or suppressed; the pulse grows weak and ceases to be felt. With all these phenomena of general prostration, the mental faculties are almost always unimpaired. Death ensues very rapidly.*

The *post-mortem* appearances are, mainly, the following: very speedy putrefaction, with development of gas in the peritoneum, intestines and bloodvessels. The blood is thick, fluid and black, and rapidly putrefies; in some cases, when examined during life, bacteria have been found in it; their morbid significance is, however, still equivocal. The spleen, always enlarged and much softened, is of a purplish or black color. The liver, kidneys, and, in fact, all the viscera are considerably congested, and of a dark color.†

Clinical Lecture.

ON THE EXCISION OF JOINTS.

Delivered at the Boston City Hospital.

By DAVID W. CHEEVER, M.D.

GENTLEMEN,—The wards contain, just now, a very interesting series of cases of joint disease, and the child on whom I am about to operate this morning, you have seen for the past month undergoing the treatment by rest and extension, for hip disease. At first apparently benefited, he has latterly grown thin, irritable, vigilant and febrile. A week ago, fluctuation was detected near the trochanter, and pus was evacuated. The case, then, may be said to be ripe for excision. During this winter, one case of double hip disease in a little girl has terminated in death. Another, an adult, after ten years of incessant supuration, and being riddled with sinuses all about the pelvis, into the rectum, above Poupart's ligament in the groin, and even on the opposite flank, and up over the false ribs, has finally succumbed beneath his sufferings. A third, an adult, after a spontaneous cure of hip disease in childhood, with dislocation and ankylosis, enjoyed a period of quiescence from disease for twenty-four years, when a fall lighted up again the dormant tendencies, new abscesses formed, and, after being bedridden for eighteen months, she has just undergone excision of the diseased bones, as a relief from suffering.

By the excision of joints, we mean the cutting out of diseased or broken joint-surfaces, trusting to the bone-reproducing power of nature to form a false joint, or, in the knee, a bony ankylosis. Although a modern operation, nature has long since shown us the lesson, in the false joints she forms in an ununited fracture or in an unreduced dislocation.

To Park, Moreau, White, Stromeyer, Esmarch, Larrey, and other surgeons, we owe the practical boldness to make the attempt of excision; but to Ollier, of Lyons, Sédillot, of Strasburg, and Langenbeck, of Berlin, the patient experiments and clinical researches which have taught us why and how to expect success—especially to M. Ollier, whose life-long researches on the regeneration of bone and the functions of the periosteum, in experiments on the lower animals, have demonstrated the laws which govern our results.

* Loc. cit. p. 157.

† Loc. cit. pp. 175 to 179.

It is true that we cannot reason strictly and directly from the lower animals to man. The lamb or the chicken repairs a fracture with the leg dangling. Their recuperative power is vastly greater than ours; yet, if not strictly comparable, their modes of bone-growth are analogous to that of man, and may point the way to human experiment and success.

In the growth and repair of bones, the periosteum, the Haversian canals and the medullary connective tissue (endosteum) all furnish the plastic elements to form osseous structure. So, too, there are three vascular systems directly concerned: that of the periosteum, that of the medullary membrane, and the nutrient artery. In diseased joints, we find the vessels enlarged and increased, and the periosteum thickened and very vascular, which is, probably, one reason why excisions for disease are better recovered from than those for injuries, where the circulation is only adapted to the wants of a healthy part, instead of the increased demands of an inflamed one.

The periosteum is far, then, from being the only source of bone-repair, though it is the most important one. If we can save the periosteum, we hope for a more perfect reproduction of bone than if it be destroyed. Hence, the importance of the most modern operations of Ollier and Sédillot, called "sub-periosteal resections." In these, we aim to scrape the bones, rather than to cut around them; to push back and preserve every portion of the periosteum, and to excise the diseased or broken joint, with the bones cleanly denuded of all soft tissue. These sub-periosteal operations give admirable results.

Ollier's experiments have demonstrated, to use his own words, that:

"If bone is removed and its periosteum left, bone will grow again.

"If the processes and articular ends of bones are removed, and the periosteum is preserved, the processes will be reproduced.

"If bone is transplanted with its periosteum, the bone will live and grow (osteo-plastic operation).

"But if cartilage is transplanted, it will degenerate, or die."

The last statement explains why, in a traumatic excision, we usually get a better result by cutting out all the articular surfaces, than by leaving any portion of them; for the feeble vitality of cartilage, nourished by imbibition, usually fails to survive the irritation of an opening in the joint, and it degenerates, suppurates and peels from the bones.

There is one very important restriction to the growth of excised bones. Since the growth of the long bones takes place between the epiphysis, or articular end, and the diaphysis or shaft, it follows that if a section of a growing bone is made above the junction of the epiphysis and diaphysis, growth in length will cease. Thus it occurs that we sometimes see an excision of the knee in childhood followed by arrest of growth in the femur, and the child, when grown up, having the excised limb from three to seven inches shorter than its fellow, and practically useless. But we must remember that the joint is diseased so high up, in some cases, that we must saw above the epiphyseal junction. Moreover, in certain joints, as the knee, if we follow the established rule to remove all the articular surfaces in excising, we inevitably go above the epiphysis, since the line of junction runs through the upper third of the articular surface of the condyles of the femur. If we go below this line and leave articular cartilage, we run the risk of its degeneration and death.

Since, then, disease or anatomical peculiarity may make it impossible for us to avoid the epiphyseal line in a given excision, it is important to inquire whether future growth will be equally interfered with, in every joint alike? Ollier has made this a matter of careful study and long experiment on the lower animals, aided by a comparison of the results of actual excisions in the human being. He has arrived at the following law:—"In the bones of the *upper* extremity, it is the ends going to form the *elbow* which grow the *least*. In the bones of the *lower* extremity, it is the ends going to form the *knee*, which grow the *most*." Therefore, excisions of the knee, shoulder or wrist are followed by more arrest of growth than those of the elbow, hip or ankle. In other words, if we excise the head of the humerus *below* the epiphysis, we shall lose *more* in future growth of the limb than if we excised the lower (condyloid) end of the humerus *above* the epiphysis, at the elbow. The wrist is as bad as the shoulder. And, in the lower extremity, if we excise the head of the femur *below* the epiphysis, we shall lose *less*, in future growth of the limb, than if we excised the lower (condyloid) end of the femur, *above* the epiphysis at the knee. The ankle is as good as the hip. It follows that the elbow gives the best results in the upper extremity; the hip (or ankle) in the lower extremity.

But other considerations now come in, for shortening in the upper extremity is of little consequence, compared with the lower; and, moreover, it is only in childhood, the growing period, that shortening can occur. The whole question of arrest of growth in the excision of joints narrows itself down, then, to the expediency of excising the *knee* in youth.

Excisions for disease give a larger percentage of recoveries than excisions for injury. The same is true of amputations. The diseased joint has already been through the inflammatory processes, and the system has become habituated to them. Yet, there are certain conditions in disease that are not so favorable. Brodie first pointed out, and later observers have confirmed the observation, that, in a patient for a long while confined to bed, the bones undergo a sort of fatty degeneration, just as the muscles do. There is a loss of phosphates, and a softening of cancellous structure, under long disuse, which resembles the incipient stage of caries.

Convalescence after excision is, at best, very slow. Three to six months for an elbow, or shoulder; eight months for a hip, and twelve to eighteen for a knee.

The ratio of mortality varies in the different joints. In the hip—uniting Dr. Hodges's and Dr. Foote's tables—we have nearly fifty per cent. of deaths, or one in two. But if we look at the influence of age, we find the mortality under ten years, 33 per cent.; from ten to twenty years, 57 per cent.; twenty to thirty years, 60 per cent.; over thirty years, 83 per cent. Thus, in childhood, when the disease is most frequently met with, after excision of the hip, two out of three recover; but in adult life, two out of three die.

Mr. Swain has collected 472 cases of excision of the knee. The mortality of all the cases averaged 27 per cent. If we include those subsequently amputated, we find the ratio of recovery, with preservation of the limb, to be about two in three. Other statistics, however, show that in chronic disease of the knee, excision is twice as fatal as

amputation. Mr. Bryant, indeed, claims to prove that, in childhood, excision of the knee is seven times as fatal as amputation; and in adult life, twenty per cent. more fatal. Accumulated statistics prove the chance of success in excision of the shoulder to be three out of four; and in excision of the elbow, two out of three.

We must bear in mind that, after all excisions, secondary amputation can usually be safely resorted to, if required; while at the hip, excision is the only operation justifiable, the mortality after amputation at the hip-joint being over 90 per cent. Says Mr. Bryant, of Guy's Hospital:—"For disease of the hip and shoulder, amputation is a very rare operation; for the knee and ankle, it is yearly becoming less common. Amputation of the arm, for diseased elbow, is still less justifiable." Obviously, in joint disease, no operative interference is to be thought of, unless the articulation has suppurated and become disorganized. Amputation is out of the question, until other measures have been exhausted in vain. Amputation and excision are equally fatal, if undertaken in *acute* suppurative disease. Let out the pus, and wait for the system to become quieted, and the inflammation chronic, before you operate.

But an operation for excising the head of the femur in chronic hip-disease is scarcely more severe than an operation elsewhere for necrosed bone. It is followed by no shock, and the child usually appears better the day after the operation than the day before. When we have evidence that the pelvis is extensively diseased, we may hesitate; yet, even here, nature is capable of almost boundless repair, if the diseased parts are freely exposed. Thus, Fergusson removed the head of the femur, the acetabulum, and portions of the ilium, ramus of the pubes and ischium, with good recovery.

In excising the hip, a V-incision gives the best drainage, which is the most important point. If the greater trochanter and some muscular attachments can be saved, they promote the future usefulness of the limb. Extension by weight and pulley is to be kept up for many weeks. The results after excision, as to shortening of the limb, are about the same as after the spontaneous cure by dislocation—two, two and a half, and even three inches. But the motions of the limb and the power of everting the foot are better in the false joint of an excision than in the ankylosed dislocation of the spontaneous cure. Lordosis is also less after excision. And yet we see some excellent results from the spontaneous cure. We would not excise every case of chronic hip-disease. But in hospitals we should do it oftener than in private practice, since the hospital patient has less chance of living through the natural cure, owing to the bad state of his surroundings at home.

Excision of the knee may be classed as the least promising of all, for these reasons:—

1. The chance of arrest of growth of the femur, in length.
2. The chance of the decay of articular cartilage, necessarily left behind, if we saw below the epiphyseal junction.
3. The greater difficulty of procuring bony ankylosis, as compared with a false joint.
4. The difficulty of securing immobility and cleanliness, together, during treatment.
5. The length of confinement to bed, and the greater mortality than from amputation.

Langenbeck has devised an operation for excising the knee, and preserving a movable joint. The incision is made parallel to the ligamentum patellæ, and the patella and quadriceps tendon are preserved. We are not informed of the results of this operation, but should suppose success to be exceptional.

Excision of the shoulder gives excellent results, although we have more or less shortening of the upper arm, often to the extent of three or four inches. Wasting and loss of power of the deltoid muscle often result, also, from this excision. Yet, if a false joint can be established as a centre of motion and rotation, the elbow, forearm and hand are extremely useful.

Excision of the elbow gives the most admirable results of all: with the least arrest of growth; the greatest reproduction of bony processes; the most complete restoration of function, and the most serviceable member. The operation is done by a single straight incision, parallel to the long axis of the limb, and running over the ulnar side of the olecranon process. The tendon and fascia of the triceps are carefully preserved in their attachment to the ulna, and the ulnar nerve should be pushed off the groove of the inner condyle with its sheath unopened. By following strictly the sub-periosteal method, scraping and pushing back the periosteal sheath of the bones, we secure the reproduction of bony prominences, resembling the condyles and the olecranon. The arm is exceedingly useful. In one case in which I operated, a young man can carry a pail of water; dress himself; use his knife and fork; do up bundles; flex, extend, pronate and supinate, and even hold out a heavy octavo book at arm's length. There is a great spreading of the lower, sawed end of the humerus; and strong buttresses of new bone for the attachment of the flexors and extensors of the forearm.

Although the chance of success is not so good in traumatic cases as in those caused by disease, yet we sometimes may save those apparently desperate, while we can amputate secondarily, if the excision fails. Two cases have occurred to me, in the last three years, of very severe injuries. Both patients sustained compound fractures into the elbow-joint, with laceration of skin and muscles on the back of the joint. The tissues in front of the elbow were uninjured. Sensation and circulation in the hand were unimpaired. Formal excision of all the articular surfaces was done, and resulted, after six months, in the preservation of the forearm and hand, with a false joint.

Formal excisions of the wrist and ankle are not so frequently called for as in the other joints. Partial gouging (*évidement* of Sedillot) is applicable to these joints and to the tarsus. By Mr. Hancock, very extensive removals of the astragalus, os calcis, or smaller tarsal bones, have been done, with the result of a passable and useful foot.

NOTCHING THE OS TO AID DILATATION.—In a case of *placenta prævia*, reported by Dr. M'Dougall, at a meeting of the Obstetrical Society of Edinburgh, it was found impossible to dilate the os, owing to the existence of a firm, narrow band, which passed around the whole inside circumference. All efforts to overcome the stricture by digital manipulation proving fruitless, it was decided to notch the os at four different points, by means of a probe-pointed bistoury. Immediately afterward, the operator was enabled to introduce three fingers and drag down the placenta. Previously, he had only been able to introduce the index finger, although the woman was completely anesthetized.—*Edinburgh Medical Journal*, Feb., 1874.