

On the comparative merits of excisions of the knee, ankle, and elbow joints, and amputation of the thigh, leg, and arm, respectively / by George L. Carrick.

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ON THE COMPARATIVE MERITS OF

14

EXCISIONS

OF THE

KNEE, ANKLE, AND ELBOW JOINTS,

AND

AMPUTATION

OF THE

THIGH, LEG, AND ARM, RESPECTIVELY.

BY

GEORGE L. CARRICK,

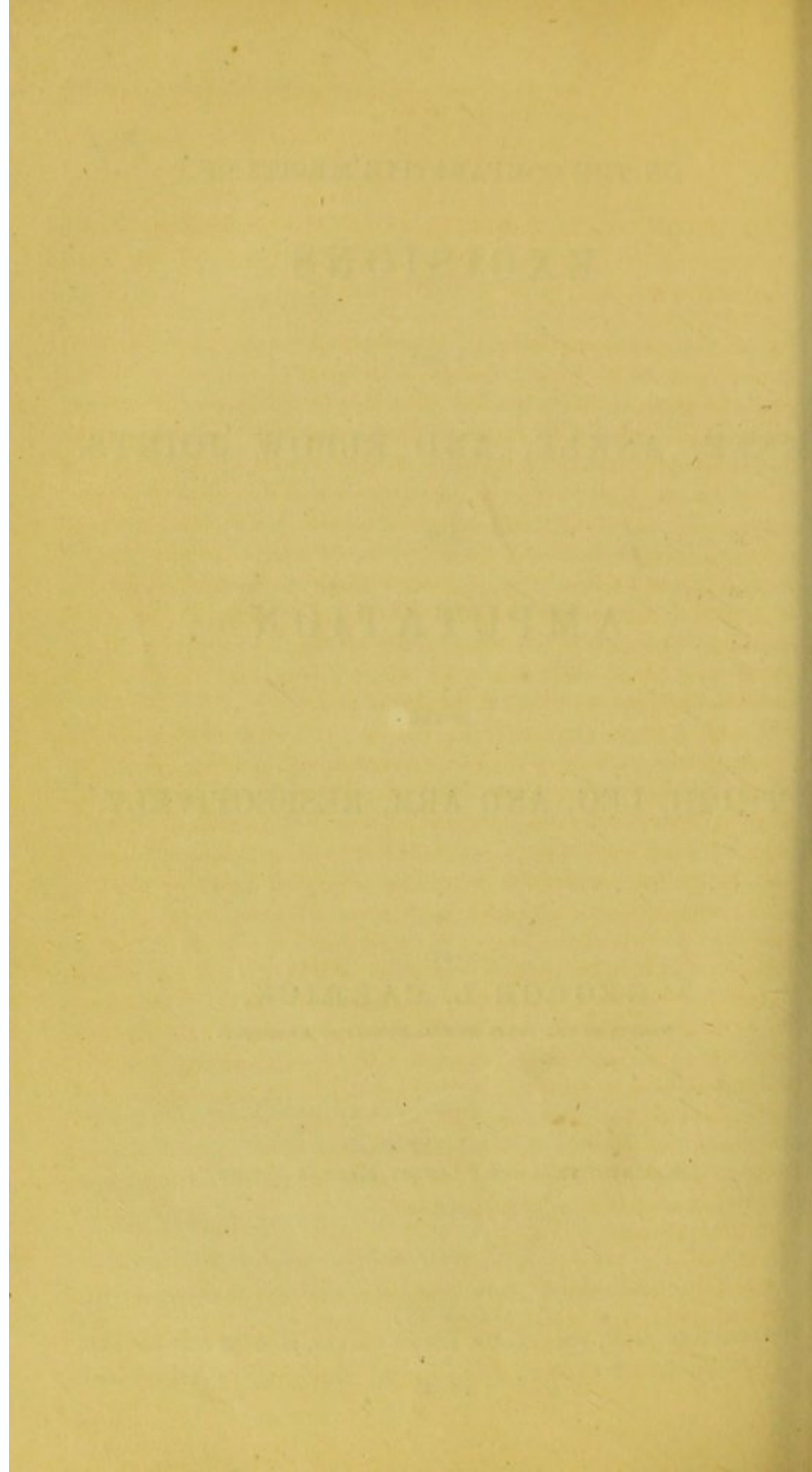
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ON THE COMPARATIVE MERITS OF EXCISIONS OF THE KNEE,
ANKLE, AND ELBOW JOINTS, AND AMPUTATION OF THE
THIGH, LEG, AND ARM RESPECTIVELY.

"In no portion of her vast domains," observes Roux,* "has surgery, since the commencement of the present century, made greater progress than in the reparation of deformities." We may also add, "In the preservation of parts, and in the prevention of deformities." This is even a greater advance than the one just mentioned by the illustrious French surgeon, as conservatism, in our art, has ever been the great aim of all the eminent men who have adorned our profession, and raised it, above all others, to the highest standard of dignity and greatness. The excision of diseased joints, for example, without removal of the limb, can, I believe, if the preserved extremity be useful, leave nothing, to be desired; while every one will, with the great authority just quoted admit that "it is quite certain that improvements have been worked in surgery which we can hardly credit, and which would greatly have astonished our ancestors, could they have lived to the present time."

We shall hereafter see that our only true data, as a whole, for comparing the advantages and disadvantages of certain operations, will be drawn almost solely from statistics. I shall, therefore—and I trust not needlessly—dwell at greater length upon that subject than upon any other connected indirectly with this paper. It is not my intention here to discuss the various diseases of bones and joints for the removal of which amputation or excision must be resorted to, as this subject, besides occupying much space and time, would be quite foreign to the title of this essay. We must therefore presume at the very outset that we know our business as surgeons; that the diseased part presents no chance of recovery, and absolutely requires removal, and that, besides rendering the patient's life miserable, it is undermining his constitution. We have, moreover, no doubt as to our diagnosis being correct, and seeing that the affected joint must be extirpated, we next proceed to the consideration of the best mode in which it may be accomplished. The object of this paper is, therefore, merely to pourtray the comparative merits of the various operations proposed and performed by eminent surgeons for extirpation of diseased joints. The two operations here to be discussed are:—

1st. Amputation.

2nd. Excision.

Let us first take a rapid glance at amputations and excisions in general, previous to entering upon their consideration as applicable to particular joints.

* Quarante années de pratique chirurgicale par Ph. S. Roux, Chirurgien de l'Hôtel Dieu. Tome premier, Chirurgie réparatrice. Paris, 1854. pp. 2 and 3.

Any definite conclusions as to the relative merits of excision or amputation, can only be drawn by a careful attention to numerous and well-authenticated cases.

There are, nevertheless, certain general principles by which we must be guided in preferring one mode of treatment to another.

STATISTICS OF MORTALITY.

An estimate of the amount of mortality which follows the performance of operations is one of the most powerful arguments we can employ for or against their adoption. Nothing should induce us to prefer one operation to another if the risk to life be greater, however numerous the other advantages. It has, in fact, been justly remarked by Mr. Syme* that "the patient's mere convenience ought to be reckoned a secondary consideration. Thus, if the fair induction from extensive experience should satisfy us that the limbs of ten persons labouring under diseased joints might be amputated with the probability of saving the lives of nine out of these whole, while excision of the joints would prove fatal to two, so that only eight would recover, though the condition of the eight would be preferable to that of the nine, I do not think this advantage ought to be regarded as of sufficient weight to balance the life that would be lost." There cannot be a doubt, I think, that any treatment we may choose to adopt, however inferior to another in other respects, ought, if its chance of a fatal issue be smaller, to be preferred. Hence, in endeavouring to prove the superiority of an operation, the percentage of mortality is the first thing to be considered, and unless we can prove it to be smaller in the one instance than in the other, any other marked superiority it may present will be of little avail. Certain exceptions to the general rule may, however, exist, and very knotty points require a careful solution before we adopt what has been advocated above, in every instance.

The good old times, in theory though not in fact, when surgeons contented themselves with preferring one operation to another without being able to assign any cause for thus proceeding, may be looked upon as almost extinct. Statistics were not then in fashion, and each surgeon advocated or denounced an operation, as its failure or success might, from his own experience—limited or otherwise—have impressed itself upon his mind. It was thus that many operations, now acknowledged useful and feasible, were, for a long period, denounced as dangerous in the extreme by the most eminent surgeons of the day, owing to the failure of a few cases under their care. How many lives might have been spared, how many new operations introduced, and how far surgery could have progressed, but for the neglect of statistics, it is difficult to tell. Without their aid we could hardly arrive at any definite conclusions as to the practicability of certain operations, and it is by

* "Treatise on the Excision of Diseased Joints," by James Syme, F.R.S.E. Edinburgh 1831. page 27.

means of them that we are led to adopt or discountenance innovations in our art. "The vast practical importance of the doctrine of statistics," observes Professor Simpson,* "and its power of elucidating, simplifying, and deciding many and various enquiries in surgical and medical science, is now becoming more and more acknowledged by the members of the profession." The great advantages derived from the statistical mode of enquiry and the various objections raised against its employment, cannot here be fully discussed, though I think it imperative to enter cursorily upon the consideration of the errors we are apt to fall into in seeking information merely from that source. In order, therefore, to compile our statistical tables correctly, to be able to draw accurate inferences therefrom, we require a sufficient number of data to build them up; else we run the risk of being led into error. The fault cannot be ascribed to the statistics themselves, but to the scanty material of which they are formed. Take excision of the knee joint as an example, we find that in the first nineteen cases in which this operation was practised, only eight patients survived its effects, thus leaving us an average mortality of 1 in 18-11ths; while in 160† cases in which it was afterwards performed, it only proved fatal thirty-two times, or one in every five. I think a more striking instance of the importance of having a sufficient and reasonable number of data upon which to found our opinion, could hardly be adduced. Neither should we allow any unsuccessful cases, from whatever cause, to escape our notice: every one should be recorded, and it is only by thus proceeding that we can arrive at correct results. There can be but little doubt that the hardship of publishing a case, which, but for the occurrence of some accident or epidemic, would have terminated successfully, is very severe. Since, however, our statistical tables are employed for comparing the sequences of various operations, it is to be presumed that accidents are as likely to occur in the one as in the other. On the introduction into surgery of a new operation, the utmost care ought to be paid to the recording of every case, whether successful or not, and each surgeon, if a true lover of the science he advocates, will not fail in so doing, though it may be opposed to his own interests. No reasonable excuse for not registering certain cases, in the compilation of statistical tables, can be urged. The practice, moreover, if once admitted, would, I fear, be frequently adopted by those members of our profession who never lose a single case without being able to advance a plausible excuse by way of explaining its failure. We only, in compiling our statistical tables, require, according to Dr. Simpson,‡ an answer to the two following questions:—

1st. Was the operation performed? (Reference being made to the particular operation the results of which we are recording.)

* "Obstetric Memoirs."

† I am here only referring to the operations performed in Britain from July, 1850, to the end of December, 1858. See "Contributions to the Surgery of Diseased Joints, with Especial Reference to the Operation of Excision." No. 1, "The Knee," by P. C. Price, Surgeon to the Great Northern Hospital. London, 1859. p. 36.

‡ "Op. cit." Vol. II. p. 559.

2nd. Did the patient die or live after its performance?

In practising a newly-introduced operation, and one which has but rarely been resorted to, we ought to discard statistics completely; not that they are false when a large number of cases is collected, but because they often prove fallacious when the number of data is small. It will be observed from what has been pointed out in a preceding page, when referring to the knee joint, that its excision seemed highly dangerous and unsatisfactory, when based upon the experience of nineteen cases only; when, however, the number of instances in which it was performed swelled up to 179, the percentage of mortality so greatly decreased as to allow the most sceptical a favourable opinion of the operation. Hence the importance, when the number of data is small, of examining into each individual case. Answers, in such instances, to Dr. Simpson's questions, would prove insufficient, as a surgeon unacquainted with aught but the degree of mortality, and having a limited number of cases only to refer to, would hardly be justified upon such grounds either in upholding or denouncing the practicability of any operation. We shall, moreover, as our statistics will be brought to bear chiefly upon the excision of joints, besides inquiring into the degree of mortality after the operation, require, if it prove successful, to know whether the patient has recovered with a sound limb or not. It may in fact be questioned whether we have a right to perform excision, supposing it even to present a smaller scale of mortality, in preference to amputation, when, besides a prolonged recovery, we may have a dangling and worse than useless limb as the result. This subject, however, will be entered upon at greater length, when we come to the consideration of the treatment of particular joints.

AMPUTATIONS.

Amputations, though designated by many as the opprobrium of surgery, require, even in our times, to be often resorted to, in order to relieve the patient's sufferings, and in many instances to save his life. "The frequency of its performance," observes Dr. Lawrie, "the mutilation which it causes, its severity, and its immediate and ultimate dangers, combine to make the operation of amputation one of the most important subjects which can occupy the attention of the practical and operative surgeon, exceeding, in hospitals, many fold, all the other capital operations combined."* Though Dr. Lawrie's remarks were made some twenty years ago, our knowledge upon this most important subject—the "Results of Amputations"—is almost as limited in 1861 as it was in 1840; and we may yet feel justified in exclaiming, with the authority just quoted, that "while the different methods which ingenuity has suggested for the removal of particular parts are minutely detailed in our best and most recent works on operative surgery, hardly one word is said of the results of their operations, either in the aggregate, or as contrasted with each other"

* "London Medical Gazette," Dec. 4, 1840, p. 394.

(p. 395). Now, although the frequency of the performance of amputations has greatly diminished since the late Dr. Lawrie penned the above, we are by no means entitled to anticipate their total discontinuance. Until something better is suggested, we must resort to amputations, and so long as they remain acknowledged operations in surgery, too much attention cannot be devoted to the consideration of their performance or their ultimate results. The strictures passed upon amputations, however groundless they may at first sight appear, are, when minutely enquired into, far from incorrect. The great error, however, which the denouncers of amputations fall into, consists in their regarding the loss of limb alone as the chief opprobrium. This loss, when we think of the suffering which is thereby brought to a close, and the prevention of extension of the disease, is extremely trivial, and may, in fact, almost be regarded as a positive advantage, rendering the operation perfectly justifiable, but for the fearful rate of mortality which follows its performance. Strange as it may appear, it is nevertheless the case, that centuries were allowed to elapse, during which thousands of limbs were removed, and yet surgeons heeded but little the results which followed their formidable operations. The importance of statistics in surgery has only been acknowledged in the present century, the sequences of amputations having received but little attention in former years. Without having by our side a record of the results of certain operations, we cannot, of course, draw any conclusions as to their practicability, and can then only rely upon the opinion of the surgeon, whose impressions as to the success of his treatment are often fallacious. Mr. Benjamin Phillips, in an admirable memoir upon the subject,* asserts that upon applying to medical men, "upon several occasions, as to the results of their individual experience they at once said, 'I very rarely lose a case after amputation:' and when they have referred to their own notes, or to the hospital records, where such a thing was practicable, they have been astonished at the extent of mortality." This clearly shows how long surgeons were, from want of statistics, suffering under the delusion that amputation of the extremities was a rarely fatal operation. The number of deaths following most amputations, those of the thigh and leg in particular, is hardly credible; though, when we refer to statistics, the facts are plainly placed before us.

Having consulted every statistical table within my reach, I have found the average amount of mortality from capital operations to be no less than 31 per cent. in cases of amputation for organic disease. In cases of amputation for accidents, 41 per cent. has been the average mortality. Hence it will be observed that amputations, so far as the percentage of mortality is concerned, have but little to recommend them.

Our first objection to amputation, therefore, is its danger to life, which danger, as we shall hereafter see, is not so great in excisions.

The second objection which may be fairly raised against amputation is the complete and irreparable loss of limb; though, as a very eminent surgeon justly

* "Medical Gazette," June 9, 1838, p. 458.

remarks, "It is better that a man should live with three limbs, than die with four." We, however, of the present day, reply that, satisfactory as it may be to live with three extremities, yet all things, the limbs excepted, being equal, we would prefer to evade death with four. "Any surgeon," observes Mr. Fergusson,* "can amputate an arm, but when once done it cannot be replaced, and no artificial apparatus can ever be compared, either in appearance or usefulness, with the parts, whatever may be their condition, after successful excision of the joint." This truism ought always to be borne in mind, and is one which should greatly influence our decision as to the practicability of an operation.

Another objection to the performance of amputation is the great shock which the system must necessarily sustain from the division of so many nerves, and the hæmorrhage which accompanies the wounding of large arteries. This last objection, in our days of chloroform, is deprived of much of its force; for the system cannot be subjected to much shock when the power of sensation is completely destroyed.

We shall now endeavour, in a cursory manner, to state the advantages which amputation possesses over excision:—

1st. The speed and facility of performing the operation, which, according to Mr. Fergusson, ought to be accomplished "in from thirty seconds to three minutes."†

When a patient's life and future comfort are at stake, the quickness of the operation need hardly, if at all, in these days of anæsthesia, be taken into consideration, and as regards the facility of its accomplishment compared with excision, it cannot upon such grounds alone be preferred, even by the tyro surgeon. These two advantages can, therefore, hardly be regarded as such, and would place the power of amputations in jeopardy, but for a point they really seem to have in their favour, viz.:

2nd. The comparative speed of the recovery, when compared with the time required for convalescence after excision. This point, though of trivial importance in hospital and town practice, requires the serious attention of the operator in the field of battle, and especially in cases of injury of the lower extremities. In wounds of the arm the subject hardly merits any consideration, as the prolonged recovery confines the patient neither to his bed nor to the hospital, and can therefore prove no barrier, to the performance of excision; in the lower extremity, however, it is quite different. That patients do recover sooner from the effects of an amputation than from excision, there cannot, I think, be a doubt; and this, as we shall hereafter see, is more particularly applicable to the lower limbs. It must, I think, be evident that a stump which has been formed from a healthy part of the thigh, and far removed from the former seat of the disease, will, *cæteris paribus*, present a better chance

* "A System of Practical Surgery," by William Fergusson, F.R.S. Fourth edition. London, 1857. p. 297.

† Op. cit., page 297.

of a speedy recovery, and will be better able to support the weight of the body than a leg weakened greatly by disease and out of exercise for months. Hence, this is a most decided advantage, and justly merits the military surgeon's consideration in those cases where a speedy recovery is desired. Yet, from what has been stated in a previous page, we cannot prefer to amputate on these grounds alone, though the treatment to be pursued in particular instances must of course be judged of by the circumstances of the case, and had better be left to the discretion of the surgeon.

Let us next proceed to consider excision of joints, and see if that operation presents any marked advantage over amputation.

EXCISION.

The extirpation of diseased joints, though hinted at by Paulus Ægineta and Heister, was not put into practice until the 14th April, 1768, when Charles White excised the head of the humerus, in the Manchester Infirmary. The operation was attended with complete success, the patient retaining the perfect use of his arm.* Vigaroux seems to have performed a similar operation at the same time; indeed, according to South,† both he and David‡ had recourse to it before White, the details, however, made their appearance in print later. The success which attended White's case with similar happy results in the cases of Bent and Orred, led to "its further extension to other joints."§ It was then performed with success by Park on the knee, and proposed by him for the elbow joint. The Moreaus put the latter operation into execution a few years after, and also introduced excision of the wrist and ankle joints. Park was, in fact, really the first not only to perform excision of the knee joint, but also to demonstrate its practicability on the elbow, before the Moreaus ever thought—or at any rate spoke—of a like proceeding. Velpeau, however, seems determined to scrape the laurels off a British head, and adorn with them the skull of a worthy, though less-deserving Gaul. I am more than astonished at Velpeau's glaring misstatement, which runs thus:—"Parck," he observes, without even taking the trouble to spell the great man's name correctly, "qui voulut les (*i.e.*, resections) étendre a tous les articles, ayant fini par en reduire de beaucoup l'importance, M. Moreau est en réalité le premier (?) qui en ait véritablement démontré les avantages."(?)|| It must, at the same

* "Cases in Surgery: with Remarks," by Charles White, F.R.S. London, 1770. page 57.

† "A System of Surgery," by J. M. Chelius. Translated from the German, by John F. South. London, 1847. Volume II. p. 968.

‡ Chelius. Vol. II. page 969.

§ Roux, in his admirable treatise on excisions, is of opinion that none of these three can claim priority. "David, de Rouen," observes that eminent surgeon, "Vigaroux de Montpellier, et White, célèbre chirurgien Anglais, firent à-peu-près en même-temps la résection de l'extrémité supérieure de l'humerus affectée de carie." See his: "De la résection ou du retranchement des portions d'os malades, soit dans les articulations, soit hors des articulations, &c., &c.," par M. Philibert-Joseph Roux, Docteur en Chirurgie, &c., &c. Paris, 1812. page 32.

|| Nouveaux Eléments de Médecine opératoire, accompagnés d'un atlas, &c., &c.," par. Alf. A. L. M. Velpeau, Chirurgien de l'Hôpital Dieu, &c., &c. Tome première. p. 535. Paris, 1832.

time, be pleasant for us to know that the whole merit of proposing excision of the knee and elbow joints is, by Roux, accorded to Park.*

The percentage of mortality, as we shall presently see from statistics, is smaller in excisions than in amputations, and hence the former operation may justly, upon these grounds alone, claim our most careful attention. It would certainly prove a task of no inconsiderable difficulty clearly to account for so small a percentage of mortality in one instance, as compared with that in another; but when excision is resorted to, we have the following decided advantages, which to a great extent account for the smaller rate of mortality.

1st. As in the operation nerves of no magnitude are severed the system cannot sustain any appreciable shock.

2nd. No chances of secondary hæmorrhage present themselves, as arteries of no great size have been divided.

3rd. No large veins being cut across, the risks of pyæmia are lessened.

4th. Since, according to the surgery of the present day, we are taught that the further we operate from the trunk the greater the chances of a successful issue, excision of course claims the advantage.

Hence it will be seen that the great calamity we so dread in amputations is here to a certain extent, though not greatly diminished. But there are other supposed advantages which undoubtedly are such, when the case terminates successfully, and without which, though life be preserved, we must regard the operation as a complete failure. One advantage I here refer to is the preservation of a sound and healthy limb, which, according to Mr. Fergusson, cannot be equalled by the best artificial substitute. The operation we undertake, however, and the extremity it is performed on, will of course influence us in attaching a greater or less importance to the preservation of the leg or arm. These questions will be more fully dwelt upon hereafter, when we come to treat of particular joints, suffice it for the present to say that, should the patient be able to use his leg well, and rest his body upon it without feeling tired, or with the arm be capable of performing flexion and extension, the success may be regarded as complete. Another advantage consists in our being able to resort to amputation, should excision prove fruitless. Thus, if we find the parts extensively diseased in attempting resection, and should that operation not be warrantable from the extent of the malady, we at once proceed to amputate; and even many weeks after the performance of the former we may, failing to obtain a satisfactory result, resort to the latter. In amputation, however, we have no chance of preserving the limb, and hence common sense would suggest that a trial should be made to save a part by removal of merely the irritating cause; that failing to give relief, we cut off the whole extremity. Having thus cursorily portrayed all the advantages of excision, I shall now pass on to a consideration of the objections raised against its adoption, which are fortunately more numerous than grave.

That the condition of the patient is superior, after successful extirpation of

* Roux. Op. cit. page 34.

his joint, to what it is after successful amputation, no one, I hope, will deny, as, from what we have already pointed out, an artificial limb is always inferior to the natural one. Hence, if the results of our resections, so far as the production of an useful limb is concerned, were always successful, no one could for a moment doubt the propriety of resorting to them in *every* instance. But certain objections do exist to this operation, and these, when duly balanced, will make us pause slightly before we extol it more than it deserves. It will be remembered that the great advantage derived from resection consists in the preservation of an *useful* extremity, which, under other circumstances, would have had to be replaced by an artificial apparatus. This great boon is, however, in many instances denied the patient; firm bony union never takes place, and the result is a worse than useless and dangling appendage, which, if it be the lower extremity, forms a great impediment to walking. To this condition a nice stump, with a well-fitted wooden limb, is of course preferable.

The second great objection well merits our most careful attention, though we shall refrain from discussing the subject until we come to the knee joint, where it has, as will presently be seen, excited a great deal of contention. It is this; that the bones of the limb, from which the articulation has been excised, never again take on an active growth, and hence the diseased extremity, should the operation have been performed in early childhood, becomes stunted in size. This objection will, of course, apply only to the performance of resection before puberty.

Tediousness in the cure forms, under certain circumstances, an objection to this operation. Thus in the field of battle, when many require to be accommodated in a single hospital, the discharge of the ailing should be as speedily accomplished as possible.

This operation is longer in being performed than amputation, which may also be urged as an objection to its employment in military practice.

These objections are not applicable to every case of excision, and it is in certain joints that we may expect to find one or more of them dominant. The advantages and disadvantages of amputation or resection, as applicable to certain joints, will be pointed out when we come to treat of those parts; so far we have considered in a general manner the most important points in reference to the two great modes of treating incurable disease of joints.

PART II.

AMPUTATION OF THE THIGH.

The frequency with which we are obliged to resort to this operation, both in the field of battle and among the poorer classes of society in hospital practice, as well as the great and fierce discussions which have prevailed in reference to the best way in which it may be performed, render it well worthy of our deepest attention. Not that the various modes of procedure influence, so far as I am aware, its fatal termination, but they may render other inconveniences less felt should the patient survive the dangers which follow its performance. To enter upon a full and lengthened description of the various ways of operating, and the after treatment, would, of course, be superfluous. Too little may, however, be said upon a subject, and I cannot conceive why the importance of this operation is so much undervalued by Dupuytren, who hardly deems it worthy of a separate description, but places it under the same head with amputation of the arm, in order, as he asserts, "to avoid repetition."* All we shall endeavour to prove, therefore, by discussing the different modes of amputation, will bear upon the results as regards the appearance and utility of the stump. The two great methods of amputating the thigh are the circular and the flap operations, the former being an ancient procedure, the latter of more recent date. That amputation by flap has, during the last thirty years, been a great favourite with British, and more particularly with Scotch surgeons, no one, I think, will doubt. In referring to the admirable and philosophic works of the two great ornaments of our Edinburgh school, Liston† and Lizars,‡ we find the circular method held in such contempt, that they hardly deign to mention it, while no satisfactory reason is assigned for thus exclusively resorting to the other mode of procedure. "The influence of these gentlemen, as well as that of Sir George Ballingall, has," according to Mr. Fergusson, "induced thousands to follow the example." The great difficulty to be encountered, however, in drawing accurate comparisons between the flap and the circular operation is the general preference which a surgeon gives to one or other of these two modes of procedure, and which he always afterwards practices. Thus, Lizars, Liston, Ballingall, and Fergusson resorted almost exclusively to the flap operation and could therefore speak with but little confidence in regard to the circular method.

"If rapidity of execution," observes Mr. Fergusson, "be taken as the test of superiority, then the flap operation should be allowed the preference; the

* "Leçons orales de Clinique Chirurgicale," faites à l'Hôtel Dieu à Paris, par M. le Baron Dupuytren, Chirurgien in Chef. Tome quatrième. Paris, 1834.

+ "Practical Surgery," by Robert Liston, Surgeon. London, 1837.

‡ "A System of Practical Surgery," by John Lizars, Professor of Surgery at the Royal College of Surgeons, Edinburgh, &c. Part I. Edinburgh, 1838.

difference, however, would only at most amount to five minutes, and this, therefore, can hardly, if chloroform be employed, be regarded as a weighty advantage." It has also been asserted, and no doubt with a considerable degree of truth, that the flap operation, by the large amount of muscle which is left to form a cushion for the bone, possesses an advantage over the circular method, where the stump is left with merely a covering of skin. This, however, as Mr. Fergusson has pointed out, will depend upon the manner in which the operation has been performed; and should Alanson's conical method be adopted, a similar calamity cannot be expected to ensue. Sir George Ballingall, Professor Salomon, and others, state their belief that the vessels from the slanting manner in which they are divided do not so completely retract in the flap operation as they do in the circular, and hence the greater amount of hæmorrhage following the adoption of the former procedure. It has, however, been shown by Mr. Fergusson that the arteries are more easily reached when we have flaps to deal with, and that ligature of a few more blood vessels cannot be productive of any evil consequences. It has, in fact, been most satisfactorily proved by him (and he treats of the subject in a most logical and masterly style), that "the evils resulting from one operation may be as great as from the other, according to the manner in which each is performed." I would hence conclude that, for the future, it will be quite immaterial which operation, the flap or the circular, is referred to, and we shall therefore speak of either under the more general title of amputation of the thigh.

In order to fix any value upon this important operation, let us first inquire into the objections raised against its performance, and having ascertained these we shall endeavour to trace any redeeming points it may possess, as compared with resection of the knee.

1st. Mortality after amputation of the thigh.

I have, in a former page, alluded to the large percentage of mortality which follows the performance of capital operations, and we find this most strikingly evinced in cases where amputation of the thigh has been resorted to. Cases in which amputation has been performed for injury have, I think, been most unjustly and indiscreetly mingled with those in which the operation was employed to arrest organic disease, and both have been drawn up into one statistical table, and brought to bear upon decisions as to the relative merits of amputation of the thigh and resection of the knee. We find upon consulting many statistical tables that the performance of amputation for injury, whether primary or secondary, invariably displays a far greater rate of mortality than when had recourse to for organic disease. However much such a proceeding may strengthen the cause of one who denounces amputation and advocates excision, it must be regarded as very unfair and mischievous. Thus, in endeavouring to do justice to both operations, and to attach to each their respective merits, I have, in compiling the following table, strenuously avoided recording any operation performed for injury or any traumatic disease, as, from what we shall presently see, the malady for which resection has been practised, has, in almost every instance, been organic.

PATHOLOGICAL AMPUTATIONS OF THE THIGH.

What hospital performed in.	Number of Cases.	Number of Deaths.	Per centage of Deaths.
1. Glasgow Hospital. ¹	92	19	21
2. Hôtel Dieu, Paris. ²	153	92	60
3. University College, London. ³	46	9	20 $\frac{1}{2}$
4. Various hospitals. ⁴	415	87	21
5. St. Thomas' Hospital. ⁵	17	4	24
6. Dorpat Hospital. ⁶	21	8	38
7. (Hospital not mentioned, but amputation was performed for chronic disease of the knee-joint). ⁷	—	—	15 (?)
8. Various Russian hospitals. ⁸	22	11	50
9. Pirogoff's private practice. ⁹	17	5	30
10. Oboohoff Hospital, St. Petersburg. ¹⁰	—	—	45
11. Edinburgh hospital. ¹¹	43	21	49
12. British hospitals. ¹²	284	107	38
13. Provincial and London hospitals. ¹³	303	71	25
Total	1,413	434	34

Where the number of cases is unknown, as in Oboohoff hospital, and in Bryant's conclusions, we have an average of 30 per cent., 45 in the former, and 15 in the latter. The high per centage of mortality following amputation of the thigh, results from the following causes:—

1st. Our operating nearer to the trunk than in excision.

2nd. Greater amount of shock, from the division of so many important nerves.

3rd. Large amount of hæmorrhage during the operation, from division of blood vessels of considerable magnitude, and also risks of "intermediate" and secondary bleeding.

4th. Greater risk of pyæmia.

The second great objection to amputation of the thigh is the thorough and permanent loss of limb thereby entailed.

Numerous patients will on no account submit to amputation, while they readily allow the performance of excision.

Having thus cursorily detailed some of the objections to amputation of the

¹ Lawrie, in "Medical Times and Gazette," for March 15th, 1844.

² Malgaigne, cited by Phillips, in "Medical Times and Gazette," for March 15th, 1844.

³ "The Science and Art of Surgery," by John Erichsen. Second Edition. 1857. p. 21.

⁴ Phillips, in "Medical Times and Gazette," March 15th, 1844.

⁵ South's Notes in Vol. II., p. 905, of "Chelius' Surgery." Operations between 1835 and 1840.

⁶ Schimanoffsky, already cited, p. 378.

⁷ Bryant in "British Medical Journal" for March 19th, 1859, page 232.

⁸ Pirogoff, quoted at page 33.

⁹ Ibidem.

¹⁰ Ibidem.

¹¹ Peacock, cited by Simpson, in "Obstetric Memoirs, &c.," page 575. Vol. II.

¹² Simpson, in the same work.

¹³ Teale, quoted by Price, in his admirable pamphlet on "The Surgery of Diseased Joints, with especial reference to the operation of excision," page 42. London, 1859.

thigh, we shall next endeavour to discover if anything may be said in favour of its adoption. The advantages of resorting to amputation in preference to excision are by no means so trivial as we may at first sight imagine. Thus, to commence with, amputation is far more speedily accomplished than resection.

2nd. There is less difficulty in the performance of the operation.

3rd. It is said that the patient more quickly recovers from its effects, and is enabled to walk about far sooner, than if excision had been resorted to. It ought, however, according to Mr. Syme, "to be recollected, that though recovery from amputation of the thigh is usually completed in from three to 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."*

EXCISION OF THE KNEE-JOINT.

This is, undoubtedly, one of the most interesting operations in modern surgery, and will therefore command our attention for a longer time than any other proceeding considered in the present essay. The reasons for this are—

1st. Because great and fierce discussions have arisen in reference to the practicability of excision of the knee.

2nd. Because it is one of the highest triumphs of conservative surgery.

3rd. Because it affords us an admirable illustration of the manner in which any new introduction into surgery is received.

4th. It gives us an admirable example of the care we should bestow upon statistics in surgery, and of the necessity of drawing our conclusions only from a sufficient number of data. We thus find Park's operation abandoned by several eminent surgeons merely because its success did not reach their highest expectations, and the failure of one or two cases successively was thought quite sufficient to cause the operation to be denounced as replete with danger and perfectly useless. Thus, Mr. Fergusson asserts that he had for a long while "preferred amputation of the thigh to excision of the knee joint, because of the indifferent success of the *dozen* or more instances which have been recorded of the latter." It really seems strange that a practitioner of world-wide fame, known for his logical reasoning and sound practice, should so hastily condemn an operation, before even trying it himself, and after its trial only about a dozen times by others. To him, however, is due the credit of reviving it, and the success which has followed its adoption in recent times has far exceeded the most sanguine expectations of Park.

Excision of the knee-joint, though claimed to have been first performed by Mr. Filkin, of Northwich, on the 23rd August 1762, was really put into execution on scientific and sound theoretical grounds by H. Park, of Liverpool, on the 2nd July, 1781. Thus the operation, taking it even for granted, though proof is wanting, that Filkin was the first to perform it, seems to have been in

* "Treatise on the Excision of Diseased Joints." By James Syme, F.R.S.E., &c. Edinburgh, 1831. page 131.

a dormant state for twenty years, its originator (?) during this long space of time never having deemed it worthy of the profession's attention until the publication of Park's admirable treatise in 1782. Supposing therefore that Filkin was the first to excise the knee-joint, he was quite unable to appreciate the advantages of the operation, and seems to have entertained no principles upon which to base his practice. The merit of first establishing it as a truly surgical operation, both in theory and in fact, belongs, therefore, without a doubt, to Park, and to him alone we are indebted for demonstrating its practicability.

His first experiments in excision were performed, strange to say, on the knee-joint, though he himself avows, that he "would rather have wished to make the first attempt of this kind on the elbow."* The opportunities for operating afforded to this distinguished surgeon seem, according to his own statements, to have been very limited, and his boldness in thus attempting it first on the knee may at once be explained. Park asserts that, after having performed experiments on the dead body, he "resolved to put this operation in practice on the first favourable opportunity." Hector M'Caghen, "a robust Scotch sailor, aged thirty-three, was admitted for a diseased knee-joint of ten years standing." The case was of a scrofulous character, "and the contraction of the flexor muscles was such as to draw back the leg so as to form a right angle with the thigh, in which position it was immoveably fixed." The patient's sufferings increased daily, and Park, thinking this a favourable opportunity for excision of the knee-joint, the man being robust and the other parts being apparently free from scrofulous affection, performed the operation with the patient's consent, on the 2nd July, 1781. His mode of procedure in performing resection will be detailed at a future period; suffice it to say that the man made a complete though tedious recovery. The patient was subject to frequent attacks of inflammation in the neighbourhood of the joint, and numerous abscesses also formed in the vicinity of the part, which tended in some degree to retard the cure. The man, moreover, met with a most unfortunate accident on March 23rd (*i.e.*, eight months after the operation) in a fall occasioned by the breaking of one of his crutches, just as he was beginning to use his limb. "Pretty high inflammation" ensued in the joint, ending in the formation of an abscess, and thus impeding his recovery. "It was not before the end of July" (*viz.*, upwards of twelve months after the operation), that his limb "acquired sufficient firmness to support the weight of his body."† Thus, though it required a year to accomplish a complete cure, Park does not hesitate to declare from what he sees of the man's limb, that it appears so much more valuable than any artificial one, that were he in the patient's situation he should infinitely prefer excision, at the price at which he (the patient) has obtained it.

* "Cases of the Excision of Carious Joints," by H. Park, Surgeon in the Liverpool Hospital, with Observations by James Jeffray, M.D. Glasgow. 1806. p. 19.

† *Op. cit.*, p. 35.

In the year 1789, Park states, in reference to the case Hector M'Caghen, "that he made several voyages to sea," after the operation, and that "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."* The first attempt therefore at excision of the knee may be regarded as a complete success; and except for the tediousness of the cure leaves nothing to be desired. In a letter to Dr. Simmons, dated Liverpool, November 5th, 1789, Mr. Park gives an account of his second operation on the knee-joint, though the day of its performance is not mentioned. This man, aged 38, though to appearances strong, came of a highly scrofulous family. The *modus operandi* was similar to that employed in the former case; the man, however, sank four months after the operation, "in spite of all efforts to save him."

P. F. Moreau, jun., in his admirable treatise on the excision of carious joints,† assures us that though translated into French by Prof. Lassus, in 1784, Park's observations on resection seem to have attracted little attention, and to have been almost wholly discredited in that country. The third case on record is that performed on Sept. 17th, 1792, by Moreau, sen., in presence of M. Percy, his colleague, M. Chamerlat and M. Gremiliet. This case progressed remarkably well for three months and a half, at the end of which period the unfortunate patient was carried off by an attack of epidemic dysentery.‡ Mr. Butcher, in his excellent memoir on excision of the knee-joint, asserts that the operation was repeated by Moreau, sen., with as little success the second as the first time. "In a third case by the younger Moreau, the result was more fortunate, the patient recovered with a serviceable limb.§" Mülder, in 1809, operated on a pregnant woman who died of tetanus four months afterwards.|| Roux extirpated the knee-joint once, and lost his patient;¶ Textor twice, and lost both; Fricke four times, and three died; while Jaeger was successful in one case.

Sir Philip Crampton was the first, after Park's failure, to revive this operation in Britain, having performed it on a female aged 23, on March 7, 1823.** The patient though of a very scrofulous habit, recovered the effects of the operation, but died of an impaired constitution three and a half years after. The second patient, also a female, æt. 22, of a strong constitution, was operated upon on August 4th, of the same year.†† She was discharged "cured" six months after the operation, the shortening of the leg being four inches. Mr. Syme excised the knee of a boy, eight years old, in 1829, and three months

* Works already quoted, p. 48.

† "Cases of the Excision of Carious Joints," by P. F. Moreau, M.D., de l'école de Paris. Translated by James Jeffray, M.D. Glasgow. 1806. p. 80.

‡ Moreau, op. cit., p. 136.

§ The Dublin Quarterly Journal of Medical Science. Vol. XIX. February and May, 1855. p. 4.

|| Ibid. p. 4.

¶ Dictionnaire des Sciences Médicales, par une Société des Médecins et des Chirurgiens. Paris, 1820. Cited by Price, in his pamphlet on the "Surgery of Diseased Joints," &c. p. 45.

** "The Dublin Hospital Reports and Communications in Medicine and Surgery." Vol. IV. p. 196.

†† Ibid. p. 203.

after the operation "the patient could make some use of it in walking."* He was afterwards discharged cured, with the diseased limb two and a half inches shorter than the other. In 1830, the same surgeon operated on a very thin, weak, unhealthy looking child, aged 7, who did not long survive the effects of the knife.


It will be observed from the preceding, that, though advocated for almost half a century before the failure of Mr. Syme's last case, excision of the knee-joint had only been performed, including Filkin's and Park's cases, some nineteen times. The operation might, perhaps, have been resorted to oftener, but those are the only cases on record. Twelve of that number had been performed on the continent. From 1830, viz., after Mr. Syme's unsuccessful case, we find it completely abandoned for a period of no less than twenty years, when it was again revived by Mr. Fergusson. Thus, during a period of sixty-nine years, the operation was performed only nineteen times, both in Great Britain and on the continent; during which period it was subjected, in this country at least, to three revivals. It was unnoticed in Britain after Park's failure, until revived, in 1823, by Sir Philip Crampton. Another effort as fruitless as the former was made by Mr. Syme in 1829, and the last and successful revivalist was Mr. Fergusson in 1850. From July, 1850, to the end of December, 1858, it has, according to Mr. Price, been performed one hundred and sixty times, and from 1858 to the present day I have collected from various journals, forty-eight cases more.

What, then, could have prompted surgeons to adopt it so readily of late years, while in former times it seems to have been almost completely abandoned? The reason is, I think, the following:—Out of 19 cases operated upon from 1781, to 1850, no fewer than 11 perished, 8 or 9 of the patients sinking, apparently, from the effects of the excision. Moreau's case, we have already seen, was most favourably progressing, when the man died of epidemic dysentery. In Mülder's case tetanus supervened after delivery, and killed the patient. Sir P. Crampton's first case was one, as he himself says, "in which excision was not applicable," the patient being of a very scrofulous habit, and sinking not from the effects of the operation, but from disease of the lungs, three and a half years after. In Mr. Syme's second case, nine days after excision was performed, "two inches of the femur were cut away with pliers, in order to prevent displacement of the bones." With these remarks we shall draw to a close the first great epoch of this operation, at the end of which twenty years of utter seclusion follow. Our thanks, however, and in fact the deepest gratitude of the profession at large, will be due to those who have made the attempts, however generally unsuccessful, to revive in spite of the prejudices of their brethren in arms, an useful and worthy operation. At the same time we cannot but wonder at the small amount of perseverance exhibited by most of its advocates, who upon failure of one of their operations

* "Treatise on the Excision of Diseased Joints," by James Syme, F.R.S.E. Edinburgh, 1831. p. 135.

seem to have completely abandoned it, and to have resorted to, as we have already seen, the more easily performed though less safe proceeding of amputation. We must make an exception in favour of Fricke, who performed resection four times, in spite of three cases out of that number proving fatal. The operation, as already stated, commenced its second epoch in 1850, then revived by Mr. Fergusson. His case, unfortunately, was unsuccessful, but in spite of the great surgeon's failure, the "proceeding was repeated six months afterwards by Mr. Jones, of Jersey, the result being highly satisfactory."* Mr. Jones performed the operation four times in one year, three cases having been attended with complete success, and numerous trials were afterwards made by almost all the eminent surgeons of Great Britain and Ireland. It would occupy too much time were each individual operation to be related, and would, at most, be nothing more than a copy, word for word, of already published cases. I have only to refer to the leading medical journals in which they are detailed at length by the operators themselves, or to Mr. Butcher's most admirable memoir, in which each is satisfactorily though briefly recorded. With these remarks I shall draw to a close this brief sketch of the history of this important operation, and shall pass on to the consideration of the various ways in which resection may be accomplished.

MODE OF PERFORMING THE OPERATION.

Park, who as we have seen was the first to perform this operation, imagined that he might excise the articular joints by making a simple longitudinal cut, commencing two inches above and ending two inches below the patella. In this, however, he was deceived, and was obliged to resort to an incision, nearly half way round the joint. The patella was then removed, the condyles of the femur were exposed by means of a catlin, upon the withdrawal of which a spatula was thrust into its place to protect the deep vessels and nerves, while the femur was sawn through. The head of the tibia was then turned out and easily sawn off. Park himself adds in a postscript that he "is quite conscious that his mode of operating is by no means perfect, but still stands in need of the finishing hand of a more able master." Moreau, senior, thus excised the knee-joint:—"A longitudinal incision was made between the vasti and flexors of the leg, down to the bone. These incisions were begun about two inches above the condyles of the femur, and were carried down, along the sides of the joint, until they reached the tibia;" "I united them," he proceeds, "by a transverse cut, which passed below the patella, penetrating to the bone." Thus the cut made use of by Park can be represented in the following way: +, forming four flaps; that of Moreau forming one, resembles this , which may be modified into the H incision. Moreau, in fact, was the first to recommend the lateral incisions to be carried downwards, should the tibia and fibula prove diseased. Sir Philip Crampton was the first in this country to perform the H incision, which

* "A System of Practical Surgery," by William Fergusson, F.R.S., &c. London, 1857. Fourth edition. p. 456.

seems to have been adopted by Mr. Jones, and formerly by Mr. Fergusson, as well as, in his first case, by Mr. Mackenzie, and now by Mr. Butcher. "San-son and Begin* recommend, after half bending the leg, to make a transverse cut from one lateral ligament to the other, and divide them and the ligament of the knee-cap at a stroke. The joint surface of the thigh and shin-bone are then easily laid bare; and, by continuing the cut according to circumstances along these bones, the joint surface of one or other bone may be protruded and thus sawn off." "Jäger 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."† It may be represented thus: —|——|— Mackenzie asserts that "the semi-lunar incision seems 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."‡ Mr. Fergusson has lately excised the knee-joint with a single incision, by making a transverse cut "just below the level of the lower border of the patella, dividing the structures down to the joint. On the leg being further flexed the tissues were readily separated from the ends of the femur and tibia; and the saw was easily applied to them and a slice taken off each."§ "The best plan," observes Mr. Syme, when referring to the performance of this operation, "is to make two semilunar incisions across the fore part of the joint, extending from one lateral ligament to the other, meeting at their extremities, and including the patella between them."|| Mr. Syme's operation necessitates, from the large amount of skin removed, the extirpation of the patella. This, however, will not be regarded as an objection by those who recommend its excision in every instance.

Ought we to endeavour to save the knee cap when healthy? The diversity of opinion upon a subject of apparently so little consequence is very great, and leaves the point, to a certain extent, still unsettled. Mr. Jones, of Jersey, was the first to leave the patella without dividing its ligament in resection of the knee, and Mr. Mackenzie asserts that "the advantage of leaving the patella cannot fail 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 more useful and more seemly than when that bone is taken away."¶ "The patella," observes Mr. Fergusson, "may in general be allowed to remain, though it may be doubted whether this

* Cited by Butcher, in first Memoir; Dublin Quarterly Journal of Medical Science, p. 51; also in "Chelius's Surgery." Vol. II. p. 981.

† "Chelius's Surgery." Vol. II. p. 981.

‡ "Monthly Journal of Medical Science." Vol. XVI. p. 540.

§ "British Medical Journal" for Feb. 26, 1859.

|| "Treatise on Excision, &c., &c." page 133.

¶ "Monthly Journal of Medical Sciences." Vol. XVI. p. 540.

bone be of much service." "In every instance," says Mr. Butcher, "the patella should, if possible, be preserved, and whenever practicable, its ligaments undivided." "Preserving the patella, and not dividing its ligament, makes the operation," according to the assertions of Mr. Jones, "more tedious and difficult; but this is a very secondary consideration when it results in obtaining a more favourable issue."*

With such arguments in favour of preserving the patella, and advocated by such eminent men, it is astonishing how strongly its total removal is again recommended by others. Thus, Dr. Kinloch assures us that he "could never appreciate the advantages said by many surgeons to be gained by leaving the patella in cases of resection,"† and would thus invariably advise its removal. "It is difficult to see," observes Mr. Pemberton, "in what way this bone (the patella), had it been in a state to have been left, could have added to the material strength of the union. I prefer, for my own part," he continues, "in all cases now to take away the patella. When left it is always unsightly (?), frequently the seat of subsequent mischief (surely not, unless the bone be diseased), and very rarely of any advantage to the power of the limb."‡ Dr. Druitt, in alluding to the removal of the patella, says, that, "perhaps it is the best plan always to do so."§ In perusing therefore the different opinions expressed as to the advisability of its removal, we cannot fail to perceive how very weak and unsatisfactory are the arguments of those who advocate extirpation of the knee cap. We have, in fact, merely the author's advice to remove it, without any reasons being adduced in support of his dogma; while, on the other hand, among those who caution us to leave the patella, we have the most complete summary of the many advantages derived therefrom. Unless therefore Drs. Kinloch, Pemberton, and Druitt, can afford us proof of the correctness of their statements, the practice they advocate can never be adopted.

Having now described the various modes of making our incisions in the performance of this operation, we shall devote a few lines to the consideration of the *saw*. Park employed the common dissecting room saw in the first case on which he operated, and thus experienced some difficulty in separating the bones without injuring the soft parts. "The common saw," observed Dr. Jeffray, "whatever be its size, being straight on its cutting edge, and on that account acting in a direct line on every thing that comes in its way, is ill adapted for this operation, when the bones are deep sunk among the flesh."|| In order to remedy this evil, Dr. Jeffray invented a most ingenious chain saw, provided with a handle at one extremity and blunt needle at the other. The needle is passed beneath the femur, the sharp teeth of the saw encircling the bone, and thus, by a rotatory motion, we may accomplish our object without in the least

* "Butcher's First Memoir," p. 55; and also "Medical Times and Gazette," for July, 1853.

† R. A. Kinloch, M.D., in the "American Journal of Medical Science," July, 1859, page 71.

‡ "British Medical Journal," December 10, 1859.

§ "The Surgeon's Vade-Mecum: a Manual of Modern Surgery," by Robert Druitt L.R.C.P.L., &c., &c. Eighth Edition. London, 1859. page 747.

|| "Observations," by James Jeffray, M.D. page 173.

injuring the surrounding textures. The application of this instrument is, however, attended by disadvantages, and hence the common saw has been generally resorted to. Mr. Butcher has employed a most excellent instrument for the removal of the articulated ends of bones, which may also be used in amputations. It consists of a narrow saw tensely stretched between two upright bars, by a screw in the middle of the uppermost cross-bar; the serrated edge may be turned upwards or outwards at leisure, and fixed in that position by means of a screw. "It cuts," according to Mr. Butcher, "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. It also cuts more rapidly than any other saw, owing to the extreme tension of the blade." It will therefore be perceived that this saw possesses every advantage over the common one, and should hence always be preferred.

Not only upon the performance of the operation does the success of the excision depend, but greatly also upon the after treatment, and this consists chiefly in keeping the leg at *rest* and *extended*. Both the rest and extension may be perfectly accomplished by Mr. Butcher's admirably-constructed box, or by the splint described by Mr. Price as used by Mr. Fergusson, in King's College Hospital.

ADVANTAGES OF EXCISION OF THE KNEE OVER AMPUTATION OF THE THIGH.

In a former page we have seen that amputation of the thigh proves fatal to thirty-four per cent. of the patients on whom it is performed. That the percentage of mortality is not so great in resection of the knee we shall next endeavour to show, adducing, at the same time, the supposed causes of this result:—

	Excision of Knee.	
	Number of Operations.	Number of Deaths.
Operations performed before 1850	19	11
Price's collection, from 1850 to 1858	160	32
Collected by myself, from 1858 to 1861	48	9
	<hr/>	<hr/>
Total.....	227	52

Or 60 per cent. in the first period; 20 per cent. in the second; and $19\frac{1}{2}$ in the third; striking an average of 21 per cent., or, if we merely take the last 208 cases, of 20 per cent. Thus the mortality is diminished by 14 per cent., when excision is resorted to instead of amputation. The statistical tables which have been brought to bear upon this question are composed of cases of all kinds, and all ages, the youngest patient operated upon being three years old, under the care of Mr. Kendall,* the oldest 58 years, under Dr. Kinloch.† The causes of death in the 52 cases were the following:—

* "Medical Times and Gazette," November 29th, 1856. Quoted by Price. page 40.
 † "American Journal of Medical Science," July, 1859. page 71.

Pyæmia	11 cases.
Exhaustion	9 „
Irritation	5 „
Shock	6 „
Dysentery	3 „
Suppression of urine ; pleuro-pneumonia ; erysi- pelas ; peritonitis ; after amputation ; fatty liver ; tetanus ; of each one case, making in all	7 „
Acute Phthisis	3 „
Causes unknown to me	8 „
<hr/>	
Total	52 „

Mr. Pemberton, taking Teale's statistics of amputation as his guide, asserts that excision, so far as the per centage of mortality is concerned, possesses merely the advantage of *one* in a hundred when compared with amputation. Based upon Mr. Teale's statistics, the conclusions he arrives at are no doubt correct ; but according to Teale's own statements, there are 25 per cent. of deaths after amputation of the thigh ; and we have already seen that, if excision be performed, only twenty in the hundred die. Thus, resection possesses the advantage over amputation by being not *one*, but *five* per cent. less fatal. Moreover, we have collected 1401 cases of amputation from various British and European hospitals (including even the statistics of Mr. Teale), and have found the average mortality to be 34 in 100.

2. The second great advantage of excision is the preservation of a strong and useful limb, which is infinitely preferable to the most refined artificial substitute. In glancing over the tables arranged by Mr. Butcher, we find that more than 50 per cent. of the patients recover with perfectly useful limbs ; 20 per cent., we have already seen, never recover from the effects of the operation, while a considerable number require the performance of amputation, or pass the rest of their lives with a useless extremity. That the operation leaves nothing to be desired, when successful, we are well aware, though surgeons who have been unfortunate in their cases are still found ready to detract from the merits of the most brilliant illustration of the happy termination of excision.

3. The operation of excision may, if unsuccessful, be followed by amputation ; thus it was thought advisable to amputate the thigh in 25 cases out of the 227 after excision had been performed, and only two of that number terminated fatally. This really seems a very small per centage of mortality, the more so as one operation must have already, to some extent, reduced the patient's strength.

4. Patients will frequently submit to resection of the knee, who would on no account permit the removal of the thigh, and a decided advantage is thus frequently gained by both parties, the operator and the one to be operated on.

DISADVANTAGES OF EXCISION AS COMPARED WITH AMPUTATION.

1. Excision has its disadvantages. They are neither numerous nor weighty, but are, nevertheless, if justice be our aim, to be considered with all possible care and caution. The most prominent of all these is the prolonged convalescence. Patients rarely regain the use of their limb sooner than six months after the operation of resection, while eight, ten, and even twelve months sometimes hardly suffice to effect a perfect cure. This disadvantage is the more keenly felt because of the confinement which the person must necessarily submit to, and the impossibility of keeping him under certain circumstances within the walls of the hospital for such a lengthened period.

2. This operation is, as a matter of course, somewhat more difficult of performance and more tedious than amputation of the thigh. The objection is, however, of very little weight under any circumstances.

3. After a tedious operation, and a still more tedious convalescence, we find the result of all our care and trouble a useless and dangling limb. This is truly a most painful and pitiful sequence, and is not unfrequently caused by a want of attention on the part of the surgeon, or a determination, on the part of the patient, to violate all prescribed rules. We frequently find, however, in spite of the operator's most assiduous care and the patient's most zealous determination to do his duty, that the disagreeable results above detailed follow the performance of resection. We cannot, at the same time, attempt to throw discredit upon a practice which only in a very small percentage of cases proves, to all intents and purposes, entirely unsuccessful. That the excision of any joint whatever, and the knee joint in particular, should, if unsuccessful, so far as the utility of the limb is concerned, be regarded as a *complete* failure, no one, I think, will deny. Hence it might be objected to our classifying these unfavourable examples of the operation in our statistics of success. It may, however, be urged, as a reply, that amputation of the thigh is by no means invariably succeeded by a healthy and useful stump, and that the point is rather difficult to settle—whether a bad amputated stump or an useless leg be the worse of the two.

4. This objection merely applies to the performance of excision during childhood and youth, and is one which merits our careful attention. Not that the full consideration of the subject has been neglected on theoretical grounds, but that the practice brought to bear upon the question has been somewhat limited, and even scanty. It is, in fact, still a matter of dispute whether the leg grows after excision of the knee joint, and a proof of the negative renders this a very palpable, and, at the same time, strong objection to resection in early childhood. We shall admit, undoubtedly, the disadvantage of excision in youth, whenever the *rule*, not the exception, is that the limb in every such instance becomes stunted in its growth, and in after years useless to the patient. Until this is fairly *proved*, however, I think we shall be quite at liberty to regard the objection as groundless. The subject is an important and a serious one, and we cannot help devoting a short space to its consideration and entering upon the question somewhat in detail.

Should we find ourselves enabled to *prove* that the limb *does* grow, after excision of the joint in early childhood, we at once dispel the objection, and thus reduce by *one*, and a very important *one*, the disadvantages of resection. What, therefore, let us inquire, is our present state of knowledge in reference to a point so complicated and so knotty? Mr. Syme was the first to attempt excision of the knee joint in early childhood. The case terminated successfully, the boy, according to the operator's early statements, "being left with a stout and well-nourished limb." The leg, however, does not seem to have kept pace with its companion, for the same author, seventeen years afterwards, asserts that "the patient seemed at first to possess a limb little inferior to its fellow, 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." The next two instances in reference to the arrest of the limb's development after excision also require careful consideration. Dr. Keith, of Aberdeen, operated upon a boy, aged nine, in 1854, and two years subsequent to the resection he informed Mr. Butcher that the patient's leg "is plump, and growing in length as fast as his sound limb."* Upon writing to Dr. Keith, in 1859 (*i.e.*, five years after the operation) about the same case, Mr. Pemberton received the following answer from the eminent Aberdonian surgeon: "He had measured his old patient's limbs, and found the left or healthy one to be seven inches longer than the right one,"† his measurements having been taken from the anterior superior spinous process of the ilium to the heel. Mr. Pemberton, in the same number of that journal, relates the case of a lad twelve years old, whom he operated upon in 1853. The limb three months after recovery was found to be three and a half inches shorter than its fellow. When measuring the extremities in 1859, Mr. Pemberton found "the sound limb to measure, from the ant. sup. spine of the ilium to the outer malleolus, 34 inches: the one which had been subjected to operation was only 25 inches long; thus showing a difference of nine inches, or a deficiency of growth, as compared with the other, of rather more than five inches since the resection."‡ The wood-cut representing the patient, and accompanying Mr. Pemberton's description of the case, presents a truly pitiable state of affairs. These are the only three cases, that I am aware of, which have been so prominently placed before the profession.

Excision has, however, been frequently performed in early childhood, without any similar disagreeable results; and several instances are recorded by Mr. Edwards, in the *Medical Times and Gazette*, where, in cases operated upon by Dr. Brotherston and himself, no after shortening of the limb was observed. As to whether the long bones of the lower extremity grow after excision of the knee joint, Mr. Edwards asserts that "an answer may frequently be found in the amount of bone removed, if it include part or all of

* "The Dublin Quarterly Journal of Medical Science." Vol. XXIII. February and May, 1857. page 60. (Second Memoir).

+ "British Medical Journal," November 26, 1859. page 960.

‡ Already cited, at page 106.

that portion of the bone in which are lodged those elements 'to the discretion of which, whether one ultimately become short or tall, is left entirely.'"* (Virchow.) "It is scarcely fair, however," continues Mr. Edwards, "to ignore the compensation system which is so frequently exhibited in the bodily economy." "Dr. Brotherston, of Alloa, removed, in January, 1855, the right knee joint of a young gentleman aged ten years, for ulceration of the cartilages. I saw the patient three years ago, walking well and with a scarcely perceptible limp. The right leg was then one-third of an inch shorter than the other. Dr. Brotherston informs me that both limbs have grown two inches every year since then, and the right leg is still one inch and two-thirds shorter than the other."* "Dr. B. has already performed this operation on a boy in 1854, and kept the limb slightly bent, so that now the lad walks on his toes, but is well in every other respect, and the *limb has grown in proportion* to the other, but is of course shortened by the portions removed at the operation. I have to-day measured the lower extremity of a girl, nine years old, from whom I removed the right knee on Feb. 20, 1857. I found that from the right trochanter to the upper edge of the tibia measured nine and a half inches; from the left ditto, ten inches; right tibia to sole eleven inches; left ditto to ditto, eleven and a half inches. I kept this child's leg slightly bent after the operation, and the angle somewhat increased afterwards, so that she requires a high heel, but undoubtedly the bones of her leg have grown during the last three years as much in proportion to the other limb as could be reasonably expected."†

It will, therefore, be perceived that, in most instances, the after development of the limbs is not arrested, and if such were the case, we surely would have been made more closely acquainted with the facts by Fergusson, Jones, Erichsen, Humphry, Price, and many others who have frequently had recourse to the performance of resection on the child. It seems, in fact, that in almost every instance where similar unhappy results to those above detailed have followed excision of the knee, too much of the articular ends both of the tibia and femur have been removed, but whether necessarily, or not, I am unprepared to say. "In young persons," observes Humphry, "care should be taken to make the section through the epiphyses of the tibia and femur; so that a thin layer of the epiphysis, with the cartilaginous medium that unites it with the shaft, is left upon each bone. If this precaution be taken, there is every reason to believe that the limb will keep pace in growth with the opposite member."‡ Mr. Humphry also informs Mr. Pemberton that in a case upon which he operated in 1854, and left the epiphyses, he found the leg, upon examination four years afterwards, to have kept pace with its fellow. Mr. Price is, if I am not in error, of the same opinion.

* "Medical Times and Gazette," February 16, 1861.

† "Medical Times and Gazette," for February 16th, 1861.

‡ I have been unable, after applying to several booksellers in town, to procure Mr. Humphry's pamphlet on "Excision of the Knee," published, if I am correctly informed, in a separate treatise. All attempts to obtain it having proved fruitless, I am thus obliged to content myself with quoting him second-hand, from the "British Medical Journal," for November 26th, 1859. page 961.

PART III.

AMPUTATION OF THE LEG.

A frequently resorted to operation in former times, is now more rarely performed, owing, in the first instance, to the introduction of Syme's and Pirogoff's operations for removal of portions of the foot; and, secondly, because of excision of the ankle joint, when the articular ends of the astragalus or tibia happen to be diseased. Thus the necessity of amputating the leg for any malady of the foot, has been greatly reduced by the timely resort to either Syme's or Pirogoff's operation, or, in a very few instances, when practicable, to resection of the ankle. The merits or demerits of amputation of the leg we shall only, of course, consider, as comparable with excision of the ankle joint. The history of the former of these two important operations time will not permit me to dwell upon, though a brief summary of the various modes in which it may be performed I shall feel myself forced to detail.

And, first, in reference to the seat of its performance: the middle of the leg, or rather a little below the middle, seems, according to most modern authorities upon the subject, the most preferable place. It would, in fact, appear, from Mr. Fergusson's statements, that surgeons have performed amputation of the leg as high up, and as low down, as could possibly be practicable; and with the invariable result that the former were obliged to descend in their rapid flight, while the latter, who had erred on the safe side, found it best to soar somewhat higher, thus "causing the two extremes to meet." Mr. Erichsen, however, recommends amputation to be performed as low down as possible, "the mortality diminishing in proportion as the limb is removed near to the ankle."* In proof of his assertion, he adduces "106 amputations in this situation, performed in Paris, where there were only 13 deaths." It was formerly objected to operate so low down on the plea that hospital patients were unable, from pecuniary considerations, to obtain a complicated artificial limb, and that they could only afford to buy a clumsy wooden apparatus, resting their bodies on their bent knee, and thus rendering a long stump positively inconvenient.†

An extremely light, useful, and cheap apparatus, somewhat resembling an inverted champagne bottle, the scooped out bottom of which, when well padded, rests the stump, may now be procured very easily, thus allowing of amputation as low down as possibly practicable, and retaining the free movements (flexion and extension) of the knee joint. Mr. Fergusson always employs it, and asserts that it is highly recommended by Dr. King, and the late Dr.

* Op. Cit., page 37.

† Dupuytren, while touching upon this subject, makes the following remarks: "Tout le monde est d'accord aujourd'hui sur les défauts et les inconvénients du procédé de Ravaton, consistant à amputer le plus bas possible et enfermer ensuite le moignon dans une bottine creuse et conique. Elle l'ulcère facilement et réduit les malades à garder le lit; ou, s'ils portent une jambe de bois, ils éprouvent des ébranlemens douloureux et se heurtent contre tous les corps qu'ils rencontrent." page 349. Vol. IV. Cited at next page.

Lawrie, of Glasgow, the latter having had a patient who, with a like artificial substitute, could walk from 12 to 14 miles a day. The modes of performing amputation of the leg are very numerous, and, like the selection of the site of the operation, vary according to the prejudices of the age, or the caprice of the surgeon. Thus Dupuytren "first divides the skin by a circular sweep; secondly, he cuts through the muscles down to the bone by a similar proceeding; thirdly, severs the interosseous muscles; fourthly, divides the periosteum; and lastly, applies the saw to the bones."* South agrees with Dupuytren as to the circular operation being preferable, but differs with that great surgeon as to the manner of accomplishing it.† Amputation of the leg by double flap is practised by almost every British surgeon of note, and the best manner of performing it was first if I am not mistaken, introduced by Liston, then extensively practised by Hey, and lastly improved upon by Fergusson. The latter tells us to "pass an amputating knife about seven inches long from one side of the limb to the other, close behind the bones, and cut a flap from the back of the leg about three or four inches in length, proportioned to the bulk of the member; next he should draw the blade across the fore part of the leg, with a semilunar sweep between the points where he has transfixed; the large flap behind and the small one in front being drawn up by an assistant the operator should then carry the knife round and between the bones, a little higher than the line of transfixion, and having cleared a space for the saw, that instrument should be applied and the separation of the part effected."‡ We have various other methods of amputating the leg, and among those by double flap, may be mentioned Roux's, who forms lateral flaps, while among those who operate with a single one, the oval and that of Teale's deserve particular mention. The mathematical precision of Teale's operation, and the great care with which the flaps require to be kept in proper position, hardly in the results repay the attention which they demand. Mr. Spence, of this city, who at the outset seems to have given this operation fair trial, perceived its shortcomings to be so numerous, that he was compelled to make some modification each time he operated, until the "original coat disappeared under the patches."

In performing this operation we must—first, guard against leaving too much flesh from the gastrocnemius and soleus to form our pad, as from the observations of many surgeons, it only impedes the cure, leaving an ulcerating surface, which may last for many weeks, and even months. Secondly, we must not allow the fibula to be shorter than the tibia, though it is not necessary to remove it, if amputation be performed in the lower two-thirds of the leg. Thirdly, as a general rule we had best clip off the lower end of the crest of the tibia, as it may irritate the skin and tissues situated anteriorly. Fourthly, in making our flaps we should, according to the injunctions of Mr. Fergusson, make "the junction between the two flaps at an acute angle," which thus pre-

* "Leçons orales de clinique chirurgicale," faites à l'hôtel Dieu, par M. le Baron Dupuytren, chirurgien-en-chef. Tome Quatrième. Paris, 1834. page 350.

† "Chelius' System of Surgery, &c." page 919. Vol. II.

‡ Op. cit., page 490.

vents the dog-ear projections so apt to occur in this operation, if the simple precaution just referred to is not observed.

MORTALITY IN AMPUTATION OF THE LEG.

So far as the fatality of this operation is concerned, we shall, I think, find considerable difficulty in proving its inferiority, on that score, to excision of the ankle joint. Resection of the ankle has, indeed, been so rarely practised, that it would be impolitic to draw up a statistical table of an operation so little resorted to. It must at the same time be admitted that amputation of the leg is by no means so hazardous a proceeding as we might at first be led to imagine; for, as we have already seen, when performed low down, and treated carefully afterwards, only 13 deaths followed its performance in 106 cases, thus giving only 12 per cent. of mortality. It would, I think, be of little use to compile any statistical tables in reference to the fatality of amputation of the leg; inasmuch as we shall not be able, from the small number of recorded cases, to follow a similar plan in considering resection of the ankle joint. Hence the mortality of amputation can only be proved, in this instance, to exceed that of excision, by bringing analogy to our aid, and by at the same time recollecting that, if the former mode of procedure be adopted, we, 1st, amputate *nearer* the trunk, thus rendering a fatal result more imminent; 2nd, we divide several large nerve trunks; 3rd, there is greater danger from hæmorrhage, owing to large arterial trunks being cut across; 4th, risk of pyæmia from wounded veins. We have seen before that such are the causes likely to make amputation of the thigh more fatal than excision of the knee joint; and hence we may conclude, analogically only, it is true, that a similar result would follow amputation of the leg, as compared with resection of the ankle.

Let us next inquire whether surgeons have been justified in so long preferring amputation of the leg to

EXCISION OF THE ANKLE JOINT.

Resection of the ankle joint was first proposed and performed by Moreau, senior, on the 15th of August, 1792. The patient, a M. Lucot, having a year previously met with a sprain, which was followed "by extensive caries of the left ankle," readily submitted to this operation, as being preferable to amputation of the leg. There was "a fistulous ulcer on each side of the joint, and the articulating surface of the tibia, as well as that of the fibula, and the body of the astragalus, were felt to be bare." The case was perfectly successful, though the cure was somewhat tardy. The patient was only able to move on crutches by the seventh month; by the eighth he could walk with a stick, and by the ninth was quite recovered. "The foot was drawn up to the leg," thus making the limb, upon the whole, shorter, by "about an inch," than it had been previous to the performance of the operation. "A new joint between the tibia and astragalus has not been found," says Moreau, "but the astra-

gulus has acquired a degree of motion on the os naviculare, the os calcis on the os cuboides, and the other bones of the tarsus have acquired a motion upon one another that is wonderful, and makes up, in a great measure, for the motion of the ankle joint, which is lost; so that, with a high-heeled shoe, this man now walks without halting."* I have cited this case at length, because of the perfect success in the first instance in which such a difficult operation was attempted. Moreau, junior, repeated his father's innovation on a lad of 17, in 1796. The ankle joint was immovable, "so that in walking the patient was obliged to bring the foot round with a sweep." Though a cure was in this instance also accomplished, "yet the functions of the limb were not so completely recovered," as in the former case.

Jäger performed resection of the ankle several times, Weber twice,† and Müllder‡ removed the lower end of a carious fibula once. In this country the ankle joint has been removed for disease, once by Mr. Fergusson,§ and four times by Mr. Hancock, the latter gentleman having been the first in Britain to resect it for disease.|| Thus far extends our very limited experience with regard to the history of this interesting operation,¶ and now a few words about its performance.

Though resection of this joint has not, as will be seen from the above, been frequently adopted, yet the various modes of performing it are almost as numerous, if not more so, than the times it has been put into execution. Moreau, senior, commenced by "making a longitudinal incision, beginning at the inferior and posterior part of the malleolus *internus*,** continuing it upwards from three to four inches. He then made another incision transverse, which extended from the inferior end of the former incision to the edge of the tendon of the peroneus brevis. He made another longitudinal incision on the inside, which began at the inferior and posterior part of the malleolus *internus*, and extended from three to four inches along the internal border of the tibia. Then, by a third (?) incision, which began at the lower end of this, he cut the skin transversely, till he came to the tendon of the tibialis anticus." The bones could thus be easily exposed by our merely raising the flaps. The fibula was removed in Moreau senior's case by a chisel, the tibia by a saw; then, turning the foot outward, and thus causing the tibia to project, he was easily enabled to detach it from the astragalus, the articular surface of which he also removed. Moreau junior tried to modify the operation by preserving

* Cases of the Excision of Carious Joints, by P. F. Moreau, de Bar-sur-Ornain, M.D. de l'école de Paris. Translated by James Jeffray, M.D. p. 145.

† Cited by South, from "Friederich und Hestelbach's Beiträge zur Natur und Heilkunde." Vol. II., p. 142, article "Zwei Resectionen im Fussgelenke."

‡ Also cited by Chelius. Vol. II., p. 984.

§ Op. Cit., p. 448.

|| *Lancet*, October 1st, 1859.

¶ In writing the above I had not consulted the "British and Foreign Medico-Chirurgical Review" for July and October, 1857, Vol. XX. The reviewer in that journal asserts that he has, from the practices of Messrs. Hancock, Wakley, Statham, Teale, Humphry, Ure, and Hutchinson, collected ten cases, "where resection had been performed for disease of the ankle joint."—page 317.

** Moreau, already cited, page 141. He surely means malleolus *externus*?

the fibula. Hancock recommends an incision "two inches above and behind the external malleolus, to be carried across the instep to about two inches above and behind the internal malleolus." He cautions us not to allow our cut to penetrate deeper than the fascia. We may then throw back the flap, and thus expose all the parts required for operation. This proceeding is merely a slight modification of Moreau's, and greatly resembles Guthrie's mode of operating.*

Resection of the ankle joint may, I think, with justice be regarded as the least successful, so far as popularity is concerned, of all the excisions, though its advantages are numerous; its disadvantages few. The ankle is frequently exposed to disease, which, however, is rarely limited to the articular ends of the tibia and astragalus alone, but generally involves some of the other bones, such as the os calcis or scaphoid; and the difficulties we frequently encounter in our attempts to diagnose the exact seat and extent of the malady, cause the operation to be more rarely resorted to than it would undoubtedly be, were the circumstances for its performance more favourable. It ought, however, to be recollected that in cases where removal of the leg would have been proposed in former times for disease of the bones in the foot, Syme's and Pirogoff's amputations at the ankle would now be preferred, and these innovations have, no doubt, greatly tended to render resection of the ankle joint so little attended to among the conservative surgeons of the present day. It must at the same time be admitted that excision of this joint possesses the following advantages over amputation of the leg:—1st. We preserve an admirable and useful limb, which, though somewhat shortened by the operation, is nevertheless highly preferable to an artificial leg. The patient is thus enabled, according to Mr. Hancock, "to walk and run about without any perceptible limp." It is true that, as the experience of Moreau points out, ankylosis is very apt to ensue after the operation, and the elasticity of the foot is thus somewhat interfered with, yet the other bones of the tarsus, by way of compensation, "acquire a motion upon one another that is truly wonderful." These advantages are, of course, only supposed to accrue where the operation has been skilfully performed; and we cannot avoid expressing it as our firm conviction that, if the cases be carefully selected, the result will always be very successful. 2nd. No arterial trunks of importance are divided in this operation, and hence there is absolutely no hæmorrhage. In order to secure this advantage, however, we should, according to Mr. Hancock, carefully guard against injuring "the anterior and posterior tibial arteries; for, if these vessels are injured, there will not be sufficient blood supplied to nourish the part, or power to heal the wound."† 3rd. Less danger from shock. 4th. No risk of pyæmia.

The disadvantages of excising the ankle joint are only two in number, the first great objection being the difficulty of performing the operation, and the

* "Commentaries on the Surgery of the War in Portugal, Spain, France, and the Netherlands," &c., &c., &c., by G. J. Guthrie, F.R.S. Fifth edition. London, 1853. Pages 99 and 100.

† "The Lancet," October 1st, 1859, page 331.

great risk we run of wounding tendons and arteries. "Under any circumstances," observes Mr. Fergusson, "I should consider such operations extremely difficult, and in most instances more dangerous than amputation in the ankle or in the leg." With every deference for the high authority just quoted, I think the latter part of his assertion may yet prove incorrect, and I do not suppose, from the few cases which I have perused, that the rate of mortality is greater in resection of the ankle joint than in amputation of the leg. From analogy, moreover, we are irresistibly led to the conclusion that greater dangers attend amputation of the leg than excision of the ankle; and of ten cases, collected by a "British and Foreign Medico-Chirurgical" reviewer, where the operation was performed for disease, "seven are reported cured," and the remaining three are said to be "under treatment," "slowly recovering," and "going on well."* The same reviewer remarks, "that he is not acquainted with a single case where the operation was followed by fatal consequences," and I can only cite one instance in which the patient did not long survive the effects of resection. The case came under the care of Mr. Hancock, and the woman died seven months after the operation from disease of the lungs, brought on by a dissipated life. Add to these ten cases four more, two of Moreau's and two of Hancock's (published in 1859), and we have fourteen in all, with only one death, and that not the direct result of the operation. But statistics when meagre, are, as we have previously pointed out, extremely dangerous to rely upon; and we shall hence, in the present instance, dispense with their aid, trusting, however, that the period may not be far distant when we shall possess a sufficient number of data to enable us with justice to determine the relative merits and demerits of an apparently useful and preservative operation. 2nd. The second disadvantage of excision of the ankle is the prolonged convalescence, confining, as it does, the patient for four, five, or even seven months, to the hospital, and thus rendering the practicability of the operation somewhat questionable in military surgery.

There is one set of cases in which excision of the ankle is highly recommended, and upon the practicability of which all surgeons seem, so far as I am aware, agreed, and that is in compound dislocations of that joint. Mr. Fergusson who, as we have already seen, is averse to its performance for disease, speaks of it in the highest terms of commendation as a means of treating these accidents. He thinks, in fact, that "there is more likelihood of saving the foot by this proceeding than by replacing it." Sir Astley Cooper "quotes nine cases occurring either in his own practice, or in that of his friends."† "All recovered, five even retaining motion at the seat of the operation." Dr. Kerr, of Northampton, in writing to Sir Astley, says:—"It has been uniformly my practice to take off the lower end of the tibia. In my early life I have seen many attempts to reduce compound dislocations without removing any part of the tibia, but, to the best of my recollection, they all ended unfavour-

* "The British and Foreign Medico-Chirurgical Review," October, 1857, page 317.

† "The British and Foreign Medico-Chirurgical Review," October, 1857.

ably, or, at least, in amputation. By the method which I have pursued, I have generally succeeded in saving the foot and a tolerable articulation."*

AMPUTATION OF THE ARM.

Amputation of the arm, though very frequently performed in olden times, is now more rarely had recourse to, as the conservative spirit of modern surgery authorizes us to remove "nothing but what is absolutely necessary." The infrequent resort to amputation of the arm has, no doubt, been caused by two most decided disadvantages which this proceeding, whether it be practised in hospital for disease, or on the field of battle for injury, possesses; and the first of these we have no hesitation in affirming is the high percentage of mortality. In order the better to elucidate this subject, I shall here adduce a few compilations from the statistics of various hospitals in different countries, and shall also pourtray, in a separate form, the percentage of mortality following amputations for traumatic causes.

MORTALITY IN AMPUTATION OF THE ARM.

					Number of Operations.	Number of Deaths.	Percentage of Deaths.
Dorpat Hospital ¹	...	...	...	...	8	2	25
Pirogoff's Practice ²	...	...	...	...	26	6	24½
University College Hospital ³	...	...	...	...	16	5	30
Various hospitals ⁴	...	...	...	...	110	26	24
Glasgow Hospital ⁵	...	...	...	...	23	4	18
Hotel Dieu, Paris ⁶	...	...	...	...	78	29	37
Parisian hospitals ⁷	...	...	...	...	61	4	6
Total					322	76	23½

TRAUMATIC.

University College ⁸	...	...	...	...	6	0	0
Paris hospitals ⁹	...	...	...	...	30	17	56½
St. Thomas's Hospital ¹⁰	...	...	...	...	6	0	0
Parisian hospitals from 1836 to 1841 ¹¹	...	...	...	...	91	41	47¼
Glasgow Hospital ¹²	...	...	...	...	53	21	33½

* "British and Foreign Medico-Chirurgical Review," October, 1857, cited from Sir Astley Cooper's work on "Dislocations," &c.

¹ From Shimanoffsky's "Remarks on Amputations," &c., already quoted.

² "Travels on the Caucasus," by N. Pirogoff. page 30.

³ "Science and Art of Surgery," J. Erichsen. p. 21.

⁴ Phillips in the "London Medical Gazette," March 15, 1844. p. 805.

⁵ Lawrie in the "London Medical Gazette," December 4, 1840. p. 397.

⁶ Phillips, as already cited.

⁷ Malgaigne, quoted by Erichsen, p. 22.

⁸ Erichsen's "Science and Art of Surgery."

⁹ Ibid.

¹⁰ "Chelius' Surgery," by South. Vol. II. p. 925.

¹¹ Simpson in "Obstetric Memoirs," &c., &c. Vol. II., p. 569.

¹² Lawrie. Ibid.

				Number of Operations.	Number of Deaths.	Percentage of Deaths.
Phillips, from various sources ¹³	...	...	...	164	49	29
British Hospitals ¹⁴	...	...	...	119	27	23
49 British hospitals ¹⁵	...	...	...	44	12	26
British army in the Crimea ¹⁶	...	...	...	"	"	23
Pirogoff, chiefly from his own practice ¹⁷	...	...	...	94	23	24 $\frac{1}{4}$
Total...				607	190	31

The difficulty of attaching any limited value to an extremity is, of course, insurmountable, the more so when we bear in mind that the preference accorded to a leg or an arm will vary according to the trade or profession in which the individual may be engaged, though it cannot, I presume, in ninety-nine cases out of a hundred, be denied that the latter is of somewhat greater importance than the former. A substitute for the leg, serving all its important purposes, may, in fact, with ease be provided, while no such thing can be procured thoroughly to replace the arm. Lastly, though this with a determined surgeon may be a questionable disadvantage, the patient frequently refuses to submit to amputation, while he readily assents to the performance of excision.

These, so far, are the great objections to amputation of the arm, and it will by all be admitted, that they are both weighty and serious. Its advantages, on the other hand, may, I think, be justly regarded as having no existence. We might, of course, as we have previously done while referring to amputation of the thigh and leg, assert that the wound is sooner in healing than in excision of the elbow, but here, unfortunately, no decided advantage is thereby gained. In the two former instances the patient was necessarily confined to bed, and was thus unable to walk about for months after the operation, while in the present case he can move from place to place as soon after excision of the elbow as he could after amputation of the arm. The operation is doubtless, however, sooner completed, and more easy of performance than

EXCISION OF THE ELBOW-JOINT.

We have endeavoured in the preceding page faithfully to depict both the advantages and disadvantages of amputation of the arm as compared with resection of the elbow, and cannot fail to observe that hardly any mode of procedure, for the accomplishment of a cure, could prove less satisfactory than the one we have referred to. In order somewhat to improve upon so coarse a proceeding, and, if possible, to save the limb, it was proposed by Park, in 1780, that in cases of diseased elbow-joint, the unhealthy parts should alone be removed, and an attempt be made to preserve a useful extremity. In

¹³ "London Medical Gazette," March 15, 1844.

¹⁴ "Obstetric Works and Contributions" of J. Y. Simpson, M.D. Vol. II. p. 571.

¹⁵ Ibid.

¹⁶ Macleod in "Edinburgh Medical Journal," for June 1856, referred to by Shimanoffsky.

¹⁷ Opera citata, pages 177 and 30.

order to demonstrate the practicability of the operation he performed it on the dead body, and, apparently, to his own great satisfaction. An opportunity for repeating the experiment on a living subject never presented itself, though Park, and Park alone, will always be regarded as the founder of this brilliant and conservative measure. It may, in fact, safely be inferred from his writings that the elbow was the first to attract his attention as being favourable for excision, and he would, according to his own assertions, rather have attempted resection upon this joint than upon the knee. At the very outset Park seems to have entertained the highest hopes of the success of the operation, and we might safely affirm that had he lived to our present time, his most sanguine expectations would have been realised.

It was, however, reserved for Moreau first to excise the elbow in the living subject, which he did in 1797, upon the person of a M. Colignon, aged 19. The operation succeeded perfectly. In 1794 he again resorted to resection of the elbow, the result being "flexion of the forearm and arm, both very distinct." He then again resorted to it on three subsequent occasions, the patients always recovering. Roux* performed the operation four times; the first took place in 1819, and three of the patients survived with useful limbs. It was then practised occasionally by other continental surgeons, but with varying results.

Among British surgeons the first who resorted to it was Sir Philip Crampton,† who, in the year 1823, resected the elbow joint of a soldier, named Alexander Gordon. It was afterwards performed by Mr. Syme, in 1841, after the publication of whose treatise the operation was more favourably received by the profession in this country and abroad than it had been heretofore, and we are far from exaggerating when we compute its performance, within these last thirty years, as numbering many thousands of cases. Hence we are led to infer that the operation has proved highly successful.

MODE OF PERFORMING EXCISION.

Park, in operating on the dead body, attained his object by a simple longitudinal incision along the posterior aspect of the joint. He thinks, however, that, where the bones are diseased, one cut would not suffice, and hence recommends, under such circumstances, a crucial incision. Moreau used the H incision, which, according to Fergusson and Syme, should always be preferred, though Langenbeck strongly advocates Park's simple longitudinal cut. Erichsen, on the other hand, recommends a T shaped incision, on the ground that it leaves a smaller cicatrix behind than the H.‡ Whatever incision we adopt we should so manage it that, by raising our flaps, the olecranon process

* Cited by Syme, from the "Revue Medicale," for January, 1830.

† "The Dublin Hospital Reports and Communications in Medicine and Surgery." Vol. iv. 1827. p. 191.

‡ This incision was first practised by Liston, and hence bears his name. It seems to have been greatly preferred to Langenbeck's in the Schleswig Holstein war. "Out of forty cases Langenbeck's operation was put in practice three times, while Liston's was employed in twenty-seven cases."—*British and Foreign Medico-Chirurgical Review*, October, 1827. p. 298.

may be laid bare. We should, moreover, in making our dissection, carefully guard against dividing, or even wounding the ulnar nerve; for, in the latter accident we have severe pain following, while the former proceeding is rightly discountenanced by every modern surgeon of note, though Moreau, strange to say, recommends its division. Dupuytren, Jäger, Roux, Crampton, Syme, Fergusson, and many others advise the nerve to be kept intact. It is true that there is no danger in dividing it, because of the after union of the cut extremities,* yet, if possible, it were best not to do so. We can easily preserve the nerve intact by a little careful manipulation in making our transverse incision, which ought not to cut deeper than the skin. Mr. Syme advises the surgeon "to use the precaution of ascertaining the situation of the nerve before introducing his knife;" and Mr. Fergusson asserts, that it had best be dissected out of its position from behind the internal condyle, and held aside with a blunt hook during the future steps of the operation. Mr. Erichsen, on the other hand, cautions us not to expose the nerve, "as it is usually imbedded in a quantity of plastic tissue," and this no doubt is easily accomplished if Liston's T shaped incision be employed.

Having reflected both our flaps, we next proceed to divide the attachment of the triceps, and, if we desire to turn the bones out, we "cut through the lateral ligaments." We then, by means of a saw or cutting pliers, remove the olecranon, and thus fully expose the extent of the malady. Should it be confined to the olecranon we remove no more of the ulna, but then proceed to take away such parts of the radius and humerus as may happen to be diseased, carefully guarding against falling into Moreau's error of sawing off too much.

It was, if I be not mistaken, first shown by Mr. Syme, that the warty excrescences observable on the lower border of the shaft of the humerus, and the upper portions of the radius and ulna, though rough and tubercular in appearance, are really deposits "of new bone, perfectly healthy in its actions." This new bone "resembles in all respects the callus which effects the reparation of fractures, and is thrown out in consequence of the irritation of the disease." This, therefore, should never be taken away; and so careful are some of our modern surgeons not to remove any healthy portion of bone, that Mr. Fergusson recommends us to do it "bit by bit," or, rather, "piecemeal."

It is after the operation that the surgeon's greatest care and attention are required to ensure a successful result, though the manner in which excision is performed is also of importance. Though strongly advised by most teachers not to divide the insertions of the biceps and brachialis anticus, we sometimes find ourselves forced to do so from the extent of disease in the radius and ulna. What, therefore, having performed our operation, are we to expect as the result? and what is our duty in regard to the after treatment of the patient? In former times, our object was supposed to be boldly

* Moreau, in taking notes of his case where the ulna nerve was divided, asserts, that "the back of the hand had evidently wasted; the little finger had no feeling" (p. 107).

achieved if an ankylosed limb were the result of the operation, though it would appear that Moreau hardly contented himself with such an unsatisfactory state of affairs, but procured in the first case on which he operated "flexion of the fore-arm upon the arm which was strong, firm, and steady." In the present day, our object in resorting to this operation is to procure, if possible, a thoroughly moveable joint, or, that failing, ankylosis at a convenient angle. After the performance of resection, the arm requires absolute rest, which may be accomplished by placing it in a half-bent posture, either upon an angular splint, "well padded and covered with oiled silk, or Mr. Butcher's box with moveable slides may be used; or Mr. Christopher Heath's splint, which secures, in the greatest perfection, the advantages of entire* repose."

The position which, according to Langenbeck and Stromeyer,† is found to "be most free from pain, is an angle of 140°." The formation of the new joint is accomplished by moving the "parts freely about during the treatment of the external wound, so as to produce a callous state of the ends of the bones, such as will terminate in movements so free as to make amends for the loss of the original joint."‡ It is here that Mr. Heath's splint is found so useful, for by means of it we can stretch the limb to any desirable extent, thus keeping the bones from coming in too close apposition, while, at the same time, the arm may be bent to any angle.

It only remains for me now, before I bring this essay to a close, to trace, as fully as I can, the merits and demerits of this mode of procedure. And, before discussing either of these peculiarities, I may as well here state that its advantages are particularly well marked, while its disadvantages are few and far between; indeed, I vainly strive to detect some fault with excision of the elbow, so as not to leave a blank on the page where its disadvantages are to be recorded, but my endeavours will, I think, prove useless, for the operation has passed a long surgical trial, and escaped untarnished. Few procedures in surgery are to be found without some blemishes upon an outwardly spotless character, and an objection may therefore be raised against resection of the elbow on the grounds that it is somewhat difficult of performance, though this, as we have previously seen, is by no means a valid objection. The recovery, also, is somewhat prolonged, but this again is attended with little inconvenience, and as regards the greater amount of care required in the after treatment, it cannot for a moment be presumed that surgeons would, when a good result may be thereby gained, deny their patients a little extra attention. These, so far as I am able to see, are the only disadvantages (if such be the word), which can be brought against the adoption of excision of the elbow as compared with amputation of the arm.

* Druitt's "Surgeon's Vade-Mecum." p. 740.

† Cited in the "Brit. and For. Med. Chir. Review," p. 298, for October, 1857, from "Gunshot Fractures," by Dr. Stromeyer; and "Resection in Gunshot Injuries," by Dr. Esmarch. Translated by S. F. Statham.

‡ Fergusson. p. 303

If, however, the objections to its performance are scanty, the advantages in its favour are numerous and weighty. So weighty, indeed, that, to quote an elegant passage from one of Mr. Butcher's memoirs, "those trembling and sceptical about the propriety of the more severe excisions of the hip, knee, and wrist joints, yield their allegiance, and assent tacitly in favour of excision of the elbow, and allow unsullied its accredited merits."*

We shall now endeavour to trace the causes which have influenced practitioners in taking thus kindly to a by no means easy or attractive operation, so far as the performance of it is concerned, and we, therefore, at once pass over to consider its advantages; in treating of which we always endeavour, whenever practicable, to head our list with a reference to the low rate of mortality of the particular operation under discussion as compared with another, the inferiority of which it is our desire to demonstrate. We have seen in a former page that the average mortality in cases of amputation of the arm for disease amounted to $23\frac{1}{4}$ per cent., and in traumatic amputations to no less than 31. I have not, I regret to say, been able to procure any statistics in reference to the fatality of excision of the elbow for disease, though I have, from cases recorded by the authorities whose works I have perused, collected forty-three cases, and four only of that number proved fatal, thus striking an average of only 9 per cent. Hence it will be observed that the difference between the two operations in the scale of mortality alone, leaves a decrease of $14\frac{3}{4}$ in favour of resection. Thus supposing it even to possess numerous disadvantages, we should still be obliged, from the small per centage of deaths which follow its performance, to give it the preference. Let us next proceed to enquire whether resection of the elbow for gunshot injuries is followed by fewer deaths than amputation of the arm performed under similar circumstances; and upon this point, I am happy to say, we have very accurate statistical tables, most of them compiled from the practices of surgeons engaged in the Schleswig Holstein and Crimean wars. We have already seen that in cases where amputation of the arm has been resorted to for traumatic injury, the percentage of mortality was 31. To contrast the two, we shall here insert a table of resections of the elbow performed for wounds in that joint:—

				Number of Excisions.	Number of Deaths.	Percentage of Deaths.
British Army in Crimea †	...	...	...	17	2	13
Schleswig Holstein War ‡	...	...	...	40	6	15
Pirogoff, in the Caucasus §	...	...	...	4	1	25
Total ...				61	9	$14\frac{3}{4}$

* "The Dublin Quarterly Journal of Medical Science," November 1st, 1855. pp. 258.

† "British and Foreign Medico-Chirurgical Review," October, 1857. page 300.

‡ "Resection in Gunshot Injuries," by Dr. Esmarch, translated by S. H. Statham, and cited in "British and Foreign Medico-Chirurgical Review," October, 1857. p. 300.

§ Works already cited. page 85.

We have already pointed out, in a former part of this essay, that the percentage of deaths following the performance of amputation of the arm was, in the British army in the Crimea, no less than 23; while in the Schleswig Holstein war, out of 54 amputations we have a mortality of 19, or, 33 per cent. We thus find, that, computing traumatic amputations of the arm to be 31 per cent., we have still an advantage of 16 in favour of the practicability of resection of the elbow joint. It is also strange to record, but such, nevertheless, is Dr. Esmarch's statement, that 5 deaths out of the 6 in the Schleswig Holstein war, were caused by pyæmia. Another very great advantage, and we would lay particular stress upon the magnitude of it, is the preservation of an admirable and useful limb by resection of this joint. So good is the limb in appearance and function that it is sometimes hardly possible to distinguish the one which has been subjected to operation from the healthy one.

And lastly, which though an old advantage, is one that frequently proves useful both to the surgeon and patient, is the fact, that patients will gladly submit to this operation who would never allow the removal of their limb "in toto."

ERRATA.

At page 3, second line from the bottom, for "Quarante armées," read "Quarante années."

At page 26, thirty-eighth line from the top, for "Mr. Price is, if I am not," read "Mr. Price is, if I be not."

