Statistics are not now available to prove whether epididymotomy produces sterility when applied in every bilateral case, but since the preponderant number of cases are unilateral, and since after epididymotomy such rapid recovery occurs in every instance, the collective gain in shortening the course of *all* cases offsets the disadvantage of an occasional sterilization.

DEVELOPMENTS IN THE SKIN-GRAFTING OPERATION FOR CANCER OF THE BREAST

WILLIAM STEWART HALSTED, M.D.
BALTIMORE

It has been my custom every year or two to request our patients operated on for mammary cancer and living in or near Baltimore to come on certain mornings to the surgical clinic of the Johns Hopkins University in order that we may observe the ultimate result, particularly with reference to the function of the arm.

For about sixteen years our practice has been to cover the fresh defect, made as small as feasible in various ways, with large Thiersch grafts. The available skin was tucked high into the armpit in order to cover the axillary vessels, to obliterate the dead space under the clavicle, and to elevate to the highest possible point the axillary fornix.

The tip of the axillary flap was usually cut away. Notwithstanding this precaution a little necrosis of the badly nourished flap was not infrequently observed, and as a consequence there occurred an occasional but rare infection of the wound, and in the location where it might be productive of great harm, namely, on the confines of the subclavicular dead space which we had attempted to obliterate in the ordinary way, by tucking up the flap and holding it in place with soft packs of gauze. Infection of this space not only delayed healing but also prevented primary union of the tucked-in skin to the wall of the thorax, to the subclavius muscle and to the subclavian and axillary vessels. In such event the healing of the dead space was by granulation, and the resulting cicatricial tissue in the axillary fornix caused or accentuated the swelling of the extremity and, more or less, prevented the free movements of the arm. Infection, furthermore, influenced unfavorably the healing of the skin-grafts.

In plastic operations the danger of the necrosis is, of course, greater than in the skin-grafting operations, because in the former the circulation of the flaps is still further impaired both by the added incisions and by the increased traction which is exercised in the effort to cover the raw surface with skin. It is expecting too much of a thin flap deprived of its fat and submitted to the pressure of a gauze pack sufficient to keep the flap in place and to obliterate the axillary dead space, always to maintain its circulation to the very edge.

With few exceptions the patients have been well satisfied with the resulting usefulness of the arm. Such restrictions of movement as they suffered from did not prevent them from dressing their hair and performing household work. But in the majority of cases, on abducting the arm beyond 90 degrees, a point would ultimately be reached, as the elbow approached the head, when a band of skin and connective tissue was seen to tug between the chest wall and the shoulder. I have repeatedly said to my patients that if this band were divided and the resulting defect covered by a skin-graft the desired motion would be permitted unless prohibited by changes in the shoulder-joint which might in time have taken place. In no instance, however, has the patient considered herself sufficiently handicapped by the restriction in the movement to care to submit to the proposed operation.

For some years we have been trying to remedy the defects of the method and have succeeded in such measure that I consider it worth while to describe the modifications which our original operation has undergone.

The incision down the arm, made shorter and shorter, was finally abandoned. The vertical cut to the clavicle is made as short as feasible and when considerable skin has been removed above is omitted.

Not infrequently the only incision of the skin is the circular one surrounding the tumor, but as a rule the one or the other of the vertical incisions has been made. By means of the two vertical incisions, one above and one below, the dissection of the axilla is, of course, facilitated. Thus the triangular flap has been definitely abolished.

The skin of the outer flap between the two vertical incisions is utilized primarily to cover completely, without any tension whatever, and redundantly the vessels of the axilla. The edge of this flap is stitched by interrupted, buried sutures of very fine silk to the fascia just below the first rib in such way that the skin partly envelops the large vessels. Then, along the entire circumference of the wound, the free edge of the skin is sutured to the underlying structures of the chest wall, the wound being made as small as desirable in the process of closure, and tension on the upper or axillary part of the outer flap assiduously avoided. Considerable traction may, however, be exercised on the mesial flap and on the lower portion of the outer flap. The form and position of the resulting defect may be seen for a given case in the accompanying illustrations. Whatever the size and shape of the grafted defect, it should usually extend to the top of the axillary fornix. Thus the thoracic or inner wall of the apex of the axilla is always lined with skin-grafts.

The arm is adducted 90 or more degrees during the stitching of the wound and is not included in the dressing. Only the gentlest pressure is exerted by the bandage holding in place the gauze handkerchiefs which should be evenly applied with solicitous care. Particularly to be avoided is the placing of a wedge of gauze in the axillary fornix, and the using of this as a kind of fulcrum to be bridged over by the adducted arm. Drainage is unnecessary.

Movements of the arm as free as possible are encouraged after the second day. These may be executed without apprehension if the wound is closed in the manner indicated.

REASONS FOR SKIN-GRAFTING IN OPERATIONS FOR CANCER OF THE BREAST

1. An almost unlimited amount of skin may be removed. From the observations made at the surgical clinic of the Johns Hopkins University it would seem that the results have been better in the cases in which larger areas of the skin were removed. According to the statistics of our clinic as prepared by Dr. Joseph C. Bloodgood, it would seem that of the various operators those have had the best results who make a practice of giving the tumor the widest berth in making the incision of the skin. These surgeons may, however, perform a more thorough operation in other respects.

Undoubtedly we often remove an unnecessarily large amount of skin; but the patient is not in the least incon-

venienced thereby, nor is the operation delayed on this account, for the reason that the defect is covered with Thiersch grafts, on the healing of which one can rely almost absolutely. Nothing is gained, therefore, by saving skin which, either because it is too close to the cancer or by reason of impairment of its circulation, is questionable.

Whatever a given surgeon's views may be in general as to the amount of skin which should be removed for the cure of mammary cancer, he is certain at times to be confronted with cases which clearly demand excision over a very wide area. In such event he will, I believe, find the procedure which I have advocated of definite value.

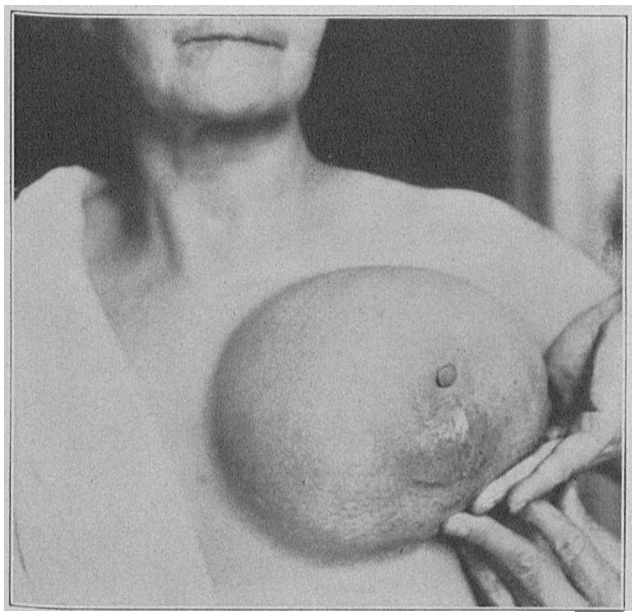

Fig. 1.—Before operation. The carcinoma infiltrated the entire gland. The skin incision corresponded quite accurately to the margin of the breast except below, where it was carried beyond it.

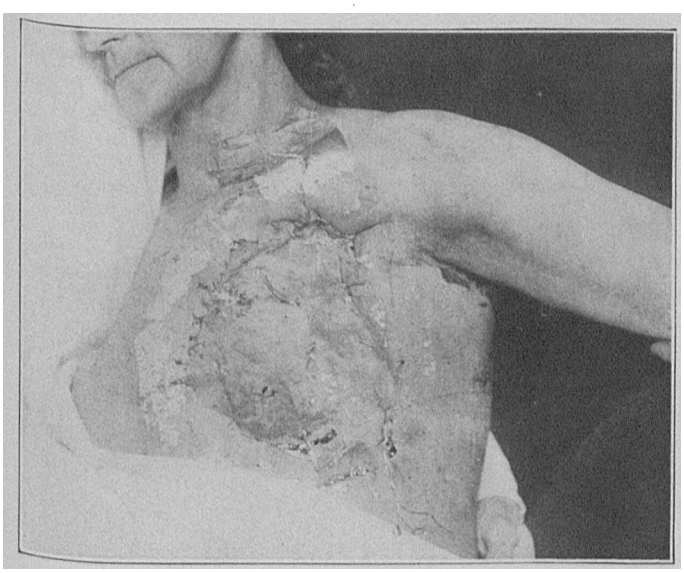

Fig. 2.—Three days after operation. Silver-foil (high lights) on the skin along the inner and upper margins of the wound.

It is better to remove too much skin than too little, for the mistake of excising an insufficient quantity is quite fatal to the patient's chances of recovery. Whether the grafted area is large or small the time required for the healing of the wound, and the range of motion permitted to the arm are the same.

2. Skin-grafts present a definite obstacle to the dissemination of carcinomatous metastases. I have seen cutaneous recurrences along the margins of the grafted area spreading with great rapidity in the skin, extend over the opposite breast, to the back and over the abdomen to the pelvis without involvement of the grafted area except by encroachment at the edges. In one such case in the course of two years, the complete mammary operation having been done on both sides and the supra-clavicular operation on the right side, the entire skin of the front of the thorax, of the right and part of the left side of the abdomen and of the right back nearly to the middle line was removed and the denuded area grafted, and yet at no point did the disease invade the grafted area except here and there for a few lines at the margins.

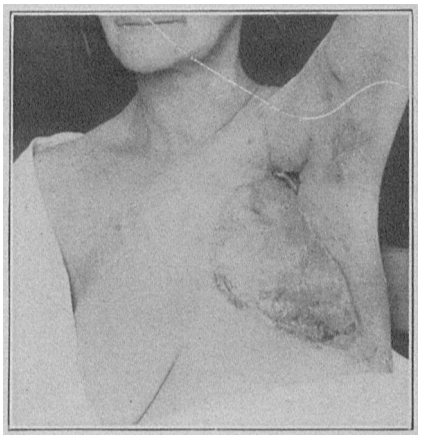

Fig. 3.—Six weeks after operation. To show the great freedom of motion.

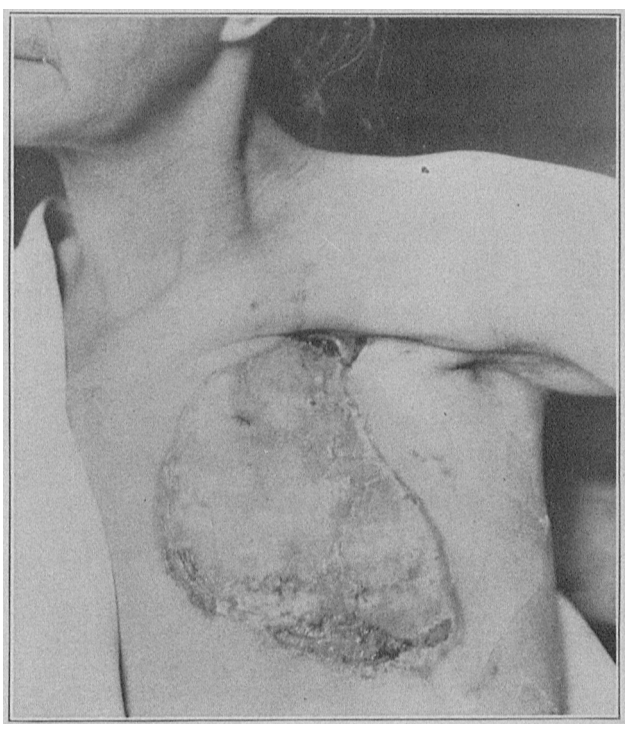

Fig. 4.—Six weeks after operation. Arm at right angle to body. Shows subclavicular fold of redundant skin.

In certain cases, as is well known, there is a particular and, it may be, early tendency of the cancer to disseminate itself in the skin and to develop the cancer en cuirasse. I formerly regarded the prognosis in these cases as quite hopeless, but my experience in comparatively recent years encourages me to feel that there may

be a much better chance for some of these patients than is generally believed. In the case referred to immediately above in which from repeated operations the woman had become actually flayed over the entire front, sides and part of the back of the thorax and over the abdomen down to the crest of the right ilium, there was at autopsy[1] no microscopic evidence of cancer in the glands or viscera or elsewhere. Dr. Winternitz, however, who made a most painstaking post-mortem examination, reported that microscopically one of the mesenteric glands and a piece of tissue removed from the cicatricial

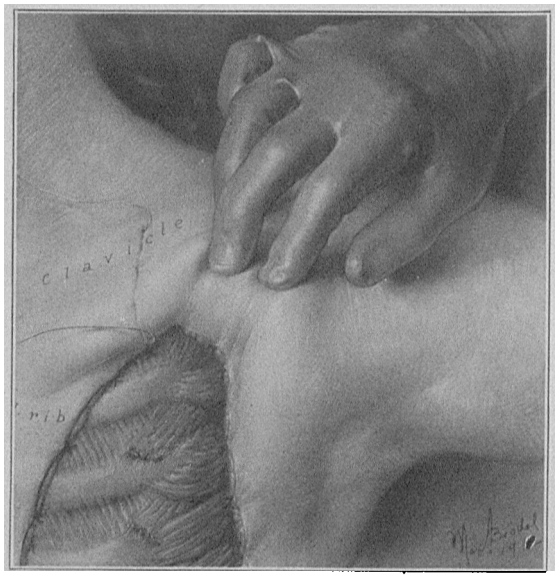

Fig. 5.—The redundant fold of skin is held up by the fingers. The skin has been stitched to the underlying muscles at the margin of the area to be grafted, the apex of which corresponds to the lower border of the first rib.

tissue of the right supraclavicular region showed involvement. At the operation above the right clavicle, performed about one year before the patient's death, it was observed that the carcinoma had invaded the tissues outside of the lymphatic glands and was extending into the sheaths of the nerve trunks of the brachial plexus. It was surprising, we thought, that the recurrence in this region had not manifested itself promptly.

It occurred to me that it might be well in certain cases evidencing this special tendency to skin metastasis—to regionary recurrence confined to the skin—to surround the denuded and grafted area, more or less completely and as might seem indicated, by a kind of moat with the hope that by such expedient the disease, should it continue to spread in the skin, might be confined to the region intervening between the two grafted areas—between the main wound and the moat placed at some distance from it.

The moat is formed by the excision of a narrow strip of skin with its underlying fat and loose fascia. Possibly the gap caused by the mere incision through the skin down to the sheaths of the muscles might suffice.

If the moat is made at the time of the primary operation the grafts should be of the Thiersch variety and covered with silver-foil. If the grafting of the moat has for any reason to be deferred—to be made secondarily on a granulating surface—the Reverdin grafts are preferable.

1. The patient died from a general infection contracted a few days after her temporary discharge from the hospital and as the result, probably, of a very fatiguing railway journey.

Silver-foil is not a suitable dressing for grafts placed on a granulating or infected surface; a piece of gutta-percha tissue riddled with holes like a porous plaster or, as suggested and practiced by Dr. Staige Davis, a rubber mesh, or some other permeable non-adherable covering should be employed. But when the surface is not infected and it is desirable to leave the dressing undisturbed for a week or more, as after operations for mammary cancer, the silver-foil has proved at our clinic to be an admirable dressing for the grafts.

3. Recurrences in the deeper planes may be promptly detected under the thin, grafted skin. These should be burnt away, down to the pleura if necessary, with the actual cautery. When the defect is covered by normal skin, as in an incomplete or in a plastic operation, not only is the underlying recurrence concealed for an indefinite period, but also the transferred skin with its lymphatic channels brought from a distance, when it becomes involved, aids in the dissemination of the disease.

We disapprove of the clever suggestion to cover the defect by the transfer of the opposite breast; less perhaps on account of the more obvious objections to it than because with this procedure recurrences in the denuded area would be so deeply covered that they could not be discovered promptly, or, perhaps, not until the transplanted breast had become involved.

One may be compelled to resort to a plastic operation when the tumor has extended so far into the axilla as to

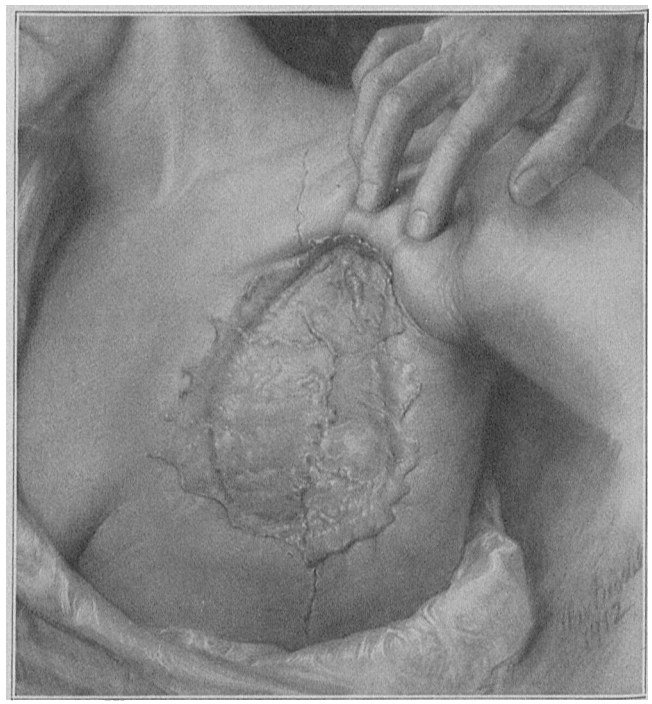

Fig. 6.—The redundant fold of skin being retracted. The defect has been covered by the Thiersch grafts.

make it necessary to provide skin from elsewhere to assist in covering the axillary vessels. Under these circumstances a more or less vertical cut up the neck on the opposite side has sufficed to release the skin which seemed available.

4. The inner or thoracic wall of the axilla being lined to the extreme apex with grafts, the skin of the outer flap may be utilized, *in redundant fashion*, for covering the axillary vessels, for obliterating the subclavian dead space and for elevating the axillary fornix.

1201 Eutaw Place.