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USE OF A GLYCERIN-SULPHONAMIDE PASTE ("EUGLAMIDE") IN TREATMENT OF BURNS

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Since the introduction of the tannic acid technique much progress has been made in the treatment of burns, though there have always been difficulties that have been only partially overcome. The limitations in our present knowledge have, however, been emphasized by the unusual conditions prevailing during the war. In civil life the lesions were mainly scalds and therefore of second degree, except in parts becoming septic, when lesions of the third degree developed.* In war the proportion of burns of the third degree is relatively high, and the problem of dealing with these lesions and their sequels has become much more important.

General Principles

The principles governing the treatment of burns are generally established. Thus it is recognized that the first aim is to save life, the second to avoid infection, and the third to prevent deformity. If life is endangered the consideration of paramount importance is the prevention of secondary shock. This is done by maintaining the body temperature and by the administration of a sedative and of intravenous plasma or serum; then, as soon as is practicable, the burnt area is cleansed and tanned.

In many cases already seen in the present war life has not been endangered, and yet the treatment has not been successful in preventing sepsis and deformity. These unfortunate results have been due essentially to the indiscriminate or faulty use of coagulating agents without consideration of the depth and site of the injury. In the case of third-degree burns there is total destruction of skin, and this lost skin has to be replaced by grafting, whatever the preliminary line of treatment adopted. The ideal mode of treatment is therefore one which as rapidly as possible will give a clean surface suitable for grafting. Up till now tanning has been the method of choice, but it has invariably resulted in infection. Under these conditions the tan separates slowly, leaving an unhealthy granulating surface. It is therefore obvious that this way of dealing with third-degree burns is unsatisfactory, and that there is an urgent need for a more efficient procedure.

The treatment of burns of the face and hands has presented special difficulties. In so far as the face is concerned the problem is mainly that of the third-degree burn, which, even when small, is apt to produce disfigurement on healing. The treatment of second-degree burns of the face should present no special difficulties: there is

no complete destruction of the skin, and therefore the use of coagulating agents should give satisfactory results. Nevertheless a number of workers who have used tanning agents have experienced difficulties in such cases.

The greatest problem, however, and one of urgent interest, is the treatment of burns of the hands. The present method of treatment in such cases is by no means satisfactory, and this applies not only to third-degree burns but even to lesions of the second degree. Those who have seen the unfortunate results of the indiscriminate application of tannic acid to burns of the hands will be convinced that the general use of coagulating agents should not be advocated; oedema and sepsis under a rigid tan, together with prolonged immobilization, have played their part in producing limitation of movement, contracture, and, in extreme cases, ischaemic necrosis.

The New Method

The method of treatment described below was evolved for the purpose of meeting these very obvious difficulties. In principle it consists in the application to the burnt area of a water-soluble sulphonamide in solution in glycerin. The sulphonamide compound albucid soluble was chosen because it was freely soluble in water, formed a neutral solution, and was known to be innocuous to tissues. It appears probable that other sulphonamide compounds which possess the qualities mentioned above would be equally effective, but limitations of time and clinical material have so far prevented the carrying out of comparative tests of different compounds.

Glycerin by itself is unsuitable for local application to the surface of the body. The albucid solution was therefore converted into a paste by the addition of a suitable quantity of kaolin. Since the paste contains a glycerin-kaolin mixture it produces the effects usually associated with cataplasma kaolin. Thus there is an increase in the flow of lymph containing antibodies and white blood corpuscles; this will tend to increase the local defence mechanism. The flow of tissue fluids together with the absorption of water by the glycerin helps to reduce the oedema, which is an undesirable feature of burns in certain localities. Preliminary observations showed that the paste tended to dry in the centre of the area of application, consequently a small quantity of cod-liver oil was incorporated. Incidentally, it is possible that this may have additional advantages—e.g., a beneficial effect on tissue repair and a local soothing action.

* In a first-degree burn there is erythema of the affected part; in a second-degree burn partial destruction of skin with or without vesication; and in a third-degree burn total destruction of skin.

Such a paste can be of value only if it does not cause any irritation. It has been found in practice that, though there may be slight pain when it is first applied to the injured area, this very rapidly passes off and does not recur. On the contrary, our experience suggests that in some cases the paste possesses an appreciable soothing effect.

The treatment of burns with this paste allows of early movement. This is of considerable importance, since the immobilization of the affected parts associated with the use of coagulating agents is an important factor in preventing the subsequent restoration to normal functional activity.

Method of Preparing the Paste.—5 grammes of soluble albucid powder is mixed with 100 c.cm. of glycerin; the mixture is then heated cautiously until the solid is completely dissolved. This usually takes about thirty minutes, the mixture being stirred from time to time. The heating is then discontinued; while the mixture is still warm 10 c.cm. of cod-liver oil is added, being thoroughly stirred in. This solution is mixed into a quantity of fine kaolin (about 80 grammes) sufficient to yield a smooth paste of the consistence of thick cream. The mixing is done in a mortar, and, later, on a white slab with a spatula, in order to produce a smooth permanent paste.

Clinical Results.—The paste has been used with success in burns of the hand (second and third degrees), the face and scalp (second and third degrees), the buttock (second and third degrees), the penis and scrotum (second degree); in septic burns, following twenty-four hours of wet dressings; and in burns of the second degree not extensive in area.

The value of the paste in certain conditions—e.g., bed-sores, carbuncles—is also being investigated, and it is hoped to report on the results at some future date.

Technique of Application

An anaesthetic may be required for cleansing, but this is not essential, except in most children, in whom fear and apprehension are prominent. Before intervention, cultures are made from the surface of the burn and from blister fluid, and these are repeated every second or third day. In second-degree lesions the affected part is cleansed with gauze wrung out of isotonic saline at body temperature. Blisters and loose epidermis are snipped and removed. In third-degree burns the surface is gently washed with warm physiological saline and all foreign material removed.

In applying the paste a thick spread is made on sterile white lint, gauze, or linen; for burns of the face a mask is cut out. Further dressing is applied if necessary, and the whole is covered with wool and bandaged. In burns affecting the face and in the region of flexures the paste and dressings are reapplied daily, but in other parts they may be kept on for three days before being changed. Where infection is present it is essential, in order to maintain a high local concentration of the sulphonamide, that daily reapplications of the paste be made, no matter the site. At each change of dressing the affected part is wiped clean with wool pledgets soaked in normal saline or cod-liver oil.

Most of the burns treated have been of the second degree, and have occurred in children. In this series neither the interval between the occurrence of the injury and admission to hospital nor the nature of the first-aid treatment appeared to influence the ultimate result. Undoubtedly some regions responded in a very promising manner to the application of the paste—e.g., the hands, the face, the abdomen, the buttocks, the feet, and the penis and scrotum; other areas—e.g., the axilla and shoulder region—showed less response but nevertheless did well. In

several patients anaesthesia was not required for preliminary cleansing. Pain was experienced on application of the paste in only a few instances, and irritation was absent. As a rule an early healing surface was obtained, as can be judged from the period during which the patient remained in hospital (see accompanying table).

The rate of healing with the paste (termed "euglamide") compared favourably with that obtained with tannic acid in the two cases in which both methods were used (Nos. 8 and 15). In each of these cases the burn on one hand was treated with silver nitrate while paste was applied to the burn on the other; the hands treated with paste healed and showed normal function before the coagulum on the other hands had begun to separate. In Case 4 (treated originally with charcoal-silver nitrate jelly) the healing properties of the paste when applied to a septic granulating surface compared very favourably with those of acriflavine under the same conditions. Initial sepsis appears to be an indication for the application of euglamide. In such patients the routine adopted up to the present is as follows: hot boric fomentations are applied every four hours for one to two days; a thick spread of the paste is then put on once daily in order to maintain a high local concentration of albucid.

Very satisfactory results were obtained in facial burns. The method of treatment in such cases has, moreover, the additional advantage that it allows the patients a certain amount of freedom, which cannot be permitted if tannic acid has been used.

So far we have had the opportunity of employing the paste in only a few burns which involved the whole depth of the skin, but the results have been promising, as is illustrated by the following case:

Case 7 had a third-degree burn of the dorsum of the hand, which was treated with euglamide from the first. The natural coagulum separated on the fifteenth day and left a granulating area of healthy appearance; at this stage a culture gave a sparse growth of *Staph. aureus*. There was complete absence of oedema and of neighbouring inflammatory reaction, while movements of the tendons were free from the first. Pain was notably absent.

Our experience with another patient suggests that the paste may prove to be very valuable in the treatment of burns of the penis and scrotum:

On admission this patient (Case 19) showed very marked local oedema. The insertion of an indwelling catheter was contemplated, but since urine had been voided just before admission the procedure was delayed. The paste was applied, and the following morning the oedema, though still pronounced, was definitely less, and catheterization proved unnecessary. A steady improvement followed.

The paste has proved of value in burns which had become septic after the use of a coagulating agent; in these cases euglamide was applied to the unhealthy granulating surface remaining after removal of the coagulum, and rapid healing was promoted (Cases 16 and 17).

The history of Case 20 is interesting (see Figs. 1-4). This patient had second-degree burns of the right hand affecting the thenar eminence, a small area of the palm, and the second and third finger clefts from the web to the level of the distal interphalangeal joint. Tannafax jelly had been applied immediately by the medical attendant; six hours later this was removed at the casualty hospital and four-hourly saline compresses were ordered. When first seen by us one week later the condition was unsatisfactory: the patient complained of local pain, severe enough to keep him awake at night; the raised epithelium had been only partly removed from the burn and there was a considerable amount of dead skin left; the areas exposed were raw, tender, and inflamed; the blister on the palm was still intact; and movement of the fingers at the metacarpo-phalangeal joints was limited to 30 degrees of

Table showing Results in a Series of Burns Treated with Euglamide

Case No.	Age (Years)	First-aid Treatment	Time elapsed till Admission	Nature of Lesion	Depth and Extent	Anaesthetic	Treatment	Days in Hospital	Remarks
1	1+	Boric ointment	30 hrs.	Scald	2nd and slight 3rd degree, left iliac fossa	Gas-and-oxygen	Cleansed; paste applied; reapplication every 3rd day	12	Application painless; non-irritant; early healing surface of tanned
2	6+	Soapy water and olive oil	1 hr.	"	2nd degree, upper arm, forearm, and hand	"	Cleansed; paste applied to upper arm and reapplied every 3rd day; other areas tanned	6 (trans. to isolation hospital)	Remarks on Case 1 apply equally well
3	2+	Vaseline and starch	24 hrs.	Burn	Small 2nd and 3rd degree, buttock	None	Cleansed; fomentations applied for 24 hrs., then paste daily	6	An instance of rapid healing
4	1+	Olive oil and flour	1½ hrs.	Scald	2nd degree, chest, shoulders, and neck	Gas-and-oxygen	Charcoal-silver nitrate jelly applied; removed on 10th day, since tan was moist and septic; acriflavine applied to one half of infected area, paste to the other. After 6 days the part with paste was healed, the part with acriflavine healthy but raw	22	Healing and antiseptic properties of the paste demonstrated
5	3+	Carron oil	1 hr.	"	2nd degree, neck, chest, and shoulders	None	Cleansed; paste applied; reapplied every 3rd day	12	Satisfactory healing
6	1+	Tannic acid jelly	1 hr.	"	2nd degree, pubis, vulva, thighs, left leg, and foot	Gas-and-oxygen	Cleansed; paste applied to foot; reapplied every 3rd day; other parts tanned	30	Foot healed by 16th day. Coagulum began to separate on 22nd day
7	5+	None	2 hrs.	Burn	3rd degree, dorsum, left hand	"	Cleansed; paste applied; reapplied every 3rd day	Under treatment	Kept perfectly dry without any sign of local inflammation; on 13th day slight moisture apparent at edges; on 15th day the natural coagulum separated, leaving healthy granulating surface
8	4+	Tannic acid jelly	2 hrs.	"	Extensive 1st, 2nd, and 3rd degree, involving ear, cheek, chin, neck, right forearm, left forearm, hands, and legs	"	Intravenous plasma; cleansed; paste applied to face and left hand; other affected parts, including right hand, tanned	Under treatment	Left hand healed perfectly by 8th day; movements full; tan on right hand still adherent, with no sign of separation
9	34	None	4 hrs.	Scald	2nd degree, dorsum right foot	None	Cleansed; paste applied; reapplied every 3rd day	9	Almost healed by 6th day
10	11	Tannic acid jelly	28 hrs.	"	2nd degree, right buttock	"	Cleansed; paste applied; reapplied every 3rd day	8	Healed by 6th day
11	—1	"	4 hrs.	Burn	2nd and 3rd degree, buttocks	Gas-and-oxygen	Cleansed; paste applied; reapplied every 3rd day	14	Very small area on right buttock still to heal on discharge; satisfactory healing considering age and site
12	1+	Olive oil	1½ hr.	Scald	2nd degree, left shoulder, arm, and chest	None	Cleansed; paste applied; reapplied daily	18	Some pain on application; a rather complicated case; scarlatiniform rash, etc.; 2 small areas still to heal on discharge
13	2+	"	2½ hrs.	"	2nd degree, left side of face, scalp, and small area of chest	Gas-and-oxygen	Cleansed; paste applied; reapplied every 3rd day	12	Face healed by 5th day; very small area on chest still to heal on discharge
14	1+	?	17 hrs.	Burn	2nd degree, involving an area 4 in. in diameter over vertex of head and left auricle; 3rd degree of scalp just posterior to auricle penetrating to bone	"	Cleansed; paste applied; reapplied daily	Under treatment	On 8th day all parts healed except area behind the ear
15	4+	Olive oil	1 hr.	Scald	Extensive 2nd degree, involving chest, abdomen, groins, thighs, left axilla, face, palm of left hand	"	Intravenous plasma; cleansed; paste applied to left hand; other parts tanned	"	Left hand healed by 9th day with full movement; no sign of separation of tan
16	7	None	1½ hr.	"	2nd degree, right forearm and both lower limbs	"	Cleansed; tanned; coagulum removed on 10th day because of sepsis; paste then applied; reapplied every 2nd day	"	Practically healed after 3 applications of paste
17	4	"	1½ hr.	"	2nd degree, scalp and right shoulder	"	Cleansed; tanned; coagulum over shoulder removed on 14th day because of sepsis; paste then applied; reapplied every 2nd day	"	Practically healed after 3 applications of paste
18	3+	Tannic acid jelly	2½ hrs.	Burn	2nd degree, lower lip and under surface of lower jaw	None	Intravenous plasma; cleansed; paste applied; dressed every 2nd day	"	Almost healed by 4th dressing
19	2+	Olive Oil	3½ hrs.	Scald	2nd degree, suprapubic area, penis, and scrotum. Very marked oedema	Gas-and-oxygen	Cleansed; paste applied as spread every 4 hours for 24 hours, then 3 times a day	"	On day following admission oedema was distinctly less; by 6th day progress was rapid
20	19	Tannic acid jelly for 6 hrs., then saline compresses	1 wk.	Burn	2nd degree, right hand thenar eminence, palm, second and third finger clefts	None	Cleansed; blisters snipped and considerable dead skin removed; paste applied; reapplied every 2nd day	Out-patient	Healed within 7 days; movements free and full

flexion. All dead epidermis and inspissated discharge were now removed, the parts cleansed with normal saline, the paste applied, and the hand placed in the position of maximum function. After two applications pain was absent, movement of the fingers was free, and the raw areas had almost healed. Apart from illustrating the value of euglamide, the history of

FIGS. 1 and 2.—Photographs of hand (Case 20) seven days after being burnt. Treatment had been tannic jelly for six hours, then saline baths and compresses. Fig. 1, with extension of fingers; Fig. 2, attempted full flexion of fingers.

FIGS. 3 and 4.—Photographs of same hand after seven days' treatment with euglamide. Fig. 3, with fingers in extension; Fig. 4, with fingers in full flexion.

this patient demonstrates that saline treatment, like tanning, may lead to unsatisfactory results and thus to condemnation of the method.

Discussion

It must be emphasized that this study is merely in its preliminary stages, as only a limited number of cases have been treated. Nevertheless the results obtained so far have been promising, and suggest that further work is desirable. The method was evolved in an attempt to solve the difficulties experienced in the treatment of burns of the hands and face and of those of third degree: most of the burns treated have been of the second degree, the type usually encountered in civil life. We have not had an opportunity of treating the many burns of the third degree met with in Service casualties. There is no suggestion that in extensive burns euglamide should be used as an alternative to tannic acid; it is well recognized that in such cases the application of a coagulating agent is essential to combat secondary shock. There are certain types of burns, however, in which euglamide treatment offers (so far as we can judge from our present experience) definite advantages as compared with other methods. This applies more especially to those lesions in the treatment of which the coagulating method has been adversely criticized; thus it is well known that all third-degree burns

become infected, while second-degree burns in certain localities—e.g., hands and face—may show undesirable after-effects when treated with tannic acid. For these reasons the saline-bath method has recently been revived, but it would appear to have certain drawbacks. It involves considerable nursing attention and the employment of elaborate facilities; this in itself would make it very difficult to deal with more than a limited number of cases at any particular time. Moreover, the method does not control sepsis, though this could be done by the addition of albucid soluble to the irrigating fluid. In this connexion it is of interest to note that Carrel and his co-workers showed that the rate of healing of wounds is appreciably increased by the addition of certain antiseptics to the irrigating fluid (Carrel and Dehelly, 1918).

The euglamide method does not appear to possess the disadvantages associated with the tannic acid and saline techniques of treatment. It has proved effective in dealing with burns of the face and hands, allowing of rapid and uneventful recovery. Indeed, in two cases in which an accurate comparison with tannic acid was possible the rate of recovery with euglamide was very gratifying. This may have been due to the fact that, with euglamide, movement of the fingers was possible from the first and oedema was rapidly controlled.

In third-degree burns the results obtained in Case 7 would suggest that the paste allows of an early separation of slough, control of sepsis, and the development of a healthy granulating surface for early skin-grafting.

Routine bacteriological examinations have been and are being made in all cases with a view to determining the possible effect of the paste on different types of infecting organisms. With the limited series of cases so far studied a discussion of the results would be premature. At the same time it is of interest to note that investigations performed by Dr. de Waal in the department of bacteriology of the University of Edinburgh have shown by means of *in vitro* experiments that albucid soluble exerts a bactericidal and bacteriostatic action against *Str. pyogenes* and also some bacteriostatic action against *B. coli*. (We are very grateful to Dr. de Waal for allowing us to quote these as yet unpublished results.)

It is possible that soluble sulphonamides other than albucid might be more suitable for the treatment of certain types of infected burns, and in our further work we hope to study the possible value of euglamide pastes containing these.

Summary

Euglamide paste has proved very useful in the treatment of burns in certain areas—e.g., hands, face, scalp, feet, abdomen, buttocks, scrotum, and penis.

In small second-degree burns the paste caused slight pain on application in a few cases; later on it is soothing, non-irritant, and healing. Preliminary cleansing can often be carried out without anaesthesia. The paste is simple to apply, and the patient has more freedom of movement than when a coagulating agent is used.

Infected burns have also responded in a very satisfactory manner to treatment with the paste.

In one purely third-degree burn treated with euglamide a clean surface suitable for grafting was rapidly obtained.

Only a limited number of cases have so far been investigated; but in our opinion the results have been promising enough to justify further work.

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REFERENCE

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