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ON
EXCISION OF THE KNEE-JOINT.

BY R. J. MACKENZIE, F.R.C.S.ED., ETC.

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HITHERTO an impression most unfavourable to the performance of the operation of excision of the knee-joint appears to have been entertained generally by the profession; and severe censures have been passed on those who have, within the last three years, revived the operation, as well by those who practically are quite ignorant on the subject, as by those whose experience and professional standing entitles their opinion to attentive consideration.

My own experience on the subject has as yet been too limited to warrant my speaking with any degree of confidence as to the result of the operation. I have performed the operation in two cases, but although the results of these cases hitherto have fully realised my expectations, yet the number is too small, and the time which has elapsed since the operation was performed is too short, to allow much weight to be attached to my personal knowledge of the operation. I have been induced, however, to write the following short notice of the subject by the conviction, from what I have lately seen of the results of the operation in several cases where it has been less recently performed, that the operation is one which has been rejected from surgical practice on insufficient grounds, and that it will yet come to supersede, in many cases, the severe operation of amputation of the thigh.

In order to enable us to arrive at a rather more definite conclusion than hitherto, as to the propriety of the operation, I propose to give a short account of the few cases in which, as far as I know, the operation has been performed.

The operation was first brought prominently before the profession by Mr Park of Liverpool, in 1783. It had been previously performed successfully by Mr Filkin of Northwich, but no satisfactory record

of Mr Filkin's case exists. Mr Park, in speaking of the result of his first case, says that a year after the operation his patient "was able to walk with great ease and firmness, without even the assistance of a stick, or of any kind of splint to support the union," "the foot being three quarters of an inch shorter than the other one." Seven years later Mr Park gives this additional account of the same case:—"To the history of the case of Hector M'Caghen, 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 perform 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 upsetting of a flat in the river Mersey." Mr Park repeated the operation, but his second case proved less fortunate, the patient, a very unfavourable subject for the operation, having died about four months after its performance.

Moreau, some time afterwards performed the operation in three cases. Of his first case he says:—"At the end of the third month the consolidation of the bones was such that I left the limb at liberty in bed; the patient moved it about at his pleasure; 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. Epidemic dysentery of a fatal kind appeared in the hospital, by which the patient was attacked, and from which he sank three months and a half after the operation. "This unfortunate accident," says Moreau, "deprived me of the pleasure of enjoying the fruits of my care; but I remain convinced of the utility of the operation, and persuaded of the propriety and necessity of performing it in similar cases. I looked on my patient as cured, for I had no relapse to dread." In Moreau's second case the operation proved fatal. In a third case by the younger Moreau, the result was more fortunate, the patient recovering with a serviceable limb.

In 1809, Mülder excised the knee-joint of a pregnant female. Two months after the operation she was delivered of twins, and some time afterwards died from tetanus.

The next notice of the operation is by Mr Crampton, in 1823. The operation in Mr Crampton's first case can scarcely be said to bear on the question of excision of the knee-joint; not only were the patella and part of the tibia removed, but upwards of six inches of the thigh bone were taken away. The patient, however, lived upwards of three years after the operation, and then died from phthisis. Mr Crampton, in his remarks on the case, says, 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 tibia, the limb, from its shortness, would have been useless. The operation was performed in the

same year in a second case by Mr Crampton. The girl, although a most unmanageable patient, made an excellent recovery. Six months after the operation, the femur and tibia were consolidated by a firm bony union. Eight months later, she is reported as being able to walk a distance of nearly five miles at once; and upwards of three years after the operation, Mr Crampton says:—"I have examined the limb, and find that the femur and tibia are firmly consolidated; the leg and thigh are not in the slightest degree wasted, but the limb is considerably bowed outwards; she wears a shoe with a cork sole four inches thick; and, to use her own expression, 'is able to stand or walk the length of a day.'"¹

The operation was next performed by Mr Syme, who, in 1829 and 1830, excised the knee-joints of two children, of seven and eight years of age. Up to this time the operation had only been performed in adults. The result in the second case was unsuccessful, the child having died about ten days after the performance of the operation. Writing in 1831, Mr Syme gives the following satisfactory account of his first case:—"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. It has been progressively improving since, and is still doing well. I have no doubt that ultimately it will be nearly as useful to him as ever; but even at present he would be very sorry to exchange it for a wooden one. He can walk and run, though with a halt, without the constrained appearance of a person with an artificial leg, and merely requires the *heel* of the shoe to be two inches higher than the other. The limb is stout and well nourished, and though slightly bowed outwards, does not occasion any disagreeable deformity; it allows a slight degree of flexion and extension." Seventeen years later, however, a much less satisfactory account of the same patient is given. In speaking of excision of the knee-joint, in 1848, Mr Syme says:—"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."

After Mr Syme's experience in 1830, the operation seems, as far as I can ascertain, to have been abandoned till within the last three years. The results of the operation on the whole had been decidedly

¹ I quote this from a work published eight years after the performance of the operation (Syme on "Excision of Diseased Joints," 1831). I understand, however, that the bones in this case yielded so much afterwards, that ultimately they were ankylosed at a right angle, a result which ordinary precautions, on the part of either patient or surgeon, might certainly have averted.

unsatisfactory. Of eleven cases in which it had been performed, six had died, and five had recovered. Of the fatal cases, however, some at least may be said to bear little on the merits of the question of excision, Mülder's case for instance, where the patient was far advanced in pregnancy when the operation was performed, and died of tetanus after parturition; and Mr Crampton's case, in which, although between six and seven inches of the thigh bone were removed, and the disease not yet eradicated, the patient lived for more than three years, and ultimately died from tubercular phthisis. The *epidemic* dysentery, however, which carried off Moreau's first case, cannot, I think, be altogether looked upon as an accidental occurrence, diarrhoea and gastro-enteritis being, as is well-known, a common cause of death after all severe operations. The result in the remaining three fatal cases was attributable in each case to the direct effects of the operation. Of the five cases which had recovered, the limb appears to have been thoroughly serviceable in three; the amount of usefulness of the limb in the fourth is unknown, and in the fifth case (Mr Syme's) the limb was ultimately useless.

In 1850, the operation was revived by Mr Fergusson; and within the last three years the operation has, as far as I can ascertain, been performed thirteen times: in three cases by Mr Fergusson, in six cases by Mr Jones of the Island of Jersey, in one case by Mr Page of Carlisle, in one case by Dr H. Stewart of Belfast, and in two cases by myself. Of the results of these cases I shall give some details immediately. Of the thirteen, three have died, two directly from the effects of the operation, and one from dysentery. The remaining ten are, as far as I know, at present alive. In five the limb is already used freely in progression; in one the result, as regards the usefulness of the limb, is yet uncertain; in one, I am ignorant as to the result; in the remaining three, sufficient time has not yet elapsed to render the result certain, but of each the most favourable expectations may be entertained.

Such is a brief outline of the history of all the cases in which, as far as I can ascertain, the operation has hitherto been performed, and I think I am justified in saying, that an impartial review of these cases, especially of the later series, at least proves that the propriety of the operation is yet an open question.

In order to contribute to the solution of this question, I shall now give a short account of the cases in which the operation has been performed within the last three years, and of the present condition of the cases in which the operation has proved successful; and I shall point out one circumstance which, in my opinion, has hitherto been erroneously allowed, in most cases, to interfere with the success of the operation. The following account of these cases, I should mention, is given, with three exceptions, from my own personal observation of them. To satisfy myself more fully as to the results of the operation than could have been done by a written description of the cases, I lately crossed the channel to the Island of Jersey, where,

by the kindness of Mr Jones, I had an opportunity of fully examining four of the patients, on whom the operation had been successfully performed; and I cannot omit this opportunity of expressing my admiration of the skill and enterprise with which Mr Jones, in a small provincial hospital, has prosecuted this branch of surgery. In addition to the cases of excision of the knee-joint, I saw in Mr Jones' wards two or three admirable results from the same operation on the elbow-joint, and one of excision of the head of the femur, which (apart from the question of the propriety of this mode of practice) would convince the most sceptical as to the usefulness of the limb after this operation.

Mr Fergusson has performed the operation three times in King's College Hospital. The subjects of all these operations were adults.

CASE I.—A male, æt. 21. The operation was performed, July 20th, 1850, and proved fatal on the ninth day from acute necrosis of the femur, the same cause of death apparently as occurred in the child operated on in 1830 by Mr Syme.

CASE II.—A female, æt. 21. The operation was performed October 30, 1852. Considerable constitutional disturbance ensued, which subsided in a few days. Convalescence, however, was protracted, at a subsequent period, by a severe attack of erysipelas. I had an opportunity of examining this patient a short time ago (six months after the performance of the operation). The wound was entirely healed, but one or two superficial sinuses discharging a little matter still existed in its neighbourhood. The limb was shorter than its fellow by about three inches, and slightly bowed outwards at the knee. Slight motion (chiefly antero-posterior) existed between the bones. The limb was still œdematous, from the effects of the erysipelatous attack. The patient moved freely about the ward on crutches. She could bear strong pressure of the tibia upwards, but as yet did not bear any weight on the limb when walking. Her general health appeared to be good.

CASE III.—A female, æt. 28. The operation was performed, April 2, 1853. This case terminated fatally with all the symptoms of pyæmia, sixteen days after the operation.

Of the six operations performed by Mr Jones, four have made excellent permanent recoveries; the fifth is convalescent, and promises an admirable result; the sixth case terminated fatally.

CASE I.—A female, æt. 25. The operation was performed January 19, 1851. Unfortunately this patient was residing at a distant part of the island from St Heliers, and during my short stay of a few hours I was unable to see her. Mr Jones has furnished me with the following account of her present condition:—

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 now is.

CASE II.—A boy of 11 years of age, when the operation was performed, April 27, 1851. This case appears to have been a peculiarly unfavourable one for the excision. Before the operation was performed, the leg (the left) was fixedly flexed on the thigh, so that the heel nearly touched the hip. The boy was emaciated and worn by hectic, and numerous sinuses existed in the leg and thigh communicating with the diseased bones. The extent of disease necessitated the removal of the femur and tibia to the extent of nearly five inches. His recovery was tedious. The condition of this patient, when I examined him, April 21, 1853, was as follows:—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 rather 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 me his confidence in it as a support, he *pirouetted* and hopped two or three yards without putting the right leg to the ground. No measurement of the limb had been made subsequently to the performance of the operation; but a careful examination of the apparatus in which it had been placed, and the conviction of Mr Jones and of the nurse who had attended the boy, satisfied me that the limb had grown upwards of two inches since the operation had been performed.

CASE III.—A lady, æt. 30. The operation was performed, September 4, 1851. Everything progressed as favourably as could have been wished, for eight days after the operation. At the end of this time, she was attacked by dysentery, from which she sank fourteen days after the performance of the operation. With regard to the cause of death in this case, Mr Jones writes to me, that “at this time affections of the bowels prevailed everywhere, and more 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. I feel fully persuaded that the operation was not the im-

mediate cause of death. Those who saw the patient with me were of the same opinion; still I am unwilling even to attempt to prove this."

CASE IV.—A boy, æt. 7. The operation was performed fifteen months ago. The condition of the patient and of the limb previously to the performance of the operation, was very similar to that of Case I., 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. The condition of this patient, when I examined him, April 21, 1853, was 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 a football with the foot of the ankylosed limb. I need scarcely say that the halt, with which this and the other boy (Case I.) walked, was very considerable and unseemly. Both, however, were provided with shoes, with a firm but light support under the sole, with which they walked steadily and easily, and with but a slight appearance of lameness.

CASE V.—A male, æt. 20. The operation was performed six months ago, previously to which the limb was flexed at an acute angle, as in Cases I. and IV. When I saw this patient (April 21, 1853), he appeared to be in good health. The parts about the knee were firmly cicatrised, 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 me that already he could walk without them, and with but a very slight halt. I have since heard from Mr Jones that this patient is progressing rapidly. 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 femur and tibia.

CASE VI.—A boy, æt. 9. The operation was performed, 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 only having elapsed since the performance of the operation, when I saw this boy, I can, of course, say nothing as to the result. He was suffering little or nothing when I saw him; and Mr Jones writes to me four weeks after the operation, that the boy progresses most favourably, and gives promise of a still more satisfactory result than in any of his former cases.

The next two cases which I have to mention are those in which I have myself performed the operation. The following brief outline of these cases is taken from the hospital reports of my house-surgeon, Dr Thom, under whose immediate care the patients were, and whose care and attention has contributed materially to the hitherto satisfactory result of these cases.

CASE I.—William Harrison, æt. 42, an hostler from Carlisle, was admitted under my care in the Infirmary by the recommendation of Mr Macdonald of Leith, September 28, 1852, suffering under disease of the left knee-joint of five years' standing. The symptoms were those which are usually attributed to ulceration of the cartilages, uniform thickening of the parts around the knee, severe gnawing pain, especially during the night, and much aggravated by the slightest motion of the joint. Considerable relief was obtained by the joint being kept immoveable in leather splints, and by the repeated application of the actual cautery. The thickening of the soft parts became diminished, and I hoped the patient was to recover with a stiff joint. A painful spot, however, remained over the inner side of the head of the tibia, on account of which the counter-irritation was continued, and the joint retained for a long time fixed by the leather splints. He continued in this condition till about the middle of January, when, without assignable cause, the pain in the knee, especially on each side of the head of the tibia, became much aggravated. The pain was now so severe and constant that, in spite of the free and frequently repeated use of morphia, he scarcely slept night nor day. The swelling of the joint again increased, and the foot and leg became œdematous. On the 26th of January I called a consultation of my colleagues on the case, as it appeared to me that the removal of the disease by operation was alone likely to save my patient. It was thought, however, that a repetition of the same measures as had been already adopted, might still save the joint. The leather splints were accordingly readjusted, and the cautery once more applied in front of the joint. No relief, however, was obtained, and after ten days' further delay I yielded (with the consent of my colleagues, who saw the case with me) to the earnest solicitation of the patient, to remove the disease by operation.

The operation was performed, February 5, 1853. A straight incision was made across the front of the joint, a little below the level of the patella, and extending to rather less than half the circumference of the limb, and at right angles to each end of this

transverse incision, a longitudinal incision of about two inches in length gave the wound somewhat the form of the letter H. 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 articular surface of the head of the tibia. It was accompanied by smart hemorrhage from the articular arteries, which was at once arrested by applying ligatures to them. 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. I carefully removed the remaining portion of the walls of these abscesses with the gouge, and then, finding that the diseased portions of bone had been entirely removed, I placed the ends of the tibia and femur in apposition, united the wound by sutures, and fixed the limb in the straight position, by applying a splint on its posterior surface. (The articular surfaces of all these bones were found almost entirely deprived of cartilage; and both the cancellous and laminated structure of the bones, at various points, were in a state of suppuration and caries. The primary disease evidently consisted of suppuration of the cancellous texture of the head of the tibia. The extent of bone removed in the operation 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).

The progress of the patient for the first two days following the operation, was most satisfactory. He slept well, which he had not done for weeks before; his pulse never rose above 80; he expressed himself as entirely relieved from the severe pain which he had been previously suffering. On the evening of the third day he began to suffer from hiccough, which verysoon became constant, and continued 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 pretty free use of the tincture of Indian hemp, and everything went on favourably till about Feb. 23, when he began to complain of pain in the region of the diaphragm, and on pressure over the right hypochondrium. Obstinate diarrhœa succeeded, the evacuations presenting no appearance of bile. He lost all appetite; became desponding as to his recovery, and lost flesh rapidly. 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. The diarrhœa continued, with short intervals, for about a month, and then gradually ceased under the use of mercurial alteratives, and the repeated application of blisters over the region of the liver. He then began to improve,

and in a short time I considered him out of danger, when he was attacked by acute pleuro-pneumonia of the right side, the inflammation extending apparently over a large surface of the diaphragmatic pleura. Under Dr Douglas' care he again recovered from this attack; and he has now for the last six weeks gone on improving steadily, and is now, I am glad to say, quite convalescent. With regard to the state of the limb during this time, I may mention shortly, that in spite of all the serious constitutional derangement, the wound progressed slowly but steadily. The long-continued diarrhoea, and the emaciated condition of the patient, rendered it no easy matter to keep the bones in good position; but under Dr Thom's careful management, this was satisfactorily accomplished. At the end of six weeks after the operation, the motion at the knee was very limited, and since this time it has progressively diminished.

The present condition of this patient (three months and a half after the operation) is as follows:—His general health is tolerably good, and is improving rapidly; he sleeps and eats well, and has no complaint of uneasiness of any kind. He is still confined to bed, but this is a measure of precaution more than of necessity, to prevent any motion at the seat of operation till the bones are firmly consolidated. The limb, which is supported by a leather splint behind the knee, and a starched bandage, is slightly bowed outwards at the knee, and is one inch and a quarter shorter than its fellow. The wound is healed, with the exception of a granulating surface on the outer side, which may be covered by the point of the finger. On the inner side, too, there is a small discharging surface, where a superficial abscess of trifling extent was opened about a week ago. There is still a little œdema of the whole limb, but this has diminished steadily for some time, and is now nearly gone. The bones at the knee are immoveably fixed as regards lateral motion, but on using a little force, slight motion backwards and forwards can still be perceived. Two or three weeks more, I have no doubt, will serve to complete the osseous ankylosis. He can move the limb freely in all directions, but is directed to keep it in as quiescent a state as possible.

The points in the progress of this case to which I would wish to direct attention, are—1st, That the patient was suffering under a high degree of irritative fever at the time of the operation; 2d, That he suffered, from the third to the tenth day following the operation, from severe and incessant hiccough, which, as the subsequent symptoms proved, was referable to a local source of irritation on the surface of the diaphragm; 3d, That, from the end of the second to the seventh week succeeding the operation, he suffered from nearly constant diarrhoea, evidently dependent on hepatic derangement of a serious character, and which, Mr Macdonald informs me, was of old standing; 4th, That, two months after the operation, he passed safely through a severe attack of pleuro-pneumonia; and lastly, that, in spite of all these untoward complications, the

wound, at the end of three months after the operation, was, with the trifling exception I have mentioned, entirely healed and the bones consolidated, though not quite immoveable, in a nearly straight position.

I think I do not misstate the case, when I say that the serious constitutional symptoms which presented themselves were wholly independent of the peculiarity of the operation, and that this 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.

CASE II.—Isaac Johnston, æt. 28, a fisherman from Shetland, was admitted under my care in the Infirmary, February 14, 1853, suffering from disease of the right knee-joint, of about ten months' standing. The affection had commenced, without assignable cause, by pains and swelling of the joint, which gradually increased; and, for two or three months previously to his admission into the hospital, had entirely disabled him from moving about. The condition of the joint was similar to that of Harrison, but the symptoms were less severe. The pain was considerably mitigated by the joint being kept immoveable in leather splints, and by the repeated application of blisters. About a month after his admission into the hospital, the pain again became more severe, and was referred chiefly to the outer side of the head of the tibia. The actual cautery was freely applied, but without giving any relief, while increasing deformity of the joint, and pain on slight motion, gave evidence of the morbid changes which were in progress in and around the articulation. Shortly after this, he had an attack of modified small-pox, from which he speedily recovered. No improvement, however, took place in the condition of the joint. He continued to lose flesh; the pain and the deformity of the joint continued to increase; and symptoms denoting suppuration of the joint presented themselves.

Sir George Ballingall, Dr Dunsmure, and Dr Gillespie, who saw the patient with me in consultation on the 2d of May, agreed with me in the necessity of performing amputation, or excision of the joint, to either of which measures the patient willingly gave his consent.

I performed the operation of excision of the joint on the 5th of May 1853. Having found the disadvantages of the H-shaped incision in my first case, I now exposed the interior of the joint by a semi-lunar incision, extending from the inner 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 ~~found~~ was dissected back, the *ligamentum patellæ* being divided, and the patella itself left in the substance of the flap. The rest of the operation was completed, as I have already described, with the important exception, that the patella was left in its place, and its immediate attachment left undis-

turbed. The cartilage, however, which remained on its surface was removed by the gouge, as well as the rough surface of bare bone around its articular margin. The amount of bleeding was very trifling: one of the articular branches and several small vessels were secured by ligature, and the wound was dressed and the limb supported as I have already described in my former case. (The interior of the joint presented the usual appearances accompanying advanced strumous disease of the synovial membrane, suppuration of the joint, universal thickening and degeneration of the membrane, and ulceration of the margins of the cartilage in nearly their entire extent. Great part of the cartilage covering the articular end of the bone was as yet unaltered. Three-fourths of an inch of the tibia, and fully an inch and a half of the femur, were removed.) With regard to the progress of this case since the performance of the operation, I need only say that the patient has suffered as little local and constitutional disturbance as usually follows excision of the elbow-joint, and certainly very much less than usually follows amputation of the thigh. He has been almost entirely free from pain, and has slept and eaten well, whilst his general appearance has been such that no one, who was unaware of the operation which had been performed, would, on seeing him, have imagined that he had undergone an operation which was dangerous to life. Nearly a half of the wound is already healed, and the remainder is covered by healthy granulations. The discharge, which has never been great, is already diminishing in quantity. 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 having been left undisturbed. Little more than a fortnight has elapsed since the operation was performed, and I am, therefore, unwilling to say more of the case at present than that it promises, as far as it has gone, a most favourable result.

Whilst writing this notice of the above cases, I have received, by the kindness of Mr Page of Carlisle, an account of another case, in which that gentleman performed the operation about a year ago on a lad of seventeen years of age. The operation was performed, June 7, 1852. 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. Mr Page gives the following account of his present condition:—"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."

The only remaining case in which I am aware of the operation having been performed within the last few years, is one in which Dr H. Stewart of Belfast was the operator. Unfortunately I have been

able to obtain no further information from Dr Stewart regarding this case than that he considers the result "very encouraging."

Such is a short summary of the cases, of which I have been able to find any record, or to get any account, in which excision of the knee-joint has been practised. It is possible that other recorded cases may have escaped my observation, and I am not without hope that this communication may elicit further information relating to the practical results of the operation.

Although my chief object has been to give information on the more recent results of the operation, I may be permitted to add a few words in defence of those who have been censured for reviving a mode of practice which, for the last twenty years, appears to have been universally abandoned.

The propriety of attempting to save a limb by excision of the knee-joint seems to depend on the three following considerations:—1st. Is the operation of excision attended by greater or less danger to life than amputation of the thigh? or, may the dangers of the two operations be considered equal? 2d. In the event of recovery after excision of the knee-joint, is the limb more or less useful and seemly than a wooden leg? 3d. Does the long confinement to the horizontal posture, which is necessary after excision of the knee-joint, in any measure counterbalance the benefits of the operation (if such benefits are proved) as compared with amputation of the limb?

A careful consideration of these questions and of the recorded results of the operation, led me several years ago to doubt the propriety of the operation having been rejected from surgical practice. I satisfied myself, by repeated trials on the dead body, that the operation could be performed without difficulty, and without the risk of wounding any important parts; and, as a teacher of surgery, I have been in the habit of mentioning to my pupils my impression that the operation had been rejected from practice on insufficient grounds. Knowing, however, the objections of my hospital colleagues to the operation, I never requested their sanction in carrying it into execution, till the late experience of Mr Fergusson and Mr Jones appeared to me to warrant my urging the question more closely on their attention, and my performing the operation in the cases which I have related.

With regard to the considerations which I have suggested as principally bearing on the merits of the operation, I would submit,—1st, That the danger of the operation may be reasonably expected to be less than that attending amputation of the thigh. The wound necessary for the removal of the diseased bones is less extensive than the wound of amputation of the thigh, whether performed by the circular or flap operation. The large vessels and nerves 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 which has of late years been suggested as of some consequence in diminishing the dangers of amputation; the shock, which always attends, to a

greater or less degree, the sudden removal of a large part of the body, is avoided.

Time and experience, however, can alone determine the comparative danger of the two operations. In the mean time, the results of the limited number of cases in which the operation has been recently practised, prove, as far as they go, that the danger to life is not great;¹ and unless some unforeseen accident should occur to the cases, which are at present in progress of convalescence, that the danger is inferior to that of amputation.

2d, With regard to the usefulness and the seemliness of the limb, I need only refer to the account I have given of the results of the operation in Mr Jones' hands, to show that the limb may retain a degree of usefulness which can never be attained by the wooden leg in common use, nor yet by the most expensive and efficient artificial limb which I have ever seen; and if, in the days of Mr Park, such a result could be obtained as that a man, whose knee-joint had been excised, could run up the rigging and perform all the duties of a seaman, surely, with all the resources of modern surgery, we ought to obtain an equally satisfactory result now.

3d, The remaining objection to the operation is the tediousness of the convalescence. This, I think, unquestionably detracts, to a certain extent, from the benefits of the operation. I am doubtful, however, after all, whether the recovery can be proved to be on the whole more tedious than the recovery from compound fracture of the leg; in some cases even the limb seems to have been restored to usefulness as soon as the patient would have been able to walk on a wooden leg, had the limb been amputated. In Mr Syme's case, for instance, "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."²

Mr Syme, in another place, says, "It ought 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."³

Another objection has been brought forward against the operation which requires to be noticed, viz., that, when the operation has been performed on children, the growth of the limb has been checked, and that, consequently, from the unequal growth of the two limbs, that on which the operation has been performed becomes so disproportioned to the other as to be ultimately useless. The only practical proof of this being so, which I can find, is Mr Syme's case;

¹ Of the last *eleven* cases in which the operation of excision has been performed, *seven* have recovered and *two* are in progress of convalescence, at the periods of six and three weeks after the operation; *two* only have died, one from dysentery and the other from pyæmia.

² Syme on Excision of Diseased Joints. 1831.

³ Ibid.

and I think it is possible that it might be attributed in this instance to ankylosis not having taken place. Experiments have been performed on animals to show that bones do not grow when deprived of their heads, but the results do not appear to be conclusive. A few years will be required to confirm this as a valid objection to the operation. Mr Jones has, in the meantime, made accurate measurements of the limbs of the three boys on whom the operation has been performed, and will have an opportunity of giving further information on the subject hereafter. I have, in an earlier part of this paper, mentioned the fact, that the limb in one of Mr Jones' cases had already, since the operation, grown considerably, and presented now no appearance of checked growth. As bearing on this question, I would be glad to know if the growth of the upper extremity is checked by excision of the elbow-joint. It is so, as far as I remember to have observed, only in a slight degree. 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. Supposing, however, that the fact is so—that 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.

I have suggested that an error has, till lately, been committed in the performance of the operation, which has been allowed to interfere most seriously with its result. I refer to *the removal of the patella*. It is said that the patella is generally extensively diseased in affections of the knee-joint demanding excision or amputation: this, I have no doubt, is an error. The amount of disease to which it is liable is very limited,—in the great majority of cases consisting only in its being more or less deprived of its cartilage, and of a rough, or perhaps carious condition of its articular aspect. The patella is rarely, if ever, the primary seat of the disease in affections of the knee-joint. When the disease commences in the bones, it invariably does so in the cancellated texture of the head of the tibia, or condyles of the femur. It is extremely rare that there is such extent of disease in the patella as to prevent its easy and effectual removal by the gouge, the body of the bone being left uninterfered with. The advantage of leaving the patella cannot fail, I think, to be very great. The natural form of the joint is preserved; the attachment of the extensor muscles is left undivided; the wound is less extensive; the annoying tendency to displacement forwards of the end of the femur seems, in a great measure, to be done away with; and there is every reason to believe that the consolidation of the bones will proceed more rapidly, and the limb ultimately be found both more useful and more seemly than when that bone is taken away. This is a point, however, which remains to be proved. In the two last cases, however, in which the operation has been performed by Mr Jones and myself, the patella has been left, and the

advantages of its having been retained are already apparent in each case.

I shall not lengthen this paper by describing what appears to me the best mode of performing the operation, but merely mention that the semilunar incision seems to me the most advantageous, as being the smallest by which the joint can be satisfactorily exposed, and as giving rise to less bleeding than the H-shaped incision. There is one point, however, to which I wish to direct attention. It has been recommended that a considerable portion of integuments should be removed by a double lunated incision, to prevent the redundancy of skin which might be expected from the large amount of bone removed in the operation. I believe that this advice, if followed, will lead to great annoyance. I have not removed any portion of integuments in the cases in which I have performed the operation, notwithstanding which, the retraction of the skin was such as to cause, in each case, more or less gaping of part of the wound. Mr Fergusson mentioned to me that he had removed a small portion of integuments in the operation, in the case now in King's College Hospital, and that, during the patient's convalescence, he had much reason to regret having done so, as the retraction of the integuments was such as to leave part of the end of the femur uncovered, and a thin cicatrix only now covers this point of bone.

I shall not add any further details as to the performance of the operation or the after-treatment of the patient. My chief object at present is to present a summary of the cases in which the operation has been recently performed, and the results of these cases as far as they have gone, and I have endeavoured to do this faithfully and impartially. From what I have myself seen, I am satisfied as to the utility of the operation, and I think that the details which I have given of these cases prove that the operation, till its recent revival, had been banished from surgical practice on insufficient grounds, and that the propriety of practising it in certain cases, is still at least an open question.