FALLACY OF A CURRENT SURGICAL FAD—THE THREE-MINUTE PREOPERATIVE SCRUB WITH HEXACHLOROPHENE SOAP*

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The popularity of G-11 soap has risen phenomenally. Four years ago the product had scarcely been heard of; today only the exceptional hospital is without it.

Many advantages are claimed for the new agent. A brief period of lathering with it is alleged to be more effective than the conventional scrub with a brush followed by an antiseptic wash. This time-saving mild toilet of the hands once a day is said greatly to reduce the numbers of bacteria on the skin, and that low flora is thought to persist under gloves and subsequently during the rest of the day.

It is noteworthy, however, that in the long history of skin disinfection many antiseptics have received enthusiastic acceptance only to be discarded later, not so much because they failed in clinical trial, but because improved methods of testing showed them to be less effective bacteriologically than had been supposed.

G-11 is a diphenolic compound having six chlorine ions. Its official name is hexachlorophene. It is a colorless, odorless, white powder, virtually insoluble in water, but soluble in alkalis, alcohol and acetone. The alkalinity of soap is sufficient to keep it in solution. Studies of its germicidal activity are complicated by the fact that extremely minute traces of the substance, as little as one part in many millions, carried over into subcultures, are sufficient to cause significant bacteriostatic effects. Failure to recognize this characteristic has led many investigators to erroneous conclusions.

In general there have been three sorts of tests used to evaluate skin disinfectants (Table I). The first two groups are of interest to the chemist and bacteriologist, but as methods of studying skin disinfection they are almost worthless. There is no definite correlation between the results obtained by them and the ability of germicides to disinfect skin. Even among the in vivo tests, the old-time scraping, rubbing, snipping, and contact technics are too crude to be worth much. The use of test bacteria on the skin has proved disappointing, inasmuch as these foreign organisms do not behave like the cutaneous flora. They are easily removed or killed; sometimes they disappear spontaneously from the skin surface. Many students in this field now believe that the serial-basin handwashing test is the only one proposed so far which is able to measure reliably the skin disinfectant action of mechanical cleansing or chemical germicides. The clinical trial is not the supreme test of a disinfectant, as some have supposed. It contains so many uncontrolled variables, all of which may contribute to the presence or absence of manifest infection, that it cannot be depended upon to evaluate one of the factors involved—the skin disinfectant employed.

What I have to report are the results and conclusions of a critical, rather painstaking study of hexachlorophene and its ability to disinfect the skin.

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1. Hexachlorophene does not disinfect the skin quickly, as alcohol does, but much more slowly (Table II and Fig. 1). This slow degenerating action is attributed to a film of the agent left on the hands after washing with the medicated soap.

2. In order to achieve this desired effect, it is necessary to use G-11 soap exclusively and frequently (i.e., many times a day). To have a preparation of G-11 soap always handy, in the operating room, on the wards, in the office, at home, and at the club is a troublesome but essential part of the routine.

3. Single washings with hexachlorophene soap have the same immediate effect
Fig. 2.—Effect of a three-minute scrub with 2 per cent G-11 soap. Curve AB indicates the degerming effect of scrubbing for eight minutes with Ivory soap, BC the effect of scrubbing with a cake of 2 per cent G-11 soap for three minutes, and CD the effect of further scrubbing with Ivory soap. It is clear that the rate of reduction remained the same throughout the test.

Fig. 3.—Effect of a ten-minute wash with G-11 soap. A liquid soap containing 2 per cent hexachlorophene was used without a brush. Obviously the immediate effect (curve BC) was less than the effect of scrubbing with Ivory soap for an equal length of time (extension of curve AB). The deviation of the first few points from curve AB is due to the presence of transient bacteria which come away more easily than the resident flora.
bacteriologically as washing with non-medicated soaps (Figs. 2 and 3).

4. Use of G-11 soap does not prevent multiplication of bacteria and increase of the cutaneous flora beneath rubber gloves (Table III). The claim that preoperative preparation of the hands with G-11 soap eliminates the danger of chance puncture or tearing of gloves is not confirmed. Although ordinary cultures taken from inside of these gloves may produce little growth because of bacteriostatic effects of the chemical present, addition of serum, which has some neutralizing action, to culture media will permit abundant growth. These same organisms falling into wounds where serum is present are therefore potentially infectious.

5. A single wash with hexachlorophene soap, or even a daily wash with it will not produce or maintain a low bacterial flora. Full regeneration of the usual flora of the skin occurs within 24 hours after a single wash with G-11 soap, including the usual collection of contaminating organisms.

6. For the first time an attempt has been made to follow day-by-day changes in the size of the bacterial flora of the hands and arms so as to observe the effects of disinfection and regeneration in proper perspective. The standard handwashing test, which of itself produces a low cutaneous flora, does not lend itself to such a study. Consequently the method was modified (Fig. 4) so as to test small representative areas of skin. This “spot testing” method, which will be described in detail elsewhere, is not as accurate as the full-scale handwashing test, but it gives surprisingly good and reproducible results.

Changes in the size of flora of my hands and arms during a four-week period are shown in Figure 5. During the first week the hands and arms were washed daily with Ivory soap without a brush for the lengths of time indicated. Each washing reduced the flora to a moderate degree, but by the next day it was as large as ever. During the second week “Septisol” (2 per cent hexachlorophene in liquid soap) was used in the same manner, with comparable results. For two days in the third week “pHisoderm” (a preparation containing ent-
sulfon, lanolin, cholesterol, petrolatum and 3 per cent hexachlorophene) was used with a brush following the stroke-counting technic recommended by Walter. The degerming effect was somewhat greater, as might be expected, but subsequent regeneration used in the manner prescribed by the manufacturers. The figures, each of which are averages of multiple individual tests, represent the numbers of viable bacteria which remain on the hands after G-11 soap has been used in the ways indicated. It is clear

![Diagram](image)

**Fig. 5.**—Changes in size of the bacterial flora of determined by the "spot test." The effects of phHisoderm, and the conventional scrub followed (dotted lines) of the flora after each washing.

of the flora was rapid. During the fourth week the hands and arms were scrubbed once a day in the conventional manner with ordinary soap for seven minutes, followed by a three-minute wash in 70 per cent alcohol. It is obvious that this last procedure had significantly greater degeming effects and that regeneration was somewhat slower.

These observations are confirmed by a large number of full-scale hand-washing tests made at appropriate intervals. The results are summarized in Table IV. In these tests, 2 per cent G-11 in liquid soap was that the results obtained with G-11 soap compare unfavorably with those obtained with the conventional scrub and alcohol wash.

7. The cutaneous flora of different persons varies in susceptibility to hexachlorophene. Obviously Subjects Y and Z (in Table IV) were less affected by G-11 than Subject X. Had those persons used G-11 soap preoperatively, they would have come to surgery with many million of living bacteria on their hands and arms. Bacteria collected from Subjects X and Y were set up

460
in vitro against graded concentrations of hexachlorophene. This study demonstrated a significant difference in sensitivity of the two groups of organisms to G-11.

Although it is true that the cutaneous flora of different individuals varies in sensitivity to alcohol also, these differences are relatively slight. In my laboratory the disinfectant effect of alcohol has been carefully measured on the hands of 11 persons. In none of them did alcohol fail to cause a rapid and great reduction in the size of the cutaneous flora.

My conclusion is that G-11 soap and pHisoderm have been over-rated. As ordinarily employed, they are relatively ineffective and unreliable as hand disinfectants. Used properly, they may have something to contribute to the perfection of surgical technic, but there is danger that their use may create a false sense of security. Certainly they should not be employed to the exclusion of thorough mechanical cleansing and chemical disinfection of the skin.

The avidity with which surgeons have taken up the new fad suggests the existence of a very general dislike for the bothersome, slightly traumatic routine of a prolonged scrub followed by an antiseptic wash. Perhaps it is important to save time and protect the operators’ hands, if that can be done without undue risk to the patient. I should like to propose, therefore, a new simplified method of preparing the hands for surgery. Wash the hands and arms with ordinary soap without a brush for three minutes, taking time out to trim and clean the nails; dry with a sterile towel; then wash for 60 seconds in 70 per cent alcohol, using gauze or washcloth friction. That procedure is brief, easy, non-traumatic, and bacteriologically efficacious. It is not as good as a seven-minute scrub and three minutes in alcohol, but our tests have shown it to be far superior to a quick wash with G-11 soap.

**Summary**

Quantitative and qualitative tests of skin disinfection, using the serial basin handwashing method and a new “spot test-

<table>
<thead>
<tr>
<th>Table IV.—Degeming Effects of Various Procedures.</th>
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<tr>
<td>Subject X</td>
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<tr>
<td>Usual flora of hands and arms before disinfection</td>
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<tr>
<td>Size of flora immediately after 10-min. wash with Septisol</td>
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<td>Size of flora after 10-min. wash with Septisol, 2-day interval</td>
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<td>Size of flora after 10-min. wash with Septisol, 1-day interval</td>
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<tr>
<td>Size of flora after 3-min. scrub with ordinary soap</td>
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<tr>
<td>Size of flora after 3-min. wash in 70% ethyl alcohol using gauze friction</td>
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It appears that the bacterial populations of the hands of different people vary in susceptibility to the agent. The fact that some individuals harbor a bacterial flora that is resistant to the action of hexachlorophene injects a disturbing element of uncertainty into its exclusive use in preparing the hands for operation. Even in those persons whose cutaneous bacterial flora has been shown by appropriate tests to be sensitive to hexachlorophene, an occasional brief wash with G-11 soap cannot be relied upon to keep the hands relatively free from infectious germs (as has been alleged), either under rubber gloves or in ordinary conditions of life.
Comparative studies show that the conventional scrub followed by a three-minute wash in 70 per cent ethyl alcohol is much more effective bacteriologically, and more consistently so, than a brief lathering with G-11 soap or pHisoderm.

For those who insist upon a time-saving, easy method of hand disinfection, the following procedure is recommended: Wash the hands and arms without a brush for three minutes, taking time out to trim and clean the nails; dry with a sterile towel; then wash for 60 seconds in 70 per cent alcohol using gauze friction. The degeming effect of this routine is not as great as with the conventional seven-minute scrub plus three-minute alcohol wash, but it is superior to that obtained by a quick wash with G-11 soap.

Discussion.—Dr. R. Russell Best, Omaha, Neb.: We are all cognizant of Dr. Price's many contributions to the study of skin germicides; in fact, in many investigations done to evaluate the various skin germicides, the methods of Price are used. About three years ago, we became interested in this subject of hexachlorophene soaps and started some experiments. We were particularly interested in the bar soap because the liquid soaps have always been more irritating to the skin of many nurses and doctors. Very likely this occurs because of the high content of potash and the cocoa oil which is used in liquid soaps.

Our experiments concerned the bacterial counts after the use of bar soaps containing hexachlorophene by the technic of direct contact to the skin with spot culture plates containing sterile blood agar. We always found a marked reduction in the counts where such a soap was used as compared to the control bar soaps. The results of our studies, in addition to the reports of other investigators, convinced us that a three-minute scrub without a brush and without the alcohol rinse was more efficient than a ten-minute scrub with plain soap using the brush and an alcohol rinse.

While we were working on this problem and before we had reached any conclusions, I went into the operating room of one of our hospitals, and found a sign on the wall giving the directions for the new scrub technic, using a liquid soap containing hexachlorophene. To prove that I was dubious and hesitant about this soap, a complaint was registered. Since I was on the operating room committee, I immediately went to the superintendent of the hospital and asked who changed the basic principles for scrubbing in the operating room. This was not clearly explained to me.

Out here in the Middle West, we had a man on the loose. I do not know how he did it, but he sold the idea to many of the operating room nurses who purchased the soap along with a nice container. I was on the defensive because our experiments with bar soap containing hexachlorophene (Dial) were supportive to the new technic with a liquid soap. With the completion of our studies, we accepted the change in technic but still objected to operating room supervisors assuming the responsibility of changing the basic principles of the scrub without a thorough investigation and discussion of the subject with an operating room committee. This is related to prove that under the circumstances I was biased and not favoring any change in technic of the surgical scrub, but finally, as the results of our investigation became available, had to accept the change.

Nungster, Thirlby and Vial injected rinsings from hands contaminated with hemolytic streptococci culture into the peritoneal cavities of mice. There was a very significant decrease in the mortality rate where rinsings came from hands using the three-minute scrub with a hexachlorophene soap as compared to the control group where rinsings came from hands using the plain soap, brush and alcohol technic for ten minutes.

Also, we have the work of Clark, Lockwood and Lewis where beef heart broth was placed in gloves after they were removed and the two types of surgical scrub had been used, one group using hexachlorophene and the other the alcohol technic. For the first 60 minutes they took counts at intervals and found that the alcohol wash was resulting in a lower count than the other group. However, after 60 minutes, it was proved that the hexachlorophene group had a lower count, demonstrating the cumulative effect of hexachlorophene.

We believe there is real merit in the surgical scrub using a liquid or bar soap containing hexachlorophene and omitting the brush and alcohol. However, we do go along with Dr. Price in his early warning on this study that we should not have false security, and permit the occasional surgeon to use this scrubbing technic unless he uses a bar soap at home in his daily toilet. Therefore, we must watch those around us who are not in the