blood, and Binz finds that it does the same in a solution of hæmoglobin.

External respiration, or the interchange of gases between the blood and the atmosphere, takes place whenever they come into sufficiently close relation with one another, as they do in the capillaries of the skin, intestinal canal, or lungs. In the frog, respiration is carried on by the skin to such an extent, that it can live for a considerable time after the lungs have been excised; but in mammalia respiration is carried on almost entirely by these organs, and any interference with their function quickly puts an end to the life of the animal. In order that the blood which circulates through the body may get rid of its carbonic acid and take up oxygen sufficient for the wants of the tissues, fresh portions of it must constantly be brought into contact with the air, and therefore it must constantly circulate through the pulmonary capillaries. But the air in the lungs would soon become saturated with carbonic acid and deprived of its oxygen by the blood which comes into contact with it, and all farther diffusion would be arrested, unless it also were constantly renewed. This is effected by the respiratory movements. These consist in the alternate enlargement and diminution of the thoracic cavity, after the fashion of a pair of bellows, by the motion of its walls and of the diaphragm. These movements are kept up in a rhythmical manner by a nervous centre, situated in the medulla oblongata and upper part of the spinal cord, which sends off periodic motor impulses to the diaphragm and inspiratory muscles. When the breathing is quiet, expiration is usually a passive act performed by the elasticity of the lungs and ribs, and by the weight of the thoracic walls. But when it becomes excited, active expiratory muscles are brought into action, and they receive their motor impulses from the respiratory centre alternately with those of inspiration. It is probable, though not certain, that the respiratory centre is not a mere reflex apparatus, which simply transmits impressions which it receives from sensory nerves to motor ones; for its activity continues, although its connections with sensory nerves be almost entirely destroyed. The periodic impulses which it imparts to the motor nerves of the respiratory muscles are not due to its being periodically excited by impressions from afferent nerves, but to its being constantly excited by the venosity of the blood circulating in it; while some resistance within itself prevents the excitation from being constantly transmitted to motor nerves, and only allows it to be so at periodical intervals.

The venosity of the blood consists in the absence of oxygen and the presence of carbonic acid, and it is not certain whether or not both of these act as excitants to the respiratory centre; but it seems not improbable that the presence of carbonic acid is the excitant, while the amount of oxygen simply alters the excitability of the centre. According to this view, when there is much oxygen in the blood, the excitability of the centre will be slight, and little affected by any irritant applied to it, whether this be carbonic acid or anything else. When the amount of oxygen in the blood is small, the centre will be very excitable and easily affected by any irritant. In venous blood, there is both little oxygen and much carbonic acid, so the centre is both rendered more sensitive, and is more strongly excited by the acid. The more venous the blood, the greater is the excitation of the respiratory centre, and the more active the respiratory movements. When other interfering circumstances are excluded, it would appear that greater excitement of the respiratory centre causes the respirations to become quicker, and, at the same time, deeper. This excited respiration is termed dyspnoea, and it occurs when the blood becomes venous in the respiratory centre. As the venosity increases, the ordinary muscles of respiration are no longer employed alone, but the expiratory and accessory muscles are called into play; and, lastly, all the muscles of the body are affected by clonic convulsive movements, called asphyxial convulsions.

When the blood which circulates in the respiratory centre is not at all venous but is perfectly arterialed, as it is when artificial respiration is vigorously performed, the centre is both rendered less sensitive, and the irritant, viz., the carbonic acid, is at the same time diminished or removed, the centre is not excited at all, and respiratory movements cease.

This condition, in which no desire for respiration is felt, and respiratory movements cease, is termed "apnoea" by German writers, and it must be carefully distinguished from the "apnoea" of English authors, which is simply extremely great dyspnoea; so great, that the blood is hardly aerated at all.

The activity of the respiratory movements and the amount of air respired in a given time, depend on the degree of excitement of the respiratory centre. As we have just seen, this excitement depends on two factors; 1. The excitability of the centre; and 2. The amount of irritation applied to it. In general, the venosity of the blood determines both factors, and it is not the venosity of the blood in the general circulation which does this, but only of that blood which courses

through the vessels of the medulla. This was shown by Hering, who passed a stream of arterialed blood through the vessels of the head while venous blood was circulating in those of the body. The respiratory movements then ceased exactly in the same way as if the whole blood in the body had been perfectly oxygenated. When he reversed these conditions, and passed arterialed blood through the body and venous blood through the head, asphyxial convulsions took place. This shows that the degree of activity of the respiratory centre in the medulla oblongata depends on the greater or less venosity of the blood circulating through it, and not on an irritating action exerted by venous blood on the ends of afferent nerves in the lungs, or other viscera.

The excitability of the respiratory centre may be greatly modified; 1. By the temperature of blood in it; 2. By the action of drugs upon it. When the blood becomes warmer, the excitability of the respiratory centre is greatly increased; the movements of respiration become much more vigorous, and it is no longer possible, by the most active artificial respiration, to produce a state of apnoea. Certain drugs, as tartar emetic, or apomorphia, when injected into the veins, also prevent the production of apnoea, but whether they do so by increasing the excitability of the centre, or by acting as irritants to it, is uncertain.

Other drugs, such as chloral, greatly diminish the excitability of the respiratory centre, so that the respirations become fewer, notwithstanding the increase of carbonic acid in the blood to which their diminution gives rise, and if the dose be large they may stop altogether. Apnoea may also be produced by means of artificial respiration with great ease after their administration, and it may last so long, that one is sometimes inclined to think that the animal is not going to breathe again at all.

FOUR CASES OF AFFECTION OF THE VERMIFORM APPENDAGE, WITH FATAL ISSUE.

By JOSEPH COATS, M.D.,

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THESE cases are brought forward, not as offering any thing very new, but as illustrative of affections of the vermiform appendage, which are not very uncommon, but which, perhaps, are not sufficiently borne in mind in ordinary practice. The cases are, themselves, so illustrative, that their description involves almost all that need be said of the conditions involved.

CASE I. Concretion in the Vermiform Appendage, consisting of inspissated Fæcal Matter. Inflammation of the Appendage, resulting in General Peritonitis.—This was the case of a middle-aged man, who, while apparently in perfect health, was attacked by symptoms resembling those of ileus, and which were at first supposed to be due to some internal incarceration of the bowel, or to strangulated hernia. A surgeon was consulted with a view to the latter question; the bowels were, however, freely moved by enemata, but without relief to the symptoms, and the patient died on the fourth day. On opening the abdomen, there were evidences of very acute recent peritonitis. The intestines were everywhere glued together with soft lymph, and the great omentum was adherent by its lower margin to the folds of intestine at the brim of the pelvis. The lymph was everywhere soft, but towards the right iliac region it was much softer than elsewhere, and there was here even fluid pus. On removing the lymph and pus, the vermiform appendage was found lying on the surface of the colon, in the form of a turgid black coiled up mass. It was much dilated, and most intensely congested, so as to have an almost gangrenous appearance. In the dilated appendage, which was congested through its entire thickness, a solid body about the size and shape of a cherry-stone was discovered. This foreign body was about the consistence of half-dry clay, and had a similar brownish yellow colour. On being cut into, this body, which, from its appearance, evidently consisted of dried fæcal matter, was seen to be stratified. The dilated portion of the appendage, in which the body was lying, did not appear to communicate with the peritoneal cavity—at least, no perforation could be discovered. The mucous membrane of the intestines was perfectly normal, and the calibre in no part obstructed.

In this case, it appears as if the small mass of inspissated fæcal matter had found its way into the vermiform appendage—possibly when of small size, as the stratification seems to indicate that it was of gradual growth, and the successive layers may have been added after its passage into the appendage. The mass acted as a foreign body, producing an intense inflammation of the appendage, which passed from its mucous to its serous surface, and thence to the general

serous surface of the abdomen. The peritoneal inflammation centred around the vermiform appendage, where alone there was a distinct formation of pus. It has been often said, that cherry-stones are apt to pass into the vermiform appendage and set up inflammation there. The foreign body, in the present case, resembled a cherry-stone both in shape and in size; and, if it had been just a little harder, might readily have been mistaken for one. It may be a matter of speculation how many of the reported cherry-stones were actually composed of inspissated faecal matter.

CASE II. *Phthisis Pulmonalis. Ulceration of the Vermiform Appendage and Abscess around it. General Peritonitis.*—Mary C., aged 16, was the subject of advanced phthisis pulmonalis, with cavities in both lungs. An acute attack supervened, which proved fatal. On opening the abdominal cavity, it was found to contain a considerable quantity of creamy pus, and the intestines were generally glued together by a very soft lymph, which was in great part breaking down into pus. A more defined abscess was discovered in the right iliac region, surrounding and lying between the folds of the vermiform appendage. The abscess, which was about the size of a walnut, contained glutinous pus, and matter of an exactly similar character distended the vermiform appendage, although it was doubtful whether any considerable communication existed between the two. The mucous membrane of the appendage was ulcerated; and, at its opening into the caecum, there was an ulcer with fungating prominent granulations. The ileum was the seat of numerous so-called tubercular ulcers, and there were also a few in the large intestine.

Here we have another case of general peritonitis resulting from disease of the vermiform appendage, but a very different disease from that in the first case. There was here ulceration of the appendage, similar to that often met with in the intestine, along with phthisis pulmonalis. It is very probable that, just as in the case of cavities in the lungs where perforation of the pleura takes place, so here a partial perforation had occurred, but its effects were confined by adhesions, and the result was the small abscess around the appendage; but, after a time, the inflammation extended from the abscess and became general over the peritoneal surface. This case reminds me very forcibly of one in which there was an ordinary diverticulum of the intestine, at the very extremity of which was situated a small ulcer, which had caused perforation. There were other ulcers in the intestine of the same nature as those in this case, but none of them seemed near causing perforation. Considering how rarely these so-called tubercular ulcers lead to anything like general peritonitis, and how seldom any actual perforation occurs, we must look on the relations of the vermiform appendage in the one case, and those of the diverticulum in the other, as predisposing to this complication.

CASE III. *Adhesion of the Extremity of the Vermiform Appendage to the Ileum. Incarceration of the Intestine.*—Jane H., aged 60, was admitted to the Royal Infirmary on July 1st, 1871, under Dr. McCall Anderson. About three weeks before, she had first experienced a severe pain in the right hip and in the abdomen, especially the right iliac fossa. This continued till admission, becoming neither better nor worse, and she described it as a smarting pain, leaving off at times. About twelve days before admission, an eruption of small blisters appeared on the hips, and the crusts remained like those of herpes zoster on admission. The right iliac fossa was very painful on pressure; the bowels were stated to be regular. On the evening of August 7th, she became much worse, and next morning was in a state of collapse, from which she did not recover, but died at 2.30 P.M. On opening the abdomen, the peritoneum was found to contain about a pint of red fluid. The lower part of the ileum was at once seen to be of a very deep red colour, and distended with gas and fluid feces. The rest of the small intestines was also somewhat distended. The deeply congested appearance of the ileum was distinctly defined, commencing abruptly about two feet above the valve, and ending about an inch above that structure. Just above the commencement of the congested part, the free extremity of the vermiform appendage was firmly adherent to the peritoneal surface of the ileum, and the whole ileum beneath that point had slipped beneath the appendage, which thus acted as a constricting band. On opening the ileum, the affected portion was seen to be intensely hyperæmic in all its coats. The general peritoneal surface was distinctly but not excessively hyperæmic.

In this case, some doubts may exist as to the exact course of events. The fatal issue seems to have been directly caused by the incarceration of two feet of the small intestine which had passed under the vermiform appendage; but the exact significance of the earlier symptoms, which existed for eight weeks before death, is more difficult to be sure of. These symptoms all pointed to some affection in the right iliac region or neighbourhood of the right hip. Now, the adhesion of the vermiform appendage was so firm that we can hardly suppose that

it was only of two months' duration, or that these symptoms were due to an inflammation resulting in this adhesion. It is difficult, however, to make any very certain statement in such a case, and possibly these symptoms may admit of such an explanation. On the other hand, the portion of small intestine may have been gradually slipping beneath the appendage during these weeks; but, as the passage was pretty wide, although the gut may have been subjected to considerable pressure and irritation, yet no actual obstruction may have taken place till just before death. This seems, on the whole, the more likely explanation, as the pain was stated to have come on suddenly, and to have been very severe. The occurrence of an attack of what appears to have been herpes zoster, in connection with this local irritation, must be an interesting point in connection with the supposed relation of this disease to affections of the nerves. The fatal issue then, was, the indirect result of a simple adhesion of the tip of the vermiform appendage to an approximate loop of small intestine; and the observation readily suggests itself, that if the exact condition could have been made out during life, a very simple operation, though a dangerous one, might have relieved the patient and averted the unfortunate result.

CASE IV. *Hydrops Appendicis Vermiformis. Transformation of the Appendage into a Large Cyst.*—In this case, the very marked affection of the appendage was only discovered after death; no symptoms during life having attracted attention to its existence. The patient died of renal disease and pericarditis. The vermiform appendage was converted into a large bulky cyst, whose general appearance is shown in the diagram. The shape of the cyst may perhaps be best described as somewhat like that of an egg attached by one of its extremities to a short cylinder. The oval part formed the free extremity, and the other end was attached to the caecum by a short process at right angles to the long axis of the cyst. The cyst, which had thus an elongated shape,

measured about five and a-quarter inches in length, and about two inches in thickness at the widest part, which was the middle of the egg-shaped portion. The cyst had a short mesentery, which was attached above to the terminal portion of the ileum, and thence passing downwards, became broader as it spread along the upper border of the cyst. The cyst-wall was generally pretty thick, comparable in this respect to the wall of the half-distended large intestine. At some parts it was thicker than at others, and in one of these places had an opaque white, almost aponeurotic appearance. This part was towards the attached end, and is outlined in the sketch. A few vessels ramified on the surface of the cyst. The contents were a yellow tenacious material, which did not flow out on a small aperture being made, and which appeared to be of about the thickness of jelly.

Cases of this kind have been described, and it is generally supposed that they originate in an obstruction of the orifice of the appendage, and the accumulation of the secretion within the canal. The obstruction may be due to the existence of a foreign body, such as inspissated faecal matter, or mucus. The obstruction leads to accumulation of the mucous secretion of the appendage, which dilates the canal and converts it into a cyst. With this dilatation, the coats usually become thin,

and by and bye ulceration occurs and perforation, with, it may be, a general peritonitis. In certain cases, however, and this seems to be one, the coats become thicker as the dilatation proceeds, and the secretion is retained while the cyst attains very large dimensions. The thick colloid contents represent the mucous secretion of the glands of the appendage.

CLINICAL REMARKS ON A CASE OF STRANGULATED FEMORAL HERNIA.

By T. H. BARTLEET, F.R.C.S.,
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FOR the following brief notes of the case, I am indebted to Mr. Shipworth, Resident Surgical Assistant.

Thomas Jones, aged 43, married, a smith, was admitted November 10th, 1874. He had had a swelling in the right femoral region, which occasionally disappeared, for the last seven years. On November 1st, the swelling increased without any special cause. His bowels were constipated; and he took aperient medicine, which produced two motions. On November 2nd, he vomited several times. On the 3rd, the vomiting continued, and he was unable to pass flatus. On the 4th, he described the vomiting as being faecal. Constipation and faecal vomiting continued until his admission on November 10th, when he was found to have a small painless hard tumour in the right femoral region. There was no impulse. The belly was distended, but not painful or tender. The patient's aspect was distressed; his temperature was 99 deg., and his pulse 85. The taxis was tried with great care, but ineffectually. Under chloroform, a transverse incision of one and a half inches was made over the neck of the sac, down to which the intervening tissues were divided on a director. The seat of stricture was the falciform margin of the saphenous opening, a few fibres of which were divided; and the contents of the sac were returned, the sac itself not being opened. The sac, which seemed likely to be drawn up by violent respiratory efforts, was held to the wound by a hare-lip pin passed through the edges of the latter, and including a piece of areolar tissue attached to the sac. The wound was dressed and rolled in the usual way.

November 10th. Vomiting had continued two or three times after the operation. He took twenty minims of tincture of opium, which relieved the vomiting, and was followed by a good night. He had passed flatus. Temperature normal; pulse 75. He had no pain.

November 13th. There was slight discharge from the wound. He had passed a firm and very copious motion.

November 28th. The wound had been dressed with tenax, and was all but healed; it measured now barely an inch.

REMARKS.—The case seems to me to present the following points of interest: the length of time during which symptoms of obstruction had lasted; the lengthened duration of faecal vomiting; the mode of operation; the after-treatment.

Symptoms of complete obstruction had lasted for nine days. The condition of the hernial tumour did not justify the opinion that strangulation had lasted thus long. I believe that the hernia was, at the beginning at all events, *incarcerated*, not *strangulated*. Now, what is an incarcerated hernia? It is a hernia in which the constriction affects only the calibre, and not the walls, of the gut; that is, the passage through the intestine is entirely closed, but the intestinal walls are not sufficiently constricted to stop the circulation through them, and consequently to cause them to sphacelate.

Faecal vomiting was present for four days. This symptom, though a common one in long standing cases of strangulated hernia, is justly considered one of serious importance. It is supposed to be due to the long continued and ineffectual peristaltic action of the intestine above the stricture, inducing a backward current of the contents of the bowel in the centre of the tube.

The Operation.—I have for some time given up the long vertical incision over the whole or greater part of the sac. I make a short transverse incision over the neck of the sac, by pinching up the integuments and transfixing; the incision being rarely as long as two inches. I divide the tissues on a director until I am able to insert a nail under the stricture. I find it rare, even in old standing and in inguinal herniae, to be unable to relieve the stricture without opening the sac. Occasionally the stricture is caused by a few fibres in the sac; and these I have, in one or two cases, very carefully divided from the outside instead of from the inside of the sac.

Herniotomy without opening the sac is an operation free from danger. No important tissues are cut through or displaced. The danger, as far as the operation is concerned, is due to the opening of the sac; for we

then make an open track for the admission of air, and sometimes of fingers, into the peritoneal cavity. I think needless alarm is often felt about the condition of the bowel, or of its strangulation by a band or by omentum, when the sac is not opened. In cases of recent strangulation, it seems to me as great a mark of unwisdom to open the sac to examine its contents, as it would be to trephine the skull to look for a possible clot underneath, in every case of injury of the skull with insensibility. Opening the sac is a *certain* risk; leaving it unopened is an *uncertain* risk. Moreover, in recent cases of strangulated hernia, it is customary to attempt reduction by taxis. Now, if it be safe to reduce a strangulated hernia by taxis, it is surely safe to do so by an operation which is as safe and simple as is extraperitoneal herniotomy. I am aware that the present case is not one of recent strangulation. The symptoms of obstruction and even faecal vomiting had lasted many days. It may be fairly asked why I did not deem it necessary to open the sac and examine the condition of its contents. My examination of the hernia before and during the operation did not favour the belief that it was gangrenous. Pain was not, and had not been, complained of. The integuments were not emphysematous, oedematous, or red; the sac was not flaccid. Had the sac or its contents been long gangrenous, the superficial tissues would have resented the presence of dead matter, as of any other foreign body. Unfortunately, there is no way of telling whether or not the contents of the sac are *just dead*; and I consider it better, in the absence of definite symptoms, to face this risk rather than that of peritonitis, so frequently consequent upon opening the sac. After I had returned the contents of the sac, the violent efforts of vomiting seemed likely to draw the sac itself up into the abdominal cavity. This was undesirable, since, had symptoms of strangulation still continued, I might have wished to open the sac and to bring into view the intestine or omentum it had contained, and which, in the paralysed state of the intestines, would almost certainly be found lying near the crural ring. I therefore kept the sac near the wound by transfixing a tag of areolar tissue attached to it (not the sac itself) by a hare-lip pin, with which I closed the wound. The necessity did not arise in this case, but the manœuvre might be useful in other cases.

With regard to after-treatment, one dose of tincture of opium relieved the sickness, and gave a good night, which the novelty of the patient's position in hospital might have prevented. After this, he had no medicine—above all, no aperient. He was kept to milk and broth diet until his bowels were open, which they were on the fourth day after the operation and the fourteenth day of constipation. The wound was dressed with tenax—an excellent dressing for these deep wounds, as it prevents the accumulation of pus, and consequently favours the contraction and healing of the wound.

THE SLEEPING SICKNESS OF WESTERN AFRICA.

By ALBERT A. GORE, M.D., F.R.C.S.I., SURGEON-MAJOR.

SOME time since, I read, in the "Notes and Queries" of a contemporary, a few brief remarks on this rare disease. As the subject is one of some interest to those who may travel in these distant regions, and to the medical officers who have to treat our West Indian soldiers, I have jotted down the following *résumé*, which may probably contain a summary of all our present knowledge on the matter.

Lethargy, from the Greek terms *λῆθη* and *ἀργία*, is placed by the older writers under their division *Neurotica*, and defined as a "mental and corporeal torpidity, with deep quiet sleep". The occasional causes being congestion or effusion in the brain by violent mental commotion, as that of fright or furious anger; by retrocedent gout, or repelled exanthems; but more generally by long continued labour of body or severe exercise of mind, cerebral exhaustion. Celsus regarded it as a nervous affection; Forester and Cheyne as chiefly dependent upon plethora or congestion. According to Mason Good, it is not unfrequently a strictly nervous affection connected with an irregular or debilitated state of the mind. The common causes of sleep, therefore, whether natural or morbid, are in many cases causes of lethargy. The older writers classified the disease under three heads.

(a.) *Lethargus absolutus*, or genuine lethargy, without intervals of sensation, waking, or consciousness.

(b.) *Lethargus cataphora*, or remissive lethargy, with short remissions or intervals of imperfect waking, sensation, and speech.

(c.) *Lethargic vigil*, or imperfect lethargy, perfect lethargy of the body, but imperfect lethargy of the mind, wandering ideas, and belief of wakefulness during sleep.

The first variety of the ancients is the later "constitutional lethargic slumber" of Blanchet and other French observers. Examples have