appearing as late as the eighteenth or twentieth day of the disease, as early as the seventh or eighth day, and sometimes never occurs. Also, first to occur may be a predominant agglutination for the typhoid bacillus, later a predominance for the paratyphoid A or B, and later a rising agglutination for the paratyphoid A or B bacillus. A second factor which makes the diagnosis unreliable is that a patient vaccinated against typhoid may show toward the typhoid bacillus a high agglutination titer, which disappears, to return when the patient is affected with a slight bronchitis.

WAX PARAFFIN FILM IN THE TREATMENT OF BURNS*

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Following the suggestion of Dr. D'Arcy Power, and using his formulas for a film, I have completed treatment in 100 out of about 250 cases treated. After the hundredth case I ceased to record the histories. The treatment was used in certain selected cases in which it seemed most indicated. The patients were selected from my service at Merritt Hospital and the Union Iron Works. Brush burns or superficial abrasions or epithelial scraping of skin surfaces are included in this number, burns from electric current, fuse explosions, hot rivets, molten metal, oil flames, hot bitumen, steam, scalds and dry heat, as well as granulating surfaces. Burns are usually localized, while the scalds are more extensive. Their pathology being the same, the treatment will be considered together. For the sake of brevity, these various burns will be considered under three headings: first degree, those which involve the superficial layer of the skin characterized by redness without vesication; second degree, those which involve the corium and are characterized by the formation of vesicles and bullae, and third degree, those which destroy the entire skin and partially or completely carbonize fat, fascia, muscles and underlying structure.

FIRST DEGREE BURNS

CASE 1.—J. R., rivet heater, had a flash burn on the side of the neck from a sudden explosion of crude oil. The burn extended from the maxilla down to the shirt collar from the front of the neck to well back under the ear. The first treatment consisted of cleansing the part of grease and dust particles with 0.5 per cent. iodine in benzine. The part was then thoroughly dried with a small warm air electric blower, such as hair dressers use for drying the hair. A very fine filament of wax was now sprayed over the surface. No other dressing was applied. The application relieved the pain. After three similar applications at intervals of twenty-four hours, the patient was discharged as cured. The film in this type of case must be very thin. A thicker coating without a gauze dressing will curl up and peel off.

CASE 2.—A similar burn covering the entire back of the neck was treated in the same way, and the patient was discharged after two applications.

CASE 3.—A flash burn the size of a dollar on the left cheek was given three applications, after which the patient was discharged.

There being no broken surface and no chance for infection, the type of burn illustrated in Case 2 generally is cured in a few days with any of the recognized treatments. Carbonized carron oil, phenolated grease or petrolatum, starch and soda, anything that

excludes the air, generally gives relief. These burns are seldom covered by dressings unless they are on the hands.

SECOND DEGREE BURNS

These are the most common, over 70 per cent. being tabulated out of the entire group. The majority are infected, especially if oils and medicated grease are applied as a first dressing. Carron oil, composed of equal parts of lime water and sweet oil, is popular among mechanics, but it is the bugbear of the surgeon. Many patients treat themselves first, and then come to the clinic for treatment of the infection.

CASE 4.—A second degree burn on the anterior surface of the leg, 3 by 4 inches square, was treated for seven days by moist dressing. The skin was thoroughly dried, every pocket of superficial skin was removed with cuticle scissors, and the wax film was applied. A considerable discharge looking like yellowish pus followed the first dressing, but this soon cleared up.

The continued moisture collecting under the wax seems to be one of the great disadvantages. However, this wound healed kindly under twenty-seven days' treatment of daily wax application, which I consider a fair result. It would probably have healed just as quickly under a moist dressing of physiologic sodium chlorid solution, sodium bicarbonate solution or a 1 per cent. watery solution of picric acid, the advantages of the latter being that the dressings can often go from two to five days without being changed.

CASE 5.—A brush wound covering the entire outer aspect of the right arm from the shoulder to the elbow, superficial in character yet one which should be classified as a second degree injury, showed but little contusion; the superficial abrasion was caused by the breaking of an air hose, causing a friction rub over the outer aspect of the arm denuding it of the superficial epithelium. The wound healed completely under six daily applications of wax.

This I consider an ideal case for wax treatment. This type of wound is not so serious as it looks, especially if the deeper structures of the skin have not been traumatized, and there is no extensive hemorrhage from the surface. They always become infected if grease is applied, and it is always tempting to place a medicated salve over this type of injury. It requires two or three weeks to heal up the infection, especially if the grease application is continued. These wounds do well under a dry application of dusting powder, one part of salicylic acid to three parts of boric acid. However, the wax worked admirably in this case, probably better than any other form of treatment would have done.

CASE 6.—A foot burn covering the anterior aspect of the foot from the ankle to the toes, while classed as a second degree burn, presented three or four small areas that were much deeper which seemed to be very slow in healing. Many of these burns could be classified as first, second and third degree. In these small areas I placed small pledgets of gauze saturated with phenolated camphor, and then covered the entire area with wax. This worked nicely. The burn healed under fourteen daily treatments of the wax film.

CASE 7.—A burn on the back of right hand, the size of a silver dollar, seemed very stubborn under the wax treatment, requiring thirty-seven daily treatments. I imagine it would have healed much faster under a picric acid or boric acid compress.

The great majority of all patients with burns continue working. One can well imagine how slow the healing must be in a malleolus burn the size of a silver

* Read before the Alameda Medical Association.

dollar, especially when it approaches the third degree. Perhaps, therefore, in recording the results of these cases, I am not doing justice to the wax film or any other method of treatment, because the parts are not placed at rest.

CASE 8.—An extensive forearm burn from hot bitumen involved the posterior aspect of the arm from the wrist to the elbow. The bitumen film was peeled off, and the superficial blistered skin removed. The arm was washed with warm phenolated solution, and then cleansed with 0.5 per cent. iodine-benzin solution. A moist compress of neutral solution of chlorinated soda was changed twice daily for four days. The wax treatment was then applied and continued for sixteen days. The wax was left on for twenty-four hours. Each day there was a free puddle of yellowish puslike material of seropurulent character under the wax film. This puddle of exudate was so abundant that I was compelled to discontinue the treatment. Each day the wound was cleansed. A moist compress of neutral solution of chlorinated soda was placed over the surface for ten minutes, then the surface was glazed dry with the hot air blower, and the wax was applied. The wax treatment in this case continued for sixteen days without any apparent improvement anywhere on the wound. I then placed moist picric acid gauze on the arm, and had the patient return in forty-eight hours. Parts of the wound were now dry. Some were still moist. I renewed the picric acid gauze and directed him to report in three days. One half of the wound was now dry, covered with a dry yellow film of stained epithelium. The next dressing showed the wound covered with dry epithelium, except a patch the size of a dollar which was covered with granulations. This was the condition of the wound after thirty days' treatment. The patient then moved to San Francisco. What has become of the granulating patch I do not know. Perhaps the preceding wax film treatment facilitated the rather rapid healing under picric acid, but the abundant secretion under the wax after sixteen applications discouraged my further use of it in this case. Endeavoring to remove all possible infection from wounds before applying the wax film, I used a saturated solution of salicylic acid (watery solution), a method quite common preceding skin grafting. When the wound was sealed with wax, however, a puddle of pus would soon follow, and the abundant moisture would seem to delay the healing. Cultures showed this yellowish exudate to contain staphylococci in all cultures taken.

THIRD DEGREE BURNS

In observing third degree burns, I have never seen a burn the size of a dime heal in less than six weeks' treatment by any other method than skin grafting. It often takes from three to five weeks to determine whether or not a burn is going to be a third degree burn. Under compress dressings the deep skin will struggle for life. About the time the wounded derma looks as though it was going to come to life, it apparently breaks down over night and sloughs off—a liquefaction necrosis. Often the wound is charred—carbonized—and will remain so for a couple of weeks before it begins to slough. Then it will be a week or ten days in sloughing before it is suitable for skin grafting. It is impossible to skin graft a wound while the patient is working. Zonas silk smeared with scarlet red will help, but nothing in my hands has completed the healing under the time mentioned above.

CASE 9.—A submalleolus burn the size of a dollar was dressed for four weeks by compress, when ready for skin grafting. The wax film was used for thirty consecutive days. Exuberant granulation appears to be a great factor under the wax treatment. The granulations became so pronounced in this case that they had to be trimmed down every four or five days. The epithelium did well for a few days,

but when the wound got to the size of a quarter it became so sluggish that I resorted to picric acid gauze. This soon caused a dry scab to form under which epithelization was completed in twenty-five days more, making twelve weeks for the entire healing of this wound. A similar wound took thirteen weeks to heal under scarlet red.

CASE 10.—A carbuncle crater the size of a quarter on the shoulder, filled with granulating tissue, was treated thirty days with wax, but discontinued thereafter and completed under picric acid gauze.

CASE 11.—A granulating wound on the inner side of the leg over the middle third of the right tibia, arising from an open incision for an abscess, demonstrated no improvement whatever after thirty applications of wax, although the wound looked ripe for skin grafting when the wax treatment was commenced. This patient was then sent to the hospital and treated by skin grafts.

Out of twenty-three cases of third degree burns, I have not been able to heal one with the wax paraffin treatment. After from twenty to thirty applications of the wax I had to resort to the aseptic scab produced by picric acid gauze or scarlet red on oil silk, or boric acid compress. The formula given by Dr. Powers is: white wax, $3\frac{1}{2}$ parts; paraffin, $3\frac{1}{2}$ parts; resin, $\frac{1}{2}$ part. This works well applied with a cotton applicator or small varnish brush, but is too dry to apply with an atomizer. The proprietary preparations which seem to carry more paraffin seem to work better with the atomizer. The technic of application was to render the burn as clean as possible, remove all epithelium, glaze the wound dry with the warm air blower, or use a Politzer bag over an alcohol flame or fan the wound until it was perfectly dry. The wax was then applied at about 130 F. either through the sprayer or with a camel's hair brush. When a thick coating covers the wound, fine filaments of absorbent cotton are pasted on until the entire wax is covered. With the spray this is tedious, so we first sprayed the wound to save traumatism, then used the brush to apply the cotton over the partially cooled wax, and then covered it all with gauze and bandage.

DISADVANTAGES

1. An infected wound is covered with a sealed dressing.
2. There is a copious seropurulent exudate in every dressing removed.
3. We have no way of controlling the temperature of the wax. Taken from the boiling water at 212 F., it is too hot. Cooling at 114, it is too cold. The degree of pain caused the patient is the only means one has of knowing if it is too hot, unless one tries it first on the back of the hand.
4. Around the skin edges it is painful.

ADVANTAGES

1. In certain types of second degree burns it is about as good as any other dressing.
2. It keeps dirt and sweat out of the wound.
3. It is a great producer of exuberant granulations.

CONCLUSIONS

I regret that I cannot accomplish results said to be attained by other clinicians in third degree burns. Growing skin over night, or growing it by wholesale, which were the topics on the subject I read about in certain popular magazines, has not been my experience.

I believe the wax film is a good addition to the various methods for treating certain denuded surfaces and burns, but not a cure for all types of injury.

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