ON
EXCISION OF THE JOINTS FOR DISEASE,
AND SPECIALLY OF THE
KNEE, HIP, AND ELBOW ;
WITH
THE HISTORIES OF TWENTY TYPICAL CASES AND
THEIR RESULTS.

BY
FREDERICK JAMES GANT, F.R.C.S.,
SURGEON TO THE ROYAL FREE HOSPITAL.

Received March 8th.—Read April 12th, 1870.

WHENEVER a limb is the seat of disease or injury, incurable except by the surgical operation of removal, to save the limb by the partial operation of excision or cutting out of the part, rather than sacrifice the whole limb by amputation, should ever be one of the principal objects of surgical practice. It is thus that joints and bones may be extirpated for disease or injury respectively, leaving the limb still a useful member, and permanently so for life.

In regard to diseased joints, the revival of the operation of excision of the knee-joint by Sir William Fergusson in 1850,

and previously that of the hip-joint by the same eminent surgeon in 1845, gave the impulse to this aspect of modern operative surgery—an impulse which was, indeed, anticipated by the revival of excision of the elbow-joint by Mr. Syme in 1830. Since these periods there has been a growing tendency in surgical practice to similar operations for the removal of such diseased parts rather than have recourse to amputation, when the conditions of disease are incurable otherwise than by operative interference. Quite recently two valuable contributions of numerous cases were brought before this Society by Mr. Henry Lee and by Professor Humphry, of Cambridge, the record of which will be found in the last volume of the 'Transactions.'

On the other hand, there are yet some well-known surgeons of repute who, whether from the force of habit in favour of an old operation or from objections grounded on experience adverse to excision, still incline to amputation.

A series of twenty consecutive cases, wherein I selected the operation of excision for disease of the knee-, hip-, and elbow-joints, may, therefore, prove interesting, partly on account of their almost unexceptionally successful results. But the primary importance of these cases will be their *typical* character, as affording illustrations of the principal *pathological conditions*, both local and constitutional, in which the same operation can be justifiably practised in other cases with the probability of success.

Having this end specially in view, I would, in the first place, submit to the consideration of the Society the conclusions to which I have been led respecting the conditions of disease and of its results which are appropriate for excision of the joints in *general*, and which, so far as they may stand the test of experience, may be regarded as principles or rules for the guidance of the surgeon in his selection of this operation. As applicable to each of the three joints—the knee, hip, and elbow—which form the subjects of this paper, the special conditions of disease which seem to be appropriate for their excision, in *particular*, will be stated in connection with each series of cases adduced.

The conditions of diseased joints, eligible whether for the operation of excision or of amputation, are those which are incurable by non-operative treatment. But in what does such incurability consist? The whole diversity of opinion and experience among surgeons in regard to the propriety of excision *versus* amputation, springs from a twofold view of the nature of the state in question. Thus scrofulous disease of the hip-joint affecting the head of the bone and the acetabulum may be considered incurable by non-operative treatment, when the disease has advanced to destruction of the articular cartilaginous surfaces without the supervention of ankylosis, so that the part has become functionally useless. Or the same disease may not be regarded as incurable until it has advanced to a further and even an extreme state of disorganisation — dislocation, partial or complete, abscess, sinuses, profuse and long-continued discharge, with the constitutional disturbance of hectic and exhaustion. Now, the turning point of distinction between these two opposite states of the same disease is this—in the one case the joint has become functionally useless, in the other to this condition is generally superadded a constitutional state of exhaustion, which leaves no period of time nor of vital reserve-power sufficient for any prolonged process of reparation after operation. Yet this measure of time and of reserve-power are the essential elements of that reparative process which will inevitably be necessary to effect osseous or ligamentous union, as the case may be, and thence a successful result after *excision*.

Accordingly, compared with *amputation*, the performance of excision under the adverse circumstances of *advanced* disease will be singularly unsuccessful. The deliberate postponement of excision until that period when constitutional exhaustion with emaciation is verging on dissolution, would be almost equivalent to operating on a corpse. By analogy I would liken it to the postponement of operation for the relief of strangulated hernia until the patient is sinking in consequence, the surgeon deliberately allowing the expenditure of the natural reserve power requisite for recovery,

without which operative interference must necessarily be a failure and the patient doomed.

As determining the propriety of excision in the *course* of joint disease I would, therefore, define *incurability* by non-operative treatment to signify ; that condition of the local disease wherein the joint has become *functionally useless* by destruction of the articular cartilages without the supervention of ankylosis, but while the constitution still retains the reserve power requisite for the long period of reparation necessary to effect union after removal of the diseased part—a period averaging three months for the knee and hip, and six weeks for the elbow.

But ankylosis might possibly take place *naturally* in some cases, and it should be well considered whether any advantages would accrue to the patient from this event as a natural cure, compared with the result of excision when successful ; for I know of no data by which to compare the relative mortality of the two modes of cure—nature *versus* excision.

What, then, are the changes which the joint and constitution undergo in the course of natural cure by ankylosis ? In the joint there is a twofold process of destruction and reparation. A piecemeal or molecular excision, so to speak, is constantly progressing, apparently by absorption and certainly by the draining away of débris of bone in the discharge until two healthy opposed surfaces are reached, so that union may at length be effected. This natural cure of joint disease entails a protracted period of recovery, extending even to many years as compared with that of weeks or months required for recovery after excision. During this ordeal the constitutional vigour is reduced, subsequently leaving the patient stamped with the aspect of suffering in former years. Occurring also as it often does during the growing period of life, the reserve power which should have been gained to meet the exigencies of after-life is used up prematurely by incessant demand in the long process of reparative ankylosis. Persons who have undergone the natural cure of diseased hip-joint, for example, may be seen hobbling about the streets, being

easily recognised by the characteristic gait of old-standing hip disease, and by their sallow and prematurely aged appearance.

This constitutional decrepitude may possibly be averted by a remarkable acceleration of the excisional part of the process. In a case represented by specimen No. 7 of the hip-joint series, an eminent surgeon differed with myself and others respecting its diagnosis; nature subsequently undertook the operation of excision *en masse*, for she severed and discharged the greater portion of the head of the femur through one of the fistulous tracks. This natural excision of a joint—the only one, I believe, on record—will be singularly suggestive to operative excisionists, and it should be equally admonitory to those surgeons who blindly oppose the operation.

The necessity for excision *after* the result of natural cure will depend on the failure of ankylosis to restore a functionally useful limb; in consequence either of an unsuitable kind of ankylosis, or an ankylosis with mal-position of the limb.

GENERAL CONDITIONS OF DISEASED JOINTS APPROPRIATE FOR EXCISION.—In accordance with the foregoing considerations, the general condition which may be here designated *functional inutility* of a joint,—whether as the result of persistent disease, or of any failure of the natural cure, comprises three conditions:

Firstly, destruction of the articular cartilages, and perhaps dislocation, without the supervention of ankylosis; and whilst the constitutional condition has not advanced to hectic and emaciation.

Secondly, ankylosis of a nature inappropriate to the use of the limb; being ligamentous where osseous union is required, as in the knee; or osseous where ligamentous connection is necessary, as in the elbow.

Thirdly, ankylosis, with mal-position of the limb. In the event of *fibrous* ankylosis, with mal-position, mechanical extension of the limb, tenotomy, or both these resources may be previously tried.

CONDITIONS OF KNEE-JOINT DISEASE APPROPRIATE FOR EXCISION, WITH NINE CASES.—The knee-joint considered in relation to the operation of excision illustrates all the foregoing rules. But there are also certain peculiar conditions pertaining to this joint, which more especially determine the propriety of this operation.

(1.) Compared with other joints, a certain *limit to the extent* of disease is essential to success. The disease must not extend in either the femur or the tibia beyond the limits requisite for the formation of sufficiently wide-based osseous surfaces to permanently support the weight of the body, and for the preservation of a sufficient length of limb to be really useful.

(2.) In *young* subjects—under the age of about ten or twelve years—it is of importance that the disease should not extend beyond the limits necessary for the preservation of the epiphysial cartilages; the integrity of these in part, at least, being requisite for maintaining the subsequent growth of the limb in length.

Cases 1 and 3 were partly narrated in the Hospital Reports of the 'Lancet' of 1860; the history of the remaining seven cases I have drawn up from clinical notes carefully taken by Mr. T. C. Murphy, Senior House Surgeon at the Royal Free Hospital.

CASE 1.—*Chronic synovitis, of traumatic origin; ulceration of the articular cartilages, and extensive caries of the ends of the femur and tibia in the knee-joint; excision. Recovery, with firm osseous union and a thoroughly useful limb in two months. Result known to be permanent after ten years.* (Plate I, fig. 1.) —Elizabeth D—, æt. 33, married, without offspring, had always enjoyed good health. September 29th, 1853, she slipped down and wrenched her right knee inwards, causing severe pain, and considerable swelling ensued. Leeches and blisters were applied from time to time without any amendment. In October, 1858, a rheumatic attack apparently affected the joint.

September 12th, 1859, admitted into the Royal Free

Hospital. The joint was considerably and uniformly swollen. Three sinuses, one being in the popliteal space, discharged a thin ichorous matter; mobility of the joint with a grating crepitus plainly declared destruction of the articular cartilages, and the leg was drawn backwards towards the buttock, rendering the limb functionally useless. The constitutional condition was that of nervous exhaustion from six years' suffering, and the patient obtained snatches of sleep occasionally only by pouring a pitcherful of cold water over the knee to extinguish the pain, as she said, with the hope of dozing off before it returned; but there was no hectic nor marked emaciation.

October 19th.—Chloroform having been administered, I excised the joint. The instruments used, and which I generally prefer, were a breast-knife and a short broad-bladed saw; or Butcher's saw may sometimes be more handy. By a curved incision, extending from one condyle of the femur to the other, and passing in its course just below the articular surface of the tibia, the joint was fairly laid open. The portions of bone removed were, the articular end of the femur immediately above the condyles and the articular surface of the tibia, a central portion of the cancellated structure of the femur also being scooped out for more than an inch in extent. The patella, although healthy, was then removed. No vessel required ligature, one or two small articular branches ceasing to bleed under pressure and exposure. The leg having been extended, the healthy surfaces of bone were seen to be adjusted to each other and in easy contact; the limb was laid in a well-padded McIntyre splint of such a length as to maintain this position. The foot-piece was screwed up perpendicularly, a direction which tends to maintain the tibial surface in apposition, and the whole limb was elevated five or six inches, which further aids the same purpose. Broad strips of adhesive plaster were drawn round the limb immediately above and below the knee, and high up on the thigh, and narrow strips around the ankle and instep. A roller bandage was applied from the foot upwards, and high up from the thigh downwards, leaving the knee uncovered. Lastly, the line of

incision was closed by points of silver-wire suture, and overlaid with strips of wet lint covered with oil silk.

The general health improved rapidly after this operation. Primary union of the wound took place, except externally, where healthy granulations sprang up.

At the end of a month the splint was removed for the purpose of cleanliness, and to see that the heel, or any other point of pressure, remained sound.

At the end of eight weeks, an unusually short period after excision of the knee-joint, the splint was finally removed. So firmly had union taken place that a bandage only was applied, the limb being slung from the shoulder, and the patient allowed to move about on crutches.

The result of this case, is permanently firm union and a symmetrically-shaped limb, there being no displacement of the femur by abduction, rotation outwards, or projection of the lower end forwards. The patient walks well, unaided by the use of a stick, and provided only with a high-heeled shoe; her carriage is so easy that the effect of excision is scarcely observable, and she can walk distances of four, six, and eight miles a day. This condition has stood the test of ten years' usage.

CASE 2.—Chronic synovitis, apparently of constitutional origin; pulpy thickening of synovial membrane; ulceration of the articular cartilages, and superficial caries of the ends of the femur and tibia; excision. Recovery, with firm osseous union and a useful limb in three months.—William A—, æt. 27, labourer, has never had any serious illness. About five years ago, swelling and trifling pain in the left knee commenced, apparently without any cause, and continued for two years. Then the knee began to stiffen, and the pain increased. Last March he underwent treatment in one of the county hospitals; the limb was placed at rest upon a splint and the joint blistered, but on leaving the hospital in June he could not put his foot to the ground, and was compelled to use crutches.

Admitted into the hospital in July, 1869. The knee was

greatly enlarged, the swelling corresponding in outline to the synovial capsule, but extending upwards anteriorly above the condyles of the femur for nearly three inches, and downwards towards the insertion of the ligamentum patellæ. This swelling had a pulpy or doughy consistence imbedding and concealing the patella and bony prominences of the joint, and projecting externally in the form of a prominent, circumscribed fluctuating tumour. The leg was drawn backwards to an angle of about 70° , the muscles of the thigh and calf were much wasted, and the limb had become quite useless. Great pain was occasioned by any attempts at extension or flexion, or by jarring the heel. Under chloroform limited motion only could be produced, and grating crepitus could be very distinctly felt in the joint. The general health remained unaffected.

July 17th.—I excised the joint by the same semi-lunar incision, removing the articular end of the femur just above the condyles, the articular surface of the tibia, and the patella. The pulpy thickened synovial membrane was also removed as much as possible. No ligatures were required. The limb was well adjusted in a McIntyre splint, and an outside interrupted splint applied.

This latter and additional security had not been used in the previous case, but I had recourse to it in the present and in subsequent cases to counteract the tendency to the threefold displacement of the femur after excision of the knee, by abduction, rotation outwards, and projection forwards of its lower end. The two first displacements give the characteristic bow-legged and twisted appearance which, in a greater or less degree, is so common in the result of knee-joint excision, and which proceeds apparently from muscular action; but the tendency to projection forwards seems to be produced by a constant sinking of the buttock in bed, whereby the lower end of the femur is tilted forwards. The side splint specially prevents or checks all three displacements.

The wound was closed with silk sutures and dressed with strips of lint soaked in carbolic lotion, one part of the

acid to forty of water, this being the first case in which I used any kind of antiseptic dressing.

In two days after the operation a slight red blush had overspread the knee, accompanied with some feverishness. This disappeared in two days more, and primary union had taken place along the line of incision except at the inner angle. All the sutures were removed, although no irritation had supervened.

In ten days the union had become firm and secure along the whole line of incision, except at the inner angle, where granulations had sprung up, leaving a small central aperture discharging.

On the seventeenth day the splints were removed, cleansed, and readjusted.

46th day.—Splints were again removed. A thick callus surrounded the ends of bone, giving to the knee an enlarged and almost globular shape. No pain on manipulation or pressure. A back splint was applied, and the limb slung, the patient began to move about on crutches.

In the course of six weeks more the union had become firmly osseous.

CASE 3.—*Scrofulous caries of the ends of the femur and the tibia in the knee-joint, of traumatic origin, partial ulceration of the articular cartilages; excision. Recovery, with union in three months. Apparent recurrence of the disease, amputation, recovery.*—John P—, æt. 18, a scrofulous-looking subject, and by occupation a coal porter. About five years and a half ago a large piece of coal fell on his right knee, and occasioned pain for some days followed by considerable swelling. In three months the hamstring muscles had become so contracted as to draw the leg backwards to nearly a right angle with the femur. He underwent treatment in five metropolitan hospitals at various intervals, making a sum total of twenty-four months or two years of treatment without operative interference.

October 19, 1859, admitted into the hospital. The joint was then uniformly swollen, a thin unhealthy purulent dis-

charge issued from two or three sinuses which led into the articulation, and the leg was much retracted. Patient much emaciated. The constitutional condition in this case, therefore, was first improved by medicine and diet.

October 31st.—I excised the joint in the manner already described. The portions of bone removed were a thin slice from the articular end of both bones; and the patella, itself sound, was also removed. No ligatures were required. The limb was put up in a McIntyre apparatus. Silk sutures and water-dressing were used to close and dress the wound.

On the eighth day after operation some secondary hæmorrhage occurred, which was arrested by the application of ice.

December 17th, or six weeks after operation, the splint was removed, and partly firm union had taken place. The splint re-applied. General health much improved.

January 2nd, 1860, or at the end of two months, the union more firm, and the limb replaced on a short posterior splint.

From this time the patient sat up in bed daily, and when the weather became warmer, he took gentle exercise with the leg suspended in a sling.

Soon after, he left the hospital for the Margate Infirmary, in order to re-establish his health.

The ultimate result of this case was apparently unsuccessful.

Ten months after excision he went into St. George's Hospital, and the limb was amputated in the thigh.

The condition, constitutional and local, for which it was deemed advisable to resort to amputation, is recorded in the Catalogue of the Pathological Museum of St. George's Hospital, under the significant heading "Repair after Excision;" and this portion of the case is also reported in the 'Path. Soc. Trans.,' vol. xii, p. 171. The former source of information states that the patient was admitted into the Hospital (St. George's), August 1st, 1860, "in a state of great emaciation and weakness, with constant pain and discharge from

numerous sinuses around the situation of the joint." On the other hand, examination of the bones after amputation showed that a considerable amount of osseous union had already taken place anteriorly, "firmly soldering the ends of bone together," and that "ossification was here progressing in various parts." It may therefore, I think, be fairly inferred that the bone continuous with the seat of this progressive reparation could not have lost its vitality, and that time only was necessary to have completely overcome any apparent tendency to carious destruction. Duly weighing the evidence on either side of the question, as to the necessity for removing the limb, I cannot accept this case as an indisputable instance of unavoidable secondary amputation after excision of the knee-joint. At the same time, I am happy to add that the amputation was followed by a "rapid recovery."

CASE 4.—*Scrofulous caries of the ends of the femur and the tibia, of traumatic origin, ulceration of the articular cartilages; excision. Recovery, with partly firm union, in three months. Formation of abscesses and sinuses around the callus, and prolonged discharge. Amputation and recovery in a month.*—Emily R—, æt. 20, unmarried. Her father and two brothers died of phthisis. Between twelve and fifteen years ago she had enlarged and painful glands in the neck. About one year ago she first noticed a slight pain occasionally in her left knee. In two or three months swelling commenced. About six months subsequently she slipped on a wet floor, and the knee struck the board violently. The pain and swelling increased, followed by retraction of the leg to a semiflexed position.

April, 1869, admitted into the hospital. The knee presented an uniform globular enlargement, measuring $15\frac{3}{8}$ inches in circumference at the widest part. This swelling was of soft consistence, but without fluctuation at any part, and of an uniformly white colour, mottled on its inner aspect with dilated veins. There was considerable tenderness on pressure over the patella, and any attempt at move-

ment caused extreme pain. The leg had become retracted nearly to the nates, and the thigh much flexed on the trunk, the knee being drawn up nearly to the chin, and appearing just under the bedclothes. Both the thigh and calf were much wasted. The lungs and other internal organs seemed healthy on physical examination. The patient's general health was much impaired, especially in regard to digestion; a capricious appetite, brownish furred tongue, and irregular bowels, being the habitual state; attacks of sickness and constipation followed by diarrhœa occurring not unfrequently. But no hectic nor any marked emaciation had supervened, for no discharge had commenced; the patient slept well and was cheerful. She had been under treatment for nine months as an out-patient at a county hospital and at a dispensary.

April 24th.—I excised the knee-joint, removing the articular end of the femur just above the condyles, and a slice from the head of the tibia; also the patella. The sections showed healthy bone, two arterial branches in the osseous surfaces spouting freely. No ligatures were required. The limb was firmly fixed in a McIntyre splint, with a long interrupted outside splint and spica bandage. The wound, closed with silk sutures, was dressed with strips of lint soaked in carbolic acid lotion.

After the operation, the principal events of importance were these:—distressing retching and sickness, arising apparently from the influence of chloroform, which continued for a week, and nearly proved fatal from exhaustion. Unrelieved by ice internally, hydrocyanic acid, creosote, or by a blister to the epigastric region, this gastric irritability subsided under the hypodermic injection of morphia, in doses of $\frac{1}{8}$ of a grain increased to a grain, while life was sustained by nutritive enemata. The wound remained inert during this week of sickness; then, on the seventh day, it began to heal by primary union partly and by granulation, along the line of incision, leaving the angles open.

The apparatus was removed and reapplied on the 21st day, 36th, 55th, 78th, and 96th day. A drainage tube introduced on

the fourth occasion was now withdrawn, as all discharge had nearly ceased. On the 96th day, or three months after the operation, partly firm union had taken place, but the patient could not raise and support the limb horizontally. A short straight back splint having been applied, she was carried down stairs into the open air daily. Her general health had much improved.

The remaining course of this case comprised the subsequent formation of abscesses and sinuses around the callus, prolonged discharge, and declining health.

December 18th, or 240th day after the operation of excision, I attempted re-excision. But the ends of the femur and tibia were found to be soft and spongy, and ununited posteriorly, where also an abscess extended some distance up the thigh. Accordingly, *amputation* was immediately resorted to in the thigh, at the juncture of its middle and upper third.

The patient recovered without an unfavorable symptom. On the 24th day she sat up, and continued to regain flesh and strength. She left the hospital for Bristol as soon as her health had become completely re-established, or at the end of ten months from the date of admission.

CASE 5.—*Scrofulous caries* of the ends of the femur and tibia, in the knee-joint; of *traumatic* origin; 12 *years' duration*, with occasional treatment; in a young woman, aged 18. *Ulceration of the articular cartilages*. *Excision*. *Secondary hæmorrhage* next day, suppressed by ice-bag. Displacement and projection of the end of the femur on the 5th day. *Re-excision* of its extremity. *Albuminous urine* supervened in a few days, with marked cachexia and prostration; and sloughing of the integument of the calf. *Amputation* in middle third of the thigh. Rapid disappearance of albumen in the urine, and restoration of strength. *Recovery* by primary union, with a perfectly sound stump in one month.

About six months afterwards, stump still sound, but the patient was affected with scrofulous conjunctivitis and opacity of the cornea; also complete deafness.

CASE 6.—*Scrofulous caries of the ends of the femur and the tibia, especially the latter, in the knee-joint of a child; of supposed traumatic origin; ulceration of the articular cartilages; excision through the epiphyses. Recovery, with firm osseous union and a useful limb in four months.*—Elizabeth A. G—, æt. 5, an apparently healthy child. About three years and a half ago, slight pain and swelling commenced in the left knee. There is no history of direct injury, but the child fell out of bed on several occasions previous to the symptoms of knee affection; and subsequently she used to expose the joint to cold air and the contact of cold substances for relief from pain. In six weeks after the first symptoms an abscess formed in the inner side of the head of the tibia; it soon broke, leaving a discharging aperture, and the leg gradually became bent backwards.

July, 1869.—Admitted into the hospital. The knee presents the characteristic globular enlargement of firm consistence, with the small discharging aperture referred to, and which led to carious bone. The leg is retracted so that only the toes touch the ground. General health good.

24th.—I excised the knee-joint, in this case making a section of the epiphysis in the condyles of the femur and in the head of the tibia, both of which were undergoing ossification. But a portion of carious bone about one inch in depth was gouged out of the inner half of the head of the tibia. No ligatures were used, the limb was carefully adjusted, and the wound dressed as in the previous cases.

Primary union took place along the line of incision, except, as usual, at the angles. The splints were removed and re-applied at the end of three weeks and five weeks. On the latter occasion union had become consolidated sufficiently to allow only slight antero-posterior motion. She could slightly raise the limb from the bed. Union subsequently became firmly osseous at the end of four months.

The three following cases illustrate excision of the knee-joint for a functionally useless limb, resulting from failures of the natural cure, whether in regard to the

kind of ankylosis or as conjoined with malposition of the limb.

CASE 7.—*Chronic synovitis* of traumatic origin, one year's duration, ten months' treatment, in a young man, H. G—, æt. 20. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous ankylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. *Useless tenotomy* of the hamstring muscles; *excision*. *Recovery*, with a thoroughly firm *osseous union* and useful limb in two months and a half. (Plate II, fig. 1.)

CASE 8.—*Scrofulous caries* of traumatic origin, fourteen years' duration, with occasional treatment, in a youth, H—, æt. 17. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous ankylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. *Useless tenotomy* of the hamstring muscles; *excision*. *Recovery*, with *osseous union* and a useful limb in two months. This patient sat up out of bed daily at the end of five weeks. (Plate II, fig. 2.)

CASE 9.—*Scrofulous caries* of traumatic origin, seven years' duration and equally prolonged treatment, latterly by *extension* of the limb, in a boy, T. W—, æt. 10. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous ankylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. *Excision through the epiphyses*. *Recovery*, with *osseous union* and a useful limb in two months and a half. (Plate I, fig. 2.)

The following facts respecting the foregoing cases of knee-joint disease and excision seem specially worthy of notice:—

(1.) *Conditions of disease*.—Caries in all cases, with destruction of the articular cartilages of both the femur and tibia. In case 1 the femur was chiefly affected, in case 6 the tibia, and in the other 7 cases both bones were about equally affected. The patella was healthy in nearly all cases.

(2.) *Commencement of the disease.*—Synovitis in 3 cases, 1, 2, and 7; scrofulous caries in the other 6 cases.

Cause.—Traumatic in 8 cases, constitutional in case 2.

(3.) *Duration of disease and of treatment previous to operation.*—Case 1, disease 6 years, treatment occasionally. Case 2, disease 5 years, 4 months' treatment. Case 3, disease $5\frac{1}{2}$ years, 2 years' treatment. Case 4, disease 1 year, 9 months' treatment. Case 5, disease 12 years, occasional treatment. Case 6, disease $3\frac{1}{2}$ years, occasional treatment. Case 7, disease 1 year, 10 months' treatment. Case 8, disease 14 years, treatment occasionally. Case 9, disease 7 years, and equally prolonged treatment.

(4.) The constitutional disorder had *not* advanced to hectic and emaciation in any of the 9 cases except in case 3. In case 1, nervous exhaustion; 2, health good; 4, health irregular, digestion impaired; 5, marked anæmia; 6, health good; 7, health good; 8, health good; 9, health delicate with constant cough.

(5.) *Age and sex.*—Age; 33, 27, 18, 20, 18, 5, 20, 17, and 10 years. Sex; five males and four females.

(6.) *Operation.*—The *incision* was semilunar downwards from condyle to condyle in all the cases. The *portions of bone* excised were the articular ends of the femur and tibia in all the cases, with additional portions of cancellated bone in cases 1 and 6. The patella was removed in all cases. The *synovial membrane* was also removed as much as possible in cases 2 and 7 of chronic synovitis. *Hæmorrhage* was considerable during the operation in all the cases, no ligatures were required, the articular vessels being secured by torsion and exposure. *Sutures*—metallic in case 1, silk in the subsequent 8 cases. *Dressings*—water dressing in cases 1 and 3, weak carbolic lotion in the other 7 cases. *Splints*—a McIntyre, or else a back splint with foot-piece in all the 9 cases, with an outside, interrupted splint in all cases except 1 and 3.

(7.) *Primary union.*—Complete, except just at angles of the incision, in cases 2, 6, 7, 8, and 9, or in 5 cases; partial in cases 1, 3, 4, and 5, or in 4 cases.

Secondary hæmorrhage in cases 3, 5, and 8; arrested by ice in the first case, by ligature in the latter 2.

(8.) *Intervals of removal of splints.*—Average period one month after operation and at similar periods subsequently, making only three or four reapplications of the retentive apparatus in each case.

(9.) *Results.*—Osseous or firm union in all the cases; except case 3, where it was incomplete, and in cases 4 and 5, which were subjected to amputation. Period of union, average three months.

(10.) *Re-excision* in case 5—a scrofulous case.

(11.) *Secondary amputation* in cases 4 and 5—both scrofulous cases; also in the questionable case 3—a scrofulous case.

(12.) *Permanent result.*—Ultimate known period—(1) 10 years, (2) 5 months, (6) 4 months, (7) 2 months, (9) 2 months.

CONDITIONS OF HIP-JOINT DISEASE APPROPRIATE FOR EXCISION, WITH SIX CASES.—Of the three conditions already defined with regard to the excision of joints in general, the first only applies to the hip-joint.

(1.) Functional inutility of the limb, depending on disease of the joint having resulted in destruction of the articular cartilages without the supervention of ankylosis, will always justify operative interference by excision. The constitutional condition will probably not then have advanced to hectic and emaciation. But the state of the general health should primarily determine the necessity for excision in all cases, and not any arbitrary consideration of the period of the disease and the condition of the joint. Whenever, therefore, the general health is manifestly failing, whatever may be the stage of hip-joint disease, excision should be resorted to without further delay. This guiding rule was strongly urged and clearly illustrated by Mr. Hancock in his recent lectures on diseases of the joints at the Royal College of Surgeons.

Nevertheless the most extreme state of exhaustion, previous to the operation of excision, may be followed by recovery

after removal of the diseased bone, as the successful results of cases 1, 2, and 4, clearly show.

(2.) Osseous ankylosis with mal-position of the limb will *not* justify the peril of attempted excision. Section of the neck of the femur is practicable, whereby the limb can be brought down to a straight position. This principle of operation was lately practised in a case by Mr. W. Adams, and I believe successfully. The following structural conditions of disease as pertaining to the hip-joint affect the propriety of its excision :

(3.) The *extent of bone* diseased may be considerable, and involve both the femur and acetabulum. In the *femur* the diseased portion may include the head, neck, great trochanter, and shaft, entering even into the medullary canal. In the *acetabulum* the diseased portion may include the whole floor of this cavity, and even extend to adjoining portions of the ilium, pubes, and ischium. Neither of these conditions of extensive osseous disease prohibits excision ; but the acetabulum not unfrequently recovers itself when the diseased head of the femur has been removed from further contact and attrition.

(4.) Dislocation is unfavorable for excision, as implying an advanced stage of the disease constitutionally. The significance of this local condition will, therefore, diminish in proportion to the absence of marked hectic and emaciation.

The clinical notes of the following cases were carefully taken, in the first two by Mr. John B. Foster, and the latter two by Mr. Marriott, then House Surgeons at the Royal Free Hospital. From these sources I have drawn up the histories as follows :—

CASE 1.—*Scrofulous caries of the femur ; the head and the articular cartilage entirely destroyed, the neck, great trochanter, and one inch of shaft involved, with one inch more of cancellated structure ; similar disease of acetabulum, and horizontal ramus of pubes ; dislocation on dorsum ilii with abscess ; disease of traumatic origin ; excision of four inches of femur, and*

one inch of cancellated structure. Recovery, with a freely movable joint and a useful limb, in three months. Result known to be permanent after two years and a half.—William M—, æt. 26, a sailor. Four years ago, on board ship, he fell from the mast, thirty feet, and pitched on his left hip. Severe pain and swelling ensued, which were relieved by cupping; but the pain became paroxysmal, sometimes being very severe, and lasting for days or weeks with interperiods of perfect ease. One year after the accident, an abscess broke over the great trochanter, and ten other sinus openings subsequently formed around the joint. Shortening of the limb commenced, apparently when the abscess broke, and it gradually became shorter. From that date the patient went into the Dover Hospital, where he remained for nearly three years.

March 28th, 1864, admitted into the Royal Free Hospital. The limb was then three inches shorter than the sound one, and much inverted, the left knee resting on the opposite thigh. Dislocation backwards on the dorsum ilii had taken place, and there was great obliquity of the pelvis. With considerable wasting of the muscles of the limb, the upper third of the thigh was much enlarged, and presented twelve openings in the neighbourhood of the joint, two of them being over the ramus of the pubes. All of them led down to diseased bone. The patient was pale and thin, had scarcely any appetite, and a bad cough. I therefore placed him under a course of tonic treatment, iron and quinine, with a nourishing diet, in order to revive, as much as possible, the power of assimilation and reparation, necessary for the long process of recovery after the operation of excision.

May 7th.—I excised the hip-joint. The principal features of the operation in this and subsequent cases were these:—A longitudinal incision on the outer side of the shaft of the femur, to the extent of three or four inches, and terminating a little above the great trochanter, was met by a slight transverse incision in that situation. The muscles attached to the latter portion of bone were severed by sinking the knife vertically in the transverse cut; the crural nerve and artery anteriorly, and the sciatic nerve and gluteal artery

posteriorly, being necessarily avoided by the limited extent of this incision. The finger was then passed down above the trochanter along the neck to the joint; or in the present case and others, to the head of the femur on the dorsum ilii, dislocation backwards having taken place. In any further detachment of the soft parts the knife was simply directed towards and on the bone. Adduction and eversion of the limb will readily make the head of the femur start from the acetabulum, or from its bed on the dorsum ilii. Sometimes, in making eversion the capsular ligament may have to be opened, and the round ligament just touched with the knife on the head of the femur; generally, both ligaments are destroyed, and the acetabulum has become so patulous, that the head of the bone, itself a remnant, can be readily turned outwards into position for application of the saw. The whole diseased portion, including perhaps the neck, great trochanter, and portion of the shaft, may be removed, either at once or by successive sections, until healthy bone is reached. Lastly, the acetabulum may have to be gouged, and perhaps adjoining portions of bone.

In the present case the femoral portion of bone was alone excised, but to the extent of four inches; and carious cancellated structure of the shaft was scooped out for about an inch, entering the medullary canal, and leaving a mere shell of hard bone, with, however, the periosteum and the soft parts attached. No ligatures were required. The wound was closed with silk sutures, and water-dressing applied. No splint was used, the limb being left to take the easiest position, so that the end of the femur hitched upon the dorsum ilii just above the acetabulum.

Excepting excessive sickness from the chloroform, the patient's health improved rapidly, and he recovered without an unfavorable symptom.

Healing by granulation took place, owing apparently to the length and depth of the wound necessary for the excision of so large a portion of bone.

June 4th, or about one month after operation, the granulation process had advanced to the surface.

July 27th, or seven weeks more, and about three months after the operation, the wound had nearly closed. Moving the limb occasioned no inconvenience, and the patient was allowed to get about on crutches. He had become quite fat; his jaded and cachectic appearance was converted into a ruddy complexion, with bright eyes, and a cheerful or rather boisterous manner; and he himself said that "William is a man again."

Known permanent result at the end of two years and a half; he walked without any support.

CASE 2.—*Caries of femur; its neck and great trochanter, the head involved, with circumferential destruction of the articular cartilage, and disease in the shaft to two inches in extent, with one inch more of cancellated structure; similar disease of acetabulum; dislocation on dorsum ilii with abscess; immediate cause, cold; excision of four inches and a half of femur, and the one inch of cancellated structure. Recovery, with a freely movable joint, and a useful limb, in two months and a half. Result known to be permanent after five years.*—J. R—, æt. 16, dairyman at Sutton-Bingham, Somersetshire. About one year ago, having caught a severe cold, he felt a slight pain in his hip, which gradually increased and extended down the thigh to the knee-joint. Afterwards he had an attack of rheumatic fever. An abscess formed over the hip; this was opened, it continued to discharge, and the limb began to shorten.

July 22nd, 1863, admitted into the hospital. There was then the same characteristic appearance of advanced hip-joint disease as in the last case; shortening of the limb to the extent of two inches and a half, inversion, the knee resting on the middle of the opposite thigh, and dislocation backwards on the dorsum ilii. Over and about the great trochanter were three sinus openings leading down to diseased bone, and discharging copiously day by day. The boy looked haggard, and was worn down to a shadow.

Considering the extremely unfavorable constitutional condition in this case, excision was resorted to with the view of

saving *life*, and possibly of preserving a sound if not an eventually serviceable limb.

August 16th.—Operation performed; four inches and a half of the femur were removed, and one inch of cancellated structure was scooped out from the lower end of the section in the shaft. No ligatures were required, and no splint applied at the time of operation.

Primary union of the wound ensued in this case.

After the first three days the boy's health took a favorable turn, and steadily improved.

In two weeks a long external splint was applied.

In ten weeks the limb could be moved freely in all directions without pain, the patient beginning to use it only on crutches. From being a miserable object he had become healthy and fat.

In 1868, or five years after the operation, he could walk without support.

CASE 3.—Caries of femur; its head and neck entirely destroyed; great trochanter and a small piece of the shaft involved; similar disease of acetabulum; dislocation and abscess on dorsum ilii; disease of traumatic origin; excision of one inch and three quarters of femur. Recovery, with a freely movable joint and a useful limb, in three months.—

G. C—, a male child, æt. 5. Two years ago he was run over, a wheel passing over the right hip. The course of this case, in respect to the joint and limb and their eventual appearance, were precisely the same as in the previous cases.

June 9th, 1864, admitted into the hospital. Dislocation on the dorsum ilii had taken place, and shortening of the limb to the extent of three inches. In October the abscess burst externally, and from that time matter was discharged freely from two sinuses in the upper part of the thigh, both of which led down to the joint. The child's general health had always been good.

November 12th.—I performed the operation precisely as in the previous cases, and the after-treatment was also the same. The result equally successful.

CASE 4.—*Caries of femur, its head and neck destroyed; similar disease of acetabulum; immediate cause, cold; excision of two inches of femur. Recovery, with a movable joint and useful limb, in two months.*—E. M—, a boy, æt. 8. Five years ago he took cold by sitting on stone pavement, and inflammation of his left hip-joint began. About eighteen months since an abscess broke, and discharged considerably and permanently through a fistulous opening. Other sinuses followed.

June 10th, 1864, admitted into the hospital. The thigh was turned inwards, forming an acute angle with the abdomen, with slight shortening of the limb, but no dislocation had taken place. Suppurative discharge, long continued, had induced emaciation almost to the degree of advanced phthisis; the child was haggard and spiritless, his expression and manner deliberate like that of a little old man, and he was altogether the picture of premature age.

Having due regard to this extreme state of constitutional exhaustion, I placed the patient under a restorative course of treatment, as in case 1, but in this case continued for seven weeks.

August 1st.—I excised the hip-joint as in the other cases, and with the same after-treatment. Primary union ensued, except in one spot, which gradually closed. The child rapidly regained flesh, yet he remained blanched and pain struck in appearance.

In two months the new joint and the limb were movable and useful, a crutch being used for support.

CASE 5.—Jane L—, *caries of femur, its head and neck destroyed; similar disease of acetabulum, of traumatic origin; 3 years' duration, 2½ years' treatment; in a female child æt. 5. Excision below great trochanter. Recovery, with a movable joint and useful limb, in 4 months. Result known to be permanent after 3 years.*

CASE 6.—Catherine R—, *scrofulous caries of femur, its head and neck destroyed; similar disease of acetabulum;*

dislocation and *abscess* on dorsum ilii; disease apparently of traumatic origin; 1 year and 8 months' duration and treatment; in a female child æt. 5. *Excision* below great trochanter. *Recovery*, with a movable joint and useful limb, in 3 months.

For the particulars of this case I am indebted to my colleague, Mr. John D. Hill, at that time Senior House-Surgeon in the hospital.

The following facts respecting the foregoing cases of hip-joint disease and excision seem specially worthy of notice.

(1.) *Conditions of disease*.—Caries in all cases, with destruction of the femoral articular cartilage, entirely in 1, 3, 4, 5, 6, or in five cases; circumferentially only in case 2. Extent of bone diseased was the head and neck in each case; with the great trochanter and portion of the shaft in cases 1, 2, 3; and an extra portion of cancellated structure of the shaft in cases 1 and 2; caries of the acetabulum to some extent in all cases, and of ramus of pubes in case 1; dislocation on dorsum ilii in cases 1, 2, 3, 6; or in 4 out of the 6 cases.

(2.) *Immediate cause*.—Injury in cases 1, 3, 5, 6; cold in 2, 4.

(3.) *Constitutional condition*.—Advanced hectic in cases 1, 2, 4, 6, or in 4 of the 6 cases; health good in cases 3 and 5.

(4.) *Previous duration of disease*—4 years, 1 year, 2 years, 5 years, 3 years, 1 year and 8 months. *Previous duration of treatment*.—Case 1, 3 years; case 5, 2½ years; case 6, 1 year and 8 months.

(5.) *Age and sex*.—Age; 26, 16, 5, 8, 5, 5 years. Sex; 4 males and 2 females.

(6.) *Operation*.—*Incision* T-shaped in all cases, *Portions of bone excised*: (1) Four inches of femur, and one inch of cancellated structure scooped out; (2) Four inches and a half of femur, and one inch of cancellated structure scooped out. In both these cases the medullary canal was entered; (3) One inch and three quarters of femur; (4) Two inches of femur; (5) Section just below great trochanter; (6)

Section just below great trochanter. Small portions of the acetabulum were scooped out in each case. *Hæmorrhage* inconsiderable in all the cases. No ligatures required. Silk sutures and water-dressing applied in all the cases. No *splint* was used in any of the cases, the section of the femur being left free to form a fibrous ankylosis.

(7.) Primary union ensued in all the cases, except the first, wherein the wound healed by granulation.

(8.) *Results*.—Firm fibrous ankylosis, with a movable joint and useful limb in all the cases.

(9.) Result known to be permanent in case 1, after 2½ years, in case 2, after 5 years, in case 5, after 3 years.

CONDITIONS OF ELBOW-JOINT DISEASE APPROPRIATE FOR EXCISION, WITH FIVE CASES.—The three conditions which severally determine the propriety of excision with regard to the joints in general, are applicable to the elbow-joint.

(1.) Functional inutility of the limb, depending on disease of the joint having resulted in destruction of the articular cartilages, without the supervention of ankylosis, will always justify excision; care being taken that the constitutional condition shall not, if possible, have approached to exhaustion. But the degree of reserve power requisite for recovery is much less than after excision of the knee or hip, owing to the average period of reparation being less by one half, or about six weeks instead of three months.

(2.) Osseous ankylosis, and particularly in connection with a useless position of the limb, will also justify excision.

(3.) The structural conditions of disease pertaining to the elbow-joint, which specially affect the propriety of its excision, relate to the *extent of bone* destroyed by disease. The limits of excision of the elbow-joint are not restricted by two of the three considerations respecting the knee-joint. Thus, the length of the portions of bone removed from the elbow is comparatively unimportant; the corresponding loss of length in the arm not much impairing the use of this member eventually; nor is it of consequence, therefore, to observe the epiphyseal lines as affecting the subsequent growth of the

bones. But it is equally requisite in the elbow as in the knee to preserve sufficiently wide surfaces for the formation of an adequately secure union; in the one case, with ligamentous mobility; in the other, with osseous consolidation.

The removal of only a thin superficial section of the articular ends of the bones in the elbow-joint, leaving the section ends too nearly in contact, is apt to be followed by osseous union and an unsuccessful result of the operation. On the other hand, any new bone which may not unfrequently have been produced in the form of a spiculated enlargement of the articular ends *above* their diseased portions, and thereby limiting the disease, should not be included in the excision. The importance of observing this limitation of the operation is particularly urged by Mr. Butcher in his work on 'Operative and Conservative Surgery.'

The notes of the following cases, excepting the first, were taken by Mr. T. C. Murphy, Senior House Surgeon at the Royal Free Hospital.

CASE 1.—Margaret R—, *chronic synovitis*, of traumatic origin, 1½ year's duration, 1 year and 2 months' treatment; in a woman *æt.* 25. *Partial ulceration* of the articular cartilages of the humerus, ulna and radius; with semiflexed position of the limb. *Excision.* *Recovery*, with a movable joint and useful limb, in six weeks. *Result known to be permanent after 7 years.*

For the particulars of this case I am indebted to my colleague, Mr. John D. Hill, then Senior House-Surgeon in the hospital.

CASE 2.—Thomas H. B—, *chronic synovitis* of traumatic origin, 1 year's duration and treatment, in a man *æt.* 29. *Ulceration* of the *articular cartilages* of the humerus, ulna and radius; with semiflexed position of the limb. *Excision.* *Recovery*, with a partially movable joint. Subsequent formation of abscess and sinuses. *Re-excision.* *Recovery*, with a movable joint and a limb useful, in flexion, extension,

pronation and supination. *Result known to be permanent after 1 year and 4 months.*

CASE 3.—Mary M—, *acute synovitis* of traumatic origin, one month's duration, in a woman *æt.* 28. *Partial ulceration* of the *articular cartilages* of the humerus, ulna and radius, with subjacent *caries*; a semiflexed position of the limb; *excessive* and *paroxysmal pain*. *Excision. Recovery*, with a movable joint by passive motion, in six weeks. *Result known to be permanent after 1 year.*

CASE 4.—Jane T—, *scrofulous caries* of the ends of the humerus and ulna in the elbow-joint of a very weakly woman *æt.* 31. *Ulceration* of the *articular cartilages*, with semiflexed position of the limb. *Excision. Recovery*, with a partially movable joint by passive motion, in two months. *Permanent result*, at the end of six months, uncertain.

CASE 5.—Locus P—, *caries* of the olecranon, of idiopathic origin, ten months' duration and treatment; idiopathic abscess opposite the outer condyle of the humerus, six years previously; in a man *æt.* 50.

Carious bone gouged out of the olecranon. The joint opened in this procedure. *Excision* of the olecranon and of the end of humerus, in order to form a freely movable joint by fibrous ankylosis. Wound nearly healed by primary union. Fibrous ankylosis progressing.

The following *general results* of excision and their relation to conditions of disease of the joints, as illustrated by the foregoing cases, may be noted in conclusion :

1. *Excision* proved successful by one operation, in 16 out of 20 cases of the knee, hip, and elbow-joints.

2. Of the 4 unsuccessful cases by one operation, 3 were cases of *scrofulous* disease, and of the knee-joint in a total of 9 cases; the remaining 1 being chronic synovitis, and of the elbow-joint in a total of 5 cases.

3. *Re-excision* was resorted to in 2 of the 4 cases; 1 knee-joint, and 1 elbow-joint, the latter with a successful result.

4. *Secondary amputation* in 3 of the 4 cases. All 3 were knee-joint cases, and subjects of scrofulous disease; 1 had been subjected to re-excision. The 3 amputations made *rapid recoveries*. These results tend to show that if the attempt to preserve a limb by previous excision, and even by re-excision of a large joint as the knee, should fail, the operation is not prejudicial to secondary amputation for the preservation of life.

5. *No death* ensued in any of the 20 cases of the knee, hip, or elbow-joints, whatever had been the condition of disease, subject to the principles of selection laid down; or whatever the operation; excision, re-excision, or secondary amputation.

DESCRIPTION OF PLATES I & II.

PLATE I.

(From photographs.)

Fig. 1.—Case 1. Elizabeth D—. Chronic synovitis of traumatic origin, ulceration of the articular cartilages, and caries of the ends of the femur and tibia in the knee-joint. Result known to be permanent after ten years. (See page 102.)

Fig. 2.—Case 9. T. W—, aged 10. Scrofulous caries of traumatic origin. (See page 112.)

PLATE II.

(From photographs.)

Fig. 1.—Case 7. H. G—, aged 20. Chronic synovitis; excision; firm osseous union and useful limb in two months and a half. (See page 112.)

Fig. 2.—Case 8. H—, aged 17. Scrofulous caries of traumatic origin; excision; osseous union and a useful limb at the end of five weeks. (See page 112.)

Fig. 1.

Fig. 2.

Fig. 1.

G.H. Ford

Fig. 2.

W. West imp