

## **The best methods of treating operative wounds / by Henry O. Marcy.**

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*With Compliments of  
Henry O. Marcy* (2)

THE BEST METHODS  
OF  
TREATING OPERATIVE WOUNDS,

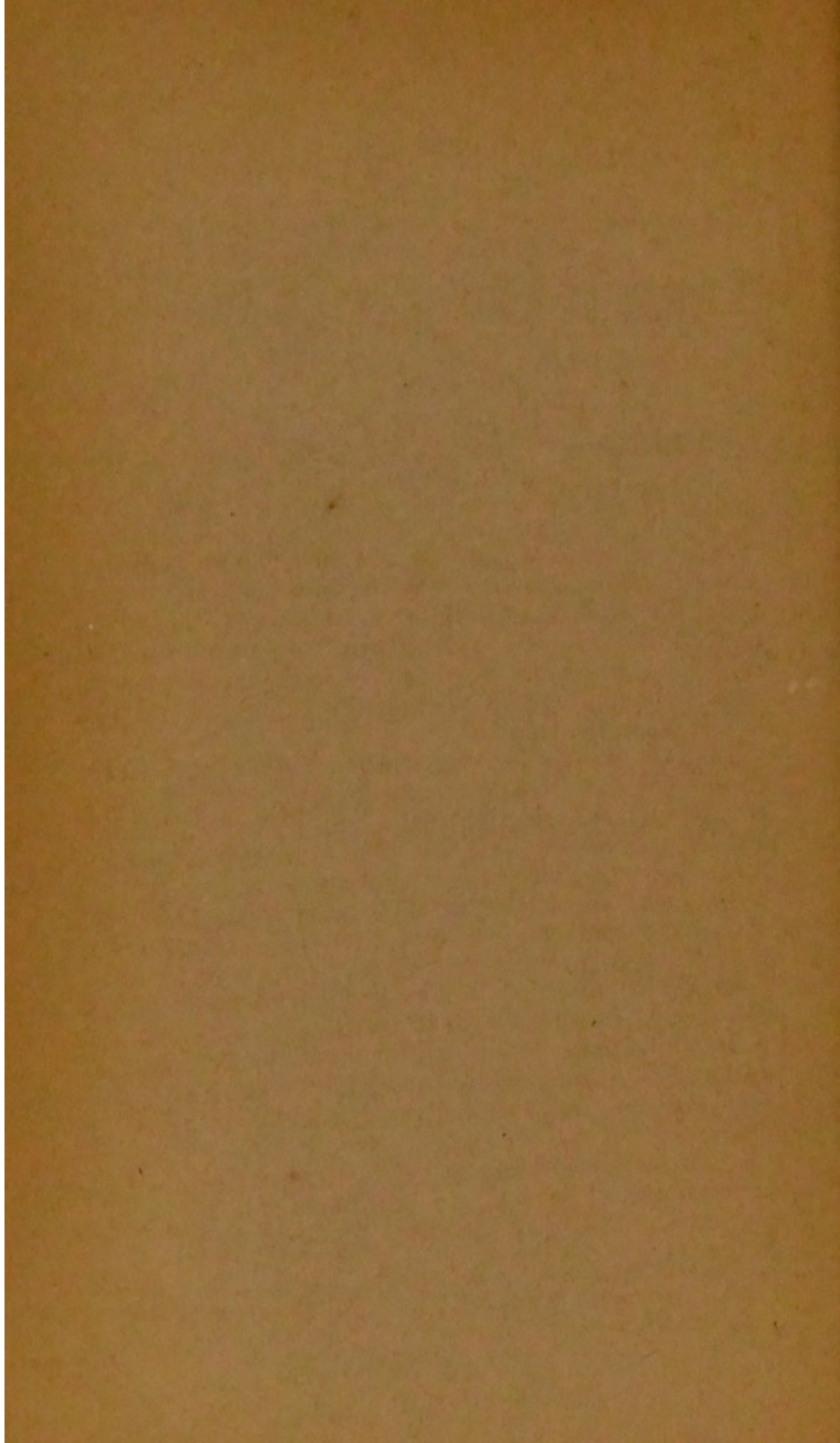
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# THE BEST METHODS OF TREATING OPERATIVE WOUNDS\*

BY

HENRY O. MARCY, A.M., M.D., BOSTON.

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The problems of our Art are of difficult solution. The limited number of well-known factors, out of which we would fain build a science, are ever so intimately and variously blended with the unknown that each clinical history is of an interest intensely dramatic, the central and all absorbing thought no less than human life itself.

Like the weavers of the wonderful old tapestries we follow with anxious gaze the outlines of the dimly traced pattern, selecting shades with doubtful short-sighted vision, and alas, like them, too often working upon the wrong side of our canvas.

Yet, with historic certainty, we sketch the progress of our art from the standpoint of the centuries and record with proud content the marvellous discoveries of our age. With prophetic sense, like a traveler in an unknown land, from some lofty point of vision, filled with inspiration at the view, we scan the outlying territories of the future, and at least in a general way, map out the vast stretches which loom up before us.

A distinguished trans-Atlantic correspondent writing in this spirit, closes with this sentiment: "The medicine of the twentieth century, Sanitary Science and Surgery!"

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\*Read before the American Academy of Medicine. Philadelphia, Oct. 26, '82.



In the enthusiasm of my younger discipleship, I had thought my subject, "The Best Methods of Treating Operative Wounds," settled at least in principle and outline. Invested with the new interest which the discussions of the last year have given, there is, perhaps, no topic of equal importance to which I could invite the attention of a professional assemblage. Indeed, no one subject has commanded a deeper interest since the days of Hippocrates to our own time. One of the first objective lessons in surgery is that, both in danger and suffering, a sub-cutaneous differs from an open wound. The *how* and the *why* have occupied the attention of the profession these two thousand years and have never been satisfactorily settled until the present. The question of operative wound treatment can be categorically answered by the statement that the best method is that which gives results in recovery nearest like those following sub-cutaneous injury, in other expression, best adapted to secure primary union.

Thanks to the revelations of the microscope and the remarkable series of investigations of Pasteur and others, this generation of the profession was early taught that fermentation and decomposition were due to the development of myriads of minute organisms; that these organisms everywhere pervaded in greater or less extent the atmosphere, and that they multiplied rapidly under the conditions of heat and moisture, especially in albuminous or nitrogenous compounds. Pasteur also showed that these fluids underwent no change when such germs were excluded therefrom, and that they could be excluded by filtering the air to which they were exposed through layers of loose cotton fibres.

Based upon these observations, simple and unimportant as they may appear to the superficial observer, there has developed the entire system of modern wound treatment. In retrospection it seems very natural that the acute mind of Mr. Lister should have defined the problem that herein lay the difference between sub-cutaneous and open wounds, and that the exclusion from the latter of the all-pervading germs would render them as amenable to nature's easy cure as the for-



mer. Convinced of the truthfulness of this belief and dominated by it, as the central thought of a life, this surgeon devoted his great genius to its solution with untiring zeal.

It was my good fortune to meet him in the hey-day of his youthful enthusiasm, and to record day by day his splendid triumphs won in the absence of all good hygiene in the wards of the old Infirmary of Edinburgh twelve years ago. Governed by the conservatism of older and often dogmatic teaching, our profession has ever been slow in adopting new methods and wisely demanded of their advocates, with rigorous severity, the reasons for their faith.

The generations had witnessed the sickening horrors of hospitalism, the dangers therefrom multiplying in almost geometric ratio to the aggregated numbers of the sick and wounded. In our own late war we learned that the wounded became endangered almost in ratio to the ability with which we adjudged ourselves able to surround them with the so-called comforts of life, while the supposed more unfortunate, upon the tented field, separated only by a canvas covering alike from the smiles and blasts of heaven, made by far the best recovery. In vain was the solution sought; the general opinion, however, was correct, a better sanitary and protective condition had been thus maintained, depending upon ventilation and cleanliness.

The history of the last ten years shows, the world over, better results following wounds, owing to improved general care and sanitary hygiene, independent of the precise mode of local treatment. The opponents of antiseptic methods claim that to this, rather than any local care, the result should be attributed. It is, however, generally conceded that the great danger to be overcome in wound treatment lies in poisonous conditions which cause the failure of primary union, and that these conditions are in a large measure owing to changes of a putrefactive character taking place in the wound, produced by the presence of vital organisms.

All are familiar with the rapidity and safety of repair which is secured in a properly adjusted simple fracture, and are alike conversant with the dangers



arising both to limb and life in compound fractures. The difference consists not in the severity of the lesion, but in the something introduced from without, which something is none other than minute living particles which cause the changes of putrescence and disseminate as a vital poison to infect the entire organism.

A better knowledge of the widely distributed forms of micro-organisms is much needed; indeed their life histories are required in order to be at all certain of many conditions which now seem most important. There can be no doubt that morphological peculiarities pertain to the same organisms at different stages of their development, that much depends upon their surroundings, as temperature, character of material with which they are mingled, etc. It is equally certain, upon the other hand, that organisms undistinguishable from each other vary greatly in their active properties. The demonstration is generally accepted, that quite a number of acute diseases depend upon the development of certain species of germs, either as a variety peculiar to the disease or modified by certain conditions which so influence their development as to produce a given series of results.

The recent studies of a very considerable number of independent investigators show a much more widely disseminated *causa causans* in the rôle which germs play in the development of disease than has been suspected hitherto even by the most ardent supporters of the germ theory.

The dissemination of pathogenic bacteria now gives an easy and satisfactory explanation to the widespread of contagious and infective diseases;—that subtle something long recognized as an important clinical factor, but hitherto too intangible for demonstration. Pasteur's culture experiments show that certain forms of very deadly bacteria may be so modified as to lose in very large share their virulence, although they are reproduced in a similar manner, and this alteration is effected only by a change of the temperature to which they are subjected. It is equally probable that the converse is true, and that the bacteria with which we are ordinarily harmlessly sur-



rounded, under certain modifying circumstances, become most destructive agents.

The study of climatology has for a long time occupied the best minds of the medical profession, and this generation has seen the Goddess of Hygiea properly enshrined within our temples, but do we not find, behind climatology, hygiene, sanitary surroundings of hospital and home, in the myriads of invisible vital agencies, a new and significant meaning!

Dr. Sternberg, Surgeon U. S. Army, in a paper upon bacteria in healthy individuals, read before the American Association for the Advancement of Science, Cincinnati, 1881, says, "The question is frequently asked, 'If bacteria are such terrible things, how is it possible that we can exist upon the earth surrounded and infested as we are by them?' Certainly there would be an end to all animal life, or rather there never would have been a beginning, if living animals had no greater resisting power than dead animal matter to the attacks of these parasites, which by numbers and rapid development make up for their minute size. On the other hand, but for the power of these little giants to pull to pieces dead animal matter, we should have dead bodies piled up on all sides of us in as perfect a state of preservation as canned lobster or pickled tongue, and there being no return to the soil of the materials composing these bodies, finally all vegetation would disappear and the surface of the earth would be a barren and desolate wilderness, covered only with the inanimate forms of successive generations of plants and animals."

In the ever-widening knowledge of our art, the relationship to and interblending of medicine and surgery becomes more intimate. The rôle which germs play in disease and injury ceases to be a theory and has become a fact as assuredly demonstrated as any in our science. Putrefactive processes so evidently depend upon their development that it is generally admitted to be true even by the opponents of antiseptic surgery. The relation which germs sustain to wounds is the question of primary importance. It has been claimed that the inflammatory



exudates do not depend upon the presence or influence of germs, but that they are met with in subcutaneous injuries: others as strongly maintain that septic organisms are primarily the sources of all the inflammatory and other troubles to which wounds are liable.

There can be no doubt that the processes of putrefaction differ very greatly in wounds subject to similar exposures. Mr. Lawson Tait, who is one of the strongest opponents of the Listerian system, but is the very disciple of cleanliness, and shows most excellent results, draws a distinction between the effect of germs upon living and dead tissues, alleging that it is only the introduction of them into the system through the medium of dead tissue which causes serious consequences. To this Mr. Stokes makes answer, "that those who hold this view ignore the elementary fact that there never was a wound, and especially one in which vessels are tied or twisted, in which dead and living tissues are not at once brought into contact." Again, if dead matter is first necessary for the growth of germs, the abscesses infested with myriads of bacteria which are observed in pyæmia and after ulcerative endocarditis, would be of difficult explanation.

There is much of truth, however, in Mr. Tait's statement; for the bio-plastic exudation from a wound of healthy tissues has a vitality of its own often superior to the most active germs, and either fails to furnish them the necessary pabulum, or walls them in from further depredation, and finally eliminates them from the body, even after a considerable development, as for example, by a localized abscess.

How different their active growths and dissemination in a devitalized patient!

A further discussion of this part of our subject would lead us beyond our present purpose. We would, however, earnestly invite the attention of all interested, to the exceedingly valuable experiments of Mr. Lister, from which he demonstrates the fact that blood clots and blood serum even have a very considerable resisting power to septic influence. These were reported at the International Medical Congress, and are reprinted in Braithwaite, for July, 1882.



Only last year we held it in belief that no competent surgeon would refuse to grant to suffering humanity everywhere the benefits arising from antiseptic surgery. In opening the discussion upon Abdominal Surgery, in the International Medical Congress of 1881, we gave this as our opinion, and stated that least of all did we believe that antiseptic surgery needed defence in London. We were familiar with the marvelous improvements in German surgery, wrought during the last decade under its usage. We had recently read the masterly work of Monsieur Championnière, and Mr. McCormac's address, with its interesting discussion, was fresh in memory. These statements and more were confirmed by our own experience which covered the period of antiseptic surgery in America from its very first introduction. It appeared that we were mistaken.

Mr. Savory's remarkable address upon surgery, before the British Medical Association in 1880, in which he claimed, from the statistics of St. Bartholemew Hospital, as good or better results without the use of antiseptic precautions, had had its influence. This author read before the Congress of 1881, above mentioned, a very valuable paper upon the causes of failure to obtain primary union in operative wounds. He closed with the following: "When is a wound to be considered septic or aseptic? Is pyrexia a sign? Is pus a sign of septicism, or the presence of bacteria, or any other of the lowest visible forms of life; or are we driven back upon the odor, and must we depend upon the sense of smell? But then, what relation is there between poison and bad odor? Who will define a septic from an aseptic state? Is it then, after all, so far as wounds are concerned, merely a question of degree? For the present, at least, I am inclined to think so?" His claim is that the remarkable improvement in the surgery of the present is due to better sanitary arrangements, and yet, in fact, how does Mr. Savory manage his wounds? Let Mr. Stokes, in his address upon surgery, read before the British Medical Association at its recent meeting at Worcester, give answer. "As regards Mr. Savory's denunciation of Listerism, I would say that,



after reading it, and also the able reply to it by my colleague, Mr. Thompson, one cannot but come to the conclusion that, when the address is stripped of all its brilliant eloquence and rhetorical decoration, two facts are, to our surprise, brought clearly to light. One is the admission of the germ theory of putrefaction, and the other, that the method of dressing employed by Mr. Savory is essentially antiseptic, consisting, as it does, of many of the features that characterizes Listerian dressings; for example, carbolized cat-gut ligatures, carbolized oil, drainage and washing the wound with a weak permanganate of potash lotion, or some other potent antiseptic.

Now, as the author of the reply to which I have referred properly asks, "Is this method fittingly characterized by its simplicity and the entire absence of all novelty?" No discussion of modern times has had a more weighty influence in moulding surgical opinion than this; especially has it been persistently misquoted and misinterpreted. Dr. Keith, than whom there could be no more competent witness, said: "For some time I have not found the carbolic spray necessary, and have not used it in my last twenty-seven cases, all of whom have recovered easily. With every possible care, the spray has not, in my hands, prevented the mildest septicæmia, and its effects on the kidney were sometimes disastrous. I have frequently seen kidney hæmorrhage follow long operations, and two deaths in hospital patients were occasioned, I believe, by carbolic acid poisoning. Though I had at one time a series of eighty recoveries under the spray, I have reluctantly given it up, believing that on the whole it did more harm than good."

Mr. Lister, in his discussion of the question, Is the spray really necessary? Replies with equal candor, "In other words, is there sufficient chance of the air of an operating theatre or private room containing septic matter which can prove effective in blood serum, to make it needful to regard the question of contamination from the atmosphere at all?" If the answer must be given in the affirmative, and the choice must lie between the spray and antiseptic irrigation during the operation, at intervals varying according to the dis-



cretion of the surgeon, with syringing the cavity of the wound after stitching, and syringing, also, at every dressing, then I should give my voice decidedly in favor of the spray, as being more sure of attaining its object, and involving less irritation of the wound, and also (if carbolic acid be the antiseptic used) much less risk of carbolic poisoning. At the same time it must be distinctly borne in mind that the spray is, beyond all question, the least important of our antiseptic means ; and that the circumstance that a surgeon does not happen to have a spray producer at hand is no excuse whatever for his abandoning the attempt to obtain aseptic results. But if the apparatus is at my disposal, I, for my part, do not dare to abandon it. By the careful use of our present means, the spray included, we have arrived, I think I may venture to say, at absolute security of attaining the great object in view, provided that we have the two essential conditions complied with, an unbroken skin to start with, and the seat of operation sufficiently distant from any source of putrefaction to admit of adequate overlapping of the surrounding integument by the requisite dressing. Such being the case, I should not feel justified, except on perfectly established grounds, in omitting any part of the machinery by which results so important to our fellow-creatures have been arrived at. Nevertheless, I am aware that, concomitantly with the perfecting of the spray, there has been an improvement in other parts of our antiseptic arrangements ; and I am not prepared to say that our increased uniformity of good results may not be due to the latter rather than to the former. And it may be, for aught I know, that, when the International Congress next meets, I shall be able to speak of results of a still higher order obtained without using the spray at all. For, if further investigation should confirm the conclusion to which our recent facts seem to point, and it should indeed be proved that all idea of atmospheric contamination of our wounds during operations may be thrown to the winds, then no one will say with more joy than myself, "Fort mit dem spray."

Notwithstanding the earnest advocacy of careful antiseptic surgery by Esmarch, Volkmann and Martin



of Germany, Sir Spencer Wells, Mr. Thornton, Mr. MacCormac, Mr. Gant, Prof. Humphry of England, and Dr. J. Marion Sims of New York, reports were written, as the verdict of the congress, that Antiseptic Surgery had received its doom, that Listerism was dead, etc. The profession in New England, eminently conservative, received a prejudicial report, in a remarkable letter, by the late Dr. Green of Portland, published in the *Boston Medical and Surgical Journal*. Many journals gave reviews more or less misleading, which remained uncorrected until the Transactions themselves appeared. Even in our late meeting of the American Medical Association at St. Paul, it was loudly proclaimed, with attempted proof, that "Listerism was dead." So strongly has the less important factor of the spray been mistaken for, or allowed to take the place of the great scientific system of antiseptic wound treatment.

A wound *per se* is not benefited by carbolic or other medication. No student of Mr. Lister would for a moment claim that a wound is other than irritated thereby and rendered less likely to quick repair, but, that it is treated in this manner as the less of two evils, for thus we exclude the contamination of putrefactive agencies, and secure an aseptic wound, surgically clean in character, as nearly as possible like a sub-cutaneous injury.

To our personal knowledge Dr. Keith, Mr. Tait and Dr. Bantock, as well as Mr. Savory, make as much emphasis upon the obtaining such conditions as any others, and hence, in our judgment, their remarkable results. Dr. Keith many years ago, before the adoption of spray by Mr. Lister, showed us the sponges which he had used in a very large number of ovariectomies and emphasized his personal care for their cleanly preservation. This included not only washing and boiling, but their submission to a bath of potash solution; immersion in ether, a careful drying and then their exclusion from dust until again required.

A friend tells us Mr. Tait is equally careful in this and other respects, and Dr. Bantock pointed out to us only last year the thoughtful attention given to every detail in the Samaritan Hospital. How delightfully



does this contrast to much of the so-called antiseptic surgery which we have seen, where, in a blind reliance upon the spray, pouring in thick clouds over the patient, in bad surroundings, dirty sponges, unprotected instruments and towels were used by unclean hands, and the failure to obtain good results charged to a system condemned because violated in all its fundamental factors! There are times and occasions, when it may be exclaimed, in the interest of systems and even science as well as individuals, "Save us from our friends."

Do facts sustain the extraordinary claims of antiseptic surgery? It would seem that a verdict could be obtained from such a tribunal, from which there could be no appeal, and thus settle the question at issue. Yet in such a problem, it is very difficult to obtain reliable data, simple as it would at first appear. Facts seem to have an especial aversion to registration. Percentages of death-rate fall far short of a representation of the care. Amount of suffering and pain, depreciation by suppuration and exhaustion, the length of the period of retention under surgical observation, and detention from active employment; all these factors come within the scope of experience. The lesson to be taught from statistical research is the proud record of recent, sudden and marvellous improvement, and whether under antiseptic regime or not, by far the most important factor appears in the scrupulous attention to cleanliness, as a "virtue next to godliness," and this, when perfectly attained, by whatever means, is no more or less than an aseptic wound, the theoretic as well as practical result sought and secured by the most careful devotion to antiseptic detail. Much of statistical evidence has been adduced which needs no repetition here.

It is scarcely more than a decade, when the mortality rates were so great in Boston and vicinity, after ovariectomy, that such leaders of the profession as Drs. Bigelow and Wyman, denounced the operation as unwarrantable, and decried the men who presumed to think differently. Now how changed!

Ovariectomy is not looked upon as a very dangerous operation, and this is due in very large measure to the



observance of the great principles of antiseptic surgery.

Yet it is just here, in the field of abdominal surgery, Mr. Lister would regard his innovations as the least triumphant.

Sir Spencer Wells' marvellous experience stretches over a wider range than any other ovariotomist, and he gives it as his unqualified opinion that the greatest gain both in safety and rapid recovery is due to these protective agencies. We have elsewhere referred to Dr. Keith, who in abandoning the spray for especial reasons, by no means ignores or fails to put them in practice. Indeed, Dr. Keith himself reports eighty successive recoveries while using the spray, a record without duplication in the history of surgery.

Mr. Thornton believes that almost the only danger in abdominal surgery is septicism. He reported last September at the Boston Meeting of the American Gynæcological Society, that of his last ninety cases of ovariotomy he had only three deaths, and these three were malignant cases. Under such protective influences, uterine tumors are removed, and the entire organ with the ovaries is ablated with fair results.

Did the occasion permit, we would gladly review the entire realm of operative surgery. The broad clinical fact pertains to the entire field. Blood poisoning, arising from altered secretions in the wound which has hitherto been the ever present dread and danger is prevented. If this is owing to putrefaction which depends upon the admission to the wound of the minute living particles, and if, by the careful application of certain precautions, these changes and their consequences may be with certainty prevented, then all these various forms of septic and pyæmic processes may and should be eradicated.

This broad antiseptic method gives scope to a great variety of detail. Prof. Esmarch has reported the following statistics of major operations as the result of the use of his modified iodoform permanent dressings:\*

" 146 extirpations of large tumors, including 40 amputations of the breast, with clearing out of the axilla, and

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\* Transactions International Med. Cong., Vol. II., p. 364.



14 castrations. Of these 3 died—viz.: 1 from pericarditis and inveterate syphilis, 1 from apoplexy and 1 from fatty degeneration of the heart. (2). 51 amputations, viz.: 18 of the femur, 27 of the leg, 5 of the upper arm, 1 of the forearm. Of these 2 died—viz.: 1 from shock depending on weakness of the heart after amputation of the thigh, 1 from delirium tremens. (3). 61 resections—viz.: 20 of the knee, 8 of the ankle-joint, 7 of the shoulder-joint, 14 of the elbow, 3 of the wrist, 5 of the ribs, 1 of the sternum, 2 of the calcaneus, 1 of the patella. (4). 11 exarticulations—viz.: 3 of the hip, 5 of the ankle, 1 of the shoulder, 1 of the knee, which died of exhaustion, the patient suffering from inveterate syphilis. (5). 26 removals of sequestra, scooping out of carious bones, abscesses and fungoid growths. (6). 13 nerve stretchings, of which 12 were cured, 1 died of tetanus. (7). 8 herniotomy cases, all of which were cured. (8). 21 cases of opening and clearing out of "cold abscesses." All recovered. (9). 12 considerable wounds and lacerations of the soft parts. All recovered. (10). 40 complicated fractures and other large operative wounds. He sums up the advantages of the antiseptic permanent dressings: (1). "The absolute rest of the wound until cicatrization is effected. (2). The healing of the majority of the cases *per primam intentionem*, even those which present the most extensive wounds. (3). The avoidance of the danger of infection, by removal of applications and bandages. (4). The diminished suffering of the patient. (5). The diminished labor of the surgeon; and (6). The diminished expense." To which might be added the great shortening of the period of disability.

The treatment of compound fractures and the open wounds of the larger articulations to my mind offer the most astounding proofs of the great value of antiseptic precautions. To those desirous of investigating more carefully this subject we would recommend the reading of Mr. MacCormac's work.

In the earlier treatment of compound fractures, with the very best of care, a very large percentage died, while by the prevention of germ development, Prof. Volkmann reports seventy-five successive cases



of compound fractures without a death, and he does not hesitate to claim that without infection there is no suppuration, and that to obtain primary union two factors are necessary, "complete disinfection and absolute apposition, so that the parts may have the chance of growing together."

While admitting that a depraved constitution and a devitalized condition would render the patient less able to resist the depredations of these vital poisons, he asserts as a demonstrated clinical fact, that such patients have a revivifying bio-plastic power sufficient under all circumstances to afford immediate and complete repair if treated antiseptically. Drainage is even more important in antiseptic treatment than without. Under the irritation of the germicide used, there is an increased exudation from the divided portions, and unless this be removed there may be tension and separation of the parts. *Disinfection, close approximation, drainage, rest and protection* are the vital factors in modern operative wound treatment.

The wide experience of the profession with carbolic acid as the germicide most relied upon, has given rise to a series of dangerous and fatal issues and causes it to be held in fear or disuse by very many who recognize its antiseptic value. This has led to experimentation with other agents, a very considerable number of which are recommended and sold for this purpose. Careful laboratory experiments have been undertaken by my assistant, Dr. Samuel Nelson, and myself in order to test the relative values of a number of antiseptics. For the destruction of organisms which cause putrefaction in wounds the agent to be selected must act quickly. For this reason we have adopted in the main the method in testing employed by Dr. A. T. Cabot, of Boston, whose admirable article, "Experiments upon the Strength of Antiseptics," was published in the *Boston Medical and Surgical Journal*, November 27, 1879.

"Ten parts of the antiseptic to be tested are added to three parts of a foul solution. After a certain measured time, two drops of the resulting mixture are transferred to an aseptic solution which is carefully



protected from the air, put aside, and watched for the first evidences of putrefaction. Suppose the putrefactive elements have preserved their vitality during this time of contact with the antiseptic; they are released from further antiseptic action when these two drops mix with, and are diluted in, the aseptic nutrient solution and are then free to set up putrefactive changes in it. If, therefore, putrefaction appears in the test solution, we know that the antiseptic had not acted long enough upon the germs of putrefaction to destroy them. We repeat the experiment with a longer time of exposure, and so proceed till we reach the time that proves sufficient for the destruction of the putrefactive elements, and we then find that the aseptic solution continues clear and sweet. The sign of putrefaction which was relied upon in these experiments was the appearance of cloudiness, due to the presence of micro-organisms and their presence or absence was always verified by the microscope."

The aseptic solution is prepared by boiling several small pieces of meat with a large quantity of water in a glass flask purified by exposure to the flame of an alcohol lamp. This flask is stopped with a rubber cork perforated by two glass tubes for the convenience of decanting. The tubes are bent downwards and the ends are carefully protected with carbolized gauze. The cork and tubes are carefully cleansed beforehand with carbolic acid. The resulting solution, if made with lean meat settles clear; if the meat is fat, the solution is rendered cloudy by fine oil drops and must be prepared again.

The mingled fluid is placed in a test tube purified by heat and this is covered by a bell glass similarly purified which rests upon a carbolized cushion. In this way it is subject to easy inspection and is protected from all external agencies.

1. Acidi carbolic 1-20 ..... 5 seconds.
2. " " 1-40 ..... 2 minutes.
3. Thymol 1-500 ..... 1 "
4. " 1-1000 exposed 2-4 minutes failed.
5. Acidi salicylici 1-100 ..... 3 "
6. Listerine ..... 4 minutes.
7. Zinci chloridi 1-12 ..... 5 minutes.



|                          |                   |         |
|--------------------------|-------------------|---------|
| 8. Quinia sulphatis 1-10 | exposed 5 minutes | failed. |
| 9. Acidi boracici 1-10   | " 5               | " "     |
| 10. Calcic chloridi 1-10 | " 5               | " "     |
| 11. Potas. permang. 1-50 | " 4               | " "     |
| 12. Boro glyceride 1-30  | " 3               | " "     |
| 13. Platt's chlorides    | " 4               | " "     |
| 14. Oil eucalyptos 1-100 | " 3               | " "     |

Dr. Cabot gives his results in the following table.

|                              |                 |
|------------------------------|-----------------|
| Acidi carbolic. 1-20         | 5 seconds.      |
| Liquor sodæ chlorinatæ. 1-10 | 15:30 seconds.  |
| Acidi salicylici 1-240       | 3 minutes.      |
| Thymol 1-500                 | 3 minutes.      |
| Thymol 1-1000                | 4 minutes.      |
| Acidi carbolic 1-40          | 4 minutes.      |
| Potas. permang. 1-60         | over 6 minutes. |
| Zinci chloridi 1-12          | over 6 minutes. |
| * Alum acetatis              | over 6 minutes. |

From these experiments necessarily imperfect, although occupying a considerable period of time and attention, we may deduce that carbolic acid still holds its place as the best agent for the rapid destruction of micro-organisms and that thymol, salicylic acid and the fluid called Listerine prepared by Lambert & Co., of St. Louis are germicidis of a trustworthy character. Any agent which is as safe as the latter and as promptly active as the former would be a valuable addition to the surgeon's armentarium.

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\* Preparations recommended by Mr. Paul Burns in London *Medical Record*, April 15, 1879, p. 168.