

SURVIVAL OF VENOUS PATCHES AUTOGRAFTED INTO THE COMMON
BILE DUCT IN DOGS

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UDC 616.367-089.843-032:611.14]-092.9

KEY WORDS: bile ducts; microsurgery; venous patch

In clinical practice it is frequently necessary to reconstruct or repair the common bile duct (CBD) in the case of stenosis, injury during operation, or excision in connection with removal of a growth. Not only have various bypassing operations been developed, but the search for material which would enable plastic procedures aimed at restoring the CBD to be performed is being pursued vigorously.

The aim of this investigation was to study the possibility of using an autologous vein to replace defects in the anterior wall of CBD. Attempts of this kind were undertaken as long ago as in 1909 by A. F. Bashkirov [1], and later by many other workers [2, 3, 7, 10], but all were unsuccessful. Patches of this kind did not survive in experiments on dogs. Either peritonitis developed after the operation or, if the animal survived, the venous graft underwent severe fibrosis which led to stenosis in the zone of the operation. In clinical practice autologous venous patches (AVP) have been used extremely rarely, and in all cases a rigid internal support was used for drainage [2]. The use of an AVP without drainage tube to close a defect in CBD temporarily is not satisfactory, because fibrous degeneration of the AVP always caused shrinking followed by stenosis of the duct. The authors cited above, who performed these operations, used ordinary surgical techniques. On theoretical grounds, the present writers concluded that ordinary operative techniques adversely affect survival of the AVP in the wall of CBD. In particular, compression of the AVP by the ordinary forceps and clips usually used in surgery is detrimental. These manipulations are extremely traumatic, and this must of course be reflected in the subsequent course of repair processes. The use of quite thick suture material, in our opinion, also is disadvantageous. The workers who performed these experiments [4-6, 11] used atraumatic No. 1-0 or No. 2-0 suture material. For operations of this kind, as our experience has shown, puncture of the AVP and the wall of CBD by such needles is quite traumatic and rough. Formation of sutures by threads of this thickness also is very traumatic. Bile leaks through the puncture wounds and microfissures thus formed. This may have two results. First, if leakage of bile is slight, foci of infiltration form, complicated in some cases by infection, or even by the formation of microabscesses. Later this leads to progressive cicatrization. Second, in more severe cases the leaking bile and local activation of infection cause lysis of the patch either at its junction with the wall or totally, with subsequent development of local peritonitis. To avoid these complications, when performing operations of this kind the present writers have used microsurgical techniques.

EXPERIMENTAL METHOD

Experiments were carried out on seven mongrel dogs of both sexes weighing 13-20 kg. The animals were anesthetized by intravenous injection of pentobarbital (25 mg/kg) and lay on their left side. Artificial ventilation of the lungs was maintained throughout the experiment. In the first stage of the operation the left femoral vein was resected through an ordinary longitudinal incision on the medial surface of the thigh. A segment of vein 15-20 mm long was removed, thoracotomy was performed through the third intercostal space inferiorly, and the diaphragm was incised in the radial direction. To give better exposure, the edges of the diaphragm and dependent lobes of the liver were sutured to the wound edges. By traction on the

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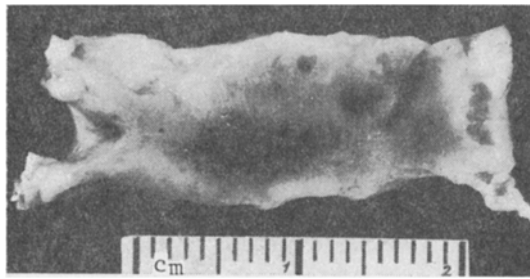


Fig. 1. Specimen of CBD. Autologous venous patch: dark in color, covered by shining, slightly rough mucous membrane of CBD, perimeter of duct unchanged.



Fig. 2. Autologous venous patch covered by normal mucous membrane of CBD. Arrow indicates suture material. Combined staining by Weigert's method (with fuchselin) and with hematoxylin and eosin. 30 x.

duodenum the gastroduodenal ligament was brought up into the wound. All subsequent manipulations were done by microsurgical techniques. The OM-2 operating microscope, made by the Leningrad "Krasnogvardeets" combine, was used. The microforceps, microscissors, and microneedle-holder were made at the Mozhaisk medical instrument factory. All manipulations were carried out under a magnification of 8-16. The CBD was separated from areolar tissue around the whole of its circumference for a distance of 30 mm. The proximal and distal portions were clamped. A "window" 8-12 mm long and 2-2.5 mm wide was excised in the anterior wall of the duct. An AVP, cut out in the shape of the "window," was sutured into the resulting defect. Circular suture with No. 8-0 prolene thread was used. The clamps were removed from the duct. The airtightness of the suture was verified by pressure on the gall bladder and by cholangiography. The diaphragm was closed with a continuous No. 1 silk suture. The chest was closed with interrupted sutures and air was evacuated from the pleural cavity at the end of the operation.

through a drainage tube. Postoperative management of the dog was as usual. Altogether seven experiments were performed. No additional therapeutic procedures were used, and the body cavities were not drained. Material for histological examination was embedded in celloidin. The remaining five animals remained under postoperative observation for a longer time. Serial sections were cut to a thickness of 10 μ , stained initially with fuchsin by Weigert's method for elastic fibers, and then counterstained with hematoxylin and eosin, so that structures of the vein could be differentiated clearly in the duct wall.

EXPERIMENTAL RESULTS

The postoperative period was uncomplicated in all seven dogs. In this report we give the results obtained 1 month after the operation. Laparotomy revealed no foci of infiltration, including along the course of CBD. Only friable adhesions, easily broken down by blunt dissection, were found. All the organs lay freely in the abdomen. Their syntone was undisturbed. The CBD was easily identified. Its diameter was normal throughout its length. Not the slightest sign of dilatation was present. The liver and pancreas likewise showed no change. A segment of the duct in the zone of the operation 25-20 mm long was removed and incised along its posterior wall so that the state of the patch could be examined from within. Microscopically the site of the sutured patch was darker in color and covered by a shining, and slightly rough mucous membrane (Fig. 1). No signs of inflammation or of calculus formation could be seen. The sutures were not visible from within. On histological examination the venous autograft appeared to be "mounted" in the wall of the duct and was firmly adherent to it. Along the suture line proliferation of the epithelial layer of the mucous membrane was present, with the formation of cyst-like dilated glands. The patch was covered on its surface and within by proliferating collagenized connective tissue, whose fibers were circularly oriented. This connective tissue contained numerous blood vessels, mainly capillaries and arteries of small caliber. Blood vessels from the outer layers of connective tissue surrounding the patch were oriented toward it. Areas of proliferating connective tissue covering the patch within were covered by the mucous membrane of the CBD; in some places microscopic papillae were present, with the formation of glandular structures in their substance. The AVP itself could be clearly identified by staining for elastic fibers and appeared as a well preserved inner layer (Fig. 2). Thinning and fragmentation of the elastic framework of the vein, and its invasion by connective tissue cells were observed. Blood vessels resembling capillaries and arteries of small caliber could be seen in the thickness of the patch. Neither inflammatory infiltration nor a macrophagal reaction was present either throughout the thickness of the graft or in the surrounding tissues. The suture material could be clearly identified along the line of the anastomosis, but with no signs of inflammation or of capsule formation around it. Thus 1 month after an operation to suture a venous autograft into CBD, it had completely taken in the wall of the duct and its inner surface was covered with mucous membrane. These observations show that by the use of microsurgical techniques, which enable operations to be performed with the greatest possible accuracy and by means of atraumatic procedures, conditions for healing can be created that are unattainable by ordinary surgical methods.

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