THE LOCAL PREPARATION OF PATIENTS
FOR OPERATION *

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The ideal operation, from an aseptic standpoint, is one in which every element connected with the procedure is free from germ life. The use of moist heat and formaldehyd gas as sterilizing agents places everything, except the skin, within the realm of the ideal. The use of sterile rubber gloves by the operator and his assistants places them, also, from a practical point of view, within the same realm. The skin of the field of operation alone remains as a subject for thought, study and experimentation.

From the point of view of the artist, the skin is a beautiful, perfectly smooth covering of the framework of the body; from the point of view of the physiologist, the skin is a wonderful regulator of bodily temperature, a marvelous excretory apparatus, a soft, pliable covering which protects the underlying tissues from the corrosive action of the air and of fluids or other substances which might come in contact with it; from the point of view of ideal asepsis, the skin is a structure marred by cracks and crevices and crater-like openings, smeared with a mass of debris, and polluted by innumerable wound-infecting micro-organisms. The cracks and crevices are formed by the natural infoldings of the epidermis and by the constant death and exfoliation of the superficial cells of the epidermis. The crater-like openings are the mouths of the ducts of the sebaceous and sweat-glands and the points of exit of the hairs. All of them are inaccessible hiding-places where germ life not only may, but does, lurk. The debris is composed of the secretions and excretions of the glands, countless broken-down cells, and mechanical dirt. It surrounds bacteria and protects them from the action of many of the chemical agents used to destroy them.

The researches of Welch, of Miguel, of Hohein, of Maggiora, of Leedham-Greene, of Heagler, and of almost numberless others show conclusively that bacteria have constant habitation on or in the skin. These germs are not free on the surface from which they might be removed by the sweep of a brush: they are imbedded in the grease and albuminous matter of the skin's debris; they are in the cracks and crevices between the cells of the superficial layers of the epidermis; they are in the crater-like mouths of the ducts of the sebaceous and sweat-glands; they are on the hairs and in the hair follicles. If the germs on the surface of the skin be removed or destroyed, their places will be taken by their fellows in the deeper layers, the latter being brought to the surface by the constant outward activity of the skin. While this action, ordinarily, will cause reinfection of the surface within from two to thirty minutes, yet it is through this action that the skin may be rendered free from germ life.

To enter the realm of the aseptic ideal, the skin of the field of operation must be free from germ life and must remain so during the course of the operative procedure. This must be proved by both clinical and laboratory results. Many writers have reported laboratory findings that support their assertions that the various methods advocated by them have produced the

ideal; the same methods in the hands of other surgeons and investigators have given different results. A perfect laboratory test of the sterility of the skin would demand a study of a piece of the skin. As this procedure is not always feasible, the test made cannot give more than approximate results. Welch passed a silk ligature through the skin; Haeger rubbed the surface of the skin with a silk ligature; Fürbinger scraped the skin with an orange-wood stick; Leedham-Greene used strips of ivory or silk; Schleich stroked the skin with platinum wire. To obtain approximately accurate tests, scrapings of the skin must be imbedded, with certainty, in the culture medium; this practically eliminates all methods of testing which do not leave the scraping instrument buried in the medium. All antiseptics used must be neutralized or removed from the skin before the test is made, because an almost infinitesimal quantity of many antiseptics will be sufficient to prevent development of bacteria. As demonstrated by Leedham-Greene and others, the skin must be moist when the scrapings are taken, because, in a dry condition, the cement substance of the epidermis holds the cells and the bacteria in place to a much greater extent than it does when moist. Tests must be made from fifteen to thirty minutes after the supposed sterilization to prove that active bacteria have not been thrown onto the surface from the deeper layers of the epidermis. To prove conclusively the value of any method, the skin should be infected with an active culture of some resistant, easily recognized, bacterium.

The many methods advocated for sterilizing the field of operation may be grouped into two classes, the wet and the dry, with a combination of these two forming a third. In the first class, the methods attempt to remove from the skin bacteria, broken-down cells, oily and fatty matter, and mechanical dirt, and to destroy any germs that may remain. In the second class, the methods omit any attempt at removal of germ life, mechanical dirt or debris, except through dry shaving, but rather attempt to destroy all germs on or in the skin and to lock up in the cracks and crevices all micro-organisms that have not been destroyed. The third class of methods combines these two ideas.

In the first class, the skin is thoroughly rubbed or scrubbed with hot water and soap and then shaved. The field is again rubbed or scrubbed with soap and hot water, or at times with a combination of castile soap, mustard flour, and corn-meal. The action of the water is that of a solvent and vehicle for the removal of exfoliated cells, mechanical dirt, some of the fatty matter of the skin, and bacteria. The water causes the superficial cells to become more or less engorged or swollen and increases exfoliation. The heat increases the solvent power of the water, acts as a stimulant to the skin, and causes a hyperemia with consequent increased activity of the glands. The soap is used to emulsify the fats on the surface of the skin, to soften the hairs, and to act as a general detergent. The official *sapo* and *sapo viridis*, hard soap, soft soap, fluid soap; soap impregnated with pumice or with such antiseptics as mercuric chlorid, mercuric iodid, phenol, boric acid, salicylic acid, trikresol, etc., are used and each has its advocates. An alkaline soap is necessary for emulsification of the fatty matter, but an excessively alkaline soap will injure the skin if used very freely. The soap should make a good lather so that it may enmesh debris and bacteria and insure their removal from the skin when it is removed. The shaving removes the hairs, which are always surgically

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dirty and which might act as a mechanical hindrance during the operation, scrapes away much of the debris, and opens the mouths of the hair follicles. Improper shaving will cause excoriations of the skin, which should be avoided at all times. The length of time devoted to the rubbing and scrubbing process varies with different surgeons from five to forty-five minutes. The advantage of prolonged mechanical cleansing, with abundant use of hot water and soap, lies in the removal of great numbers of bacteria and debris, many of the former being brought to the surface from the deeper layers through the increased activity of the skin. The objection to prolonged mechanical cleansing, especially when a stiff brush is used, is found in the removal of too many cells with consequent minute excoriations which make the skin much more vulnerable. The mechanical cleansing is followed by the application of antiseptic solutions.

As a result of experience and experimentation, the chemical sterilization of the skin is being limited more and more to the use of alcohol in from 60 per cent. to 80 per cent. strength and solutions of mercuric chlorid, of biniodid of mercury, of iodine (with or without the addition of potassium iodid), and of thymol.

Possibly habit has much to do with the continued use of aqueous solutions of mercuric chlorid. They have been used since the early days of antiseptics, although it has been proved by Harrington, by Post and Nicoll and numerous others, that the solutions used have practically no germicidal value in the time the germs are exposed to their action. Post and Nicoll conclude from their experiments that watery solutions of mercuric chlorid "are absolutely ineffective where prompt disinfection is required, as in the disinfection of the hands and fields of operation." The mercuric chlorid coagulates albumin. Aqueous solutions have slight, if any, power of penetration into the deeper layers of the epidermis.

Alcoholic solutions of mercuric chlorid are much more efficient than aqueous, and markedly so when used on a dry skin. When the solution is acidulated, as advocated by Harrington, it has still greater germicidal power. Harrington's solution will destroy all ordinary germs in from thirty seconds to two minutes. It is painfully irritating to the skin and for this reason should be used only after the patient has been anesthetized. It should be removed within a minute or so by washing with 70 per cent. alcohol.

Watery solutions of biniodid of mercury, especially when combined with potassium iodid, are much more efficient than the same strength solutions of mercuric chlorid. This combination does not coagulate albumin, but requires from ten to thirty minutes to destroy germ life. Alcoholic solutions of the biniodid are much more efficient than the aqueous.

Alcohol, chemically pure, as shown by Koch, has no germicidal power; Sternberg's experiments show that 95 per cent., also, is without germicidal effect. Post and Nicoll claimed germicidal power in solutions as weak as 30 per cent.; Leedham-Greene, after a long series of experiments, concluded that the greatest germicidal power was found in strengths of from 60 per cent. to 70 per cent. Alcohol has the power to penetrate into the cracks and crevices of the skin, as claimed by Braatz, through its ability to decompose and remove small particles of air that may be present. Its penetrating power is much greater on a dry than on a wet skin. Alcohol hardens and fixes the superficial cells of the epidermis. As a solvent or vehicle for the

various antiseptics used on the skin, it is vastly superior to water, the alcoholic solutions penetrating more deeply and having greater germicidal power than the aqueous. The alcoholic solutions are more efficient when made with 70 per cent. alcohol than with 95 per cent.

Since the original paper of Grossich appeared in 1908, iodine has been lauded by surgeons far and wide as the chemical which would place the skin of the field of operation in the realm of ideal asepsis. Grossich's method is to shave the part dry and paint it with a 10 or 12 per cent. solution of iodine in alcohol. He insisted, and his conclusions have been confirmed by the studies of others, that the skin must be dry when the iodine is applied; that the presence of water prevents penetration of the iodine because the water macerates the epidermal cells and causes them to swell, thus plugging up the cracks and crevices and openings in the skin. Iodine applied to a wet skin has a tendency to cause suppuration and blistering. The original method of Grossich has been modified by others, the strength of solution being changed considerably, a fractional sterilization being instituted, and the application of iodine being made on a dry skin after it had been shaved and thoroughly scrubbed.

Aqueous solutions of iodine are less efficient than alcoholic. Solutions made with 70 per cent. alcohol have greater germicidal power than those made with 95 per cent. The addition of potassium iodid makes the solution much more stable and enhances the germicidal value. The official tincture of iodine, containing 7 per cent. iodine and 5 per cent. potassium iodid in 95 per cent. alcohol, is increased in germicidal power by diluting with one part water to four parts tincture.

Iodine in benzene, 1:1000, as a preliminary wash for the skin, followed by the application of a 3 per cent. solution of iodine in alcohol, is lauded by some surgeons. The benzol acts as a "solvent which dissolves and carries into solution all of the oily or waxy substances found normally on the skin, in its various crevices and appendages." Zanetti advises the use of a saturated solution which contains 9.75 per cent. iodine.

A 5 per cent. solution of thymol in alcohol has distinct antiseptic powers, but it is not markedly germicidal. Its use is advocated because it can be used on a wet or dry field without increasing the dangers of suppuration and blistering as iodine does on a wet skin.

To remove fatty matter, act as a germicide, and aid in drying the skin after the use of the wet methods, washing with ether is resorted to. It does not dry the skin sufficiently to allow the immediate application of iodine.

In the second, or dry, class of methods, the field of operation is shaved dry and is then painted with an alcoholic solution of iodine or rubbed with a 1:1000 solution of mercuric chlorid in 70 per cent. alcohol. Two or more applications of either may be made, time being allowed between the applications for thorough drying. In this class of methods, attempt is made to kill all germs with which the agent comes in contact, and so harden and contract the superficial cells of the epidermis that all remaining germ life may be prevented, effectually, from reaching the surface of the skin. To aid in obtaining this result, the skin may be covered with adhesive rubber dam, as advised by Murphy, or painted with a special varnish, as advised by McDonald.

A combination of the methods consists in the use of the wet from ten to twelve hours before operation and the application of the dry eight to ten hours later, followed by a second application after the patient has been placed on the operating-table.

The proper application of these methods will afford a field of operation that will be sufficiently sterile to allow healing *per primam* in a very large majority of cases, the natural resistance of the tissues being capable of overcoming the activities of the remaining micro-organisms. None of the germicides mentioned will destroy, with certainty, all germs on or within the skin. It may be rendered free from germ life, however, if the powers of Nature are called into play. It is well recognized that few infected wounds are seen in those who bathe frequently, or in those whose occupation causes sweating. In both instances the skin is kept more active and actually cleansed by being washed from within outward. During health there is never-ceasing exfoliation of epidermal cells and unremitting excretion and secretion of the products of the sebaceous and sweat-glands. By stimulating this activity of the skin it is possible to have it wash itself so free from germ life that it will remain sterile until infected from without.

In several tests made at the German Hospital (and I wish to take this opportunity to thank the members of the resident staff for the interest and aid given me in making the tests), the only perfect results were obtained in those cases in which the skin had been washed from within outward by the forces of Nature. In these tests scrapings of the skin were taken with orange-wood sticks or mother-of-pearl strips roughened, the wood or pearl strips being imbedded in liquefied agar or bouillon and incubated for ninety-six hours.

In one series of tests, both wet and dry methods were used. The chemical agents used were neutralized or removed. Tests were made before and after neutralization. Practically every test made before neutralization gave no growths; after neutralization, more than 60 per cent. gave growths. The various fields were then protected by sterile coverings and another test was made thirty minutes later. In one instance in which iodine had been used according to the dry method, and in one in which the skin had been scrubbed with mustard flour, no growths were obtained. In every other instance of this series of about eighty-five tests, a growth was obtained, the natural activity of the skin having brought to the surface active bacteria from the deeper layers of the epidermis.

In another series of tests of the hands, the number of bacteria obtained from the surface decreased with succeeding operations, the hands being scrubbed and incased in sterile rubber gloves between each two operations. After the seventh or eighth operation the skin of the hands of the operator was sterile and remained so until contaminated from without. The decrease in the number of bacteria found was proportionate to the activity of the hands of the person tested, the operator showing the greatest decrease, the first assistant the next decrease, etc.

In another series, the skin was thoroughly sweated by exposure to a steam bath or in a hot-air oven. After the sweating the skin was washed with sterile water and soap and was then tested. Twelve per cent. of these tests gave no growth after ninety-six hours' incubation.

In another series, cataplasma kaolini, as made at the German Hospital, was applied hot to a wet-shaved part and allowed to remain in place twelve hours. It was then removed and the field was washed with soap and water and tested. Another application of the cataplasma was then made and the same procedure carried out at twelve-hour intervals for forty-eight hours. The skin was then protected by a dry sterile covering and again tested after a twelve-hour interval. In this series, 100 per cent. of the tests gave growths at the end of twelve hours; 50 per cent. gave growths at the end of twenty-four hours. No growths were obtained in any instance after the twenty-four-hour test. The cataplasma kaolini, as made at the German Hospital, consists of 50 per cent. glycerin and 50 per cent. of kaolin combined with a negligible quantity of flavoring-matter and antiseptics. In this application, advantage is taken of the heat which is retained by the cataplasma for a considerable period of time and of the power of the glycerin to abstract fluids from the tissues, which, according to Cushny, is due to its great avidity for water. The combined action of the heat and the glycerin is to cause such an outpouring of fluids from the skin that it literally washes itself and frees itself from all germ life.

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PITUITARY EXTRACT

AN EXAMINATION OF SOME COMMERCIAL PREPARATIONS
MADE FROM THE POSTERIOR LOBE OF
THE PITUITARY BODY*

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Among the numerous therapeutic agents which have been introduced into medicine within the last few years is pituitary extract, an aqueous decoction of the small structure known as the pituitary body, which lies at the base of the brain. This important structure is enclosed in the bony cavity of the sphenoid bone, the sella turcica; when it is extirpated death soon results or when it is invaded by new growths marked metabolic changes occur.

The pituitary body, or as it is more often termed the pituitary gland, is a neuroglandular structure which in the higher animals is composed of two main parts, an anterior or glandular lobe, and a posterior lobe, the "pars nervosa," which contains nervous tissue mainly. The posterior lobe is small in comparison with the anterior lobe and has surrounding it an epithelial covering, the "pars intermedia," which separates it from the anterior lobe.

In its development it is seen to have a double origin, the anterior part and pars intermedia arising from an upgrowth of buccal ectoderm (Rathke's pouch), which meets a prolongation of neural ectoderm from the anterior brain vesicle. As development proceeds, the buccal ectoderm gradually envelops the projecting neural ectoderm like a pouch, the prolongation thus enclosed later becoming the posterior lobe. During the development of the sphenoid bone the mass of buccal ectoderm becomes enclosed in it and almost obliterates the space between the buccal pouch and neural ectoderm.

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