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Butcher, Richard G. H., 1819-1891.

Publication/Creation

Dublin : Hodges and Smith, 1855.

Persistent URL

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ON
EXCISION OF THE KNEE-JOINT.

BY

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WITH COLOURED PLATES.

From the Dublin Quarterly Journal of Medical Science, February, 1855.

DUBLIN :

HODGES AND SMITH, GRAFTON-STREET,

BOOKSELLERS TO THE UNIVERSITY.

1855.


DUBLIN :
Printed at the University Press,
BY M. H. GILL.

322404



TO THE MEMORY
OF
R. J. MACKENZIE, ESQ., F.R.C.S.E.,
WHOSE GREAT PROFESSIONAL ATTAINMENTS
AND
HEROIC SELF-DEVOTION
HAVE WON THE ADMIRATION
OF
EVERY FRIEND OF SCIENCE AND HUMANITY,

The following Pages
ARE INSCRIBED,
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THE GREAT AND THE GOOD.



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ON
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CARIES, and all those kinds of lesions comprised under the name of White Swellings, often become so serious as to be beyond any other remedy than the removal of the diseased portions; they occasion, in fact, three-fourths of the amputations which occur. Amputation of the thigh removes the whole of the limb, and obliges us to sacrifice a great extent of sound parts. The question has been asked, if it would not be possible to restrict ourselves to the removal of the tissues and the portions of bone actually diseased? The honour of originating the operation, as it is now performed, of basing it on sound surgical principles, and of showing its applicability to several of the large articulations, is unquestionably due to Mr. Henry Park, of Liverpool. The papers in which this gentleman proposes the operation evince a candid, reflecting, and enterprising mind. The circumstance of his not having had the opportunity of carrying his ideas extensively into practice, will weigh little with those who can appreciate the sound arguments by which the proposal is supported; and, as Mr. Blackburne observes, "the foresight which predicts the result of an untried measure evinces higher talent than the industry which collects together the evidences of experience." The record of the first actual performance of excision of the knee-joint is given in a letter from Mr. Park to Percival Pott, bearing date September 18, 1782; and from this account we find that the operation was performed by him in a case of scrofulous disease of the knee-joint, on the 2nd of July, 1781. In the year 1789, 5th of No-

vember, we have another case of excision of the knee-joint, as communicated in a letter to Dr. Simmons, and published in the eleventh volume of the London Medical Journal. Eight years having elapsed since his former bold operation, he reverts to it as crowned with success, and thus writes:—"To the history of the case of Hector M'Caghen, there related, I have now to add, that he afterwards made several voyages to sea, in which he was able to go aloft with considerable agility, and to pursue all the duties of a seaman; that he was twice shipwrecked, and suffered great hardships without feeling any further complaint in that limb; but was at last unfortunately drowned by the oversetting of a flat in the river Mersey." Having completed this reference, he thus describes the second case upon which he operated:—A man, aged thirty years, but who was in every way unfitted for it, both from constitutional taint and extensive implication of the soft parts. The operation was performed agreeably to the patient's choice, and with little variation from the former one. However, this case was less fortunate, and the man sank about four months after its performance. After the publication of Mr. Park's pamphlet, Mr. Filkin, of Northwich, claimed priority as having performed a similar operation twenty years before, with success. Application was made for the particulars of the case, but disappointment followed, as that gentleman was soon after seized with a paralytic affection which greatly impaired his faculties, and at last terminated in his death. His son, a practising surgeon in Northwich, soon after answered by letter, from which the following is an extract:—"You will, I fear, think me very remiss in not answering your kind favour long before; but as my father's notes do not describe the case of the operation of the knee so plainly as I could wish, I have waited till an opportunity occurred, when I could see the man, to have what he knew on the matter; and though all I can collect on the subject is very trifling, still I beg leave to send you what little information I have gained. The patient was always of a scrofulous habit, and had for many years a tumour on the knee, which gradually increased in size, and to which every topical application was used without effect. By accident falling from a horse, the patella was fractured; and from a small wound there was discharged about half a pound of fetid, foul-coloured pus. Amputation was immediately proposed, but the parents not consenting, my father was called in. Having frequently thought this method might sometimes succeed, and having performed it once on the dead body, he proposed it to the parents of the patient in this case, though it was

an unfavourable one, the patient's general health being much impaired. The parents consenting, a day was fixed for the operation, which was performed 23rd of August, 1762. The ligaments were found in a very sloughy, suppurative state, with the cartilages greatly injured, and the heads of the bones much diseased, particularly the head of the tibia. The patella, with the head of the femur and a portion of the tibia, were removed; a good digestion came on; the limb was kept in a straight position, and on the 21st of November, 1762, he was got so well as to require no further attention. The person is now living, and sometimes goes to Liverpool, where, if you will give me leave, I will desire him to call upon you." If the details of this case be correct, we have evidence of life being saved by operation, but are left in total ignorance of a point nearly as vital—the usefulness of the limb afterwards in progression.

In the year 1784 Mr. Park's observations on cutting out the articulating end of the bones of the elbow and knee-joints were translated and published in France by the celebrated Professor Lassus, whose authority, one would have thought, might have procured for them a favourable reception. They were received with astonishment; and so far were they from gaining credit, that even so late as 1789, they had acquired so small a number of partisans in the Academy of Surgery that some cases of a similar kind, which were presented to the Society by the senior Moreau, were rejected, though they were of such a nature, and stated in a way that might have deserved a more favourable reception. In September, 1792, M. Moreau excised the whole of a carious knee-joint from the son of a M. Clause, apothecary at Chalons-sur-Marne, in the presence of Baron Perey, Surgeon-General to the army of Kellerman, of M. Chameralat, his colleague, and of several other eminent surgeons, both civil and military. The operation is described as being attended with success. In three months and a half afterwards the wound was healed, and the limb had acquired a considerable degree of firmness; but the Prussians, in retiring from the French territory, left behind them an epidemic dysentery, which, as is well known, carried off the greater part of those who were attacked by it. It got into the hospital at Bar, where the patient was attacked, and he sank three months and a half after the operation. "This unfortunate accident," adds Moreau, "deprived me of the pleasure of enjoying the fruits of my care; but I remained convinced of the utility of the operation, and persuaded of the propriety of performing it in similar cases; I looked on my patient as cured,

for I had no relapse to dread." Moreau operated a second time, and the operation proved also fatal. In a third case, by the younger Moreau, the result was more fortunate; the patient recovered with a serviceable limb. About this time, too, various excisions of the ankle, shoulder, elbow, and wrist-joints, were likewise accomplished; but in spite of the successful results of these cases, the operation, in reference to the knee, failed to excite attention. In subsequent observations by Mr. Park, in September, 1805, he writes:—"I am mortified to see that it [his pamphlet on *Excision of the Knee*, published in 1782] has to this day produced very little of the effect it was intended to produce." On the 21st of October, 1809, Mülder extirpated the knee-joint of a pregnant woman in the hospital of Gröningen; but she died of tetanus on the 8th of the following February. From a long period after this we find but little notice of the operation being performed, not, indeed, until the year 1823, when Sir Philip Crampton had recourse to it. Before and about this time in France and Germany there were a few instances in which it was executed, and with varying success. M. Roux (Private Correspondence, 1831) has published a case; his patient died on the nineteenth day. M. Fricke is said to have performed it four times, one only being cured. M. Textor operated twice; both patients died; M. Jaeger successfully in one case.

In the year 1823 Sir Philip Crampton operated a second time. His first case was that of a "woman aged 23, of a strumous habit and emaciated appearance, marked by several scars of scrofulous ulceration, some of which at the time were open on the left hand and arm." The second was also a female, a young woman, aged 22, "strong and remarkably good-looking, with dark hair, blue eyes, and sallow complexion, but presenting no peculiar character of a strumous habit." The first died three years and a half after the operation, without ever having been perfectly cured; the second recovered, and walked with a sole which had to be four inches thick^a. Mr. Syme next performed the operation, in 1829, on a boy aged eight years, with success; and in the year 1830 he repeated the operation on a little girl aged 7, "a very thin, weak, unhealthy-looking child." She sank eleven days after the operation. After Mr. Syme's experience at this time the operation was abandoned until within the last few years, when it was again revived.

For practical purposes I conceive it is absolutely essential to

^a Dublin Hospital Reports, vol. iv.

divide the institution of this operation into two distinct epochs—the first comprising all the cases operated on from the time of Park's first case in 1781 up to the period of its abandonment after Mr. Syme's failure in 1830; the second, including all those from the period of its revival by Mr. Fergusson in 1850 up to the present time.

The following is a Table of the Cases operated on within the first epoch:—

Operation.	No. of Cases.	Results.
Mr. Park,	2	1 cured, 1 died.
Filkin,	1	Cured.
The Moreaus, . .	3	1 cured, 1 died from operation, 1 from dysentery when the limb was nearly well.
Mülder,	1	Cured of operation, died of tetanus after delivery.
Fricke,	4	1 cured, 3 died.
Textor,	2	Both died.
Jaeger,	1	Cured.
Roux,	1	Died.
Crampton, . . .	2	1 cured, the other recovered from the operation, but was not cured,
Syme,	2	1 cured, 1 died.

On superficial inspection of this Table, the results of the operation on the whole will appear decidedly unsatisfactory. However, on closely analyzing the fatal cases, some will be found to bear but little upon the question of excision. Objection may be taken to Moreau's first case, for the patient died of epidemic dysentery. Immediately before he was attacked, his condition was most satisfactory; and the following is the statement made by Moreau:—"The consolidation of the bones was such that I left the limb at liberty in bed; the patient moved it about at his pleasure. I used the plank only in getting him out of bed. In short, I flattered myself that I should be able to make him walk upon crutches in a month or six weeks, but an event with which my operation had nothing to do deprived me of that satisfaction." Again, in Mülder's case the patient died of tetanus, after delivery; a result which cannot fairly be ascribed to the particular operation executed. Every practical surgeon is aware that it may supervene after amputation. To support this view, I may here mention that Samuel Cooper gives a case where it came on after amputation of the thigh. And it may not be known to some, that the melancholy death of the late Earl of Darnley was from tetanus, consequent on

having accidentally chopped off two of his toes with an axe. In some habits, a simple incised wound may give rise to tetanus. Cooper states that, "in St. Bartholomew's Hospital it once followed the operation of removing the breast." It likewise has been known to occur after the operation for hernia, and that required for ligaturing the larger arteries; these facts, then, forcibly substantiate the above view. After child-bearing it occasionally comes on; and to this cause, I think, we should attribute the death in Mülder's case^a. Sir Philip Crampton, in his remarks upon the first case in which he operated, admits that it "was one to which the operation of excision was not applicable." "The disease had proceeded too far; for even had it been possible to have removed the whole of the diseased bone, and that union had taken place between the femur and the tibia, the limb, from its shortness, would have been useless. Add to this, that the highly scrofulous constitution of the patient, as evinced by the open sores on the hand, and ultimately by the disease of the lungs, was in the highest degree unfavourable to the restoration of the healthy action in the constitution and in the part which was essential to the reunion of the bones^b." Why excision was ever performed in this case I cannot conceive; a faulty diagnosis might certainly have been made, but when once the bones were exposed, an opportunity was afforded of rectifying the error by amputation. "For the extent of more than three inches above the condyles the femur was without periosteum, the purulent matter lying in contact with the naked bone." And when, upon the saw being applied, and the section completed, here "the cancelli of the cut surface of the femur were diseased and filled with pus, and the periosteum posteriorly detached from the bone, requiring an inch and a quarter more of the femur to be cut off." Thus six inches of the femur were taken away, together with the articulating surface of the tibia, and "about half an inch of the head of the tibia, the cancelli of which were loaded with lardaceous matter and with pus." Every surgeon, I think, will agree with Sir Philip Crampton, that "the case was one to which the operation of excision was not applicable."

Mr. Syme was the first surgeon who excised the knee-joint

^a We are indebted to Professor Simpson of Edinburgh for a most valuable paper on Tetanus following Lesions of the Uterus, Abortion, and Parturition (*Edinburgh Monthly Journal of Medical Science*, February, 1854, p. 97). From a series of twenty-four cases, Dr. Simpson proves that traumatic tetanus does occasionally supervene as a secondary obstetrical disease.

^b *Dublin Hospital Reports*, vol. iv. p. 202.

at the tender age of childhood. I think it very questionable how far the fatal issue in his second case should be ascribed to the operation of excision. The surgery of the case is imperfect and bad; for *after* the operation the limb was not placed in proper position, and the child was subjected to additional violence in eleven days after the first operation. "On the 6th of January," writes Mr. Syme, "in order to prevent displacement of the bones, which all our efforts had been insufficient to effect completely, I cut away about two inches of the femur with the pliers, and then observed, with much concern, that the bone was denuded beyond the farthest extent to which my finger could reach. The patient began to sink soon afterwards, and died on the 8th^a." The result here might have been anticipated; for it was scarcely to be presumed that while the child lay prostrated by the fever of one severe operation, she could, with impunity, bear a second. I must leave the reader to judge whether this protracted and imperfect operation is a fair exposition of excision of the knee-joint as practised in the present day. From this period (1830) up to the year 1850 I cannot find any notice of excision of the knee having been performed. It remained for Mr. Fergusson, to whom our profession is so deeply indebted, to revive the operation in London at the latter date. Immediately after, he was followed by other able surgeons, and most conspicuously prominent must for ever stand the names of Jones of Jersey, and Mackenzie of Edinburgh, as identified with this subject. The former is still spared to labour in his glorious calling, while, alas! the latter has been taken from amongst us by the pestilence that sweepeth abroad. It will be in the remembrance of many, that last year, shortly after our armies proceeded to the East, Mackenzie quickly followed, leaving a very extensive practice in Edinburgh. At this time his reputation as an able surgeon was fully established, so it was not to attain this title that he went abroad; no, the act was in consonance with his whole professional career,—*an ever straining after truth actuated him.* There were some surgical points which he laboured to establish, and for the expectant fulfilment of these he relinquished everything else. Although broken down in health, and weakened in body, he did not return home, but advanced with the British army to the battle field, relieving the pangs and sufferings of those brave and wounded men by whom he was surrounded, and who exulted in his presence. In this act we have forcibly portrayed

^a Syme on Excision of Diseased Joints, 1831, p. 139.

the indomitable perseverance of his character; and Science may well mourn over her departed son.

The second period, then, in which I shall examine this operation of excision of the knee-joint includes all the cases occurring from 1850 up to the present time. And I shall endeavour to give a short summary of each, and as nearly in the order in which they occurred as possible.

CASE I.—Mr. Fergusson, on the 20th July, 1850, excised the knee-joint from a man aged twenty-one years. An H incision was made in front; one inch and three-quarters of the lower end of the femur, as well as the head of the tibia for about three-quarters of an inch, were sawn off from before backwards, and the sharp margins of the bones pared down with the forceps; the patella was cut out, and the flaps brought together by points of suture. The patient was under the influence of chloroform. On the third day severe rigors and high fever set in. On the seventh day some slight mitigation of suffering, but only temporary, for on the eighth day rigors came on again; the patient was bathed in cold perspiration; and on the following day he became delirious and sank. On examination after death, the bone seemed to be attacked with acute necrosis; the cancellated structure being full of pus; the tibia, for the distance of nearly two inches, was in the same condition.

CASE II.—On the 19th of January, 1851, Mr. Jones cut out the knee-joint; patient a female, aged 25. The H incision was adopted, and the patient placed under the influence of chloroform. The length of bone removed measured four inches. Mr. Mackenzie, writing in January, 1853, gives the following satisfactory account of her:—"She is in perfect health, the parts about the knee having been long entirely healed. The shortening of the limb is a little over three inches. Complete ankylosis has not taken place, so that she requires a support on the inner side of the bone, with which she can move about freely, and can stand at her washing-tub for hours together. She is perfectly satisfied with her condition; and with a more secure support for the knee, which is being made for her at present, the limb will be rendered still much more serviceable than it was."

CASE III.—On the 27th April, 1851, Mr. Jones operated on a boy aged eleven years. The extent of bone removed from the tibia and femur measured two inches and a quarter. This, though at first appearing a very unpromising case, did admirably. The boy was emaciated and worn, and the leg was fixedly flexed on the thigh, so that the heel nearly touched the

hip. Mr. Mackenzie examined this little patient in two years after, and then he appeared to be in perfect health. The limb was sound and whole, although numerous cicatrices gave ample evidence of the extent of the previous disease. Complete ankylosis had taken place at the seat of operation, the limb being a little bowed outwards, and slightly flexed at the knee. The shortening of the limb, when compared with the other, was under four inches; the muscles of the limb were well developed. He could walk and run quickly without any aid from a stick, could stand on the limb alone, and, to show his confidence in it as a support, he *pirouetted* and hopped two or three yards without putting the right leg to the ground.

CASE IV.—Mr. Jones resected the knee-joint in the case of a lady aged thirty years, September 4, 1851. Everything progressed most favourably for eight days, when diarrhœa came on, followed immediately by dysentery: no treatment pursued was able to check it, and she sank on the seventeenth, thirteen days after the operation. Mr. Jones states it as his conviction, that the operation was not the immediate cause of death; for he says at this time affections of the bowels prevailed everywhere, and much particularly in the vicinity where this lady resided; indeed, it was the epidemic of the day. The mortality at this period was very great, and very few persons laboured under or died of any other disease.

CASE V.—Mr. Page, of Carlisle, performed excision of the knee-joint, June 7th, 1852; patient a young lad, aged seventeen years. The patella, and two and a half inches of the femur and tibia were removed. At no time after the operation was there any important amount of constitutional disturbance. A year after, Mr. Page, writing to Mr. Mackenzie, gave the following interesting account:—"He is now able to walk quite firmly, and without a stick, for a short distance, and is daily gaining greater control over the limb. He wears a shoe, the sole of which is about three inches thickened, that being the amount of shortening. The thigh and leg bones are firmly united, forming a firm and perfectly straight limb. The size in the situation of the excised joint is about that of the opposite knee."

Again, we have reference to this case in March, 1854, made by Mr. Page in a letter to Mr. Mackenzie, and read before the Medico-Chirurgical Society of Edinburgh:—"During the last year my patient has been able to walk with gradually increasing facility; and when I lately saw him he told me that he had been for many weeks employed in a cotton factory, where he

works as long as any of the other hands, and is obliged to stand or walk during the greater part of the day. He also said that on Sundays he not unfrequently walks six or seven miles into the country with his companions, and is able to walk with any of them. At the time I operated on this boy I was fearful lest the limb might not keep pace in growth afterwards with the rest of the body; but I am glad to find, by careful measurement, that there is now no greater shortness than at first, although the boy has grown considerably."

CASE VI.—Mr. Fergusson excised the joint from a female, aged twenty-one years, October 30, 1852, by an H-shaped incision. Chloroform was used. The condyles of the femur, and the head of the tibia and fibula, were sawn off, and the patella dissected out. In this case, Mr. Fergusson, considering the flap too long, "cut off about one inch and a half of it." The wound was closed with sutures, and large pieces of lint, damped in cold water, secured by a roller, were applied to the joint. The patient was placed in bed, the limb lying on a straight-channelled splint with foot-piece, being gently supported by Salter's swing, and so adjusted as to be somewhat raised. Considerable constitutional disturbance ensued, but subsided in a few days. Her convalescence was protracted by an attack of erysipelas; however, six months later, she was able to move freely about the ward on crutches, and her general health was good. Shortly after she resumed her employment, and was able to walk well without any artificial assistance."

CASE VII.—In January, 1852, Mr. Jones excised the knee-joint of a little boy aged seven years. The condition of the patient and of the limb was very similar to Mr. Jones' first case, the leg being fixedly flexed to the full extent on the thigh. Rather more than four inches of the femur and tibia were removed in the operation. Mr. Mackenzie represents the condition of this child in fifteen months after, as follows:—"The boy is in perfect health, the parts about the knee having been for long entirely healed. Complete ankylosis has taken place, the limb being slightly bent forwards at the knee; the limb is $2\frac{3}{4}$ inches shorter than its fellow. He stands equally securely on either foot, walks and runs quickly without any support; and to show me the use he could make of his limb, he ran up and down the ward, kicking his cap like football with the foot of the ankylosed limb." He was provided with a shoe, with a firm but light support under the sole, with which he walked steadily and easily, and with but a slight appearance of lameness.

CASE VIII.—In September, 1852, Mr. Jones excised the knee-joint of a man aged 20, previously to which the limb was flexed at an acute angle. Mr. Mackenzie saw this patient in April, 1853, and he mentions that he was then in good health. The parts about the knee were firmly cicatrized, with the exception of a superficial sinus, which still continued to discharge a little matter. All swelling had disappeared, and the limb, with the exception of this trifling sinus, appeared perfectly sound, and presented less trace of the operation which had been performed than I could have conceived possible. There was complete ankylosis in the straight position. The extent of shortening of the limb was rather under an inch and a quarter. He walked about the ward with crutches, the limb not yet having acquired sufficient strength to allow of his walking easily without support. He laid aside his crutches, however, and showed Mr. Mackenzie that he could walk without them, and with but a very slight halt. Mr. Mackenzie concludes by stating: “As far as I could judge, this case promises the most perfect result which can be reasonably expected after the removal of the patella and articulating ends of the tibia and fibula.”

CASE IX.—Mr. Mackenzie excised the left knee-joint for incurable disease of five years' standing, February 5, 1853; patient a man aged 42. The operation was performed quite according to the plan of Moreau, the patella being first removed, then the condyles of the femur, and lastly, the articulating surface of the head of the tibia. On dividing the tibia with the saw, the cavities of two abscesses in the cancellated texture of the bone were laid open, each of a size capable of containing a grape; these were carefully removed with the gouge; the ends of the tibia and femur were placed in apposition, the wound brought together by suture; the limb steadied by applying a splint on its posterior surface. The extent of bone removed amounted to rather more than two inches, an inch and a half of the femur, and a little more than half an inch of the tibia. This patient, for several days, laboured under most distressing hiccough, unmitigated by all the remedies which were employed to relieve it, for six successive days and nights. The spasm of the diaphragm at length yielded on the seventh day, under the continued pressure of a seven pound weight over the epigastrium and the free use of Indian hemp. The wound, however, never presented during this time any very unfavourable appearance. Primary union had failed in the greater part of its extent, but the discharge was moderate, and the entire surface was covered by healthy granulations. Considerable difficulty, however, was experienced, from the unfavourable condition of

the patient, in keeping the bones in proper position, the end of the thigh-bone having a great tendency to project forwards and outwards. He was seized with troublesome diarrhœa, and attacked after by severe acute pleuro-pneumonia of the right side, extending over a large surface of the diaphragmatic pleura, yet he recovered all these; and during the time the limb progressed towards cure, slowly but steadily. In three months and a half after the operation his condition is represented as most satisfactory. His general health was restored, he ate and slept well, and had no complaint of uneasiness of any kind; confined to bed, as a matter of precaution more than necessity; wound healed, with the exception of a granulating surface on the outer side, about the size of the point of the finger. The bones at the knee are immovably fixed as regards lateral motion, but on using much force, slight motion backwards and forwards. Mr. Mackenzie observes, in conclusion:—"I think I do not mistake the case when I say, that the serious constitutional symptoms which presented themselves were wholly independent of the peculiarity of the operation, and that the patient survived, and made a good recovery, in spite of complications under which he must almost inevitably have sunk had he suffered amputation of the thigh."

In the Reports of the Medico-Chirurgical Society of Edinburgh^a I find the following satisfactory notice of this case:—"A patient, a man between forty and fifty years of age, was there exhibited, on whom Mr. Mackenzie had performed the operation of excision of the knee-joint a year previously. He appeared to be in robust health, and traversed the hall, in various directions, with ease and celerity. In walking, the toes were pointed downwards, but, his body yielding slightly, he planted the foot firmly on the ground, and rested his entire weight on the limb without uneasiness. In the horizontal posture he elevated and depressed it with the greatest nicety. On examination the limb was found slightly curved outwards, firmly ankylosed at the knee, three-quarters of an inch shorter than its fellow, and equal in muscular development. The heel of the shoe was raised inside three-fourths of an inch to allow for the shortening. He stated that he had been walking for six months."

CASE X.—Dr. Pritchard excised the left knee-joint from a man aged twenty years, March 16, 1853. Half an inch of the inferior extremity of the femur was taken away, and a thin slice of the tibia and fibula, merely the articular surface. An-

^a Association Medical Journal, March 10, 1854.

chylosis was established in six weeks, and at the end of three months the wounds were firmly cicatrized, with an absence of all pain, and the weight of the body could be borne upon the limb. Complete recovery subsequently followed.

CASE XI.—Mr. Evan Thomas performed resection of the knee-joint upon a boy, aged twelve years, on the 28th of March, 1853. “The articulating end of the femur was removed, and half an inch of the tibia. There was firm union in ten weeks, without a bad symptom.”

CASE XII.—On the 2nd of April, 1853, Mr. Fergusson excised the knee-joint of a woman, aged 28. The patient was placed under the influence of chloroform, and the H incision adopted. The lower extremity of the femur was sawed off just above the condyles, and about an inch of the upper part of the tibia removed by the horizontal action of the saw. When the lower extremity of the shaft of the femur was examined it was found that the periosteum came off very easily, and Mr. Fergusson thought it prudent to remove about an inch and a half of the denuded bone. The patella being eroded, was likewise taken away. This case terminated fatally, with all the symptoms of pyemia, sixteen days after the operation.

CASE XIII.—Mr. Jones excised the knee-joint of a boy, aged nine years, April 17, 1853. In this case the patella was not removed, its carious surface only having been taken away by the gouge. The head of the tibia and condyles of the femur were removed without division of either the tendinous or ligamentous attachments of the patella. Four days had only elapsed after the performance of the operation when Mr. Mackenzie saw this child, and then “he was suffering little or nothing.” But Mr. Jones, writing in four weeks after the operation, states, “the boy progresses most favourably, and gives promise of a still more satisfactory result than in any of his former cases.” We have, however, a very important and later statement of this case.

CASE XIV.—On the 5th of May, 1853, Mr. Mackenzie excised the knee-joint from a man, aged 28, by a semilunar incision, extending from the inner side of the inner condyle of the femur to a corresponding point over the condyle, the incision passing in front of the joint nearly as low as the tuberosity of the tibia; the flap thus formed was dissected back, the ligamentum patella being divided, and the patella itself left in the substance of the flap. The patella was left undisturbed, its cartilage being removed with the gouge, as well as the rough surface of bare bone around its articular margin. Three-fourths of an inch of the tibia, and fully an inch and a half of

the femur, were removed. "There has not been the slightest tendency to displacement of the bones from the straight position, a circumstance which I attribute in a considerable measure to the patella and its attachments being left undisturbed." In ten months after the operation Mr. Mackenzie, at the Medico-Chirurgical Society of Edinburgh, alluded to this case, and stated "that recovery from various causes proved more tedious than it had at first promised to be." The patient, however, progressed satisfactorily, though slowly, and Mr. Mackenzie had no fear as to the ultimate result. The limb was becoming rigid at the knee, and was straight, shapely, and but moderately shortened. He hoped at a future meeting to present this patient with a sound and serviceable limb. Having written to Edinburgh relative to this case, I have been informed that the patient was dismissed from hospital September 15, four months after the operation, and walked three miles in a few days after his discharge.

CASE XV.—Mr. Cotton excised the knee-joint of a boy, aged $9\frac{1}{2}$, for confirmed disease of three years' standing. The operation was performed October 5, 1853. The patient was put under the influence of chloroform, and the H incision adopted. The patella being diseased, was removed. The ends of the bones, which were carious and destitute of cartilage, being made to project by flexing the limb, the saw was applied to the femur, and a thin slice of its diseased surface was removed. The head of the tibia, which was much damaged, was treated in a similar manner; whilst that of the fibula, also involved, was excised with the cutting forceps. "On bringing the parts into contact, by extending the limb and correcting the eversion of the foot, the ends of the bones were found somewhat separated in front, but tightly wedged together posteriorly, the femur projecting considerably forwards. An additional slice of that bone was consequently cut with the saw, at a level angle, in a posterior direction; the soft parts and vessels being protected by a copper spatula, and the projecting edge in front was further bevelled off previously to adjusting the limb upon a ready prepared Macintyre's splint. On the 26th of December it is stated the patient "sat up, an immaterial ulcerating surface alone remaining on the outer side of the joint. He was directed not to amuse himself so frequently with flexing the knee upon the splint, to which habit attention had been directed. February 1, 1854. The splint had been dispensed with some days; he sat before the fire with the knee bent, and elevated the limb with ease. A high-heeled boot was supplied to compensate for moderate shortening. He was ordered to be allowed

to range the wards at will, as the constantly sitting posture seemed to cause a tendency to throw the end of the femur forwards." On July 26th his condition is thus described:—"The boy has occasionally presented himself at the hospital up to this time. He attends regularly at the village school, a distance from home. He walks firmly, and with tolerable speed, though with a stooping gait, which he is trying to correct, and which he thinks is owing to his having been obliged to sit so long a time at the hospital. The tendency forwards of the femur is strikingly lessened. There exists considerable power of flexion at the knee. The limb is equally developed with its fellow, and he is able to project it forwards or backwards with ease. Indeed, up to this period, the case, without exception, has been deemed one of a highly satisfactory character."

CASE XVI.—Mr. Gore, of Bath, excised the knee-joint from a boy, aged fourteen years, on the 31st of October, 1853. He had suffered from scrofulous disease of the knee-joint for about three years, the knee being enlarged to about the size of a moderately large melon. The patella was removed with a thin slice of the tibia, and upwards of an inch of the femur. The patient suffered singularly little constitutional disturbance or pain, with a very moderate amount of suppuration, and could not have been said to have had a bad symptom throughout. He remained in the house until the middle of January, though the wound had been all but closed for a month previously; his detention arising partly from a wish to insure firm bony union, and partly from the severity of the weather,—his home was in the country, some miles from Bath, and our roads (at this time), covered with snow. When he left the hospital the limb was quite firm, solid bony union having taken place. There was a moderate curvature with the convexity outwards. The apparent amount of shortening was about an inch and a half. He had not been permitted at that time to bear any weight on the limb; but on the bed he could raise it, and move it freely and boldly; the impression on the minds of all who saw him being, that he had a truly serviceable limb.

CASE XVII.—On the 26th of November, 1853, Mr. Keith, of Aberdeen, excised the knee-joint from a little boy, aged nine years, affected with incurable scrofulous disease. The leg was fixedly bent on the thigh at an acute angle, the heel almost touching the nates. The child being placed under chloroform, an incision was made from the inner to the outer condyle of the femur in a semicircular line, the point of the flap reaching to the head of the tibia, the ligamentum patellæ being then cut through. The flap, including the patella, was dissected from

all its connexions to a line fairly above the condyles; the lateral and crucial ligaments were cut, when the utmost facility presented for sawing off the condyles of the femur. The articulating surface of the tibia was then sawn off from behind forwards, the line of section not reaching so low as the fibula, two inches in whole being the exact measures of the two portions of bone removed at the operation. The surface of the patella was sliced off, and the remaining portion of the patella being evidently healthy, was allowed to rest in situ. The wound was closed by stitches, and the limb, extended straight without any difficulty, was laid and secured in a well-fitting Macintyre metal fracture frame. On Monday, the 10th of February, 1854 (the seventy-sixth day), the wound was firmly cicatrized, and the joint stiffened firmly by ankylosis; and on the eighty-second day he was daily going about. In an extract from a letter to Mr. Mackenzie from Dr. Keith, written about this time, and read at the Medico-Chirurgical Society of Edinburgh, "the patient was so firm on his feet, and so sound at the *ankylosed* joint, as no longer to require surgical care. The limb is straight as an arrow, and solid at the joint."

CASE XVIII.—Mr. Evan Thomas, of Manchester, excised the knee-joint from a boy, aged sixteen years, November 15, 1853. "About the same extent of bones removed as in his former case; the boy is still under treatment; there is firm union; inflammation of an erysipelatous kind came on a few days after operation; frightful suppuration followed amongst the sheaths of the thigh and leg." Mr. Thomas concludes by saying, "I hope the boy will eventually recover."

CASE XIX.—Mr. Mackenzie excised the knee-joint from a lad, aged eighteen years, December 24, 1853. Chloroform was given; at the time he was in a far advanced stage of hectic, emaciated, and much exhausted by continued suffering. He was most reluctant to submit to amputation; and having seen one of Mr. Mackenzie's patients walking about, upon whom the operation of excision of the knee-joint had been performed, he expressed an anxious wish that an attempt should be made to save the limb by the performance of this operation. Mr. Mackenzie looked upon it as a matter of regret that this request had been complied with; for although amputation held out but a small chance of recovery, the case was little suited to test the merits of the operation of excision. Immediate and great relief followed the operation, and, as far as the limb was concerned, everything had progressed as favourably as could have been wished. Diarrhœa, however, which had been threatened before the performance of the operation, set in; the tongue

and lips became covered with aphthous crusts; he suffered from cough and night-sweats, and sank in the course of a month after the operation. The wound was in a great part healed, and no difficulty had been experienced in keeping the limb in excellent position. Permission could not be obtained to examine the body; but Mr. Mackenzie had little doubt that tubercular disease of internal organs would have been found.

CASE XX.—Next in order comes the case in which I excised the knee-joint, January 20, 1854. I shall reserve it, however, to the last, being anxious to give all its details at full length.

CASE XXI.—Mr. Erichsen excised the knee-joint from a boy, aged seven years, February 15, 1854. The patient was rendered insensible by chloroform. A first incision was made an inch above the inner condyle of the femur, along the side of the joint, to about an inch below the patella; a second incision ran across the leg; and a third parallel to the first, on the other side of the joint; the flap, including the patella, was then raised, and the lower two inches of the femur removed with the saw. The upper portion of the tibia was sliced off, and a portion of the outer part gouged away; the under surface of the patella was likewise scraped, the hemorrhage being altogether very trifling.

CASE XXII.—Mr. Pemberton excised the knee-joint for strumous disease, from a boy, aged 12, on the 8th of February, 1854. The extent of the tibia and femur taken away amounted to three inches and a quarter; the patella was preserved; the wounds healed slowly but perfectly, and a firm cartilaginous union binds the bones together.

CASE XXIII.—Mr. Mackenzie excised the knee-joint of a boy, aged 12, April 15, 1854, for caries of the extremities of the femur and tibia. Chloroform was administered; the patient died twelve days after the operation. On post-mortem examination an ounce of purulent fluid was found in each pleura; numerous tubercular deposits were discovered in the apex of the left lung, and likewise a few at its base; in the intermediate portion of the organ, its structure was extensively disorganized, and readily broke down under the fingers. Miliary tubercles were scattered through the right lung, and at one spot, in the inferior lobe, there was a small cavity with sloughing walls.

CASE XXIV.—On the 17th of May, 1854, Mr. Keith excised the knee-joint from a boy, aged fourteen and a half years, of a very scrofulous diathesis, having numerous cicatrices of former strumous abscesses on both sides of his neck, both groins, and all around the ankle-joint of the right limb, the one from

which the knee-joint was excised. The limb was wasted, and fixedly bent at a right angle to the thigh; the knee-joint was greatly enlarged, tender to the touch, and incapable of being moved in any degree, the attempt causing much suffering. An abscess opened from it externally by two fistulous apertures at either side of the popliteal space. Under chloroform the joint was opened by the semilunar incision; one inch and five-eighths were sawn off the femur, and three-eighths of an inch from the tibia, making in the whole two inches of bone removed. The surface of the patella was pared and smoothed, and the degenerated synovial membrane dissected from the face of the flap. On September 9, one hundred and fifteenth day after the operation, he was dismissed from the hospital cured, the bones of the thigh and leg being firmly united by ankylosis. Numerous small abscesses were opened at different times through the treatment the moment pus was ascertained to be formed.

CASE XXV.—Dr. Stewart, of Belfast General Hospital, excised the knee-joint with, I believe, good results. Said to be “encouraging.”

CASE XXVI.—In July, 1854, Mr. Jones, of Jersey, excised the knee-joint from a young woman, aged sixteen years. The patella was preserved, and its ligament not divided. The case is exceedingly interesting from the severe complication that accompanied it. Mr. Jones, in writing to me, November 6, 1854, says: “This case has given me infinite trouble, attributable to a cause I was perfectly ignorant of. It appears that the poor girl fell three weeks before the operation, and injured her back very much; this she kept entirely to herself, and only mentioned it to me some days after the operation. An examination showed me there existed an immense abscess in the lumbar region. I punctured it, and fully a quart of pus was discharged. Naturally this extra drain on the system, and the length of time it continued, materially weakened a frame already much exhausted, and, as a natural consequence, I had much to struggle with in the shape of sinuses, &c. My patient is, however, improving rapidly in health, and I now flatter myself she will recover and have a useful limb.”

CASE XXVII.—On the 29th of July, 1854, Mr. Fergusson excised the knee-joint of a boy, aged ten years, who had suffered from chronic inflammation and disorganization of the articulation for several years. The H-shaped incision was made in front of the joint, and the flaps reflected; the condyles of the femur, and the articular surfaces of the tibia, were removed by the transverse section of a broad and short saw. After the soft parts had been carefully cleared away, the carious surface

of the patella was gouged away, and the remaining portion of the bone left. It was also found, when the operation was nearly completed, that the lower part of the shaft of the femur, close to the condyles just removed, was bare of periosteum, and Mr. Fergusson judged it prudent to remove the unprotected portion of bone to the extent of about an inch.

CASE XXVIII.—Mr. Holt excised the knee-joint, August 7, 1854, of a patient, a little boy, aged eight years. Two years before this period he had been struck on the left knee by a brick, and, with some occasional intervals of ease, had suffered to the period of his admission. The knee was greatly swollen; an opening existed in the popliteal space, through which caries of the lower part of the femur was detected. His health had suffered materially, and urgent constitutional symptoms demanded the removal of the part. Mr. Holt preferred excision, “as the growth of the patient, and the absence of organic mischief, led me to infer he would rally sufficiently for the after requirements of the operation.” “About three-quarters of an inch of the tibia and an inch of the femur were removed. The synovial membrane, which was degenerated into that pulpy character described by Sir B. Brodie, entirely dissected off.” After the removal of the bones the limb was placed in the straight position, in which it was maintained by the application of a straight splint.

CASE XXIX.—On the 26th of August, 1854, Mr. Statham excised the knee-joint from a young woman, aged 20. The operation was executed by lateral flaps, and the patella and its ligament not meddled with. About one inch of bone was removed, including that from the femur and tibia; two large sinuses existed, to which the dilute nitric acid was applied.

CASE XXX.—Mr. Henry Smith excised the knee-joint, October 18, 1854, of a patient, a boy, aged six years. The patient had disease of the knee-joint of twelve months' standing, together with abscess in the head of the tibia. Various and repeated endeavours had been made to cure the joint, and straighten the limb, which had become much flexed, but all in vain. The patient's health was much shaken, and even six months before the above date another surgeon condemned the limb to amputation. Mr. Smith, in writing to me, November 26, 1854, says: “I operated by making a large semilunar flap in front, and took away a good two inches of bone, more than I should have done had the abscess not existed in the head of the tibia. The patient had not a bad symptom. I did not touch the dressings for a week after the operation, and then found the wound nearly united.” “The little boy rapidly increased in

health. The limb has been kept perfectly straight; is now getting firm at the knee; there are one or two sinuses discharging moderately only. In little more than a month the patient was enabled to sit up on a sofa for several hours."

CASE XXXI.—Mr. Erichsen removed by excision the knee-joint of a boy, aged six years, October 11, 1854. The disease was of two years' standing. The tibia and patella were alone engaged; the former was extensively; an inch of the tibia was removed, and the articular surface of the patella gouged out; the articular end of the femur was quite sound, and not interfered with. The case progressed most favourably.

I shall now proceed to detail the particulars of my own case.

John Game, aged thirty-three years, by trade a shoemaker, was admitted into Mercer's Hospital, December 3, 1853, with incurable disease of the left knee-joint. The local affection was accompanied by a train of constitutional symptoms so severe, that at this time I urged the propriety of either excising the joint or amputating the limb. The proposition, however, would not be received by the man himself, or his friends, and he was immediately taken from the hospital. His case was lost sight of until January 12, 1854, when again he sought my opinion, consenting to undergo any operation that might be considered necessary. He was admitted into the house on the following morning.

From early childhood, through life up to advanced manhood, this individual, at different periods, had exacerbations of suffering in the diseased joint, sometimes so severe in character that on three different occasions amputation was proposed and rejected.

Here, then, at the very commencement we have a lesson of great value,—a lesson that teaches what powerful, continued, and repeated efforts nature makes to check disease, to arrest it in its progress, to save life.

The following is the history of the case. When a child, six years old, he strained his knee in leaping; he limped after the accident and was unable to walk or even stand upon the limb for nearly five weeks, during which time he was confined to bed, leeches, and unremittingly stuped. After this treatment all pain left the joint for nearly five years, which time having passed over, it occasionally came back, together with stiffness, but never to any serious degree. About this period he was bound apprentice to a shoemaker, and closely kept to work at his trade; after sitting for some hours he frequently

experienced unusual pain, which after rest would likewise pass away. When aged between 19 and 20, after taking some exercise, the pain violently returned; acute inflammation was set up, and that to such a pitch as to endanger life. He was taken into hospital and treated, but with little good effect for some days; the case progressing unfavourably, amputation was proposed. A few days passed over, and the propriety of the measure was more forcibly urged; the man took fright and returned home; by quietness and rest, counter-irritants, &c., all danger again passed away. During the ensuing twelve years he at different times experienced uneasiness and pain in the joint, while on two occasions the inflammatory symptoms ran so high, and the attendant fever assumed a type so severe, that amputation was supposed to afford the only access to safety and recovery. Yet here, too, all urgent symptoms passed away by the ordinary treatment of leeching, &c. So far for the restorative effects of nature, mildly assisted, exerted over one in whom life was maintained by a well-balanced action of the vital organs, and in which each organ duly performed its well-apportioned office. The foregoing details bring the patient's history up to January, 1853. At this time he was in the habit of carrying heavy buckets of offal to some animals which he fed at the rere of his house; while thus employed he slipped and missed his footing, and in the effort to recover himself violently wrenched the affected knee; after this he was perfectly lame, and confined to bed; all his former resources failed in checking the inflammation or alleviating pain. At this time, too, a most inclement season, with intense frost, set in, and to these combined influences he attributed the severity of the attack; the foot became œdematous, and numerous abscesses formed in the vicinity of the joint, particularly upon its outer and posterior surfaces, but did not break until the October following. After this he was worn out by suffering and compelled to come to hospital in December, when I first saw him, and from the type of the constitutional disturbance, the wasting hectic, urged the propriety of the operative measures adverted to.

As already stated, he could not be persuaded to submit, but after six weeks' additional suffering he gladly availed himself of the order to be placed under my care. On seeing him at this time I was very forcibly struck with his altered condition for the worse: he had become rapidly emaciated, and his countenance had a haggard, greasy look; the features sharpened. Pulse very frequent, not below 140, not hard or strong; great languor and sense of weakness; a bloodless, withered state of the skin, with burning sensation in the palms of the hands and

soles of the feet. He had constant restlessness, disturbed sleep, and total loss of appetite; night-sweats and irregular chillings alternating frequently with diarrhœa. The local changes in and about the joint originating these symptoms were conspicuously developed: the thigh was wasted, while the leg did not at all participate to the same extent in this change. The leg was bent at a considerable angle with the thigh, and rigidly fixed in this position. On viewing the joint in front, the condyles of the femur lay very obliquely, the internal being far more prominent, sharp, irregular, than the external. The leg was partly rotated outwards, and drawn outwards and backwards. The patella was cast also somewhat outwards, and lay sunken obliquely, its inner edge being distinctly felt beneath the strained integuments; thus, the anterior configuration of the joint was remarkably distorted; pressure over any part of this region caused the greatest suffering. Though the leg could not be straightened, yet it admitted of slight rotation, sufficient to elicit distinct grating or crepitus, proving the destruction of inter-articular cartilages and those of incrustation, while the motion was sufficient to justify the conclusion, that the crucial ligaments were also destroyed. Numerous sinuses on the outside of the joint, and in the line of the outer hamstring tendons, testified to the fact of profuse suppuration implicating the softer tissues around, and on introducing a probe through the most dependent external sinus, it could, by a little manipulation, be passed into the joint and at once brought in contact with carious bone. The under surface of the external condyle of the femur communicated to the instrument the gritty feel as of a multitude of little fractures. On passing the probe forwards the patella afforded a similar evidence of being implicated, while no such proof presented of the tibia being engaged, after the most careful investigation. Through some of the many sinuses, projecting, red, fleshy papillæ appeared; while from all, flowed abundant secretion, varying, however, in consistence and colour: that from the infiltrated tissues being a consistent, yellowish fluid, suspending numerous flocculent particles; while on the other hand, that from the vicinity of the diseased bone was thin, sanious, and fetid. The lower part of the shaft of the femur, for three inches above the condyles, was considerably thickened, which I attributed in a great measure to the repeated effusions of lymph in the proximity of the periosteum; suffice it to say, in no one point could the shaft of the bone be discovered softened, or stripped of its coverings. Taking these various points, then, into consideration, and having full evidence that the constitution proved itself no longer equal to the strug-

gle, I considered any further attempt to preserve the joint would only plunge the patient into so sunken a condition, that no mortal effort, no human skill nor science, could again recall the consolatory choice of operative interference for the sake of preserving life.

The minuteness with which the foregoing examination was conducted, leading to a very accurate and just estimation of the extent of disease, emboldened me in the propriety of the project of excising the joint. A few days were necessary to prepare the patient, and on January 20 I operated after the following manner.

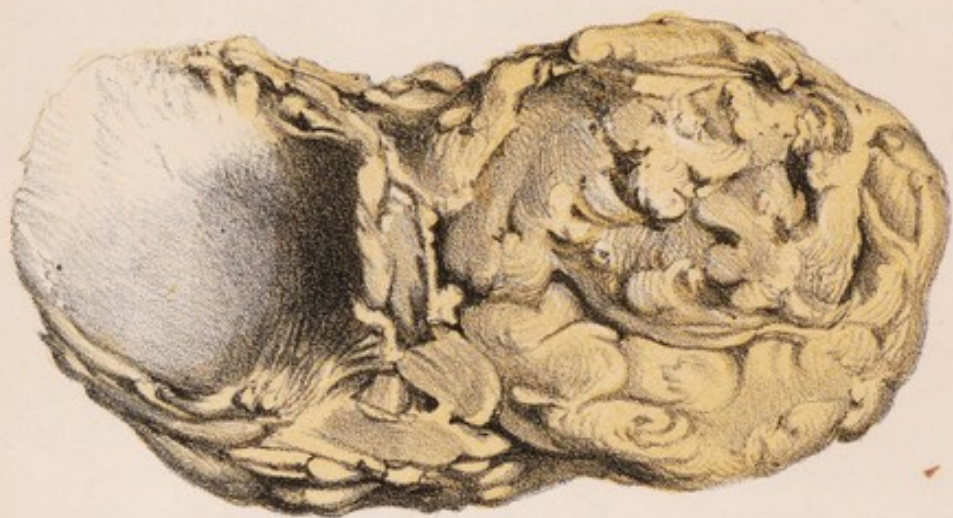
The patient was placed upon a table, lying on his back, and in a few minutes brought under the anæsthetic influence of chloroform. The leg at the extreme of extension was steadied; the sole of the foot being planted upon the table and held so forcibly, while the thigh was rigidly fixed by a second assistant. Standing on the left side of the patient, I leant over the knee, steadying its outer side against my chest, and with a strong scalpel cut along the inner side of the joint to about the extent of five inches; this incision was commenced below, at a point about two inches lower than the articulating surface of the tibia, and corresponding to a line a little anterior to its inner sharp edge; the knife was at once thrust down to the bone, and, holding the same relationship, was carried upwards along the femur for three inches; the saphena vein was thus gradually left behind the track of the wound. A similar incision was rapidly made on the outside, commencing below the head of the fibula, and carried upwards above the external condyle; through the entire extent of this, too, the knife was swept along the bones. Both vertical incisions being completed, they were connected by a transverse one, passing an inch above the attachment of the ligamentum patellæ to the tibia; the latter wound opened the joint fully; the lower flap was freed downwards a short way, while that containing the patella was dissected upwards, but with some difficulty, owing to the thick matted cellulo-fibrous tissues which constituted its bulk. The internal and external lateral ligaments were next divided, together with adventitious bands, the result of organized lymph deposits; the anterior crucial ligament was destroyed, but the deeper fibres of the posterior remained intact, and incorporated by dense structure with the posterior ligament of the joint; these in turn were divided, but much difficulty was experienced in detaching them from the posterior surfaces of the bones, with due consideration for the popliteal vessels,

which not only lay upon the dense elastic material, but were embedded in it. The knife was next rapidly swept round the condyles of the femur, the disease not extending higher. In the same way the articulating end of the tibia was freed from the soft parts around its circumference; the ligamentous structures being thus cut through, the leg was forcibly flexed, and the ends of the bones thrust forward; and now the accuracy of the diagnosis was fully verified. The femur presented its external condyle nearly all removed by caries, while the internal was not at all so extensively diseased, its posterior half being stripped of its cartilage of incrustation, and carious behind the intervening space; between the condyles was likewise carious. The external condyle of the tibia had its cartilage of incrustation removed, which was replaced by a thick fibrous substitute, while the internal presented its normal appearance (we had here strong evidence of the efforts of nature to check disease). The patella was quite carious, hollowed, and reduced to a complete shell; therefore, it was dissected carefully out, the integuments in front, and covering it, being preserved together with the fibrous attachments implanted at its upper and lower edges. The bones being sufficiently exposed, I next proceeded to cut off their extremities, and for this purpose used the saw, which I prefer for amputations; its blade being turned in the supports and steadied so, it was easily passed behind the condyles of the femur and made to cut forwards; a few movements were sufficient to complete the section. In a similar way its serrated edge was placed behind the tibia, and urged forwards, so as to remove a thin osseous slice together with the surface of the bone. The head of the fibula was not diseased; lying below the surface of the tibia it did not prevent the apposition of the bones; it was, therefore, left intact for this special reason, as well as that the attachment of the biceps should not be interfered with. The entire amount of bone removed measured two inches.

Plate I.—Shows the condition of the surfaces of the bones, and the extent to which caries had progressed.

Plate II.—Exhibits the amount of bones removed, when placed in situ and apposition.

On closely examining the divided osseous surfaces, nothing could promise more favourably: that of the femur was compact and healthy in every respect, while the periosteum was adherent all around. That of the tibia preserved its natural spongy





arrangement, free from all traces of disease. To the facility with which the bones were cut, and the peculiar adaptation of my saw to the purpose, I shall again advert. The hemorrhage was but trifling; three small arteries were secured. And I next proceeded to place the limb in position and dress the wound. The former was a matter of great difficulty; notwithstanding the relaxation arising from the shortening of the limb, it required considerable force to press back the bones so as to make them assume a horizontal position; this was entirely owing to the permanently rigid contraction of the flexor tendons. When the limb was pressed into the straight position, the cut ends of the tibia and femur lay closely in contact, but pressure could not be removed from the forepart of the limb for an instant, so great was the tendency to distortion. The upper and lower flaps were brought together by a few points of the interrupted suture; and the vertical incisions treated in a similar way, except opposite the line of section of the bones, where the edges were left apart to permit of the escape of any oozing of blood or serum, or of pus when formed; a few folds of lint wetted in cold water were then applied over the wounds, and the limb placed in the horizontal position in a wooden case which I had made for the purpose. The sides were attached to the back part by hinges, so as to allow of being let down at the time of dressing; they were likewise of unequal length, the internal extending nearly as high as the ramus of the pubis, while the external passed up to the axilla, similar to the long splint used by me in fractures of the thigh; the lower end of each lateral piece presented on the inner surface a number of grooves about an inch apart, so that when the sides were elevated the foot-board was received into any opposite pair of them, according to the distance required; this lower piece acted in two ways: not only did it maintain the foot at a right angle with the leg, but it steadied the sides and prevented their being pressed inwards from their vertical direction by the tapes and buckles which girted the apparatus on the outside. The box was supplied with hair cushions, carefully adapted to its entire extent, some being covered with oiled silk. In addition to the posterior, lateral, and foot support, a broad splint, well padded, had to be placed over the anterior surface of the thigh, extending from a little below Poupert's ligament as far as the junction of the upper and middle thirds of the leg, and secured firmly down by the surrounding web belts, so as to counteract the powerful tendency towards the distortion of the limb forwards. I have already mentioned that the external side of the

case passed up to the axilla, the object being to insure the straight position for the limb. It was kept in contact with the trunk by a wide girth passed around both. The patient expressed himself as being very comfortable with the limb done up in this way, and it was satisfactory to the surgeon to behold it, every requirement seemed so entirely fulfilled. During the operation and the straightening of the limb the man was kept under the influence of chloroform, and so perfectly did it act, that he was insensible to pain; true, a few minutes sufficed for the execution of both, but by this great boon to science, the most intense and excruciating agony was avoided, and the shock rendered nominal. On removing the handkerchief wetted with the chloroform from the face, the patient quickly recovered consciousness. The dressings being completed, he was removed to bed.

The bed was prepared in the following way: a hair mattress was laid over a feather bed, raised towards the feet; a blanket folded several times was placed over the part upon which the shoulders and hips rested; thus the returning circulation was favoured, and the chance of excoriation of the prominent parts of the buttocks guarded against. Four ounces of wine and forty minims of Battley's sedative were given; this was at 11 A. M. In half an hour reaction was considerably established, and bleeding took place from the lower angle of the inner wound; two stitches were cut out, and I succeeded in ligaturing the vessel that yielded blood,—an artery fully as large as the radial; there being no further flow, the stitches were replaced. From this procedure I was gratified with the construction of the wooden case, for I was enabled to let down its inner side and at once get at the bleeding part without disturbing the limb from its posterior support. The thigh was warm, but the leg and foot were very cold, so I had the entire wrapped in flannel and wadding, with hot jars placed close to the foot.

Visited 4 P. M. No return of bleeding; complains of great pain in the wound and startings of the limb; ordered forty minims of Battley, two ounces of wine, and a large cup of strong beef-tea.

8 P. M. Temperature of leg natural; pain less; forty drops of Battley with twenty of spiritus etheris nitrosi; and in an hour after, the yolk of two eggs, and two ounces of sherry and boiled milk.

Visited 11 P. M. Suffering great pain and startings in the limb; ordered forty minims of Battley, and if awake at 2 o'clock, to be repeated.

January 21, 9 A. M. An additional dose of Battley, thirty

minims, had to be given at 5 A. M., pain was so great. By the report of the gentleman who watched him through the night, he had no sleep, and was troubled with continued startings. Pulse was very rapid, that of irritation; great depression; suffering no pain in the limb; occasional startings and cramps; had to administer sedatives and stimulants in large quantities. He got in the fourteen hours 200 minims of Battley's sedative, eight ounces of wine, three ounces of brandy, each in divided doses; and for nutriment, six eggs, beaten up with brandy, and two large cups of beef-tea.

22nd. He has had no sleep since before the operation; his countenance is pale, lips bluish. Pulse 136, not so much that of irritation; irritation certainly subsiding; but the collapse is very great; tongue moist, but white; drew off with a catheter a pint of urine. The limb lies easy, yet occasional spasms in it; purulent matter is beginning to be secreted. The worst symptom present is the sense of sinking, accompanied by alarming prostration. It was quite clear that the only chance of prolonging life lay in the freest exhibition of wine and opium; they were administered with nutriment almost every hour in the fourteen following; during this period he took 225 minims of Battley, twenty-six ounces of sherry wine, eight eggs, and two pints of beef-tea.

23rd, 9 A. M. The large quantity of wine and opium swallowed has told so far. He is reported to have had sleep at intervals, now for the first time since the operation. The pulse has also come down ten beats, being only 126: it is also more full and steady. He is perfectly free from headach, and has emptied the bladder of his own accord. The limb lies easy; suppuration freely established; ligatures not producing tension or redness, therefore suffered to remain; complains of flatulence and pains in the colon, accompanied by slight nausea. Saw the long tube passed up the intestine to a considerable height, by it a large amount of air escaped; immediately a full enema of oil, turpentine, and hot water was administered, and after half an hour was returned together with full, solid discharges, and a quantity of highly fetid air. Removed the patient, supported in the horizontal position, and with great caution, to a fresh bed. In an hour after, the bowels were freed, he felt most comfortable, and took freely some toast and tea, all nausea and pain having disappeared. On this day diminished the opium, but increased the wine and food. In fourteen hours took 165 minims of Battley, sherry wine twenty-nine ounces, six eggs, two pints of beef-tea, and bread.

24th, 9 A. M. Is much better; slept through the entire night, and was free from restlessness and startings in the limb on going to sleep. Countenance *composed*; eyes bright, intelligent; no expression of suffering about the forehead or mouth, and feels himself "greatly refreshed from sleep." Pulse developed and steady, 120; respirations natural; temperature of body and limb natural; tongue clean and moist; full complement of urine secreted and passed; limb free from pain, not disturbed; opium and wine diminished; nourishment as before. In fourteen hours took Battley, 120 minims, sherry wine fourteen ounces, brandy two ounces.

25th, 9 A. M. Has slept well through the night; countenance quite cheerful; pulse 115, steady, soft, and compressible. On my visiting him, he was eating his breakfast with appetite. The startings in the limb have ceased; the knee is free from pain or tension; no erysipelatous blush or morbid heat; matter passing in abundance from the wounds at either side. In fourteen hours he took Battley, 90 minims, sherry wine fourteen ounces; nourishment increased.

26th, 9 A. M. Slept well; pulse 115; countenance cheerful; dressed the limb for the first time since the operation, six days having elapsed; great tendency to spasm and starting of the limb forwards; this was very remarkable when the splint in front and the lateral and side supports were loosened; the limb, however, was kept rigidly extended while the matter was pressed out from between the flaps, &c.; adjusted fresh pads; oiled-silk, with wadding under the limb to soak up discharge. This being accomplished, the anterior splint was applied, as before, to counteract the tendency to displacement forwards, and the case closed. Immediately after, the patient was removed to a fresh bed. In the fourteen hours he took Battley, 33 minims, sherry wine and food as on yesterday.

27th, 9 A. M. Had but little sleep, his bowels being moved four times in the night; however, the discharges were thick and consistent, and evidently dependent on the large amount of nutriment swallowed during the previous days. Pulse 115; limb free from startings; discharge from wounds free, but not re-dressed. His bowels having, in a few hours, being again affected, ordered an astringent mixture with opium. He took in fourteen hours Battley, 120 minims, port wine eight ounces, spirits, six ounces, rice, coffee, &c., as nourishment.

28th, 9 A. M. Had sleep at intervals; bowels not moved since yesterday morning; pulse 110, feeble, yet steady; tongue clean and moist; says he has had a cold sweat; countenance

pale. Dressed the limb, first letting down the side splints, while an assistant made pressure upon the forepart of the thigh to prevent its being drawn forwards; to resist the muscles doing so required great force. All matter being pressed out from beneath the flaps and sinuses, the limb was cleansed and done up as before. He took in fourteen hours Battley, 45 minims, wine six ounces, spirits eight ounces, eggs, chop, coffee, &c., for nourishment.

29th, 9 A. M. Slept all night; pulse 110, more volume in it, and quite steady; no cold sweats; tongue moist and clean; has had no startings in the limb; re-dressed it, carefully letting down the side splints, and supporting it in front; removed the stitches; flaps united through entire extent in front by adhesive inflammation; discharge from lateral wounds good, and moderate in quantity; in some points granulations springing up, florid and healthy; re-adjusted parts as before; removed the patient to a fresh bed, and placed him on a perforated pillow, as the integuments over the sacrum became reddened, from the constant pressure, owing to the one position being enforced; washed the surface over with a strong solution of nitrate of silver; opium not required now; ordered only 40 minims of Battley, to be given at night; wine, spirits, and food, as on yesterday.

February 2nd. Everything has been continued as at last report; going on most favourably; the limb has been dressed each day, the only change is in the profuse quantity of the discharge; used as dressing lint, soaked in a strong solution of tannin and sulphate of zinc, ten grains of each to the ounce of water; wine, spirits; diet, liberal, as before; no opium now.

4th. Is much better; wounds not discharging so freely; gave the joint considerable support by strapping its sides and forepart with soap-plaster, at the same time without disturbing the limb from its horizontal bed. The patient does not complain of starting in it now when left at rest; but the slackening of the splints instantly induces spasm, so that at each time of dressing the limb requires to be as forcibly pressed down as ever.

11th. Going on favourably in every respect; the strapping and support by pads afforded to the walls of the joint have diminished greatly the discharge, and lessened the secreting surfaces. Dressed with the same carefulness as from the first; no alteration in diet.

March 1st. Limb becoming quite solid. Ever since last report the limb has been dressed each day, and carefully strapped. Some small abscesses which formed at the incision were opened

and quickly obliterated. The discharge from the joint is very considerably diminished, and a firm union is being established between the tibia and femur; so far has the union advanced, that now all tendency to distortion of the lower end of the femur forwards has subsided. The patient is still, however, strictly confined to the recumbent posture.

April 2nd. Now the limb is quite rigid, and can be lifted from the bed *en masse*; the wounds are nearly healed, the chief amount of discharge being from the original sinus. Ever since last report the pressure over the sinuses and joint has been enforced by careful strapping with soap-plaster, in addition to the application of the mechanical apparatus, so as to prevent the slightest motion between the recently connected bones.

10th. Permitted the man to sit up in bed, supported by pillows, the limb remaining steadily fixed in the wooden case to enable him to do so. The prolonged, external side of the box was cut off; it perfectly fulfilled its office, but was no longer necessary.

May 10th. Removed the wooden case, and substituted side splints, a front support for the thigh, and a back piece; the external splint passed from the trochanter downwards below the foot; the internal one from the pubis to a like extent, while one lay in front of the thigh, and a fourth extended along the posterior surface of the limb, and as low down as the inferior third of the leg. All were supported by bandages, evenly rolled outside, while the joint was more immediately embraced both by adhesive straps and pads judiciously arranged over the sinuses. By this adjustment he was enabled for the first time to lie upon his side, and rest so, without detriment to the limb.

15th. Discharge so trifling, did not change the splints since last report. The man's general health remarkably improved; and the union between the bones is quite solid; readjusted as before.

June 10th. Discharge very small; not more than a teaspoonful from the inner wound; external wound healed; small discharge from an old sinus on the outer side; two have closed up altogether. The leg and thigh are firmly united together; so perfect is the union that I removed the heavy splints, and merely applied a light one to the posterior surface of the limb, extending along the thigh and upper third of the leg. The foot and leg were first evenly rolled, and then the splint placed behind, with a compress corresponding to the popliteal space. The sinuses were padded, and all retained by a roller passed from below upwards. This dressing afforded the greatest com-

fort, owing to its lightness. The patient was dressed, and permitted to lie upon the outside of the bed.

June 15th. The same mode of dressing as at last report adopted, and the patient was permitted to move about the ward assisted by crutches; this he could do very satisfactorily. The limb rested well upon the ground, was not more than two inches short,—in fact, a slipper with a thin pad in it made up for all deficiency in length.

July 10th. Still slight discharge from the site of one of the original sinuses, that upon the outside and lowest down; all others obliterated. Since last report the man has been moving about freely, assisted with crutches; the limb does not seem to have suffered at all by the motion; it remains rigidly ankylosed; however, he is not yet able to sustain the weight of the body upon it unassisted.

August 8th. A small abscess formed on the outside of the lower third of the thigh, and a second in front of the lower end of the femur; quiet to be observed; poultice and suitable dressings.

16th. Recent abscesses healed, while the original sinus externally still discharges. With the limb supported by the posterior splint the patient is able to move about as before.

20th. The joint is now free from all uneasiness, is perfectly firm, and the patient is able to go about with the assistance of one crutch. On the 5th of September he left the hospital in this condition.

The foregoing is a summary of the cases of which I have been able to find any record, or to gain any account of by inquiry; it is possible that some may have escaped my observation, if so, I trust the omission may be the cause of eliciting still further practical information on the matter. In the following Table will be found all the cases operated on from 1850 up to the present time: the name of the operator, the institution in which each operation was performed, the age and sex of the patient, the date of the operation, and the result as to life and limb.

TABLE of all the Cases operated on within the Second

Surgeon.	Hospitals.	Sex and Age of Patient.
Mr. Fergusson,	King's College, Hospital, London,	Male, aged 21 years,
Mr. Jones,	Jersey Hospital,	Female, aged 25 ,,
Mr. Jones,	Jersey Hospital,	Male, aged 11 ,,
Mr. Jones,	Jersey Hospital,	Female, aged 30 ,,
Mr. Jones,	Jersey Hospital,	Male, aged 7 ,,
Mr. Page,	Cumberland Infirmary,	Male, aged 14 ,,
Mr. Jones,	Jersey Hospital,	Male, aged 20 ,,
Mr. Fergusson,	King's College Hospital, London,	Female, aged 21 ,,
Mr. Mackenzie,	Royal Infirmary, Edinburgh,	Male, aged 42 ,,
Dr. Pritchard,	Hunmanby Hospital, Yorkshire,	Male, aged 20 ,,
Mr. E. Thomas,	Manchester Workhouse Hospital,	Male, aged 12 ,,
Mr. Fergusson,	King's College Hospital, London,	Female, aged 28 ,,
Mr. Jones,	Jersey Hospital,	Male, aged 9 ,,
Mr. Mackenzie,	Royal Infirmary, Edinburgh,	Male, aged 28 ,,
Dr. Cotton,	West Norfolk Hospital,	Male, aged 9½ ,,
Mr. Gore,	Bath Hospital,	Male, aged 14 ,,
Mr. E. Thomas,	Manchester Workhouse Hospital,	Male, aged 16 ,,
Dr. Keith,	Royal Infirmary, Aberdeen,	Male, aged 9 ,,
Mr. Mackenzie,	Royal Infirmary, Edinburgh,	Male, aged 18 ,,
Dr. Stewart,	Belfast Hospital,
Mr. Butcher,	Mercer's Hospital, Dublin,	Male, aged 33 ,,
Mr. Erichsen,	University College Hospital, London,	Male, aged 7 ,,
Mr. Pemberton,	Birmingham General Hospital,	Male, aged 12 ,,
Mr. Mackenzie,	Royal Infirmary, Edinburgh,	Male, aged 12 ,,
Dr. Keith,	Royal Infirmary, Aberdeen,	Male, aged 14½ ,,
Mr. Jones,	Jersey Hospital,	Female, aged 16 ,,
Mr. Fergusson,	King's College Hospital, London,	Male, aged 10 ,,
Mr. Holt,	Westminster Hospital, London,	Male, aged 8 ,,
Mr. Statham,	University College Hospital, London,	Female, aged 20 ,,
Mr. Smith,	Westminster General Dispensary, London,	Male, aged 6 ,,
Mr. Erichsen,	University College Hospital, London,	Male, aged 6 ,,

Epoch, from July, 1850, to December, 1854, inclusive.

Date of Operation.	Result as to Life.	Condition of the Limb. Observations.
July 20, 1850, . . .	Death,	From operation.
January 19, 1851, .	Cured,	With perfect use of the limb.
April 27, 1851, . . .	Cured,	With perfect use of the limb.
September 4, 1851, .	Death,	From epidemic dysentery.
January 25, 1852, .	Cured,	With perfect use of the limb.
June 7, 1852, . . .	Cured,	With perfect use of the limb.
September, 1852, . .	Cured,	With perfect use of the limb.
October 30, 1852, .	Cured,	With perfect use of the limb.
February 5, 1853, .	Cured,	With perfect use of the limb.
March 16, 1853, . .	Cured,	With perfect use of the limb.
March 28, 1853, . .	Cured,	With perfect use of the limb.
April 2, 1853, . . .	Death,	From pyemia, sixteen days after the operation.
April 17, 1853, . . .	Cured,	With perfect use of the limb.
May 5, 1853, . . .	Cured,	With perfect use of the limb.
October 5, 1853, . .	Cured,	With a limb most useful in progression.
October 31, 1853, . .	Cured,	With perfect use of the limb.
November 15, 1853, .	Under treatment,	Recovery.
November 26, 1853, .	Cured,	With perfect use of the limb.
December 24, 1853, .	Death,	Twenty-four days after operation, from exhaustion consequent upon obstinate diarrhœa.
.	Said to be "encouraging."
January 20, 1854, .	Cured,	With perfect use of the limb.
February 15, 1854, .	Cured,	Perfect ankylosis. Use of the limb delayed by severe erysipelas.
February 8, 1854, .	Cured,	With perfect use of the limb.
April 15, 1854, . . .	Death,	From phthisis, twelve days after the operation. Operation warranted to relieve agony.
May 17, 1854, . . .	Cured,	With perfect use of the limb.
July, 1854,	Under treatment,	Recovering rapidly.
July 29, 1854, . . .	Under treatment,	Recovering rapidly.
August 7, 1854, . . .	Rapidly recovering,	After six weeks, bones ankylosed.
August 28, 1854, . .	Rapidly recovering,	Union between the bones complete.
October 18, 1854, . .	Rapidly recovering,	Union between the bones far advanced.
October 11, 1854, . .	Rapidly recovering,	Good ankylosis; nearly quite firm.

The results from the foregoing statistics, as summed up in this Table, are most startling: thirty-one operations are recorded; out of this number five have died: but, as we dealt with the former Table, the details of by-gone days, even so must we deal with this, the record of modern surgery, and in the same way scrutinize closely how far these deaths are to be attributed to the special operation executed. Exception, I think, may justly be taken to Mr. Jones' third case, and the death fairly ascribed to the epidemic dysentery of the day, which at this time raged with such fatality "that few persons laboured under or died of any other disease." Again, Mr. Fergusson's third case died from pyemia sixteen days after the operation. Every experienced surgeon is well acquainted with the fact, that after comparatively trifling operations, after the simplest amputation, pus may enter the circulation and destroy life. In illustration: very recently, in Mercer's Hospital I amputated the fore-arm by double flap; a few seconds completed the task; the patient was healthy in every internal organ, and protected from any shock by the anæsthetic influence of chloroform. The case progressed most favourably, as was to have been anticipated, but this happy state lasted only some days, for soon a violent diarrhœa and shivering fit preceded the local change of a diffused inflammatory blush, an engorged and puffed condition of the wound,—tremblings and irregular shivering fits, with chattering of the teeth, contracted limbs with a morbid diminution of temperature, laboured and hurried breathing, with a small, soft, rapid pulse, at once awakened alarm in my mind as to the fatal blood-poisoning; the sunken, haggard countenance, the leaden hue, the hollow eyes, the contracted features; and later, the withered flabby aspect of the cut parts, exuding a grayish fetid discharge, attended with occasional delirium; rapidly accelerated and deeply laboured respirations alternating with expirations loaded with purulent fetor, confirmed the opinion; while, on the thirteenth day preceding death, constant sharp screams escaped from the sufferer, shrill, ringing, unearthly. At this time the eyes had lost all their brightness; the corneæ were opaque, lids apart; the lips and teeth covered with a fuliginous paste; the limbs from time to time agitated by subsultus; and later, a deeper, a more prolonged struggle terminated in death. Post-mortem examination revealed what the symptoms had so clearly portrayed,—pyemia, the cause of death. The death in Mr. Mackenzie's third case is not to be laid down to the particular operation; so far as the condition of the limb went, all was most satisfactory,

when violent diarrhœa attacked the patient, which proved fatal on the twenty-fourth day. Mr. Mackenzie's fourth case would have died whether operated on or not; certainly the rapid death cannot be ascribed to the particular operation performed. Far be it from me to throw even the semblance of censure upon one of such admitted ability; of course, from the physical signs on examination, this accomplished surgeon was perfectly conversant with the diseased condition of the thoracic viscera, and most likely removed the joint, the cause of excruciating suffering, of intolerable agony, on the same principle that amputation is justifiably performed even in cases hopeless as to ultimate recovery. Thus, then, out of 31 operations, 25 have recovered, out of which 17 are walking about with perfect use of the limb; 6 have been operated on since August last; yet in 4 of these union between the bones is already accomplished, and the remaining 2 are rapidly recovering. One case, operated on in November, 1853, is still under treatment, from numerous complications having arisen, and 1 is said to be "encouraging;" 1 has died from epidemic dysentery; 1 from pyemia; 1 from obstinate diarrhœa; 1 from phthisis, twelve days after the operation was performed to mitigate excessive agony; and 1 from the immediate effects of the operation.

Mr. Fergusson may well look with satisfaction upon this array of successful cases, and feel an innate pride at having revived an operation unwisely rejected, yet now productive of such splendid results. From these data we have sufficient evidence to prove that the operation is not so dangerous to life as had been heretofore supposed; and, above all, as contrasted with amputation of the thigh, either for injury or disease, it is far and away less hazardous. I shall transcribe from Mr. Erichsen's valuable work on Surgery a Table showing the mortality resulting from amputation of the thigh, performed for injury and disease, as noted in University College Hospital.

Result of Amputation of the Thigh from Injury and Disease.

	No. of Cases.	Cured.	Died.	Mortality per Cent.
No. 1.—Injury, . . .	19	8	11	58
No. 2.—Disease, . . .	34	27	7	20½

Malgaigne's statistics from the Parisian Hospitals make the mortality far greater, viz. :—

	No. of Cases.	Died.	Mortality per Cent.
No. 1.—Injury,	46	34	75
No. 2.—Disease,	153	92	60

While Mr. Syme, in advocating amputation at the knee-joint^a, still further proclaims the mortality of amputations of the thigh, and in these words: "The stern evidence of hospital statistics still shows, that the average frequency of death is not less than from 50 to 70 per cent., while it cannot be denied that many of the survivors suffer from uneasiness connected with protrusion of the bone."

By some it may be said that a fair estimate cannot be drawn from tabular statistics, because that many of the amputations were performed in hopeless cases; true to a certain extent the objection maintains, but it must be admitted that in far milder cases, when the joint could not be cured by ordinary means, success swells the favourable return for amputation; while excision would not only have preserved the life, but also, with judicious management, the limb in a serviceable condition. These Tables, when contrasted with my second, upon excision of the joint, set at rest for ever the question of the comparative danger of the two operations. In them we have forcibly demonstrated that *the danger of excision is considerably less than that attending amputation of the thigh.* The wound necessary for the removal of the diseased bones is less extensive than that attending amputation of the thigh, whether performed by the circular or flap operation. This I have over and over proved upon the dead body. On this point Mr. Syme has two statements, one to suit the favourable view of the operation which he took when writing in 1831, and another to suit a special purpose,—to put down a rival,—in 1853. At the former period he mentions: "The operation requires comparatively small superficial incisions"^b; and at the latter: "The large size of the wound, just double that of amputation"^c. Mr. Fergusson, however, is very explicit on this matter^d: "He would repeat

^a Edinburgh Monthly Journal, May, 1845.

^b Syme on Excision of Diseased Joints, p. 131.

^c Edinburgh Monthly Journal, July, 1853, p. 89.

^d Lancet, April 16, 1853, p. 368.

that he considered the extent of wounded surface larger in amputation than in excision." The main vessels and nerves of the limb are not divided in the operation, the parts involved in the incisions being principally the integuments and ligamentous apparatus of the joint. The medullary canal of the bone is not laid open (a point now laid much stress upon by Cruveilhier, and urged by Mr. Syme in advocating amputation at the knee and ankle-joint). The shock, which always attends to a greater or less degree the sudden removal of a large part of the body, is avoided. In connexion with this last remark I wish particularly to cite Mr. Syme's opinion: "Every one who has attended the Hotel Dieu must have remarked the frequency of death, or rather the rarity of recovery, after the removal of limbs in such circumstances (speaking of caries); and though the evil seldom goes to such an extent in other places, I am sure all practical surgeons must be familiar with it. It is also observed, that adult patients, who have suffered amputation for caries, often fall into bad health and die of dropsy, or some other chronic complaint, within a year or two after the operation. These bad effects seem referrible, with most probability, to the disturbance which is excited in the system by taking away a considerable part of the body"^a.

The next inquiry to be answered, and it is of the utmost importance, is in reference to the after-utility and seemliness of the limb; or, in other words, whether, if excision be performed and recovery take place, is the limb more sightly and useful than an artificial one. The above data are sufficiently comprehensive and incontrovertible to settle likewise this question, without it at all being necessary to revert to the cases included in the first epoch, terminated so abruptly by Mr. Syme's failure. But it may be necessary to add, in reference to both Park's and Crampton's cases, Mr. Syme has recently, in the spirit of facetious criticism, thus expressed himself: "Although the operation had been limited to cases favourable for recovery, a large portion of the patients, whose fate could be regarded as decided, had perished. In some cases there had been no osseous union, and in others ankylosis with miserable deformity. Thus, in Sir P. Crampton's only successful case, the famous one of Anne Lynch, who could walk the length of a day, it appeared, from the bones which were in the Lincoln's Inn Fields' Museum, that the tibia and os femoris were united at a right angle, so that the progressive motion must have been of a very rare and remarkable kind; while the subject of Mr. Park's never to be

^a On Excision of Diseased Joints, p. 15, *et seq.*

too frequently quoted case, probably made a better appearance climbing up the rigging of his ship, like the quadrumanous inhabitant of a tropical forest, than he would have done as a biped on terra firma"^a. Mr. Syme's imaginative conception, as applied to Park's case, is contradicted by, and at variance with, the written facts; and, as relates to Sir P. Crampton's case, I shall make no observation, as the gentleman is still alive and capable of shielding himself. Even from Mr. Syme's showing, the specimen proves this much, that the bones at least are firmly knit together by a bony junction; and, doubtless, this union might have been effected in a straight position. That the usefulness and seemliness of the limb can be preserved, is indisputably proved by the united experience of numerous able surgeons, viz. :—

In Mr. Jones' first case the woman was able to follow her business as a laundress, and stand at a washing tub for hours together. In his second, the patient, a little boy, could walk, and even quickly, without any aid from a stick; he could stand on the limb alone; and, to show his confidence in it as a support, he pirouetted, and hopped two or three yards without putting his right leg to the ground. This was two years after the operation, and attested by Mr. Mackenzie. In Mr. Jones' fourth case, the patient, a little boy, stands equally secure on either foot; walks and runs quickly without any support; and, to show the use which he could make of this limb, he ran up and down the ward kicking his hat, like a football, with the foot of the ankylosed limb. This occurred fifteen months after the operation, and was witnessed by Mr. Mackenzie. In Mr. Jones' fifth case, at the end of six months, the patient, a young man, walked about the ward with crutches, the limb not having yet acquired sufficient strength to allow of his walking easily without support. He laid aside his crutches, however, and showed that he could walk without them. The truthfulness of this statement is attested by Mr. Mackenzie; but the satisfactory issue does not stop here, for we find that this patient was introduced to the inspection of the Medical Society of London on Saturday, November 19, 1853, by Mr. H. Smith, and the following is the gratifying report: "He walked up and down the room without any artificial appliance whatever, and was able to use his limb very extensively, it being perfectly straight, and only half an inch shorter than its fellow, so that it is not necessary for him to wear a high-heeled boot. The knee is ankylosed, there being hardly any move-

^a Edinburgh Monthly Journal, July, 1853, p. 90.

ment; the man is in perfect health, and stated that he had walked as far as six miles together, and is now enabled to carry on his occupation, which is that of a house-painter." Mr. Jones' sixth case, the patient, a little boy, was presented to the Medical Society of London, November 19, 1853, by Mr. H. Smith, seven months after the operation. The limb was quite straight, and there was perfect bony ankylosis at the knee. In this instance, however, the patella had not been removed, so that the boy had full power of lifting the limb, inasmuch as the attachment of the great extensor tendon was left. It was noticed that this little boy walked up the room with the aid of two sticks. This was explained by the existence of a circumstance which rendered the case very interesting. This was a dislocation of the hip of the opposite side, which had occurred spontaneously from disease some few weeks after the operation. Fortunately, however, the disease in the hip had become arrested, and the patient, although he ordinarily used two sticks, was enabled to walk resting upon the arm of another person. He was daily getting strength; and, doubtless, in time, would be able to progress with facility; and Mr. Smith very justly remarks, "if amputation of the thigh had been done, and he used a wooden leg, the dislocation of the hip on the other side would have prevented progression; the superiority, therefore, of excision of the knee-joint was doubly shown in this example." Nothing can be more fortunate than the issue of the case operated on by Mr. Page, of Carlisle, in June, 1852. Through his kindness I have received the following particulars:—

" *Carlisle, November 2, 1854.*

"MY DEAR SIR,—On receipt of your letter I sent for the lad, now nineteen years old, whose knee-joint I excised in June, 1852. I overtook him this morning on his way to the infirmary; he was walking without a stick, and was able to keep up with my horse, which was going at a walking pace, for several hundred yards. He has been, for the greater part of a year, employed at the steam-loom in a cotton factory, which obliges him to be standing or walking through the day; and he says he is able to do as much work, and to earn as much wages, as any one in the establishment. The limb looks quite healthy, and is perfectly straight, and the bones of the thigh and leg are firmly united together." Mr. Page concludes by saying: "I have not yet met with another case in which I have thought the operation altogether advisable, but I shall certainly resort to it again whenever a favourable opportunity may occur.—I am, dear Sir, yours faithfully, W. B. PAGE."

In Mr. Fergusson's second case we are informed, that after six months the young woman was able to move freely about the ward on crutches; and shortly after she resumed her employment, and was able to walk well without any artificial assistance. In Mr. Mackenzie's first case, operated on in February, 1853, we have evidence of the nicest medical surgery, conducting the patient safely through many complications,—obstinate hiccough, wasting diarrhœa; and, lastly, acute pleuropneumonia, extending over a large surface of the diaphragmatic pleura. We have the happy result of this case published in the Reports of the Medico-Chirurgical Society of Edinburgh^a. It is thus reported: "a patient, a man between forty and fifty years of age, was then exhibited, in whom Mr. Mackenzie had performed the operation of excision of the knee-joint a year previously. He appeared to be in robust health, and traversed the hall in various directions with ease and celerity. In walking, the toes were pointed downwards, but his body yielding slightly, he planted the foot firmly on the ground, and rested his entire weight on the limb, without uneasiness. In the horizontal posture he elevated and depressed it with the greatest nicety. On examination the limb was found slightly curved outwards, firmly ankylosed at the knee, three-quarters of an inch shorter than its fellow, and equal in muscular development. The heel of the shoe was raised inside three-fourths of an inch to allow for the shortening; he stated that he had been walking for six months."

In reference to Dr. Gore's case, operated on in October, 1853, I have just received the annexed gratifying intelligence: "The success of the case has been, and continues in all respects complete, both as regards the boy's health, and the use of the limb. He has long discontinued the use of a stick; the bony union is solid; he walks, runs, and plays, with more activity than other boys of his age."

From Mr. Keith, the able surgeon of Aberdeen, I have received the following communication, relative to the case of John Hay, on whom he performed excision of the knee-joint, November 26, 1853:—

Aberdeen, 31st October, 1854.

"MY DEAR SIR,—I have pleasure in replying to your inquiries. John Hay is healthy and active on his legs as a cricket. I append a note to his case, herewith sent to you, which ought to satisfy any one. The following is the valuable termination

^a Association Medical Journal, March 10, 1854,

of the case: 'October 26, 1854.—He runs his mother's errands without staff or cane. The skin is as sound around the knee as on any part of his body; the joint firmly anchylosed; the limb plump and growing. His shoe-heel contains a wedge of cork $1\frac{1}{4}$ inch thick; with this he runs, seldom taking time to walk.'

Mr. Holt, in his letter to me, dated October 31, mentions the important fact, in relation to the case operated on August 7, 1854: "At the expiration of six weeks the bones were anchylosed, and I have no doubt his (the boy's) case will be perfectly successful." The same satisfactory intelligence I have obtained through the politeness of Mr. Statham, in reference to the case in which he excised the knee-joint on the 26th of August. He thus expresses himself confident of success, in his letter to me, dated November 20: "I believe I can safely say that the union is complete, and that she will recover."

From Mr. Evan Thomas, of Manchester, I have received the following report, as to the condition of the boy upon whom he operated, March 28, 1853:—

"Manchester, November 16, 1854.

"The boy upon whom I first operated is in perfect health, and to see him walk you could only perceive that he had a stiff knee; there appears to be hardly any shortening of the limb."

In reference to the case operated upon by Dr. Cotton, Senior Surgeon to the West Norfolk Hospital, I have just obtained from that gentleman the following satisfactory account. I am the more pleased at this, because some very severe criticism has been bestowed upon it in the last November Number of the Edinburgh Medical and Surgical Journal (p. 796):—

"MY DEAR SIR,—I have much pleasure indeed in replying to your communication, and in assuring you that the report of knee resection, in Association Journal of August 4, gave anything rather than a coloured description of the progress and well-doing of the case. Beyond a gradually diminished power of *flexion* at the knee, almost now amounting to firm anchylosis, the patient, up to this time, November 17, 1854 (upwards of twelve months), has improved in general health and strength. He attends, a distance from home, a village school; walks with firmness, and runs with tolerable speed; but the gait continues somewhat stooping. The limb has become more developed, and equals its fellow, but retains the position represented erect in

the woodcut, in lieu of that of the sitting posture, which was permitted before the power of flexion of the knee became impaired."

Having written to Mr. Pemberton, Surgeon to the Birmingham General Hospital, relative to the present condition of the boy upon whom he operated in the February of the present year, I have, through his politeness, received the following satisfactory report, dated this 21st day of November, 1854: "The boy walks about anywhere with the aid of a stick, a leather knee-cap, and a high-heeled shoe."

From Dr. Pritchard I have just obtained the following very satisfactory details relative to the patient upon whom he operated in March, 1853:—

*"Hunmanby Scarboro', Yorkshire,
" November 21, 1854.*

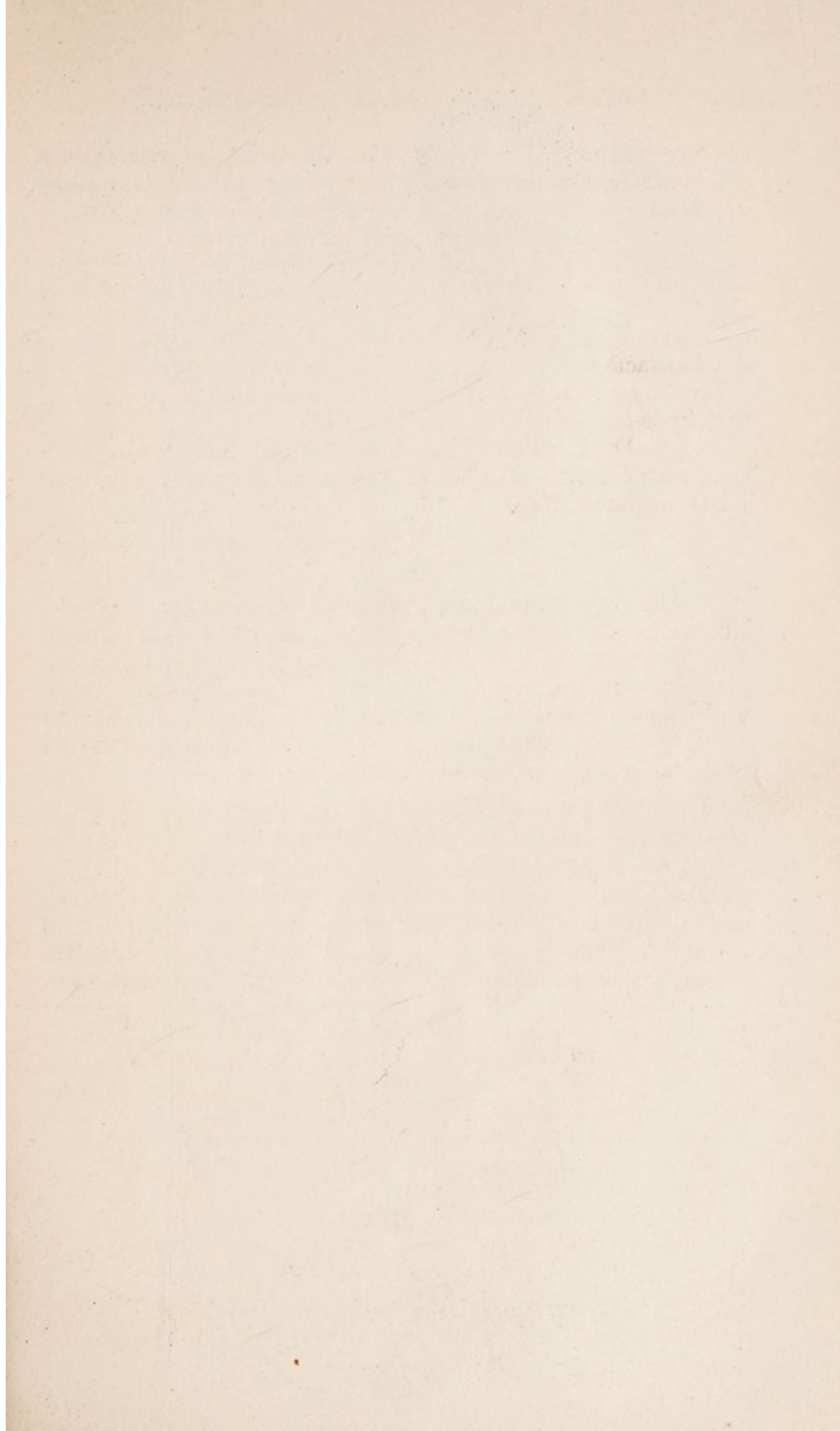
"The patient continues to follow his occupation in trade, and walks almost free from lameness; the only visible alteration from a natural gait is an inclination of the body to the opposite side on each pace or progression. To use his own expression, he never feels fatigued in that limb, but always tires, after a smart walk, in the sound leg; still he can manage a five-mile walk easily, and, he thinks, ten at a push."

Dr. Keith's second case, that operated on in May, 1854, has turned out equally as fortunate as his first.

In his letter to me, dated October 31, 1854, he states:—"On the ninety-ninth day he [the patient] walked; on the one hundred and fifteenth day he was dismissed cured. And yesterday, October 30, he walked to the hospital, a distance of nearly a mile, with a limb stiffly ankylosed, to show himself. He lifts the limb about with freedom, and that without the slightest uneasiness. While walking, he rests on the toes with confidence. The heel wants $2\frac{1}{4}$ inches to touch the ground when he stands erect, with the pelvis squared, showing the height of the heel which his boot requires to enable him to walk comfortably. The whole limb is plump, and he himself florid and healthy to look at. He has grown sensibly in weight and stoutness since the operation."

In reference to the two cases operated on by Mr. Erichsen, the distinguished Professor of University College, London, both have been successful.

In a letter which I have just received (December 9, 1854) through the courtesy of that gentleman, I am informed that the





patient operated on in February, 1854, "is now in excellent health, his *limb ankylosed*. A small sinus leads under the patella, but does not touch bone. The shortening amounts to about two inches. A very severe attack of erysipelas [of the limb, brought on by the application of caustic to the sinus, has retarded the progress of the cure somewhat."

In relation to the boy operated on in October last, the same report states:—"There is a good ankylosis, nearly quite firm; the wounds healed, with the exception of a very small sinus. The child's health is greatly improved, whereas before he was emaciated and weak."

Having written to Mr. Fergusson, the distinguished Surgeon of London, relative to the boy in whose case he resected the knee-joint in July last, I have received the following important information:—

"MY DEAR SIR,—The boy from whom I removed the knee-joint by resection in July last is now in excellent health, and the limb is all that could be desired under the circumstances. The wound has long since healed; and although I have not yet permitted him to rest on the limb, he can move it in all directions freely,—the knee, of course, being stiff. My chief reason for not permitting a free use is that the ankylosis does not seem to have been perfect hitherto. The last time I saw him, about three months ago, it seemed all but complete. From all I can learn, it occurs to me that the proceeding is likely to be established in a great many instances wherein amputation would have been performed in earlier times, and with a much more satisfactory result. I, therefore, anticipate that my efforts in the cause of 'conservative surgery' will prove eminently successful in this instance.—Believe me, my dear Sir, yours, with great esteem, WILLIAM FERGUSSON.

"*Richard Butcher, Esq., Dublin.*"

The following is the appearance and condition of the man upon whom I operated January 20 of the present year. Being anxious to have an accurate drawing of the man, I sent for him to come to the hospital on this day, 8th of December, 1854, and I shall now describe his condition^a:—He stands erect, without the slightest droop. From being an emaciated, worn creature, he has become large and fat, with the entire muscular system well developed. The sickly hue and haggard expression have left his face, and he now looks cheerful and happy. He

^a The accompanying lithograph represents the appearance of the patient at present.

feels in admirable health. On closely examining the limbs, the affected one has nearly recovered its dimensions and muscular tone, the thigh perfectly so; it preserves an accurate axis with the trunk, but is slightly straighter than the sound limb. The adapted surfaces of the tibia and femur are bound together by a rigid, permanent union; grown into each other, they are immovable and fixed. The motions of the limb, effected by the muscles of the hip, are very perfect. When in the horizontal posture, the patient can elevate, depress, rotate inwards or outwards the limb, with the greatest precision and accuracy; he possesses a like power in executing those movements either rapidly or slowly. Unsupported he can sustain the entire weight of his body upon the limb, unassisted by stick or cane. He can walk steadily with scarcely any perceptible halt, the limb being one solid piece. The amount of shortening is not very conspicuous, being two inches; it is not much greater than is absolutely necessary for the perfection of progression under the circumstances. A layer of cork beneath the heel, inside of his shoe, fully compensates for the loss, and conceals all deformity. The motions of the ankle-joint are perfectly preserved. It is true, that upon first making the attempt to walk, even for a short distance, he complained of uneasiness and feeling tired first in this joint, but never referred pain to the knee. This enfeebled condition of the ankle may be fairly ascribed to the maintenance of the limb in a constrained and straight position for such a length of time; it has been, however, only a temporary uneasiness, which gradual exercise and time have removed. The patient can now walk without any support; he plants the limb firmly upon the ground without being sensible of the slightest concussion, and feels confident and satisfied in its strength. On the day before yesterday he walked to the Park and about the grounds, a distance of over four miles, assisted by a walking-stick; and he assured me he was not in the least degree fatigued or the worse for it. Though the bones are grown into each other, yet I never permit the man to go out without an artificial support to the joint: a short splint placed behind, and steadied with a few turns of a roller, answers every purpose. It should be borne in mind, that only eleven months have elapsed since the operation was performed; and I consider half that number more, at least, necessary to pass over before immunity from bowing of the limb can be secured. One sinus still remains on the outer side of the limb above the united bones, discharging a thin, oily fluid; it is strictly confined to the soft parts, and limited to the sheath of the biceps muscle.

Ever since the man left the hospital, now nearly three months

ago, he has followed his trade as a shoemaker; and in this business the limb is of great service; for it is necessary to grasp the shoe between the thighs at their lower part so as to steady it for stitching. This he is perfectly enabled to accomplish by supporting the limb upon a form. Had the thigh been amputated, he says he could not have worked at his employment.

The portions of bone taken away in this case are truly represented of their full size; and the figure of the man as he stands *now*, eleven months after the operation, is most accurately depicted by the faithful pencil of Mr. Connolly. The bones and original drawings are in my possession.

From the foregoing details, the attested record of truthful, eminent surgeons, the usefulness of the limb must be admitted as perfectly adapted and adequate for progression. The question as to the seemliness of the member is, I think, as satisfactorily answered. In reference to both these deductions I can raise my voice powerfully in the affirmative.

The tediousness of the convalescence has been urged as an argument against the operation of excision. No doubt, this unquestionably detracts, in a limited degree, from the benefits of the measure; yet, upon attentive consideration, it will not be found to pertain as forcibly as might at first sight appear. In some of the cases recorded, the patient was able to walk as soon as he possibly could upon a wooden leg, if amputation of the thigh had been performed. Mr. Syme, in his work on *Excision of Diseased Joints*, states, in reference to the first case upon which he operated, "in the course of four weeks after the operation the wound was all but healed; and the limb, before the expiration of three months, had regained so much strength that the patient could make some use of it in walking" (p. 137). Again, Mr. Syme states at page 131:—"It ought here to be recollected, too, that though recovery from amputation of the thigh is usually completed in three or four weeks, it is generally *at least as many months* before the patient can rest the weight of his body on the face of the stump so as to use it in standing or walking." In reference to this point, I would sum up, in a few words, my own opinion:—The limb must be kept immovably fixed, by proper apparatus, for a length of time; but this necessarily does not imply confinement to bed and exclusion from being placed on a couch in the garden in fine weather. Neither does it, in the better classes, prohibit carriage exercise, agreeable society, &c. &c. In either grade the result in saving a serviceable limb will more than compensate for all the weariness and restrictions necessarily entailed. Ano-

ther objection has been brought forward against the operation of excision, and which demands grave consideration. It has been asserted, that where the operation is performed in early life, the growth of the limb has been checked, and, consequently, that the lower extremities do not keep pace with each other, and hence one becomes so disproportioned to the other as to be ultimately useless. The only existing proof of this which I can discover is in Mr. Syme's case. On this point he thus expresses himself in 1848, alluding to the child upon whom he operated seventeen years before:—"The knee-joint may be excised, but not with the effect of preserving a limb so useful as an artificial substitute after amputation of the thigh. I tried the operation, nearly twenty years ago, on a boy who recovered perfectly from it, and seemed at first to possess a limb little inferior to its fellow, except in so far as it was stiff at the knee. But in the course of time it was found that the growth of the two limbs was not equal, and that the one which had been the subject of operation gradually diminished in respective length, until it wanted several inches of reaching the ground when the patient stood erect"^a. It is well known that a number of experiments have been performed upon animals to show that bones do not grow when deprived of their heads. This Anthony White stated to be the case; but the results do not seem to confirm such a conclusion. While, on the other hand, we have a number of experiments on the lower animals to prove that a limb may continue to be useful even after the removal of the articulating extremities from one of the joints. Vermaudois excised the head of a femur in a dog; in the course of a few weeks the animal was found to have acquired some power over the injured limb, and ultimately could make free and strong use of it, though the shortening occasioned a limp in the walk. A similar result attended like parallel experiments made by Koeler and Wachter.

In order to account for the result as it happened to Mr. Syme, a solution is afforded by Mackenzie. "He thinks it is possible that it might be attributed in this instance to ankylosis not having taken place." There is no doubt that upon close examination it will be found that the bones were not placed in proper apposition until "after several unsuccessful attempts at the end of several days." Yet after all this "the patient could walk and run, though with a halt, without the constrained appearance of a person with an artificial leg." The report goes on to say: "The limb is stout and well nourished, and though

^a Contributions to the Pathology and Practice of Surgery, p. 225.

slightly bowed outwards, does not occasion any disagreeable deformity; it allows a slight degree of flexion and extension^a. To this mismanagement I conceive may be attributed, in a great measure, the blighted growth of the limb. The question may fairly be asked, is the growth of the upper extremity checked by excision of the elbow-joint? Surely, the numerous children who have undergone this operation at the age of six or seven, have not grown to adult age with the stunted arm and hand of little more than an infant. If so, Mr. Syme, as the luminary of the north, has left us in great darkness, though vaunting his "dozens of cases"^b. Yet he never alludes to such a sequence, which, if it ever occurred, surely could not have been overlooked by one of such penetrating acumen. Practically upon the growth of the limb, after excision of the knee-joint, we have now truthful, authentic information. It is distinctly stated by Mr. Page in the report of his case: "At the time I operated on this boy I was fearful lest a like misfortune should happen to him as that in Mr. Syme's case, where the patient was growing, and that the limb might not keep pace in growth afterwards with the rest of the body; but I am glad to find, by careful measurement, that there is now no greater shortness than at first, although the boy has grown considerably." In Mr. Keith's letter, which I have already referred to, we have additional evidence as to the growth of the limb after excision of the joint, in allusion to the case of John Hay, aged 9, operated on in November, 1853. He writes:—"October 26, 1854. He runs his mother's errands without staff or cane; the skin is sound around the knee as on any part of his body; the joint firmly ankylosed; the limb plump and *growing*; his shoe-heel contains a wedge of cork, $1\frac{1}{4}$ inch thick; with this he runs, seldom taking time to walk."

Having written a few days since to Mr. Jones, of Jersey, relative to this most interesting and important question, he faithfully assures me that the two boys, upon whom he operated in 1851 and 1852, are in perfect health, and able to walk miles without experiencing the least fatigue; and he concludes by saying: "It is my firm conviction that Mr. Syme's views are not correct upon the point you allude to;" and he corroborates his impression by the following demonstrative proof: "My last case (in 1853) must, in a great measure, set this point at rest. In this case I preserved the patella, and did not divide its ligament. The cure in this instance was most perfect, and

^a Syme on Excision of Diseased Joints, p. 131.

^b On the Pathology and Practice of Surgery, p. 247.

became so in a very short time. About three months ago symptoms of visceral disease came on, attended with diarrhoea, and a fortnight since my patient died. (This letter is dated November 6, 1854.) I have seldom had a more interesting post-mortem examination. There cannot be a doubt that, in this instance, the limb, from which the joint was excised, kept pace with the other in every respect. The leg and thigh were carefully measured after the operation, as also the former and latter on the sound side; and, after death, all the bones were compared, and with the most satisfactory result. I have now this specimen in my museum, and a most interesting one it is; there is solid bony union, and the specimen shows the immense advantage there is in preserving the patella and its ligament."

The most truthful statements ever recorded have met with some sceptics; and to such, in the present instance, I would say,—even suppose the limb is so much respectively shortened in after years,—the objection applies only to the operation being performed on children, and has nothing to do with the question of the propriety of excision in the adult.

In order that excision of the knee-joint may prove successful, it becomes imperative that the cases are carefully selected; by "successful" I imply not only the preservation of life, but also the saving of a limb, better than any artificial substitute, no matter how beautifully contrived. It is not applicable, for obvious reasons, where the bones entering into the articulation are very extensively diseased; for though I admit a better chance of preserving life would be secured by excision, even in this case, than by amputation, yet the member would be faulty as a means of progression; it would be short, and a useless appendage. I need scarcely make allusion to organic disease of the viscera as affording an insurmountable objection; but this applies, with equal force, to the non-proprity of amputation. In such a condition either operation becomes only justifiable to alleviate excruciating torture. I do not lay much stress upon the integuments being extremely disorganized, or think that such a state militates with any force against excision, for in numerous instances, after removing carious and dead bones, I have been forcibly struck by the remarkable rapidity with which the soft parts set up healthy action and recover themselves,—parts undermined and sinuous when relieved from irritation, and set at rest, become very amenable to simple management. It has been objected too, that after resection the discharge is very great, and runs the patient rapidly into hectic. No doubt the discharge from the divided surfaces is considerable,—may be profuse,—yet is healthy; it

is essential to the process of reparation, and diminishes day by day according to judicious management; it is not so with the ichorous discharge, created from the morbid action aroused by the presence of diseased and deadened bones, which, acting as the poisoning supply of the constitutional disturbance, seals the doom of the being, unless relieved by operative surgery. It should never be forgotten, that resection of the knee-joint is only advocated as a substitute for amputation, and not for the simple mode of incising the joint, to which practice Mr. Gay has recently directed the notice of the profession. If Mr. Gay will just consider this axiom, and read carefully the practical evidence which I have advanced from most able surgeons, he will perceive how premature, hasty, and incorrect is his statement, that resection "is not only a useless, but an unphilosophical mode of treatment for diseased joints"^a. Equally absurd is the opinion of Mayo, denouncing all excisions except that of the shoulder. In his *Outlines of Pathology* it is written: "Excision of the articular ends of bones, in joint diseases, leads me to speak with no approbation. I suspect, when it has been performed successfully, it has been performed before the degree of exhaustion which renders an operation decidedly necessary has arrived. Where an operation is clearly required, the constitution has generally no longer force enough to support the tedious process of restoration which follows excision; it is better, in my opinion, to wait till all chance of other cure has failed, and then to amputate." I shall merely refer to Park's case, or to the one upon which I operated, as given in detail, to afford a perfect refutation to this statement as applied to the knee.

The applicability of the operation of excision of the knee-joint to cases of recent accident, and gunshot wounds, will depend upon the extent, and be estimated by the amount of injury the soft parts, including the vessels and nerves, have sustained, as well as that inflicted upon the bones. The practical surgeon will be able to compute with accuracy, after careful examination of the parts, how far this method of preservative surgery can be put into practice, and trusted to with hopes of success.

Dr. Buck, of the New York Hospital, has applied this operation to a case of angular ankylosis of the knee. In Mott's edition of *Velpeau's Surgery* will be found a full account of the case in which this operation was successfully performed. In this country I do not think the experiment is likely to be

^a *Lancet*, November 22, 1851.

followed, even granting the condition of the patient to be such as Dr. Buck describes previous to his operation:—"Since his recovery from the effects of the injury the patient had enjoyed uninterrupted good health, and had been free from pain or tenderness in the knee. He had been accustomed to walk with one crutch, though sometimes he dispensed with it, and stooped to accommodate himself to the shortened condition of his limb."

Lest this opinion of mine should be considered hasty, I shall just append that of M. Bonnet of Lyons, quoted from his last great work^a. M. Bonnet, speaking particularly of the *cuneiform exsection* for angular ankylosis, says: "It is one of those operations which may be performed under the influence of those illusions which preoccupy the mind of every one who has invented a new operation; but no one, who is not seduced by the charm which clings around all new discoveries, would be willing to expose his patient to the consequences of a compound fracture, and consequently to loss of life, in order to shorten a limb already too short, and to substitute one deformity for another."

Various operative methods are advocated for exsection of the knee. Park performed a crucial incision, whose transverse branch, placed above the patella, would comprise the half of the circumference of the limb. After having divided the tendons of the extensor muscles of the leg, and turned back the four flaps, raised up the patella, made the section of the lateral ligaments, and divided through the articulation from before backwards, Park inserted a large knife along the posterior surface of the femur, in order to detach the soft parts from it, while taking care to avoid the popliteal vessels. Nothing now remained than to saw the bone above the condyles; the extremity of the tibia is afterwards exsected with the same precautions.

Mülder proceeded in like manner; only, after having cut through the thigh-bone, he bent the leg, by which the condyles were protruded, and then he sawed off the upper part of the shin and splint bones, having passed a spatula behind them.

Moreau recommends two lateral incisions, a little in front of the borders of the ham, which incisions he unites by dividing transversely the skin and ligaments below the patella, in such manner as to penetrate down to the articulation; afterwards he detaches from the posterior surface of the bone the soft parts which surround it, then dissects and raises up the quadrilateral flap circumscribed by the three first incisions, and afterwards performs the section of the femur with the same precautions

^a *Traité des Maladies des Articulations.* 2 vols. 8vo, 1845.

used in the process of Park. If the bones of the leg are also affected at the same time, the outer incision should be prolonged as far as the head of the fibula. Another is made upon the crest of the tibia, by which means we have two lower flaps, one on the inner, the other on the outer side, which flaps are to be dissected and turned down. The posterior surface of the tibia is then to be isolated from the vessels and nerves, as well as from the origin of the gastrocnemius; and finally, all the portions of the diseased bones are to be removed by means of the saw.

The process laid down by MM. Sanson and Begin is as follows:—They recommend, after half bending the leg, to make a transverse cut from one lateral ligament to the other, and to divide them and the ligament of the knee-cap at a stroke. The joint surfaces of the thigh and shin bone are then easily laid bare; and by continuing the cut, according to circumstances, along these bones, the joint surfaces of one or other bone may be protruded and easily sawn off.

Jaeger proceeds in like manner, making upon a transverse cut, nine inches long, which divides the ligament of the knee-cap and the lateral ligaments, two side cuts an inch long, of which each is distant about an inch from either end of the transverse cut.

The process of Mr. Syme differs from those above in more respects than one. The operator makes in front of the articulation two semilunar incisions, one above and the other below, which are united together on a line with the lateral ligaments and circumscribe a transverse ellipse, including the patella; he then excises this ellipse and the bone which is comprised within it, divides the ligaments, and opens into the articulation, and excises in succession the diseased extremities of the femur and tibia.

Mr. Fergusson's directions for the performance of this operation are the following: "An incision between three and four inches should be made on each side of the joint opposite the lateral ligaments, and a third should be carried across the forepart so as to unite the whole like the letter H. The ends of the lateral incisions should be at nearly equal distances above and below the articulation, and that in front should extend over the patella. This bone should now be detached by dividing the textures around it close to its margins, and the soft parts should then be dissected upwards and downwards to a sufficient extent to permit a thorough examination of the diseased bones. And to facilitate this, as well as the future stages of the operation, the lateral and crucial ligaments should be divided; the

saw, forceps, and gouge, must be used according to circumstances. The diseased portion of the femur may be first removed, and then the head of the tibia, and also the head of the fibula, should it be involved in the affection. In using the knife in the posterior part of the joint more care is required than in cutting deep into the elbow, for in dividing the crucial ligaments there is nothing between the instrument and the popliteal vessels but the posterior ligament and some cellular texture; in applying the saw, too, more care is required."

Mr. Jones at first selected Moreau's method of operating; but latterly, in addition, he not only saves the patella when practicable, as recommended first by Mackenzie, but also the ligamentum patellæ. The operation was performed by him on the 17th of April, 1853, after this mode: "A longitudinal incision was made on each side of the knee-joint, midway between the vasti and flexors of the leg, full five inches in extent, rather more than half the length was over the femur, and rather less than half over the tibia. These two cuts were down to the bones; they were connected by a transverse one just over the prominence of the tubercle of the tibia, care being taken to avoid cutting the ligamentum patellæ by this incision; the flap thus defined was reflected upwards, the patella, its ligament, and the joint, thereby exposed. The synovial capsule was cut through as far as it could be seen; the patella and its ligament were now drawn over the internal condyle, while the joint was kept extended. It was next forcibly flexed, the crucial ligaments, almost breaking in the act, only required a slight touch of the knife to divide them completely,—the articular surfaces of both bones were thus completely brought to view, and their ends sawn off. The patella (after the diseased portion had been gouged out) and its ligament were replaced as nearly as possible in their natural state." Mr. Jones, however, does not recommend this plan of operation as adapted to all cases of knee excision, but, continues,—“very far from it; there are cases in which it is altogether inadmissible; and I feel persuaded that whoever adheres to one mode only will often find himself wofully disappointed in the result”^a.

In Mr. Mackenzie's first case he performed the operation after Moreau's method; but in his second and subsequent operations he adopted another plan. In his second case he thus expresses himself:—“Having found the disadvantages of the H-shaped incision in my first case, I now exposed the interior of the joint by a semilunar incision, extending from the inner

^a Medical Times and Gazette, July, 1853, p. 11.

side of the inner condyle of the femur to a corresponding point over the outer condyle, the incision passing in front of the joint nearly as low as the tuberosity of the tibia; the flap thus formed was dissected back, the *ligamentum patellæ* being divided, and the patella itself left in the substance of the flap; the cartilage which remained on its surface was removed by the gouge, as well as the rough surface of bare bone around its articular margin." In every other essential particular the operation was conducted as after Moreau's plan.

The method which I have pursued, as will be seen by a reference to the case of Game, was very nearly in accordance with that recommended by Moreau. Each step of the proceeding has been carefully described and attached to the case. From various trials upon the dead body, I am convinced the joint can be very readily excised by the semilunar incision advocated by Mackenzie; and I would further add, every word which he has written in relation to this subject is truly correct, and becomes the more valuable now that he is no more.

I shall next lay stress upon some of the chief points prominent in the execution of this bold operation, as also the after management of the limb, and the best way of meeting and allaying the constitutional disturbance so frequently evoked after severe operative measures. The shock resulting from excision is said to be far greater than after amputation. In order to arrive at a correct conclusion upon this statement, it would be necessary to lay down the precise condition of the soft parts about the knee, the length of time the disease existed, the efforts at repair set up from time to time, &c. For by a reference to the foregoing cases it will be seen the facility with which in most instances the joint has been excised, while in others it proved to be a far more difficult and tedious measure. I do not think I would be dealing fairly with this subject unless I adverted to the great difficulties which Park encountered in his first case, though a bold, able, and dexterous operator,—it is the more necessary to do so, because all recent reports only extol the facility with which excision may be accomplished. I freely admit all this too; and without egotism may say I have as good use of my hands as most operating surgeons, yet in the case which I have given excision was by no means an easy measure. I merely wish to mention these facts, not to deter, but simply to put the surgeon upon his guard, so that he may fairly weigh all things before he sets about this operation. It is not out of place to mention again, that in the case which I cut, all the soft parts resisted the knife like Indian-rubber. Great difficulty was experienced in detaching the flaps from the bones:

all were matted together, particularly behind, so that extreme caution was required in liberating the bones in the vicinity of the popliteal vessels. I speak these things because I do not think they should be concealed. A like condition of parts may embarrass the young operator if he is not resolutely prepared. While, on the other hand, I might mention the operation performed by me was by no means a prolonged one: it was executed within four minutes, though the obstacles to its completion were very great.

Happily, the shock now need not be so greatly estimated or dwelt upon. Chloroform protects the sufferer; and I certainly attribute much of the success which in latter days has attended this formidable operation to the beneficial agency of this potent medicine. In nearly all the cases which I have collected, it has been used; in every successful instance narrated it has been given. In the case upon which I operated, the man was reduced to the lowest state, and would almost to a certainty have sunk from the shock either after amputation or excision, yet by this powerful means all violent struggles were prevented, and, of course, the patient saved from subsequent exhaustion. How different this tranquil sleep from the writhing torture of the sufferer under a similar operation described by Sir Philip Crampton:—"The poor girl, who, in coming into the operating-room, exhibited the greatest fortitude, and even cheerfulness, on the instant that the knife was applied to the skin became so ungovernable that four strong assistants could with the utmost difficulty retain her upon the table. This necessarily prolonged the operation, and, no doubt, very much increased its severity. The removal of the divided extremity of the femur, which in the case of Connolly was effected with the utmost ease, in perhaps less than a minute, was here rendered a work of infinite difficulty and danger, as when the knife was passing between the popliteal artery and the bone, and actually in contact with the former, no entreaty could induce the poor girl, *whom terror seemed to have deprived of her reason*, to remain for one moment at rest; she struggled so violently with both limbs, that it was with a degree of labour and anxiety, such as I had never before experienced, that I at length succeeded in passing the edge of the knife round the condyles posteriorly, and thus detaching the divided extremity of the femur"^a.

I have enumerated various methods of operation recommended by the distinguished names attached to each. By incisions planned after either, the joint can be very readily reached

^a Dublin Hospital Reports, vol. iv, p. 205.

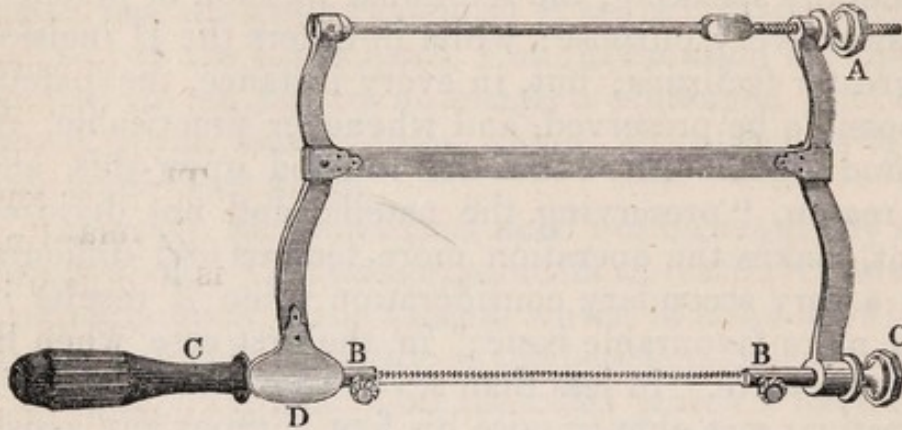
and exposed. I consider that in the selection of any, the wound must extend far back, to allow of the free discharge of matter, and the case to be operated on must not altogether be lost sight of, as some peculiarity may require special consideration. Generally speaking, the semilunar incision of Mackenzie will answer every purpose; while in others the H incision will offer greater facilities; but, in every instance, the patella should if possible be preserved, and whenever practicable, its ligaments undivided. Mr. Jones has insisted upon this, and with good reason, "preserving the patella, and not dividing its ligament, makes the operation more tedious and difficult; but this is a very secondary consideration when it results in obtaining a more favourable issue;" in the first case when he adopted this measure, "in less than seven weeks after the operation the patient was able to raise his foot without any assistance; while a young man who occupied the next bed, and in whose case everything had gone on favourably, was only able to do so in as many months"^a.

Amongst the many modes of incising the soft parts which I have mentioned, there is not one to which exception can fairly be taken except that of Mr. Syme. He advises an elliptical piece to be cut from the anterior wall of the joint, included in the arms of the ellipse the patella. I do not for a moment doubt the propriety of removing the bone *when diseased*; but I know no condition that can warrant the cutting away of the flaps; if they are in a perfectly healthy state they will not be found too great after a little time; they will adapt themselves by contraction to the altered state of the parts beneath: if they are perforated by sinuses, and present an appearance which by some may be called disease, they will recover themselves after the carious bones are removed, and not be found too extensive, but will constitute an accurate involucrum for the divided osseous surfaces. Again, such a proceeding would be totally at variance with Mr. Mackenzie's improvement in the operation, the saving of the patella, and also with that of Jones, embracing not only the conservation of the bone, but likewise its ligamentous attachments.

Having so disposed of the soft parts, we next come to the division of the bones, the cutting of the diseased surfaces from the femur and tibia. The saw which I have used for this purpose is one to which I have before drawn the attention of the profession; during the last four years I have employed it in all amputations and resections, and am now far more satisfied

^a Medical Times and Gazette, July, 1853.

of its efficiency than ever; it is peculiarly adapted for resections. First I will present to the reader an accurate woodcut of the instrument, with its serrated edge turned outwards as used in resection.



I shall next digress for a moment in order to give a description of the instrument. The measurement of the full-sized saw is as follows:—The upright pieces are six inches high, half an inch wide, and two lines thick; the one remote from the handle is received into the transverse bar, and is movable; the depth of the blade is three lines, with the teeth well set off from each other, and inclined forwards; the length of the blade is six inches, with the sockets included eight inches and a half; the middle bar is half an inch deep and two lines thick; and the upper bar is rounded, with a screw at one end: (A, the nut applied to the screw, which makes tense the blade; BB, the pins that secure the blade in the sockets; cc, the handle and nut, by turning which the blade is rotated to any angle; D, the rest for the index finger; at present the blade stands turned, and fixed for exsection; concealed by the finger rest, on the opposite side is a small screw which prevents the rotation of the blade). The instrument for capital operations I have had made of the above proportions, but it is also executed on a smaller scale for minor operations. The advantages which I conceive this saw possesses over every other are the following: from the extreme shallowness of the blade it readily cuts in a curve, if required; and from its slender proportions it can be easily slipped under the flaps, and used without bruising them, or catching in the retractor. No matter how unsteadily or unevenly the limb is supported and held by the assistant, the saw cannot be locked; the thin, shallow back, the fine setting of the teeth, the mode in which they project to either side, all contribute to prevent the possibility of such an occurrence, for a perpendicular section of the blade shows it to preserve a triangular form, the base below, therefore, the

instrument must work freely in the groove which it has made. It cuts more evenly than any other saw, and the bones cannot be splintered by it, consequences resulting from the fineness of its setting, and the lightness of the instrument; and lastly, it cuts more rapidly than any other saw, owing to the extreme tension of the blade, produced by acting on the screw in connexion with the upper bar of the instrument; the effect being perfected in a very material manner by the mode in which the blade is rivetted in a direct line with the teeth. This instrument will be found most useful in all resections, for, by relaxing the screw above, the sockets in which the blade is lodged are permitted to rotate, so that the teeth may be directed outwards, as seen in the woodcut; while, by unscrewing the pin, marked B, the blade is readily detached, and being sharp at the point, is easily passed behind the bone (an arrangement necessary, if there is no breach of continuity), with its edge applied to it, or at any angle required; the blade is again fastened at B, and when made tense, a few movements of the instrument will readily sever the bone from within outwards. Again, owing to the facility it affords in cutting curves, it is well adapted for removing exostoses, cutting out the great trochanter, &c. But to return to the subject, this saw is peculiarly applicable to resection of joints. In these cases I conceive it is far better in the first instance to separate the bones from each other before they are sawn: by this method the entire proceeding can be accomplished with greater facility, and with less danger to the vessels than when they are left undivided. When the portions to be removed are sufficiently freed from the soft parts, the fine blade of the instrument is placed behind the bone, its serrated edge in contact with it, and held firmly so; then, by a few sawing movements, the instrument cuts its way outwards, rapidly dividing the part. If the surgeon prefers not separating the bones previous to cutting them, then, I say, the saw is equally applicable, for he can detach the sharp end of the blade, and after passing it behind the bone, make it fast again, and with the same facility effect his purpose. The thinnest shell of bone may be removed by this instrument with the same evenness and precision as a larger section. This is strikingly illustrated in the portions which I cut off from the tibia and femur in the case of Game. I have very recently employed this saw with like satisfaction in a case of excision of the elbow-joint, when it equally answered every purpose.

After any of these methods of operation the hemorrhage is very trifling; of course, if a vessel of magnitude springs, it must be secured by ligature.

Immediately after excision of the joint is accomplished, before the patient has been taken from the operating table, the limb should be placed in the extended position, and retained so immovably in a solid case, such as I have described. In some instances it has been shown that the difficulty to force back the femur, and prevent its projecting in front, has been very great; by proper manipulation this difficulty can be overcome, without violence, by one or either of the following measures. Generally speaking, this, the milder method, will succeed: when the ends of the bones are cut away, gradual, yet powerful extension, continued for ten or fifteen minutes, and longer if necessary, should be made upon the leg, so as to counteract, tire out, and subdue, the violent contraction of the hamstring muscles. During this manœuvre the thigh should be gently, yet steadily, pressed backwards, so that the cut surfaces of the bones may be opposed to each other, and then, being pressed back into a straight line, and retained so by proper supports, they offer mechanical resistance to each other, and thus displacement is prevented; but if this method fails,—and it will most likely do so in those cases where the leg has been for a length of time flexed upon the thigh, and the muscles have assumed a spastic contraction of a settled character,—here I would most certainly recommend the surgeon to divide the hamstring tendons (in preference to cutting off another piece of the healthy bone). This becomes more imperative when the head of the fibula has not been removed, and the tendon of the biceps interfered with; it is the powerful and spasmodic action of these muscles dragging the leg upwards and backwards, that creates to a great extent the deformity, by the thrusting of the thigh bone forwards: by their division, then, not only is reduction easily secured, but all tendency to after displacement checked. The limb, I repeat it, should be secured from the very first in the extended position, and rigidly maintained so through the entire cure. In my mind the same arguments apply here as in the treatment of fractures of the thigh^a, the object of the surgeon being, in either case, to avert spasm, and to obtain as quickly as possible a permanent osseous union between the disunited bones.

Some operators contend that a slight degree of flexion and extension is desirable after excision of the knee-joint; to this opinion I cannot subscribe, for two reasons: first, because as a means of sustentation the limb would be found inadequate,

^a See my Essay on Fractures of the Thigh Bone, Dublin Quarterly Journal of Medical Science, February, 1853.

and not so slightly in appearance; secondly, the very motion perpetuated between these bones, already prone to carry on unhealthy action, would become an exciting cause for a renewed development of disease. No; I conceive, for perfection as a result of excision, the tibia and femur should be grown into each other and bound by callus; and, far better still, when the patella, deprived of its cartilage, and undisturbed from its berth in front, becomes fused into this connexion. A limb cured in this way will harmlessly endure the fatigues of travel. An objection has been made to uniting the limb in one solid piece, on the grounds of its liability to fracture being far greater than when some motion is permitted between the bones. My answer is, such a result has never taken place; and I am equally certain that the force requisite to break the callus union or limb in any part of its length would entail far more grave and serious mischief if applied to a limb enjoying partial motion; in the latter, the fibro-ligamentous structures would be all torn up from their connexions, and, as a sequence, high and active inflammation readily set up, followed by the rapid formation of matter, and all its train of fearful consequences. Even suppose this burst of mischief checked by energetic treatment, the danger would not be removed: a slow, insidious action would rouse up the latent disease, which in turn would prey upon the general health, until the only chance of preserving life would centre in amputation. Now, in the former case, no such dismal consequences present themselves; the fractured limb might be brought to its full length, and maintained so by the application of the long splint, until union be again accomplished.

The amount of success following all severe operative measures greatly depends upon the care and assiduity bestowed on the after treatment, both locally and constitutionally. Probably in the entire range of operative surgery there is no class of cases which demands such close and attentive looking after as that now under consideration. It will not be sufficient for the surgeon after he completes a severe resection, be it in ever so masterly a manner, to delegate his duties to another, and after he puts aside the knife to consider his part done. No; if he is desirous of success, he must use his own hands, and be the dresser; while by his watchful eye he will readily discover the early threatening of incipient mischief. After all severe surgical operations I am in the habit of employing stimulants and sedatives very freely, together with nutritious food apportioned to the assimilating powers of the individual. This treatment is most imperatively urgent where the patient is advanced in life and has endured lingering disease for a length of time.

It is, I would say, equally necessary to the infant and the child; whereas, in reference to the middle periods of life, the diminution or increase of supply must to a great extent rest upon the judgment of the practitioner. By the copious administration of stimulants the flagging powers of life are upheld; by the free exhibition of sedatives, pain and irritation and spasm are subdued. To how great an extent it may become necessary to press these measures is amply illustrated in the case which I have given in full detail. Here it was necessary absolutely to flood the patient with wine and opium, and in every way abundantly to supply nutritive aliment.

In the foregoing pages I have endeavoured to give an unbiassed and candid exposition of all the facts bearing upon the important question of resection of the knee-joint,—a question of vital importance to the profession and to society at large. In doing so, I trust I have dispassionately considered the subject, and every contingency likely to arise. The important information afforded by numerous hospital surgeons, whose names are herein recorded, makes the mass of evidence brought to bear upon the subject all-convincing and conclusive. Not only are the ordinary details of the cases given, but likewise a continuous account of them afforded up to the present day, thereby creating a record sufficiently comprehensive towards refuting every objection, and establishing the operation of excision of the knee-joint upon the soundest principles of our art, upon the solid basis of truth.

In conclusion, I have only to add how deeply I feel indebted to those able men who so readily answered all my inquiries, and to thank them in the name of that noble profession under whose banners we have taken soldiership, and whose cause we have pledged ourselves to support and exalt.

