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ON DISEASED CONDITIONS OF THE KNEE-JOINT.

BY

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SECTION III.—OPERATIVE INTERFERENCE.

THE progress of disease in the knee-joint must occasionally lead to the positive necessity for its removal. A rapid and acute affection may so depress the vital powers as to call for immediate interference on the part of the surgeon, in order that the patient's life may be saved; or the slower advance of some chronic malady may, little by little, reduce him to such straits as to demand the removal of the disease, lest continuous pain and copious purulent discharges should prove too much for his endurance. Or, again, long continued disease, perhaps ill treated, or entirely neglected, may leave a knee-joint so deformed as to be not only useless, but an absolute encumbrance to its owner. In each and all of these cases, a very grave responsibility rests with the surgeon in deciding, first as to the exact period at which operative measures should be had recourse to, and secondly as to the nature of the operation which should be performed. With regard to the first of these difficulties, Bryant has well remarked, that

"Every surgeon must be able to recall cases where disorganisation of a joint had taken place, whether from disease of the synovial membrane, cartilages, or bones, where the question of amputation or excision had been suggested; and which the patient or his friends had positively refused, and where, to crown all, a recovery had taken place." (*Diseases and Injuries of the Joints*, chap. ix, p. 139.)

That is to say, with an useful ankylosed joint. We must acknowledge the truth of this observation. Even the most acute insight into pathological conditions may yet fail to calculate correctly the power which any given individual possesses to resist disease or to repair its inroads. Nature, if she be fairly treated, will after all do the work of healing more completely than Art can ever hope to do; and it is a sad error to expose a patient to all the risks and distress of an operation, the result of which may, after all, be far inferior to what she herself might have effected. Yet, on the other hand, too long waiting on Nature's offices betrays the timid surgeon. He lets his patient slip from his grasp. His timely aid might have saved a life, although at the sacrifice of a limb; or he might have achieved a still greater triumph, and not only rescued his patient from impending death, but have left him with a limb, not indeed perfect as before, but still most useful

for the purposes of locomotion. A day, a week, or a month of too long waiting, and his chance is gone.

Perhaps the second difficulty referred to is the greater one; viz., the nature of the operation which should be performed for the removal of the disease.

Excision of the Knee.

The time was when no alternative existed for the surgeon, except the removal of an incurable knee-joint by amputation through the thigh. How many useful limbs have been thus sacrificed, and are, I fear, still being so, it is impossible to say. It is, however, satisfactory to find that the march of surgical science has provided another means of relief in excision of the diseased articular surfaces of the knee-joint; and the surgeon has now the opportunity of choosing whether he will remove the entire limb by amputation, or only the diseased joint, leaving a sound thigh and an useful leg and foot to his patient.

Great as is this addition to surgical science, I suppose there are few subjects which have caused more professional wrangling and discussion than this one of excision of the knee-joint. More than a hundred years have elapsed since Filkin of Northwich first performed the operation, and during the last fifteen it has been kept constantly under the notice of the profession by one of the most eminent professors of surgery in England, and has been more or less practised in nearly all the hospitals of the United Kingdom. It has been written about, and lectured about. Statistics about it, more or less reliable, have been collected from all parts of the world, and placed before the profession; and yet, in the face of all this, I fear I write but the simple truth when I state that there is very little more unanimity on the subject of knee-joint excision now than there was years ago, when first the dispute commenced. Nor am I inclined to think that this fact arises from any great fault on either side. Its first supporters may have been—I think they have been—too sanguine of success. They have promised a little more for the operation than now that it has, as it were, come of age, it is able to perform. It has been performed in cases, no doubt, unfavourable to its perfect success; and operators have been too hasty in returning as perfect cases those which time has proved to be anything but so. On the other hand, long before it had received a just trial, there was an evident tendency to "write it down". Men who had never performed the operation, some who had never even seen it done, wrote about it and talked about it as if it were one of the most fearful innovations surgery had ever witnessed. I remember well an old and most experienced surgeon, who was intensely prejudiced against the operation. He was present when I excised a joint; and, when the knee was laid open, I heard him remark that it was the most horrible operation he had ever seen. The case did exceedingly well; and I know that my friend has much modified his opinions as to this procedure.

It is really superfluous for me to repeat the oft-told history of this operation. Butcher, Holmes, Hodges, the American surgeon, Professor Fergusson, and the late Mr. Price, have each and all of them laid before the profession most full and interesting details as to its rise and progress. The last named

surgeon has most laboriously collected a large number of cases of excision of the knee from the year 1761 to the end of the year 1860; and he has divided this period into three, thus:

	Cases.	Cured.	Died.	Amputated.	Died.
From 1760 to 1830...	17	7	10	0	0
" 1830 to 1850...	9	9	4	0	0
" *1850 to 1860...	238	150	52	36	7
Total.....	264	162	66	36	7

The first thing that strikes one in this table is the fact that, whereas in the first two periods 14 deaths occurred in 26 cases, or more than *one-half*, in the last period only 66 out of 264, or just exactly *one-quarter*, died from the immediate effects of the operation. In a foot-note appended to Mr. Price's table by Mr. H. Smith, it is stated that, at King's College Hospital, out of the first 24 cases, exactly *one-half* died; whilst in the last 29, only 5 deaths have taken place. These facts speak for themselves, and can leave no doubt that a better knowledge of the operation and after-treatment, combined with a more judicious selection of cases, has considerably reduced the mortality attending upon it.

Since 1860, Mr. H. Smith has obtained statistics of other cases of excision of the knee which have been performed by the British surgeons tabulated by Price, and the following is the result: 52 cases; 37 cured, 10 died, 3 amputated, 2 died, 2 doubtful as to the result.

These statistics, again, show an improved rate of mortality, more than two-thirds of the cases having recovered with "useful limbs". Nor do I think that we have as yet reached the limit of perfection. I trust that I shall presently show that there are many points the strict observance of which, both in the selection of cases for operation, and in the operation itself and after-treatment, will secure for it a yet greater immunity from the heavy death-rate which at present attends upon it. The term "useful limbs", quoted above, leads me to protest against a rather unfair attack which has been made upon the expression. The talented editor of *A System of Surgery*, seems to have entered upon a crusade against the operation of excision of the knee. In addition to his article in the *System of Surgery*, he has written another in a periodical (*British and Foreign Med.-Chir. Review*, No. LIX, July 1862, p. 225), in which, giving him every possible credit for fair dealing, and for many truthful observations on the subject, I really think he has endeavoured to make the very worst of the operation. I shall refer to Hodges' essay at a later period; but I would just remark here, that the 208 cases he has tabulated are taken not exclusively from British sources; and this is the only explanation I can give of the difference of success, as shown by his statistics and by those I have already produced—a difference which, I trust I may be allowed to say, reflects credit upon English surgery. The term "useful limb", however, really seems to me to be perfectly explicit, and sufficiently indicative of the successful issue of any given case. I do not see how we can avoid accepting it *as such*, without directly impugning the honesty of the person who reported the case, and, in many cases, of the surgeon who performed the operation. It does not follow at all that, because the

editor of *A System of Surgery* once saw a limb amputated which had been reported as "a sound and useful one",* suspicion should be cast upon all other cases to which this term is appended, without further comment. Many limbs may honestly be reported as "useful" ones, after excision of the knee, which are even "riddled with sinuses leading to diseased bone"; and it must be the experience of any surgeon who has seen much of excision of the knee, that, however troublesome sinuses and diseased bone may be to surgeon and patient, both are very frequently rewarded for waiting, by the most perfect result which surgery can procure.

Another point I would draw attention to. It is really no argument against excision of the knee, that a certain number of cases wherein it has been performed eventually require amputation. Excision of the knee has been frequently justifiable, even although amputation of the thigh has afterwards become a dire necessity. Nay, I would even go further, and say that it is a positive duty which the surgeon owes to his patient to give him the chance of saving a sound leg and foot, before having recourse to that last extremity—amputation of the limb. If the after-treatment of a case of excision of the knee be such as it should be, I contend that there are very few cases where, at the end of a considerable time, the patient is not as well able to undergo amputation of the thigh, if it be imperative, as he was before the operation of excision. Of course, I exclude from this observation all such cases as acute necrosis of the bone, etc., which are the usual causes of immediate mortality after excision of the knee. I think, too, that it is hardly fair to charge all the deaths following amputation after excision upon the excision operation. Who is to say that death would not have resulted if amputation had been resorted to as a primary procedure? In fact, the statistics of this operation are at present most unreliable, owing, I have no doubt, to the very incomplete manner in which our hospital records are preserved. In the case of simple amputation, it is easy to record and collect the fact either of death following the operation, or of recovery; but, in the case of excision, a lapse of time is required to test the true result of the operation, and during that time the patient too often passes from the observation of the hospital authorities, and no more is heard of him. Feeling, therefore, that a mere record of operations performed during any given period must of necessity be very incomplete, however extensive, I shall content myself with referring to those only with which I am either myself personally acquainted, or about which I have reliable information.

Modes of Performing the Operation of Excision. It now becomes my duty, in compliance with the more immediate requirements of this essay, to consider the diseased conditions in which this operation is advisable. And at this point I consider it to be most convenient to recount the method by which the operation is performed.

The patient being carried to the table, and placed fully under the influence of chloroform, an incision should be made across the joint sufficiently large to expose the ends of the femur and tibia. The old H-incision is, I think, now nearly abandoned; for it was in reality far more extensive than there is any

* These cases were all performed by British surgeons.

* See foot note to article in *Med.-Chir. Rev.*, LIX, p. 225.

necessity for. The horseshoe U-incision, extending from the back part of one condyle to the back part of the other, across the joint, below the patella, dividing the skin and ligamentum patellæ at one sweep, is a very useful and now common mode of proceeding. Care should be taken that this incision should be commenced and terminated well behind the condyles of the femur; as it will then be found to afford, when the limb is placed in position, two dependent points for the escape of matter. Another method—and in some cases a preferable one, as producing a smaller wound—is to carry the incision transversely across the joint. Mr. Henry Smith, in a note appended to Price's work, attributes the introduction of this plan to Sir W. Fergusson; but I think that Mr. Kempe of Exeter used it some years ago, and has continually done so with the best results. The joint having been laid open in front, an assistant should gently flex the limb. The flexion should be very gentle, or mischief will be done to the bone. There is a preparation, showing how the spine of the tibia was thus wrenched off; and I have the record of a case where the surgeon, in forcibly flexing the limb, tore off the entire epiphysis of the tibia. (See *Pathological Society's Trans.*, vol. xvii.) The surgeon may now introduce the fingers of his left hand into the joint, and, by drawing up the condyles of the femur, put all the parts on the stretch, and thus facilitate their division; for it must be remembered that, in the flexed condition of the joint, the external and internal lateral ligaments are relaxed. The position of these ligaments must also not be forgotten; they are placed nearer to the hinder than to the fore part of the joint. The lateral ligaments being divided, and the crucial (if they remain), the integuments must now be carefully dissected up from the femur, and the portion of bone to be removed exposed. In considering the anatomy of the femur, I have already referred to the extreme importance of cutting this bone through at a proper angle. Much of the after-success of the operation depends upon the manner in which this portion of it is accomplished. Owing to the width of the pelvis, the two femora are necessarily oblique in their axes, and the internal condyle is prolonged, as before noticed, in order to compensate for this; and that the articular surfaces of the femur and tibia may be parallel. Hence it follows that, in cutting both the bones, it is of the greatest moment to maintain this parallelism by taking care to make the slices removed of the same thickness throughout; or if, by any chance, any difference should be made in one section, that a compensatory allowance should be made in the other. It is also most important that the saw, when applied to the femur, should be held exactly perpendicularly to the shaft of that bone. And a difficulty arises here in practice, owing to the tilting of the thigh necessary in order to separate it from the tibia. An unwary operator may be misled by the position of the thigh, and apply the saw perpendicularly to the patient's body, instead of to the bone about to be sawn; the same rule applying, though in a less degree, to the tibia. When the femur is cut thus incorrectly, the tibia, if brought into apposition with it, must necessarily bow outwards, as is frequently seen. Two femora are sent in with this essay, to illustrate the correct and incorrect methods of cutting the bones. If the patella be fixed, as it frequently is, to the external condyle,

it may sometimes be included in the section; or it may be torn from its adhesions, if they be only fibrous. At any rate, the bone should in all cases be removed. Hodges states that the percentage of death on amputation, following cases in which the patella was removed, was 21.31; whilst in cases where the patella was left, the percentage was 60.54—giving 39.23 in favour of removal of this bone. It is hardly necessary to remark, that the smallest possible portion of bone, consistent with the entire removal of disease, should be sawn off.

Much difference of opinion exists as to the kind of saw that should be used. For my own part, I know of none better than the common hand-saw, made sufficiently broad in the blade to cut through the broad surfaces of bone with which we have to deal. Butcher's saw is used by many surgeons; but it is neither so firm, nor so entirely at the command of the operator, as the less complicated one above referred to.

After the section of the bones has been completed, any circumscribed patches of disease may be removed with the gouge, and the rough edges pared off with the bone-forceps.

It is frequently the case, that the contraction of the hamstring tendons is so great, that much difficulty is experienced in placing the femur and tibia in good apposition. Under these circumstances, it is advisable to divide these tendons through the wound, when, in all probability, the difficulty will be overcome. If, however, it is still impossible to place the bones in good apposition, it will then be necessary to remove another slice from the femur. This proceeding should, however, be avoided, if possible, as it materially shortens the limb, and imparts an air of bungling to the operation. As much of the synovial membrane as possible should be removed, whether diseased or not, as its presence materially retards the future good progress of the case. Any suspicious-looking tissue should also be taken away; a pair of stout scissors, cutting on the flat, being very useful for this work.

It is very necessary to arrest all hæmorrhage before the limb is finally put up. I think we are too sparing in our ligatures in this operation. Every bleeding point in the soft tissues should be tied. I have frequently seen the most free hæmorrhage from the cut edges of the periosteum. A careful search for bleeding points should be here made. A little patience and a stream of ice-water will generally arrest oozing from the surfaces of the bones. It is most distressing to the patient, and a fertile source of ill success, to have to take down the limb, reopen the wound, and search for bleeding vessels. That free secondary hæmorrhage does sometimes supervene, we know from various recorded cases; but it has never been my lot, in a pretty extensive personal experience of the treatment of excision cases, to meet with one that required the after-application of a ligature, the actual cautery, or a styptic of any kind. I am convinced that this danger is overrated, and that ordinary care at the time of the operation may prevent its occurrence.

All hæmorrhage having ceased, the cut ends of the bones should now be brought into apposition, great care being taken to prevent any of the soft parts slipping between them. Just at this stage of the proceeding, the patient should be most fully under the influence of chloroform, in order that no

spasm of the muscles may interfere with the complete adjustment of the limb. This is a point the neglect of which is a *very* frequent cause of damage to the limb. I have frequently seen severe spasm of the muscles of the thigh suddenly pull the femur up and render the adjustment of the limb most difficult.

The bones being adjusted, the limb should be immediately placed on the retaining apparatus, whatever that may be. I have no hesitation as to my own choice in the matter. There is no apparatus equal to the iron splint described, shown in Fig. 4,* and which is, I believe, the only one ever used now by Sir W. Fergusson. The side splint is, I think, in *very* many cases, a superfluity; and I have frequently dispensed with its use throughout the entire run of the case. The box advocated by Mr. Butcher (Fig. 5) is far inferior, although that eminent surgeon has turned

Fig. 4.

Fig. 5.

out of it many good cases. My objections to it are, first, that it is of wood, and absorbs the discharges; secondly, that it is very cumbersome, and cannot be swung; and thirdly, that, in order to get at the limb, a portion if not the entire retentive apparatus must be undone, thus exposing the limb to the risk of jars and starts very detrimental to its well-being. Some surgeons use an ordinary McIntyre splint, which is in many ways most inconvenient. The splint should be well padded, great care being taken that the pad in the thigh and leg part should overlap the edge of the splint, to prevent galling at any part. That portion of it immediately under the knee should be covered with Macintosh sheeting, and should be made rather full, so as to project into the popliteal space. Small supplemental pads, also covered with Macintosh, should be at hand; one especially being often required to go under the head of the tibia, to prevent its tendency to fall backwards behind the femur. Webbing straps and buckles should also be at hand. In my own cases, I am not only most anxious to see the splint well prepared, but I also prepare the limb itself for its long sojourn

in the splint. All the prominent points of bone, especially the malleoli, the heel, and the tendo Achillis, should be covered with amadou spread with soap-plaster. The foot should be carefully bandaged from the toes up to just below the tubercle of the tibia. A bandage should also be firmly applied to the thigh from above downwards. I believe this latter precaution to be a most useful one; for not only does it to a very great extent control spasmodic action of the femoral muscles, but it also prevents matter from burrowing back amongst them—a complication most tedious to deal with, and often fatal to the good result of the operation. All these preparations should be made in the ward before the operation. A little care and supplemental bandaging will prevent the permanent bandages from being soiled during the operation.

The limb is now to be placed in the splint; and, the bones being in perfect apposition, I am in the habit of fixing it by four strips of adhesive plaster—one a little above the malleoli, another just below the head of the tibia, another just above the condyles of the femur, and the last at the upper part of the thigh. As a final step, the wound should be brought together by two or three wire sutures, the sides being left open for the free exit of all discharges. There is a double object in leaving the wound open to the last moment. First, we are able to secure more perfect adaptation of the ends of the bones; and secondly, to stop any further bleeding points which may present themselves in the soft tissues. Finally, a bandage is applied, further confining the limb to the splint, but leaving the wound exposed, which should only be covered by a square piece of wet lint.

The patient should now be removed to bed, placed on a water-pillow, and the leg swung in a "Salter's swing" (Fig. 6). I make a great point of the water-

Fig. 6.

pillow. By it the pelvis is as it were swung, and the patient can move about with the greatest freedom, without a single jar being communicated to the limb. If the patient be, as is sometimes the case in females, of

* I have to thank Dr. Druce for his permission to borrow Figs. 4, 5, and 6, from his well known *Surgeon's Vade-Mecum*.

an excitable nervous temperament, the administration of a subcutaneous injection of one-third of a grain of morphia, before the effects of chloroform have passed off, has a most quieting effect, and will often procure long and refreshing sleep.

After-Treatment. In a case managed as above described, the after-treatment is of the simplest kind. Throughout, one great object must be kept steadily in view; viz., the perfect immobility of the limb. In a well managed case of excision, there is not the slightest possible necessity to touch any of the retentive appliances for at least a month or six weeks after the operation; and then, in all probability, the limb may be once for all removed from the splint, and placed in some other support. I find that cotton-wool, carefully tucked in under the edge of the bandages nearest the wound, and changed once or twice a day, effectually prevents the matter from running up by the sides of the splint, and then collecting under the bandages and becoming offensive. If the discharge is very profuse, a drainage-tube inserted on each side, at the lower point of the wound, will conduct off a great deal of pus, and prevent its soiling the splint and bandages. When suppuration is fairly set in, it is often useful to syringe out the wound with a solution of Condy's fluid, or with the "red lotion"; but, of course, any local application will be made in accordance with the particular condition of the case. I have never seen it used, but I can quite conceive that the application of a bag of ice to the parts immediately after the operation, and the retaining it continuously for some days, would prevent the approach of much evil, and be a source of great comfort to the patient.

The position of the limb should be a continual source of care. The judicious application of a pad, strap, and buckle may rectify any commencing displacement. The bowing outwards of the joint is one of the most troublesome distortions we have to meet with. To prevent this, I have had a "truss-pad" made, which, taking its fixed point from a bar attached to the inner side of the splint, passes over the joint, and presses the limb inwards and a little downwards. A very good drawing of this apparatus is appended. (Fig. 7.)

Fig. 7.

I have thus minutely described the steps of this important operation, and the after-treatment of the case, because I am convinced from my own observation, and from the accounts I have read, that frequently very many of the precautions which I have recounted are entirely neglected, and cases which might have turned out successfully have been lost or suffered amputation. Not long ago, I saw a case where, on account of not very excessive secondary bowing, the limb was taken down on the evening of the operation, the sutures were removed, and the actual

cautery freely applied. Again, about the third or fourth day, when suppuration has freely commenced, I have known the limb removed from the splint (the wooden trough of Butcher) to cleanse it. Price, in his analysis of cases, gives many examples where limbs were undoubtedly sacrificed to bad after-treatment. For instance, in one case, the cause for amputation was stated to be "exhaustion, and the pain from dislocation which had occurred." (Price, *On the Knee-Joint*, p. 77.) The patella was allowed to slip between the ends of the bones, and "the patient died from exhaustion and irritation after some months." In another case, "considerable difficulty was experienced in keeping the bones in apposition: irritation of their extremities, and the consequent lighting up of unhealthy suppuration, induced necrosis of the lower end of the femur; so that amputation was needed after some weeks." (Price, *op. cit.*, p. 85.) In another case, amputation was resorted to "on account of non-union, necrosis, and displacement of the cut ends of the bones." Three cases—"a clumsy flat leather splint with the first case, the McIntyre in the others, with too frequent shiftings, being used to support and steady the limb"—very soon came to amputation. In two cases, "mechanical irritation of the cut ends of the bones induced such an amount of inflammatory mischief in both of the bones and periosteum, that death was thereby the consequence." In another case, "on the third day the dressings had been changed, and a pillow and sand-bags substituted for the splint." In another, "the patient was shifted every few days;" in another, "the tibia and femur were allowed to shift their positions;" and in all these amputation was had recourse to. Thus twelve cases are recounted where the want of success following this operation must be entirely attributed to insufficient care in the after-treatment.

I need hardly point out that, until the treatment of these cases is better understood, statistical records of ill success must be taken for what they are worth. Sir W. Fergusson, in his lectures on "The Progress of Anatomy and Surgery during the present Century," delivered at the Royal College of Surgeons, has very aptly compared this operation to a compound fracture of the femur or upper end of the tibia. Would any surgeon in his senses take down a compound fracture every three or four days to see how it was going on or to clean the splint? And if, as is more than likely, such a case came to amputation, or the patient died of "irritation", would this be used as an argument against the attempt to save the limb, and in favour of primary amputation? I think it would rather be set down as an indication that the surgeon who thus acted did not know his business, and had sacrificed his patient's limb or life. I know that there are many more difficulties to contend with in treating a case of excision of the knee, than in a compound fracture of the lower extremity; but the principle should be the same in both cases—perfect and prolonged immobility secured by the use of appropriate retentive apparatus. When surgeons thoroughly recognise this principle of action, we shall begin to find out that the results of the operation of excision of the knee-joint are not quite so bad as some would have us think they ever must be.

[To be continued.]