RAILWAY SURGERY

SKIN GRAFTING.*

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The practice of skin grafting, while usually regarded as a comparatively modern surgical feat, in reality was performed hundreds of years ago. In Leonard Freeman's little book on this subject he states that it was performed by the ancient Hindus two thousand years ago, and in support of this assertion he further relates:

It was the custom in India to punish certain offenses by cutting off the nose. As an almost necessary consequence, there appeared at an early date men skilled in plastic surgery, who belonged, strangely enough, to a low and despised class, the tile-makers' caste. Their work is said to have been excellent, even superior in some respects to that done at the present time. One of the most remarkable achievements of these pioneers in surgery was the replacement of the nose by a graft from the thick skin of the gluteal region, a feat which even now cannot be repeated with certainty. When we consider that the subcutaneous fat was included and that no support could have been had from underlying tissues, the success obtained seems little short of marvelous. . . .

It is probable that skin grafting, like some other arts, was largely lost sight of during the Middle Ages, although here and there a more or less authentic account of an isolated case has been preserved. For instance, it is related by Sancassani (1731 to 1738), that a female street vender, in order to prove the efficacy of a certain salve, was accustomed to cut a piece of skin from her leg, pass it around the audience upon a plate, and then replace it in its original position, covering it with salve. Such perfect union took place that the site of the operation was scarcely discernible.

About the end of the eighteenth century some account of the Indian methods of grafting was brought to Europe by travelers. The statements, however, were credited by few, and those who did

believe were generally disappointed when they tried the experiment themselves. Nevertheless Van Helmont states that Tagliacozza, a Bologna surgeon famous for his achievements in rhinoplasty, constructed a nose for a patient in Brussels from the skin of the arm of a workman; but Tagliacozza has been credited with so many wonderful things that it is difficult to sift the true from the false. The skin from the back of a student's hand is said to have been used by Dzondi in the formation of a woman's nose, and Bunker succeeded in getting a portion of a graft from the thigh to adhere in a similar operation.

As early as 1836, Hoffacker, surgeon to a students' duelling corps in Heidelberg, succeeded in reuniting numerous severed portions of noses and a piece of a lip."

In recent medical literature we find similar cases reported. In Johns Hopkins Hospital Bulletin, October-November, 1892, Finney reports a case where a finger after being completely severed from the body seven hours became reunited. Another case where the soft parts of a nose grew in place after having been separated an hour is reported by Kelley in the *Times and Register*, Philadelphia, August 16, 1890.

Grafts have been defined as autodermic when from the patient's own body and isodermic, heterodermic or homo-dermic when taken from another individual. The terms autogenous and heterogeneous grafting are also used to describe the two sources of supply. As a rule the grafts thrive best when taken from the patient's own body. In my own experience I have undoubtedly secured the best results I have ever had when I secured the grafts from the patient himself, although in several cases when the patient's vitality was not so good. I have had most satisfactory results with the iso-dermic grafts, in two cases getting the skin from several individuals.

I have always been very careful to ascertain that the donors were in perfect health, as there is no doubt that diseases can be

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transmitted in this way. It often happens that the patient's general condition is so far below normal that it would be unwise to impose on him the nervous shock incident

to removing the skin from his own body. In such cases we are fortunate if we can find healthy donors in whom the spirit of altruism and brotherly love prevails to the extent necessary to cause them to shed their blood and cuticle for the afflicted one.

In these modern days, when greed and selfishness seem to predominate in the hearts of men, it is refreshing and uplifting to find men ready to make a blood sacrifice for one of their friends. It has been my privilege and experience in every case where I have asked for volunteers to find a ready response among white people. In one instance where I needed isodermic grafts to save the foot of an injured engineer, five of his friends (fellow employes) volunteered, and each gave all the skin I required, without fear and without reproach, and the foot was saved. No doubt many of you have seen such examples of unselfish, generous courage, and have felt, as I have, the moral uplift of such an experience.

As to the methods; those of Reverdin and Thiersch are the two principal ones used. Reverdin being the pioneer. His report to the Societe Imperiale de Chirurgie, Dec. 8, 1869, first brought the subject prominently before the world, and was followed in 1872 by a more exhaustive paper in which he states that while he spoke of the small bits as "epidermic grafts," yet that title is not wholly correct, as he included a little of the dermis and the whole epidermis.

In a very interesting paper by Dr. J. S. Davis of Johns Hopkins (Journal A. M. A. September 19, 1914), he makes a very forceful plea for the "use of small, deep grafts" taken and applied according to Reverdin's suggestions, except that he takes more of the true skin than in the older method. His article is profusely illustrated and quite clear as to technique and treatment. I have read and studied it with interest, and yet I must confess he has failed to convince me of the superiority of his modified Reverdin method to that of the far more frequently used one of Thiersch with its modifications. The chief objections to his type of grafting are its tediousness, time required, its poor cosmetic result and the greater tendency to keloid formations. I cannot find a single

good reason for preferring it to that of Thiersch.

After describing the technique in detail, Freeman states: "In fact, the only excuse for using the Reverdin method is its comparative painlessness and insignificance as an operation."

Where it is impracticable to secure a healthy granulating surface, the Reverdin grafts may be used with greater chance of

In my own work I have never found it necessary to anesthetize my patient in order to scrape away exuberant granulations. A few days' treatment with antiseptic irrigations usually puts them in healthy condition. If they are sluggish and indolent, painting with iodine, followed by a 25 per cent solution of Balsam Peru in castor oil will furnish the necessary stimulus.

When ready for grafting the surface

success, but if one is willing to properly prepare his surface for grafting, and give proper attention to the technical details of the work, the method of Thiersch will yield far more brilliant results.

As to this procedure, Freeman remarks: "There is no process of skin grafting so simple, so reliable, and so generally applicable as the method of Thiersch, and yet it has never received the thorough recognition to which it is entitled."

Therefore, it seems proper to emphasize the value of this procedure on occasions such as this and to relate personal experiences to further stimulate interest in the subject.

should be thoroughly irrigated with normal salt solution before placing the grafts.

The best place for obtaining the grafts is the anterior surface of the thigh, although I have frequently taken them from the arm when I did not wish very long grafts, also when several friends of the patient are giving skin it is quicker and easier to take it from their arms. When the skin is taken from the patient himself, I prefer the thigh. It is better to anesthetize the patient in this case. In fact, it is far better to get the skin from the patient himself if his general condition will admit of it. In this event no one is made to suffer, and larger

and better grafts can be removed when one is not hampered by the nervousness and suffering of the donor.

Some practice is necessary before one can remove the grafts deftly. An assistant should make the surface tense by placing his hands on both sides of the limb or pulling the skin down while the operator pulls it up, and with a very sharp razor cuts long strips. The

operator cuts towards himself with a side-to-side sawing motion, keeping skin and razor wet with salt solution. The razor should not emerge until a strip sufficiently long has been cut, as it is much easier to manipulate large grafts and requires less time. It is not necessary to cut through the entire thickness of skin, but if this is done, the value of the graft is not diminished, although the scar from its removal is longer in healing and more permanent.

The strips of skin will often curl up on the razor, but may be smoothed out in a

basin of warm sterile salt solution, using a long-handled needle and small forceps. Afterwards I place them on oil silk wet with salt solution, and slide them from this on to the granulating surface. Some authorities advise overlapping each strip and the borders of the ulcer. If skin is very plentiful this may be done, but I have never found it necessary. If I use a long broad graft I perforate it to facilitate drainage and enhance its chances to live.

With Thiersch the removal of granulations was one of the principal features of his original method. He claimed that the more or less large and soft, superficial granulations, during their slow transformation into connective tissue, were the cause of cicatricial contraction, and that this contraction could be avoided by scraping away the granulations until firmer tissue was reached. He also thought that grafts grew better when this was done. This advice was universally followed until it was demonstrated by Schnitzler and Ewald that it is unnecessary to remove healthy granulations and that grafting can be done directly upon their unaltered surfaces with the production of a movable skin, and without appreciable subsequent contraction.

Instead of scraping with a curette, Sick simply rubs away the granulations with a bunch of gauze, or a stiff nail brush may be used. Halsted, McBurney and others prefer to shave the surface with a scalpel or an amputating knife, claiming that a smoother surface is obtained devoid of partially separated and bruised portions of tissue, which tend to become necrotic and interfere with the vitality of the transplanted skin.

As stated previously, I have not found it necessary to curet or shave off the granulations. I prefer a moist dressing of normal salt solution on gauze, with strips of perforated oiled silk, which is kept in warm saline solution until ready for use. Numerous methods of dressing are in use, including

dry dressing, the open method with a wire cage, sterilized olive oil, boric acid solution, splinting the grafts with wide meshed curtain netting soaked in gutta percha and chloroform, silk netting treated with paraffine, etc.

Bernhard advocates exposure of the newly grafted area for a short time to the direct rays of the sun, while Schepelmann douches the new skin for several weeks with hot air, by means of a special electric instrument, claiming that better and more permanent results are thus obtained. Thies covers the grafts with a thick layer of fine sand, which has been sterilized by boiling in a 1 per cent solution of sodium carbonate and then dried. He considers that this method has a number of advantages, among which are the removal of fluids by capillary suction, the splinting of the grafts and the prevention of coagulation of the discharges by the alkalinity of the material. The sand should be changed frequently.

I have found the dressings I have used entirely satisfactory and have therefore tried none of these others. I usually remove the dressing in from five to seven days. The pictures illustrating are of the two most seriously burned patients I have ever successfully treated. In both recovery was due to skin grafting. Not only restoration to health, but also prevention of deformity and distressing disability was accomplished by grafting. Both patients, together with five others, were burned and scalded in a boiler explosion at the Bemis Cotton Mills near Jackson, and all were brought to our sanatorium for treatment. The white patient was burned almost beyond recognition. His face, head, neck, ears, hands, arms, legs and entire back were burned to the second and third degree. The photo shows that the ears were partly burned off, but gives no adequate picture of the depth and extent of surface involved. It does show the fine, smooth appearance of the back and legs, however, and this cosmetic and functional result is

due to Thiersch grafts (in this case of heterogeneous origin), the donors being his brother and a friend and a recently circumcised baby, whose foreskin played an important part in covering an extensive raw, ugly granulating area on one leg. The patient's vitality was very low, and at times he ran a high temperature, but finally after a very tedious convalescence he was restored to perfect health with no functional disability of limbs or body.

The negro whose photos are shown, suffered a compound fracture of the skull, necessitating trephining and removal of fragments of bone from the brain. In addition he was burned extensively and deeply on face, head, back, side, arm, thigh and legs. The burn on calf of leg was of the third degree, extending from ankle to three inches above the knee. The muscles partially sloughed away, almost exposing the vessels in the popliteal space.

To secure donors of skin for him was impossible. When the request was made of his wife, she was horrified, and exclaimed, "Who, me, let you cut off my skin for him? Naw, sir, I didn't promise to do dat when I married him." Fearing that I would insist, she left the hospital and eventually deserted the patient and has nevermore returned to his bed and board. The spirit of altruism has not yet permeated the colored race to the extent necessary to cause them to shed blood for each other.

Therefore, the patient was anesthetized and the required amount of skin in long, broad strips was removed from the opposite thigh and successfully grafted on leg and side and axilla, preventing contraction that would have seriously crippled the patient, and hastening and insuring his complete recovery.

DISCUSSION.

Dr. R. W. Knor, Houston, Texas.—I am in the habit of anesthetizing the patient to do skin grafting, especially on large surfaces. I think it well to do this on account of pain that is produced in getting rid of the exuberant granulation. A good soap and water scrubbing is also important

in getting rid of pus. In the lower limbs spinal anesthesia can be used to good advantage. The technique adopted is as follows: Transfer the grafts directly from the razor to the wound surface; any other method is tedious and difficult. If the grafts are transferred to a salt solution they have a tendency to curl up, and in this condition they are very difficult to apply. As a dressing for the grafts I now use exclusively narrow strips of oxide of zinc plaster which comes in sterile packages. These strips are put across the wound in a basket like way, and on this is applied a dressing consisting of gauze slightly moistened with sterile salt solution. The secretions that may form are taken up by this and the gauze can be changed without disturbing the grafts. The zinc plaster can be removed in four or five days, at which time the grafts will have thoroughly taken and moist applications for a few days longer will complete the work. This method has been exceedingly successful in my hands.

Dr. Denegre Martin, New Orleans, La.—The doctor's teaching is this: That we have in these cases a superficial or granulating layer and a deep horizontal layer, and it is in the horizontal layer that we get the blood supply to the skin, so that if we cut through the chorion then replacing the skin from the vascular surface we get an ideal condition. I have been doing this ever since it was taught at first—probably three or four hundred, and rarely one fails.

Another thing: If you put these grafts on top of the granulating surface before the maximum amount of contraction has taken place, the contraction will go on. The way to do that is to watch. Nature is making an effort to cure that ulcer. You see the blue margin of the granulating surface, then you realize it is the best time to do that grafting.

The Riverdin method is a graft put on the granulating surface, and is a very different condition altogether.

The latest thing is the suggestion of Davis. I find it is the easiest thing to apply, and our results are excellent. It does away with all of the old methods. We found if we could use the gauze it would absorb the pus, etc., and the gauze just simply covered over, and it does very well.

The dressing of that graft is the most important of the whole thing, and the doctor has brought out another thing. Just take it right off. Dressing of the graft is more important, because, unless you fix your dressing, you will find in a week or ten days the graft is all bunched up. I put on the dressing at first, hold that with adhesive strips, and that with a wad of cotton, because that causes not enough pressure to interfere with the circulation of the graft itself.

Dr. F. L. Watson, Oklahoma City, Okla.—I think Dr. Crook's paper is indeed a very important one, and his mentioning skin grafting in connection with burns should call to our minds that we should use it very much more frequently in burns that we do. I realize that in the colored race we sometimes encounter the difficulties that the doctor mentioned, but I am surprised that it should have occurred to a gentleman from the South. I think the doctor's trouble lay in the fact that his explanation to the lady was made too

plain. Had he used more polysyllables that were unintelligible even to himself, then he could have secured the skin.

We all know, in following a burn, as the slough occurs and granulation begins, a local leukocytosis, so to speak, takes place, and that the site of the burn is cofferdammed against infection. Those of us who have lived in the mining district where we have extensive burns have noticed that we have few infections. We have our first rise of temperature then the local areas learned to take care of themselves, and it does not matter so much what technique you use. We cleanse the skin, in using the autogenous graft, and even scrape the skin as if you were going to implant a vaccination, and distribute the scrapings around the granulating surface. They will adhere because the rich blood supply that exists that nature has thrown up there and is only anxious to protect any skin graft which may be applied by whatsoever technique.

Dr. Wm. M. Perkins, New Orleans, La.—I arise just to say a word for the dog—*the Riverdin graft.* First, I wish to congratulate Dr. Crook upon such masterly grafting as brought a man a new foot and a new wife and thirty additional pounds of flesh.

Out here is a Greek colony, and a short time ago they had a horned rooster out there "imported from Greece." Shortly afterwards another appeared, "imported at great expense." They sold settings of eggs sired by those roosters at \$4 per setting. It was found afterwards they had been grafting spurs on the heads of young roosters! Those Greeks as successful grafters surprise even Dr. Crook, as the results of their work are growing indefinitely.

The doctor says the ladies take up the new fashions—and perhaps each lady prefers her own style of hat. I guess each one prefers his own graft technic. My pet technic for dressing grafts on limbs is to take two or three layers of gauze, much larger than the area to be covered, and wrap them thoroughly around the limb and let all the drainage occur through it. If it becomes necessary to drain through a graft, the gauze may be clipped. The gauze being wrapped firmly and smoothly around the limb, any amount of dressing can be applied to suit your taste. Slightly moistened gauze fits snugly and soon dries. If one puts it on carelessly it slips and tears off the grafts. I believe that the oiled silk and rubber dressing are more or less bad, especially in warm weather.

Dr. W. W. Crawford, Hattiesburg, Miss.—Without wishing to prolong the discussion, I desire to relate very briefly a case of skin grafting that came under my observation a year ago, with this history: A woman of about thirty-five years of age, weighing about 190 pounds, had, eleven years ago, a case of puerperal sepsis following the birth of her first child. This sepsis was the complication of a very bad laceration. The end result of the puerperal fever was that all the mucosa of both vagina and endometrium were destroyed. The granulations incident to repair completely filled the uterus and vagina. There was nothing but the urethra to show the original location of the vagina. The patient, of course, did not menstruate for a period of eleven years. We undertook to correct the deformity for her.

We thought perhaps we might restore the vagina and at least make her more comfortable, because she was suffering a great deal with bladder trouble, due to the fact that the bladder had fallen into original space occupied by vagina. We tunneled out the original location of the vagina, hoping, as we got into it further that we could find at least some remnant of mucosa left. It was necessary to dissect the bladder and lift it up. We found the location of the cervix. Grasping it we tunneled out what we thought was probably the original canal. We packed that and took two large flaps from the thigh, turning them in and making a new vagina. The skin grew, and it was only necessary to do a little additional skin grafting. As a result of this operation the woman has a restoration of the vagina, and, what is much more interesting to us, she menstruates each month painlessly. As I said, this operation was done about the first of December last year, and but for the integrity of the skin graft, it would not have been possible.

Dr. A. C. Scott, Temple, Texas—Gentlemen, I do not wish to prolong this discussion, but it is an interesting one to me. I have enjoyed the paper very much, and feel that it is a little bit like some of the styles spoken of this afternoon. We are inclined to follow the styles, whether they are practical or not.

I think in skin graft we should bear in mind those things which cause failure of skin grafting to grow. It does not matter how much you put on some of these grafts, some of them are going to grow. At one time my associate and myself had quite a dispute as to whether these grafts should be very thin or very thick, and one day we were working on a space where we had to cover 4x10 inches in size, and he planted his grafts on one end and I planted mine on the other, and his were all thick and mine were all thin. I was certain his would die out and he was as certain mine would. Neither died out, so that satisfied us as to whether they should be thick or thin.

Most surgeons will recognize the fact that grafts do not grow well upon surfaces that are very septic. We know, also, where grafts are placed upon very fresh wounds, where they are still bleeding all over, that they may not grow so well. We know on fresh surfaces where we dress the wound and allow it to remain long enough for the oozing to cease, thin grafts placed upon the surface nearly all grow without much trouble. In considering the subject we know that profuse discharges are detrimental to the growth, and when 1½ by 2 or 3 inches long are placed on, when the secretions increase underneath they do not lie in close contact with the capillary vessels beneath, and if they do not lie in close contact, they fail to get the proper nourishment and fail to take hold, so to speak, and are very much more apt to be lost.

The writer of the paper spoke of perforating the graft. I was glad to hear him mention that, because I have been very much interested in that phase of skin grafting for a number of years. I think it was four or five years ago when I pre-

sented a paper at Hot Springs, Va., upon this subject, in which I gave quite a lot of the details which we have been using for several years, and the main thing we laid stress upon was the necessity of perforating these large grafts in order to keep the secretions from ballooning them up.

We find we can handle these grafts best by spreading them out on rubber tissue with the raw side up, than by using the rubber tissue, if it is wet; the skin surface is placed down on the rubber tissue, they will stick very closely, and we can perforate them easily, cut them into the sizes and shapes of the wounds we have to fit. We can make them triangular or almost any shape we wish, in order to fit the tissues being covered.

There is just one thing that must be taken into consideration in placing skin grafts: There was a point mentioned by Dr. Martin, they must not be allowed to slide. I think Dr. Knox spoke of holding them down with adhesive plaster. It does not matter much how you hold them down, so you hold them long enough to get a good hold and train them, and many grafts which have taken hold pretty well may be peeled off if the dressing has been allowed to become filled with dry secretion then peeled off roughly, without consideration for the delicate tissues to which they are attached.

After we have perforated the rubber tissue, cover in about the wound, place the raw side down, leaving the rubber tissue which has been perforated when the graft is right in contact with it, then any substance you want to put on there is all right, I think—the gauze, etc.

Dr. Crook (closes)—There are distinguished and efficient "grafters" among the membership of this Association. This paper was originally written to be read in Virginia, but on account of the illness of my little boy, I did not get to read it there, and so brought it down here. I did not try to teach the Texans anything new about "grafting."

I had not thought of getting the sterile strips of adhesive plaster. I had always looked upon this as being unsterile, but the doctor says it comes prepared for that purpose. It is absolutely necessary to hold the grafts in position; and then you must provide for drainage by perforating the oil silk, and in large grafts perforating the grafts. I think the plan of cutting both at the same time a very good suggestion.

I would be a little slow to use the vaseline, as suggested by Dr. Martin, because I believe the vaseline would have a tendency to cause the graft to curl up or slip off, but if the doctor has had favorable experience with it I am sure it is a good thing.

In large hospitals, especially large emergency hospitals, where one has a case that requires a great deal of skin, one can nurse that along for a few days, when probably he will have an amputation, and from this freshly amputated leg or arm can take all the skin he wants for grafting. This is done in large hospitals, where they have all sorts of cases on hand at the same time.