

# IMMEDIATE SKIN GRAFTING IN THE TREATMENT OF BURNS

## A PRELIMINARY REPORT

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IN February, 1941, Mason<sup>1</sup> made a plea that burns be regarded as surgical wounds; and thought that results might be improved if the same principles used in treatment of other traumatic wounds be followed. These principles of cleansing, débridement, hemostasis, closure, and rest, are well known and generally accepted. Moreover, it is known that they hold only if wounds are cared for within a few hours following injury; preferably within six hours, certainly not longer than 12 hours. It is probable that this simple view of burns has not previously obtained because of the wide extent of the injury and the poorly understood cause of the shock found in severe burns.

Without going into the various theories of shock production, it now seems probable that shock in burns is, for the most part, due to fluid loss from the burned surface, and into the tissues about and beneath the burn; this loss of fluid accounting for the decrease in circulating fluid and protein and relative increase in blood cells. With this better understanding of burn shock, it is now possible to more adequately control it by plasma administration guided by frequent hematocrit, and plasma protein determinations. In fact, if the burn is seen soon, it is possible, within certain limits, to forestall shock by replacing plasma as it is lost. It, therefore, becomes possible, in even extensive burns, to save patients whose injuries would formerly have caused death from shock within a few hours of the injury.

The extent of the wound and its treatment then becomes increasingly important, for we are now able to save patients with wounds of much greater surface-area. But with the partial solution of this problem another has appeared. These patients may be successfully carried through the initial shock period only to succumb as long as one to three months later. This late death is probably not entirely due to infection, although this is the generally accepted view. It may be that there is a loss from these extensive open wounds of necessary body constituents not as yet understood.

There are various facts which support this view. Extreme emaciation develops in these patients with large granulating surfaces, and they may die in this stage even though infection seems minimal. This is illustrated by the following brief case report:

**Case 1.**—S.M.H., No. 167072; G. S., white, male, age 35, received deep third-degree burns of the entire trunk and most of the upper extremities, and first- and second-degree burns of the face and hands. The area involved, as estimated by Berkow's charts, was 55 per cent of the body surface. The burn occurred one to four hours before admission.

The exact time was not known as the man had been found in an alcoholic stupor on a burning davenport. He was in deep shock—B.P. 60/0, Hb. 23.5 Gm., hematocrit 63.2. Within the next 64 hours he received 5800 cc. of plasma and 7500 cc. of saline intravenously before his blood pressure stabilized at 120/60. The burned areas were tanned but became grossly infected. On the ninth day he was started on tub baths in an attempt to remove necrotic tissue and control infection. The temperature chart showed continual improvement and the granulations became quite clean. In spite of this he became emaciated and very weak. He steadily lost weight and strength in spite of the fact that the lesions appeared cleaner. Many areas were perfectly healthy and pinch-grafting was started. During the fourth week he became irrational and delirious, with high fever, and a blood culture showed *B. aerogenes*, 260 colonies per cc.. He expired on the 30th day.

We have observed that the fever curve of a patient comes down in step-like plateaus as a large granulating surface is covered at intervals.

**Case 2.**—S.M.H., No. 37348; H. S., white, male, age 11, received a total third-degree burn of the left lower extremity from hip to ankle, a second-degree burn of the medial surface of the right lower leg from knee to ankle, first- and second-degree burns of the hands, and first-degree burns of the face. The total body area involved was estimated as 30 per cent. He was seen one hour after injury. He was not in shock—B.P. 110/68, hematocrit 59.9, Hb. 16.5 Gm. The serious nature of the burn was not recognized by the house officer who saw him, and he was started on saline compresses, without intravenous therapy. Moderate shock developed and was controlled by plasma administration. He developed severe infection in the necrotic tissue. This was gradually controlled by saline compresses and saline tubs. It was 40 days before the necrotic tissue had separated and granulations enough appeared so that skin grafting could be considered. He was running a septic type of temperature, averaging about 39°C. (102.2°F.). About one-quarter of the left lower extremity was covered with split-thickness grafts. The temperature averaged 38.5°C. (101°F.) after this. Ten days later another quarter of the leg was covered, and immediately the temperature plateau fell to 38°C. (100.4°F.). Thirteen days after this, most of the remaining open half of the extremity was grafted, and the average temperature curve dramatically and promptly fell to 37.5°C. (about 100°F.).

This boy during his illness became extremely emaciated but survived and over a period of two to three months, gradually returned to normal.

It is common experience that there is improvement of the general condition of the patient if a large granulating surface is covered with homografts—even though these grafts, as is well known, persist only from two to six weeks.

It would seem then that if Mason's view, that a burn is a traumatic wound, is accepted, that treatment should be directed toward an attempt to secure primary healing. This, if possible, would eliminate these delayed deaths caused by the open wound. We believe that the various methods of local treatment of burns now in use do not meet this requirement.

**Tanning.**—There are many agents used to produce an eschar over the burned surface. The one most commonly used is tannic acid. The objective of these agents has been stated as: (1) To prevent fluid loss by sealing the surface; (2) to prevent the absorption of decomposition products of the dead tissue; (3) to provide a comfortable dressing which need not be changed; and (4) to prevent infection. From the standpoint of wound care, we have

never considered tanning to conform to the principles necessary for first-intention healing. In deep second-degree burns there is probably some destruction of viable epithelial remnants by the tanning. But the greatest violation of surgical principles by tanning is the locking-in of micro-organisms. Most tanned burns, in our experience, eventually become infected.

*Local Treatment by Antiseptics.*—The production of an eschar by various dyes, designed to prevent the infection so commonly encountered in tannic acid treatment, has the same objections as tanning. Infection is usually not prevented.

*Saline Baths or Compresses.*—This method is, perhaps, of the greatest use in the late treatment of extensive granulating areas. It has been employed in primary treatment of burns. It is of most use for burns of the hands and face. But in third-degree burns the end-result is a granulating wound which is frequently more or less infected. In our experience, it is quite arduous for an acutely ill patient, and must oftentimes be discontinued because of exhaustion. Its main advantage over tanning is that third-degree areas are ordinarily ready for grafting at a considerably earlier date.

*The Closed Compression Dressing Method.*—This treatment is based on sound surgical principles. It is in essence the Orr-Trueta treatment of compound fractures applied to burns. It was originated by Koch and Mason, and Mason<sup>1</sup> states that by this method the mortality rate in the Children's Wards, at Cook County Hospital, has been reduced from 10 to 3.9 per cent. In brief it consists in: (1) Thorough soap cleansing. (2) Débridement of loosened epidermis. (3) The application of ointment-saturated gauze strips over the area. (4) The application of a voluminous dressing, applied under moderate pressure. (5) Leaving the dressing in place for 10 to 14 days.

We are in complete accord with this method, and believe it superior to any other now in use. It is ideal for first- and second-degree burns. Healing *per primam* usually occurs in two weeks. The patient is more comfortable than by any other method about which we know, and there is a minimum expenditure of effort in nursing care.

However, when third-degree burns are present, it is not ideal. The cleansing and superficial débridement does not remove all the dead tissue. This remains as a nidus for infection and a focus of absorption. These areas must, of necessity, become granulating wounds, with their attendant problems.

*Immediate Skin Grafting.*—In an attempt to fulfil the principles for wound healing *per primam*, we have débrided the third-degree areas, and immediately covered them with split-thickness skin grafts.

Our plan of treatment at present is as follows:

1. To be acceptable for immediate débridement and skin grafting, the burn must have occurred not more than six hours previously. With experience it may be possible to extend this time limit.
2. Hematocrit and plasma protein determinations are made at once.
3. Parenteral plasma is started.

4. Under anesthesia, the burn is washed with soap and soft gauze for ten minutes. This removes the blisters and desquamated epidermis from the second-degree areas. The cleansing is completed with a saline flush. No antiseptic is used.

5. The blood pressure and pulse is carefully watched for any signs of incipient shock, and the plasma administration is governed accordingly.

6. Obvious third-degree areas are completely excised, and hemostasis carefully attended to. If there is doubt about an area being third-degree in depth, it is not excised, as it is in these questionable areas that hair follicles and glandular remnants are usually present in sufficient amounts to allow spontaneous epithelization.

7. Grafts of about 0.010 of an inch thickness are cut with the dermatome and sutured over the excised areas.

8. The donor areas are dressed with one thickness of vaselined gauze smoothly applied, and a snug, sterile gauze-roll bandage.

9. The entire burned area is dressed in the same manner. A voluminous gauze dressing is applied over the vaselined gauze and this is held in place under some compression by either Ace-bandage or stockinette applied as a roller-bandage.

10. Adjacent joints are immobilized by the application of plaster encasement directly over the dressing.

11. Plasma, saline, or whole blood is administered during the postoperative period, as indicated by frequent hematocrit, plasma protein, and Hb determinations.

12. The dressing is not disturbed for 14 days unless a mounting fever or other signs indicate that infection has occurred.

13. If the area is healed on removal of the first dressing, a second dressing of vaselined gauze, a thin layer of dry gauze, and an elastic roller-bandage is applied. This is worn as protection for another 14 days. It is then removed and treatment terminated.

This method of treatment and the postoperative course is illustrated in the following case report:

**Case 3.**—S.M.H., No. 188918; D. B., white, male, age 11, was admitted to Strong Memorial Hospital, one-half hour after being burned on the back. He was not in shock—B.P. 150/85, pulse 100. He was in considerable pain. The burn, as estimated by Berkow's charts, covered about 8 to 10 per cent of the body. It involved the back and a small area over the posterior aspect of the left upper arm. Cold cream had been applied to the burned area.

In the central portion of the burn on the back the skin was an ivory-gray color. About this there was a wide zone of hyperemia on which there were large, weeping areas, intact blebs, and hanging shreds of epidermis. An hematocrit reading, 45 minutes after injury, was 49.3, and the plasma proteins 6.58. He was treated by the method outlined above. During operation, and the immediate postoperative period, he was given 600 cc. of whole plasma and 250 cc. of saline. No shock occurred. His postoperative course was satisfactory. The temperature never rose above 38.7°C. (101.5°F.), and returned to normal on the seventh postoperative day. From the fifth postoperative day



FIG. 1b

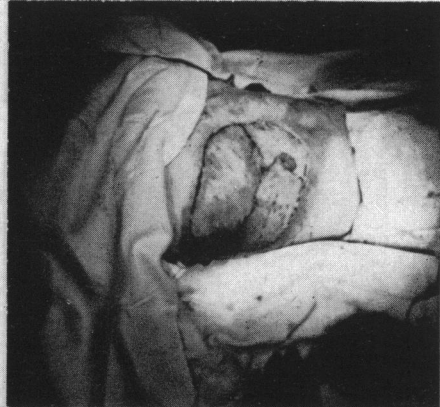
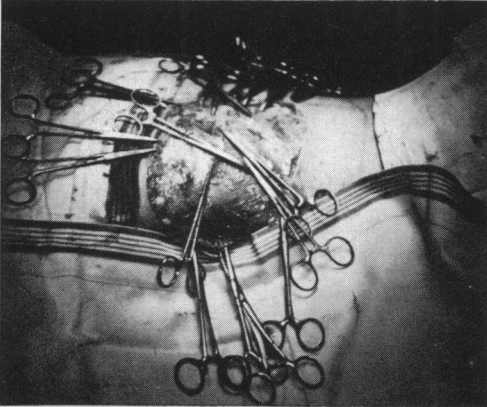


FIG. 2b

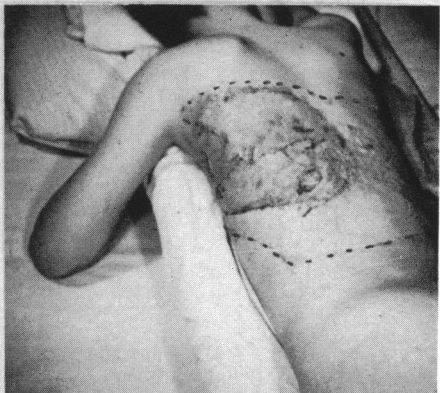
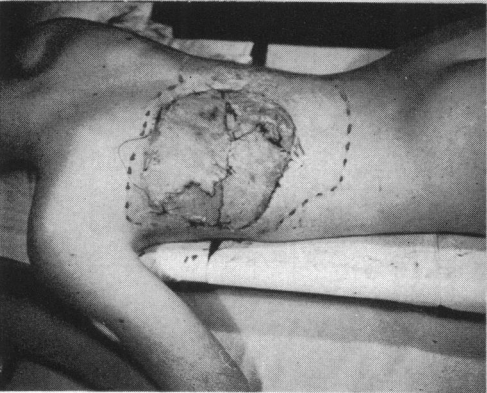


FIG. 3b

FIG. 1.—Case 3: One and one-half hours after injury. Soap cleansing has just been completed, under anesthesia. The extent of the burn is indicated by the dotted area. The white central area is deep third-degree burn. Note that cleansing has completely removed all blisters and desquamated epidermis.

FIG. 2.—Case 3: (a) The third-degree area has been completely excised; in places this excision went down to muscle before normal tissue was encountered. (b) Skin grafts .010 inches thick, cut from buttock and thigh and sutured over excised area.

FIG. 3.—Case 3: Appearance of wound on first change of dressing on the 14th postoperative day. The first- and second-degree burns have healed and the graft has taken completely. The wound has healed *per primam*. He felt perfectly well and was allowed up. Discharged on 17th postoperative day.

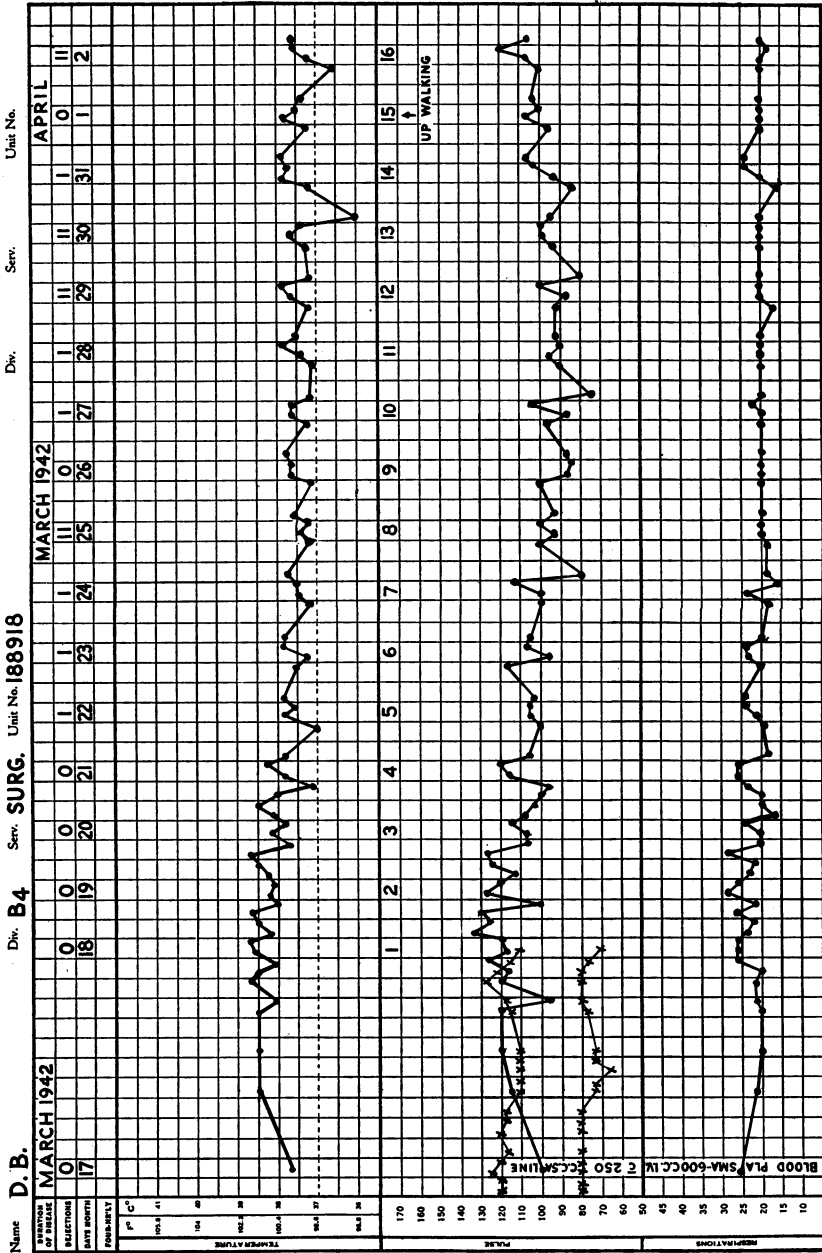


CHART 1.—Case 3: Showing that vital signs returned to normal on fifth postoperative day.

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on he was comfortable. The dressing was removed on the fourteenth postoperative day. The entire area was epithelized. One small mixed area of third- and deep second-degree burn, which was purposely not débrided, showed the papillary layer, and was sensitive to touch and temperature changes. The remainder of the burn was painless. A new dressing was applied as outlined above. He was allowed up. On the seventeenth postoperative day he was discharged.

TABLE I

TABULATION OF BLOOD STUDIES IN CASE 3 DURING THE INITIAL TREATMENT AND POSTOPERATIVE COURSE.  
WITHIN 36 HOURS THE VARIOUS DETERMINATIONS WERE WITHIN NORMAL LIMITS.

Name: D. B.		Specific Gravity	Hemato-crit	Total Protein	Albumen	Glob.	Hb. Gm.	W. B. C.	Remarks
3-16-42	6:45 P.M.	1.0272	49.3	6.58	4.13	2.45			45 min. after burns, before any treatment
	8:40 P.M.	1.0266	47.2	6.19	3.84	2.35			After 100 cc. whole plasma and cleansing and débridement
	9:30 P.M.	1.0270	47.1	5.98	3.90	2.08			After 150 cc. whole plasma during skin grafting
	11:45 P.M.	1.0264	44.7	6.16	4.05	2.11			After 300 cc. whole plasma and skin grafting
3-17-42	4:00 P.M.	1.0256	36.8	5.99	3.86	2.13	11.7	10,000	After 600 cc. whole plasma plus 250 cc' saline, i. v., disc. at 4 P. M.
	9:00 A.M.	1.0263	33.8	6.20	4.03	2.17			No more i. v. fluid; taking fluids well p. o. No parenteral therapy
3-18-42	11:00 A.M.	1.0275	43.3						
3-19-42							11.8	8,000	
3-20-42	11:15 A.M.	1.0271	43.2	6.23	3.47	2.76			
3-21-42							11.3	6,500	
3-22-42									
3-23-42							11.5	8,100	
							Total	600 cc. plasma (whole) 250 cc. saline	

CONCLUSIONS

1. Burns are traumatic wounds, accompanied by local loss of blood plasma both from the weeping surface and into the tissues. This plasma loss produces shock by depleting the circulating plasma.

2. Ideal treatment of burns should accomplish the following: Restore lost plasma; prevent further plasma loss; prevent absorption of burned tissue; forestall infection; and promote primary healing.

A first- and second-degree burn, given proper care, will heal *per primam*. A third-degree burn, treated by former methods, can heal only by second intention.

4. By the immediate cleansing and *complete* débridement of a burn, with immediate grafting of deeply injured areas, plus the application of the usual compression dressing and immobilization used over free grafts, it is possible to obtain primary healing of the entire wound.

REFERENCE

<sup>1</sup> Mason, Michael L.: Local Treatment of the Burned Area. Surg., Gynec. & Obst., 72, 250, February, 1941.