ON THE INHALATION OF THE VAPOUR OF ETHER IN SURGICAL OPERATIONS

By JOHN D. SNOW

(Continued from page 267)

Except a headache, on one or two occasions, the only unpleasant effect that I have ever seen from the inhalation of ether has been sickness and vomiting, which are only occasional results, and seldom occur except when a meal has been taken just before the ether,—a measure which I prevent when I have the opportunity. It is when, after a meal, the etherization is deep—for instance, in the fourth degree—and continued for some time, that vomiting is most liable to occur. It may take place either during the insensibility or not till after it. The contents of the stomach are in some cases rejected merely by the action of the stomach and the œsophagus, without any accompanying straining, or even the assistance of the respiratory muscles, and without apparent sickness. At other times, both during insensibility and afterwards, the vomiting is accompanied by an expression of sickness in the features, diminished temperature of the surface, with or without sweating, and diminished strength and frequency of the pulse. When sickness occurs it greatly prolongs and increases the insensibility to what the surgeon is doing; even if the consciousness has returned, pain is seldom felt during the sickness. The nausea and vomiting generally subside immediately; but, in two or three instances, have continued till the following day.

The blood that flows in operations under the influence of ether is not much altered in colour. The blood which

spirts from a divided artery is sometimes of its usual vermilion tint, at the very time when the inhalation is going on; frequently, under these circumstances, however, the arterial blood is rather less bright than usual, but the venous blood being at the same time less dark than common, the flow of mixed blood is of the ordinary colour of such blood; and the patient's lips remain unchanged in hue. It has been only when the patient has been holding his breath, or coughing, that I have observed the arterial blood to be of a dark colour; and I consider that those writers who have described it as being, usually or always, of a venous appearance, must have used inhalers that did not allow of a proper supply of air. The blood always coagulates on the floor of the operating theatre, and the black blood which flows during an amputation when the tourniquet is applied, constantly becomes afterwards red on the surface from exposure to the air. (6)

There has not been any considerable secondary hæmorrhage, except in one case, after an amputation; and, therefore, I cannot look upon ether as causing any increased liability to it: nor, indeed, is there anything to prevent every vessel, large enough to require a ligature, being tied at the time of the operation; for there is a good pulse,—a better pulse, indeed, generally than there would be if the operation were performed without the ether.

The following account of the exhibition of the ether, in a few cases, from notes taken just afterwards, is introduced to illustrate the usual effects of it.

CASE A.

A gentleman, aged 49, whose health was much impaired by long illness and residence in the East Indies, had suffered for several years from stricture of the urethra, with fistulous openings in it. No catheter could be introduced, and none of his urine passed the natural way. On April 24, Mr. Liston performed an operation for his relief, part of which consisted in cutting into

the urethra in the perinæum. Mr. Thomas Moreton, Mr. Emanuel Baker, the usual medical attendant of the patient, and Mr. Cadge, were present. The patient having been bandaged as for lithotomy, began to inhale. He breathed steadily and pretty deeply, and became insensible without any excitement or struggling. In four minutes the eyes were turned rather upwards, and there was slight snoring. The operation was now commenced, and it caused no sign of pain. It was concluded in seven minutes, during which he inhaled, at intervals, vapour more diluted than at first. Two or three minutes after the conclusion of the operation, he said a few words incoherently like a drunken man, but was not spoken to, and became silent again. Five minutes after the conclusion of the operation he spoke rationally, saying that he did not begin to feel any stupefying effect from the ether yet. The pulse was but little influenced throughout.

After having been put into bed it was found that there was hæmorrhage, and it became necessary to take up a small artery. He could not be got to lie still enough for it to be seized, so the ether was given again, twenty minutes after he had recovered his consciousness, and thirty-six minutes after the commencement of the first inhalation. In two minutes he was quite insensible, the eyes being turned up, and the respiration rather snoring: he was lifted up, and some cushions placed under him, and he inhaled a little more vapour, and then the artery was secured as he lay quite motionless, and he recovered his consciousness a minute or two afterwards.

℥xiv. of ether were consumed on the first occasion, and ℥vi. on the second. The temperature of the water-bath was 67°; somewhat higher than I now employ.

Being situated at the patient's head, I did not see the operation, and consequently could take no notes of it. It was successful in establishing the natural channel for the urine, and the fistulous openings gradually closed up. The patient had spectral illusions occasionally for a week or two after the operation, but was not alarmed by them, and did not mistake them for realities. He fancied they were caused by the ether; but they most likely depended on his weakly condition, for a time increased by the loss of blood during the operation. I have not heard of anything of the kind after ether in any other case.

Case B.

On June 19, a lady below the middle age, a patient of Dr. Locock's, who was present, inhaled the ether for an operation, which Mr. Liston performed. Her malady was, in the first instance, a simple serous cyst, at the inner part of the left eyebrow, over the frontal sinus. The walls of the cyst were bony, except at the most prominent point, and here there was only

membrane. The cyst was punctured, and the opening kept patulous by caustic potash. Suppuration followed, and for a time the walls collapsed and the swelling diminished; but afterwards the opening in the bone contracted so much as to prevent the free exit of the pus.

The water-bath being prepared at 64°, the inhalation was commenced, and went on easily and steadily, and insensibility was induced without any struggling. Four minutes after the process was fully commenced, the eyes were turned upwards and towards the right, the pupils being rather contracted, and at this time the operation was begun, without causing a flinch or cry. Mr. Liston made a crucial incision, reflected the flaps, and cleared the bone for the application of the trephine. The inhalation had been left off just after the operation began, and by this time there were evidences of returning sensibility—motion of the eyelids and a little groaning—so the ether was resumed, and Mr. Liston waited half a minute before applying the trephine; at this time the patient was rather rigid from a general contraction of the muscular system, which became relaxed just afterwards, during the concluding part of the operation. A circular piece of bone was removed with a moderate-sized trephine, and a great quantity of pus escaped. The cavity was found to lead to the bottom of the frontal sinus, and some lint was lightly pushed into it. The second inhalation (with the vapour more diluted than in the first, by means of the two-way tap I then used) was continued during the trephining, for I did not know that the operation would be concluded so soon, and was left off just as the operation was concluded. At this time the breathing was inclined to be stertorous, and accompanied by gentle blowing with the lips; but it returned to the natural state in about two minutes. A minute or two afterwards the patient vomited, and she began to recover her consciousness two or three minutes later—about six minutes after the ether had been left off. She spoke in rather an excited way at first, about the operation she had undergone without feeling it, and forgot this conversation; for some minutes afterwards she inquired if the operation was going to begin. When I left, half an hour after the operation, the patient had recovered from the effects of the ether, all but a feeling of sickness, which soon afterwards subsided.

In a short time she was able to wear a plug of India rubber, which kept the soft parts from closing, and the discharge has been since gradually diminishing.

Case C.

St. George's Hospital, July 22.—Mr. Cæsar Hawkins operated on James Fry, æt. 30, for necrosis of the tibia. The patient inhaled without any impediment, except from a little coughing.

In between three and four minutes he appeared to be established in the third degree. The vapour was now somewhat reduced in strength, and in a minute longer the eyelids were nearly passive; there was an approach to snoring, and the countenance was devoid of expression. The operation was now commenced without the least sign of pain. He had a little dilute vapour occasionally during the operation. The bone was trephined in two places, and the operation completed in five minutes, by the removal of a considerable sequestrum, and he shewed no sign of pain during the performance of it. It was observed, that the pupils of the eyes were sensible to light during the complete state of general insensibility, whilst the lower jaw was hanging down. The pulse was good throughout, but somewhat accelerated. He recovered his faculties soon after he was removed to bed. He had no sequelæ of any kind from the ether, and said that he had the best sleep during the operation that he had had for a long time. ℥ij. of ether were used. He recovered favourably.

CASE D.

Directly after the above operation, Mr. Tatum performed lithotomy on Henry Hemson, æt. 10 years, in good general health. In between two and three minutes after he began to inhale, he was perfectly insensible, the eyelids drooping, and the eyes being rather turned up. The staff was introduced without sign of pain, and he was moved to the bottom of the bed; the ether, in the meantime, having been left off. He inhaled again for about half a minute before the operation began; for he had begun to show signs of sensibility by opening his eyes. The operation was performed without the least sign of pain. I could not see the steps of it, but it was concluded in about two minutes by the extraction of a mulberry calculus, about the size of a kidney bean. He seemed in the third degree during the operation, and not quite so deeply etherized as on the introduction of the staff. He looked about him directly the operation was concluded, and began to sing a school lesson. His face was florid all the time of the inhalation. Mr. Tatum informed me, that the bladder had a tendency to contract, and empty itself by the side of the staff, at the beginning of the operation: this would probably have been prevented by his being etherized a degree further, viz. to the fourth. The little boy quickly recovered.

The following case shews the smallest amount of etherization with which an operation can be satisfactorily performed, as it seemed only just carried to the third degree.

CASE E.

Mr. Keate, assisted by Mr. H. C. Johnson, operated on Sir ——, for two sinuses by the side of the rectum. The patient was rather nervous about the ether, but when he had commenced inhaled very well. In two minutes the eyes were turned quite up, the lids however being kept closed, and they were briskly closed again directly they were lifted up. The face-piece being removed for a moment, the features were observed to be unaltered in expression. At this moment, the expiratory valve was opened a little, to dilute the vapour further; the water in the bath being 64°, and consequently, the patient having been breathing equal parts of air and vapour. At the end of another minute—the third from the commencement of inhalation—there was no further alteration in the patient, except, perhaps, that the eyelids did not close again so briskly on being lifted by the finger; but I observed that Mr. Keate had got a probe introduced into one of the sinuses unknown to me, and with this proof of the patient's insensibility, I requested that the operation might be performed, although otherwise I should have thought the patient scarcely ready for it. During the division of the first sinus the patient held his breath, and moved one hand a little, and stretched out his fingers; and during the division of the second sinus he also moved one foot a little, but not so as to interfere in any way with the operation; and he did not move his body or utter the least sound. The inhalation was discontinued just as the operation was concluded; and half a minute afterwards, as Mr. Keate was thrusting a pledget of lint into the wound, the patient flinched and uttered an angry expression; and directly afterwards he tried to raise himself up from the sofa, but was easily prevented. In less than a minute, he said that he had been in Lancashire disputing with some people; and on Mr. Keate informing him that the operation was concluded, he expressed his surprise and satisfaction, and seemed to have recovered his faculties completely, having been unconscious only three or four minutes altogether. The pulse was counted between the operation and the introduction of the lint, and it was at the rate of 88 in the minute. ʒvijss. of ether were expended.

The attitude and respiration of this patient, and the slight movement of his limbs during the operation, were precisely the same as those of a person suppressing the usual indications of pain, and I have noticed the same thing in some other cases. The dream about the conversation probably occurred at the moment when he first spoke.

In the following case the difficulties in the way of etherization were greater than in any other instance I have

seen, but would have been much lessened, and the patient could have been kept steadier during the operation, if I had had at that time the experience and precaution to recommend a semi-recumbent posture on a table or couch, instead of that of sitting in a common chair.

CASE F.

Miss R. had a tumor of the lower jaw, which commenced fourteen or fifteen years ago, at the symphysis, and extended laterally till it reached nearly the size of the fist, producing great deformity. On May 28, Mr. Liston removed the tumor; Mr. Morton, Mr. Cadge, and some other surgeons, being present and assisting. The patient, who appeared to be between twenty and thirty years of age, was in good general health, but had suffered occasionally from epilepsy. The inhaler was prepared with the water-bath at 65°—the temperature of the water in the room. She was with difficulty got to inhale, even whilst she preserved her consciousness, and in the course of a minute or two, when she passed into the second degree, and had lost the knowledge of where she was, and what was being done, the difficulty was still greater; she sobbed and screamed very much, and stamped with the feet, and pushed the face-piece off with her hands. She was, however, held by those present; and when the face-piece was pushed away it was put on again directly, and in two or three minutes the screaming and all the efforts of a voluntary character ceased, and she passed into the third degree, but became, at the same time, extended in a state of great rigidity, so that she could not be kept seated, and appeared to be in epileptic convulsions with frothing at the mouth. The exhibition of the ether was persevered in, and the patient became suddenly quiet, going into the fourth degree of etherization about five minutes after the inhalation was commenced. She was placed again in the chair; the breathing became slow, deep and regular, and the eyelids were observed to have lost their sensibility. The inhalation having been continued a little longer, was left off about six minutes after it was begun, and the operation was immediately commenced. An incision was made along the inferior edge of the jaw, and a second crossing it over the chin, from below the middle of the free border of the lip; the flaps were dissected off, and the bone exposed: during this part of the operation the patient sat breathing quietly, and not moving or uttering a sound. Mr. Liston then extracted two or three molar teeth with the forceps, and at this time the patient uttered a sound expressive of pain, and struggled. The struggling and demonstrations of pain continued as the bone was being cut through far back on each side. At this time I dipped a small

sponge in ether, and held it to the patient's nostrils, standing behind her (7). Although her mouth was, of course, widely open, she was breathing in some measure by the nostrils, and in a little time became quiet, being apparently perfectly insensible. The bone having been divided, the tumor was depressed, and removed by dividing the mucous membrane and hyoid muscles, the tongue being held forward by a strong ligature drawn through it. The sponge was wetted occasionally, and kept applied to the nostrils, but without the effect of keeping up complete insensibility; for, apparently, the breathing was sometimes performed entirely by the mouth, where, of course, the sponge could not be placed, and the patient struggled again now and then during the tying of the arteries. The pulse was very good, though frequent, at the end of the operation, notwithstanding the loss of blood necessarily attendant on it. She was put into bed ten or twelve minutes after the operation began, and some small arterial branches were secured afterwards. At this time she seemed to have recovered her consciousness (the nature of the operation, however, preventing her from speaking for some time). The wound healed by the first intention, and the patient was able to walk out within a fortnight. She said that she felt nothing of the removal of the tumor, and she was much satisfied with the ether; but for which, indeed, she could not have been prevailed on to submit to the operation. Her appearance was much improved, the deformity caused by the want of the jaw being much less than that which the tumor produced.

Ether contributes other benefits besides preventing the pain. It keeps patients still, who otherwise would not be. I gave it lately, for this object alone, to a child on whom Mr. George Pollock operated for cataract by drilling. The child was perfectly quiet, and the eye and eyelids were quite passive. It had been operated on before, and without the ether would have made all the resistance in its power. In the case related at page 350, Mr. Liston considers that he should have been unable to secure the bleeding vessel without the second application of the ether.

The relaxing effects of ether are much greater than those of the warm-bath and emetics. In the case, No. 40 of the list subsequently to be given, Mr. Tatum reduced a dislocation of the shoulder of ten weeks' duration, in a

muscular man, under the influence of ether, when it was observed, before the traction was exerted, that the muscles were completely relaxed, and the arm much more moveable than before the inhalation. Other cases of reduction of old dislocations, under the effects of ether, have been related in the medical journals, and also cases in which the surgeon was enabled, by means of it, to reduce strangulated herniæ with the taxis, where, otherwise, an operation would have been required. In Case 7 of the second list, farther on, the ether superseded one of the most difficult operations in surgery, and enabled Mr. Liston to get a catheter into the bladder without using the knife.

The real value of the inhalation of ether in surgical operations must be mainly determined by the ultimate success of the cases in which it is practised. A surgical operation is a necessary evil, submitted to for the advantage of a greater good which is expected to result from it; and if the ether added at all to the danger of the operation, or diminished in any way the full advantages to be derived from the operation, it would be the surgeon's duty to recommend his patient to submit to the pain, excruciating as it often would be to him, and distressing to those who have to witness it. It is very evident, *a priori*, that an agent which so alters the circumstances of the patient, cannot be without its effects on the ultimate results of capital operations; and since severe pain generally exerts a deleterious influence on the economy, and the use of ether in thousands of trivial operations has shewn it, when properly managed, to be attended, either with no danger, or the least conceivable amount of it, it seems to follow that etherization must lessen the danger of serious operations, unless we think (with one or two renowned doubters, who seem to look upon a surgical operation as a natural process, in which the

pain plays some essential part), that the sufferings of the patient in some way aid his recovery, instead of being deleterious to him. However, the proper and philosophical course to pursue, as soon as we have the opportunity, and one generally followed in medical science in similar instances, is impartially to examine the results, disregarding what we might beforehand expect.

In order to contribute what I can towards such an examination of the influence of ether over the results of surgical practice, I subjoin a list of all the operations in which I have administered the ether in St. George's and University College Hospitals. In the very few cases which ended unfavourably, and in some of the others, I have added notes, which I have copied from the Hospital case-books. The operations down to about Midsummer were briefly but correctly reported as far as related to the ether, in the Lancet, from time to time. In no case in which I have given the ether did the patient know anything of the operation, except, two or three times, some trivial part of it, such as tying an additional small artery after the inhalation had been discontinued. And it may be remarked, that the constant success with which ether is capable of being employed, is one of its greatest advantages; and, that the patient may have the full benefit of this discovery, he should not only be spared the pain, but also the anticipation of it, often so depressing to his powers, and should feel confident, from the time the operation is proposed, that he will suffer no pain, and be exposed to no danger. In most of the following cases the patients have looked forward to the operation merely as the time when they would get rid of a painful joint, or some other troublesome disease; and this has been generally the case also in private practice.

LIST OF OPERATIONS WITH ETHER AT ST. GEORGE'S HOSPITAL

1. January 28, Mr. Cæsar Hawkins removed dead bone from the interior of the tibia of William Daphne, aged 6 years.—Recovered. Left the hospital March 10.

2. On the same day Mr. Cutler performed amputation of the thigh on the patient whose case is subjoined:—

"William Cowen, aged 23, a stout healthy-looking groom, was admitted into the Oxford Ward, Dec. 1, 1846, having a short time previously been thrown with great violence by a horse. On the interior and anterior surface of the right thigh, about its middle, a wound in two lines, meeting at a right angle, and three inches long each way, penetrated the muscles in its whole extent, and exposed the bone. The vessels were almost laid bare, but the hæmorrhage was slight. The right leg was fractured at its lower third, with much comminution. Four days after admission, inflammation of an erysipelatous character appeared round the wound, and crept up the limb during the following eight days. Considerable irritative fever and depression gradually supervened, and increased as the discharge became more profuse and ill-conditioned. 29th. A very large quantity of foul pus was let out by an incision on the external surface of the thigh, and on the 27th of January, 1847, the knee-joint presented every appearance of being distended with pus. The patient was in such a state of extreme depression, as to render any motion, or attempt at examination, productive of most alarming symptoms; and a phthisical cough troubled him. Such was the state of the case, when, at a consultation of the surgeons, it was determined to give him the chance of an operation under the influence of ether. On Jan. 28, therefore, the vapour was administered by Dr. Snow. In less than three minutes perfect insensibility was produced, and it was continued whilst the patient (who was in too weakly a state to bear removal to the operating table) was drawn to the foot of the bed, and amputation of the thigh performed, consciousness only returning during the washing of the stump, which was productive of pain. He said that he felt nothing of the operation: no sickness or headache followed. He passed an excellent night, free from the usual startings of the stump; was in good spirits next day, and smiled when addressed. On the twelfth day he was up. From this time his health slowly and gradually improved: the cough, at all events, did not increase. The stump granulated, without an unfavourable symptom, till the beginning of April, when some inflammation about it, and slight fever, ended in the formation of an abscess. He was discharged May 12, to go into the country, the stump being nearly healed, and small sores only remaining of the ulcers.

"He was re-admitted to the hospital this autumn, almost destitute, much emaciated, and suffering with cough and haemoptysis.

He has derived considerable benefit from the treatment, and will shortly be discharged."—ADOLPHUS J. GEE.

3. On the same day, also, Mr. Tatum removed a large fatty tumor from the shoulder of Francis Lewis, aged 42; a man of colour.—Recovered. Left the hospital May 26.

4. Feb. 4, Mr. Cæsar Hawkins operated for necrosis of the tibia, on a young woman—(I neglected to take down the name and age in this and one or two other cases).—Recovered, and left the hospital.

5. On the same day, Mr. Cutler performed the operation for fistula in ano, in a middle-aged man.—Cured.

6. On the same day, also, Mr. Tatum amputated the breast of Caroline H——, aged 32 (married), for scirrhus.—Recovered. Left the hospital March 3.

7. Feb. 11, Mr. Cutler performed lithotomy on Wm. Doran, aged 4 years.—Recovered without an unfavourable symptom, and left the hospital March 3.

8. The same day, Mr. Henry Charles Johnson amputated the breast of Ellen A——, aged 40 (widow), for scirrhus. This patient was suffering from bronchitis at the time of the operation, and the ether caused a good deal of coughing, and was left off somewhat prematurely on this account, and the operation performed. There was some struggling, but the patient talked during the operation about matters quite unconnected with it, and said afterwards that she felt no pain. Her cough was relieved for the first two or three days after the operation.—She recovered favourably, and left March 10.

9. Feb. 25, Mr. Cutler removed the right mamma of Mary F——, a cook, aged 54, affected with scirrhus tumor.—Recovered. Left on March 31.

10. The same day, Mr. Cutler amputated the thigh of Thomas Hood, aged 13 years, for long-standing scrofulous disease of the knee-joint, by which he was much debilitated.—Recovered. Left April 7.

11. On Feb. 25, also, Mr. Henry James Johnson amputated the thigh of Anne Atkinson, æt. 11:—

"This little girl was admitted August 19, 1846, under the care of Mr. Keate, in a weakly, emaciated condition, with necrosis and caries of the left leg, reported of a month's standing, and to have commenced suddenly, with pain and fever. The entire middle third of the tibia appeared to be diseased, and several sinuous openings existed in this situation, leading to necrosed and carious bone. The tenderness was excessive.

"Dec. 24, 1846, the health having improved somewhat under treatment, numerous small pieces of dead bone were removed by operation; no immediate ill effects followed, and the wound continued in a tolerably healthy condition till about the second week in January, 1847, when it was attacked by erysipelas, which in the

course of a week extended up the thigh, and then faded rapidly, leaving the patient much reduced, and the knee-joint, and the thigh immediately above it, red, tumid, and painful. Thus the case continued, the patient getting weaker, and the abscesses increasing up the thigh. As the great tenderness of the parts, and the state of the patient, precluded every attempt to examine the state of the limb in the usual manner, the ether vapour was administered by Dr. Snow's apparatus, with perfect success, and, while the patient continued in a state of unconsciousness, the condition of the parts was ascertained sufficiently for the surgeons in consultation to determine on amputation.

"Feb. 25. The thigh was removed at its middle third by the flap operation, the ether vapour being again inhaled with the same success as before. On examining the limb it was found that the abscess was situated in the ham, and amongst the muscles of the thigh, having a very slight connection with the joint, which was, for the most part, healthy. No sickness or headache followed. The patient had a sound night's rest, undisturbed by starting of the stump, and the following day said she was much easier than she had been for a long time, and did not know till 9 this morning that the limb had been removed. She never gained strength, however: there was scarcely an attempt at healing, and the bone was exposed. She sank gradually, and died March 5."—ADOLPHUS J. GEE.

Examination, eleven hours after death.

"*General Appearances.*—The body was a good deal emaciated. There were superficial sloughs on the sacrum, trochanters, and crests of the ileum. The left leg had been amputated above the knee: the extremity of the bone was exposed, and the stump in an unhealthy condition. The right foot was œdematous.

"*Thorax.*—There were some recent adhesions of the pleura on the left side, chiefly at the outer and back part of the chest. Some shreds of lymph were adhering to the surface of the lungs, but there was no fluid in the cavity of the pleura. The anterior portions of the left lung were healthy and crepitant, but the posterior and lower portions were much congested, consolidated, and contained numerous secondary abscesses, in various states of suppuration and of various sizes; the seat of the abscesses being chiefly near the surface of the lung. The right lung was in a similar condition to the left, containing various abscesses at its posterior part.

"The heart was healthy, but flaccid; the blood particularly fluid. There were some loose fibrinous coagula in the cavities.

"*Abdomen.*—The viscera were all healthy.

"*Left lower extremity.*—The extremity of the bone was denuded of periosteum to about the extent of half an inch, and the bone itself of a dark colour. The wound was foul at the posterior part, but in front had apparently been commencing to heal. Liga-

tures were found attached to the femoral vein and artery, the wound around being both foul and unhealthy. The periosteum was easily pulled off the bone for some distance above the sawn extremity. On opening the femoral vein it was found to be filled with thin darkish-coloured pus as high as the bifurcation of the abdominal cava; but the lining membrane gave no indication of inflammation of the coats of the vein."—GEO. POLLOCK.

12. March 4, Mr. Tatum amputated the leg of a man, much reduced by disease of the ankle-joint.—Recovered.

13. The same day, Mr. Tatum also amputated the leg of James Thomas, aged 17, for strumous disease of the foot.—Recovered. Left May 12.

14. March 11, Mr. Cutler removed the great toe of Henry Bunn, aged 14, together with its metatarsal bone, for strumous disease of the bones.—Recovered, and left the hospital.

15. The same day, Mr. Tatum amputated the thigh of James Stanmore, aged 15.

"He was admitted Feb. 24. Inflammation of the leg began twenty-three weeks before his admission, and matter was let out from the knee about three months before his admission. When admitted he was much emaciated, and very pale. Pulse very quick, weak, and sharp. Tongue clean and moist. The natural shape of the extremity was lost, and it was at least double its natural size. Several incisions in various parts of the leg, and two or three fistulous openings on the knee, were discharging tolerably healthy pus, and the skin round the incisions was thickened and tuberculated. The thigh and left nates were highly œdematous, and there was a large excavated bed-sore over the sacrum. Shortly after admission an attack of shivering was followed by increased swelling, and a blush of erysipelas from the hip to the knee. His appetite became worse, and his debility increased. March 8, these symptoms subsided, and on the 11th amputation was performed. As the patient could not be moved, owing to the excessive tenderness of the part, and his weakly condition, he was brought into the theatre on the bed. After inhaling the vapour of ether for two or three minutes by Dr. Snow's apparatus, he fell into a state of perfect insensibility, was drawn to the edge of the bed, and the operation performed, without his evincing any sign of consciousness. The parts cut through were highly œdematous, and the muscles pale and flabby. Some sickness occurred on his return to the ward, but he slept well, with very little starting; he suffered, however, more from that cause on the following day, but was quite easy on the 13th, on which day the stump was dressed for the first time. No union had taken place—suppuration had commenced. The case progressed favourably till the 19th (the eighth day after the operation), when, after suffering much pain during the night in the stump—relieved in the morning by dressing—the patient was seized, about 1 P.M., with a severe

rigor, followed by a slight hot stage. Pulse frequent, and very weak; tongue clean and pale. From this time he sank rapidly, several rigors occurring daily. There were bilious vomiting and stools. Latterly he was free from all local pain. The discharge from the wound was profuse and fœtid, and the bone protruded slightly, but the stump in other respects looked well. There was slight wandering delirium the last two days only. He died on the 27th."—ADOLPHUS J. GEE.

Examination, fifty-seven hours after death.

"*General appearances.*—The body was much emaciated. The pelvis was a good deal distorted, from lying in bed. The left leg had been amputated recently above the knee, and the wound was still open. There was a considerable bed-sore on the sacrum.

"*Thorax.*—There were some old pleuritic adhesions on the left side of the chest. There was considerable inflammation and softening of the lower and back part of the left lung, with several secondry abscesses. There were old adhesions of the pleura on the right side, and several secondary abscesses in the back part of the lower lobe of the right lung. The heart was healthy, and contained some loose fibrinous coagula.

"*Abdomen.*—There were some adhesions of the peritoneum at the upper surface of the liver. The viscera were generally healthy. There was a small quantity of pus in front of the left hip-joint, apparently in the substance of one of the inguinal glands. The glands in the groin were generally enlarged, and of a black colour. The cellular sheath of the femoral vessels was much condensed, and very much firmer than usual. The femoral vein was blocked up with pus and purulent coagula, and the interior of the vessel was of a black colour. This inflamed condition extended from the end of the stump to the interior of the pelvis. The end of the bone was protruding from the stump, and quite exposed. There was a large quantity of matter burrowing up, in the back part of the stump, in the substance of the muscles. New bone had been recently thrown out on the lower part of the surface of the bone. The head of the femur was dislocated on the dorsum of the ileum, and perfect, though recent, anchylosis had taken place between the two bones. The acetabulum was filled with recent darkish-coloured lymph, and almost all traces of cartilage had disappeared. The bones forming the joint, &c., were softened, and readily cut with the knife."—GEO. POLLOCK.

16. March 18, Mr. Keate amputated the leg of Samuel Richards, aged 9, a boy of colour, for disease of the ankle-joint.—Recovered.

17. The same day, Mr. Cæsar Hawkins amputated the fore-arm of Henry Knight, aged 45, for disease of the wrist-joint.—Recovered.

18. The same day, also, Mr. Henry Charles Johnson amputated the breast of Mary A——, aged 48, married, for scirrhus.—Recovered, Left the hospital April 14.

19. April 1, Mr. Cæsar Hawkins removed a fatty tumor from the shoulder of Mary Brindle, aged 48, a cook.—Recovered. Left April 21.

20. The same day, Mr. Cutler amputated the leg of George Stamper, aged 23, who was admitted March 25, with disease of the ankle-joint of five years' standing. There is a scar on the left side of the sternum, from which a piece of dead bone separated five years ago. He has had a cough during the last winter, and Mr. Gee's notes contain the following:—"Dr. Fuller examined his chest, and found that there was some condensation at the upper part of the right lung." On examining the limb after the amputation, the ankle-joint was found to be destroyed; about half an inch of the inferior articulating extremity of the tibia being perfectly necrosed and loose, the articulating surface of the astragalus deprived of its cartilage, and nearly all the bones of the foot softened. His cough was relieved the first two days after the operation, and still more so as his health improved. The stump healed by granulation, and he left on May 5.

21. April 8, Mr. Cæsar Hawkins amputated the thigh of Thomas Witcher, aged 18, for disease of the knee-joint.—Recovered. Left on May 19.

22. The same day, Mr. Cæsar Hawkins also amputated the forearm of George Richardson, aged 48, for severe disease of the wrist-joint. This patient was in a very bad state of health, and suspected to have disease of the lungs.—Recovered. Left May 19.

23. The same day, Mr. H. C. Johnson operated for hare-lip on a little girl apparently about twelve years old—an out-patient. Cured.

24. April 15, Mr. Cæsar Hawkins operated on Mary Andrews, aged 57, by needles and ligatures, for a vascular tumor of the lip. Cured. Left May 15.

25. Same day, Mr. Cæsar Hawkins operated for necrosis of the metatarsus, on Caroline Collins, aged 7.—Recovered.

26. April 29, Mr. Cutler amputated the thigh of Ann Coston, a servant, aged 19. This patient had been subject to inflammation of the knee-joint from her childhood, and from Midsummer to Christmas last year she was in the hospital with symptoms of ulceration of the cartilages, but went out much relieved. She was re-admitted on March 17. The pain had recurred about a month after leaving the hospital, and had been getting worse ever since. The pain and tenderness still increasing, and being accompanied with starting of the limb again, and her general health being good, amputation was performed by a circular incision. The cartilages were found to be extensively destroyed. Two hours after the operation she was comfortable—the pulse quiet and regular, the stump oozing freely. An hour later, there was sudden hæmorrhage from the wound in a jet. The stump was opened, and was found full of coagula, which Mr. Cutler removed, and secured two vessels. There was not much

blood lost, and there was no return of the hæmorrhage. She suffered from starting in the stump and pain in the abdomen, the first two days. These symptoms subsided; but on May the 3rd she became worse, and was attacked with sloughing phagedena of the stump.* On the 5th the ulceration ceased, after having exposed the shaft of the bone, and by the 16th she was much improved, having a good appetite, and the stump granulating. She went on improving till the 26th, being then upon crutches; but the following day she was again attacked with sloughing phagedena, with much pain and fever, and a brown tongue. On the 30th the ulceration ceased, but in a day or two began to extend again. On the 4th of June, however, the complaint seemed to be finally arrested, and from this time she steadily improved, and an excellent stump was formed by granulation, and contraction of the skin over it. She was discharged convalescent on August 11.

27. The same day, Mr. Tatum amputated the thigh of Maria Lindley, aged 15, for disease of the knee-joint. She went on favourably, and on the 26th of May was so far recovered as to leave the hospital with the stump nearly healed, but she returned again in a few days with sloughing phagedena. The flaps sloughed off, leaving the bone bare, and she was extremely ill for some time, but recovered, and left the hospital with a good stump.

28. May 6. Mr. Keate amputated the thigh of George Missen, a labourer, aged 26, for extensive and long-standing disease of the knee-joint. June 12, discharged convalescent—going into the country.

29. May 13. Mr. Cæsar Hawkins performed an operation for necrosis of the humerus, on George Uren, aged 16. The operation necessarily lasted a long time, but the boy was perfectly insensible throughout its duration. The wound healed extremely well. In a week the patient was going about the ward, and was soon quite well.

30. May 20. Mr. Keate operated on Sarah Perrott, aged 21, for necrosis of the tibia. Recovered.

31. Same day, Mr. Cæsar Hawkins removed an epulis from the mouth of George Patient, aged 34. Recovered. Left June 2.

32. Same day, also, Mr. Tatum amputated the leg of William Walsh, aged 22, much emaciated and very feeble, for scrofulous disease of the ankle. Recovered. Left the hospital July 7.

33. May 27. Mr. Cutler operated on Alfred Frith, aged 18, for necrosis of the tibia. Was soon well.

* The wounds resulting from the operations had healed well—in a great measure by the first intention—till about this period, when sloughing phagedena being prevalent in the hospital (and apparently in the neighbourhood, for some patients came in with it) it attacked some of them. It did not, however, commence first amongst the subjects of operation. See a clinical lecture on this subject, by Mr. Hawkins, in the Medical Gazette.

34. June 3. Mr. Tatum amputated the thigh of Ellen Benson, aged 14, for disease of the knee-joint of long duration: the cartilages were destroyed. On the 8th, she was going on favourably, but soon after this was attacked with sloughing phagedæna. The end of the bone had to be sawn off, and she remained for a long time in a very precarious state, with hectic and diarrhœa. After a time, however, her health improved somewhat, and she left the hospital on Aug. 4, to go into the country. On Sept. 14th, the nurse had heard from her friends that she was still improving.

35. June 10. Mr. Cæsar Hawkins removed a malignant tumor of the testis from Thomas Wild, aged 46. "This man was admitted May 5, with enlargement of the left testis, which commenced five months previously. It was about the size of an ostrich's egg, irregularly pyriform, dense, and hard, with some fluid in the tunica vaginalis above it. There was no pain, but some tenderness. The scrotal veins were not enlarged; the cord was apparently healthy. The epidymis and testis were not distinguishable. In the left breast, also, there was a tumor about the size of a small chestnut, not very hard, having an irregular corded surface, very moveable, unattached to the skin or nipple, and neither tender nor painful. The patient was thin, and had an unhealthy aspect. The appetite was bad, and pulse weak. His health improved considerably, and the tenderness diminished soon after admission.—10th. About an ounce of yellow albuminous fluid was let out of the tunica vaginalis by a grooved needle, and a course of mercury and sarsaparilla was commenced, but discontinued on the 30th, as the testicle increased in size under it.—June 10th. Castration was performed: the patient being placed under the influence of ether was perfectly insensible to the operation. The tumor removed was about five inches long, and two and a half in diameter. A section through it presented a purplish hue; it was composed of a soft pulpy substance, and much dark red fluid could be squeezed out of it. The centre was somewhat harder, yellowish, and intersected by white bands. No trace of the healthy structure of the testis could be discovered. The tunica vaginalis at the upper part contained about an ounce of yellow fluid, and had the disease projecting into it. No headache or any other symptom followed the etherization, and for the six succeeding days the case progressed well.—15th. Some slight pain under the right scapula was complained of, but on the 17th, after having the previous evening suffered from slight chilliness, he was seized with some pain, unattended by tenderness, in the right ilium and lumbar regions, and frequent bilious vomiting and diarrhœa. The countenance was yellow, haggard, and anxious. Pulse accelerated, and tongue rather dry.—18th. All these symptoms continued, and there was tenderness on the right side of the abdomen, and no water having been passed for twelve hours, about half a pint loaded with lithates was drawn off.—19th. There was some swelling and tympanitis at the

upper part of the abdomen, with very little pain. At 9 P.M. he died. For the last twenty-four hours the sickness was almost incessant; a black grumous matter being vomited."—ADOLPHUS J. GEE.

Examination, sixteen hours and a half after death.

"*General Appearances.*—The body was well formed, but emaciated. There was a hard swelling, about the size of a small egg, felt in the left breast, which, on being cut into, proved to be simple enlargement of the gland.

"*Thorax.*—In the cavity of the left pleura there was some thin bloody serum. The left lung was slightly congested, and filled with frothy serum. On the anterior surface of the middle lobe there was an encephaloid deposit of about the size of a nutmeg. There were two similar deposits in the middle lobe of the right lung. The heart was quite healthy.

"*Abdomen.*—There was a considerable quantity of pus in the peritoneal cavity. The intestines were glued together by bands of lymph. The vessels of the intestines were injected. There were several small deposits of a malignant nature on the lower part of the ileum. There was a large encephaloid tumor, of about the size of an orange, lying in the third and fourth lumbar vertebræ. The vessels were quite free, and lying behind it. All the viscera were healthy."—Entered by Mr. Mackin, house-surgeon. GEO. POLLOCK.

36. The same day, Mr. Cutler amputated the middle finger of John Felton, aged 63, a countryman.—Cured. Left the hospital July 6.

37. June 17, Mr. Cæsar Hawkins amputated the thumb of Joseph Croker, aged 20, on account of scrofulous disease of the bones.—Recovered.

38. June 24, Mr. Cutler amputated the leg of John Gale, aged 19, for disease of the ankle-joint of six months' standing, having first lanced an abscess in it whilst he was insensible, and ascertained with the probe that the joint was extensively diseased.—Recovered. Left the hospital July 28.

39. The same day, Mr. Tatum operated on James Walters, aged 14, for necrosis of the tibia.—Recovered.

40. The same day, Mr. Tatum also reduced a dislocation of the shoulder, with the pullies, of ten weeks' standing, in Richard Rowlings, aged 31.—Recovered the proper use of the joint.

41. July 1, Mr. Cutler amputated the thigh of Mary Lessiter, aged 26, for extensive and long-standing disease of the knee, by which she was reduced to a very feeble state.—Improved from the time of the operation, and left the hospital August 24, in good health.

42. The same day, Mr. Cutler also amputated the leg of Henry Stanton, aged 44:—

"This patient, a stout hale man of temperate habits, was admitted

June 9, with an irregularly-shaped, dark, and very painful ulcer over the tibia, about the middle of the left leg; the limb below it was indurated and swelled, and the ankle-joint was fixed. The ulcer was of thirty years' standing, and proceeded from a severe lacerated wound, caused by the shaft of a gig, exposing the bone, which frequently exfoliated. The ulcer remaining had been productive of much suffering, and continued about the size of the palm of the hand, till a short time before admission, when it rapidly increased a third. The ulceration having ceased under the treatment, on the 1st of July amputation was performed, by the earnest desire of the patient. The operation was a long one, owing to the difficulty experienced in securing some of the vessels. The patient having inhaled ether, was insensible to the early part of it, but recovered consciousness during the application of the ligatures, the inhalation being discontinued, [under an impression that the operation was on the point of being concluded]. On examination, the tibia, immediately under the ulcer, was found to be thickened, carious superficially, its compact tissue very hard, and the cancelli softened. Considerable pain in the loins, to which it appeared he was subject, supervened shortly after the operation, and was the cause of a restless night. The following morning it still continued, and the urine was alkaline, but clear. The tongue was moist; pulse weak and regular. A draught of opium and ether relieved the pain, but at 9 A.M. of the 3d, a rigor, followed by heat and sweating, occurred, and a fatal train of symptoms rapidly appeared.—5th. The stump looked somewhat sloughy.—6th. The whole surface of it was affected with phagedæna. The urine was again acid, pulse 120, very weak, tongue clean and rather dry, and he sweated freely. About 2 P.M. on the 7th, he was seized with a second rigor, from which he did not recover: the lips continued pale, skin cool, and pulse imperceptible, and he died 6½ P.M."—ADOLPHUS J. GEE.

Examination, twenty hours after death.

"*General Appearances.*—The body was rather fat, and its surface exsanguine. The left leg had been amputated below the knee-joint. The stump was sloughy on its surface, with no evidence of granulation; above the wound the leg was rather œdematous.

"*Thorax.*—The lungs were crepitant and healthy throughout. The cavity of the pericardium contained a very small quantity of blood-stained serum. The heart was rather large and flabby, and the structure soft, and lacerable without difficulty: there was much fat on its surface. The left ventricle was somewhat dilated, the walls not hypertrophied, but much fat mixed up with the muscular structure. The aortic valves were much thickened, and two of them so much affected and contracted, that they together were about the size of a healthy one; almost cartilaginous in structure, but free from atheroma. The right ventricle was considerably dilated, and

its walls were extremely thin, in some places having very little muscular structure between the external and internal membranes, and the muscular structure throughout having a considerable proportion of fat mixed with it: the inner surface generally was blood-stained. The cavities contained some fibrinous and some black coagula.

"*Abdomen.*—The viscera were healthy.

"There was no inflammation of the femoral or iliac veins."—GEO. POLLOCK.

43. July 8, Mr. Henry Charles Johnson removed three encysted tumors from the scalp of a middle-aged woman (an out-patient).—Recovered.

44. July 22, Mr. Cæsar Hawkins operated on James Fry, aged 30, for necrosis of the tibia.—Recovered. (This case and the next are described at pp. 352 and 353.)

45. The same day, Mr. Tatum performed lithotomy on Henry Hemson, aged 10 years.—Recovered without an untoward symptom.

46. August 5, Mr. Cæsar Hawkins removed four loose cartilages (one of them ossified, and as big as a seed of nux vomica) from the knee-joint of Francis Clayton, aged 27, a countryman, who had been troubled with the largest one eleven years. The operation was performed by getting the foreign bodies into a suitable position under the skin, and cutting directly upon them, and pressing them out.—Recovered. Left the hospital Sept. 1.

47. August 12, Mr. H. Charles Johnson operated for the removal of an old and unsightly cicatrix from the lower lip of Christopher Woodward, aged 25.—Recovered.

48. August 19, Mr. Tatum performed an operation on Betsy Power, aged 17, for necrosis of the tibia.—Sept. 16. In good health, and wound fast filling up by granulations.

49. August 26, Mr. Cutler removed a scirrhous tumor situated in the cellular tissue, just above the right mammary gland, of Diana Jones, spinster, aged 49.—Recovered, and left the hospital Sept. 15.

50. Sept. 2, Mr. Henry James Johnson removed a scirrhous tumor of the mamma of Martha F——, aged 36.—Sept. 16. Going on well, filling up by granulation; a good deal of skin was affected, and had to be removed.

51. The same day, Mr. Henry Charles Johnson removed a scirrhous tumor from the breast of Sarah H——, aged 45.—Sept. 16. Healing favourably.

52. The same day, Mr. H. C. Johnson also opened a deep-seated abscess of the mamma of Elizabeth R——, aged 40. She was placed on the operating table, and had the ether, as it was surmised that a larger operation might be found necessary.—Sept. 16. Nearly well.

In addition to the above operations, Mr. T. B. Bumpsted, house-surgeon at the hospital, has administered the ether in four cases of

emergency, with the same kind of apparatus. One was a case of compound comminuted fracture of the thigh, occurring to John Lidgate, aged 26, on the 27th of July, in which Mr. H. Charles Johnson amputated high up, just below the trochanters. Another operation was an amputation of the arm, performed also by Mr. H. C. Johnson, on account of the brachial artery being opened by ulceration a few days subsequent to an accident to the elbow. The two remaining operations were for strangulated femoral hernia in women.—All the four patients recovered.

The following are the operations in which I have administered ether in University College Hospital:—

1. May 3, Mr. Liston performed lithotomy on Joseph Rice, aged 28, who had come from Australia to have the operation done. A ligature had to be applied to an artery in the anterior part of the wound—apparently an irregularly distributed branch of the pudic: the calculus was a globular mulberry one. The patient went on well. After the 26th, no more urine passed by the wound.—Discharged, cured, June 6.

2. The same day, Mr. Liston also removed a large encysted tumor, in a sloughing state, from the scalp of a woman, aged 72.—Recovered.

3. June 4, Mr. Liston performed excision of the elbow-joint of John Harris, aged 37, on account of extensive disease of the joint and surrounding parts, following an accident. The soft parts having been dissected off, the whole of the articulating part of the condyles of the humerus, the head of the radius, and the ulna (as low down as the coronoid process), were removed. Went on favourably.—Discharged, cured, July 27. Uses the hand, and has considerable power of flexion and extension.

4. June 5, Mr. Quain amputated the thigh of Charles P——, aged 12, for disease of the knee-joint of some years' standing. Antero-posterior flaps were made: pus flowed at the first incision, showing that the abscess extended up the thigh. The circular incisions were made so as to exclude the abscess.—Recovered favourably. Discharged, cured, in August.

5. June 7, Mr. Liston performed lithotomy on John Atkin, aged 70, in whom the presence of stone had been diagnosed eight years previously. A few hours after the operation there was some hæmorrhage from the bladder through the elastic tube, the urine passing by the side of the tube; but it ceased of itself. He suffered from pain and feverishness for a few days, but afterwards went on favourably, and left well on August 17.

6. The same day, Mr. Liston amputated the index finger of Mary Mills, aged 25, at the metacarpo-phalangeal articulation, for spina ventosa of the proximal phalanx.—Discharged, cured, June 20.

7. June 18. Mr. Liston introduced a catheter for John Willis, aged 42, who had stricture of the urethra, caused by an injury twelve years ago. He passed his urine in a very small stream for the last three years, and latterly only by drops, and no catheter could be introduced. Mr. Liston intended to divide the stricture by cutting in the middle line of the perinæum, but when the patient was got fully under the influence of the ether in the fourth degree, a No. 1 catheter was introduced right into the bladder through the stricture, and the intended operation was not required. The catheter was tied, to retain it in the bladder. On the 23d it was removed, and No. 2 passed, and then No. 3, which was allowed to remain two hours: he could now pass his urine in a moderately-sized stream. He went on well till July 22, when he had an attack of suppression of urine. He recovered from this, and went out cured on the 27th of July, being able to pass his urine in a good stream.

8. June 26. Mr. Quain amputated the index finger of Joseph Phillips, aged 70, at its metacarpo-phalangeal articulation, for necrosis of the bones of the phalanges.—Became out-patient July 12: was cured.

9. The same day, Mr. Quain also amputated the leg of Robert Gray, aged 54, below the calf, for disease of the tarsus, caused by an injury two years and a half before. "There was considerable difficulty in securing the peroneal artery, which was retracted beneath the fibula. He was insensible during the operation, but owing to the length of time occupied in securing the arteries, the effect of the ether had almost passed off." The stump healed very well, but a few days after the operation, diarrhœa, to which he had been subject for two years, set in, and could not be permanently checked, and he died August 14. After death the mucous surface of the large intestine was found to be abraded at intervals in its whole length. It was of a dark slate colour in the greater part, and where the slate colour was wanting, the vessels were injected. The gut was also much thickened. The small intestines were healthy, and the other viscera nearly natural.

10. July 2. Mr. Liston amputated the thigh of Belinda Norris, aged 15, for disease of the knee-joint of four years' duration. She was in a state of great debility, but her health improved from the day of the operation, and she was discharged, cured, in August.

11. The same day, Mr. Liston performed an operation on Emily Cannon, aged 5½ years, for scrofulous disease of the metatarsal bone of the great toe, removing it at the metatarso-tarsal joint.—Progressed favourably, and was made an out-patient in August.

12. The same day Mr. Liston reduced a recent dislocation backwards of the elbow, in a boy (an out-patient).—Cured.

13. July 9. (In a private ward of the hospital), Mr. Liston operated for prolapsus ani on A. H., a woman aged 27, removing some hæmorrhoids and folds of relaxed mucous membrane.—Cured.

14. The same day, Mr. Liston extracted a polypus from the nose of a young female.—Cured.

15. The same day, (in the operating theatre), Mr. Liston removed a diseased testicle from Joseuh B., aged 47.—Discharged cured, August 14.

16. The same day, Mr. Liston performed lithotomy on Charles Butler, aged 10½ years, removing a mulberry calculus about the size of a bean. The child got rapidly well.

17. The same day, Mr. Liston amputated the ring finger of Sarah Powell, aged 14, at its metacarpo-phalangeal articulation, for disease of its first phalanx. Made out-patient, July 13.

18. July 23. Mr. Liston amputated the arm of George Aliston, aged 26. The arm had been affected with scrofulous disease for twenty years. It commenced in the elbow-joint, and extended to the fore-arm, hand, and fingers. The limb was much swollen, and had several ulcers and fistulous openings in it. It was amputated by antero-posterior flaps, rather above the middle of the humerus. The patient, who was in a state of great debility from the disease, went on favourably till the 27th, when erysipelas attacked the stump. On the 28th, erysipelas attacked the face also; it subsided in a day or two, but the debility continued, with low muttering delirium, and he died August 1st.

Autopsy, twenty-six hours after death.

Body much emaciated. Old adhesions of the right pleuræ. Puckering of the apices of both lungs, and a cavity the size of a pea in the apex of the right one. Heart and other viscera healthy. Stump sloughy; flaps partly adherent, but loose from bone, which was denuded of periosteum.

19. July 31. Mr. Quain amputated the thigh of James Godden, aged 27, for disease of the knee-joint of twenty years' standing. He was extremely ill and feeble at the time of the operation, but recovered favourably, and was discharged cured, Sept. 16.

20. Aug. 3. Mr. Quain removed a tumor from the front of the tibia of Sarah Howell, aged 19. Made out-patient, Sept. 8.

21. Aug. 11. Mr. Morton operated for stone in the bladder, on Mary Ann M——, aged 35.

"This patient was admitted 17th July, 1847; married six years, and of good constitution. Soon after a natural labour, two years and a half ago, she began to experience pain and heat during micturition. As the symptoms increased she was sounded in the country, but no stone was detected. About a year ago, she miscarried in the fifth month of pregnancy. About this time she was again examined twice, but no stone was discovered, and the disease was regarded and treated as one affecting the coats of the bladder. About this time, also, the urine began to deposit much mucous and phosphatic sediment. It was also alkaline, and contained some

albumen and pus-globules. Mr. Morton examined her, and at once found a large rough stone. Aug. 11. She was placed under the influence of ether by Dr. Snow, a Weiss's three-branched dilator introduced into the urethra, and that canal dilated to its full extent. The cervix vesica was then notched, in the direction of the rami of the pubes, to a limited extent, and the forefinger introduced into the bladder, and the parts still further dilated. The forceps were then introduced, and a large rough stone extracted, the patient having been perfectly insensible throughout the operation. By Mr. Liston's advice a tube was introduced into the bladder, and allowed to remain for twenty-four hours. The stone weighed iv. drs. xii. grs. Its long diameter was an inch and three-quarters, its short diameter an inch and a quarter; the long circumference four inches, and the short one two inches and seven-eighths. Aug. 19. Hitherto she has had no incontinence of urine, and is quite well. Sept. 1. She left the hospital in good health, but she is not able to retain her urine so long as formerly, though this varies, as on some days she can do so for five hours at a time, whilst at other times she passes it every quarter of an hour."

22. August 30. Mr. Liston dissected out a large tumor from the side of the face and neck of Thomas H——, aged 66. It dipped behind the angle of the jaw, and had been operated on before. The wound healed chiefly by the first intention.

23. Sept. 8. Mr. Liston performed lithotomy on Benjamin Bonsey, aged 76. The stone was about two inches in its long diameter. Sept. 16. Going on well to this time.

It is very evident, that in none of the six cases that ended fatally, out of the foregoing two lists, can the event have been caused, or in any degree promoted, by the inhalation of ether, since there are very sufficient and well-recognised causes to account for the result.

The case of Stanton, No. 42 in the first list, is particularly illustrative of the great safety of ether under proper management, in cases which might be presumed to be the most unfavourable for its use. The disease of the heart in this man was very great, and etherization was carried to its full extent, and complete insensibility kept up for a quarter of an hour, yet not the least ill effect resulted from it; he completely recovered from the influence of the ether before he was removed from the operating table. The

patient—a bad subject for the operation, undertaken at his particular request—was attacked with phagedenic ulceration, and died in one of the cold fits of the fever attending it; the strength of the heart being apparently insufficient to establish re-action.

The following Tables shew the result of the larger operations. One case of lithotomy is not included; as, although the patient is going on favourably, time enough has not yet transpired for the result to be declared.

1. ST. GEORGE'S HOSPITAL.

Operations		No. of Cases	Recoveries	Deaths
Amputations	Thigh	11	9	2
	Leg	7	6	1
	Arm	1	1	0
	Fore-arm ..	2	2	0
	Total ..	21	18	3
Lithotomy..		2	2	0

2. UNIVERSITY COLLEGE HOSPITAL.

Operations		No. of Cases	Recoveries	Deaths
Amputations	Thigh	3	3	0
	Leg	1	0	1
	Arm	1	0	1
	Total ..	5	3	2
Lithotomy..		3	3	0

3. BOTH HOSPITALS COMBINED.

Operations		No. of Cases	Recoveries	Deaths
Amputations	Thigh	14	12	2
	Leg	8	6	2
	Arm	2	1	1
	Fore-arm ..	2	2	0
	Total ..	26	21	5
Lithotomy..		5	5	0

The first Table includes the two amputations in which Mr. Bumpsted administered the ether, and it comprises, I believe, all the amputations at St. George's Hospital since January 28, except one—an amputation of the leg after an injury, which was performed without ether, and I think in the night-time—(the patient recovered). The deaths after all the twenty-six amputations, as shown in the third Table, are five, which is a little below 20 per cent. This is lower than the average mortality after the removal of diseased limbs; Dr. Lawrie's return of the Glasgow Infirmary, for instance, giving 24 per cent. (The mortality after amputations on account of injuries was 54 per cent in his return.) The five cases of lithotomy all ended in recovery. There were six operations on the female breast at St. George's Hospital, in which the whole gland was removed, and the patients all recovered from the operation. Finally, after the fifty-six operations in this hospital, there were but four deaths; and after twenty-two operations in University College Hospital, but two deaths. Although this number of operations is not large enough to determine a question of this kind, yet it must be admitted that the results are so

far very satisfactory, and tend to confirm the expectation which we might reasonably entertain beforehand, respecting the influence of ether over the patients' recovery.

APPENDIX

The Notes refer to the Numbers in parentheses in the Text.

NOTE (1), p. 61.

THE circulation of the blood continues for a little time in animals after the respiration has been arrested by the influence of ether, and it ceases, apparently, from want of respiration, and not from the direct effects of the ether. This I observed early in the year, but it was first made known by the Parisian physiologists. The reason of this, I believe, is not that ether is incapable of paralyzing the heart and blood-vessels, but that it sooner affects the medulla oblongata, and the nerves connected with it, than the ganglionic nervous system. Indeed, I have ascertained that such is the case, from observations I have made on frogs. If placed in air containing but 20 or 30 per cent of vapour of ether, they very quickly become affected, probably from the rapid absorption of the vapour by the skin: in a minute or two the respiration ceases, and they have every appearance of being dead, except that the heart can be seen pulsating on the under side of the chest. If they are now withdrawn, the circulation continues, the ether gradually evaporates by the skin, and respiration recommences, in a period varying from 5 to 15 minutes, according to the length of the previous exposure to the vapour: whilst, on the other hand, if they are allowed to remain in the air containing vapour, more ether continues to be absorbed, and in about five minutes the heart ceases to beat perceptibly, although its pulsations would continue for hours without the respiration, even in a frog immersed

in water that has been deprived of its air by boiling. Some slight vermicular contractions of the heart, that would be visible on dissection, continue for a little time, and if the frogs are withdrawn from the vapour during this interval, and kept moist, they may yet recover, although they sometimes show no signs of life for an hour and a half.

Although etherization and asphyxia resemble each other in some respects, yet the rapidity with which frogs are affected with ether, whilst they are so very slowly asphyxiated by privation of air, proves that they differ widely, and shows clearly enough that the effects of the vapour of ether are not due to its excluding part of the oxygen of the air by the space it occupies, as might at first, perhaps, be supposed. That such is not the way in which ether acts I ascertained in a more direct way in the beginning of the year, by supplying artificially the oxygen so displaced, when I found that the peculiar effects of ether were produced in animals just as readily as before. If hydrogen, nitrogen, or any neutral gas which does not support life, were mixed with the air, in even half the quantity that vapour of ether is commonly mixed with it, the oxygen of the air, over-diluted, would fail to be imbibed into the blood in exchange for carbonic acid, and the patient would suffer asphyxia, the blood being arrested in its passage through the pulmonary capillaries. The oxygen is often reduced by the vapour of ether to 10 or 11 per cent. of what the patient breathes, whilst if it were reduced but to 16 per cent. by a gas which is not absorbed, no increased efforts of respiration would prevent asphyxia from quickly supervening.* That nothing of the kind takes place during the inhalation of ether depends on the circumstance that the vapour is absorbed as fast as it reaches the air-cells of

* See a paper "On the Pathological Effects of Atmospheres vitiated by Carbonic Acid Gas, and by a Diminution of the due Proportion of Oxygen."—*Edin. Med. Surg. Journ.*, Jan. 1846.

the lungs, leaving the oxygen in its usual proportion per cent.; and to get enough of it the patient usually enlarges his respiratory movements instinctively, as he would do if situated on a high mountain, where the air is much rarefied.

NOTE (2), p. 63.

When air is admitted to a liquid containing ether, the liquid parts with some of its ether to the air; whilst, if air containing ether is admitted to a liquid containing none, it parts with some of its ether to the liquid; and in either case a balance is established. The interposition of a thin animal membrane between the liquid and air, like that between the blood and the air in the lungs, does not interrupt this interchange. The quantity of ether that a limited portion of air will withdraw in the form of vapour, from a liquid containing it, is determined by the temperature and the quantity in the liquid: for instance, if the liquid is saturated with ether, the air will become saturated also, for that particular temperature; if the liquid is half saturated, the air can only withdraw as much as will half saturate it; and so on, in a direct ratio, as I have ascertained by experiments. It is not improbable that some of the ether inhaled is decomposed in the body; but this does not alter the question of de-etherization in this manner, for assuredly by far the greater proportion of the ether escapes by the breath unaltered.

Ether exists in the blood during etherization as a liquid, not as vapour. Although the temperature of the blood is a little higher than the boiling point of ether, yet it is capable of absorbing the vapour readily, and holding it in solution. 100 parts of water at 60° will hold in solution about 10 parts of ether, or rather more than 23 times their own volume of the vapour: at 100°—the temperature of the blood —water will absorb and hold in solution about half the

above quantity, and it is capable of absorbing the vapour of ether, and holding it dissolved at all temperatures up to 212°, its own boiling point, but in a constantly diminishing quantity. Blood, on account of its density, absorbs less ether than water at corresponding temperatures; but it is capable of absorbing more than it has ever the opportunity of doing in the process of etherization.

NOTE (3), p. 169.

The quantity of water contained in washed ether is more than sufficient to saturate the driest air at any temperature at which it can be breathed; and that it does rise in vapour along with the ether, may be experimentally ascertained, by attaching two tubes containing chloride of calcium to an inhaler, or a Wolf's bottle, in which there is some ether, washed and not deprived of the water, and then passing air over the whole; when it will be found that the air, after parting with all its moisture to the chloride of calcium in the first tube, takes up water again along with the ether, and gives it up to the chloride in the second tube, in quantity increasing with the temperature.

NOTE (4), p. 256.

The size of the patient is the only circumstance which I have observed constantly to influence the quantity of ether required to produce insensibility, when the inhalation goes on steadily; if the inhalation is interrupted, however, more ether is used, as the process has to commence, in some measure, afresh. The man who was the subject of excision of the elbow-joint by Mr. Liston, in University College Hospital, might seem an exception to this. The ether was finished soon after the operation began, although ℥ij. had been put into the inhaler; I found afterwards, however, that it had not been all inhaled, but that a great

part of it (owing to an irregularity in the volute of the inhaler I was using, by which the passage for air was much contracted at one place), had been splashed into the elastic tube, whilst the patient was breathing deeply and forcibly. Females generally consume less ether than males, but then they are usually of less stature and weight. Hard drinkers do *not* appear to require more ether than others, and are not more difficult to render insensible. The time occupied in producing complete insensibility varies with the activity and depth of the respiration; but it seldom exceeds two to three minutes in a child, or four to six minutes in an adult, when the inhalation is not interrupted; unless the vapour gets diluted to a greater extent, by the valve being kept open, or the face-piece not fitting, or by some other means.

NOTE (5), p. 260.

There is no difficulty in distinguishing voluntary motion from excito-motory movements, or the rhythmic automatic ones, in a patient who is unconscious of what is occurring around. Voluntary motion is recognized as such at once, even in an animalcule under the microscope, but much more readily in one's own species. Both sensation and voluntary motion may exist in the second degree of etherization without consciousness, as in natural sleep, when a person feels the heat or the cold, and pushes off the coverlet, or folds it closer round him, according to circumstances, without waking; consequently, the assertion of the patient that he has had no pain is not to be considered a proof that there has been none, in cases where there have been unequivocal demonstrations of it. On the other hand, every little struggle or moan must not be considered a proof of pain, since it may be independent of the operation, or merely excito-motory, or the result of very obscure sensation. And when cries expressive of pain do

occur, they must not be taken as a measure of the pain, for when the patient is unconscious he is not using the slightest self-control. There is no room for an opinion that the patients generally have pain, and are unconscious or oblivious of it; for when the ether is well administered, there is generally no expression of any kind by the features or voice, and a number of patients recover their mental faculties and special senses, whilst the sensibility is still so far blunted that the minor parts of an operation cause no pain.

NOTE (6), p. 350.

Dr. Pring, of Weston-super-Mare, found (as he stated in the Lancet, May 1st), that ether will render arterial blood dark-coloured, and impair its coagulation out of the body; but a much larger quantity of ether was no doubt introduced than enters the blood during inhalation.

NOTE (7), p. 356.

The method of giving ether with no other appliance than a sponge placed over the mouth and nostrils, which was introduced by Dr. Smith, of Cheltenham, is one that will succeed in causing insensibility; and this is a happy circumstance that will extend the use of ether to many cases of emergency, in which otherwise the patients might be deprived of its benefits. In the cases of infants it is perhaps the best way of exhibiting ether, but for children of two years of age and upwards I have a small face-piece, and prefer to use the inhaler. The simple sponge is preferable, for all cases, to many of the apparatuses which were in use, and Dr. Morton, of Boston, U.S. (as appears by a communication he sent to the Lancet), uses it in preference to the inhaler he at first employed; but I cannot admit that it is equal to a good apparatus. It is an expensive means,

as not one-half of the ether which is dissipated enters either the mouth or nostrils of the patient; and it is a means which does not admit of any kind of regulation as regards the strength of the vapour.

In large operations on the face, like that described at page 355, the administration of the vapour of ether per rectum—the method of Prof. Pirogoff, of St. Petersburgh —would certainly be better than inhalation, if it is equally safe and manageable. The Professor, (I think I have read so), has removed the superior maxillary bone, under the influence of ether exhibited in this way. He recommends this plan, indeed, in all cases, as preferable to inhalation, on account of certain disadvantages and discomforts which he considers attend the latter; but, in all probability, he has not seen inhalation practised with a good apparatus, and I have not had sufficient experience of his method to be able to speak of its merits.

THE END