

ments of a true science. The art must, as in all arts, rest upon the judgment of the one practicing it. When such reasoning prevails there can be no place for any of the conflicting theories; there can be no allopathic, homœopathic, hydropathic, uro-pathic, or any other of the various schisms in medicine. Our practice would then be spoken of and given the confidence due to a rational profession, because all the methods of treatment would be referable to the primary organic disturbance rather than to vague and ever varying symptoms. Inasmuch as we deal with natural phenomena which are always uniform, except in varying conditions we have the elements of as true a science as chemistry, astronomy or physics. The art, to be sure as all other arts, must rest upon the varied and conflicting judgment of those attempting to apply it. With the principles of a true science established, our profession will be glorified because it reaches out and grasps the forces of the Eternal, which tends in the constant changes to conserve human life for a higher end.

AMPUTATIONS IN THE LIGHT OF MECHANICAL SCIENCE.

Read in the Section of Surgery and Anatomy at the Forty-third annual meeting of the American Medical Association, held at Detroit, Mich., June, 1892.

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Dr. Oscar H. Allis, in his paper before the Pennsylvania State Medical Society, June 4, 1891, said: "Don't amputate through the joint; go above or below it." Such a statement by a surgeon of such thoughtfulness and eminence must necessarily carry with it a vast majority of men who amputate, but who allow other men to do their thinking. No one, of course, would for a moment suspect Dr. Allis of making such a statement unless he believed it, and such a conclusion could only be the result of a thorough investigation of the prothegenetic as well as of the mechanical phases of the question.

After having made a study of the matter for the past number of years, I am compelled to make the statement that joint amputations afford the best stumps, and no surgeon is justified in going three inches above the ankle and knee, as the limb maker, Truax, suggests when a disarticulation can be made. Why should three inches of a human extremity be sacrificed because of lack of ingenuity on the part of the mechanic? No; but rather compel the mechanic to fit the stumps you send to him.

There are many reasons why the natural articular surface of a bone covered with abundant soft tissue makes a more durable stump than one formed by a cut through the shaft of a bone. Nothing is more natural than that dealers should, and do, advertise the goods they have for sale, and if he can make a leg that will fit a joint amputation, he will so advertise and recommend the surgeon to disarticulate; but if he cannot successfully do this, he is sure to advise the surgeon to go far enough above the joint to make room for the machinery of his limb. Is this merciful or right in any sense? Yes, it is right unless it is possible to adjust an artificial limb to joint amputation, but it is radically wrong if such

limbs can be made and proven more durable and comfortable to the wearer. Dr. Mordecai Price, of Philadelphia, said: "If he had to have an amputation below the knee, he would prosecute a man that would give him a stump of more than four or five inches." While it is undoubtedly unwise to go nearer than three inches, and better six inches above the ankle, when the articulation has to be sacrificed. I am firmly convinced that a Syme's amputation makes the best stump possible, and I may say the most comfortable of all stumps. I am also convinced that a disarticulation at the knee joint furnishes a most admirable stump for the adjustment of an artificial limb, and is much more serviceable than at any point above the joint.

Why then should amputations be made through the joint in preference to points above. 1. The broad articular ends of bones make better stumps than cuts through the shaft.

2. The knob (I may be allowed to call it) formed by the condyles at the knee, and maleoli at the ankle, furnishes points about and above which the socket can be adjusted which prevents the pumping motion so common and so very objectionable when a cone stump is to be fitted.

3. Artificial limb makers can and do make limbs for disarticulations.

As to the first proposition. No one will doubt the advisability of making disarticulations, nor will they recommend the sacrifice of one inch more of human tissue than is absolutely necessary, provided stumps at the joints can be satisfactorily fitted. One maker says: "Amputations at the knee are very favorable and are preferable to any point above." Again, the same maker says in speaking of Syme's amputation: "This amputation leaves a stump that combines the greater number of favorable conditions * * * is better than above or below * * * the end of the stump bears the weight, and the patient can be supplied with a leg that fills the highest possible conditions and at the least cost."

Other quotations might be made, but suffice it to prove that limbs *are* made for disarticulations and are better than above the joints.

In Syme's amputation, I have a patient wearing an adjustable lacing socket limb made by the Pittsburgh Artificial Limb Co., who is a freight conductor, and he can jump on and off trains going as fast as he ever could.

I have a number of letters from men with Syme's amputation wearing limbs, and in no case do I find anything but commendation for the satisfaction they get in wearing their substitute.

Puddlers, railroaders, clerks, and laborers of all description, who are compelled to stand or walk all day, have no complaints to make.

In a Syme's or knee operation, the bearing can be received and divided at the will of the patient between two different points. In case of the ankle by simply slacking the lacing of the socket, the bearing can be thrown on the end of the stump, and by tightening the lacing the weight can be received by the head of the tibia.

In knee amputations, so also can the bearing be shifted from the end of stump at the knee joint or upon the muscles of the thigh as may be the pleasure of the wearer. In either case, the patient learns to all the time divide the weight upon the two points and thus make just half the pressure that would be in a leg or thigh amputation.

Surgeons would hardly question the advisability of doing disarticulations provided they were sure they were giving their patients a stump that could be fitted by the mechanic. Again, who will question the advantage of the broad surface of the condyles covered with synovial membrane cartilage, and the structures nature intended to receive pressure, has over the end of a bone cut through the shaft.

The practice of sawing off the condyles and the malleoli is certainly a misguided step. These knob like ends made by the condyles and the malleoli are of wonderful advantage to the patient. When a conical stump is put into a corresponding socket, there is nothing to hold the leg in the socket but a strap worn over the shoulder. This is all right; but in disarticulations this is unnecessary. From the fact that the condyles and malleoli have a greater diameter than a few inches above these points, the limb maker is able to adjust these points and thus prevent the annoying pumping motion of the stump in the socket.

If the condyles or malleoli have to be removed, then there should be no question as to the advisability of making the cut far enough from the joint to allow room for the machinery of the limb maker. It is also argued that when one-half of a joint is removed a substitute cannot be made and retain the normal relationship of the joint. This is not the case, for I have here a limb that places the joint parallel with the lower end of the femur. These photos show a patient wearing one of these limbs, and as you see in the three positions, the act of a full step is shown, which is evidence that a joint can be substituted and the normal relationship of the joint retained.

I am firmly convinced that artificial limb makers should make their limbs so as to make the bearings upon but four points:

1. The ankle as in Syme's.
2. Below knee, or about the head of the tibia.
3. Knee.
4. Perineum.

By this I mean that a conical stump of soft tissue which draws the skin back over the end of the bone, cannot be as comfortable to the patient as a bearing upon the normal articular ends of the bones, or fixed bony prominences.

In all amputations above the knee, I am sure that the future limb will be made so as to receive the bearing on the *tuber ischii* by the use of the Thomas' ring.

Orthopædic surgeons have long since considered this the only bearing for splints that are to receive the weight of the body.

As to tarsal amputations, I believe the proper thing to do in such cases is to perform your Chopart, or a Hayes, tenotomize the tendo Achilles, and in some way induce ankylosis of the remaining tarsal and tibio-tarsal joints. This, you will say, will throw the patient upon the remaining end of the stump in the act of walking, and thus make a limp. I say no.

Please study the part taken by the ankle joint in making one step. As the foot is thrown forward, the ankle joint is extended, and when the leg is perpendicular the joint is at a right angle to the axis of the leg. As the body is thrown forward, the joint does not go into flexion as might be supposed, but instead the foot retains almost the same relationship to the leg as it did when the body was vertical to it. If this

be true, then the act of flexion of the foot is not essential to graceful walking. If you notice, as you throw the body forward, there is a graceful rise of the heel from the surface, and the body's weight is received by the ball of the toe.

In other words, the ankle-joint of an artificial limb plays a very minor part in the act of walking. Dr. Cathcart, of Edinburgh, Scotland, has made a thorough study of this subject, and to his papers I most respectfully refer you.

Truax, in his article upon amputations, says: "See that the end of the bone is well rounded or smoothed at its outer border." This reminds me of the boy in my practice who wanted a brass knob put on the end of the bone in his leg after amputation. Nothing is more absurd, and would tend more to encourage necrosis of the end of the bone.

Surgeons should not only know what limb makers cannot do, but they should also know what they can do; and it is their duty to study the prothetical side of the question as well as the surgical.

The writer would do well to cut into a stump of a dead man and see that nature does the rounding up of the end of the bone, and if the surgeon would dare to assist her, his meddlesomeness would be criminal.

The photos 1, 2 and 3 represent a disarticulation at the knee joint, with the knee in the positions necessary in the act of walking. Cuts 4, 5 and 6 represent a Syme's amputation. The patient is a railroad freight conductor, who runs over trains, and jumps on and off trains at ten miles per hour. This man says the point of bearing is just where he wants it—either on the end of the stump or around the head

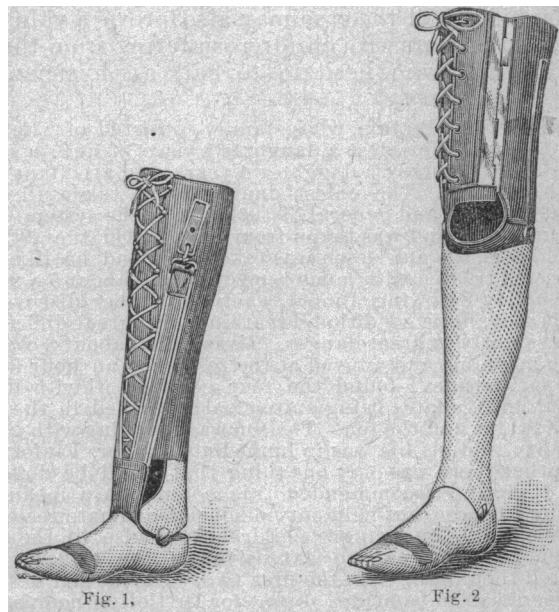


Fig. 1.

Fig. 2.

of the tibia. Cut 1 represents an artificial limb for a Syme's amputation, and cut 2 represents one for a knee joint amputation.

Dr. Adams inquired as to the use of an artificial foot after Pirogoff's operation.

Dr. McCurdy replied that this operation should not be made at any time, but a good foot can be made for this operation.

Dr. King, of Missouri, disagreed with almost every point made in the paper, basing his objections on considerable experience in railroad surgery. He said that the best artificial limbs were the hollowed out willow limbs, and he con-

sidered the cone-shaped stump to be the best. The patient is not expected to walk on the end of the stump. He made it a rule wherever he could to go above the joint.

Dr. Craig, of Pennsylvania, said that he had made a special study of the surgery of the lower extremity, and he agreed with Dr. King. The effect of saving the joint after the ball of the foot is removed is to make the man a permanent cripple. The amputation two inches above the ankle joint gives you no more control than a few inches below the knee, but it exposes a large portion of the limb to friction, and makes a tender limb from the effects of the wrappings round the lower extremity. He believed that every foot to be removed near the ankle joint will be better removed halfway between the ankle and knee.

FORCED RESPIRATION (FELL METHOD), PER FACE MASK AND TRACHEOTOMY IN DIPHTHERIA. REPORT OF CASE.

Read before the Section of Surgery and Anatomy, at the Forty third annual meeting of the American Medical Association, held at Detroit, Mich., June, 1892.

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The following case is presented with the belief that it has some features of novelty of an interesting character and

1. To illustrate how forced respiration may be of great value in surgical operations associated with conditions of asphyxia.

2. To illustrate its value per face mask and also tracheotomy in cases of membranous diphtheria and croup.

3. To demonstrate the value of peroxide of hydrogen in asphyxia produced by membranous exudates in the trachea and bronchi of the lungs.

The history of the case may also prove a valuable lesson to parents with children suffering from throat trouble, and who hesitate to call a physician in time.

A resident of Buffalo, whose family consisted of wife and four children, the eldest a daughter 9 years of age; a son 7 years and 3 months; a daughter 4 years, and an infant son, 2 years of age. The eldest daughter was taken ill with throat troubles and general disturbance of the system. She was quite sick and was taken from school. On the 29th of March, 1892, the eldest son was taken sick, and he like the sister, was treated with home remedies until about 5 A.M., on the Sunday following, June 4, when the father discovered him in a cyanotic condition, breathing with great difficulty, and evidently in great danger. I was called about 8 o'clock in the morning, and arrived at the residence an hour later. On examination I found the four children ill with diphtheria, the exudates being quite clearly marked in the eldest daughter and the son. The son was respiring with great difficulty, and his life was in immediate danger. I informed the father there was only one thing that could be done at that time, and recommended tracheotomy as a means of holding the case, but held out no hope of ultimate recovery of the child. The younger children were also ill, the exudation, however, not so extensive, as the disease had affected them later than the first two. The mother desired the operation to be made. I sent for Dr. Colton, near by, to assist me, but before we were ready to make the operation the lad became unconscious from the cyanosis, and necessarily in a very desperate condition. He was placed upon a table, the initial incision made for the operation of tracheotomy. The blood was purple. No anæsthetic was used, as it was not necessary. A few moments after the first incision was made Dr. Colton called my attention to the fact that the pupils of the eyes were rapidly dilating. I had fortunately prepared my forced respiration apparatus so as to have it ready for immediate use should occasion warrant, and had it not been ready I undoubtedly would have had the experience which frequently comes to some surgeons, of death occurring during the operation. I immediately placed the forced respiration cup upon the face and respired

for the little fellow, resulting in changing the blood to a bright scarlet in the wound in the neck and causing the return of auto-respiration. I proceeded with the operation, and found it necessary before I completed it to repeat the respiratory work with the forced respiration apparatus some six or seven times, in some instances having to respire quite a little time before auto-respiration was re-established. This is an unusual and peculiarly interesting fact, associated with the question of interference with respiration through exudates in the respiratory tract, that it is possible, (it may be for a short time only,) to breathe, retain the life of a patient, overcome the influence of the exudate and tone up the system so as to enable auto-respiration to be carried on. I completed the operation and placed the tracheotomy tube in the trachea, and even then found it necessary before consciousness returned to respire some time for the lad. After becoming conscious he breathed with very little trouble for quite a period of time. The general treatment directed was a spray application to the throat and nasal passages of the peroxide of hydrogen, about 30 per cent. aqueous solution. The father was directed to use this occasionally in the wound in the neck if he found it necessary. The afternoon of the day of operation revealed a condition similar to that which existed after the operation in the morning. The boy was moving around the house, although the respirations were at all times more or less labored. At intervals the inner tube of the tracheotomy tube would close up with the exudate and require frequent cleansing. The father stated on my second call that if he had followed my directions to merely spray lightly the wound in the neck, his boy would have died before my return. He found it necessary to place the tube of the spraying apparatus in the opening in the neck, or in the tracheotomy tube, frequently to prevent the cyanotic condition from ensuing, that "the spray appeared to liquify the membrane, or the matterly substance, and cause it to come away in a foamy, frothy state." During the afternoon the condition of patient became worse, the membranes filling up the trachea apparently, so that Dr. Colton, who was present, applied the forced respiration through the tracheotomy tube, again relieving the little patient from the severe dyspnoea which prevailed at the time. Sunday night the case progressed about the same, frequent resort having to be made to the peroxide of hydrogen to enable the little fellow to get along at all. On Monday and Tuesday extensive membranous casts of the tubes and trachea were coughed up and passed out of the tracheal opening. The boy retained his vigor under the adverse conditions existing until Tuesday afternoon, when the exudate seemed to be increasing and interfered with the respiratory efforts, which condition could not be overcome, even by the forced respiration apparatus, and about eleven o'clock Tuesday evening the patient died from exhaustion and heart failure.

The other patients in the house had upon my arrival been placed upon the common method of treatment which I used in these cases, tincture of chloride of iron, chlorate of potash, bichloride solution and so on internally, with the peroxide of hydrogen spray used every 10 to 15 minutes. While the exudates in their cases were very extensive, there appeared to be no serious invasion of the lung tissue, and they both made a nice recovery without any serious complications.

It was very clearly evidenced in the case of the boy that he would have died before I could possibly have performed the operation of tracheotomy had it not been for the forced respiration apparatus. How many cases of a serious character might be benefited, or have life retained by such work, and tided over the most serious results, cannot be foretold. It is unreasonable to assert that some patients may not recover who are as seriously sick as was this young boy.

Regarding the peroxide of hydrogen, its value was unquestioned. It produced liquefaction of the membranes in the throat; but whether a weaker solution would have proved more satisfactory or not, I am not prepared to state. As mentioned, the solution was about 33 per cent., and this apparently produced