

Observations on Dogs with Common Bile Duct Anastomosed with Staplers.* (30506)

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In abdominal surgery, lesions of the common bile duct, especially, present a severe complication. Recently, Michie & Gunn(3) reported an incidence of injury in the Scandinavian countries, England and Scotland, of approximately one in 300-500 cholecystectomies; the course of the patients was often marked by inflammation and damage of liver and pancreas, and mortality was high, up to 30%(1).

Many types of reconstructive procedures have been described. Because results are still unsatisfactory, we felt it worthwhile to try the Nakayama vascular stapler(4) for an end-to-end anastomosis of the cut common bile duct.

Methods. In 10 mongrel male and female dogs (11-18 kg) cholecystectomy was performed under pentobarbital sodium anesthesia. Strict asepsis was employed, and antibiotics were administered postoperatively. The common duct was isolated, and 1-2 cm were resected 2 cm above the duodenum. Vascular staplers were used as described by Nakayama (Fig. 1). Two rings of medium size (int. diameter 3 mm) were placed on both ends of the cut duct, the walls were everted and hooked on the spikes of the rings, which were then brought together by clamps. The anastomosis did not produce tension, and no foreign body was inside the duct. Before and after operation, body weight, alkaline phosphatase, and serum bilirubin were determined. Fifty-eight to 82 days after operation the dogs were sacrificed.

Results. Six dogs survived the operation; all showed a severe weight loss (avg. 2.3 kg) and high levels of alkaline phosphatase that decreased slowly. In 2 dogs the values returned to normal, whereas in one dog it remained slightly elevated. Two dogs had elevated values before the operation (Table I).

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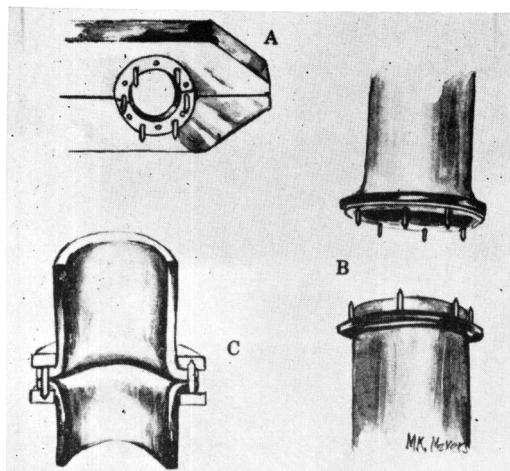


FIG. 1. Demonstration in 3 steps of end-to-end anastomosis with staplers. A: The ring placed in the clamp. B: The rings placed on both ends of the cut duct, the wall everted in the upper one. C: The staplers put together, just before the hooks are bent.

Only 2 dogs had transiently elevated serum bilirubin during the first week postoperatively (3.8 and 4.1 mg% respectively); all other dogs showed normal values.

Results of the autopsies were quite uniform. There was severe stenosis and fibrosis at the anastomosis with only $\frac{1}{2}$ -1 mm opening and dramatic dilatation of the biliary tree above the anastomosis (Fig. 2). In dog No. 3 the duct-system was filled with numerous bile-pigment stones, 1 to 3 mm in diameter, and in dog No. 5 one bile-pigment stone measuring 3 mm in diameter was found. The

TABLE I. Alkaline Phosphatase Before and After Section and Anastomosis of the Common Bile Duct (Gomori's Method, Normal Value 1-6 U).

Dog No.	Before operation	After operation		
		1 wk	4 wk	6 wk
1	1	65	19	12
2	2	51	15	8
3	19	6	8	3
4	2	36	18	13
5	8	32	10	6
6	2	20	41	32



FIG. 2. Autopsy specimen. 1. Tremendous dilation of hepatic ducts. 2. Normal common bile duct. Arrow shows the anastomosis.

livers were macroscopically normal.

Discussion and conclusions. Staplers have been a great advance for anastomosis of small blood vessels, especially in organ transplantation; long term follow-up studies have shown that small arteries and veins were patent without stenosis for long periods(2,5). Unfortunately, in the case of the common bile duct, the anastomosis resulted in fibrosis and stenosis, although at the time of operation the diameter of the duct was not changed by the rings. In our experiments, devascularization may have resulted in inflammation, edema and sclerosis; section of nerve fibers and absence of peristalsis in the duct may have been factors. Success of staplers in anastomosis of arteries and veins may be due to faster and more constant perfusion of these vessels than is the case in the common bile duct.

Gall stones in dogs are extremely rare. In

2 dogs of this series, stones were found proximal to the stenosis; no foreign body was present in the duct.

Serum bilirubin returned to normal in all dogs, while alkaline phosphatase became normal in only 2 dogs, even though there was marked stenosis and proximal dilatation of the duct.

Although our results were obtained in the dog, we cannot recommend the stapler method for repair of the common duct in humans, but this preparation may be useful for studying biological changes in non-icteric common bile duct obstruction.

Summary. Nakayama's vascular stapler was employed for repair of a cut common bile duct of 6 dogs. Two dogs had transient jaundice; high blood alkaline phosphatase levels, decreasing slowly, appeared in all 6 dogs. Autopsy 2-3 months after surgery showed severe stenosis and fibrosis at the anastomosis with considerable dilatation above. The results do not encourage the use of the method in humans.

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