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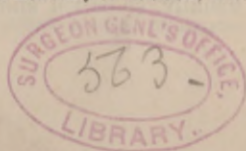
MULTIPLE SYNCHRONOUS AMPUTATIONS.*

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It has not been many years since the recovery of a man who had suffered the loss of two of his limbs at one operation was considered so remarkable as to be worthy of record and report in the medical journals. Now-a-days these recoveries are no longer remarkable and excite but little comment. Modern machinery and the large increase in the number of factories, mines and railroads, have made these multiple operations much more frequent than formerly, and the injuries necessitating them are such as the older surgeons rarely ever saw. Notwithstanding these extreme traumata, the death rate is steadily declining after multiple amputations. I thought it might be profitable to discuss some of the reasons of this greatly improved rate of recovery, and beg to call attention to some which have appeared to me paramount.

Of course, standing at the head of the causes, in common with all modern operations, anti- and aseptic methods of operation must be regarded as having greatly contributed to this beneficent result. As the majority of deaths after multiple operations have always occurred within a few hours after the operation, it must be considered, however, that there are other influences which have mightily aided in bringing about the good

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results of to-day. What then has contributed to enable so many patients to recover from the multiple repeated traumatisms? One chief factor in these good results is undoubtedly the prompter and more efficient aid these dreadful wounds receive after they occur. The establishment of local surgeonries along the line of railroads, at mines, and in connection with large manufacturing establishments, the education of the masses to give more intelligent first aid to the injured, and the facilities of increased hospital accommodations for rapidity of transportation are all sub-agencies in this general result. These are, however, but general statements—let us examine some of the particulars.

If the traumata are what produces the greatest mortality, in order to understand the improvement, we must first analyze the immediate results of large wounds. *Shock* is the first result of a large crushing wound. As the subject of shock will be discussed in later and more exhaustive papers on the programme, with apologies to the readers of these papers, I will only detain you to make some statements as to the results of my own observations and investigations with reference to shock. I have long held the belief that surgical shock is of two kinds, or composed of two elements—the one immediate and frequently antecedent to the injury, the other secondary and subsequent. The immediate or antecedent shock is *psychical*, and may occur when there is absolutely no somatic injury; the secondary and subsequent shock is the one with which the surgeon usually has to contend, and this is due to hemorrhage. So that if hemorrhage be prevented or stopped before the patient has lost any large quantity of blood, there will be comparatively little shock. I think it has been abundantly proved that immediate amputation offers the best chance of recovery after serious injuries; it is, usually, so-called shock which prevents early opera.

tions. If, therefore, hemorrhage be prevented and no great shock occurs, the operation may be done immediately and the chances of recovery are markedly improved. It seems to me the appreciation of this point in practice has greatly reduced the mortality after multiple operations. Another point of great importance is, I think, that surgeons are better physiologists and therapists than they formerly were. This is simply in line with the general advance in the whole science (I do not say art) of medicine. The indications for stimulation and measures for resuscitation, generally, are much better understood than formerly. So that if one has to combat shock, he goes about it much more rationally than in former years. Instead of hastening through an immediate amputation, careful control of hemorrhage, by an Esmarch tourniquet, careful antisepsis of the wound and surrounding parts are practiced, and during a sufficient interval saline infusions, hot saline enemata, strychnia and digitalis are given, and when the blood-vessels are again filled and the heart's action has recovered some of its tone and strength, by careful hæmostasis, the operations may be done and in the majority of cases safely done.

There are two frequently employed measures of resuscitation, one of which, in my hands, has not been very satisfactory, and the other, I believe, injurious, I should like to discuss more fully. My allotted time will permit little more than bare mention, however. I refer to saline intra-venous infusion and the use of alcohol or ether as a stimulant.

Theoretically, the intra-venous injection of a so-called "normal" saline solution would appear the readiest and best method of restoring a circulating medium after severe hemorrhage. In the hands of other operators it has had brilliant effect and done great good. Though I have resorted to the measure

in many instances, the good effect has appeared to me very evanescent and disappointing. I have, by the use of these injections, restored radial pulses which were entirely inappreciable, brought back some color to prolabia and to the surface generally, but the result was very transitory and seemed very soon to lose its efficiency, and I have been repeatedly disappointed by losing my patient after using the injections. The use of saline injections into the rectum has proven much more satisfactory in my practice, and I employ them very frequently. As is well known, saline solutions (even albuminous solutions highly salted) are readily absorbed from the rectum, and the introduction into the mesenteric and portal circulation, though indirectly, of this hot solution, I have found a much more permanent method of stimulating a failing general circulation.

The use of alcohol, as a stimulant in shock, has seemed harmful in so many instances that I have quite abandoned it. As a vaso-motor paralyzer, it encourages hemorrhage and oozing; it is apt to increase restlessness, and when given in large doses it weakens the heart, through its paralyzing effect on the nerves of innervation. The effect of ether is similar to that of alcohol, and when it is used hypodermically it intensifies the weakening effect of its anæsthetic action if an operation is to be done or has been performed.

Strychnia is now my "sheet anchor" in cases of great weakness after severe injuries. If an anæsthetic is to be or has been used, especially if chloroform is the anæsthetic selected, I use digitalis as well as strychnia. I give as much as one-eighth grain of strychnia sulphate hypodermically in the course of three or four hours, when there is urgent need of stimulating the heart. I have never observed any ill effects from this large quantity. Beginning, usually,

with one-sixtieth of a grain, the injections are repeated sometimes two or three times in the course of an operation lasting forty or fifty minutes, and continued after the patient has been put to bed, at longer intervals of course, together with the use of digitalis and rectal injections of hot saline solution. A number of cases, apparently moribund when received, has reacted and recovered under this treatment.

Following shock, according to the ordinary teaching, one must expect hemorrhage in these cases of severe multiple injuries. It is true, in my opinion, that after the psychological shock, which always acts as a powerful vaso-motor irritant, as well as a paralyzer of the innervating nerves of the heart, there results a paresis of the vaso-motor nerves, and as the effect of the first shock wears off, which is apt to occur either in a few minutes or in an hour or more, the open and paralyzed vessels pour out a steady stream of blood if not controlled. Fortunately, in the crushing injuries which usually require multiple operations, the vessels are also divided by tearing rather than by incision, and the elongation and pressure at the same time which, mechanically severs the continuity of the vessels, as well as the other soft tissues, results in partially closing the vessels by attenuation of the lumen and the curling up of the inner and middle coats of the arteries, so that the free flow of blood is obstructed and hemorrhage is slow though persistent as a rule. Laymen have been so generally indoctrinated into the elements of controlling hemorrhage and appliances for doing this are in many railroads and establishments freely furnished and kept at hand, that now-a-days a man is not nearly so apt to bleed to death as formerly, and it is very rare for an injured man not to receive some appliance for the control of hemorrhage very soon after the accident.

Besides the ready assistance for the control of

hemorrhage, another powerful factor in saving life after multiple injuries—as was said before—is the abundance of hospitals along lines of transportation, and skilled surgeons to give aid. Instead of transporting the injured man for miles and miles to a city hospital, or, worse, attempting with bad surroundings and wretched appliances and assistants to do the necessary amputations along the wayside or at the home of the patient, it rarely happens that in the regions where railroad centers and factories and mines abound, that the injured man cannot be taken in a short time to a fairly well equipped hospital where he will receive skilled attention and modern treatment. The later statistics of amputations mortality rate furnish strong arguments for the multiplication of small hospitals. I am afraid the tendency at present is to overdo this charity, but properly distributed and regulated, there can be no question of their great good and most efficient lowering of the death rate after injuries.

As stated before, if the patient is in a condition to bear the operation, the best time to operate is immediately. Very frequently, however, the patient is not in a condition to bear the operation. In my judgment, it is very unwise to attempt multiple amputations, or indeed, any major operation, if the patient is very weak, immediately upon his reception by the surgeon. With the appliances for disinfection, dressing and hæmostasis, which every ordinarily equipped surgeon has always at hand, the operation may be deferred for a period of hours without danger of serious infection. The limit of this period must always be the very beginning of so-called inflammatory reaction in the crushed members. It is far less dangerous to operate in three or four hours, even if the patient is alarmingly weak, than to wait until infection has taken place and an interstitial phlegmonous inflamma-

tion has been established. I am convinced there can be no rules laid down to guide a surgeon in determining, in any given case, whether a patient is too weak or not for multiple amputation. One must judge the *individual* in every case as well as the indications of physical signs, etc. Physique, physiognomy, age as well as the general condition of the patient, are all important factors in the problem. I most strenuously deprecate the doctrine that in very marked conditions of shock an improvement is to be expected when the patient has been anæsthetized. That this *does* happen in many cases is true enough, but it is only in the cases of psychical shock and not in cases of acute anæmia. It is a very unsafe rule to follow, therefore, and not to be depended upon. If some time has supervened since the injury, and the patient has not been made extremely anxious by irregular or careless transportation, frightened in other words, in my experience conditions of weakness are simply made worse by anæsthesia.

The method and manner of anæsthetizing are also important matters. Both of the commonly used general anæsthetics, ether and chloroform, I have found weakening. To reduce this effect to a minimum, it is important to employ small doses and to continue the inhalation as short a time as practicable. In order to facilitate this I have found morphia, given in a moderate dose, hypodermically, ten minutes before the anæsthesia is begun, to be a very reliable and valuable agent; it materially assists in the anæsthesia and markedly lessens the quantity of the anæsthetic required. The manner of giving the anæsthetic is also important. Forcing and smothering ought to be sedulously avoided. Whatever cone be used, it should be borne in mind that in these weak conditions a liberal admixture of air is necessary. The degree of anæsthesia should never be profound, but simply

to the stage of loss of reflex and partial relaxation. The anæsthetic should be entirely discontinued as soon as the suturing of the stump is begun. Usually with the use of morphia the state of anæsthesia continues long enough for the operator to comfortably place and tie his sutures.

In the technique of the operation there is one point paramount—*the patient must not lose much blood*. Too great rapidity of operating is to be deprecated, because the operator, in his hurry, is apt to overlook muscular branches of arteries, which will almost surely ooze fatally, unless they be found and secured. With apologies to my friend from Pittsburgh, I believe all principal and larger vessels, arteries and veins, should be *ligated*.

In regard to the stumps themselves the same rules, in the main, hold good as apply to single major amputations. The flaps should be adequate to cover the end of the stumps, without tension. Care should be employed to have the incision through sound tissues, so there shall not be any subsequent sloughing. It is necessary, as a rule, to employ some form of drainage, as very little tension, from accumulated serum, is apt, in very weak conditions, to result in serious delay and, perhaps, injury to the healing. I believe something is gained in point of time to have two operators engaged separately at the same time. In multiple amputations my senior assistant always operates on one limb, while I take another. We have a separate set of assistants and go on independently of one another, unless some hitch occurs when my attention is called and I assume the entire direction. Thus, my multiple, or at least double amputations, are strictly synchronous.

It is an extremely difficult matter to make a thoroughly aseptic operation of double or multiple amputations, on account of the nature of the injuries

and, usually, the extreme soiling of the wounds and surroundings. Antiseptics must, therefore, be used carefully, and all solutions employed should be warm. After careful douching with a warm sublimate solution, one of common table salt, sterilized by heat, will wash away the irritating mercurial and preserve antiseptics at the same time. I have learned to prefer the moist dressings at first and later dry sterilized dressings for these stumps. I regard it as of great importance to immobilize the limbs by appropriate splints after the operation, to prevent pain, to prevent loosening and disarrangement of the dressings and flaps, to give rest to the parts, and thus to promote rapid union.

After the operation I give a quantity of fluid by rectum and by mouth. Concentrated liquid food, and most careful nursing and watching are necessary in order to keep up and carefully gauge the necessary stimulation with strychnia and digitalis.

I have had no time to look through the files of various hospital reports during the last ten years, and I have found, in surgical works, a great dearth of separate and clear statistics of multiple amputations.

I can only give a very short and incomplete list. It will serve, however, for comparing the results obtained ten or fifteen years ago and now. As is well known, it makes a great difference in prognosis as to whether the multiple operations are done for pathological conditions or for acute injuries. The operations done for injuries have proven, as a rule, more than three times as fatal as those done for diseased conditions.

Dr. Ashhurst writes (*International Cyclopaedia of Surgery*, Vol. I, p 590.):—"Double synchronous amputations are not very rare, but (except when feet or hands only are involved) are, unfortunately, not, usually successful." He then gives statistics of eleven cases, two of which were operated on for pathological conditions, with seven deaths.

Schede (*Pitha & Billroth. Handbuch der Allgemeinen und Speciellen Chirurgie, Zweiter Band, Zweite Abtheilung, p. 238*) gives a list of twenty-four cases of complicated injuries, some of them requiring double amputation, with eleven deaths—over forty-four per cent. mortality.

Oberst (*Die Amputationen an Prof. Billroth's Klinik, 1877-'80, Dr. Anton Wolfer, 1882*) notes thirteen cases of double amputations at Billroth's clinic from 1877-'80, with three deaths; eight operations for injury, three deaths, and five for diseases, no deaths—a general mortality rate of twenty-three per cent.

The foregoing may be classed as old statistics, later ones are much better.

P. Delon (*Centralblatt für Chirurgie, No. 11, p. 284*) is cited as having collected 106 double amputations of the lower extremities from the records—presumably chiefly from European operators. Of these only sixty-two had the result noted. There were six deaths, or a little less than ten per cent. (Eleven cases of double amputations above the knee, with two deaths; forty-five amputations of both lower extremities below the knee, with three deaths, and six amputations of one below and one above the knee, with one death). These were done for both pathological conditions and accidents—chiefly for pathological conditions.

My own statistics will exhibit best the progressively lessened death rate obtained through the adoption of better methods with the assistance of more modern therapeutics. These statistics especially exemplify the point I wish chiefly to make, namely, that the paramount factor in the success of multiple synchronous operations is the sedulous saving of blood, and the importance of always delaying operations until the first effect of acute anæmia has, to an extent, passed

away. These operations, performed by the same operator, under the same conditions of surroundings, etc., would, naturally, be affected in their result chiefly by the greater experience of the operator together with improved methods. They were all done after antiseptic methods.

In the last fourteen years I have had fifty-one double synchronous major operations and nine deaths. They were divided as follows:

	<i>Cases</i>	<i>Deaths.</i>
Amputation of both lower extremities, . . .	31	8
Amputation of both upper extremities, . . .	9	0
Amputation of one lower and one upper extremity,	5	1
Amputation of one extremity and some other major operation at same time, . . .	6	0
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	51	9

General mortality rate 17.66 per cent.

During this period, viz., fourteen years, there were eight triple operations and four deaths, and one quadruple operation which was followed by recovery. In the first six years the usual recommendation of not waiting in shock, but to operate during exhaustion from acute anæmia was followed. The chief stimulants used were alcohol and ether, and sometimes atropia, and the operations were hurried all that was possible, and oozing and hemorrhage from the small vessels were not as carefully controlled as they might have been on account of the idea that great rapidity of operating was necessary. During this period there were thirteen double operations and six deaths, 46.25 per cent. mortality.

In the second period of eight years, since surgical shock has been regarded as acute anæmia and has been treated as such, and the operations delayed until partial restitution of the circulation has been estab-

lished and when hemorrhage has been controlled carefully, before, during and after operations, there have been thirty-eight double synchronous operations and four deaths, a mortality rate of 10.8 per cent. There have been six triple operations and three deaths, 33.13 per cent. mortality, and one quadruple operation, followed by recovery. Results have grown progressively better too; for instance, in the last three years there were eighteen double operations and one death, and in the last two years thirteen double operations and no death.

All of these cases were recent multiple injuries, and very commonly other parts besides the limbs requiring amputations were also injured. I believe, therefore, the results of this later period will go far towards establishing that it is improved treatment of shock and the concomitants which markedly lessen the mortality after multiple synchronous operations.