

KAOKO O. KETTUNEN: Skin Arthroplasty in the light of Animal Experiments with special reference to Functional Metaplasia of Connective Tissue.

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Ejnar Munksgaard, Copenhagen 1958

(Author's Abstract)

The purpose of the animal experiments carried out was to elucidate the changes which take place in an autogenous full-thickness skin graft when used as interposition material in arthroplasties in the hip joint of cats.

Thirty-seven adult cats in all were used for the experiments, on 30 of which, comprising the experimental series, a skin interposition arthroplasty was made in the left hip joint. In the operation the joint cartilage of the acetabulum was removed and a full-thickness skin graft was inserted into the acetabulum so that the epidermis faced the freshened articular surface. The control series consisted of seven cats subjected to the same operation as was carried out in the experimental series, but without interposition. The periods of observation ranged between the 7th and 240 days from the operation.

The joints operated upon were under observation macroscopically and by roentgenography. The fate of the interposition material was studied by histological, histochemical and historadiographical examinations.

The results obtained in the experiments may briefly be summed up as follows:

In the control series, in which no skin interposition was used, the articular surface mainly consisted of naked bone surface. Roentgenographically the articular space in the joint operated upon had either narrowed or partly disappeared. Microscopy showed that the granulation tissue growing from the freshened articular surface became destroyed through the effect of articular weight and function that the new connective tissue was only preserved in areas where the articular weight was slight. Under the influence of loading and function the preserved connective tissue underwent metaplastic development into cartilage. Yet the cartilage formed no continuous extensive layer to replace the articular cartilage but occurred in the form of small islets in hollows of the uneven articular surface.

In the experimental series the autogenous full-thickness skin graft

proved a very suitable material for interposition in arthroplasties. The organism tolerated the full-thickness skin graft as interposition material in the joint very well. During the two first months of observation the graft was still distinguishable. In the course of the third month of observation the interposition material was transformed into tissue which macroscopically had the appearance of cartilage; the articular surface became covered by a thin continuous layer of cartilage. The inserted skin exhibited a good vitality and tolerated the loading due to the joint well. Both macroscopically and in x-ray films the skin arthroplasty joint exhibited a development to a joint with functionally highly valuable characteristics.

Microscopically the epidermis of the skin graft was seen to degenerate owing to wear and tear of the joint and no epithelial cysts formed.

From the freshened articular surface of the acetabulum granulation tissue grew between the graft and the bone surface. The new connective tissue also replaced the disintegrating islets of epidermal cells and the degenerating subcutaneous fatty tissue. Both in the cutis and in the new connective tissue the fibrils line up parallel with the outline of the articular surface owing to the weight of the joint, during the two first months of observation. At the beginning of the third month a process of cartilaginous metaplasia manifests itself in the connective tissue used as interposition material. The metaplasia begins and reaches its most advanced stage in the weight-bearing area of the joint. At the initial stage of the process the ground substance of the connective tissue increases, the collagenous fibres break up into thin undulating fibrils which seem to disappear into the ground substance. At the same time slightly differentiated connective tissue cells may be seen in the increased ground substance, gradually transforming themselves into cartilage cells. The cartilage resulting from the metaplastic development is histologically of either fibrous or hyaline type. In the absence of loading and function of the joint no cartilaginous metaplasia takes place.

In the course of the metaplasia both metachromasia and the P.A.S. positive material increase in the ground substance. The substance staining metachromatically which was decomposed by the testicular hyaluronidase enzyme, is chondroitin sulphate A. The P.A.S. positive material was resistant to testicular hyaluronidase and malt diastase and very likely is one of the neutral mucopolysaccharides.

In historadiography the mass of the normal connective tissue mainly localizes in tissular fibrils while considerably less of ground substance

mass is seen. In the connective tissue undergoing metaplasia homogenization of the distribution of the mass was apparent. This may be accounted for, on the one hand, by the increase in the mass of the ground substance, on the other by the breaking up and merging with the ground substance of the mass of the connective tissue fibrils.

The new metaplastic cartilage showed no appreciable tendency to ossification.

The authors concludes that the autogenous whole-thickness skin graft with subcutaneous fatty tissue is eminently suitable as interposition material. The epidermis of the skin is destroyed by the weight and function of the joint and the connective tissue acting as interposition material undergoes functional metaplastic development into cartilage. If no interposition material is used, articular weight and function tend to destroy the granulation tissue growing from the freshened articular surface so that in these cases the articular surface consists of naked bone.

ERKKI KALLIO: Skin Arthroplasty of the Hip Joint and Corresponding Alloplastic Methods in the Light of a Clinical Study.

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(Author's Abstract)

The object of this work was to investigate the results obtained with a new method of arthroplasty in which whole-thickness skin with fatty tissue is used as interposition material, and which has been developed in the Orthopaedic Clinic of the University of Helsinki. Follow-up examinations were simultaneously made of the patients on whom alloplastic hip arthroplasty had previously been performed in the Clinic. Since furthermore nearly all the operations had been performed by the same surgeon, this provided a good opportunity to compare the results of the recent skin arthroplasties with those of the earlier vitallium cup and endoprosthesis arthroplasties.

After a survey of the literature on arthroplasties the writer reviews the publications dealing with the use of skin for this purpose. Skin was used already earlier as an interposition material in arthroplasties but the data on these isolated cases is limited almost to brief references only. Following a chapter describing the statics and mechanics of the