ON
THE PATHOLOGY
OF
HOOPING COUGH.

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IT is somewhat strange that the pathology of Hooping Cough, a disease which affects almost every individual, and which is frequently fatal in its termination, should have received but little attention. The treatment is, in most cases, left to the care of nurses and mothers, aided by the nostrums of empyrics, and frequently by superstitious observances ; whilst the serious nature of the complaint remains disregarded in consequence of the numbers who recover without medical treatment, and of the fact, that when the assistance of the physician is at length obtained, and the disease proves fatal, the death of the patient is not ascribed to Hooping Cough, but to inflammation of the

lungs, or to convulsions, the most prominent symptom of the fatal stage of the disease.

It is allowed that we possess no means more effectual for the advancement of medical science than the close investigation of those morbid changes of structure which have taken place in consequence of disease; I have, therefore, gladly availed myself of numerous opportunities of making inspections after death, and it is with much diffidence that I now lay before the Society the result of some of my examinations, in the hope that however imperfect these observations may be, they may tend to form a more correct diagnosis, and consequently lead to a more judicious and successful mode of treatment.

As the appearances on dissection, in all the cases that I have examined, have been precisely the same, I conceive we are fully justified in considering them the effects of the continued and uncontrolled action of Hooping Cough.

The construction of the lungs displays a surface of the greatest possible extent in a given volume, and hence the blood and air are enabled to act upon each other to the greatest possible advantage. Various have been the opinions of anatomists and physiologists on the *intimate* structure of these organs. Magendie* conceives that the air-

* Précis Élémentaire de Physiologie.

cells communicate with each other, but are enveloped in a thin layer of cellular tissue, which separates the neighbouring lobules : a small bronchial tube is furnished to each lobule which does not proceed further than the envelope, and then terminates abruptly as soon as it reaches the parenchyma ; hence he doubts the probability of the air-cells being lined with a *mucous membrane*. Reisseisen * appears to have considered them with the most minute attention. The conclusions to which he has come are, that the extreme bronchia are subdivided into a multitude of small canals, each terminating by a globular cul-de-sac ; the canals being grouped together somewhat in the manner of the ultimate subdivisions of the flower stalks of the cauliflower.

The lungs together with the heart and large vessels are contained within the cavity of the chest, whose unyielding walls present an obstacle to that examination which we have the power of making in disease of the abdominal viscera. The tender age, also, at which Hooping Cough usually occurs, (on which account we are unable to obtain accurate information of the feelings of the patient,) and the great similarity of the symptoms of most of the diseases of the chest, contribute so many difficulties in discriminating correctly between them, that I venture to hope this attempt to elucidate the nature and seat of Hoop-

* De Fabrica Pulmonum.

ing Cough will not be otherwise than favourably received by the Society.

The usual symptoms by which this disease is distinguished, are cough, coming on generally abruptly, attended sooner or later by the sonorous inspiration called hooping; the paroxysms consist of a number of short expirations quickly succeeding each other, producing almost a feeling of suffocation, followed by a full crowing inspiration*.

The cough then re-commences, and the fit continues until the patient is relieved by the expectoration or vomiting of a quantity of phlegm alone, or together with the contents of the stomach. The extremities become cold during the fit, and the paroxysms are usually most frequent and most severe during the night. If the disease be not accompanied by fever, the little patient seems quite well after the fit, and returns to his pursuits with eagerness; even if vomiting terminate the paroxysm, the appetite is immediately keen for food. In the more advanced stage of the severe form of the complaint, however, fever is present between the paroxysms, the hooping usually disappears, the face becomes livid, swollen, and opaque, the lips purple, the pulse very rapid, and the extremities cold, whilst the skin of the body is burning hot. The breathing becomes irregular

* Burns.

and præcordial or abdominal. The appearances detailed in the following cases which I had an opportunity of examining after death, seem to throw some light on the nature and seat of the complaint.

CASE I.

On Monday, 26th March, 1828, I visited Sarah Allison, aged two years, residing in Blewett's Buildings, Fetter Lane; she lay upon the left side; respiration difficult, irregular, and nearly the whole act taking place by the diaphragm alone; pulse very frequent; face puffy and livid; lips purple; nostrils dry; alæ of the nose in considerable action; tongue white; countenance anxious; skin of the body hot; great thirst; extremities cold; frequent paroxysms of cough, during which the child put its little fingers down its throat to get rid of the phlegm; bowels open. She had been for three weeks affected with Hooping Cough, and several children had died of the same disease in the neighbourhood. She was freely leeches and blistered, and took saline mixture with digitalis and conium, with warm bath to the lower extremities; she took no other food than barley-water.

On the 29th, difficulty of breathing increased; great restlessness; face livid; respiration very irregular and abdominal; flatulent distension of

the abdomen. In the evening, the hands became clenched and turned inwards; face puffy; jaw locked; each side of the body in turns convulsed, and she died in a few hours.

Dissection, thirty-six hours after death.—There were no adhesions of the pleura, nor any fluid in the cavity of the chest; the lungs did not collapse, they contained much air, which was with difficulty pressed out: in different parts of the lungs, but chiefly in the lower portions of all the lobes, a change of structure had taken place, which has been termed lobular hepatization; this was more evident in the middle lobe of the right lung, which was quite contracted to the size of the pancreas, and which it very much resembled in the sensation which it conveyed to the touch; the septa dividing the lobules were distinctly seen, and appeared perfectly healthy, the lobules themselves quite dense, and somewhat resembling the muscular structure of the heart; several of the smaller bronchial tubes were much dilated, and lined with thick mucus; there was no appearance of inflammation in the trachæa or in the larger bronchial tubes.

CASE II.

John Allison, aged $7\frac{1}{2}$ months, brother to the preceding; a remarkably strong and vigorous child, had been affected for a fortnight with Hoop-

ing Cough ; but as he took the breast freely, and was very lively, little had been thought of his complaints. I found him, on the 11th of April, 1828, breathing with great difficulty ; respirations 62 in a minute, irregular and abdominal ; nostrils dry, and alæ of the nose in great action ; pulse 140 ; tongue white and furred. Three leeches were applied to the chest, and a small blister, for four hours, between the shoulders ; a grain of calomel and one-eighth of a grain of tartarized antimony, every eight hours. On the 13th he had several convulsion fits, and the abdomen became distended with flatus. The evacuations, like chopped grass and offensive, passed during the paroxysms of cough. 14th. Very sick from the antimony ; had taken the breast several times, but as often vomited the milk. Bowels freely purged ; motions not so green and offensive. 15th. System affected by mercury ; tongue white, dry, and swollen ; inner parts of the mouth and lips blistered, nostrils dry, skin of the upper parts of the body intensely hot, extremities cold, face flushed, lips purplish, breathing more laborious, catching, and abdominal. Died in the afternoon.

Dissection, forty hours after death, carefully made for me by my talented friend Dr. Hodgkin. The head was rather large, the forehead remarkably protuberant ; the calvaria was not raised with greater difficulty than usually attends the operation in the infant. The quantity of serum in the ventri-

cles and under the arachnoid coat was rather larger than was natural. The substance of the brain was of the soft consistence natural to the organ at the age of the subject. The only morbid appearance observable except the before mentioned slight effusion, was an irregular venous marbling of the medullary matter. There was no trace of pleuritic inflammation on either side of the chest. About one-fourth of both lungs, towards their posterior and inferior part, was the subject of a morbid change; the structure was rendered very firm and dense; its limits were perfectly defined, the septa between the lobules constituting the boundaries. The portions in which this change had taken place were of a dull red colour, perfectly void of air, sinking instantly when put into water, and undergoing no change when thin slices were subjected to ablution in it. The individual lobules were firmer than they are often found in hepatized lungs; and the cellular membrane between them retaining its natural structure, produced a combination of looseness and density, which has not been inaptly compared to that met with in the pancreas. The remaining portions of the lungs were of a light colour, of an uniform texture, spongy and crepitant; but very little, if any, of the air pervading the cells could be expelled by the bronchial tubes. Most of the tubes were filled with a light yellow secretion, which, in the greater number, had assumed a concrete form, having very much the character of fibrine; in others it was in the

form of a thick puriform mucus : where it occurred in the concrete form, it adhered, though slightly, to the lining membrane of the tubes. This membrane was generally pale beneath the false membrane, but in some places it was a little reddened; most of the divisions of the tubes were somewhat dilated ; the concrete secretion which filled them readily explained the difficulty of expressing air from the lungs. The heart was healthy : the blood in the right ventricle had formed a coagulum free from red particles : the abdominal viscera were generally healthy, and offered nothing remarkable, except that the right lobe of the liver had a deep cleft, producing an extra lobule.

CASE III.

March 2d, 1829. Louisa Cash, aged nine months, residing at 55, Baldwin's Gardens, has been three weeks affected with Hooping Cough, during which time the cough has been severe, with much hooping ; she has not hooped for the last three days : face is now puffed and pale, lips livid, breathing sonorous and catching, chiefly performed by the diaphragm, is reported to have had as many as seven convulsive fits since last evening : whilst taking this report was seized with a convulsive fit : skin of the body hot, extremities not quite cold, bowels open, pulse 145. An ounce of blood was

taken from the chest by cupping, and afterwards four leeches were applied to the temples ; small doses of calomel and antimony every three hours.

March 3d. Has had no fit of convulsions since 4 o'clock yesterday ; takes the breast freely, though she vomits the milk very soon after. Countenance pale and death-like. Alæ of the nose in considerable action : respirations 68 in a minute, and abdominal after every four or five inspirations. She appears to hold her breath, and then let it go, with some expulsive effort, and as it were with reluctance. Pulse very frequent ; cough short, but severe ; does not hoop ; bowels purged. A blister was applied to the back of the neck for four hours, and the medicines continued.

March 4th. Symptoms much the same : paroxysms of cough more frequent, with expectoration, whether mucous or purulent not ascertained, being swallowed, as is usual at this age. In the evening convulsions returned. Died at 9.

Dissection eighteen hours after death. No signs of pleuritic inflammation, no effusion. Both lungs had undergone the change so minutely described in the last case ; the middle lobe of the right side more particularly the seat of this morbid condition, much contracted, and quite impervious throughout to air. The lower portions of the other lobes on both sides were similarly affected ; the re-

maining or upper portions of the lungs were crepitant, but did not collapse on opening the chest. The bronchial tubes in many places, when cut open, appeared somewhat dilated.

CASE IV.

May 4th, 1829.

Anne Jones, aged $3\frac{1}{2}$ years, No. 9, Tash Street, Gray's Inn Lane, lies in bed with the legs drawn up; urine retained; countenance flushed; lips purple; some thirst. Pulse 148, irregular; respiration 66, abdominal; bowels open; urine scanty. Has kept her bed for eight days, during which time fever has been present between the paroxysms of cough. Had a convulsion fit this morning; six leeches were immediately applied to the throat, and a smart purge of rhubarb and calomel; in the evening a fluid drachm of ipecacuan wine was given every ten minutes, until she vomited. Warm water to the lower half of the body.

5th. Made water freely in the bath, and appeared somewhat relieved by the depletion of yesterday; tongue white anteriorly, brownish towards the root; pulse 160; respiration 68, still abdominal and irregular; lips of rather better colour; vomited a considerable quantity of mucopurulent fluid.—Small doses of calomel and anti-

mony with saline mixture and nitric ether, were ordered.

6th. Pulse 136, irregular; lies on the side, and is very drowsy; coughs, but does not expectorate; bowels open; respiration 70, abdominal and irregular; skin of the body hot, and extremities cold; in the evening she became strongly convulsed for about half an hour, previously to which she had appeared much better; the face remained puffy and purple, and she died shortly after.

Dissection, 36 hours after death.—No adhesions in the chest, nor any effusion; the inferior portion of all the lobes were in the peculiar state before described; the middle lobe of the right lung, as observed in former cases, quite contracted and changed, as in the case of Sarah Allison. There was nothing in this case like membrane, but dense muco-purulent secretion filled the more minute bronchial tubes; the heart was quite healthy, except at its apex there appeared a small flattened cyst five or six lines in diameter, which contained a limpid fluid.

Remarks.

It will be observed that in the cases which have been detailed, the same morbid change had taken

place. In many others which I have inspected, I have invariably found the same appearances, uncomplicated with any evidence of plueritic inflammation. In the lower and posterior portions of the lungs, the structure was rendered very firm and dense; the portions which were the subject of this change, exactly defined by the septa; of a dull red colour, devoid of air, sinking instantly in water, and thin slices undergoing no change by ablution. The individual lobules were more dense than in hepatized lungs, and the cellular membrane between them retaining its natural structure, conveyed to the touch the same sensation that is felt on handling the pancreas: the upper portions of the lungs were spongy and crepitant; but very little air, however, could be expelled by the bronchial tubes. Most of the smaller tubes were filled with thick secretion, in one of the cases with false membrane, in all of them the divisions of the tubes were somewhat dilated. This dilatation of the bronchial tubes is an organic lesion frequently overlooked, and to be detected only by tracing the individual tubes to their ultimate ramifications. Laennec has remarked *, that, in peripneumony of children, death usually takes place in the stage of engorgement, or after the supervention of a lobular hepatization; that is to say, a hepatization occupying only some detached points, which he explains by adverting to the

* De L'Auscultation Mediate.

greater necessity of respiration at this period of life, children requiring a greater proportion of air than adults. I apprehend, however, that the appearances detailed differ from those found in peripneumony. In Hooping Cough the lung is always dense and *contracted*, as if the air had been expelled, and from the throwing out of adhesive matter, the sides of the air-cells had been agglutinated together, while, in hepatization, the lung is less dense than in hooping cough, and is rendered more *voluminous* than in its natural state. The dilatation of the tubes and air-cells takes place in forcible expiration, in consequence of the plugging up of the bronchial tubes by false membrane, or dense muco-purulent secretion : *a foundation for future asthma*. It would appear then, that in this rapidly fatal stage of the complaint, an adhesive form of inflammation is set up in the different air-cells at the same time, mucus is secreted in less quantity than natural, a fibrinous exudation takes place, and adhesion of the parieties of the cells is the consequence ; whilst the cellular membrane, separating the individual lobules, retains its natural structure : a form of disease which exactly resembles croup in a different part of the respiratory apparatus. It may be well, perhaps, if we point out the symptoms by which this state of the lung may be distinguished during life. There is fever between the paroxysms of the cough ; the respiration becomes more rapid, irregular, and abdominal ; that is, the action of re-

spiration is performed by the diaphragm : the alæ of the nose are called into action ; the face is puffed, pallid, and opaque ; and the lips purple.

This appearance of the lip is doubtless dependent on pulmonary obstruction, whether temporary or permanent, of which it is, perhaps, the most unerring symptom ; it arises as well in consequence of the impervious state of the dense contracted portions, as from the dilated cells found in other parts of the lung, for Sir E. Home has shewn * that the transmission of the blood from the pulmonary artery to the pulmonary vein takes place only during expiration, or partial contraction of the air-cells. In the treatment of this stage of the complaint no time should be lost in the application of remedies ; the approach to a fatal termination is rapid, and nearly the same promptitude is necessary here as in croup. Leeches are too slow in their mode of abstracting blood, to be of effectual service ; I have so often been disappointed in the application of them, that I have long since discontinued their use in this case ; I have, however, been much satisfied with the result of the prompt and bold extraction of blood by cupping, followed by calomel and antimony, or James's powder in small doses, repeated at short intervals, until the symptoms detailed give way to others less distressing to the little sufferer ; secretion of

* Phil. Trans. of the Royal Society for 1827. Part. I.

mucus takes place; the adhesive membrane is absorbed, or thrown off and expectorated; the breathing becomes less laborious; the diaphragm taking a smaller part in the operation, and the lips assume a more natural colour. The quantity of blood to be taken is greater than, from the pulse or age of the patient, we should be led to suppose requisite or even safe.