

## STERILIZATION OF THE SKIN AND OTHER SURFACES BY A MIXTURE OF CRYSTAL VIOLET AND BRILLIANT GREEN.

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The problem how to effect absolute sterilization of the skin is of the utmost importance in surgery, but it is difficult of solution because all the usually employed antiseptics are more or less strongly irritant, so that their prolonged application for the purpose of seeking out organisms lying beneath the superficial layer of epithelial squames, or sequestered in the sweat and sebaceous glands and the hair follicles, is impossible. Their action is thus limited to the surface of the skin only, and those organisms which lie deeper escape destruction. Moreover, they are rendered inactive by admixture with albuminous substances, so that the blood from the wound, on coming in contact with the prepared skin, immediately neutralizes the small amount of the antiseptic. For example, every trace of the iodine colour has disappeared from the neighbourhood of the wound long before the operation is finished.

It may be argued that the iodine has already sterilized the skin, but this would only be true if the sterilization extended throughout the bacteria-bearing regions of the skin, whereas it is limited to the surface. The result is that the rubbing of the soddened skin surrounding the wound, which is more or less inevitable as the operation proceeds, first removes the layer of superficial sterility and then begins to detach epithelial scales which the antiseptic has never reached. The conveyance of such unsterilized squames into the wound is a potential cause of sepsis.

To avoid such conveyance the modern surgeon attaches sterilized towels to the edges of the wound. Fixation of the towels so as absolutely to cut out the skin is simple in straightforward operations where little manipulation of the wound is needed, but quite the reverse in certain prolonged and difficult operations involving much manipulation, and it is in such that perfect aseptic technique is most particularly desirable. The use of sterile towels to cut out the skin has the further disadvantages that they add a complication to the general technique, tend to handicap the surgeon, and increase the expense—a matter of no small moment to hospitals nowadays.

One of us (V. B.) carried out a number of experiments aiming at cutting out the skin surface altogether by covering it with a layer of impermeable varnish; a number of varnishes were used, the basis of them all being asphalt dissolved in various volatile media, to which was added in different experiments mastic, collodion, and caoutchouc. The experiments failed; although the desired result was attained so long as the skin was smooth and dry, yet when it was sweaty or crinkled, as in the case of the abdomen of parous women, the varnish before the close of the operation began to peel off at the edges of the wound.

In consequence, one of us (C. H. B.) suggested the use of a strong solution of crystal violet and brilliant green to produce not only a sterile, but an actively antiseptic condition of the skin, since these substances are both extremely potent antiseptics,\* and at the same time devoid of irritating effect on the skin when applied in high concentrations. The method which we have employed, and which has been used as a routine at the Middlesex Hospital by one of us (V. B.) for the last two and a half years, is as follows:

The solution contains 1 per cent. of a mixture of equal parts of crystal violet\* and brilliant green† dissolved in equal parts of rectified spirit and water. (The powder is dissolved in the undiluted spirit first of all and the water

then added.) Six hours before the operation (except in certain cases) the solution is painted over the skin of the operation area; a compress of lint soaked in the same and covered by a sheet of waterproof batiste, is then applied and kept in position by a binder or bandage. This compress is removed on the operating table and no further painting done. The result is that the skin is stained an intense violet-black; the staining remains unchanged throughout the operation and indeed for a week or two afterwards.† This prolonged application of the antiseptic produces no irritation of the skin, nor of more sensitive surfaces such as the vulva and vagina.

The theoretical advantages of an antiseptic capable of being applied in such concentration and over such a period are obvious. The epithelial squames throughout the entire thickness of this layer become permeated with the dyes. Should a squame become detached and conveyed into the wound it carries with it a definite amount of a potent but practically non-irritating antiseptic, and the skin surface exposed is not merely initially sterilized, but remains antiseptic throughout the operation.

The clinical results accord with the theoretical. The advance made is chiefly apparent not in the average surgical case in which healing was rarely unsatisfactory with the older methods, but in certain operations in which infection of the wound is specially liable to occur. Thus the healing in cases of the radical extirpation of carcinoma of the cervix, an operation in which suppuration in the operation area has been a not uncommon complication, has immensely improved. In these patients not only is there a special liability to transference of skin organisms into the parietal wound on account of the prolonged operation and the amount of manipulation required, but there is a very definite risk of virulent organisms being transplanted from the divided vagina into the operation area. Various methods aiming at preliminary sterilization of the vagina have been employed in the past, but none of them has been so successful as that we now employ—namely, packing the vagina for six hours beforehand with gauze soaked in violet-green.

Further, a marked advance has been shown in the progress of cases of operations involving the perineal, perianal, vaginal and vulval regions, areas the sterilization of which has hitherto been impracticable. Owing to the absence of irritant effect violet-green can be applied to these parts by compress or pack for the same length of time as it can be applied to the abdomen, the leg, or the arm.

### Bacteriological Tests.

In order to test bacteriologically the value of violet-green as a skin sterilizer we have made cultures from a series of patients prepared for operation with this antiseptic. The cultures were taken in the following manner: With a sharp needle the skin was deeply scratched, not merely stroked, and the surface of an agar plate inoculated; the needle was then resterilized, the skin again scratched, and the plate again inoculated, and so on up to four times for each case. The object of this procedure was to obtain cultures, not merely from the surface of the skin, but from the deeper epithelial layers, and, further, to make the inoculation from each separate scratch act as a control to the others on the same plate. In each patient two areas of skin were chosen, the abdominal skin and the perianal skin, and separate plates were used for each area. The perianal skin was specially selected as being the most bacteria-laden portion of the external surface of the body, and therefore as testing the efficacy of the sterilizing agent in the most rigorous manner.

The violet-green was applied to the abdominal skin for six hours in the manner already described, but only for three hours to the perianal and perineal regions, so as not to interfere with micturition. Our results are as follows:

Violet-green—abdominal skin ...	...	22 cases
Result: No growth at all in ...	...	22 "
Violet-green—perianal skin ...	...	20 "
Result:		
No growth at all in ...	...	17 "
Growth in two of the four streaks in ...	...	1 case
Growth in one of the four streaks in ...	...	2 cases

The growths that occurred in the last two cases were due to the needle being drawn absolutely through the

\* The substance employed should be hexa- or penta-methyl violet or a mixture of these.

† Specified as brilliant green sulphate zinc-free.

‡ If desired the colour may be removed by rubbing the surface with hypochlorite solution, for example, "eusol."

anus, a recess into which it is impossible to be sure the antiseptic has thoroughly reached. The streaks corresponding to such passage of the needle showed growth, whilst the others did not. This mistake was avoided in the control experiments.

The following control experiments were carried out:

The perianal skin was untreated in 6 cases. Result: Growth in all four streaks in all cases.

The perianal skin was treated with iodine in 10 cases. The skin was painted with 2 per cent. iodine solution in rectified spirit one hour beforehand and again painted immediately before making the cultures—three streaks only to each case.

Result:

No growth at all in	...	...	1 case
Growth in all three streaks in	...	...	3 cases
Growth in two streaks in	...	...	3 "
Growth in one streak in	...	...	3 "

The very marked superiority of violet-green over the commonly used iodine is strikingly demonstrated.

For further experimental proofs of the superiority of the violet-green mixture as a means of effecting both thorough and rapid sterilization of the skin we are indebted to the observations of Drs. J. Walter McLeod and R. E. Bevan Brown (unpublished).

The method which these workers adopted was to cut a portion of skin from an amputated limb into portions, which were then placed in sterile Petri capsules. A loopful of a dense emulsion of bacterial culture, faeces, etc., was smeared on the centre of each piece and the surface was allowed to dry. Then the antiseptic was applied either by dropping it on to the surface or by laying on the skin a small piece of lint soaked in the antiseptic solution. At the end of the period of application excess of antiseptic was washed off with spirit and the latter was allowed to evaporate; after the surface had dried, a loopful of sterile peptone water was vigorously rubbed over the treated surface, and the loop was then used to inoculate the test medium. By the application of violet-green, skin inoculated with emulsions of faeces or of soil was completely sterilized, as tested both in aerobic and anaerobic cultures, after twelve to fifteen minutes; *B. tetani* and two strains of *perfringens* type were also killed in fifteen minutes. A 2½ per cent. solution of iodine in spirit was equally effective under similar conditions; but when iodine in 1 per cent. strength was tested on *B. perfringens* it was found to be a less efficient antiseptic than violet-green. The superiority of violet-green was also strikingly apparent in the case of certain resistant organisms; thus, a sporing aerobic bacillus of a type akin to *B. subtilis*, which was very resistant to sterilization by heat, was not killed after ten minutes' application by such practically impossible antiseptics as a saturated solution of iodine in chloroform, 33 per cent. bromine in chloroform, formaldehyde (40 per cent.), liquefied carbolic acid, 5 per cent. hydrochloric acid in saturated watery solution of corrosive sublimate, or 10 per cent. nitrate of silver; 5 per cent. picric acid in spirit, 10 per cent. lysol, 2 per cent. hypochlorous acid, 15 per cent. nitric acid in spirit, also failed to effect sterilization in five to ten minutes; strong tincture of iodine applied for one hour had no obvious effect on this organism, but after twelve hours' application produced sterility. On the other hand, the violet-green solution sterilized the skin after acting for fifteen to thirty minutes.

Streptococci and staphylococci are among the most susceptible organisms to these dyes, hence the above results apply *a fortiori* to those organisms.

REFERENCE.

<sup>1</sup> Browning. *Applied Bacteriology*, London, 1913.

## Memoranda:

### MEDICAL, SURGICAL, OBSTETRICAL.

#### MYOPIA AND MYOPIC ASTIGMATISM IN RELATION TO THE GLARE OF MESOPOTAMIA.

DURING at least nine months of the year the glare experienced in Mesopotamia is a very real trouble. It is with a feeling of great relief that the first rain is greeted; it comes in December and reduces the glaring white of the soil to a muddy brown colour. The country round Basra consists of the river, the Shatt-al-Arab, with a belt of palm trees of varying depth, and then the desert. The date palm is practically the only tree in this part of the country, and its fruit is the principal wealth of the land, but it is an unsatisfactory tree for giving shade, and is usually so covered with dust as to have a greyish colour which gives no rest to the eyes.

The troops are supplied with glare protectors fitted with a green-tinted glass. There can be no question of the comfort that these afford and of the feeling of coolness

experienced on putting them on. Some medical men have asserted that the wearing of glare protectors is as important a prophylactic against heat-stroke as a sun helmet. This, I think, is far too positive a statement. It is generally accepted, after the experience of last summer, which was an unusually severe one, that when a man who has not unduly exposed himself to the sun is attacked by heat-stroke of the apoplectic form he is at the time suffering from some form of toxæmia. In this area the cause of the toxæmia was usually the early stages of sandfly fever or malaria, but alcoholism and even constipation were often the underlying factor.

The point which I wish to bring forward is that persons with myopia, and especially with myopic astigmatism, suffer to a very marked extent from the glare, often to such an extent as to render them useless for any outdoor employment. Men with high degrees of myopia in this country are of little use. Even with glare protectors over their correcting glasses or with tinted lenses, they cannot cope with the conditions.

I will report one case of rather exceptional severity, though cases of a similar nature but of less severity came to the eye department at Basra.

Pte. S. stated (May 21st, 1917) that on the previous day, when coming out from church into the sun, he suddenly saw colours and then became blind. He was taken indoors, and in a few minutes he recovered his vision. Shortly after this he went again to the parade ground, when his sight went in a similar manner and has not returned.

On examination, the vision of the right eye was only bare perception of light, and with the left he could count fingers at a few feet. There was some slight conjunctival injection and considerable photophobia. Both pupils were equal and reacted normally. The eyeballs were somewhat tender to pressure, but the tension was normal. He was wearing -7 D. sphere. before both eyes. His refraction worked out at -6 D. sphere. -2 D. cylinder axis horizontal for both eyes. The fundus of each eye showed a typical myopic appearance with large temporal crescents, but no active disease was seen. The media were clear.

He was admitted to hospital on the same day, put to bed in a dark corner of the ward as possible, and given a strychnine mixture three times a day. By the end of a week the photophobia and conjunctival injection had disappeared, and the vision had returned completely. He was subsequently evacuated to India.

I am indebted to Lieut.-Colonel Gee, I.M.S., in whose hospital the ophthalmic department is situated, for permission to publish this case.

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#### PADDING THOMAS EXTENSION SPLINTS BY PARAFFIN WAX.

I wish to bring under the notice of surgeons using the Thomas extension leg splint a rapid method of padding the groin ring. It consists in first padding the iron ring in the usual way by winding on to it strips of carpet felting about 1½ in. in width. Each layer as it is wound on is sewn with thin thread to prevent it unrolling or shifting its position, and each successive layer is sewn through to the preceding one. The last quarter of an inch of the padding should be flannel or flannelette sewn in the same manner, and continued until the padding is of the required size and shape.

The whole ring is now immersed in melted paraffin wax, or this is poured over it hot until it permeates the whole padding. When dry and hard all excrescences can be shaved off and the waxed surface rubbed smooth. No leather or other covering is used. It is greasy but clean and does not stick to the skin, and is impervious to moisture. The heat of the body keeps the padding in a soft resilient state, and it moulds itself slightly to the body. If soiled it can be washed, or scraped, or shaved to clean it.

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#### RECURRENCE OF BILIARY OBSTRUCTION BY GALL STONE AFTER REMOVAL BY OPERATION: ACUTE PANCREATITIS: DEATH.

A very stout man, aged 53, was admitted to the Royal Infirmary, Glasgow, under my care, on November 26th, with distension of the abdomen, which was tender all over; the bowels had not acted for six days. Tenderness to pressure was most marked over the right hypochondriac