantity, produced various tints of red, orange, peach blossom, and pink. Muriatic and other acids caused a faint pink tinge, slowly in the cold, but deeply and quickly with the aid of heat; it faded on exposure to the air. In the afternoon, she passed, also after hip bath, urine of specific gravity 1015. It was very acid, and turbid, with a scanty flocculent deposit, albuminous. Nitric acid produced a pink colour. On evaporating down to one-third, and adding nitric acid, delicate plumose phosphates, a few large globular urates, pus, and pavement epithelium made their appearance.

Seventh day. *Convalescence* beginning. Urine 3ix; had

specific gravity 1012; was less turbid, but acid and albuminous. Nitric acid caused a faint red tint, which was best marked in the cold.

In the evening, 3ix was passed. It was turbid, of a whitish colour, of specific gravity 1035, very acid, and non-albuminous. It had a copious, flocculent, white precipitate chiefly composed of pus (from leucorrhœal discharge), and contained also pavement epithelium, compound granular bodies, and a few caudate granular cells. The *high specific gravity* in this case was undoubtedly due to the copious admixture of pus.

Eighth day. Urine 3ix; it had specific gravity 1010, was turbid, of ammoniacal odour, acid, and very albuminous. Nitric acid caused a red colour. The copious white sediment consisted of pus.

Ninth day. Urine was passed in abundance; it was paler in colour, clearer, of specific gravity 1008, acid, and very phosphatic. Nitric acid caused an orange reaction. The sediment was purulent.

Tenth day. Urine 3vii; specific gravity 1009; it was slightly acid, albuminous, and phosphatic. Nitric acid caused a brownish-red colour. The sediment was purulent.

Eleventh day. Urine 3xxiv; it was of specific gravity 1008-12, acid, and albuminous. Heat and nitric acid caused a pinkish-red colour. It contained abundance of urea.

Twelfth day. The sediment was still purulent; it also contained very granular epithelium, a few compound granular bodies, and cruciform and plumose phosphates.

Thirteenth day. Urine 3viii; it was of specific gravity 1007, acid, phosphatic. The reaction with heat and acid was pinkish red.

Fourteenth day. Urine 3xvi; it was of specific gravity 1010, acid, and had a purulent sediment (leucorrhœal).

Sixteenth day. The specific gravity of the urine was 1020; it was very acid, of a pale straw colour, and albuminous. The sediment contained abundance of large well formed pus-corpuscles, bodies resembling free epithelial nuclei, and phosphates. Urea was plentiful.

CASE IV. A. W., a girl aged 7½. Admitted in advanced collapse; passed through all the phases of the disease, and was discharged, *recovered*, in twenty-one days.

Third day. The first urine, passed after warm hip-bath, was of specific gravity 1015, of a deep amber colour, turbid, acid, and albuminous. The reaction with heat and nitric acid was deep orange red. It contained little urea; it gradually became loaded with urates. The sediment (one-sixth of the bulk) contained, under the microscope, renal casts, transparent, granular, and oily; granular pus-like corpuscles, "annular bodies", similar to those occurring in the stools and vomit; amorphous granular urates; compound granular bodies; and a few dumb-bell oxalates.

Sixth day. Urine 3vii, also passed after hip-bath. It was of a pale amber colour, acid, of specific gravity 1012, slightly albuminous, and phosphatic. The reaction with heat and nitric acid was purplish.

Eighth day. *Fever* begun. Urine 3vii; was of specific gravity 1010, slightly albuminous. The reaction with nitric acid was faint pink. It contained abundance of urea. The sides of the urine jar were covered with large, irregular, striated, dark red crystals of uric acid, which also occurred in the form of delicate lozenges and rhombs in the scanty sediment.

Ninth day. Urine 3xxi; it was of sp. gr. 1010, acid, of pale straw colour, and non-albuminous. The reaction with heat and acid was brownish yellow. Uric acid was still found on the sides of the jar, and in the sediment. After the lapse of two days, it was wholly converted into urate of ammonia. The body of the patient was covered with the so-called "cholera exanthem".

Tenth day. Urine 3xix; was of sp. gr. 1014, clear, amber-coloured, and acid. The reaction with heat and acid was brownish. Uric acid still adhered to the jar and in the sediment.

Twelfth day. Urine was of sp. gr. 1012, and had no trace of uric acid.

Fourteenth day. Urine 3xxi; was of sp. gr. 1012, clear,

neutral, and non-albuminous. The sediment again contained a few uric acid crystals, besides epithelium, chiefly shrunk and atrophied.

Sixteenth day. The urine was abundant; sp. gr. 1007-10. There was no reaction with heat and acid. The sediment contained epithelium, pus, and compound granular bodies.

CASE V. A. F., a married man, aged 48. Admitted in mild collapse; died in the "consecutive fever", in seven days.

Second day. The first urine, passed after hip-bath, amounted to 3iv; it was of specific gravity 1018, acid, turbid, of a deep amber colour, and albuminous. The reaction with nitric acid was faint orange red.

Third day. The urine, 3vj, was of specific gravity 1016, acid, and albuminous. The reaction with nitric acid was orange red. The sediment contained transparent and granular casts, and dumb bell oxalates.

Fourth day. The urine was albuminous. The reaction with heat and nitric acid was greenish yellow, gradually passing into brownish yellow.

Fifth day. The urine, 3vij, was of specific gravity 1012, of pale amber colour, had no sediment, and was slightly albuminous. The reaction, with heat and nitric acid, was greenish yellow.

Sixth day. The urine, 3xij, was of specific gravity 1010, pale in colour, acid, and slightly albuminous. There was no reaction with heat and nitric acid. The sediment contained a large number of casts, and a few uric acid crystals.

Seventh day. The urine was of specific gravity 1010, turbid, acid, and albuminous.

Ninth day. There were removed by catheter from the bladder, at the *post mortem* examination, four ounces of turbid amber-coloured urine, of specific gravity 1014, acid, and albuminous. It contained a number of floating shreds of softened mucous membrane, and flocculi of mucus, consisting chiefly, under the microscope, of fibre cells and epithelium. The reaction with heat and acid was faint pink.

CASE VI. M. F., a married woman, aged 40. Admitted in collapse; died in the "consecutive fever", on the third day.

Third day. Urine, 3iss, removed by catheter, about half an hour before death. It was alkaline, deep amber-coloured, turbid, and albuminous. The reaction with heat and acid was intense blood red, which slowly passed into orange red. With nitric acid, in the cold, it struck a fine crimson red. When it was concentrated by evaporation, and nitric acid added, it gave no indication of urea, but exhibited great effervescence, and the development of a rich crimson tint. The sediment was scanty and flocculent, consisting chiefly of the elements of the softened mucous membrane of the bladder.

iv. *The Breath.* The air expired from the lungs in respiration has been frequently described as cold during the collapse stage; I have certainly found it cool, but never distinctly cold. The thermometer did not indicate any great difference between its temperature and that of the body generally. It has no particular odour in the collapse or reaction stages, but, in the consecutive fever, it is frequently very fetid, possessing the characters usually implied in the term "feverish" or "sick breath". It appears to differ in no way from the air expired in health, or various familiar diseases; but chemists tell us it is singularly deficient in the proportion of free carbonic acid it contains, and that it is comparatively loaded with carbonate of ammonia. Of the presence of a considerable amount of ammonia, it is easy to satisfy one's self by holding before the mouth of a patient, during expiration, a rod dipped in muriatic acid. Whether as a cause or effect of this deficit of carbonic acid in the breath, it is generally stated that the blood of cholera is highly charged with carbon, and consequently eminently stands in need of oxygenation; and this idea is the basis of several lines of treatment, *e. g.*, the inhalation of oxygen and nitrous oxide. So far as this view is considered supported by the generally received, but probably erroneous pathological statement, that the blood in

cholera is very black, tarry, and viscid, I cannot subscribe to it, denying, as I do, the fact on which it is based; for cholera blood has not appeared to me to differ materially from that seen in many other diseases, *e. g.*, chronic affections of the lungs. A deficient oxygenation is more probably a mere result of pulmonary congestion, which, like congestion of the other internal viscera, is an effect, or accidental sequence, of the collapse—one of the essential features of cholera. It seems as erroneous to look upon any such condition of the blood as a cause of cholera, as to regard the presence of "cholera corpuscles" or *vibrios* in the evacuations or intestines as the *origo mali*. I allude, however, only to the general appearance of the blood of the heart, great vessels, and viscera of patients dying in various stages of cholera, as presented at a *post mortem* examination. That the blood is often considerably altered in its chemical relations—again, however, as a consequence, and not as a cause—we have the best ground for believing, viz., eminent scientific testimony.

Besides the substances detected by chemists as existing, or deficient, in the breath of cholera, I believe that, at particular periods of the disease, it is loaded with a most noxious volatile matter; in other words, with the cholera poison, which has been reproduced in the human system. Of what nature this poison is, I know not; but of this I feel assured, that cholera nurses, and others in more or less constant and immediate attendance on the victims of the disease, from their sad experience of its frequently fatal effects, consider the inhalation of the breath of patients highly dangerous; and I have frequently seen nurses prostrated with premonitory symptoms by its accidental inspiration for a short time. I repeat my belief that the greater part, if not the whole, of the cholera poison is eliminated from the human body by the pulmonary and cutaneous systems.

v. *The sweat.* Diaphoresis, more or less profuse, is a frequent concomitant of all the stages of cholera. The temperature of the sweat varies in the different stages of the disease, being in the fever often very warm, in collapse frequently cool and even sometimes cold. It has generally a greasy or unctuous feeling, and its odour is strong, disagreeable, and peculiar—the effluvia from the body of a single patient being frequently sufficient to taint a whole ward. This odour may be due to the presence of a volatile poison similar to that probably existing in the breath: for the emanations from the skin of cholera patients are in the highest degree dangerous, and, attached to body-clothes, etc., are most fertile sources of contagion. Instances are innumerable of washerwomen engaged in washing the clothes or bedding of patients being seized with and dying of the disease; and of clothes of dead patients being packed up and sent to a distance, and after the lapse of days, weeks, or months being opened up with the result of communicating the disease to persons previously in perfect health, and in localities up to that date exempt. I have known several washerwomen and nurses to die of cholera, and many instances of premonitory symptoms, thus produced; and the opinion is common among the cholera nurses whom I have met, that the effluvia from the clothes, sweat, and breath are likely to produce fatal cholera, if respired for any length of time. By using the body and bed-clothes of a fatal case, saturated with the effluvia in question, I succeeded, after a long series of experiments, in propagating the disease to several of the lower animals, previously in apparently good health. The practical deductions from the above facts I shall reserve for future discussion. Here, also, carbonate of ammonia has been proved by chemists to exist in abundance: its presence can be rendered evident by the use of the muriatic acid test mentioned in the case of the breath. Annular bodies, such as occur in the stools, have also been stated by microscopists to be herediscoverable; but, even were their existence real (a point I cannot corroborate), it must be accidental, and can, for the reasons already adduced, have no causal relation to the disease. Its reaction has been, in the few cases I examined it, acid; this is contrary to the statement of Dr. Herapath, who says it

is uniformly alkaline: he, however, describes *all* the excretions in cholera as alkaline, and gives as the cause the ascertained presence of carbonate of ammonia, a circumstance to which he appears to me to attribute undue importance. This alkaline reaction, except in the case of the stools, is quite opposed to my own observations.

[To be continued.]

Crichton Royal Institution, Dumfries, April 1854.

ATMOSPHERIC CHANGES RELATING TO THE PREVALENCE OF CHOLERA.

By J. A. HINGESTON, Esq.

THE state of the weather during the recent outbreak of the cholera at Leeds, Dublin, and Glasgow, may be shown by the following table.

On comparing my report of the thermometer with that of Mr. Glaisher's, of Lewisham, I find that my average is below his in the spring of the year, and above his in the autumn. This difference is in all probability owing to the proximity of the ocean,—the surface of which is warmer than the atmosphere in the autumn, but colder in the spring. But most likely my means of observation are not

so well appointed as his, in this respect. The mortality from ordinary causes was, at this time, quoted as being sixty below the average. There was a very still state of the atmosphere, which was dark, misty, and on one day smelling disagreeably. There was a high barometer, although the air was loaded with vapour. Out of twenty-four cases of Asiatic cholera reported at Leeds, there were thirteen deaths.

This state of the atmosphere is so invariably attendant on the outbreak of cholera, that it may be regarded as a necessary condition for the activity of the disease. It would be affirming too much, to say that it is its cause.

I observed one peculiarity at this time which seemed to me a favourable omen, and such at least for the present it has shown itself to be. I allude to the lateritious sediment in the urine, which has prevailed a good deal lately. On former occasions, when the cholera has been rife, the urine has shown the predominance of the oxalic, or even the phosphatic diathesis; but on the present occasion it is just the reverse, the urea not appearing to be retained within the circulation. Its elimination is a sign of health, and contra-indicates the existence or duration of cholera.

Among the meteorological phenomena, it is proper to mention the appearance of a comet on the border of Pisces, near to the star η Andromedæ, on March 29th.

Brighton, April, 1854.

1854.	Wind.	Clouds.	Dew and rain.	Moisture.	Force of wind.	Temperature.	Thermometer.	Barometer.
March 5	N.E.S.	Morning mist; cloudless noon; overcast.	Dew.	Moist; dry; dusty; and clear.	Calm.	Chilly.	40—50	Set fair; falling.
March 6 (Moon first quarter, 7 P.M.)	E.S.S.E.	Clear night; morning mist; cloudless noon; thick mist.		Dry and dusty.	Ditto.	Cold; sharp white frost; ice.	25—45	Ditto $\frac{1}{4}$ below.
March 7	N.W.S.	Dark mist; bright strati; dark mist.		Moist; thick.	Ditto.	Ditto.	29—50	$\frac{2}{3}$ below.
March 8	W.S.W.	Ditto; ditto; strati; dark mist.		Ditto.	Ditto; light air S.W.	Ditto.	45—57	Ditto.
March 9	W.S.W.	Ditto; ditto; ditto; ditto.		Moist fog, smelling disagreeably.	Ditto.	Raw cold.	48—62	$\frac{2}{3}$ below.
March 10 ..	W.S.W. N.W.	Overcast; strati; cloudless afternoon.	Light rain.	Wet fog.	Wind rising S.W.; squally.	Warmer, but chilly.	50—54	Fair.

DISLOCATION OF BOTH HIPS AT THE SAME TIME IN THE SAME SUBJECT.

By H. L. PRICHARD, Esq.

CASE I. Thomas Phillips, aged 15, a railway waggoner at the Cwmavon works, on the evening of the 25th of March, while in a stooping posture in the act of turning the switch, was overtaken and knocked down by a truck running with some velocity down an inclined plane. He escaped the wheels; but the body of the carriage, which was ten inches only from the ground, passed over him, and, as he described it, "doubled him up".

The case presented a remarkable appearance. The knees and toes were inverted; the former were closely approximating each other, while the latter rather overlapped one another. The head of each femur was distinctly felt under the glutei, on the dorsum of the ilium.

The reduction of the right hip was readily effected with the pulleys, in the manner recommended by Sir Astley Cooper, with no other preparation than that of chloroform, which the patient took *con amore*. In eight or ten minutes the bone passed into its socket with a satisfactory jerk, audible to the bystanders. The left was immediately afterwards subjected to the treatment in like manner, but was not so

easily reduced. Extension having been kept up during thirty-five minutes, the knee was found to have descended parallel with that on the opposite side. The pulleys were relaxed, and the limb simultaneously rotated, while my colleague, Mr. F. M. Russell, kept up the transverse extension in the usual manner, and the reduction was effected, but without a perceptible crack,—attributable, I apprehend, to the exhaustion of the muscles from continued extension. I presume an accident of this description is very rare. It is the first with which I have met; and I do not recollect to have read of such a case.

As an addendum to the foregoing, I may be allowed to record a case which occurred in my practice last evening (fourteen days after the double dislocation), bearing out the singular coincidence in accidents, which, I doubt not, most of us of some years' experience must have observed.

CASE II. Thomas Walters, aged 16, was run over by a train of coal trucks. When first seen, he was lying on his left side in bed. He complained of excruciating pain, referrible to his right hip and thigh. His knee was rather everted, and the foot inverted. On examination, the knee was found to be shorter than the opposite one by an inch and a half; but the trochanter major was in its normal position, and no crepitus was discoverable. The tibia and fibula, however, above the malleoli were fractured. On