CICATRIZATION OF WOUNDS.

VII. THE USE OF CHLORAMINE-T PASTE FOR THE STERILIZATION OF WOUNDS.

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It has been shown in a previous communication¹ that a wound cicatrizes rapidly if the surface is sterile. If it is more or less infected, the rate of cicatrization is slow or the wound enlarges. In order to obtain a convenient method for the sterilization of wounds we have endeavored to prepare an antiseptic paste which will retain its aseptic properties.

It has been found¹ that ointments and other fatty substances are inefficient when applied to wounds, because the bacteria and antiseptic are covered with fatty material which isolates them from each other and permits the bacteria to multiply freely. Hence the antiseptic paste must be soluble, and the bactericidal agent must be embodied in a substrate suitably chosen so that the whole constitutes a system physically homogeneous. On the other hand, to enable the antiseptic to act continuously the base should be absorbed slowly by the tissues in order to renew the surface of contact constantly. Neutral sodium stearate was used for this purpose because of the facility with which it is made antiseptic and also because it is not injurious to the tissues. It is well known that the slightly soluble sodium soaps, far from being irritating agents, are, on the contrary, soothing. Moreover, they give pastes sufficiently plastic for the dressing of wounds. One of Dakin's chloramines was selected as the bactericidal agent. After many trials we have used the following formula.

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Neutral sodium stearate ................................................................. 86 gm.
Chloramine-T .................................................................................. 4-10 "
Distilled water ............................................................................... 1,000 cc.

Of the less soluble sodium soaps it is essential to choose those derived from saturated fatty acids and not having double ethylene linkages. The presence of such groups which readily take up the elements of hypochlorous acid (HClO) causes a rapid disappearance of chloramine. On the other hand, stearic acid is a product of sufficient purity and is easily procured; its sodium salt obtained by boiling the calculated amount diluted with caustic soda is aseptic.

We have tried some pastes less concentrated in stearate, but they separate into two portions; the lower part is watery, and the upper portion richer in stearate so that it has the concentration indicated above, which is a minimum.

We have chosen as an antiseptic to combine with the sodium stearate one of the substances studied by Dakin, known as chloramine-T, which is the sodium salt of toluene sodium p-sulfochloramide. The reasons for choosing this substance were its high bactericidal power, the absence of caustic action on the skin, the possibility of an exact estimation of its strength, and its stability at a high temperature, which allows the substances to dissolve in a boiling solution of stearate. The question of using sodium hypochlorite was not considered because this product changes rapidly under the influence of heat, and especially because of the sensitiveness of soap solutions to the action of electrolytes.

Several trials were made with various proportions of chloramine-T. 20 gm. per kilo seem to make the paste irritating, thus rendering it useless. 15 gm. per kilo are tolerated by the wounds but are slightly irritating to the skin and congest the granulations, giving them a purple color. 10 gm. per kilo cause neither irritation nor pain; the wounds tolerate application for weeks. At this concentration the bactericidal action is strong enough to disinfect surface wounds completely, as rapidly as Dakin's solution (sodium hypochlorite 0.50 per cent). At the level of contact of the paste and tissues a thick greenish liquid gradually forms, which is apparently the result of the action of the secretion of the wound upon the paste. Bacteriological examination shows the secretion to be sterile, but it is
important to wash it away every day with neutral sodium oleate before making a fresh application. For wounds in the process of cicatrization, paste with 10 gm. of chloramine-T per kilo seems to retard the repair slightly. If the percentage of chloramine-T is further decreased, the antiseptic action decreases proportionately. With 4 gm. per kilo the action on infected wounds is extremely weak, but those that have been disinfected remain sterile and their cicatrization is normal.

The preparation of chloramine paste is as follows: Boil a liter of distilled water and add 80 gm. of stearic acid. When this has melted, gradually add enough caustic soda to saponify the fatty acid and after complete solution add 4 to 10 gm. of chloramine-T, according to the concentration desired. The mixture is then placed in a mixing machine and shaken until thoroughly cooled. The paste is a smooth snow-white cream. Microscopic examination shows that it is composed of a compact felting of fine needles retaining in capillary suspension a colorless liquid. The sodium stearate is slightly soluble at a cold temperature and produces this crystalline felting which retains in its interstices the antiseptic solution. The paste can be kept either in low glass jars or tin tubes, as tin is not corroded by chloramine-T.

The principal disadvantage of this paste is its poor power of preservation; numerous trials showed that 10 per cent of chloramine-T disappeared per month. Substances which might have rendered the paste more stable were either inefficient or lessened its keeping properties. The stability of the paste is limited by the stability of the solution of chloramine-T because the antiseptic is in solution in the paste.

CONCLUSION.

Dakin's toluene sodium p-sulfochloramide, mixed with sodium stearate, forms a paste sufficiently active and stable to be used in the treatment of wounds.