ries. With each cardiac systole the arteries, in addition to expansile movements, rise *en masse* from their beds, and with each cardiac diastole they, in addition to retractile movements, fall back to their beds. This change of place must occasion a pushing out of the tissues over the spot towards which the artery moves, and a simultaneous drawing in of the tissues over the spot from which it moves. The locomotion will be in the direction of least resistance, and in the case of superficial arteries is likely to be to one side as well as forwards. If a visible superficial pulse, notably the radial, be watched, the artery appears to roll to one side in systole and fall back in diastole; the contiguous integuments simultaneously rising at one spot and falling at another.

Now if the explorer be placed fairly over the artery it receives the force of the locomotion as well as the expansion, and so is pushed up in systole, causing to be registered the positive arterial pulse; whereas if the explorer be placed by the side of the artery over the spot from which the latter moves in systole it is affected by an aspiration, and so is drawn down in systole, causing to be registered the negative arterial pulse. Moreover, impingement of the instrument in this situation tends to facilitate the arterial displacement. The positive trace falls in diastole in consequence of emptying and retreat of the artery, while the negative rises in diastole in consequence of return of the artery to its apposition with the explorer. The secondary waves of the negative traces are the same as in the positive, because the delicate contact of the explorer is sufficient to receive their impression as transmitted along the artery; and the small diastolic waves are more distinct in the negative because the lighter pressure is more favorable for their reflection, the pressure in the case of the positive trace almost, if not quite, obliterating the arterial lumen in diastole. Also, for the same reason (lighter compression of the artery), the respiratory undulations are more marked in the negative line.

The characteristics given unmistakably stamp the trace under consideration as of arterial origin. The negative venous trace, where obtainable, differs essentially from this in form and in chronometry; besides the vein would be effectually collapsed by the pressure employed to develop this trace.

The demonstration of the negative arterial pulse adds an interesting fact to our knowledge of the physiology of the pulsations, and one whose utility is already apparent, in that its recognition will relieve the study of the negative venous pulse from a source of confusion in fact seriously encountered.

THE NEGATIVE CARDIAC TRACE.

This is a proper place to allude to the negative trace of the pulsations of the heart, a phenomenon already recognized, but whose explanation has not been entirely satisfactory.

The negative cardiac trace is usually of less amplitude than the positive, although in some cases it equals or even exceeds it, and in some again only the negative can be obtained. Its main descent begins synchronously with the main ascent of the positive, and it marks the same duration of systole and diastole;

the secondary waves also correspond in number and position with those of the positive.

Fig. 5 shows simultaneous traces of the same heart, taken both positively and negatively. The vertical lines show the synchronism between the traces.

With regard to the mechanism of production I believe it is similar to that of the negative arterial

FIG. 5.

namely, by a rhythmical locomotion of the organ. With a certain position of the explorer the heart glides or rolls from under it in systole and returns to it in diastole, causing the negative trace; whereas when the explorer is placed fairly over the spot of greatest positive impulse the heart presses it in systole and remits the pressure in diastole, causing the positive trace. Cardiac aspiration from reduction of volume, although conceivable as a possible factor, does not of itself afford a sufficient explanation, for cardiac reduction of volume can only begin a notable time after the beginning of systole, whereas the negative cardiac trace begins, as demonstrated, synchronously with systole.

THE MANAGEMENT OF PATIENTS DURING CAPITAL OPERATIONS.¹

BY GEORGE W. GAY, M. D.

THE object of this paper is to call attention to the management of patients while they are undergoing severe and critical operations. As it is oftentimes the little things which tell in these cases, and which go far toward deciding the result, we shall dwell especially upon their importance, and hope not to be thought trivial in so doing.

A brief narration of three cases which have lately been under our care at the Boston City Hospital will illustrate our ideas upon the subject much better than would any abstract remarks.

CASE I. While walking upon the sidewalk, March 17, 1883, Mr. S., aged fifty-two years, was thrown into the air by an explosion of ignited gas in an adjacent cellar, and fell into the excavation amidst paving stones, bricks, and other débris. Having been brought to the hospital within an hour of the accident, he was found to have sustained a compound comminuted fracture of the left tibia into the knee-joint. The leg was enormously swollen, tense, blue, and cold, and there was no pulsation in the tibial arteries. Above the knee was a large, ragged wound extending deeply into the bruised tissues of the thigh.

The patient had evidently lost considerable blood from subcutaneous hæmorrhage, and he was in a partial collapse. He was conscious, but restless; pulse weak and rapid; skin pale and cold.

Nothing whatever was given by the mouth, as a

¹ Read before the Boston Society for Medical Improvement, June 11, 1883.

pretty extensive accident-room experience has proved to us that food and stimulants poured into the stomach of a person while in collapse do no good, but on the contrary sooner or later produce vomiting, and thereby increase the prostration. A stimulant dose of morphine (one eighth of a grain) was given subcutaneously, and warm injections of brandy and water were given by the rectum. He was surrounded with heaters, covered with blankets and a rubber sheet, and kept as quiet as possible.

In an hour or two the patient had rallied sufficiently in our opinion to undergo a rapid amputation of the thigh. Everything being in readiness a little ether was given, and at the earliest possible moment the limb was quickly removed by transfixion at the junction of the lower and middle thirds. As soon as the bone was divided the anæsthetic was taken away, and no more was given. The result was that the patient was unconscious but a few moments, and regained his senses long before the vessels were secured and the stump was dressed. There was very little additional shock resulting from the operation, and the vomiting was unimportant.

The treatment pursued before the operation was continued for several hours after it, when small quantities of milk punch were given by the stomach and retained, and the question of nourishment gave us no more trouble. Omitting all details of the convalescence, suffice it to say that the patient made a good recovery.

CASE II. Thomas G., an expressman, twenty-two years of age, was brought to the hospital January 11, 1883, suffering from a large sarcomatous tumor of the left thigh. The disease was of six months' duration, and began as a small, tender bunch over the internal condyle of the femur.

When first seen by us it involved the lower half of the thigh, and was discharging large quantities of a dirty, sanious fluid. The glands below Poupart's ligament were slightly enlarged, but the abdominal cavity was apparently free from disease.

The patient was in a state of extreme exhaustion. Pulse 150. Temperature 103° F. Pale and emaciated, but there was no cough, vomiting, nor diarrhœa. It having been explained to him that an amputation, though attended with danger, was the only measure that promised relief to his suffering or could prolong his life, he requested that it should be done. For a few days efforts were made to improve his condition by means of liquid food, stimulants, tincture of digitalis, and tincture of nux vomica.

When ready for operation he was brought from the ward in his own bed, surrounded by heaters and covered with blankets and a rubber sheet. A very little ether having been given he was quickly transferred to the operating table, still covered up warmly, and the thigh was amputated as rapidly as possible by the circular method at the middle third. The ether was at once stopped, not over three ounces having been used, and in three minutes the patient was conscious. There was almost no shock from the operation, no vomiting, and in twenty-four hours the temperature was normal, and the patient "felt better than he had for months."

During convalescence he was free from pain, ate heartily, and grew fat. The wound healed kindly, with the exception of a small spot over the end of the femur, which became pale and œdematous, and looked like the original disease. The glands in the groin also began to enlarge.

Five weeks after the amputation a second operation was done for the purpose of removing the remainder of the femur. A long incision was made on the outer surface of the stump, the head of the femur disarticulated, and the bone carefully dissected out. The operation was necessarily of considerable length, the hæmorrhage was pretty free, and the shock was marked.

The contrast in the effect upon the patient of the two operations was very characteristic. In the first instance, although he was in a miserable condition, yet after a severe but quick operation he rallied almost instantly, while in the second case he was in a comparatively good condition, and yet after a prolonged operation the prostration was very severe. He finally rallied however, and got nearly well, when he was seized with pleuro-pneumonia, and died in a week.

CASE III. R. H., conductor, about twenty-seven years of age, was run over by a horse-car January 19, 1883, and received a compound fracture of the left tibia and fibula at the lower part of the middle third. The line of fracture was very oblique, and the tissues were considerably bruised.

Treatment consisted in placing the limb in a "plaster posterior" splint, and applying compound tincture of benzoin under carbolized gauze. Profuse suppuration and necrosis followed, and after several weeks the fragments were carefully adjusted and wired together.

In spite of all our efforts the patient gradually failed, and all hopes of saving the limb were abandoned. The pulse was rapid and feeble, the temperature was high; he was pale and emaciated, and suffered from chills, sweats, and great irritability of the nervous system, being delirious at night; his appetite was poor, but there was no vomiting nor diarrhœa.

It was evident that an amputation of the leg was the only means which could save his life, but it was the general opinion of the surgeons who saw him in consultation that he would not survive the operation over thirty-six hours.

A rapid amputation was completed March 18th under the same precautions as were used in the last case. The utmost care was taken to prevent shock and exhaustion by saving as much time, blood, and animal heat as possible. The result was all that could have been desired. The patient rallied well from the anæsthetic a few moments after the leg was removed, and his temperature fell five degrees inside of twenty-four hours. Convalescence was rapid, and the stump was healed in a fortnight.

The idea pretty generally prevails that in these days of anæsthetics time is of little or no consequence in doing capital operations. I do not accept this view of the matter. Experience has taught me that in the class of cases under consideration the more quickly the operation is completed, and the earlier the patient is allowed to rally from the anæsthetic, the less will be the subsequent shock and exhaustion. This fact is particularly noticeable in children, in whom a temporary collapse is not uncommon after a severe or a prolonged operation. There can be no doubt that a long operation is debilitating to the nervous system of any one, even when it is done without pain or without the loss of much blood.

It is claimed by some that as sulphuric ether is a powerful stimulant when injected under the skin, its inhalation is therefore beneficial in cases of great prostration requiring an operation. While the primary effects of this agent when inhaled are stimulating, the

ultimate result has seemed to us to be depressing, and especially so in those persons prostrated by injury or disease.

Usually the pain experienced by patients in the later stages of an operation is not detrimental. It is momentary, and soon forgotten, as they are still somewhat dazed by the anæsthetic. An opiate given previous to the operation also tends to allay suffering and produce quiet. Moreover, the pain seems to be less severe toward the close of an operation than it is at the commencement. Every surgeon must have noticed this fact in connection with operations about the face, when it is oftentimes not practicable to keep the person completely under the anæsthetic. Fear and dread are to a great degree absent when an operation is well under way.

These facts have led me to remove the anæsthetic at a much earlier stage in many operations than is the general custom, and I think with beneficial results to the patients.

In concluding we would urge that special attention be paid to the following particulars while doing critical or capital operations:—

If shock or collapse be present put nothing into the stomach, but stimulate and nourish by the skin and rectum.

Take extra pains to keep the patient warm by means of heaters, blankets, and a rubber sheet.

Disturb him as little as possible with examinations, moving, changing of clothes, or dressings, etc.

Use the least possible quantity of the anæsthetic, and allow the patient to rally early, depending upon opiates to control subsequent pain and inquietude.

Finish the operation as quickly as is compatible with its proper performance.

Get the patient into a warmed bed as soon as possible, and without any exposure to cold.

Preserve the utmost quiet, and avoid doing too much for the patient until fair reaction has taken place.

By observing these precautions we are confident that in more than one instance recovery has taken place, in which by neglecting them the result would have been fatal.

THE HYGIENE OF THE LYING-IN ROOM.¹

BY FRANCIS MINOT, M. D.

IN a valuable paper lately read before this Society, Dr. Reynolds pointed out the advantage of visiting patients previous to their confinement, with the view of obtaining a knowledge of their general health, and of the presence or absence of symptoms which might indicate the possibility of grave complications during and after labor. Among other things he suggested the propriety of making an examination of the urine should there be any reason to suspect renal disease. It has occurred to me that a visit to the apartment in which the woman is to be confined is equally important, in order to ascertain, if possible, its sanitary condition (and also that of the house itself), and to remedy any existing defects which might be prejudicial to her health. I have reported to the Society some cases in which I believe that serious disease, and even death, occurred in the puerperal state from defective sanitary

conditions which might have been obviated if proper precautions had been taken. No surgeon would now undertake a serious operation, such as ovariectomy, without a preliminary survey of the house, as well as of the room in which it was to be performed. Women in the puerperal condition are peculiarly sensitive to the influence of bad drainage and imperfect ventilation, and in modern lying-in hospitals every effort is made to protect patients from these evils. It is somewhat remarkable that so little attention is paid to the hygiene of the lying-in room in private dwellings. It is well known that the drainage and plumbing of a great many houses are defective, allowing a more or less ready access of sewer gas to their interiors, and sometimes giving rise to typhoid fever, diphtheria, scarlatina, and other diseases. It is time that our attention should be awakened to the danger of this poison in the lying-in room. In anticipation of the confinement, it would be wise if an examination of the condition of the drainage and plumbing of the house should be made by an expert in every case in which its integrity had not been already ascertained, in order that any existing defects might be remedied.

The lying-in room should be large, if possible should face the south, and should be provided with an open fire-place which will not smoke. It should not have a "set basin," or other convenience connected with a drain, and it should not communicate by a door with another room containing a water-closet, bath-tub, or set basin; or, if this be inevitable, paper should be pasted over all the edges of the door and key-hole, on both sides, and the door should be kept locked. If a room containing a set basin must be occupied by the patient, it is well to have the waste pipe cut off, and the lower end sealed by the plumber, a pail being placed beneath the basin to receive the waste-water. An examination of the gas-fixtures should also be made to insure against the escape of illuminating gas into the room, a very frequent occurrence, not only in hotels and lodging houses, but also in private dwellings. The wall paper should also be inspected, and tested for arsenic, if need be. The room should be thoroughly swept and cleaned before the period of confinement, and all useless furniture be removed, as well as the numerous ornaments, books, work-baskets, etc., which are apt to encumber the tables and mantel-piece to the inconvenience of the attendants of the patient. Ether and a sufficient supply of a solution of carbolic acid should be provided, as well as an abundance of towels, sheets, etc.

Whenever the weather is so cool that the room is uncomfortable with an open window, a fire should be kept constantly burning in the fire-place during the period of lying-in. The fuel, if possible, should be wood or cannel-coal. Even in warm weather, if the ventilation of the room be not satisfactory, it is well to have a kerosene lamp, or a portable gas jet, connected by a flexible tube with a gas bracket, kept burning in the chimney. Except in very cold weather, a window should always be left open, at least sufficiently to allow some air to enter; in many cases it is enough to raise the lower sash a little, so as to admit a current above it.

Women are usually delivered on a large double bed, which is sometimes so low as to cause much fatigue to the attendants. The patient, especially while under ether, often becomes unmanageable in the middle of it, beyond the reach of the doctor and the nurse. The

¹ Read before the Obstetrical Society of Boston, November 11, 1882.