THE MORBID ANATOMY OF CROUP.

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I HAVE gradually arrived at the conclusion that English writers on croup have confounded two very different diseases. They describe croup as an inflammatory non-contagious disease, resulting usually from exposure to cold, more common in northern latitudes and in cold seasons than in the south and in the summer, and apt to recur year after year in the same subject, although usually in a milder form. The disease is to be treated by warm baths, warm fomentation to the throat, steam inhalation, and nauseating doses of ipecacuanha or antimony. Some authors advise mercury to be given. If the disease prove fatal, false membranes are described as occurring in the larynx, and often extending into the trachea and bronchi. In this account we have the history, the symptoms, and the treatment of acute catarrhal laryngitis; but the morbid anatomy is that of diphtheria, a disease which has an entirely different history. The first English writer who described the false membranes as the distinctive feature of croup was Dr. Home, whose pamphlet "On the Nature, Cause, and Cure of Croup" was published in 1765. He gives a brief history of the first two cases in which he observed this striking anatomical change. The first case was that of a boy, aged 7, who died after a few days' illness with symptoms of croup. Four days after the death of the boy, his sister, aged 5, was seized with similar symptoms, and died suffocated on the third day. In both cases, false membranes were found in the larynx and trachea. The fact of two cases occurring in quick succession in the same family would alone render it probable that the disease was diphtheria, and not inflammatory croup. The probability is still further increased by the fact that in the second case the tonsils were swollen and covered with mucus, and there was some difficulty in swallowing. From that time to this there has been a tradition amongst English writers that an exudation of false membrane is the usual result of inflammatory croup in children. Bretonneau refers to Dr. Home's cases of croup as examples of "malignant angina", which is one of his synonyms for diphtheria. (*Memoirs on Diphtheria*, New Sydenham Society, p. 107.)

Dr. Cheyne's work "On the Pathology of the Membrane of Larynx and Bronchi," published in 1809, has been a great authority on the subject of croup. That he met with cases of diphtheria is evident, from his statement that he had seen several children whom he would have supposed to be suffering from the second stage of croup, but in whom, upon examination, he discovered what he calls "sloughs on the tonsils and uvula." The children died; and, although the bodies were not examined, he expressed his belief that, since the cough, voice, and breathing were those of the second stage of croup, "the larynx would have been found lined as the fauces were."

It is only during the last few years that diphtheria has been recognised amongst English practitioners as a distinct specific, infectious and sometimes epidemic, disease. Meanwhile, the French pathologists Bretonneau, Trousseau, etc., have given a complete history of diphtheria. Croup they describe as a disease characterised by an exudation of false membrane, forming a part of the history of diphtheria, and quite distinct from catarrhal laryngitis, which Bretonneau calls "stridulous angina" and "tracheitis," and Guersant designates "stridulous laryngitis, or false croup." There is here no question of laryngismus stridulus, or spasmodic croup. (See the *Memoirs on Diphtheria*, translated by the New Sydenham Society.) Guersant remarks that the cough is loud and sonorous in cases of stridulous laryngitis; while in membranous laryngitis or diphtheria it is hoarse and stifled by the exudation. The voice, too, in this latter affection is not simply hoarse, but almost suppressed.

My attention was first specially directed to this subject by finding no false membranes in the air-passages after death from acute catarrhal laryngitis in children. Mr. Porter, in his book on the *Larynx*, mentions three cases of fatal croup without false membranes in children, aged respectively 5, 4½, and 2½ years. Sir Thomas Watson says "there are a few cases in which this adventitious membrane is not formed at all; the inner surface of the windpipe is seen to be merely reddened and tumid, and covered with viscid mucus; or, perhaps, with a shred or two of concrete albumen here and there." Then I have occasionally met with cases of supposed inflammatory croup in which I found during life diphtheritic exudation on the tonsils, soft palate, or pharynx. With these appearances were associated other indications of the true nature of the disease; perhaps evidence of infection, discharge from the nostrils, swelling of the glands under the jaw, albumen in the urine. In some cases, the evidence is less complete. Most writers on diphtheria describe cases (and I have seen some) in which there is either no exudation visible on the fauces, or there is a scanty secretion, which soon dis-

appears while the exudation within the air-passages increases and destroys life. And, again, there are other cases in which the diphtheritic exudation begins in the air-passages, and never extends to the fauces. In such cases, the diagnosis may sometimes be difficult. (See Trousseau's *Clinical Medicine*, vol. ii, p. 486-7, New Sydenham Society.)

Our present knowledge of this subject warrants us, I think, in stating positively that two distinct diseases have been confounded under the name of croup by many English writers. 1. Acute catarrhal laryngitis. This, in children, is inflammatory croup; and, whether it occur in children or in adults, the only structural change in the larynx and trachea after death is congestion and swelling; sometimes superficial abrasion of the mucous membrane, with mucous or puriform exudation on the surface, but no tenacious false membrane. 2. Diphtheritic croup, which, whether it occurs in the child or in the adult, is attended with the formation of a more or less abundant and tenacious false membrane in the air-passages. The exudation of false membrane depends, not upon the age of the patient or the intensity of the inflammation, but upon the specific character of the disease; so that the presence of the false membrane after death would suffice, in a doubtful case, to determine the nature of the malady.

One circumstance that has helped to perpetuate error with regard to the morbid anatomy of croup has been the fact that inflammatory croup is a far less fatal disease than diphtheritic croup. Most cases of the former recover when early and judiciously treated, while of the latter by far the greater number die. Therefore, after death with croupy symptoms, false membranes are more frequently present than absent. Both Home and Cheyne report several cases of recovery which were nearly certainly cases of simple laryngitis or inflammatory croup.

The practical importance of distinguishing acute catarrhal laryngitis or inflammatory croup from diphtheritic disease of the air-passages is manifest, when we consider that the treatment which usually puts a stop to the former disease is unsuitable, and even injurious in cases of diphtheria, a disease which requires an entirely different method of treatment, and in which local remedies are especially valuable.

ON THE BODY-WEIGHT AND UREA IN A CASE OF STARVATION.*

BY DAVID NICHOLSON, M.B. Aberd.,

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THE ingestion of food is a necessary and not unpleasing part of our active existence; and we have all realised the special gratification that arises from it after a prolonged abstinence. If we could possibly imagine a chronic state of hunger with a strictly periodical supply of food in such quantity as only just to ward off from the body the injurious results of deficiency or of want, we should have some conception of the delight that food affords to prisoners not only in the act, but in the hope, of its participation. We should at the same time arrive at some idea of the value that the prisoner attaches to his food, and of the vigilance and precision which he exercises in watching that he receives his due allowance. Curiously enough, for all this, prisoners are found at times to act on the very opposite principle, and refuse their food. Now, under what circumstances does a prisoner reject this morsel, usually so delicious, he being at the time able, but *unwilling*, for reasons of his own, to partake of it? As far as I have observed, the occasions on which a prisoner resorts to complete or partial abstinence, may be comprised under three heads: 1. In order simply to make himself ill, so as to avoid work or to go into hospital; 2. As a part of the process of feigned insanity, as, for instance, on the grounds that poison has been put into the food; 3. From a feeling of resentment at supposed ill-treatment, in the foolish hope of giving annoyance to the offending individual—a state of mind not so uncommon as we would at first think it. It would be out of place to enter upon its discussion here; although I may state that it was a feeling of this sort that actuated the prisoner to self-starvation in the present case.

The question of what has been called the "balance of the vital economy" is not only interesting in itself, but important and valuable in the ordinary relationship of life in proportion as we are able to unravel its many intricacies, and to open out the benefits to be obtained from an accurate solution of it. To arrive at a true notion of the effect of the ingestion of food upon the body and its egesta, it is necessary, in the first place, to ascertain, as far as possible, the relation that the body has to itself in the absence of food ingested; *i.e.*, during starvation. Investigations in this direction have been made, although not

* Read in the Physiological Section at the Annual Meeting of the British Medical Association in Leeds, July 1869.

without much trouble, upon the lower animals, giving us comparative results; but, from the inconvenience and torture they necessitate, man cannot for any length of time submit himself as a subject for their furtherance. In ordinary life, when a case of starvation turns up, it is little adapted for close investigation, even if the necessary means were at hand for following it out; seeing that, besides, the cooperation, active or passive, of the individual, is required. For these reasons, I thought it worth while to place before you my notes of this case; for the prisoner, if he did not help me, was so far complacent as not to obstruct me.

On the morning of the 26th December, 1868, prisoner H. W., aged 23, took his ordinary breakfast of 12 ounces of bread and three-fourths of a pint of cocoa. During the forenoon, for some misdemeanour, he was awarded a punishment of three days' bread and water. Being in a sullen temper, he refused his mid-day meal, and did not touch the food that was put in his cell for him until some time after 8 in the evening of the 29th, a period of at least one hundred and thirty-four hours, or five and a half days. During the first and second days only did he take any water—perhaps a pint and a half or two pints in all. From the sixth to the ninth day, he partook of very little—about a pint of oatmeal-porridge, containing milk, in the twenty-four hours. After the ninth day, he took all the diet allotted to him. Fortunately, for another purpose, I had his body weighed at the very commencement, and during the experiment he was weighed every day or two. I was careful not to ask too much of him, lest his caprice should put an end to the whole; and I place before you the observations that I made, extending over a period of eighteen days.

His general aspect, beyond a somewhat pinched expression of face, was not much altered, and he preserved a sullen silence throughout. He regularly took his exercise, which consisted of an hour's walking in the open air every day. The heart-sounds became rather faint, and the pulse soft and slow. There was no feverishness nor heat; the skin became very dry. Pressure on the pit of the stomach on the fifth day caused him to wince.* I regret that I was unable at the time to make a more comprehensive analysis of the urine, so as to get a comparative statement of the various ingredients. The general characters of that secretion were—intense acidity, rich bright red colour, highly aromatic odour (to me most like sandal-wood), with mucous deposit after standing twenty-four or forty-eight hours; characters which of course diminished in intensity as food and drink were taken. Phosphates were thrown down daily by heat, the cloud being most dense about the fourth and fifth days. No albumen was found. A trifling deposit of urates appeared on one or two occasions, when the urine had stood forty-eight hours; but the urine of the fourth day presented, at the end of twenty-four hours, a large brickdust deposit of them, weighing in all 34 grains (you will see presently that the fourth day was otherwise peculiar). Urea was readily thrown down during the abstinence, in the form of nitrate and oxalate—the former in large, flat, yellow plates, overlying each other, and occupying considerably more than half the bulk when equal parts of urine (unconcentrated) and nitric acid were used. The oxalate was thrown down in thick colourless rhomboids.

The man's net *body-weight* at the commencement was 107½ lbs. At the end of the first three days, he had lost 5 lbs. He lost another pound on the fourth day. The lowest ascertained weight was 100½ lbs. on the sixth day, after a small portion of food had been taken. On the tenth day, he took all the diet allowed him, and regained his original weight on the thirteenth day. The first time that he took any food was on the sixth day, when he had about a pint of porridge, containing four ounces of oatmeal and half a pint of milk; and he took the same quantity on the seventh, eighth, and ninth days, with a small piece of bread extra on the last of these. On and after the tenth day, he took all the diet (a punishment one) that he was allowed. It consisted daily of 20 ounces of bread, a pound of potatoes, and two pints of oatmeal-porridge, as above. The nutritive value of this dietary in ounces, calculated according to Dr. Parkes's Tables, is as follows: albuminates, 3.72; fat, 1.36; carbohydrates, 19.41; salts, .98.

On the twelfth day, his bowels were open for the first time. It will be found that the range of body-weight is comprised in three stages, each of which corresponds with a period in the dietary: 1. From the commencement up to the fifth day, with an absolute fast, when there was a loss of seven pounds; 2. From the fifth to the ninth day, with a minimum of food, when the weight remained stationary at its lowest point; 3. From the ninth to the thirteenth day, with a reasonable amount of food (non-animal) when there was a gain of seven pounds. It might be expected that a five days' positive starvation would have entailed a greater loss in body-weight than seven pounds; but, if we bear in mind that fat is the tissue most readily and abundantly disposed of during inanition, and that this man, from his stay in prison,

had already parted with all that he could spare, we shall the better understand how the loss was not so great as it might have been under ordinary circumstances; while at the same time we shall be enabled to arrive more closely at the loss sustained by the other tissues in supplying the wants of a body feeding upon itself. At the end of the third day, he had lost 5 lbs., being a loss of 1.6 lb. per day. During the fourth day, he lost a pound. During the fifth, although he was not weighed, I presume that he lost about a pound, for two reasons; first, because he lost no more than a pound on the previous day (the daily loss being in inverse ratio to the duration of the fast); and, secondly, because on the sixth day he was at the minimum ascertained weight of 100½ lbs, after partaking of an amount of food which only just maintained him at the same weight during four successive days. Reckoning, then, the loss on the fifth day at 1 lb., although it might probably be rather less, we have an average daily loss of 1.4 lbs. during the period of starvation, the proportion being considerably higher during the first three, than during the last two days. The body knows well how to utilise a limited diet, and it was an evidence of the economy practised by the system, to find that a pint of oatmeal-gruel sustained the balance in weight at its minimum for several days. The *urea* was estimated up to the thirteenth day by Davy's method, with the hypochlorite of soda, and after that by the mercury process of Liebig.* Taking the third, fourth, and fifth days, when there was an entire abstinence from food and drink, the total excretion of urea was 884 grains, being an average of 294.6 grains per day. This would give an average of 21 grains of urea per ounce of urine, and of 2.9 grains per pound of body-weight. This average per pound of body-weight is nearly a grain in excess of the estimate arrived at by Ranke, in his experiments on himself and on animals, during the fasting state; and it is accounted for by the remarkable excretion of urea on the fourth day, which alone was almost equal to the excretion of the third and fifth days together.

The urine of the fourth day stands out from that of any other day, not only in respect of the great ureal excretion, but also on account of an exceptional deposit of 34 grains of urates at the end of the twenty-four hours. How are we to account for this? Was it a sort of wash-out of the system, and somewhat accidental? Or was it of such a nature that calculations made without including it would be altogether erroneous? Comparing the fourth with the third day, we find that the almost double excretion of urea was held in solution in about the same quantity of urine, while a comparison with the fifth day shows us that the fourth day's excess did not consist of a stronger solution of urea, but in a larger quantity of urine, viz., 16 ounces on the fourth, as compared with 9½ on the fifth; with a difference of about one grain of urea per ounce in favour of the latter. I am inclined to look upon the fourth day as exceptional, and as giving rather abnormal data; but I admit that I am unable to explain away the fact of such a relative excess of urea having been excreted. Taking the fifth day by itself, we find that its results approximate more closely those obtained by Ranke and other observers, who show that about two grains of urea per pound of body-weight are excreted daily during inanition. I shall briefly comment upon it. On the fifth day passed without any food, and the third without any drink, the man lost a pound in weight. He passed 9½ ounces of urine, which at a specific gravity of 1.036 would give us a loss by the renal secretion of 9.8 ounces. Now it has been estimated by Ranke that the daily loss by carbon, during inanition, is equal to 17.82 grains per pound of body-weight, and this would give us a loss of 4 ounces by the lungs. We have, therefore, a total loss by kidneys and lungs of 13.8 ounces, leaving 2.2 ounces to be accounted for mainly by cutaneous exhalation—for the bowels did not act. These results, if they cannot be said to be absolutely correct are sufficiently approximative to deserve notice.

There were 244 grains of urea excreted on the fifth day, being at the rate of 2.4 grains per pound of body-weight. With reference to this, if, as Professor Haughton's calculations go to show, every four grains of urea excreted are equal to a weight of five tons raised one foot, we have an amount of work done in this case equivalent to 305 foot-tons. This work is almost entirely *vital*, and of the most economical sort; for, in the first place, there was little bodily labour or exercise, and then, there was no mass of food taken by the mouth to call forth the work ordinarily expended in digestion. Again, 244 grains of urea comprise 113 grains of nitrogen, and these would correspond to the metamorphosis of 712 grains of albumen. This would probably include nearly the whole of the nitrogen, as little would be expected to find its way into the bowels under such circumstances.

* The calculations during starvation are not interfered with by the intestinal egesta, as his bowels did not act until the eleventh day.

* I have found close comparative results between the two methods; using, of course, a fresh solution of hypochlorite. In the estimates made by Liebig's process, the chloride of sodium was not separated, but the average deduction of a c. c. from the number of cubic centimetres of mercury-solution required, was made.

After maintaining for three days his minimum weight, on a small and somewhat uncertain quantity of food, he took, on the tenth day, all the diet given him. I have already shown that, by calculation, it contained in ounces 3.72 of albuminates, 19.41 of carbohydrates, and 1.36 of fat. Taking these together, we have one part of nitrogenous food to six of carboniferous. The total nitrogen is 255 grains, the total carbon 5119 grains, including 875 grains contained in the nitrogenous substances. Absolutely, these are high figures, especially when we have the man at rest; while the relative proportion of carbon to nitrogen is also considerably above the usual dietary estimates.

As far as mere nutritive elements are concerned, we have a supply here not only capable of repairing the ordinary tissue-waste, but sufficient also to provide a surplus, which the system is unable immediately to utilise, beyond storing it up in the form of adipose tissue. This additional fat, arising from excess of hydrocarbons in the blood, adds merely body-weight and bulk. There is no corresponding increase of the more highly organised tissues which give forth strength and stamina, and consequently these fall off, and are besides rather clogged by the fatty accumulation. It almost invariably happens that, if, in the course of several months, a man's health is not affected by the monotony of the diet of which I have been speaking, he gains in weight, but not in strength. He becomes stouter, but not proportionately strong, as he is deprived of that healthy use of his muscles which preserves their power and vigour. The original body-weight (107½ lbs.) having been reached in the case of H. W., the excretion of urea for the last four days averaged 307 grains, being at the rate of 2.8 grains per pound of body-weight in twenty-four hours, and that on a non-animal diet containing 250 grains of nitrogen.

December 23rd, 1869. It is curious to note the obstinacy with which this man refused to take his food. Although it was put into his cell regularly, and remained there all night, he would not, and did not, touch it, and he continued this with very little interference to his bodily functions until the sixth day. It shows how persistently the body clings to its life, eating itself, as it were, by a process of capillary cannibalism, rather than die out at once for want of food supplied by the proper channel to repair the natural waste.

ON BICHLORIDE OF METHYLENE: AN ACCOUNT OF ONE HUNDRED CASES OF ITS USE AS AN ANÆSTHETIC.

By PHILIP MIALI, Surgeon to the Bradford Infirmary.

(*Editorial Abstract of Original Paper.*)

THE author commonly uses the cylinder introduced by Mr. Peter Marshall. Most of the administrations were for operations on the eye; but it was used also for amputation of the thigh and leg, and removal of the breast.

Insensibility in adults was generally produced in from two to five minutes; the average being 3 minutes 20 seconds; the minimum, 1½ minute; the maximum, 5 minutes.

One dose of a drachm was generally sufficient to produce anæsthesia. In females, less than this will suffice. More than a drachm and a half was never found necessary to produce the first insensibility. The maximum quantity required before the completion of an operation was three drachms and a half.

The author proceeds to compare these results with those from the administration of chloroform. The average time taken to produce full anæsthesia was: in

Men—3 minutes 20 seconds with bichloride of methylene.

6 minutes 20 seconds with chloroform.

Women—2 minutes 22 seconds with bichloride of methylene.

4 minutes 18 seconds with chloroform.

Children—1 minute 16 seconds with bichloride of methylene.

2 minutes 24 seconds with chloroform.

The quantity of chloroform required was about double that of the bichloride of methylene. The duration of insensibility after removal of the inhaler was not found to vary with sex and age, as the time of the invasion was. It was not uncommon to find the patient completely conscious and walking away in less than three minutes after the commencement of inhalation.

Vomiting occurred forty-two times out of ninety-seven; nausea merely, six times. Vomiting did not occur once before anæsthesia was complete. The author thinks that the use of the bichloride is not likely to be much more free from consequent vomiting than chloroform.

The pulse was unaltered in 4 cases, quickened in 9, and lessened in frequency in 23.

The respiration was nearly always quickened. In five cases in which

the respiration gave warning of impending danger, prompt measures were successful in restoring the patient.

The author is satisfied as to the safety of this anæsthetic, and thinks it is easily managed with average precautions. It is important to exclude rather than admit air. The apparatus should be well applied to the face. In small operations, it is decidedly preferable to chloroform, and for larger ones quite as useful.

TWO CASES OF EMPYEMA SUCCESSFULLY TREATED BY DRAINAGE-TUBE.

By WILLIAM PALEY, M.D., Peterborough.

CASE I.—Miss B., aged 10½, of good constitution, was seen by me on the 3rd of March last, for a most severe attack of double pneumonia, complicated with pleurisy on the right side, coming on after measles. The symptoms were so urgent, and the exhaustion so great, that the child was only kept alive by the free use of stimulant and most careful feeding. I saw her again on the 18th of March, and found her reduced almost to a skeleton, so weak that she was unable to move a limb; the left lung was slowly recovering, but on the right side slight effusion had commenced.

On April 3rd, in consequence of the urgent dyspnoea and increasing debility, the chest was punctured by a trochar in the ordinary method. About four pints of thick pus were removed, and the wound closed. Considerable relief was afforded for the first four days after the operation, but in ten days' time the chest was quite full again, and the child as weak as ever—indeed, the chances of recovery were so small that I had great difficulty in persuading the parents to allow any further operation.

On April 13th, the following operation was performed. On a level with the ensiform cartilage, and a little to the right of the nipple, a direct opening was made into the chest with a medium-sized trochar. After about a pint of pus had been discharged, an India-rubber-tube (such as is used for feeding-bottles), about two feet and a half long, and with a few small openings cut into it, with a pair of scissors, at the end to be left in the chest, was passed through the cannula for about six inches. The cannula was then withdrawn over the tube, and the latter was securely tied to two pieces of plaster above and below the wound with a piece of silk, the patient lying near the edge of the bed, and on the affected side; the lower end of the tube was placed in a basin half full of water, on a chair at the bed-side, and kept under water by a weight tied to it. No operation could have answered better. Not a single bad symptom or difficulty of any kind occurred during the whole subsequent treatment. The tube was kept in for six days; the fluid was slowly evacuated without any air being admitted into the pleura; the lung expanded as the fluid was withdrawn gradually, taking its place, so that no vacuum was ever left in the chest. The tube, being quite soft, caused no pain at the wound, and did not seem to irritate either the lung or pleura by its presence in the chest. When the tube was withdrawn, the opening in the chest was kept covered by a piece of wet lint, with oiled silk over it; and for the next four months small quantities of pus continued to be discharged—at first, daily, and afterwards, from time to time. After a fortnight, the child was allowed to get out of bed; and, as she gained strength, was carried out into the open air as much as possible; and, as soon as she could be moved, was sent to the sea-side, where she remained six weeks.

I saw her about a week ago, and, save a very little falling in of the chest under the right clavicle, scarcely any other trace of the serious mischief that had previously existed was left. The chest was fairly resonant all over that side, and a well-marked respiratory murmur existed throughout the lung. The general health and strength of the child was as well as ever. The wound had been quite closed since the end of August last.

For all the details of the operation and its successful performance, I am indebted to my friend and colleague at the Hospital here, Dr. T. J. Walker.

CASE II.—The next case was even more successful than the first. Master A., aged 10½, of fairly strong constitution, had been ill with pleurisy, followed by empyema, since the end of March. The child had been most carefully treated from the first, under the superintendence of one of our best local physicians. The chest had been twice tapped by a trochar, and the wound closed in the ordinary method before I saw him, on the 16th of June last. I found the whole left side of the chest quite full of fluid: the child could only lie on the affected side; was greatly reduced in strength; had very little appetite; and the abdomen was large and distended. The operation was performed by Dr. Sinclair in my presence on June 17th, precisely in the same way