

# Early Excision and Grafting in Third Degree Burns

B. W. HAYNES, JR., M.D.

*From the Department of Surgery, Medical College of Virginia, Richmond, Virginia*

THE CONCEPT of early excision and grafting in third degree burns is a natural one, appealing to surgeons who are accustomed to managing wounds by debridement with predictable success. It is a particularly appealing concept because alternate methods of burn wound management designed to expeditiously remove dead tissue are often unsatisfactory committing the patient to a prolonged septic clinical course. Serious attempts<sup>1, 2, 3, 6</sup> to define the role of early excision and grafting have resulted in some clarification but have left questions unanswered. Jackson, Topley and Cason<sup>2</sup> concluded in a controlled case series that no conclusive evidence for decreased mortality or infection and shortened healing time existed. They excised 20–30% body surface with an over-all graft take of 70%. Switzer *et al.*<sup>6</sup> noted a high mortality in children treated by excision improved by total vs. partial excision and recommended careful case selection. Cramer *et al.*<sup>1</sup> staged excisions and were able to salvage four high risk (95% plus mortality) patients. MacMillan,<sup>3</sup> after a long and careful study of the problem, concluded that excisions under 15% body surface area (BSA) could improve mortality and shorten healing. In large burns (over 25% 3°) no protection against overwhelming infection could be demonstrated. He emphasized excision of all burn, to the level of the deep fascia, preferably during the first 5 days after injury and resurfacing with sheet grafts.

The case experience to be reported in

this paper is a selection of patients admitted to the Burn Service of the Medical College of Virginia Hospitals. The selection of cases was made by the author though treatment was executed commonly by the surgical housestaff. In retrospect, an evolutionary series of hypotheses guided the selection. These hypotheses are set down without claim to originality and with free admission of bias.

I. The most common cause of death, increased morbidity and prolonged wound healing is burn wound infection. Complications of burn wound infection include septicemia and pneumonitis.

II. The severity of burn wound infection is related directly to the size and depth of the burn, and, importantly, to the time required for separation of slough and development of a clean granulating wound. The effects of infection are cumulative.

III. Early excision of third degree burn, preferably *all* burn followed by prompt wound healing by graft, should result in decreased mortality, morbidity, and time of wound healing.

In execution of these concepts, additional guide lines were laid down.

(1) Large excisions (greater than 5% BSA) and especially in older patients are best performed after circulatory, renal and cardiac function are evaluated and stabilized. This means in effect 2 or more days after injury.

(2) Excision of skin and subcutaneous tissue to the level of the deep fascia are carried out in an effort to avoid lingering slough delaying skin cover and healing. The difficulty in differentiating healthy from slough-destined fat plus the avascular

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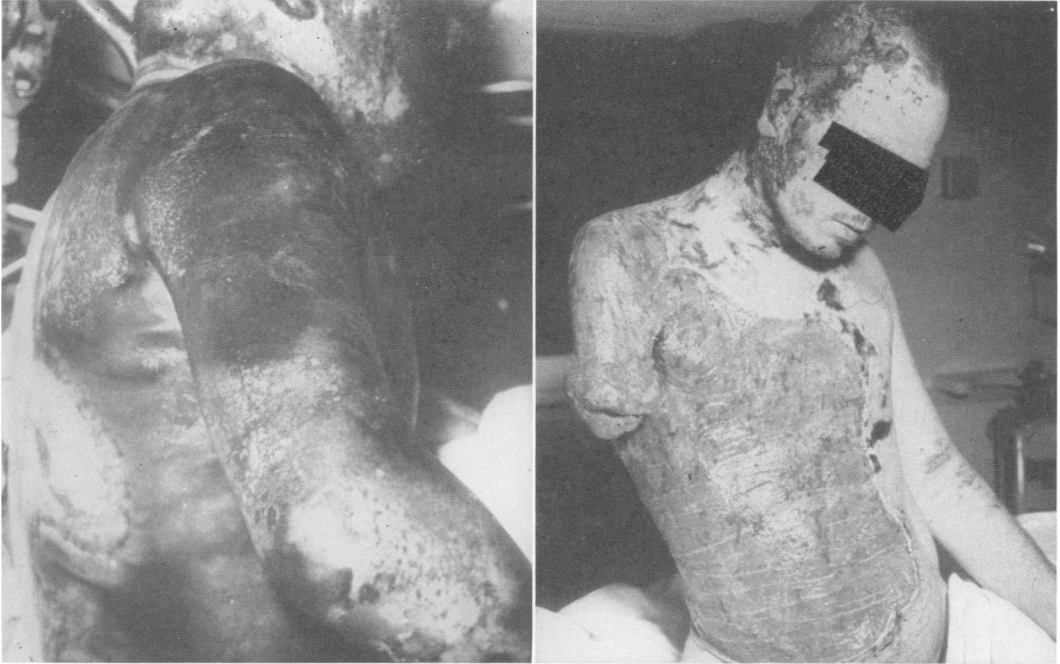


FIG. 1 A (left). V. B. 30% electrical burn (18% 3°). Excision of chest wall. Amputation of right arm. FIG. 1 B (right). V. B. After 18% excision. Wound is ready for grafting (14 days).

suprafascial plane are the reasons for this choice. In extremity excisions, use of a tourniquet minimizes blood loss.

(3) Immediate (primary) autografting is believed to be the operation of choice with delayed autografting a close second choice. Grafts are placed immediately when conditions are considered to be optimal; that is, a dry wound, healthy excised bed, good patient condition, and adequate donor site to risk significant graft loss.

(4) Split-thickness sheet grafts of largest possible size are used to resurface the wound. This technique results in shortest healing time, least scar hypertrophy, and best functional and cosmetic results. The Brown dermatome is the instrument of choice.

(5) Skin homografts are used immediately postexcision in certain poor risk patients with large injuries in the hope of diminishing wound infection.



FIG. 1 C. V. B. Almost healed 34 days after injury.

TABLE 1. Table of Cases.

Patients	Age	Sex	Area Burn		Excision		Autograft		Healing Time Days	L.A. 50 3° only %	Comments			
			3°	Total	Days Post Burn	Area %	Imme- diate	Take % (days)				Take %	De- layed (days)	Excision
Group I—3-29 years														
J. B. 5-12-49-97	15	M	10	32	3	2	No	5	95	1,000	2,500	44	31.6	Excision forearm, hand excellent delayed graft take. Good result.
Y. M. 4-00-50-14	3	F	15	15	2	15	Yes	60	95	500	500	31	27.6	Excision abdomen, anterior thighs. Prompt healing, but with flexion contracture requiring correction.
R. B. B-36-55-39	4	M	3	3	1	3	No	4	95	0	250	15	27.6	Excision anterior half right leg and ankle. Excellent result.
C. H. 4-00-61-65	4	M	5	13	8	<1	Yes	30	85	250	950	45	27.6	Excision dorsum left hand and fingers. Poor result—remainder healed satisfactorily.
R. H. 5-33-46-59	4	M	3	6	6	3	No	11	95	500	750	46	27.6	Excision anterior half leg, knee to ankle. Delayed autograft—excellent result.
J. T. 5-18-74-78	22	M	5.5	5.5	0	3	No	46	90	0	1,500	113	31.6	Excision axillary area, electrical injury—Pedicel graft. Multiple procedures—poor result.
F. D. 9-23-45-48	21	M	7	7	5	7	No	23	95	1,000	2,000	53	31.6	Excision back and buttock. Excellent auto-graft take and result.
R. P. 5-07-89-95	32	M	15	20	10	15	No	7 61 84	90 50 80	0	2,000	115	31.6	Excision both legs posterior thigh, anterior leg, knee to ankle. Tendon loss. Patellar & tibial graft—Excellent result.
J. G. 9-27-53-25	10	M	15	23	4	15	No	16	95	500	1,000	45	33.3	Excision both legs, posterior thighs, circumferential knee to groin. Excellent result.
V. B. 5-26-84-88	25	M	18	30	2	18	No	14	90	3,500	6,000	34	31.6	Excision chest wall, shoulder, amputation arm. Electrical burn. Excellent graft take.
A. J. 5-12-42-78	8	M	14	14	3	14	No	4 34	90 90	1,000	4,500	65	33.3	Circumferential excision thigh to ankle. Excellent result.
T. C. B-20-79-19	24	M	24	29	14	16	No	17 32 59	80 60 90	1,000	4,000	166	31.6	Excision both legs, mid-thigh to ankle. Split graft over excised tibia. Foot drop. Good result.
L. C. B-36-08-14	29	M	30	60	3	30	No			1,500	2,500	Died 12 days	31.6	Excised both legs groin to ankle. Staphylococcal septicemia.
Group II—30-49 years														
M. N. 5-03-70-62	32	M	<1	<1	1	<1	Yes	95		0	0	11	31.6	Circumscribed 3° burn of foot. Excellent result.
R. P. B-33-09-49	39	M	3	3	4	3	Yes	90				77	31.6	Excision areas thighs and scalp. Pedicle flap closure scalp. Excellent result. Electrical burn.
W. B. B-38-47-63	46	M	8	10	4	8	No	4 58	80 80	1,500	2,500	47	21.5	Excision chest wall, costal cartilage necrosis Good result.

TABLE 1.—(Continued)

Patients	Age	Sex	Area Burn		Excision		Autograft		Blood Replacement		Healing Time Days	I.A. 50 3° only %	Comments		
			3°	Total	Days Post Burn	Area %	Imme- diate	De- layed (days)	Take %	Excision				Total	
T. B. B·11·94·73	30	M	8	8	2	8	Yes	80	31	90	1,500	1,500	41	31.6	Excision chestwall, axilla, upper arm. Excellent functional result. No further surgery.
M. W. B·38·66·79	48	M	22	25	5	10	No				2,000	7,500	Died 20 days	21.5	Excision leg—lower thigh to ankle. Massive upper G-I hemorrhage, staphylococcal septicemia.
P. A. B·38·08·57	38	M	30	52	6	25	No				7,000	7,000	Died 75 days	31.6	Excision both legs; homograft X5, eventual amputations. Disseminated aspergillosis.
Group III—50-78 years															
E. L. B·01·38·90	54	F	3	3	2	3	No	4	80	0	0	0	40	21.5	Excision forearm and hand. Amputation 5th finger. Good result.
E. B. B·33·96·12	57	F	3	3	10	3	No	7	75	500	500	500	96	21.5	Excision areas leg and thigh. Delayed healing.
B. J. B·34·22·78	73	M	3	4	5	3	No	5	80	0	0	0	58	8.5	Excision thigh, delayed autograft, good take. Re-admitted, infected, delayed healing.
R. C. 9·25·41·49	67	M	3	3	8	3	No	9	95	1,000	1,000	1,000	46	8.5	Excision forearm and elbow area. Good take of graft. Pulmonary embolus. Prolonged hospitalization.
J. S. 9·08·02·70	70	M	4	4	15	4	Yes	80		1,000	1,000		39	8.5	Excision thigh. Immediate graft—excellent result.
L. B. 5·02·45·09	73	M	8	10	2	8	No	2	50	1,500	1,500	1,500	Died 23 days	8.5	Excision back. Poor graft take. Congestive heart failure, sepsis.
J. W. 3·00·14·59	78	M	8	8	2	8	Yes	50	20	80	1,000	1,500	Died 36 days	8.5	Excision back, poor immediate graft take. Hypotension, shock.
A. R. 9·33·68·07	67	M	10	10	6	10	No	5	95	500	2,000	2,000	49	8.5	Excision posterior thigh, leg circumferential knee to ankle. Excellent result.
F. S. 5·00·87·79	74	M	10	11	3	10	No	26	90	0	0	0	60	8.5	Amputation A-K. Small graft. Good result.
T. R. 9·25·41·49	50	M	37	42	3	16	No			750	5,000	5,000	Died 22 days	21.5	Excision both legs mid thigh to ankle. Good homograft take. Severe bronchopneumonia.
J. A. W. B·29·75·04	75	M	18	18	1	18	Yes	25		2,000	4,300	4,300	Died 11 days	8.5	Excision anterior chest, abdomen, upper thighs. Poor granulations and graft take.

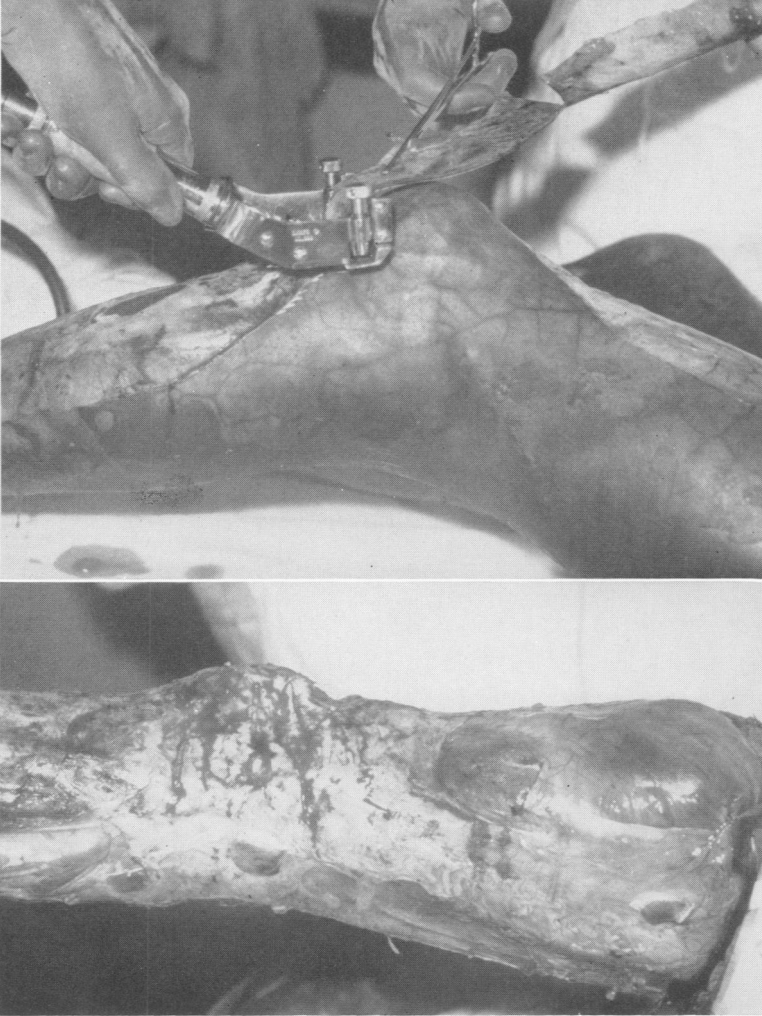


FIG. 2 A. P. A. 52% burn (30% 3°). Excision both legs, groin to ankle.

FIG. 2 B. P. A. Excised leg (total excision 25%).

### Results

There are 30 cases in the series (Table 1). The patients ranged in age from 3 to 78 years. There were 3 females and 27 males. The patients have been divided into 3 groups according to age.

*Group I.* There were 13 patients in the age group 3 to 29 years with one death. The total area of burn varied from 3 to 60% body surface area and the third degree burn from 3 to 30% body surface area. Excisions were carried out between the first and fourteenth day after burn, and the area excised varied from less than 1% to 30%.

Only two of the 13 patients had immediate autografts, both of which had poor graft takes. Both were subsequently re-grafted with excellent takes. The remainder of the patients, excepting L. C., received delayed autografts with generally good to excellent graft takes. Blood loss during excision in the group was generally about 1,000 cc., the largest volume being 3,500 cc. in patient V. B. who had a large chest wall excision and arm amputation (Fig. 1A, B, C). An excellent graft take was obtained. In general, extremity excisions were associated with less blood loss than trunk ex-

FIG. 2 C. P. A. Skin Homograft  $\times 5$ . Required bilateral amputations, died 75 days post-burn in disseminated aspergillosis.



cisions primarily because of the use of a tourniquet which also facilitated the accomplishment of the procedure. The total blood replacement required for the rest of the clinical course was usually less than that of the excision alone. Intra-operative shock was uncommon. The healing time represents an approximation but offers a good index of effectiveness of the treatment. The LA 50 column is included for reference and is defined as the amount of 3rd degree burn for patients of similar age required to produce 50% mortality. This datum was computed from a larger series of 1,831 patients treated in our institution.<sup>5</sup> The patient in this group who died, L. C., received a 60% burn, 30% third degree, and on the third day after injury, had a primary excision of both legs, groin to ankle, and subsequently died of staphylococcal septicemia.

*Group II.* There were six patients in this group varying in age from 30 to 48 years. The size of their burns ranged from less than 1% to 52% total with less than 1% to 30% third degree. The excisions were carried out between the first and sixth day after injury. Excisions involved less than 1% up to 25%. There were two deaths of

patients in the group, who had 10 and 25% body surface areas excised. Three of the six patients received primary autografts with excellent graft take. One of these, patient T. B., required a subsequent autograft, and all three had good to excellent results. Patient W. B. received two delayed autografts with excellent graft take and good final result. Of the two patients who died, M. W. received no graft, developed massive upper gastrointestinal hemorrhage, and staphylococcal septicemia. The second patient who died, P. A., who received a 52% total burn with 30% third degree, had a massive excision of 25% body surface area on the sixth postburn day, the application of skin homografts five times, and eventually died of disseminated aspergillosis (Fig. 2A, B, C).

*Group III.* There were 11 patients in Group 3 ranging in age from 50 to 78 years. The total burns varied from 3% to 43% with 3° burns varying from 3% to 37%. The excisions were carried out between the first and the fifteenth day postburn, and the areas excised ranged from 3% to 18% body surface area. Of the 11 patients, three received immediate autografts with poor takes in two. Eight patients received de-

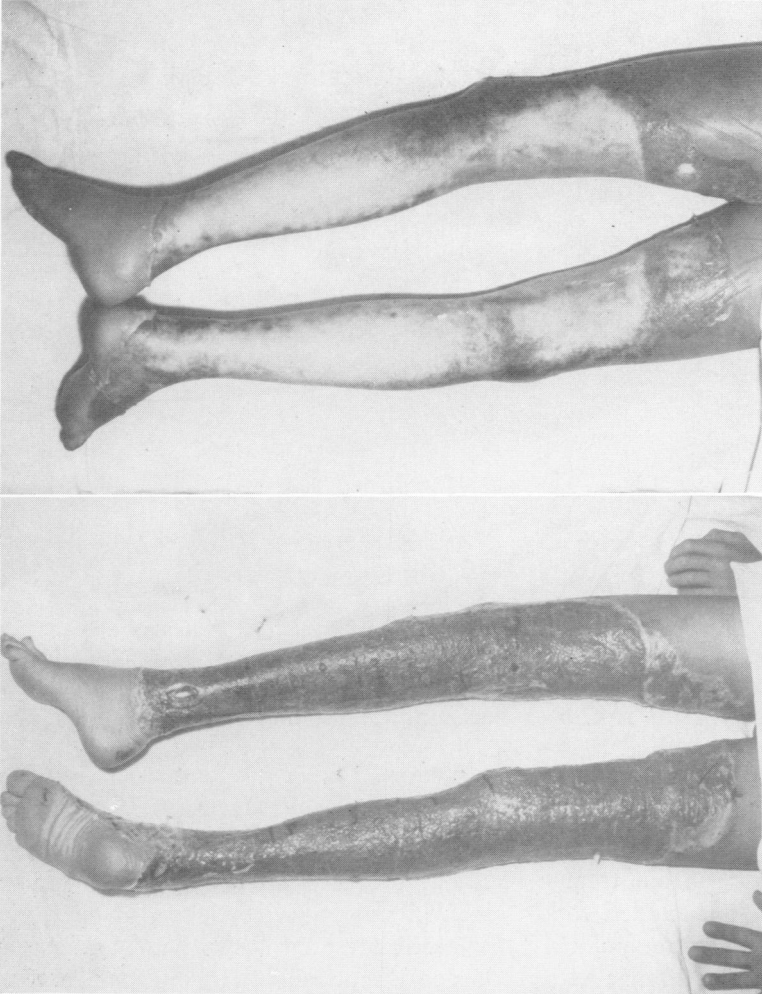


FIG. 3 A. J. G. 23% burn (15% 3°) involving both legs circumferentially and posterior thighs.

FIG. 3 B. J. G. After bilateral excision (15%) ready for autograft (16 days).

laid autografts, six had graft takes of 80% or more. Four patients in this group died. In L. B., a 73-year-old man with 10% total burn, 8% third degree, the burn was excised on the second day postburn, removing 8% of his body surface area. An autograft 2 days later took only 50%. The patient subsequently developed severe sepsis, congestive heart failure, and died 23 days after injury. Patient J. W., a 78-year-old man, received 8% third degree burn total, and 2 days later the burn was excised with an immediate autograft and a resulting 50% take. Twenty days later a second graft resulted in a 80% take. The patient developed a septic course, hypotension, shock,

and died 36 days after injury. Patient T. R., a 50-year-old man, received 42% total burn, 37% third degree, and 16% of the burn was excised on day 3 after injury. He was treated immediately with skin homografts with a good take although he developed an overwhelming septic course characterized by bronchopneumonia and died 22 days after injury. Patient J. A. W., a 75-year-old man, received 18% total burn, 18% third degree, and his total burn was excised on day one with an immediate autograft which took 25%. He died 11 days after injury, with poor granulations and poor wound healing.

FIG. 3 C. J. G. Almost healed, one skin graft (45 days after injury).



### Discussion

Group I (ages 3 to 29 years) might be characterized as good risk with good to excellent results of primary excision up to approximately 15% body surface area. Although there were only two immediate autografts in the group, the percentage take in both was poor. In contrast, the delayed autograft group demonstrated a generally excellent growth of skin. Patient C. H. had a 30% graft take which was attributed to inadequate excision of dead tissue, and patient Y. M. developed significant hemorrhage between the graft (60% take). Although it is difficult to say whether the time of wound healing was shortened by excision, certain individual cases point strongly to this view. For example, patient R. B. with a 3% body surface area excision over the anterior half of the leg from the knee to the ankle was healed in 15 days after injury. Patient Y. M. with 15% (abdomen and anterior thighs) excised was healed with two autografts by 31 days after injury. In certain instances the quality of the result was also striking. Patient J. G. with bilateral excisions (15%) from above the knee to the ankle, had beautiful graft healing with early functional recovery 45 days from the time of injury (Fig. 3A, B, C). Patient V. B., with a massive anterior, pos-

terior, and lateral chest wall excision had virtually healed wounds within one month of injury (Fig. 1A, B, C). R. P. received a 15% excision from mid-thigh anteriorly to ankle bilaterally including  $\frac{3}{4}$  of circumference of the legs. There was, in addition, loss of most of the extensor tendons and the tibia and patellae were exposed bilaterally. Resurfacing these areas with split grafts after debridement was followed by excellent wound healing and function (Fig. 4A, B). F. D. had 7% of his back and buttock excised and a delayed autograft. His wounds healed nicely with an excellent result (Fig. 5A, B, C). Although superior results in terms of appearance and function can be obtained without excision, it is apparent that in certain cases the method provides a combination of high quality result and shortened healing time. The patient who died in this group (L. C.) was in a high risk category and nothing in his clinical course suggested that excision had altered the risk.

Group II (30 to 49 years) might be characterized as good to excellent results in excisions up to 8% body surface area with two deaths of patients who had 10 and 25% body surface areas excised. Of four patients with good to excellent results, primary autografting was done in three with



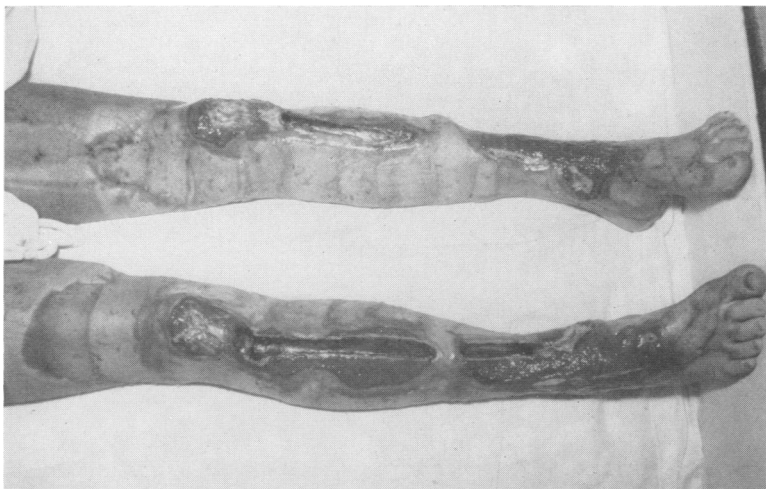


FIG. 4 A. R. P. 20% burn (15% 3°). Excision 15% 10 days after burn. Autograft 7 days after excision, 90% take. Exposed tibia and patella bilaterally prior to second autograft.

a high percentage of graft takes. The fourth, W. B., was a deep chest wall injury involving costal cartilage necrosis which responded well to delayed autograft and



FIG. 4 B. R. P. Healed wound 6 months after injury. Excellent function.

secondary debridement. The two patients who died, M. W. and P. A., received high risk injuries. M. W. in spite of massive GI hemorrhage and staphylococcal septicemia survived 20 days whereas P. A., perhaps under the influence of excision plus homograft five times, survived 75 days and succumbed to disseminated aspergillosis (Fig. 2A, B, C). It is likely that excision and homograft significantly prolonged the course in this patient. Patient M. N., with a small circumscribed third degree burn of the dorsum of the foot, was healed in 11 days after injury, and there can be little question that the healing time was shortened in this instance. It is also likely that T. B. with an 8% third degree excision of the chest who healed in 41 days represents a significantly shortened time of healing over conventional therapy.

Group III (50 to 78 years) might be characterized as high risk with good to excellent results in four patients, poor results in three, and deaths in four. Excisions varied from 3 to 18% body surface area and there were three immediate autografts with one good take and excellent result. As in previous groups, delayed autografting was associated with a high percentage of graft takes. The most striking result in the group was A. R., a 67-year-old man who

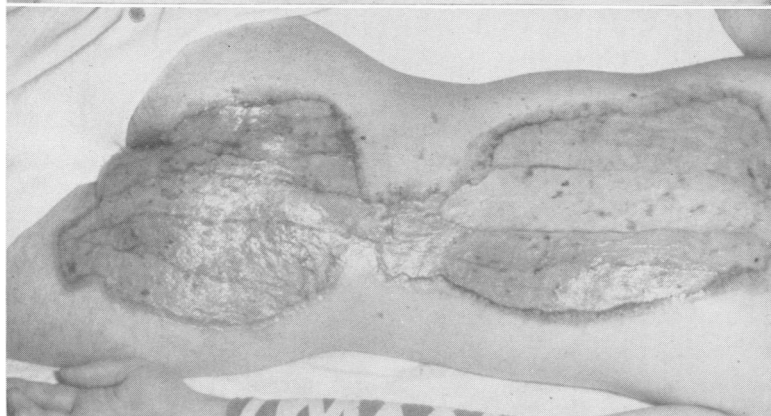
FIG. 5 A. F. D. 7%  
3° burn, buttock and  
back.



FIG. 5 B. F. D. Exci-  
sion 7% five days post  
burn.



FIG. 5 C. F. D.  
Healed 53 days after in-  
jury with superior result.



received a 10% third degree burn of the posterior thigh and leg which was excised totally 6 days after injury. Five days later an autograft had a 95% take and the patient was healed 49 days after injury with an excellent functional and cosmetic result. Not only did the per cent of third degree burn exceed LA 50 but the result was su-

perior as well. F. S., a 74-year-old man with 11% total burn, 10% third degree, was treated by AK amputation, removing most of the burned area. J. S., 70 years of age, had 4% of his thigh excised with excellent immediate graft take and wound healing in 39 days. E. L., a 54-year-old woman, had excision of 3% body surface area of the

forearm and hand with amputation at the 5th finger followed by wound healing in approximately 40 days. Poor results in the group were associated with delayed healing or complications such as pulmonary embolism. In patients who died the per cent of third degree burn approximately equalled or exceeded LA 50's in each case. Comparison to survival time of a larger group of patients treated in our institution by other methods<sup>5</sup> does not suggest that primary excision in the older patients increased survival time.

From these data it appears that the excision technic produces superior results in patients with less than 10-15% body surface area of third degree burn, preferably with all or nearly all of the burn excised. In certain cases healing time is shortened. Others are difficult to evaluate. Best results are in younger age groups. The older ages have a higher incidence of delay in wound healing, but excellent results are possible in selected cases. Immediate autografting is often associated with diminished take of grafts. Delayed autografting is commonly associated with high percentage of takes. There is no evidence to suggest a deleterious effect of leaving the wound open to granulate before the application of delayed autografts.

### Summary

Early excision and immediate or delayed autografting has been performed in 30 pa-

tients with burns up to 60% body surface areas, whose ages varied from 3 to 78 years.

This experience points out that the excision technic can produce superior results in patients with less than 10-15% body surface area third degree burn. It is important to excise all or nearly all of the burn. Certain cases point to a definite shortening of healing time. Although best results are seen in younger age groups, elderly patients often had good to excellent results. A greater incidence of delay in healing was observed in older age groups. Immediate autografting resulted in less percentage graft take than delayed autografting. The use of a tourniquet in extremity excisions was important in minimizing blood loss.

With careful case selection, early excision and grafting can produce excellent results.

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### DISCUSSION

DR. ERLE E. PEACOCK, JR. (Chapel Hill): The problem here may be the long delay required between excision and grafting, B. W. I think the principle of getting rid of eschar, burned tissue as rapidly as possible has been clearly demonstrated and with which I agree. But we would have han-

dled this differently by either grafting immediately at that moment or provided no more than 24 hours of dressings to be sure that hemostasis was intact.

The reason for doing so is that the wound healing process, with all of its misery and devastation, such as contraction, collagen synthesis, and so forth goes on during this 8- to 10-day period.