

STUDIES ON BONE TRANSPLANTATION IN THE FRONTAL SINUS OF PATIENTS AND DOGS

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Chronic frontal sinusitis is a frequently encountered surgical problem of rhinology. Difficulties in the surgical cure of this disease are produced by a tendency toward reinfection and the formation of mucocoele and pyocoele. Deformity of the operative region was also a frequent sequel. For these reasons we have been somewhat reluctant to do surgical procedures on the frontal sinus.

We have obtained better results after animal and clinical experiments using autogenous and homogenous bone transplantation into the frontal sinus indicating that this technical improvement would enable us to avoid most of these postoperative complications.

Animal experiments

Healthy adult dogs were used as experimental animals and two types of bone were implanted into the frontal sinus:

1. fresh autogenous bone fragments, obtained from the iliac crest; and
2. homogenous bone fragments which had been preserved in 0,1 percent solution of merthiolate.

The same type of bone was implanted in both frontal cavities of each dog after all soft tissue had been removed. Prior to implantation, the bone fragments were kept in a buffered solution containing penicillin and sulfa while the implantation site was being prepared. The homogenous bone fragments were found to be sterile on culture in every instance and extreme care was taken to avoid contamination during the implantation.

After sacrifice each frontal region was exstirpated as a single block and after decalcification serial celoidin sections were prepared and stained with hematoxylin and eosin.

Findings in dogs: (1) Autogenous bone after one week; the frontal cavity was found to be filled with connective tissue and some resorption of the implanted bone, associated with the presence of osteoblasts. Osteoblasts and abundant capillary proliferations were evident in the connective tissue. After one month; osteoblasts and capillary proliferation increased in frequency and in volume and became more dense. At this time adiposoid-tissue began to appear. At three months: the cavity was completely filled with adiposoid tissue and trabeculae and the establishment of functional bone reformation was evident. The histological behavior of the tissue of the series (2) in which homogenous

bone had been implanted, resembled that of group (1) except that the production of granulation tissue was three times as great as that associated with the autogenous fragments.

Throughout the study inflammatory reactions were not particularly evident in either series.

After the above experiment we investigated the question as to whether or not the transplanted homogenous bone might act as antigen and produce an antigen-antibody reaction. Each week after implantation during a six-week period the dogs were bled from the femoral vein and serum was collected. The results of precipitation tests showed that specific antibodies against the implanted bone had not been formed. At the same time we investigated the question as to whether there was any fluctuation of the segmentation of serum-protein, especially that of γ -globulin, which might have been caused by homogenous bone transplantation. We found that while total protein, alpha- and beta-globulin and the A/G ratio did not fluctuate significantly γ -globulin increased in from one to two weeks after operation.

Clinical experiments: The frontal sinuses on 92 sides of 72 patients with chronic suppuration of the frontal sinus were operated on. The bony plate forming the anterior wall of the frontal sinus was completely excised and the lining mucoperiosteum of the sinus was completely removed. The nasofrontal opening was enlarged. Autogenous or homogenous bone fragments were then implanted in the involved sinus. The incisional wound was closed by primary suture.

In patients with bilateral frontal sinusitis we operated as a rule on the left side first and about 10 days later, on the right.

Autogenous bone implants: The autogenous bone was taken from the iliac crest of the patient. In 57 sides of 49 cases of chronic frontal sinusitis autogenous bone was implanted. Two sides of 2 cases showed evidence of infection during the first week. The infection subsided in one case after one week of penicillin injection into the infected region. In the other infected case the implants were removed but the size of the sinus was greatly reduced, by the proliferation of granulation tissue. The 55 sides of the 47 remaining cases healed without evidences of infection.

Homogenous bone implants: Homogenous bone implants were inserted on 35 sides of 23 patients. Rib-fragments were used which had been stored from 3 days to one month in 0.1 % merthiolate solution. Bacteriological examination of the rib fragments before implantation showed no evidence of contamination. Healing occurred without incident except in 2 sides of 2 cases in which a post-operative fistula developed in the incision line, in one case 4 days in the other 8 days after operation. Both fistula closed spontaneously with chemotherapy. In the remaining 21 cases the postoperative courses were uneventful. After operation we followed the progress of healing in each case radiographically. We observed the presence of shadows which we interpreted as new bone formation about 50 days after the operation in the early cases. At the end of a year, the cavity was completely obliterated by new bone formation. The same results were obtained in the cases of both homogenous

and autogenous bone implants. No antigen-antibody reaction was identified in any of the cases. There were no evident fluctuation of the serum proteins.

Review of the literature: Ogston was the first to report opening the frontal sinuses for the drainage of infection. Riedel, in 1898, first described the complete oblitative operation on the frontal sinus. Mosher obtained good experimental results by filling the frontal cavity with gelatine sponge. Tato in 1954, and Bergara in 1955, reported that adipose tissue placed in the frontal sinus cavity post operatively appeared to produce satisfactory.

In using autogenous bone to fill the post-operative frontal sinus cavity we have obtained satisfactory results. This method has few disadvantages. Possibly the most important is that the patient must have the bone removed from the iliac crest. Occasionally when the cavity is too large, it is difficult to obtain a sufficient quantity of autogenous bone. These drawbacks are obviated by the use of preserved homogenous bone. We believe that from the results obtained from these experiments it is reasonable to conclude that either autogenous or homogenous bone used to ablate the frontal sinus cavity will be found satisfactory, for relieving the presenting symptoms and preventing recurrence of the disease. This technic also gives a good cosmetic appearance post operatively to the region of operation. We believe this method to be a significant improvement in the surgical technic used for external operations for the purpose of eradicating chronic suppuration involving the frontal sinuses.

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