

CHOICE OF SUTURE MATERIAL FOR OPERATIONS ON THE BILIARY TRACT

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One of the factors which detracts from the quality of operations is suture material [1, 4]. A ligature of any material induces traumatic edema and leukocytic infiltration around itself. Their intensity depends on the physical and chemical inertia of the thread, its structure, and the site of its implantation. It is particularly important to take these matters into account when the diameter of anastomosed organs does not allow wide communications to be created between them. Under these conditions ligatures may prove to be an additional obstacle to the functioning of organs on which operations have been performed [2-4, 5].

There are few references in the literature to the study of how evolution of the morphologic picture in the region of gastrointestinal anastomoses depends on the type of suture material used. In the writers' view, this is an important problem not only because of the anatomical features of the biliary system, but also because of the heterogeneity of the sutured tissues and simultaneous exposure of the threads to bile, pancreatic juice, and intestinal contents.

The aim of this investigation was to determine the biologically most inert of the suture materials widely used in surgical practice.

EXPERIMENTAL METHOD

Experiments were carried out on 75 mongrel dogs. An end-to-side choledochoduodenostomy was performed on all the experimental animals under ether anesthesia. Depending on the suture material used the experiments were divided into the following series: catgut - 25 animals (series I), silk - 25 animals (series II), Kapron - 25 animals (series III). In all experiments the anastomosis was formed by a double layer of sutures. For the second (buried) row of sutures No. 3 silk was used.

Macroscopic and microscopic investigations of the anastomosis were undertaken 3, 7, 15, 30, 90, 180, and 360 days after the operation. Sections were stained with hematoxylin and eosin and by Van Gieson's method, acid and alkaline phosphatase activity was studied by Gomori's method and nonspecific esterase activity by the simultaneous azo-coupling method of Nachlas and Seligman.

EXPERIMENTAL RESULTS

Ligatures were found during macroscopic study of six preparations in the region of the mouth of the anastomosis 90 and 180 days after the operation. In two experiments of series I the silk threads had sloughed from the second row of sutures. In every case the ligatures disturbed the normal outflow of bile to some degree, as shown by dilatation of the extrahepatic bile ducts. In nearly all cases threads of suture material were adherent to a small vessel or nerve fiber, which prevented their complete separation.

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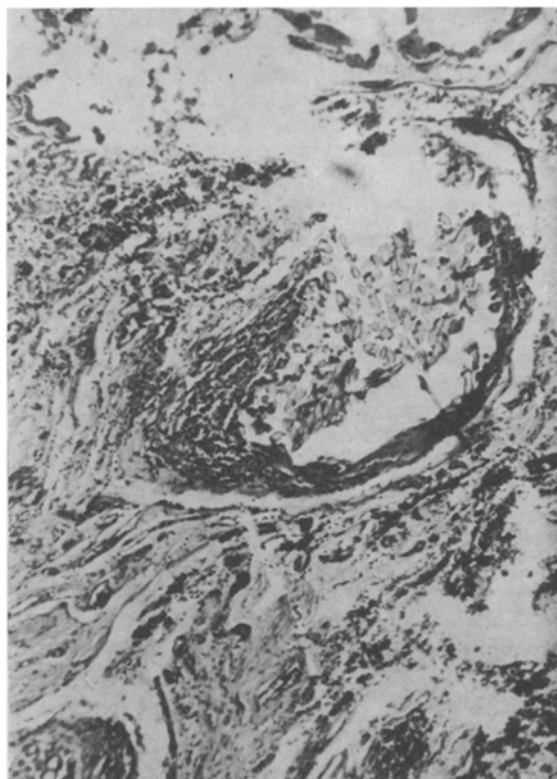


Fig. 1. Morphologic picture of anastomosis on 30th day after operation: capsule around Kapron thread, consisting of multinuclear macrophages and epithelioid cells (inner layer) and collagen fibers with fibrocytes (outer layer), 90 \times .

Microscopically, as early as on the first day after the operation the suture material in the experiments of series I showed fragmentation. A foreign body granuloma with solitary multinuclear giant cells and with increased nonspecific esterase activity, could be seen around the threads. In the region of chromic catgut ligatures extensive hematomas with signs of organization were found. In the experiments of series II grouping of macrophages with high esterase activity and of leukocytes with alkaline phosphatase activity was found. The same cells were distributed among the fibers of suture material. In preparations from series III the threads were surrounded by a zone of moderately intensive productive inflammation, in which two layers of cells could be differentiated. Immediately next to the fibers was a layer of multinuclear macrophages and epithelioid cells. The outer layer was formed by collagen fibers with fibrocytes (Fig. 1).

By the 30th day the morphologic pattern of anastomosis in experimental series I was characterized by the presence of fragments of catgut thread, surrounded by macrophages with moderately visible enzyme activity. In test series II and III the threads were enclosed in a two-layered capsule composed of macrophages, fibroblasts, fibrocytes (in series III preparations), and collagen fibers.

From 90 to 180 days after the operation particles of catgut threads surrounded by collections of macrophages were present in the region of the anastomosis. In most experiments of series II the silk ligatures of the first row of sutures could not be found. Ligatures not yet sloughed were present among the fibers, surrounded by a considerable layer of epithelioid cells with weak enzyme activity, beyond which was a fibrous capsule. In some experiments the cell reaction was considerable and extended to neighboring tissues in the form of inflammatory infiltration. At this period migration of ligatures was observed into the intestinal lumen from the buried layer of sutures. These ligatures were surrounded by a zone of nonspecific productive inflammation, involving many macrophages (Fig. 2).

Silk ligatures surrounded by a double-layer capsule and belonging to the first row of sutures were still present at the edges of the anastomosis scar 1 year after the operation

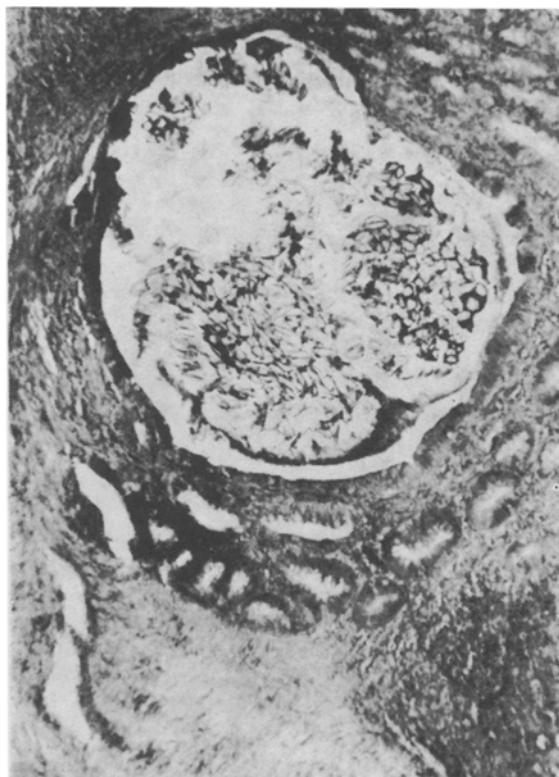


Fig. 2. Morphologic picture of intestinal mucosa 90 days after operation: section through silk thread migrating from buried layer of sutures. Surrounded by zone of nonspecific productive inflammation, 90 \times .

in only one of six cases. In most experiments, however, ligatures of the second layer were found. The capsule consisted of three layers of cells. The inner layer was formed by lymphoid cells, the next layer consisted of epithelioid cells and fibroblasts arranged perpendicularly to the thread, and the third layer consisted of lymphoid cells, macrophages, empty capillaries, and solitary fibroblasts. In three of six cases in series III Kapron threads surrounded by a thin fibrous capsule were present at the edges of the anastomosis scar.

The use of types of suture material widely used in surgery of the biliary system (catgut, silk, Kapron) thus causes the development of very different morphological processes in the region of the suture. Despite early fragmentation, catgut threads remain for a relatively long time in the tissues of the anastomosis, maintaining cellular activity in their vicinity.

The polyfilamentary structure of silk gives rise to marked inflammation in the suture track and delayed maturation of connective tissue, which are basically due to long contact between tissues of the suture track and liquids of a highly irritant nature. A particularly unfavorable factor is delayed sloughing of silk ligatures.

The morphologic picture around Kapron threads is distinguished by more rapid cell differentiation leading to the formation of a connective-tissue layer of minimal size in the region of the choledochoduodenostomy. This fact indicates that Kapron is the biologically most inert of the types of suture material studied.

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