

A Technic for Repeated Bile Collections from an Intact Enterohepatic Circulation (35863)

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Enzymatic (1) and gas chromatographic technics (2) for the quantification of bile acids developed in the past 10 years, have resulted in the publication of vast data on the composition of bile. Almost without exception, bile for these studies has been obtained under nonphysiologic conditions, *e.g.*, single sampling of duodenal bile from fasting humans, collections from tubes in the common duct proximal to the sphincter of Oddi, or from chronic fistula preparations. However, interruption of the enterohepatic circulation changes the composition of bile (1), concentrations of the constituents of bile vary with sampling technics (2), and the volume, total solutes and percentage concentration of constituents vary throughout a 24-hr period (3). We have modified technics, first used by Dragstedt *et al.* (4) and later by Preshaw and Grossman (5), in studies of pancreatic secretion to develop a canine preparation which allows repeated sampling of bile from an intact enterohepatic circulation.

Figure 1 is a diagrammatical representation of the method we have used to construct a duodenal pouch containing the intact sphincter of Oddi, draining through a Gregory cannula (6) into the duodenum opposite a Thomas cannula (7) in the reconstituted duodenum and extending through the abdominal wall.

Surgical technic. The upper abdomen is opened through a right paramedian incision. Vessels between the duodenum and the pancreas are carefully ligated with fine silk to mobilize a segment of duodenum 1.5 cm distal and proximal to the point of entry of the common duct. After ligation of the accessory pancreatic duct the duodenum is transected at points 1 cm and 3 cm proximal to the

main pancreatic duct. The Gregory cannula is passed through the antemesenteric wall of the duodenal segment and proximal and distal ends of the pouch are closed in 2 layers. A purse-string suture of 00 silk is placed around the point of egress of the cannula from the pouch together with 4 stay sutures at angles about the cannula. The collar of the Gregory cannula is placed snugly against the pouch wall and 2 set screws are tightened. The stay sutures and the cannula are led through 3 layers of greater omentum to prevent leakage from the pouch along the cannula. The duodenum is then reconstituted in 2 layers, and the Gregory cannula is introduced into the duodenum through a stab incision. The stay sutures from the pouch are placed at angles about the point of entry of the cannula into the reconstituted duodenum and tied snugly. The Thomas cannula is next introduced into the duodenum at a point immediately opposite the Gregory cannula. A purse-string suture and 4 stay sutures of 00 silk are placed about the Thomas cannula and the cannula is brought through the abdominal wall just below the right costal margin. The stay sutures from the duodenum are attached to parietal peritoneum snugly fixing the duodenum to peritoneum. The collar of the Thomas cannula is then screwed onto the male portion of the external phlange to prevent retraction. The incision is closed and the animals are maintained on intravenous fluids for 72 hr.

During experiments, the screw cap is removed from the Thomas cannula and a balloon catheter is placed in the Gregory cannula for total externalization of bile. A second small tube can be placed in the cork occluding the Thomas cannula to return bile to the duodenum after sampling. After completion of the experiment, the catheter is removed

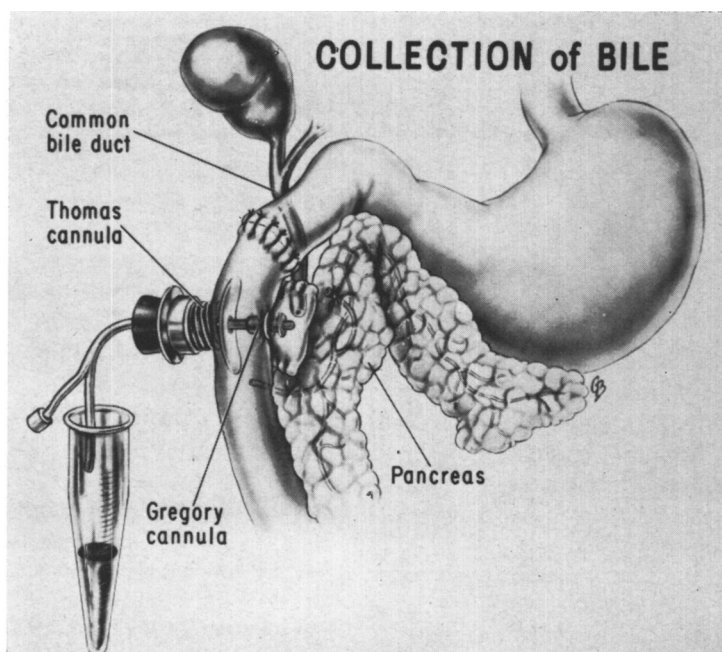


FIG. 1. Duodenal pouch for repeated bile collections.

leaving the enterohepatic circulation intact.

To document the superiority of this model for repeated total bile collection from an intact enterohepatic circulation we placed Gregory cannulas in the cecum and ileum of 3 animals at the time of construction of bile duct pouches. In 3 additional animals, cannulas were placed in the cecum and ileum, but a Thomas cannula was placed in the duodenum opposite the ampulla of Vater for bile duct cannulation. At 3 weeks after operation, the common duct was cannulated (3 animals) or a balloon catheter was placed in the Gregory cannula of the bile duct pouch (3 animals). Five milliliters of 5 mM cholic acid in saline containing 2 μ Ci of cholic acid 24- 14 C was instilled through the cecal cannula. The appearance of radioactivity in fistula bile and ileal effluent was monitored during a 24-hr period. Radioactivity was absent from ileal contents for 60 min in all animals, but was present in ileal contents of 2 animals with common duct cannulas after the first hour until the twelfth hr of the collection period. Radioactivity was absent from ileal contents throughout the collection period in all animals with a common duct pouch.

Twenty $\pm$ 2.4% of the labeled bile acid instilled in the colon was recovered in fistula bile after 24 hr. Ninety percent of this amount was recovered in 7 hr in the 3 animals with a common duct pouch, and 77% in 7 hr in the 2 animals who had radioactivity in the ileal contents. We concluded that diversion was incomplete in the latter 2 animals.

We have now constructed this pouch in more than 20 animals, 2 of whom are still being used in experiments 15 months later.

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