

## Burns — Some Concepts Concerning Treatment

by LeRoy Heffernan '63

A discussion concerning the treatment of burns naturally has to make mention of the two chief avenues of approach used today—that is—the closed method incorporating the use of dressings and the open method where dressings are excluded from the burned area. Despite the method which the practitioner prefers to use, new methods, techniques and adjustments to present therapy are being developed and investigated to achieve the ideal treatment for burns.

I would like briefly to discuss one such adjunct being investigated for the treatment of burns—the use of aluminum.

In 1948 Brown, Farmer and Franks—speaking on the closed method, sought to discover a method that would prevent excess saturation of the occlusive dressings which in turn leads to highly undesired maceration of the tissues. Their chief focus of attention was aluminium foil (.001 inches). The burned area in the cases under investigation was cleaned first with cetavalon, then dry aluminum foil (sterilized by autoclaving) was smoothed by hand onto the burned surface and then routine pressure dressings were applied over the foil. This treatment was used in fifty cases with burns ranging from one per cent second degree burns to seventy per cent second and third degree burns. The results indicated that some of the burns treated with aluminum foil demonstrated faster and improved healing over the standard methods, but the results were by no means outstanding.

There has been mention of aluminum dust as a local application for burn treatment. With aluminum dust (obtained from aluminum paint) the results in superficial second degree burns were the same as those treated with aluminum foil—but the dust was not as effective as the foil in deep second and third degree burns, that is, the third degree areas treated initially with the foil were ready for grafting by the eighteenth day, whereas the areas covered with aluminum dust were delayed an additional two weeks. So, aluminum dust was not thought much of at this time.

In the intervening years much work had been done on the assessment of the various methods of treating burns by such men as Wallace, Blocker, Farmer and Franks; with leanings towards the exposure method. This method of treating acute thermal burns was largely discontinued immediately preceding the Second World War, following the demonstrations of the injurious effects of tannic acid—which not only caused additional damage to the burned surface but also was absorbed and caused damage to the liver and kidneys. But on the other hand tannic acid did form a dry tegument which had advantages.

In considering the exposure method, an eschar is allowed to form unaided as a result of plasma's normal clotting process and desiccation. Some advantages of the exposure method are:

1. Time and expense involved in application of occlusive dressings is reduced.
2. Marginal skin surrounding the burned area does not become inflamed or irritated.
3. There is less tendency for the deep partial thickness burns to be converted to full thickness skin loss.
4. Infection is reduced.
5. Appetite and general well being return more quickly.
6. Nursing care is simplified.

Some disadvantages are:

1. The burn eschar is slow in forming and it is rigid, unelastic and cracks whenever movement occurs.

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2. Where the covering is broken, plasma escapes and pathogenic organisms may gain entry.
3. Difficulties are encountered in handling circumferential burns.
4. The procedure requires more hospitalization.
5. The open treatment does not provide the splinting action of occlusive dressings.
6. Patients treated by exposure are unsuitable for transportation during the first few days.

So in an attempt to overcome some of these disadvantages, aluminum powder or dust was again tried—and chief among the leaders in this investigation were Farmer, Franks et al. The use of aluminum powder on burns was tried as a method of choice in hundreds of small burns seen in the out-patient department of the Hospital for Sick Children, Toronto. 125 in-patients also were treated in this fashion regardless of location or configuration of the burn.

#### METHOD.

In these instances shock was treated as required, then the burned area was cleaned prior to the application of the powder which was applied directly by dusting from a salt shaker or indirectly by first dusting the powder onto a gauze pad and then patting the burned surface. The latter method is used for under surfaces. On the ward the nurse repeats dusting every six hours for the first forty-eight hours as required.

#### RESULTS.

a. In twenty-four hours, a definite pliable covering had formed and it became thicker and dry over the next day. The eschar is tough, dry and odorless and is moderately flexible so that it tends to bend rather than crack, so that splinting, etc., has not proven to be necessary. With circumferential burns the powder is sprinkled directly onto the bedding under the patient and, therefore, friction is reduced and adherence to the bedding is not a problem.

b. Deep second and third degree burns can be recognized in spite of the opaque covering by the formation of a characteristically thicker, rippled eschar (the wavy appearance may be due to the increased shrinkage of more deeply burned tissue). On palpation the superficial second degree burns feel spongy in contrast to the deeper one which is more resistant. Thus, this type of eschar is of some use in distinguishing between a superficial and a deep burn.

c. In eight to twelve days the eschar of superficial burns gradually separates at the edges with complete healing. Adherence of the eschar beyond fourteen days is indicative of a deeper burn. Occasionally the aluminum eschar on third degree burns has been allowed to remain until spontaneous separation has occurred with the formation of granulation tissue beneath and this can be followed immediately by grafting. The separation in some of these cases has taken as long as four weeks and some patients have been sent home in the interim. The eschar tend to remain adherent in the deep second degree burns until epithelization of the surface beneath has occurred.

#### ALUMINUM POWDER.

a. Size: if under five microns, it leaves a tattoo on the skin of deep second degree burns. If from 25 to 500 microns it is too coarse to adhere and form the desired cover. The ideal is 50 microns—no tattooing; adheres to burn surface readily; fine enough to provide a lubricating action between the surface and bed clothes and in the flexor folds.

b. It is non-toxic; does not form granulomas; does not increase the incidence of keloid formation; no irritation.

The authors also report that some hundreds of minor burns have been treated on an out-patient basis with aluminum powder. The majority have been left other-



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wise exposed, and all have healed satisfactorily without untoward incidents. In some cases, a dressing was used over the initial aluminum cover. These have remained dry and free from infection. The superficial burns have been completely healed in ten days. In many cases the patients returned for observation wearing street clothes directly over the eschar.

#### CONCLUSION.

It can be seen from the above discussion that the use of aluminum powder has perhaps some very desirable advantages that can easily be incorporated into the treatment of burns. It forms a dry, bland, pliable covering and therefore handling is easier. It is valuable in circumferential burns and, therefore, can be put directly on bedding and thus largely obliterates this problem in open treatment. It is a non-irritating, non-toxic, tough, dry cover and it allows early transportation. Finally while the claim is not made that it is a cure-all, it is believed that it is a quick, safe, local application which gives increased scope to the exposure treatment of burns.

Having just mentioned the use of aluminum as perhaps a valuable adjunct in the treatment of burns, I should now like to mention what could be another important aid in combatting burns—the use of ice water or cold water. I should like to make it clear however, that when speaking on the use of water, I refer to its use only in the immediate emergency treatment of burns.

Schulman and his group in Los Angeles used this method in 150 patients in ages ranging from 17 to 66 with burns of all degrees but of areas of less than twenty per cent of the total body surface. These patients were treated by the immediate immersion of the burned part in ice water. Most of the burns were of thermal origin, but also chemical and electrical burns have been treated in the same manner. This treatment was begun originally as an emergency measure to provide immediate alleviation of pain, but the effect on the burn seems in most instances to have lessened the damaging sequelae expected.

#### METHOD.

1. The area is immersed immediately into a large basin or other vessel of cold water to which ice cubes and hexachlorophene are added. The temperature range is between 41 - 55 degrees F. (5 - 13 degrees C.)

2. When this is impractical as in case of burns of the head, neck, abdominal wall, shoulders and back, cold wet towels which are kept in a bucket of ice water are applied to the burned areas.

3. Those patients who come in already bandaged have their dressings soaked off under ice water as soon as possible and it is believed that the combination of the low temperature, the bactericidal effect of the hexachlorophene and the mechanical cleansing by water serves to inhibit bacterial growth.

4. The time factor between injury and treatment determines the result and one should initiate treatment as soon as the patient is seen.

#### RESULTS.

1. In every patient thus treated immediate gratifying relief of pain was experienced. In fact, pain would return if the program was interrupted too soon.

2. It has been learned that the cold water treatment must be continued until it is possible to discontinue treatment without the return of pain and this time required may be from 20 minutes to several hours.

3. Pain ordinarily lasts 24 hours or more in first degree burns. Relief in these patients was immediate and the pain was absent when the involved part was removed from the water after the above mentioned times.

4. During treatment, pain returns as the packs or the ice water become warmed, and the patient indicates when the cold packs must be reapplied or the temperature of the water lowered by the addition of more ice.

5. No infections have been encountered in those patients so treated within one hour of the injury.

6. Following the initial treatment, the open burn regimen or the closed method may be applied for the further treatment of the burn. The chief concern here being with the initial emergency care and the results recorded indicate that whatever the subsequent management may be, those patients who receive initial ice water treatment fare better than those who do not.

The impression gained is that although the primary injurious effect of the burn has taken place, the usual inflammatory process secondary to the burn can be reduced in degree and at times reversed by ice water therapy. The visible area of redness of the skin, an objective finding which can be measured, is obviously reduced in extent while the cold is applied and does not reappear later. It is this observation that suggests an alteration in the pathological state. It is logical to speculate that the lowered skin temperature would inhibit capillary engorgement and the resultant fluid loss, and that the lowered metabolic requirements of the already damaged tissues would tend to preserve the viability. Such observations seem to be confirmed by animal studies.

Reynolds, Brown and Price reduced the 24 hour mortality of severely burned mice from 95 per cent in the untreated control group to 37 per cent in the group treated by cold water application, the treatment being started within one minute of the burn injury. In four clinic patients treated by these authors with cold water applications they report immediate, almost complete pain relief. The burns appeared to heal more promptly and with less tissue destruction than previous clinical experience had led them to anticipate.

Zitowitz and Hardy studied the influence of cold water on thermal burns in rats. They concluded that "exposure to cold reduces the burn severity and healing time if applied soon after the burn".

Stone and Martin studied the effects of general and local hypothermia in the dog. They stated that the metabolic rate was definitely lowered and through the prevention of peripheral vasoconstriction, the loss of colloids, electrolytes and fluid into the burned area was diminished. During the first six hours there was only moderate alteration of blood volume relationships, so that adequate time was available for colloid replacement. The morbidity was diminished as long as the hypothermia was not prolonged too long.

Ofeigsson conducted experiments in which cold water treatment was applied to burns produced on the abdominal skin of white albino rats and compared the results with untreated burns in controls. This revealed a striking phenomenon which may explain some of the beneficial effects of cold water treatment. In the scalded areas of water cooled tissues, patches of almost normal skin could be found near the periphery or centrally, although the intervening areas were more or less affected by the scald. In the control group the damage was always uniform over the entire scalded area and later became most marked at one point, usually in or near the center of the scalded area. The patchy areas of less damaged tissue in the cold water treated animals may be responsible for the better regeneration of these tissues when compared with the more uniform damage of the controls. Also, seldom did the macroscopic changes extend deeper than the subcutis of the treated animals, but in the controls the pathologic process seemed only superficial initially but gradually extended deeper into the tissues so that after 16 to 21 days it reached into the muscles and sometimes through the peritoneum, forming adhesions with adjacent intestines. The process was always most pronounced at the center of the burn forming a funnel shaped necrosis or gangrene as it extended deeper. Again on the 21st day when the surviving animals were killed, almost all controls had died or had such far advanced effects that they

would have died in a short time; in contrast, most of the treated rats were alive and well, the scalded areas had healed or were covered with healthy granulations.

#### CONCLUSION.

Scattered references are to be found in literature of this form of immediate treatment being used on severely burned patients (50 per cent or more of body burned). Some success is reported but the number of cases is small. There are indications that it might be of some help, while the value of this form of therapy for patients with extensive burns and shock remains to be tested on a larger scale. It merits for those of a lesser degree burn should be seriously considered in the light of the aforementioned observations. Although scattered references in the literature are unanimous in praise of this form of treatment it is not generally used today. Indeed most doctors say, "It just isn't done", although no-one quite knows why.

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