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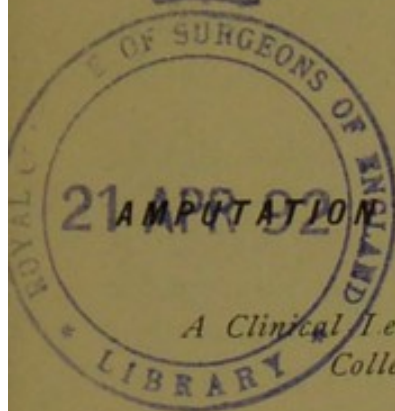
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AMPUTATION AT THE HIP-JOINT BY WYETH'S METHOD.

A Clinical Lecture delivered at the Jefferson Medical College Hospital, February 3, 1892.

BY W. W. KEEN, M.D.,

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IN JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

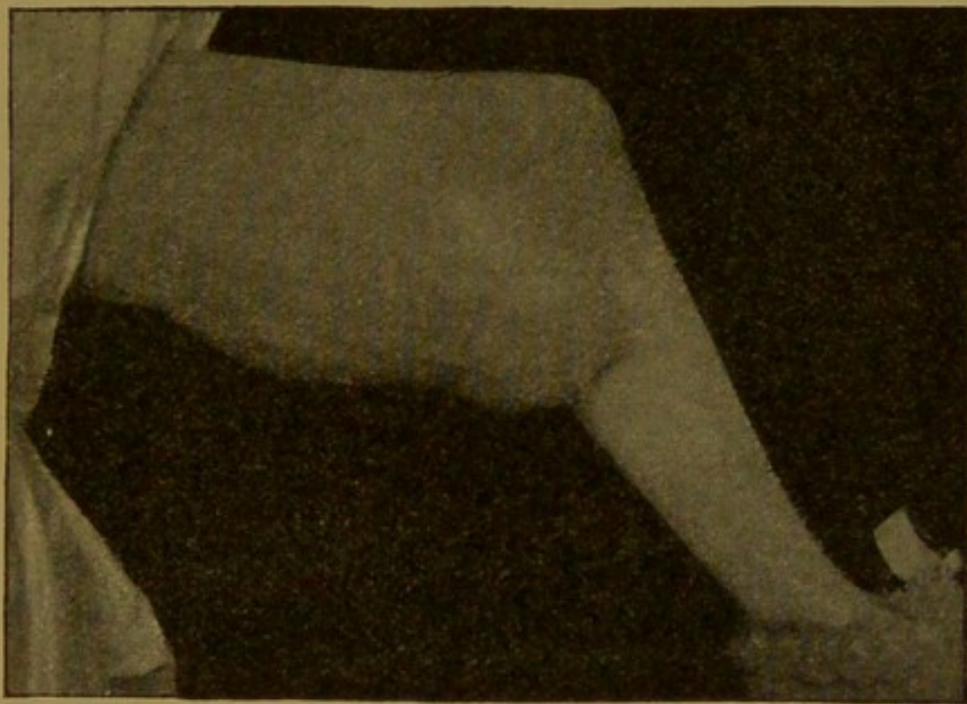
GENTLEMEN: The operation that I have to do before you to-day is a very rare one. The surgical members of the Faculty of this College have performed only five operations of this kind, but these five have been remarkable in one respect. The late Professor Joseph Pancoast did two amputations at the hip-joint; the first one was done at the Pennsylvania Hospital in the earlier part of 1860—just before I began the study of medicine—and in this case, for the first time, he adopted the method of preventing hemorrhage by an abdominal or aortic tourniquet; the case recovered. His second case was done in 1865, in the old College building, and also recovered. The late Professor Samuel D. Gross first operated in 1862, at the Philadelphia Hospital—an operation that I had the pleasure of seeing; his second was performed in 1865, and his third, in this amphitheater, in 1879; all three recovered. You observe, therefore, the remarkable fact that my surgical predecessors have done five amputations at the hip-joint with five recoveries. It must be remembered, also, that these operations were in the pre-antiseptic days, and that the mortality of hip-joint amputation varies from 40 to 93

per cent. It is, I hope, a happy augury for the result in his case. Let me now give you the history of the patient:

Mrs. T., thirty years of age; residence, Bahia, Brazil; entered the Jefferson Hospital January 19, 1892. She was born in Texas, the family history being good. A brother was never very rugged, but has no organic trouble. At nine years of age the patient had her right arm fractured above the elbow, with injury of the musculo-spiral nerve; this produced wrist-drop that has never passed away, and the muscles of the arm are wasted. She had whooping-cough at thirteen, which left her with a bad cough for five or six years. Her greatest weight was 106 pounds, and she now weighs 101 pounds. Her height is five feet two inches. She married at twenty, and immediately went to Brazil as a missionary, since which time she has never been very strong. She has had three living children, and one miscarriage at three months. Two years ago she had a severe attack of smallpox, and, while recovering, an abscess formed at the seat of the old fracture of the arm.

Her present trouble commenced about seventeen months ago. At that time, while pregnant with her last child, both legs swelled, the left much more than the right. A great deal of pain accompanied the swelling. The pain and swelling diminished after the birth of her child, but there remained a lump in the left popliteal space. In May, 1891, this began to be very painful, the pain being sharp and shooting in character. Soon after this the tumor also began to increase in size until it now extends from the top of the calf nearly to the groin. In Brazil she consulted both native and English physicians, and they decided that amputation at the hip-joint was the only possible means of relief, and advised her to come to the United States to have it done. Her health has improved on the voyage from Brazil. She arrived in this country only a few days ago. A slight systolic

cardiac murmur is heard over the base of the heart. The tumor measures twelve and five-tenths inches in length, and the circumference of the lower part of the thigh is twenty-three inches. The lymphatics in the groin are not enlarged. The pains are now dull in character and not as severe as they have been. Her digestion is good. She is, unfortunately, five months pregnant.



Having now given you the history of her case, so soon as the patient is brought in you will observe that the tumor extends well up toward the hip, but that there is still room for a flap between the tumor and the joint. You would naturally, therefore, ask me, Why not spare her the more severe operation of amputation at the hip-joint itself and amputate at the junction of the upper and middle thirds of the thigh? My answer is this: The tumor is undoubtedly a sarcoma. I fear that it has originated from the bone or its periosteum—an osteo-sarcoma—and if so, the probabilities are that the entire

bone is infected, and, therefore, to leave the upper portion of it would be, in all probability, to leave a source of infection from which the disease would start anew and destroy her life. Even if the bone is not involved, the soft parts are infiltrated so high up that there is not room for flaps of undoubtedly healthy tissue for a thigh amputation; hence the operation must be at the hip-joint or not at all. I am very loth to do any operation at all, the danger is so great. In addition to that, in this special case her present pregnancy creates so large an additional percentage of danger that I would gladly do no operation.

The question will then naturally suggest itself to you, Why not wait until after her confinement? or, Why not induce premature labor? As to the first: It would be necessary to wait four months for the completion of her normal term of pregnancy and at least one month for the puerperal period to pass. These five months might be cut down to four, possibly, by inducing premature labor at the eighth month; but not only do we not know what her condition might be after labor, whether premature or at term, but the disease, in all probability, in from four to five months from now would be so far advanced that I should then decline to do any operation. To induce labor now and to wait for a month to pass would be a possibility; but, inasmuch as we are not at all certain that she will abort after the amputation, I think we are justified in trying to save the lives of both mother and child; moreover, this is her own strong desire. Abortion will depend chiefly upon whether the operation can be made aseptic. If sepsis follows, abortion will almost surely occur; but if the wound runs an aseptic course, I think we shall probably avoid this calamity.

The *reasons* for amputation at the hip are twofold: First, traumatism; secondly, some new-growth—especially osteo-sarcoma. Occasionally other causes exist,

but practically the traumatism and these pathologic causes cover more than nine-tenths of the cases. The *dangers* of the operation are threefold: First, and foremost, hemorrhage; secondly, shock; and thirdly, the later danger of sepsis, with all its complications. These are especially prone to follow operation at the hip-joint, on account of the lowered vitality of the system after operation, the enormous surface that is exposed, and the difficulty of preventing infection from the urine and feces.

I. The means by which *hemorrhage* is met are varied. First, the older methods of ligating the superficial and deep femoral arteries and veins prior to amputation; or compression of the abdominal aorta, which, as I have told you, was first devised and done by my predecessor, Professor Joseph Pancoast. Both of these, however, have great disadvantages. Ligation of the femoral vessels obviates hemorrhage from these vessels in the anterior flap, but it does not at all control hemorrhage from the gluteal, the sciatic, the obturator, and the circumflex and numerous muscular branches in the posterior flap. Compression of the aorta exposes the patient to dangerous pressure on the solar plexus or on the viscera, and, in addition, in our present case, is absolutely ruled out by her pregnancy.

Secondly, a few years ago Dr. Frank Woodbury,¹ a graduate of this school, proposed to insert the hand into the rectum and compress the common iliac artery. Soon afterward Van Buren, of New York, repeated the proposition. This, I believe, has never been done; but it possibly suggested a mechanical means which has answered a good purpose in several cases—Davies's lever. This English surgeon, following out the same idea, proposed to use a long, well-rounded, and smooth

¹ The American Journal of the Medical Sciences, January, 1874, p. 131.

ebony stick, which might be compared to a couple of feet of broomstick. This was inserted in the rectum, and by lifting the handle, the other end being over the common iliac artery, this vessel could be compressed. Injury to the rectum, however, and the want of absolute reliability have caused this method to be viewed with only moderate favor.

Thirdly, the Furneaux-Jordan method. A compress is laid over the external iliac artery just above Poupart's ligament, and a band of elastic tubing is passed between the thighs, carried inside the tuberosity of the ischium below and within the crest of the ilium above. When the tubing is drawn sufficiently tight it arrests the pulsation in the external iliac artery by its pressure. I have tested this method repeatedly on the living model, and I confess that it has not given me any satisfaction; I have had great difficulty in controlling the artery.

Fourthly, Trendelenburg proposed to pass a stout pin under the femoral vessels and compress them by an elastic tube wound around the two extremities of the pin in a figure-of eight.

You will notice that all these methods were open to one of two objections: if they arrested the blood both in the anterior and posterior parts of the thigh, they were objectionable on mechanical grounds by reason of the possible injury to the solar plexus, the intestines, or the rectum; or if they compressed the vessels in the anterior flap alone (the external iliac or the femoral), they were objectionable because of the great hemorrhage from the posterior flap. It was reserved for an American surgeon—a gentleman who has done me the honor to come from New York and be present at the operation to-day—Professor John A. Wyeth, to devise what is undoubtedly the best method, and, in fact, what I think we may call now the only method of hemostasis in amputation at the hip-joint. In addition to these methods of preventing hemorrhage, Erskine Mason pro-

posed that, as far as possible, we should save the blood that is in the leg by Esmarch's bandage. In some cases the entire limb can be Esmarched from the toe to the groin, but in our present case it will not do to apply the Esmarch bandage higher than the lower border of the tumor, otherwise some of the sarcomatous elements might be driven into the circulation. Wyeth's operation is done as follows :

Two stout pins, twelve inches long and one-quarter of an inch in diameter at the head, are passed through the upper part of the thigh. The object of these pins is to hold in place a piece of elastic tubing which is wound tightly around the thigh just above them ; the tubing will constrict all the bloodvessels in the entire thigh, and is prevented from slipping down by means of the pins. The exact place of the pins is not very important, but they must be passed through the tissues at points where they will not injure any large vessels or nerves. The first one is passed about one and one-half inches below the anterior superior spine and slightly to its inner side and emerges just back of the trochanter major. The second one is passed an inch below the spine of the pubes internally to the saphenous opening and emerges just in front of the tuberosity of the ischium. Elastic tubing, half an inch in diameter, is then wound five or six times around the thigh, and is secured by stout forceps, or, better, by tying it. This tubing should not be ordinary white-rubber tubing, which is not very elastic, but should be of pure rubber. The control of the hemorrhage by this method, as you will see, must be absolute. Do not make one mistake : when I make the circular amputation you will see a large amount of blood flow out, but this will be wholly from the leg and not from the trunk ; so soon as this has escaped the hemorrhage will entirely cease. About five inches below Poupart's ligament a circular incision is made through the skin and the superficial fascia ; this is then dissected

back, as a cuff, until the level of the lesser trochanter is reached; the muscles are then divided circularly down to the bone, and the bone is sawn off. Dr. Wyeth has made the happy suggestion that, when the bone is bare, instead of dividing it at the same level as the muscles, the tissue be stripped down for several inches and the bone sawn much lower down; the protruding part of the bone then serves as a handle for manipulation. This is far superior to sawing the bone at the lesser trochanter and seizing the stump of the bone with the lion-jawed or other forceps.

The next step is to secure the bloodvessels. The principal ones will be the superficial and deep femoral arteries and veins, in front, just under the deep fascia. Posterior to the bone, along with the sciatic nerve, run the sciatic vessels; externally, toward the gluteal region, the gluteal vessels, and lower down, the circumflex. Internally, at about the middle or a little posteriorly, lies the obturator. Besides these there is a large number of muscular branches which cannot be found until the elastic tubing is gradually loosened, after the important vessels have been secured. The vessels being all tied, even down to the smallest spouting branches in the muscular tissue, the elastic tubing, which has been partially released, is now removed and the pins drawn out. The upper portion of the femur is then dissected loose from the soft parts, hugging the bone as closely as possible, so as to avoid dividing any large vessels. The muscles are then cut loose from the trochanters, and the capsule of the hip-joint is exposed and opened. The ligamentum teres is now severed and the entire upper extremities of the bone removed.

II. The second danger, as I have mentioned, is *shock*. This is met in several ways. First, our patient has had an ounce of brandy and one-twentieth of a grain of strychnine. Secondly, I shall operate, as you observe, with the patient in a Trendelenburg chair; by means of

this I can at any moment not only keep the patient horizontal, but, if I choose, I can put the head lower than the hips at the touch of a spring. Thirdly, in any serious operation the chilling of the patient from the necessary exposure of the person becomes a matter of great moment; especially is this true in an amputation so high up as the hip-joint. Accordingly, I have had both of my patient's arms, the right leg, and the entire body well wrapped in a thick layer of raw cotton kept in place by bandages. This is particularly necessary in using Trendelenburg's chair, which is narrow and cannot accommodate any hot-water bottles or other means of artificial heat. Fourthly, I have digitalis, the galvanic battery, and hot enemata all ready for use should they be required. In spite of all these, however, the shock must be severe. One cannot remove nearly one-fifth of the entire body without it.

III. The third danger is *sepsis*. I can dismiss this in a very few words. The leg, the buttock, and the abdomen have all been prepared as is usual in all my operations. This has been done for two days in succession, in order to obtain absolute asepsis. Secondly, the bowels have been opened gently and the rectum washed by an enema of warm water. Thirdly, the vagina has been disinfected by a douche of bichloride of mercury (1 : 2000), followed by hot water, and, to avoid a sudden possible opening of the bowels or any vaginal infection, an antiseptic towel has been secured over the vulva.

The patient is now on the chair; an aseptic sheet is under her, another one over her body, and a third envelops the right leg, which will be held by one of the clinical assistants. The steps of the operation are followed precisely as I have given them to you.

The operation being completed, let me say a few words in reference to it. The wrapping of the person of the patient in cotton is, I think, a matter of a great deal of importance in preserving the body-heat. It is very

evident that she has not suffered nearly so much from shock as she otherwise would have done. I have operated as quickly as I could consistently with thoroughness. No operation must be done so quickly that it is done badly; but if done well, the more quickly it is done the better. You have seen, however, that the operation has taken fifty minutes. Two steps caused delay: first, the separation of the soft parts from the bone, and secondly, the ligation of the numerous vessels. In any other case I should not separate the soft parts, as I did here, by a knife. I should prefer the scissors, which, to a certain extent, would crush the small vessels; or, still better, I should be disposed to strip up the periosteum, in order to avoid the numerous small vessels which have taken so much time both in finding and ligating. Of course, at the *linea aspera* the tissues must be divided by the knife or scissors. One vessel, you especially noticed, was troublesome. It lay just outside the capsule in a wound of great depth, and was difficult to find and seize separately from the capsule. Should I ever have occasion to amputate at the hip again I should undoubtedly prefer to slit up the soft parts on the inside if need be, or if dividing the muscular tissues about the great trochanter gave trouble, to slit them at the outside—these additional incisions practically counting for nothing in healing and for much in facility of dealing with hemorrhage or with the muscles.

I cannot express too high an opinion of Dr. Wyeth's method of primary hemostasis. Not one drop of blood was lost from the trunk until after the large vessels were secured. On relaxing the compression of the tubing, of course, a large number of vessels required ligation, and then after removal of the bone quite a number more, so that thirty-three ligatures in all were required. This large number was probably due to the great vascularity of the thigh, as the tumor required a large amount of blood for its growth. I think it probable that the patient

lost about from eight to ten ounces of blood during the later securing of the vessels and enucleation of the bone. Dr. Wyeth's idea of a low amputation of the bone is a very happy one, the bony handle being very satisfactory. Whether the stripping up of the periosteum from the bone in order to separate the soft parts with less hemorrhage would be a source of danger has occurred to me. I shall ask my assistant, Dr. Coplin, to examine the periosteum of the upper part of this bone in order to determine whether there is any sarcomatous infiltration. If there is, it precludes at once the propriety of stripping up the periosteum.

If there is no sign of any such infiltration, the stripping up of the periosteum would not only avoid the danger by diminishing the hemorrhage, but would also have the possible advantage that in this partially complete periosteal tube there may be developed a more or less tough and resisting substitute for bone, which may make the wearing of an artificial limb less irksome. In most hip joint amputations, an artificial leg can be worn only for a few hours each day, the rest of the time patient going about on crutches.

Two drainage-tubes have been placed in the wound, you notice, at both the external and internal extremities of it, both reaching up to the acetabulum. In a wound of such enormous surface and so very deep as this, drainage is essential, but the tubes may be removed at the end of two or three days, so that no sinus will remain and no avenue of deep infection exist.

The mortality of amputation at the hip-joint is very great. It is, perhaps, the gravest operation in all surgery. You will find in the *International Encyclopedia of Surgery* (i, 684) a table, prepared by a former assistant of mine, Dr. F. C. Sheppard, which contains the largest number of cases ever gathered together, 633 in number. Let me give you simply three summaries: First, in military surgery there were 238 cases of hip-

joint amputations, with an average mortality of 87 per cent. Among these, primary and intermediate operations give the frightful mortality of 93 per cent.—only 7 out of 100 recovered! Amputation at the hip, therefore, during a campaign is almost equivalent to a death-warrant.

Secondly, in civil practice, after traumatism, including gunshot wounds, there were 71 cases, but the death-rate fell at once to 66 per cent. by reason of the better care and earlier attention and the absence of the hardships and privations inevitable during war.

Thirdly, and more encouragingly, there were 276 cases of amputation for pathologic causes, with an average mortality of 40 per cent. At best you see, therefore, our patient has to face a terrible risk, and, in view of her pregnancy, an exceptionally large risk.

March 10, 1892. The night after the operation, for about forty-eight hours, the patient suffered from traumatic delirium, although her temperature only rose to 100.8°. With this delirium she entirely lost control of the bladder. The greatest care was taken to prevent, if possible, infection of the wound by the urine. The inner drainage-tube was removed on the second day. No general infection took place, but by the end of the third day some pus showed itself in the track of the inner drainage-tube and infected the outer one soon afterward. The outer one was retained for several days—first, on account of a very abundant serous oozing, and later on account of the local suppuration. There was not, however, any general infection, and the temperature never rose to 100° after the first twenty-four hours. The flaps united excellently, except in the track of the drainage-tubes.

At no time was there the least indication of any disturbance of her pregnancy. This I attribute to the absence of general septic infection; had it taken place I have no doubt that abortion would have followed the

high fever and general constitutional disturbance that would have attended it.

For the first forty-eight hours especially, the pain was very severe in the amputated leg, particularly in the foot-sole, and morphine in small doses was required to relieve it. The phantom leg was raised from the bed and held suspended in the air. Removal of the sutures seemed to increase its apparent reality, and up to the present time (March, 1892) the leg remains still as vivid as before. The position of the leg at present varies somewhat with the position of the stump. It is always, however, to some extent in advance of the stump—*e. g.*, when she is lying upon the bed it is a little above the bed. Usually the knee is bent, and the knee itself has been rather vividly perceived. Within the last week or ten days the leg has begun to shorten—not that the foot is attached, for instance, to the middle of the calf, but the entire leg seems to be shortening in its length. The pain is still felt occasionally in the foot-sole and sometimes shoots up from the lost foot to the stump.

Should I have occasion to repeat the operation, I should certainly use but one drain, placing that externally to avoid the possibility of infection.

