Use of Fresh Pigskin Grafts in Chronic Ulcer*

(A preliminary study)

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THE management of chronic ulcers has been a challenging problem in our part of the county especially as many of the ulcers fail to heal despite treatments such as antibiotics, dressings with materials like magsulf glycerine and Eusol paraffin, immobilization in Plaster of Paris casts and skin grafting. Very often the problem has been the absence of an "ideal dressing". The ideal dressing should close the wound tightly to prevent bacterial contamination from the skin. It should have an antibacterial effect and should reduce fluid, and protein loss. It should be able to maintain an adequate electrolyte balance and if possible stimulate the healing of the wound and lessen the pain. In other words it should have almost all the physiological properties of an autotransplant. But, for obvious reasons routine use of homograft, as a means of dressing is not feasible.

This need for a substitute for human skin prompted many early investigators to try heterografts from animals. First attempt at heteragrafting in the U.S.A. was performed by Dr. E.W. Lee in Boston in 1880. Such attempts were made earlier in Europe. In 1881, Girdiner first reported cadaver skin grafting. Results were poor since the aim was to get a permanent survival of the grafts. In modern times heterografting has been used as a temporary form of biological dressing. In 1951, Silvetti & Associates conducted a major study using bovine embryo skin. In 1953 Brown and his associates demonstrated the feasibility of the clinical use of cadaver skin as a biological dressing for extensive burns and other denuded areas. In 1960 Snyderman, Miller and Lizardo studied the survival of homografts and pig skin heterografts in patients with neoplastic diseases. In 1965, Bertram, E. Bromberg and associates conducted an exhaustive study using fresh pig skin grafts in mice. Later they employed pigskin heterografts clinically in 19 patients (14 with burns, 4 with large ulcers and one with congenital skin defects) over a period of 2 years. No adverse effects were noted in any instance and the grafts appeared viable for a period of about 2 weeks and provided effective wound covering. Negative cultures were obtained from the graft between 7 and 14 days from 2 patients. In 1973, Elliot and associates used commercial porcine skin grafts in 124 patients with burns, traumatic

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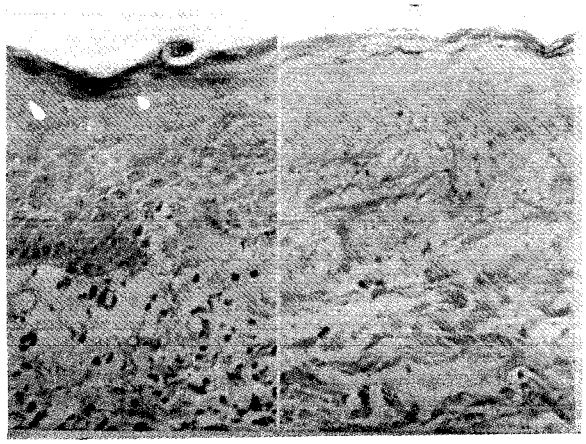

Por ine skin *Human skin*

Fig. 1—Microscopic photograph showing the histology of porcine skin & human skin.

Fig. 2—Ulcer on the medial aspect of right ankle.

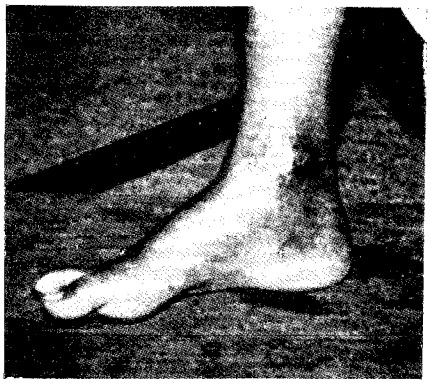

Fig. 3—Same case completely healed after 9 days with treatment with porcine skin graft.

Fig. 4—Ulcer on the lateral aspect of right leg.

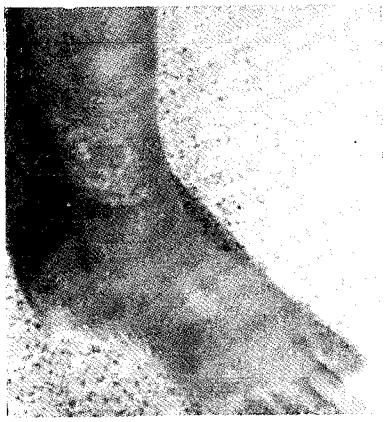

Fig. 5—Same case completely healed after 11 days with treatment with procine skin graft.

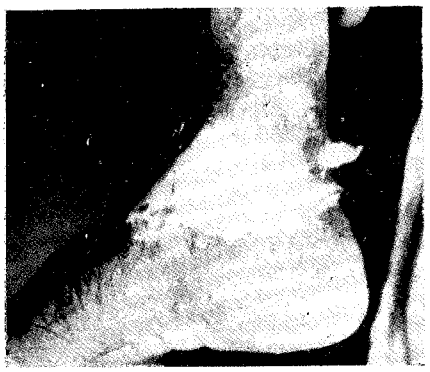

Fig. 6—The case who come ba k after 9 months with broken down infected scar.

wounds and ulcers. In Sweden, Berit Hansson and his associates have used sterile frozen pigskin grafts for dressing ischaemic ulcers in geriatric patients.

Homografting and heterografting is possible because the final death of skin does not occur at the same moment as cessation of breathing and circulation. There is a period of continued viability or respiration of skin and it is this differentiation in the times of death that makes these methods possible. Investigations are being continued elsewhere regarding this differentiation of time with a view of determining the limits of survival and of optimum for removal.

Pig skin, fresh as well as freeze-dried, has been widely used in studies for a number of reasons.

1. It has got a close structural similarity to human skin. Like human skin, the pigskin consists of two major layers, the epidermis and the dermis. The epidermis has the same different layers like stratum corneum, str. lucidum, str. granulosum, str. spinosum and str. basale. It is rougher, thicker and tougher than human skin due to an increased rate of keratinization especially at the areas of friction. The dermis consists of the papillary and reticular layers. The dermal appendages i.e. the sebaceous glands, sweat glands and hair follicles also closely resemble human skin. The sebaceous glands are smaller than those of human skin and they are rather rudimentary. The sweat glands as well as sebaceous glands are seen in close relation to the hair follicles usually in a one-to-one ratio. The hair follicles are arranged in groups of three.
2. The sparcity of hair as compared to other animal skin makes pigskin quite suitable for usage as a heterograft.
3. Further there is considerable technical ease in obtaining split pigskin grafts from the wide and comparatively tense body surface.
4. Compared to human and cadaver skin there is readily available unlimited supply of pigskin.

Fresh pigskin grafts can be stored in refrigerators at 3 to 4°C in saline soaked gauze upto 14 days. It has been observed that perhaps, refrigeration of the graft enhances the resistance of the skin to certain microorganisms.

Clinical Study

We have conducted a clinical study on 20 patients with chronic nonspecific ulcers using fresh pigskin grafts as a form of temporary biological dressing. The period of study span out from Aug. 76 to Dec. 78. The purpose of this preliminary study was to evaluate the effectiveness of fresh pigskin grafts stored at 4°C in promoting wound healing of chronic nonspecific ulcers.

Pigskin Grafts

We have used fresh pigskin grafts collected from the Meat products of India factory, Koothattukulam. White pigs devoid

of any skin diseases were selected. The pig was rendered unconscious first by giving electric shock to the head. It was then killed by a stab which cut through the heart and the great vessels. The hairs from the paravertebral region, abdomen, forelegs and hindlegs of the dead pig were shaven off. The surface was then scrubbed with soap and then savlon solution. Split skin grafts 1 to 1.5 mm thick were taken using Humby's skin grafting knife under possible aseptic conditions. They were put in sterile polythene bags containing a little of normal saline and crystalline pencillin powder. A swab for culture was taken from each bag which was then sealed with heat. These polythene bags were kept in ice-box during transportation and later transferred to refrigerator. The swabs taken were sent for culture. Only sterile pigskin grafts were used for the study.

Patient Material

20 patients with chronic non-specific ulcers were included in the clinical study. All of them received fresh pigskin graft dressings. Before starting treatment a swab for culture was taken from the ulcer. The ulcer was cleaned well with savlon solution and then with saline. Fresh pigskin grafts were applied over the ulcer so as to cover it up completely. A paraffin gauze dressing was given over it and an elastocrepe bandage applied. The patient was put on a broad spectrum antibiotic and supportive treatment. The dressings were changed on alternate days and fresh pigskin grafts applied till the ulcer healed well by scar tissue. Swabs for culture from the ulcer were taken when the ulcer became clean.

The details of the 20 patients were as follows :

1. **Sex Distribution**

Male : 16 Female : 4

2. **Age Distribution**

	M	F	Total
10 yrs. to 20 yrs.	3	3	6
20 ,, 30 ,,	5	1	6
30 ,, 40 ,,	1	—	1
40 ,, 50 ,,	3	—	3
50 yrs. and above	4	—	4
Total	16	4	20

3. **Economic Status**

Low income group	15
Middle income group	5

4. **Duration of Ulcer**

Less than 1 yr.	13
1 to 2 yrs.	5
2 to 3 yrs.	2

5. **Trauma as the Cause**

17 cases

6. **Previous Treatment**

Antibiotics	—all cases
POP casts	—2 cases
Skin grafting	—6 cases (all rejected)

7. **Site of Ulcer**

Lower extremity	17
Upper extremity	3

8. **Discharge from the Ulcer**

Purulent	8
Serous	12

9. **Oedema around the Ulcer**

Present	7
Absent	13

10. **Culture from Ulcer**

Sterile	7
Ps. pyocyneus	7
Staph. aureus	4
Ps. pyocyneus & Staph Aureus	2

Results

All cases healed with a firm scar.

1. Number of days taken for healing :
   9 days—12 cases, all with serous discharge.
   11 days—8 cases, all with purulent discharge.

The pattern of healing in ulcers with serous discharge was as follows :

3rd day—ulcer became clean
5th day—healing started from the sides.
9th day—healing complete.

Those ulcers with purulent discharge had a little more prolonged course of healing.

5th day—pus was completely absent and wound was clean.
7th day—healing started from the sides.
11th day—healing was complete.

2. Culture from ulcer became sterile when the ulcer was clean.
3. There was no adverse effects like allergic reaction noted in any of the patients.
4. Follow up :
   Of the 20 patients 15 have come back for review. Of these, 13 patients had a stable scar and had no complaints. One patient came back after nine months with an infected brokendown scar. On examination this patient had developed varicosity of short saphenous veins. The wound healed with antibiotics and dressings with Nurazone Ointment. Another patient came back after 6 months with mild cellullitis around the scar which responded well to antibiotics.

Discussion

Fresh pigskin grafts seems to be an answer to the problem of ideal dressing that we have mentioned about in the outset. It has successfully brought about the healing of the ulcer by promoting epithelisation under the graft. There are more studies to indicate that the heterografts have a positive effect on the ulcer healing by stimulation of the regrowth of healthy fibres as well as ingrowing of tissues from the sore edges. Further the pain in the open ulcer has been considerably reduced and the change of dressings of pigskin grafts has been almost painless.

It has been found that the pigskin grafts has antibacterial properties. This interesting phenomenon has been explained by Elliott & Hoehn in 1973 as that it stops bacterial contamination from the skin, since it closes the ulcer tightly. Peter Mansell of U.K. has proved experimentally that application of pigskin over the ulcer stops the growth of proteus and coliform bacteria, retards the growth of staph. aureus, but had no effect on ps. pyocyaneus. In our study we could get a complete inhibition of growth of ps. pyocyneus as well as staph. aureus.

It has been established that pigskin grafts reduce the loss of fluid, electrolytes and protein. It also reduces the evaporative loss of heat.

Immunological studies show that no antibodies against the heterograft have been produced in the serum of the patient treated with pigskin grafts. Only when attempts at keeping the heterografts for long periods were made that minimal immunological response was evident. In none of the studies conducted so far, there was any evidence of vascularisation of the hetergraft seen.

In conclusion, we have found the fresh pigskin graft to be a good available temporary biological dressing for chronic ulcers. The question is whether this is a temporary cure or a permanent one. This, only time and further followup can tell us. This has just been a preliminary study. We intend to conduct further studies involving various aspects especially the immunological response to the pigskin grafts.

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