ABILITY OF INDUCED BONE TISSUE TO SUPPORT ITSELF

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The ability of induced bone tissue formed under the influence of transplanted transitional epithelium to support itself was studied by autoradiography. After resorption of the transitional epithelial graft, accompanied by a marked decrease in the proliferation activity of this tissue, the induced bone tissue also was found to cease proliferation.

The appearance of extraskeletal osteogenesis in the adult organism under the influence of transitional epithelium is an example of a typical process of induction. Bone tissue develops under the influence of both auto- and homografts of transitional epithelium [2-5, 9]. The induced osteogenesis commences on the 10th day after transplantation. In the case of autografting of transitional epithelium the induced bone tissue grows until the 20th day after transplantation and then, according to results obtained by a number of workers, it passes into an equilibrium or steady state [4, 9, 10]. So far as the bone tissue induced by the homografts of transitional epithelium is concerned, because of an immunological reaction which develops by the 20th-25th day after transplantation, resorption of the transitional epithelium takes place. Investigations [3, 4, 9, 10] have shown that resorption of the transitional epithelium is followed by resorption of the induced bone. Other workers, including Dozinel [5], report that after resorption of the transitional epithelial homograft the induced bone tissue continues to exist indefinitely. Consequently, the question whether bone tissue requires the constant action of the inducer in order to maintain its histogenesis or whether it can support itself remains unresolved.

It was therefore decided to study the proliferative activity of induced bone tissue in the period of resorption of the transitional epithelial homograft.

EXPERIMENTAL METHOD

Minced tissue of the urinary bladder wall was transplanted homoplastically beneath the fascia of the rectus abdominis muscle of five guinea pigs weighing 250-300 g. The donor animals were sacrificed, laparotomy performed, and the urinary bladder removed.

In control experiments autografting of the urinary bladder wall was performed.

On the 25th day after transplantation the animals received an injection of thymidine-H^3 in a dose of 1 μCi/g body weight and were sacrificed 1 h later. The grafts and surrounding tissue were fixed in Carnoy's solutions and decalcified in 5% HNO_3. After histological treatment, sections were cut to a thickness of 5-7μ and every tenth section was used. They were treated for 20 min in 3% perchloric acid solution, dried, and coated with type M liquid emulsion. Exposure lasted 21 days. After development, the sections were stained with hematoxylin and methyl green-pyronine. Cells with at least five grains of silver more than the background were regarded as labeled.

EXPERIMENTAL RESULTS

The homografts of transitional epithelium were much smaller and softer than the autografts.

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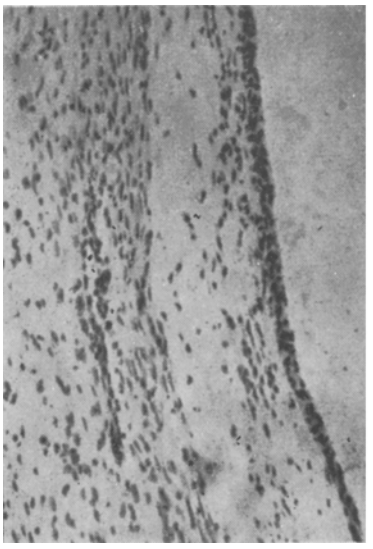

Fig. 1

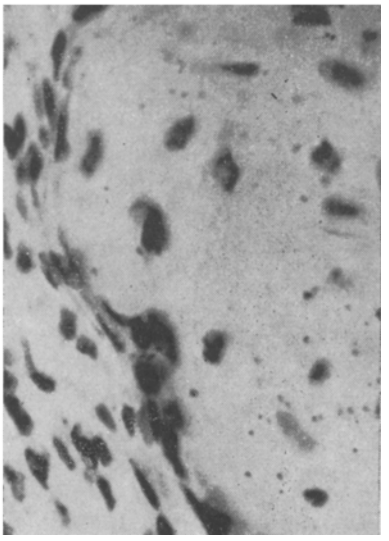

Fig. 2

Fig. 1. Induced bone tissue on 25th day after transitional epithelial homografting. Layer of homografted transitional epithelium undergoing resorption can be seen on the right. Hematoxylin, 20 ×.

Fig. 2. Sources of bone tissue induced by transitional epithelial homograft on 25th day after grafting. Hematoxylin, 60 ×.

Epithelial cysts were visible in the sections through the homografts. Their walls were thin and in many places their integrity was disturbed. In the layers of epithelium lymphocytes were seen among the epithelial cells, and some of them were labeled. The layers of epithelium were not equally infiltrated by lymphocytes. However, regardless of whether the layers were infiltrated with lymphocytes or not, or whether the integrity of their structure was preserved or not, no labeled epithelial cells could be found. Connective tissue in the region of the epithelial cysts were infiltrated by lymphocytes. The induced bone tissue lost its characteristic appearance (Fig. 1 and 2). The layer of osteoblasts in many places was absent altogether and the bony matrix was directly contiguous with the fibroblastic layer. All the osteoblastic layer still remained, it was ill-defined. No labeled osteogenic cells could be found. The index of labeled cells nearest to the focus of osteogenesis was 3-4%. Mostly fibroblasts and lymphocytes were labeled, and no labeled preosteoblasts could be found.

In the autoradiographs obtained from autografted animals the morphology of the transitional epithelial grafts and of the induced bone tissue was the same as that described previously [1-4, 9]. The layer of epithelium preserved their integrity. The index of labeled epithelial cells in the inducing layer was 0.8%. The bone tissue retained its characteristic appearance and the layer of osteoblasts and preosteoblasts was clearly defined. The index of labeled osteoblasts and preosteoblasts was 1-1.5 and 3.5-5% respectively.

As the results show, during resorption of the homografted transitional epithelium, as reflected by a disturbance of the integrity of the epithelial layers and disappearance of proliferative activity, proliferation of the induced bone tissue also ceased, whereas after the autografting operation, when the transitional epithelium persisted indefinitely, the induced bone tissue also continued to proliferate. This applies both to the 25th day after transplantation and also to later periods [1, 2]. The information obtained is evidence that the character of histogenesis of induced bone tissue depends on the inductive activity of the transitional epithelium and on its inability to support itself.

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