

RISTO KIVILAAKSO: Changes in the Whole-Thickness Skin Graft Buried in Tissue

Experimental Study

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Ejnar Munksgaard, Copenhagen 1955

(Author's Abstract)

The purpose of the investigation was to elucidate, by means of animal experiments:

1. the fate of the epithelium of the whole-thickness skin graft both in abdominal cavity and in subcutaneous tissue,
2. how the attachment of the whole-thickness skin graft to muscular tissue and to tendon tissue occurs,
3. what changes take place in the whole-thickness skin graft under tension when embedded in tissue and subject to pull from different directions as in a muscular defect, and when subject to pull in one direction as is the case in a tendon defect.

Only rabbits were used for the experiments. To study changes of the skin graft in a muscular defect, the lateral part of the abdominal walls was used, and in a tendon defect the Achillis tendon was used. In all 75 operations were made, and the changes in the skin graft were studied both with the naked eye and microscopically after varying periods from operation, ranging from 3 to 360 days.

In cases which run a regular course towards the end of the first week, the accumulation of lymphocytes and leucocytes has pushed between the epithelium and corium where it thrusts its way onward like a wedge, detaching the epithelium. At the beginning of the second week this exsudate is replaced by granulation tissue, which first divides the epithelial layer into small islets around the hair follicles. These, too, disappear by the beginning of the third week, so that on the analysis slide at 15 days, there is no longer any epithelial tissue present.

Yet if some of the epithelial cells have succeeded in surviving this time, they tend to form small cysts, which do not hamper the healing of the site of the implantation much, nor its function. One real complication, though a rare one, is the appearance of large cysts of macroscopic size, which are due to the disappearance of the tension in the graft, which with its epithelium then forms a part of the wall of the cyst.

The hair stumps inside the follicles as a rule line up parallel with the tension from the beginning of the third week, and such fragments

occur even in transplant sites of a year's duration without any reaction being noted in the adjacent tissue.

The disappearance of the epithelium occurs in approximately the same manner in the abdominal cavity and in subcutaneous tissue.

The attachment of the skin graft to the muscular tissue takes place as follows: first some exsudate accumulates in the space between the graft and the muscle. At the end of the first week the exsudate is replaced by a loose young tissue rich in cells and capillaries, which seems to originate in the internal and external perimysium. At the same time, this tissue begins to penetrate into the interstices between the fibril bundles of the transplant which have widened evidently because of the oedema. Towards the second week fibril strands which follow the course of the tension begin to form in this young tissue. During the maturation phase, after the second week, these fibril strands group themselves into fibril bundles and they proceed from the internal and especially the external perimysium, whose own fibril bundles have thickened. The muscle cells themselves remain completely passive.

In the attachment to the tendon the granulation tissue seems to have its origin in the connective tissue covering the tendon, which proliferates considerably, and possibly to some extent in the connective tissue inside the tendon, the endotenon. At the tendon stump ends the fibril bundles break up into strands and the new granulation tissue penetrates between these strands apparently thus attaching this young tissue to the original tendon. Yet it should be noted that no division seems to take place in the tendon cells themselves, so that the tendon does not participate in the act of attachment.

Changes in the skin graft itself occur in approximately the same manner in the muscular tissue and in the tendon defect.—During the first week the interstitial spaces between the fibril bundles of the transplant fill up with exsudate and lymphocytes and leucocytes. During the second week this exsudate is replaced by loose granulation tissue which penetrates into it from the surroundings, and in the marginal part also begins to force its way into fibril bundles breaking them up into fibril strands. This process continues in the third week while at the same time the fibril strands adopt the direction of the tension. Simultaneously new thin fibril strands begin to form. In the fourth and fifth weeks, along with an increase in number, the fibril strands group themselves into parallel bundles, whose thickness and strength increase with time while the cell concentration decreases and the cell nuclei change into stab forms.

In 90-day preparations, when a quiescent phase has set in, the

graft area resembles a normal fascia or tendon although the amount of cells remains somewhat above normal. The effect of the tension becomes clearly apparent through the fact that in the tendon defect when the graft is under tension acting in one direction, all the fibril strands, both those which have formed through division, and the new ones, and later the fibril bundles, organize themselves in the direction of the tension. In the muscle defect, on the other hand, when under tension from different directions, the fibril strands on the same level pursue a parallel course, but those at different levels cross each other. This is because the direction of the muscular tension varies on the different levels and the fibril bundles follow the direction of the tension acting on each level.

The experiments have shown that when a whole-thickness skin graft is used the organism destroys or isolates in it the tissue which is ectodermal in origin, and transforms the tissue which has developed from the mesoderm into an organic part of itself.

MAC FELLÄNDER: Radical Operation in Tuberculosis of the Spine

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(Author's Abstract)

This work is a study of 100 patients with tuberculous spondylitis, who were subjected to radical operation combined with chemotherapy.

The bone lesions were exposed in the thoracic region by costo-transversectomy, and in the lumbar region by extraperitoneal incision. The operation was performed primarily without pretreatment. A poor general condition was not considered to be a contra-indication, nor was the presence of other tuberculous manifestations. The postoperative orthopaedic treatment consisted in recumbency in a plaster bed for about two months.

By the operative procedure employed patho-anatomical observations could be done in stages which earlier have not been subjected to study. In a few cases bone lesions occurred without an abscess and sometimes centrally in the vertebral bodies, the surface being intact. These closed bone lesions could also be attacked by surgery. The so-called anterior spondylitis which is generally considered to be a special form with superficial tuberculous destruction of the vertebral bodies

is in the author's opinion caused by pure pressure from an abscess, at least in an early stage.

Besides histological examination, culture for the tubercle bacillus, guinea pig inoculation and routine culture were carried out on material collected at operation. This comprehensive investigation was found to be of value in establishing a correct diagnosis. In eight cases other conditions than tuberculous spondylitis were revealed, chronic pyogenic osteomyelitis of the spine in six and tumours in two cases.

All the patients were after operation controlled by continuous clinical and radiographic examinations. The period of observation was one to four years. In view of the short period of observation it has been stressed that although the results may not be regarded as definite, the investigation is necessary to enable a further elaboration of the therapeutic method. Sixty-two patients were fully able to work and 73 could be regarded as clinically healed with respect to the spondylitis.

The mean length of hospitalization was 5 months. Two-thirds of those patients who were able to work returned to employment within the first postoperative year.

The radiographic results were divided into the following groups: I: Total block; II: Partial block; III: Clear outlines; IV: Doubtful; V: Not healed. Patients belonging to the first three groups were judged as radiographically healed. Healing occurred in 52 per cent of the cases. 16 per cent were doubtful, but probably in the healing stage.

Radiographic healing occurred in a much shorter time than after conservative treatment. Six patients obtained healing in less than one year, and of 31 patients who had been controlled by X-ray at regular intervals all had healed two and a half years after operation.

None of the patients who were operated upon after the age of 60 years showed either clinical or radiographic healing and therefore radical operation in such cases is recommended only when the clinical symptoms are marked.

Five patients in this series had paraplegia. With respect to both restoration of motor function and healing of the tuberculous process the results were so good that radical operation is recommended without previous expectant treatment.

The presence of coexisting extraspinal manifestations of tuberculosis did not influence the results. In the pre-chemotherapeutic era the prognosis was very unfavourable in such cases. Radical operation for the spondylitis seemed to have a beneficial effect on coexisting active pulmonary tuberculosis.

In 25 cases with well-defined bone cavities these were filled with bone after the radical evacuation. No serious disadvantages of this

intervention were noticed. Thirteen of these cases could be regarded as radiographically healed. The method is recommended in cases of lesions that radiographically show a not very marked inflammatory perifocal reactive zone, and the most suitable bone filling material is spongy bone, autoplasmic or homoplasmic.

Osteosynthesis between arches and spinous processes did not improve the results; in fact, sometimes it prevented block formation between the vertebral bodies.

Recurrence of a sinus or an abscess was recorded in 36 cases, being soft-tissue recurrence in more than half of the cases. The end-results were not adversely affected by these recurrences. Some cases healed spontaneously, but most of them were subjected to reoperation which usually was a smaller intervention than the primary operation.

At the end of the observation nine patients had died, all from tuberculous disease. Three patients died in connection with the operation. In five of the cases the operation did not, from all indications, affect the unfavourable course.