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FREQUENCY OF RECURRENCE OF SARCOMA,  
WITH ESPECIAL REFERENCE TO AMPUTATION AT THE HIP-JOINT  
ON ACCOUNT OF THIS NEOPLASM.

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THE surgeon of large experience cannot fail to be impressed with the extremely malignant character of sarcoma as shown by the frequent recurrence of this neoplasm, either locally or remotely. This is true whether the tumor is removed by dissection without amputation, or when an amputation is made more or less remote from the growth. What I have to say here does not refer to that rare and most fatal variety of this neoplasm known as the melanotic sarcoma, but of the three ordinary surgical forms, the round, the spindle-cell, and the myeloid or giant-cell varieties. For a while I thought that perhaps I was unusually unfortunate in dealing with these cases, but in later years a study of the reports of other surgeons convinces me that my experience was not exceptional; that in fact sarcoma was the most malignant form of neoplasm.

In my own practice I can now recall but two cases which in strict propriety can be claimed as cured, and to these I will call especial attention. I have a number of patients still sur-

viving, one now in the fourth year after a hip-joint amputation with no sign of recurrence; but I cannot yet count this case as cured, for I have under observation, also, a man at whose shoulder-joint I amputated five years ago for an osteosarcoma of the upper end of the humerus, but which five months ago recurred in the stump. This and other cases show how fallacious it is to pronounce as cured patients who have once become the victims of this unfortunate disease.

Within the last twelve months, while engaged in collecting the cases in which amputation at the hip-joint had been performed by my method, I was impressed with the frequent recurrence of sarcomata in the lungs or other viscera, and occasionally in the stump, even when the disease was seemingly entirely confined to the bone and well removed from the line of incision in forming the flaps.

Out of 267 cases of amputation at the hip by this method there were 131 done on account of sarcoma, fourteen of these, or 10.6 per cent., ending fatally, wholly or in part as a result of the operation. This ratio of mortality is in my opinion large, for the reason that in several of the fatal cases there were complications grave enough to have rendered success practically impossible. Gangrene existed in one instance for two weeks before the operation, the patient being *in extremis*, and showing a rectal temperature of 104° F. at the time of amputation, dying in shock soon after. Another case was in collapse and practically hopeless by reason of severe hæmorrhage which occurred, due to breaking down of a large vascular osteosarcoma; a third case recovered from the operation but died from what was termed "tubercular peritonitis" on the eleventh day; while a fourth case, after a good recovery from the operation, suffered pyogenic infection of the flaps and died from septicæmia on the twenty-sixth day. In one other fatal instance the disease involved the tissue so high up that the acetabulum and the pelvis were infiltrated, necessitating curettage of an extensive region above the tourniquet, and followed by death in shock four hours later. A sixth case is included in the death list, although the patient succumbed from asphyxia on the twelfth

day, the positive cause of death not being disclosed, but in all probability due to rapid infiltration of the lungs with the sarcomatous elements. There were, however, no complications in eight of the fatal cases, dying from four to twenty-six hours after the operation, most of them in shock, and no doubt death was due in very great measure to this formidable procedure.

If the complicated cases were eliminated and only the eight fatal and uncomplicated cases considered, the death-rate would be 6 per cent.; and Mr. Thomas Chavasse, of the Birmingham General Hospital, in an excellent paper on amputation at the hip-joint, in the London *Lancet* of July 21, 1900, asserts that in properly selected cases the death-rate by this method should in future not exceed even this low percentage.

Of the 117 cases which survived operation, I have obtained more or less satisfactory histories of eighty-three. In fifty-two of these it is noted that the disease recurred, but since, in one instance, the neoplasm could not be entirely removed, this case is properly excluded. There are then a total of fifty-one, or over 63 per cent., ending fatally by recurrence.

If, however, a careful analysis of the cases in which the disease returned is made, it is evident that this estimate of the ratio of recurrence is too low, for in many of the cases classed in the non-recurring list so short a period of time had elapsed since the operation, that judging by the statistics in the recurring tables, the large majority of these will without doubt ultimately be added to the list of fatalities. Thus, of the fifty-one recurring cases, twenty-seven returned between one month and twelve months after amputation, while in five out of the twenty-nine cases reported as not having recurred when last heard from, only three, four, six, eight, and twelve months respectively had elapsed since the operation.

From the list of cases upon which this paper is based one may infer that the location of the tumor, that is, its proximity to the line of incision in forming the flaps, or the fact of its being confined to the bone, endosteal or periosteal or involving the soft parts, has little, if any, influence upon the ultimate safety of the patient. Thus of the five patients operated upon

by the writer, in the case which longest survived, the man being now alive and well three years after operation, the tumor began as an osteosarcoma at the great trochanter and immediately below this point, and by periosteal extension had infiltrated the soft parts as high as the obturator foramen, from which a very considerable mass of the sarcomatous material was curetted. It seemed, in fact, the most unfavorable of all my cases. In another, seemingly ideal for the reason that the tumor was an osteosarcoma, and confined to the bone just at and above the condyles, with fully sixteen inches from the upper limit of the mass to the hip-joint, the patient survived only twelve months, dying from recurrence in the lungs, the stump remaining uninvolved. In another instance a neurosarcoma of the internal popliteal nerve recurred in the soft parts at the knee, and again at the middle of the thigh; and then, when a hip-joint disarticulation was done, the stump escaped, the disease recurred in the lungs, causing death eleven months after the last operation.

Two other of my cases of osteosarcoma of the femur, one a girl of seventeen and the other a youth of twenty, died respectively six months and thirteen months after the operation from recurrence in the lung with no involvement in the stump.

Professor Charles B. Nancrede reports five cases, the longest survival being a girl of fifteen, who was living, at last account, two years after the operation. Of the other four, a man, thirty-two years of age, died in six months from recurrence in the stump; another man, thirty-five years old, died within a year, the stump being involved; a third, a man thirty years old, died from recurrence in the lungs and brain sixteen months later, while a girl of sixteen had the neoplasm recur in the stump with general metastasis before death, nine months after operation.

Of the three cases of Mr. Thomas Chavasse that survived operation on account of sarcoma, two were endosteal and one of periosteal origin. There was no recurrence in the stump in either case, but the disease returned in the left lung in one endosteal case thirteen months later; in both lungs in the other

case of endosteal origin, while the periosteal sarcoma ended fatally eleven months with recurrence in both lungs.

Among the encouraging cases, the longest survival (nine years and still in good health), the disease was a myelosarcoma of the neck of the femur in a boy of fourteen, operated upon by Dr. Harry M. Sherman, of San Francisco.

In an unusually interesting case by Professor J. D. Griffith, of Kansas City, in which an enormous osteosarcoma extended from the trochanter down to near the knee, the patient still survives, four years after the operation, although the flaps were taken from immediately over the location of the growth. On the other hand, in a case operated upon by Professor H. H. Grant, of Louisville (a surgeon of large experience and well-known skill), in a man of forty-three years, the tumor being at the knee and well away from the line of operation, death ensued fourteen months later from recurrence in the lymphatics of the abdominal wall just above Poupart's ligament.

Of the eighty-three cases, twenty-nine are reported as not having returned. The longest surviving case which may be justly counted as a cure is that reported by Dr. Harry M. Sherman, of San Francisco, California, in a boy of fourteen, for myelosarcoma of the neck of femur, the patient being now alive and well, nine years after the operation.

Two cases survived seven years, one for osteosarcoma of the condyle of femur, by Dr. W. C. Dugan, of Louisville, Kentucky, still living at this date; while the second case, a boy of fifteen, by Dr. A. M. Phelps, of New York City, was living seven years after operation when last heard from two years ago.

There are also two in the five-year list, one still surviving and well at this date, by Dr. L. L. Shropshire, of San Antonio, Texas, the patient a negro of twenty years, the sarcoma involving the lower and middle third of the femur. In the second case the history terminated one and a half years ago, a girl of seventeen years at time of operation, having periosteal sarcoma of the femur, was living and well five years after operation.

Three survived four years. One of these, by Dr. J. D.

Griffith, of Kansas City, in a male twenty-one years of age, was of enormous size, extending from the trochanter nearly to the knee, the flaps being cut from immediately over the neoplasm. There is no recurrence at this date. The other two cases were living and well when last heard from four years after operation. One by Dr. Leonard Freeman, a central osteosarcoma of the lower third in a man forty-seven years of age; the other by Dr. D. C. Hawley, of Vermont, an osteosarcoma of the femur in a man twenty-one years of age.

Three cases are in the three-year group without recurrence. One by the writer, situated at the great trochanter, the neoplasm having spread to the soft parts as high as the obturator foramen, from which the disease was cured. This patient is living and well now three years after the operation, and will be again referred to. In the other two cases the histories are not complete, one by Dr. Robert Weir, with no recurrence when last heard from, and another by Dr. F. A. Duns-moor, a man of twenty-five years for sarcoma of the lower end of the femur, had not returned when the history closed.

Three cases were surviving two and a half years after operation. One, a boy of six years, by Dr. A. M. Phelps, was living and well when last heard from two years ago. The other two of this group are still living at this date. One by Dr. J. D. Griffith, a child of five years, and a woman of thirty-five years operated upon in 1898 by Dr. Charles K. Briddon.

Nine cases are reported as surviving two years. Those living and well at this date are, one by Dr. J. D. Griffith in a child of nine years; another by Dr. Charles S. Hamilton, of Columbus, Ohio, a woman of thirty-two years, who is not only well at this date, but has borne a healthy child since the operation. The other cases were living when last heard from, but the histories are not complete, as the patients were lost sight of. One a woman of twenty-six years, operated upon in 1892 by Dr. Frank Hartley; a woman of twenty-four years, by Dr. W. N. Van Lennep, of Philadelphia, in 1895; a man of thirty years, by Dr. Charles K. Briddon; a man of thirty-five years, by Dr. R. W. Stewart in 1895; a woman of twenty-nine years,

with periosteal sarcoma, by Mr. George Heaton; a man of thirty years, operated upon in 1897 by Dr. H. P. Cooper; and a girl of sixteen years, by Dr. Charles B. Nancrede, 1894.

One case, a woman of twenty-four years, having sarcoma of the soft parts of the thigh, operated upon by Dr. W. B. Coley in 1898, was surviving eighteen months later.

One case, a child of five months with myxosarcoma of the knee, was well fourteen months later when last heard from, the operator being Dr. F. W. Parham, of New Orleans.

One case by Dr. E. W. Holmes, a man of twenty-three years of age, with osteosarcoma of the femur, had no recurrence at last report, one year after the operation.

Dr. M. B. Herrman reports no recurrence in a man twenty-four years of age, eight months after operation.

Dr. W. B. Coley operated upon a man of forty-five years for osteosarcoma, with no recurrence at last report six months after operation, while in Dr. Charles McBurney's case no recurrence had taken place three months later, when the patient was last heard from, the operation being done in 1890, on a man of thirty-four years, for osteosarcoma of the femur.

The cases which recurred fatally with the period of immunity are as follows: One a boy of eighteen years for sarcoma of the thigh, operated upon by Dr. Frank Murray, of New York, in 1894, with death from recurrence in the lung four years after operation. Case 2, a woman of thirty years, operated upon in 1892 by Dr. W. W. Keen; patient lived three and one-half years, and died from recurrence, most probably in the abdominal viscera, as there was no mention of involvement of the lungs in the report. This case has an additional interest, being one of two cases of pregnancy when the operation was performed, the woman going to term and giving birth to a healthy child.

Five cases survived two years, one by Dr. W. B. Coley, in a girl of thirteen years, chondrosarcoma of the femur recurred fatally in two years, location of recurrence not given. Another by Dr. Vinke, girl of sixteen years, recurred in the stump and mesenteric glands; another by Dr. Van Lennep, in a girl with

recurrence in the lung, and a fourth case by Dr. L. L. Hill, of Montgomery, Alabama, osteosarcoma of the femur forty-four inches in circumference, male, thirty-five years of age, recurred in the stump. A fifth, by Dr. Carl Beck, of New York, an osteosarcoma of the femur, woman fifty-four years of age, recurred in the lung and pleura.

One case by Dr. A. C. Bernays, lad of eighteen years, for sarcoma of the thigh, survived twenty months, died from recurrence in the lung.

Seven survived eighteen months. One sarcoma of the soft parts recurred in the stump and iliac fossa; a second recurred at the sacro-iliac synchondrosis; third recurred in the lung; fourth in the pleura; fifth in the liver; sixth in the abdominal viscera; seventh in the lung.

One case survived sixteen months, recurring in lung and brain.

One fifteen months, with recurrence in the lung.

Three survived fourteen months. One recurred just above Poupart's ligament; second recurred in the stump, and a third in the lung.

Two survived thirteen months, both dying from recurrence in the lung.

Five survived one year. One by the writer, osteosarcoma of the lower third of the femur, recurred in the lung; a second case returned in the lungs, and a third recurrence, location not stated; fourth recurred in the scalp, orbit, and elsewhere, and fifth in the glands and viscera of the abdomen and chest.

Three cases are reported as having died "within a year;" one recurring in the stump, another case of sarcoma of the soft parts of the thigh in the lung, and a third by Dr. McRae, in a lad of seventeen years, for osteosarcoma from recurrence in the pleura near the pericardium.

Four cases survived eleven months, two recurring in the lungs, one in the liver; the fourth, location of recurrence not stated.

Two survived nine months, one dying from general metastasis; second, from recurrence in the lungs.

One case recurred fatally in eight months, the stump being intact. At time of operation this case, however, suffered from lancinating pains in the chest.

One recurred in the abdominal viscera seven months after operation, the stump being intact.

Eight cases survived six months. Three recurred in the stump, three in the lungs, one in the lungs and abdomen, and one probably in the brain, as the patient died from apoplexy as was reported.

In addition to the foregoing, one case is reported as having perished several months from recurrence, location not given, died in a few months, the disease having been left in the stump at time of operation.

Another recurred "very early" in the lungs, while another died in a few months, the disease having been left in the stump at time of operation.

The following summary gives the location of the recurring neoplasm: Lung, 23; lung and brain, 1; lung and pleura, 1; lung and abdomen, 1; pleura, 2; abdominal viscera, 3; liver, 1; abdomen and chest, 1; stump, 10; stump and mesenteric glands, 1; stump and general metastasis, 1; stump and iliac fossa, 1; lymphatic, just above Poupart's ligament, 1; sacro-iliac synchondrosis, 1; location not given, 4; apoplexy, 1. Total, 53.

In concluding these statistics, deplorable enough, yet not so unfavorable as those submitted by others who have made a study of sarcoma of the long bones, I desire to add the following cases from my personal experience.

On the 20th of May, 1884, W. P., thirty-three years of age, came under my care with the following history: About six months before this date he had been struck with the butt-end of a billiard-cue upon the abdominal wall, a little to the right of the median line and half-way between the pubes and the umbilicus. The contusion caused him no special concern, and after two or three weeks of slight soreness and ecchymosis disappeared. At the end of two months, a small induration showed itself over the original point of injury. This gradually increased in size, was

not painful, and when I saw him on the date above given there was a hard sessile mass extending from the level of the umbilicus to just above the pubes, and spreading two inches to the left and four inches to the right of the median line. The tumor was adherent to the muscles and was not painful on pressure. The notes taken at the time say that the "patient is fairly well nourished, appetite is poor, bowels regular, tongue slightly coated." He states that "during the last two months he has lost flesh and strength." He had a specific urethritis fifteen years ago which left no complications, and five years later had three small chancroidal ulcers of the prepuce which healed under local treatment, and were followed by no secondary symptoms.

On the 21st of May, under ether, I made an exploratory incision and removed a considerable piece of the neoplasm for microscopical study, the section extending as deep as the centre of the tumor, which bled slightly, the hæmorrhage being readily controlled by packing. Examination of the section by Dr. William H. Welch, now of Johns Hopkins University, Dr. William L. Wardwell, a former pupil of Cohnheim's laboratory, and myself showed it to be a sarcoma. Having about this time noticed in the *Centralblatt für Chirurgie* a report of three cases of sarcoma which were claimed to have been cured by the repeated injection into the mass of arsenous acid, I obtained the consent of the patient to try this treatment after convincing him that his condition was hopeless without it. With the ordinary hypodermic syringe I injected into the tumor around its circumference two or three drops of Fowler's solution in one spot, and then going about an inch farther repeated the process two or three times. These injections produced very considerable pain, but were continued daily or every other day for two weeks, when, by reason of the inflammation they had already caused and the increasing pain, the patient begged me to desist, stating that he would prefer death to the suffering which the treatment entailed. By this time the tumor where the earlier injections had been made was swollen, exceedingly painful, œdematous, and red, although the redness did not have the bright or polish-like character of a true erysipelas. He was by this time running temperatures varying from 100° to 103° F. with all the concomitant symptoms of pyogenic sepsis. The injections were discontinued, warm local applications were made in order to produce suppuration and allay the inflammatory symptoms which the

injections had induced, and on June 17, at his request, he was discharged and permitted to go to his home in the South. His condition was so bad at this time that I scarcely hoped that he would survive much more than the trip home, and deeming him so utterly hopeless I did not think it necessary to make inquiry by letter when he may have died. I had no doubt, however, that he was dead. Imagine my surprise when, two years later, the physician who had sent him to me originally called upon me in New York and informed me the patient was living and in perfect health; that the sarcoma had disappeared, and there was nothing now to show for it except the scar in the integument caused by my exploratory incision. He has never had any recurrence of the growth, and was living a year ago in perfect physical condition and weighing 170 pounds, which was at least forty pounds more than he weighed when he was under my care in 1884.

I believe that this patient was cured by the streptococcus infection, local and general, which the injection of arsenous acid and the consequent bacterial invasion produced.

About this time there occurred another case in the experience of a distinguished colleague, Dr. A. G. Gerster, of New York, in Mt. Sinai Hospital, where we were then on duty. It was that of a young woman of twenty-two years of age who had a spindle-cell sarcoma of the thigh, for which an amputation was made. The disease recurred in the stump, and the patient was again admitted to the hospital, but after examination, it being very properly pronounced inoperable, she was discharged, and was to have left the hospital in a day or two. Symptoms of erysipelas meanwhile developed in the stump, and she was immediately removed to the isolation ward, where the inflammation rapidly spreading over the skin of the abdomen deeply infected the sarcomatous mass, which broke down and underwent extensive sloughing. No treatment was undertaken except to nourish the patient. She gradually recovered, all symptoms of the sarcoma disappeared. She is to-day in perfect health, sixteen years after the attack.

In August, 1893, Mr. J. P., thirty-five years of age, came into my private hospital suffering from a large tumor situated between the normal location of the gall-bladder and the middle line of the abdomen and extending from the edge of the liver as far as the umbilicus, pushing the abdominal wall forward and making an elevation of several inches above the ordinary level. This patient

was very pale, greatly emaciated, and so feeble that he could not walk without assistance. He had been tapped for dropsy on three or four occasions before he came to me, and on the day after he arrived in New York I removed by measurement five gallons of fluid from the peritoneal cavity by tapping between the umbilicus and the pubes. When the abdominal wall collapsed after evacuating this fluid, I could make out a hard, round, slightly movable tumor which was globe-shaped, with a transverse and antero-posterior diameter of about six inches, and probably eight inches in the longest measurement. In view of the hopelessness of his condition, I advised him to permit me as a last resort to explore by incision this tumor, and if I could not remove it with safety, to induce a pyogenic infection of the anterior surface of the mass. On the following day, August 23, 1893, this operation was done. I exposed the tumor by an incision five or six inches in length. It was quite firm to the touch and seemed to be developed from the gastrohepatic omentum, extending from the under surface of the liver immediately over the portal vein downward and to the left in the direction of the umbilicus. It had a net-work of large vessels on its anterior surface, none of which were divided in the exploratory operation. I did not undertake to do anything at this time except to pack the wound with non-sterile gauze. Infection and suppuration rapidly supervened, and within two weeks' time there was a very marked amelioration of the symptoms. The dropsy returned very slowly. He was tapped only on one other occasion, about six weeks after the operation, and about a gallon and a half of fluid were removed. The wound was kept open and suppurating for about two months, at the end of which time, as well as we could estimate, the tumor was about one-half of the original size.

Four years later he returned to me, having suffered severe hæmorrhages from the lower bowel, which I discovered were due to hæmorrhoids, and which I removed by operation. It is now four years since this last operation and eight years since the first infection of this neoplasm. The remnant of this tumor can still be felt, but it gives him no annoyance. He is an active man, being at this time mayor of the city of Augusta, Georgia, and president of a large corporation doing a business which requires the greatest activity. I saw him within the last four months, and he was seemingly in the best possible physical condition.

In the same month, when the preceding patient was under my care, Mr. J. L. consulted me in regard to a painful trouble of the right upper jaw which he said had been pronounced an abscess, for the relief of which two or three of the upper jaw teeth of that side had been extracted, and an opening made into the antrum of Highmore, through which a small quantity of pus was discharging. Thinking that the diagnosis was correct, I enlarged the drainage opening, and advised that a plug of chewing gum be inserted into the hole when he was eating, so that foreign substances would not be driven into the antrum in the act of mastication. He did not improve as result of free drainage, and returned to me in January, 1894. I became suspicious, then, of malignant disease, and advised an exploration to determine this, to which he submitted. I removed enough of the upper alveolus to permit an exploration of the antrum maxillare, from which I curetted a suspicious-looking material, which being bathed in pus did not present the ordinary macroscopical appearance of sarcoma or carcinoma. I submitted this specimen with the history of the case to Professor J. Mitchell Prudden, of the pathological laboratory of the College of Physicians and Surgeons, New York, who reported that it was without doubt a sarcoma. I acquainted the patient with the result of the consultation, and advised a complete removal of the upper jaw, to which he immediately consented. The ordinary incision was made, the integument and the muscles lifted carefully, and all of the upper jaw removed, together with a portion of the soft palate, which I feared was involved. The incision in the roof of the mouth extended well over to the left side, and a portion of the vomer was taken away with the rest of the upper jaw of the right side. As the growth seemed to be attached more particularly to the roof of the antrum, especially to that portion forming the floor of the orbital cavity, I determined to remove this; and, in order to support the globe of the eye in its natural position, with a very delicate sharp chisel I cut away the floor of the orbit from the narrow margins of the orbital cavity formed by the maxilla, leaving a rim of bone not unlike the rim of a pair of spectacles, but removing the floor of the orbit behind this rim well back to the posterior limit of the antrum. The operation was the most extensive one of its character I have ever undertaken, but the patient recovered without any interesting complications.

The operation took place on the 1st of February, 1894, and on the 1st of March I began to induce in him a general streptococcus infection. I employed at first Coley's mixture of the bacillus prodigiosus and the streptococcus of Fehleisen, and produced with this the usual febrile reaction. About this time a case of erysipelas came under the care of one of my assistants, and I determined to use the serum from this patient in the hope of inducing a general infection which would destroy any sarcoma cells which might have been left in the operative field or which might have been already transported to other parts by the veins or lymphatics. The serum from the blebs of the erysipelatos patient, three or four drops at a time, was thrown under the skin of the abdomen, but produced no pyogenic or streptococcus infection that was noticeable. The character of this man, his patient courage, and the fact that he desired to try every possible means to effect a cure without regard to any personal risk to himself, determined me to the extreme measure of inducing, if possible, a pronounced erysipelatos infection. With this end in view I secured from Dr. Buxton, of the Loomis Laboratory in New York, a very virulent quality of the streptococcus of Fehleisen which had been increased in intensity by being passed several times through the rabbit, and these I employed until at last from an injection into the thigh just above the knee I produced an erysipelas-like inflammation of the skin which, travelling in both directions, but chiefly upward, spread on to the abdomen as high as half-way from the umbilicus to the xiphoid appendix, chiefly upon the left side, it being the left thigh which furnished the point of inoculation. Through the whole months of March and April he bore this heroic treatment manfully, and, although considerably the worse for wear when it was over, he left for his home to await the results. They are such that to this date he is entirely well, is a busy and successful lawyer in active practice, and has had constructed an artificial jaw with a movable palate, and converses so well that one unacquainted with him before the operation could not detect any unnatural intonation of voice or impediment of speech.

In October, 1895, three or four days after a preliminary ligation of the left subclavian artery in its third surgical division under cocaine anæsthesia, which was done to arrest hæmorrhage from a large osteosarcoma of the upper end of the humerus of that side, under a general narcosis of ether I amputated the left

upper extremity at the shoulder-joint, taking away the soft parts so thoroughly that there was no material to furnish the covering for the stump, which, after the hæmorrhage was arrested by ligatures and compression, was left open for subsequent pyogenic infection. This healed slowly by granulation with extensive supuration, and two months after the operation I began to inject pure laboratory cultures of Fehleisen's coccus, producing well marked symptoms of streptococcus infection. I noticed in this case, as in the one I have just reported, that it was exceedingly difficult to induce an infection with Fehleisen's coccus until a week or two after a continuous injection of Coley's mixture, which seemed to break down the resistance of the tissues and permit the invading organisms of Fehleisen's coccus to take hold and produce their characteristic infection. Within the first six months of this amputation I infected the patient twice in this manner, and advised him to come for a few injections at least twice a year for the next two or three years. He came to my clinic to exhibit himself several times after this. On two occasions he was injected two or three times with the erysipelatous mixture. I did not see him, however, after 1898 until within about six months ago, when he returned, very much concerned about a swelling which was beginning to show itself just below the acromion process of the scapula in the scar which had covered over the wound of amputation. His condition, due, I believe, in a measure to alcoholic dissipation as well as to the recurrence of the disease in the stump, was bad. Being convinced that the sarcoma had returned, I advised him to submit to a thorough removal of the clavicle and scapula and the soft parts connected with them. He was placed in ether narcosis and an incision commenced a sufficient distance from the margin of induration. Fortunately, this incision was very slight, not more than four inches long and one-half inch deep, for the hæmorrhage was very profuse. There were no blood-vessels of any size, not even a spurt, and yet the wound bled so freely it was all I could do to control it by crowding in gauze, applying forcible compression. I waited from fifteen to twenty minutes to see if it would cease, but when the compression was removed it bled seemingly as profusely as ever. I saw then that I could not complete the operation, and abandoned it, packing the wound and permitting it again to become infected with pus organisms. I also had him return to my clinic, and introduced into the mass on three

occasions from three to as high as ten drops at one time of Coley's mixture. I used on one other occasion the pure streptococcus, two minims. This induced very marked reactions each time, and were followed by improvement in the condition of the tumor and in the patient's general condition. He is still up and about attending to his business, but has kept away from the surgeon for the last three or four months. The prognosis in this man's case is, of course, unfavorable, and I do not think he will survive more than a year.

I sincerely believe, since this is the only case in which I have ever done this amputation for sarcoma in which the patient survived longer than a year, that this man's life was prolonged by the streptococcus infection; and, finally, the only one of my five hip-joint amputations for sarcoma which survived over a year, and which still survives, three years after the operation, was permitted to become thoroughly infected with pyogenic organisms by leaving a large portion of the wound open and packing it with loose gauze.

That streptococcus toxæmia, either erysipelatous or pyogenic, has an inhibitory influence upon sarcomata I have no doubt; and since, almost without exception, in cases not subjected to this infection, recurrence is the rule, I am of the opinion it should be practised whether or not the case is operable; and when an extirpation or complete removal of the part involved by amputation has been made, infection should be induced, and repeated at intervals not longer than six months for at least six years after the operation.

## DISCUSSION.

DR. W. W. KEEN said that the first thing that strikes one in connection with the subject of the paper was the great mortality, an experience which is not limited entirely to Dr. Wyeth or the cases he has collected in his paper. He had personally had four cases of sarcoma in the upper extremity and in the lower extremity two, one of which Dr. Wyeth had referred to. They were all operated on and all died. In three of those in the upper extremity, he removed not only the entire arm, but also the clavicle and scapula with it. The fourth was a very noticeable case,



because of the rapidity of its growth. She was in Dr. Weir Mitchell's clinic at the Orthopædic Hospital, and suffered great pain at the upper end of the humerus, without any indication of any tumor whatever at first. But in the course of a short time a very small, ring-like tumor developed around the surgical neck of the humerus, which Dr. Keen diagnosticated as an osteosarcoma of endosteal origin, and advised amputation at the shoulder-joint. A delay of four or five days ensued, and in this short interval the tumor had perceptibly increased in size. The amputation at the shoulder-joint was done. She got along very well for a short time; then a universal sarcomatosis set in. When she died, there were over 100 tumors on the surface.

Of the two cases in the lower extremity to which Dr. Wyeth had referred, one was in the fifth month of pregnancy. She recovered after an operation at the hip-joint by Wyeth's method. She went to Texas, was successfully confined there, and returned to Brazil to her missionary work. Three and a half years afterwards she died from an internal recurrence; of the precise nature of it the speaker was not aware. The other was a case which Dr. Chalmers Da Costa had published. The patient came to Dr. Keen at the Jefferson Clinic, and Dr. Da Costa was asked to operate on in the clinic, as his was the next succeeding clinic and speed was necessary. In this case recurrence was noted almost immediately. It was especially interesting because the tumor was so high up that it invaded the groin, and it was not possible to apply the method of Wyeth. Accordingly, the abdomen was opened by Dr. Hearn. He compressed the right iliac through the abdomen, while the hip was disarticulated. She made a recovery from the operation, but died soon after from a speedy recurrence, so speedy that it might be called a continuation of the disease rather than a recurrence.

This certainly is a very mournful list. The question occurs, in view of these facts, is it desirable to operate on these patients or not? Distinctly, we should operate on them. Only 10 per cent., or thereabouts, die, as is shown by Dr. Wyeth's table, as the result of operation. A large number have certainly a prolonged life by reason of the amputation, the recurrence taking place at varying intervals, from a few months up to one, two, three, five years, and life is undoubtedly prolonged from what it would have been had no operation been performed. But more than that, not only is life

prolonged but death is made a very much more comfortable process, if one may so speak of it; the recurrence almost always being in the internal organs, and therefore the foul discharges and very painful ulcers of the surface are avoided.

Dr. Keen was of opinion that no operation in continuity, as a rule, is allowable in these cases. If the reports of this large number of cases in which amputation at the hip-joint and at the shoulder-joint have been done are correct, and yet recurrence has taken place, it is perfectly clear that any amputation in continuity, even supposing the tumor to be in the lower end of the femur, is inadmissible. Amputation should be unhesitatingly at the hip-joint and not below the trochanters, as one is tempted to do. Thoroughness is the only possible way in which cure can be obtained. There are unquestionably a few cases which are cured for a number of years, and possibly, so far as we can judge, permanently cured. A case that is cured for even one, two, or three years is rescued from an early grave, and, therefore, though the result as to cure is small in percentage, yet only by radical operation is even that small percentage possible.

Dr. Wyeth's suggestion of a deliberate erysipelas infection is a very good one. The only question that would arise is whether it ought to be a primary infection at the time of operation, when the fatality would be very considerable; or whether it would not be better that the surgeon should strive for an aseptic operation for immediate cure, and then, as has been narrated in some of the cases, a deliberate secondary infection even with the erysipelas streptococcus itself. The results shown in Dr. Wyeth's personal cases have been such as to lead to the hope that this is a possibility; and although the percentages that Dr. Coley has reported to us are not large, yet they are encouraging.

Dr. Keen said that recently a child of six years, with a very extensive sarcoma of the soft parts of the right thigh, had been brought to his clinic. The child had already been operated at the Polyclinic by the younger Morton, but recurrence had followed. Dr. Keen was very much disinclined to operate because the child was in a wretched general condition, but the point that decided him positively against it was the one that he desired to emphasize.

About six years ago, Dr. Chalmers Da Costa published a paper, of greater importance than the profession have thus far

recognized, on the effect of ether as an anæsthetic on the hæmoglobin. He showed by a number of cases that the administration of ether, no matter for what purpose,—even without operation, and therefore when the loss of blood could not have influenced the loss of hæmoglobin,—diminished the amount of hæmoglobin very perceptibly. Mikulicz also has called attention to this, and recently in the *ANNALS OF SURGERY* an admirable paper by Hamilton Fish was published, in which he has borne testimony to the same effect. Mikulicz has stated that if the hæmoglobin is below 30 per cent., and ether is administered, the patient is in great danger, as the administration of ether diminishes the hæmoglobin by 10 to 20 per cent., which will make it impossible for oxygenation to go on, and therefore will invite death. In the case of this child, when he investigated the hæmoglobin, he found it was down to 45 per cent., and he rejected operation at once. He thought the rule that is proposed by Fish and by Da Costa, that we are not to operate on any case in which the hæmoglobin is below 50 per cent., is correct, and that where the hæmoglobin is below 30 per cent. we are very apt to have death on the table.

DR. WILLIAM B. COLEY said that the first patient whom he had subjected to amputation at the hip-joint was a girl, aged eleven years, with a large, acute, traumatic, spindle-celled, periosteal sarcoma of the femur. The operation was performed at the New York Post-Graduate Hospital on July 25, 1897. The patient made an excellent recovery, the wound healing by first intention. The later history of this case he had been unable to trace.

His second case was also a periosteal sarcoma of the femur, occurring in a boy aged six years. The tumor was of exceedingly rapid growth, and, although when first seen by himself in May, 1898, amputation at the hip-joint was strongly advised, the parents did not consent to an operation until the following September, and then only after a portion of the tumor had been removed by the family physician and the diagnosis of sarcoma was confirmed by microscopic examination. The tumor at that time extended over nearly the entire length of the femur. The child was considerably emaciated, and it was very doubtful whether he would survive the operation. He performed amputation on September 9, 1898, the operation being completed in thirty-three minutes. Not more than a drachm of blood was lost, and there was practi-

cally no shock following the operation. About two months later the disease recurred in the abdomen and lungs, and caused death about six months after operation.

His third case was a girl, thirteen years of age, with a chondrosarcoma of the femur. The tumor was first noticed in January, 1898, and was comparatively small when he operated on June 2, 1898. There was practically no blood lost, and the patient made an excellent recovery. The small size of the tumor, together with the fact that the growth was a chondrosarcoma, made up largely of cartilage, further, the fact that the operation was performed within six months from the discovery of the tumor, all seemed to make the prognosis extremely hopeful. The patient, however, after remaining well for about a year, began to slowly emaciate, and died one and a half years after operation from generalization of the disease.

His fourth patient was a man, aged forty-nine years, with a recurrent, spindle-celled sarcoma of the left thigh, originating in the fascia. The growth extended nearly to Scarpa's triangle, and operation was much more difficult than in the preceding case. Amputation was performed on the 15th of October, 1898. The patient made an uninterrupted recovery, but after remaining well for one and a half years, local recurrence set in, which, he believes, proved fatal the following year.

His fifth patient was a young lady, twenty-four years of age, with recurrent, spindle-celled sarcoma of the fascia and muscles of the thigh. The erysipelas toxins were tried prior to amputation, with the result that the growth apparently disappeared and the patient left the hospital. After a few months local recurrence followed, and he performed amputation at the hip-joint. In this case there was some sloughing of the flap, which caused some delay in the wound healing. The patient has remained in perfect health up to the present time. Examination made a few days ago showed no evidence of local or general recurrence.

His last patient was a blacksmith, forty-five years old, with acute traumatic periosteal sarcoma of the femur, following the kick of a horse in January, 1900. A tumor developed at the site of the fracture almost immediately after union, and continued to increase in size up to August 10, 1900, the time of his first observation. The diagnosis of sarcoma being at that time unmistakable, immediate amputation was advised, without preliminary explora-

tory incision. The operation was performed on August 19, 1900, and, although the patient's general condition was far from good,—he was suffering from valvular disease of the heart,—he nevertheless made an excellent recovery. After returning to his home, Dr. Coley advised long-continued treatment with the mixed toxins, which treatment is now being carried out by his family physician, who states that the patient has remained in good health up to the present time, there being no signs of return. While the operation in this case was practically bloodless, he omitted the precaution he had observed in all the other cases, namely, of slowly releasing the rubber tubing after all the vessels that were visible had been tied, and there was some loss of blood from a vessel that had retracted underneath a muscle in the region of the acetabulum.

Dr. Coley believes that Dr. Wyeth, in his earlier paper, advocated closing the wound and applying the dressing before releasing the rubber tubing. If this procedure had been followed in his own cases, he was certain that in at least two death would have resulted from hæmorrhage. It is better that the tube should always be released slowly, and every vessel should be clamped and tied before closing the wound, relying in no way upon pressure. The shock after operation was in no case very marked, and the condition of the patient never called for infusion.

The striking decrease in the mortality of hip-joint amputation has been largely due to better means of controlling hæmorrhage; and of all the methods that have been devised up to the present time, he believes that Dr. Wyeth's, for simplicity and effectiveness, is by far the best. Butlin's statistics show that of forty-seven cases of sarcoma of the femur in which amputation of the hip-joint was performed, 25 per cent. died of the operation; although it is only fair to state that his later collection of cases, twenty-four in number, shows a mortality of but 12 per cent. against 25 per cent. in the earlier series.

Dr. Coley strongly protested against the custom of many good surgeons of exploring a sarcoma of the femur and removing a portion for microscopical examination. He was convinced that this procedure, especially in a tumor of high vascularity, is fraught with grave peril to the patient by reason of the chance of some of the infectious agent, be it a micro-organism or an infected cell, being carried to other parts of the body. He had observed very

rapid generalization of the disease follow such exploration, and he had given it up. In case of doubt—and in early cases there may be doubt—the best plan is to prepare the patient for an operation, and, after the tourniquet has been applied, the tumor can be cut into, and the gross appearance will rarely, if ever, leave the diagnosis still in doubt; a frozen section could be made if need be.

In addition to the six cases of sarcoma of the femur or thigh treated by amputation at the hip-joint, he had had three other cases of sarcoma in which he performed amputation of the thigh just below the trochanter, all by Wyeth's method. In two of these the disease was a periosteal sarcoma of the femur, and the third a mixed cell sarcoma, originating in the soft parts. One of the patients, with a periosteal growth, died four months after operation, from metastases in the lungs. The second is now well one and a half years after operation, though another operation will remove the remaining portion of the femur, has just been performed by Dr. I. D. Bloom, presumably for recurrence. The third (soft parts) recurred in the glands of the groin, and died four months after operation.

In the case of periosteal sarcoma that died four months after operation, no toxins were used. In the second case, alive and well one and a half years after operation, and just operated upon, the toxins were used both prior to and for a considerable period after amputation as a prophylactic. In the third, with sarcoma of the soft parts, the toxins were used prior to amputation for a local recurrence with little apparent effect.

While he had had no deaths from operation in any of these nine cases of sarcoma of the femur and thigh, the final results, especially in those in which the toxins were not used after amputation, are exceedingly discouraging, and go far towards confirming the opinion of Butlin as to the hopelessness of sarcoma of the femur, even when treated with the most radical measure. Of Butlin's collection of sixty-eight cases of sarcoma of the femur treated by hip-joint or high amputation, only one was known to have remained well beyond three years.

One patient whom he saw in consultation some four years ago, a girl of thirteen, with periosteal sarcoma of the femur, and in which he advised amputation at the hip-joint, was operated upon by Dr. J. D. Rushmore, of Brooklyn, and has remained well

over three years. The only other successful cases that he knew of are, first, the patient operated upon by Dr. Geo. F. Shrady, eighteen years ago, by high amputation. The patient is still in good health. Dr. Shrady is unable to state whether the sarcoma was of central or periosteal origin; but the diagnosis was confirmed by microscopical examination, and there is no question as to the nature of the disease; and, second, the case reported by Reinhard. Even adding these three successful cases to Butlin's and those which Dr. Wyeth has been able to collect, it is clear that, in sarcoma of the femur, especially if of periosteal origin, we have to deal with a disease of the most malignant type known, and one which, in the majority of cases, has proven beyond the power of surgical resources to combat.

As to what may be expected from the toxins in these cases, while thus far there have been no cases of sarcoma of the femur cured by the toxins alone, there have been five cases of sarcoma in other long bones successfully treated,—three of the tibia, one of the fibula, and one of the radius. Only one of these cases was treated by Dr. Coley. This was a spindle-celled sarcoma of the tibia. The tumor was recurrent, and the diagnosis had been confirmed by Dr. John Caven, Professor of Pathology at the University of Toronto. The patient is well and in perfect health at the present time, two and one-half years after treatment.

He was of opinion that, instead of adopting the plan advocated by Dr. Wyeth, of using the toxins immediately after operation, before the wound has healed, the better way would be to strive for aseptic wound healing, and then, as soon as the patient had fully recovered from the operation, for example, three to four weeks later, give systematic injections of the mixed toxins for a considerable period of time, say one to two years, with occasional intervals of rest. In such a case he should advise much smaller doses than in cases in which a tumor actually exists, aiming to get only a slight reaction. Such treatment could be easily carried out by the family physician, and it would not confine the patient to bed.

The evidence in proof of the value of the toxins in preventing the recurrence of sarcoma, and even carcinoma, is slowly but surely increasing. The following are a few of the most striking examples:

Recurrent spindle-celled sarcoma of the leg and popliteal re-

gion (three times recurrent) disappeared under the prolonged use of the toxins; then recurred. Amputation at the middle of the thigh was performed, but the disease quickly recurred in the gluteal region and was entirely inoperable. Further treatment with the toxins caused a decrease in the size of the tumor, so that it was possible to remove most of it by operation. The patient was kept steadily upon the toxin treatment for more than a year afterwards; she has remained perfectly well up to the present time, four years afterwards.

Another most convincing case is that of a physician with an eight times recurrent sarcoma of the soft parts of the chest wall. The growths were recurring very rapidly and increasing in malignancy. He received injections of the toxins for nearly three and a half years, and is now in perfect health, without any signs of recurrence, nearly seven years from the beginning and four years from the cessation of the treatment.

He could cite other similar examples did time permit, but these will suffice to prove that the toxins, when persistently used, furnish us a valuable means of prophylaxis against recurrence.

Williams's collection of cases of sarcoma showed 29 per cent. of sarcoma of the bones and a considerable number of sarcoma of the femur. Of 320 cases of sarcoma he had personally observed, 25 per cent. were sarcoma of the bones, of which fourteen were sarcoma of the femur. Dr. Coley endorsed strongly the position taken by Dr. Keen, that, in spite of the very discouraging statistics, operation should be advocated. The first case of sarcoma of the femur he observed after leaving hospital was in a patient who refused operation, and whom he followed until she died. The death was infinitely distressing. The profuse discharges, the inflammation, and the foul sloughing that occurred, made the death from that recurrence following an operation infinitely preferable.

As to treatment with toxins. At the same time that he performed many of these operations for sarcoma of the femur, he had not made it the practice of using toxins as a prophylactic measure after amputation. During the last year or more he had been advocating the toxin after all operations for sarcoma, not at the time of wound healing. He thought the position taken by Dr. Keen to be the better one, that of getting the patient over the operation in the way of aseptic wound healing. But after the

wound healing has taken place, he would adopt the suggestion advocated by Dr. Wyeth, or a course that is preferable, viz., putting the patient upon a continued systematic treatment with the mixed toxins for at least one or two years after operation. The treatment should be given for one or two months at a time, giving the milder doses, not causing the high temperatures, but getting a mild reaction, and not in any way preventing the patient from attending to his or her duties.

As bearing upon the value of such treatment, he cited a few cases in which the toxins had been used as prophylactic treatment. One was an especially interesting case, being a sarcoma which started in the bones of the foot; operated upon originally by Dr. Bull, and later by himself in 1894. The foot was first removed by Dr. Bull, and afterwards he also removed a tumor—size of a child's head—in the popliteal space and thigh. The tumor recurred locally, and after having disappeared with the toxins, recurred a year and a half later in the stump; a high amputation just below the trochanter was done, and about a year later the disease recurred in the gluteal region, a place where it could be no longer removed. Then the patient was put on systematic treatment with toxins for about a year by himself, and later the treatment was carried on by Dr. Risk, of Summit, New Jersey. He had a recent letter from her stating that she was still in perfect health, more than four years after she was treated by himself and two years after all treatment had been left off. In another case, of a spindle-cell sarcoma of the soft parts of the chest occurring in a well-known surgeon not far from New York, he had eight operations for this disease, and the recurrences were taking place at shorter and shorter intervals, and, from any other stand-point than the toxin treatment, the patient seemed absolutely hopeless. The growths were changing in character from fibrous spindle-celled until they had become almost entirely round-celled and very vascular, and the round cells predominated. Toxins were given to this patient for a space of nearly four years at small intervals, part of the time by Dr. Coley and part of the time by the surgeon's assistant, in such small doses that he was able to continue his work all the time. He has had no treatment for nearly four years. He weighs 190 pounds and is still in perfect health. He could mention other similar cases did time permit.

Dr. Coley did not claim that the toxins will cure all cases,

or even most cases, but that a sufficient number have been cured to make it worth while to give these hopeless patients the benefit of the only chances of life. As to final results, he stated that in the older cases, prior to 1898, fifteen remained well from three to eight years. All of these cases were hopeless and inoperable, and in all but two the diagnoses were proved by microscopical examination in the hands of competent microscopists. The other two cases in which the examination was not made were cases in which the clinical aspects of tumor with a history of repeated recurrences placed the diagnosis beyond any reasonable doubt.

These are but a few cases compared with the large number (140) treated, but of cases of spindle-cell nearly 50 per cent. have yielded to treatment. Of the successful cases treated by this method in the hands of other men, ten were round-celled; four cases of round-cell sarcoma have been treated with success, one being a round-cell sarcoma of the lip occurring in a little girl five years of age. The disease disappeared, and the child has remained in perfect health four years after treatment.

He had had one case of sarcoma of tibia, recurrent spindle celled, treated with success, and the patient is now well, nearly two and a half years. Amputation was avoided, and the leg is perfectly strong.

DR. DEEVER said that in view of the frightful mortality of this disease, why would it not be better not to close the wound, but treat it as an open wound and infect it immediately? If cure can be brought about in this way, it is justified. His experience with amputation of the shoulder-joint had been limited. He had amputated for sarcoma at the shoulder and hip-joint in two cases; both died within a year. Another case he referred to in which Dr. Keen was associated with his brother, Dr. H. C. Deaver. That case involved the whole of the upper extremity. The patient died with sarcoma within a year. He recently had seen a case, that Dr. Coley had also seen of sarcoma of the neck and of the jaw, in which there had been several operations. He had seen her recently, and believed her now to be attacked with sarcoma of the mediastinum. With osteosarcomata of the jaw his experience had been more satisfactory.

DR. BLOODGOOD said that within the last few months he had studied carefully all the cases of sarcoma of bone which had been observed in Professor Halsted's clinic from the opening of the

hospital in 1889 to the present day; the ultimate results had been encouraging. The relation between the character of the tumor and the ultimate result impresses one that there is a difference in the malignancy in the different sarcoma of bone. This seems especially true of those cases of sarcoma which are made up chiefly of giant cells. König ("Text-Book on Surgery") called attention to this many years ago, and claims to have cured a number of cases by curetting or chiselling of the tumor only. Karewski (*Berliner klinische Wochenschrift*, August, 1898) and Hinds (*British Medical Journal*, February 26, 1898) each report a case of giant-cell sarcoma situated in medullary cavity apparently cured by chiselling.

Although many authorities agree with Dr. Wyeth in performing an amputation at the highest joint for every case of sarcoma of bone, yet there are a number of authorities whose experience has taught them that, in many cases of sarcoma of the long bones, resection rather than amputation will yield equally good results. Mikulicz first advocated this in 1895 (*Archiv für klinische Chirurgie*, 1895, Band i, p. 661). Weisinger (*Deutsche medicinische Wochenschrift*, October, 1898), reporting a number of cases of resection for malignant sarcoma of the long bones, refers to Mikulicz's previous article, and agrees with his conclusions. Morton (*British Medical Journal*, July 23, 1898) and Karewski (*Berliner klinische Wochenschrift*, August 22, 1898) also report cases of resection for malignant sarcoma of the long bones. All authorities seem to argue that the chief danger in sarcoma of the bone is internal metastasis, and that local recurrence is uncommon even when the low amputation or a resection is performed. Dr. Wyeth's cases demonstrate this. The higher amputation, of course, cannot give immunity to internal metastasis; and if further experience demonstrates that the lower amputation, or, better, the resection, gives equal immunity to local recurrence, such operations, of course, give the patient more useful limbs in both upper and lower extremity. In some of Mikulicz's cases, ten centimetres of the femur or tibia were resected; bony union and a very serviceable limb resulted. In the upper extremity extensive resection, although it leaves a flail joint, yet the patients are able to use their hands to great advantage. One of Halsted's earliest cases demonstrated this. The patient was a colored woman. About seven years ago, seven centimetres of the

radius and ulna, including the wrist-joint articulation, were resected. The tumor was a pure giant-cell sarcoma, originating in the periosteum, but had infiltrated the medullary cavity of the ulna bone and some of the surrounding muscles. The patient is living and well to-day, and earns a living by ironing.

Of course, as Mikulicz wrote some years ago, the earlier we operate in sarcoma of bone the better are the chances for a complete removal of the disease by resection.

A greater number of cases, however, observed over a period of at least six years, must be collected before the question of resection rather than amputation for sarcoma of the long bones can be settled. His own limited experience in the clinical observation and pathological study forced him to agree with König and other authorities that there is a difference in the malignancy of sarcoma of bone. These less malignant tumors can be recognized at operation by the gross pathological picture, and these tumors can be cured by less extensive operation. Mikulicz's and Weisinger's position, that even the most malignant sarcoma of bone, even if the tumor has infiltrated into the surrounding muscles, can be cured by resection, is not yet confirmed; but nevertheless the experience of these two authorities and others would justify the operation of resection for the most malignant sarcoma, providing that the disease is still confined to the bone and the periosteum.

DR. DE FOREST WILLARD said that there was present a physician, Dr. McCollin, in the amputation of whose thigh he had assisted Dr. Agnew more than ten years ago. He had a medullary sarcoma of the lower end of the femur, so far advanced that the bone broke on slight force in getting out of bed. The amputation was made at the upper third of the thigh. He has been doing ten years of good, solid professional work since that time.

In sarcoma, fracture is not infrequent. In another case of amputation for sarcoma of the lower end of the femur he had the same accident occur as he picked up the limb to amputate. This person later had sarcoma in almost every organ of the body, even in the heart walls and in the endocardium. He was now treating a fracture of the femur produced by voluntary muscular action in a case of recurrent sarcoma, and had seen a number of such instances. In one case both humeri broke within three weeks from trivial causes.

In a case of amputation at the shoulder-joint which he per-

formed three years ago for small round-celled sarcoma there has been no recurrence since.

DR. McCOLLIN said that it was eleven years, the twelfth day of June, since he was operated on by Dr. Agnew. He believed that all present wanted to take off the left leg at the hip-joint except Dr. Agnew, who insisted on there being a short stump left. It had been a great comfort to him. He had been able to walk and do his work. He had not had any recurrence or pain. It healed up rapidly, and on the sixteenth day after operation he went out to see a patient.

He was exceedingly interested in the toxin treatment. It recalled to his mind a case upon which Dr. Barton operated, a young man who had a sarcoma of the abdomen. Upon making an exploratory operation, it was found impossible to remove it. The wound was closed and the young man put to bed. Great inflammation started up immediately afterwards. Six weeks after, when he got out of bed, he had no tumor, and never has had any since. That has been at least four years ago.

DR. RODMAN spoke of the only case of a successful amputation for sarcoma that he had ever known, and it was in the pre-aseptic era. He was operated in October, 1879, by the elder Gross. The wound suppurated very freely, and the man went home to Texas. Five years afterwards he was in good health.

Dr. Rodman believed that infection should be invited, and thought the same principle should be made use of in operations for tubercular glands. It is a well known fact that suppuration is more apt to cure tubercular glands permanently than excision followed by primary union. There is an antagonism between the germs of suppuration and tuberculosis, and there is far less risk to recurrence if suppuration occurs. One often sees middle-aged and old people with scars indicating scrofulous glands in childhood.

The only successful case of operation for sarcoma he had had was after excision of the lower jaw. The patient lived many years afterwards. In a second case, excision of upper jaw, eighteen months since operation have elapsed, without recurrence.

He believed that the toxins should be used in all cases after operation. He had seen betterment in many cases, but had never seen positive cure.

He had been using the toxins ever since 1893, in all of his

cases of inoperable sarcoma, but has only seen temporary betterment, unless the case now under observation should prove to be the exception to a very general rule.

DR. COLEY remarked apropos of the question as to whether the early results of operations for sarcoma were better than the recent ones, and the statement that if the theory of infection held true they ought to have been better, that a very careful reading of Gross's classical article on sarcoma, published in the *American Journal*, 1879, will convince any one that those results were better than those which had been given by Dr. Wyeth. This bears out the fact that infection occurred, and in pre-antiseptic days had better effect and gave better results. There is no way of explaining these better results except on the theory of infection. As to later recurrence, he had two cases of sarcoma of the jaw, one recurring ten years after excision of the lower jaw, and another lower-jaw sarcoma occurring five years after excision of the lower jaw.

DR. ROBERT G. LE CONTE said that there was one point that had been touched on but lightly in the discussion, namely, the degree of malignancy of the growth when compared to the age of the patient. In an experience limited to six cases of sarcoma of the extremities, he had noticed that the speed of recurrence had been directly proportional to the youth of the patient, in other words, that the most favorable forms of sarcoma are more malignant in the young than the most malignant forms are in elderly people. Dr. Coley had spoken of a chondrosarcoma of the condyle of the femur in a young girl, where, from the situation and character of the growth, he had every reason to expect a favorable result after operation, yet recurrence occurred very quickly, and death soon followed. As an antithesis to this case, Dr. Le Conte reported the history of a farmer aged forty-seven, whom he saw in March, 1898. The man had suffered severely for more than ten years with rheumatic gout, and urate of soda had been freely deposited about the finger-joints. In one finger the chalky deposit was as large as an olive, and the joints were ankylosed so that it interfered with his work. He wished to have it amputated. In examining him there was found a hard, lobulated tumor at the right femoral ring as large as an orange, which he stated had appeared about a year previously as a small nodule. The right popliteal space was also the seat of an ill-defined tumor.

The later growth he had only noticed a couple of months. The growths were evidently malignant, and amputation was advised, which was refused; but Dr. Le Conte was given permission to remove the femoral tumor at the time that he amputated the finger. The femoral tumor proved to be a mass of lymphatic glands, the seat of melanotic sarcoma. Nine months later the man returned to the hospital during the service of one of his colleagues. The popliteal growth had increased to the size of two fists, and interfered very much with locomotion. There was no local return in the femoral region, nor any evidence of metastasis to internal organs. The thigh was amputated at the middle, as he positively refused a hip removal.

Six months after the amputation recurrence occurred locally in the stump and also in the abdominal wall, and he finally died in July, 1900, from internal recurrence. He therefore lived eighteen months after the amputation, twenty-seven months after the removal of the femoral glands, and thirty-seven months from the first appearance of the femoral tumor, which was surely secondary to the popliteal growth. The contrast between these two cases is certainly very great, and it makes one feel that, in estimating the malignancy of a sarcoma, the age of the patient is of more importance than the type of cells in the tumor.

DR. WYETH said that he had learned by experience that the safety of the patient lies in the early recognition of these malignant neoplasms, and their immediate and radical removal. He approved most earnestly of the remarks of Professor Keen to the effect that they should be operated upon, no matter where the lesion may be located. It is certain death to permit a tumor to run its course.

In regard to the question of the advisability of an immediate infection of a stump after an amputation, or a secondary infection induced after all the acute inflammatory symptoms caused by the operation have subsided, he would be determined somewhat by the condition of the patient at the close of the operation. In an anæmic subject with low resistance it would be probably more dangerous and increase the mortality of the operation to infect the stump at the time of operation. Where the patient was, however, in good condition, he would prefer to infect the stump at once. Fortunately, the majority of cases of amputation at the hip for sarcoma are in excellent condition after the operation. In these

he insisted upon immediate infection, for the following reasons: First, it does not materially add to the danger of death from the operation; in the second place, these patients, when they have recovered from the immediate effects of an amputation, feel so well that it is difficult to get them to return for an infection, and the tendency to recurrence is so great that it is safest for them to run the small additional risk of the streptococcus infection than the return of the disease. It may seem dangerous, and may be construed by some to be unsurgical, but this form of cruelty may be compared to that which Hamlet expressed when he said, "I must be cruel, only to be kind."

Another important point in the consideration of sarcomata is the fact that in many instances the germs of the disease have already escaped from the tumor before the operation is undertaken and have lodged in distant viscera, where they lay dormant in these secondary deposits until the conditions are favorable to their development, and then grow rapidly, as shown in the cases reported. Streptococcus infection, if it does not cure, will without doubt weaken the germs which have undergone metastasis and retard their development.