

Common Bile Duct Cannulation in Swine

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Bile duct cannulation is most frequently performed to study hepatic metabolism and secretion of pharmaceuticals in swine. The bile duct must be cannulated in a reentry fashion for experiments longer than a few days, otherwise pathology due to a lack of intestinal bile will occur. Cholecystectomy may have to be performed as part of the procedure if pure bile secretion from the liver is required. The bile in the gall bladder tends to develop different characteristics from bile excreted directly from the liver over time.

Anatomy

The gall bladder is located in a fossa between the quadrate and right medial lobes of the liver. The hepatic bile duct exits the liver caudally dorsal to the gall bladder. It joins the cystic and common bile ducts shortly after entering the porta hepaticus. The bile duct is located in the porta hepaticus ventral to the portal vein and hepatic artery. It may be identified as a translucent tubular structure within the mesenteric attachments in this area and it courses caudally to enter the duodenum as a separate duct from the pancreatic duct. The internal diameter of the common bile duct varies substantially between animals even at the same weight and breed. Typically it is approximately 3mm ID in a 20-30 kg pig. Most ducts can accommodate a 5 Fr catheter because of the ability to expand the duct.

Catheter Design

Re-entry biliary catheters are commercially available or may be custom designed. Catheters within the abdomen are generally constructed of silicone for flexibility. Having a combination polyethylene catheter helps avoid kinking of the catheter. The tips of the catheter that are placed inside the duct are more readily placed if they are made of the sturdier polyethylene material. Having suture retention beads on the catheter helps to ensure retention within the duct. Re-entry catheters typically cannulate both proximal and distal ends of the duct with a flow pathway from the hepatic side of the duct to a sampling port at the skin surface and then reflow into the duodenal side of the duct. Using this type of catheter the flow of bile is interrupted for sampling by inflating a balloon in the catheter. Other types of catheters are inserted into the duct towards the liver with the distal end of the duct ligated. In this type of catheter the flow of bile goes to a sampling port on the surface of the skin and then reflows into the duodenum through a catheter inserted into the duodenum. In either design the flow of bile from the liver to the duodenum is only interrupted during the sampling procedure.

Surgical Technique

A midline celiotomy is performed from the xiphoid process to the umbilicus. Self retaining retractors and wetted laparotomy sponges are utilized to visualize the bile duct system in the right apical quadrant of the abdomen. The gall bladder is visualized and squeezed lightly to illuminate the common bile duct with bile. The fascial tissue is dissected to expose the common duct. A wetted sponge is placed under the duct and an elastic vessel loop is preplaced cranial and caudal to the entry site for the catheter. After retraction, the duct is nicked with iris scissors. A vascular pick is utilized to open the lumen for catheterization. The catheter is inserted into the abdomen in the right cranial paramedian area of the abdominal wall distant to the celiotomy incision.

When utilizing the T-tube catheter with an occlusal balloon, the tube is inserted cranially and then caudally. Ligatures are placed around both ends of the catheter to keep it in place.

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When utilizing the bypass catheter, the catheter with retention beads is placed retrograde into the duct. Ligatures are utilized cranially and caudally after insertion. The second duodenal catheter is inserted into the cranial duodenum. The catheter is held in place within the lumen with a pursestring suture and simple interrupted sutures in through the cuff and the serosa.

If a cholecystectomy is to be performed, it is done at this time. The sampling port, which has been preplaced, is flushed with saline and a port pocket is made to place the device subcutaneously. For a procedure of only a few days, the sampling port may be sutured to the skin and protected with a circumferential bandage.

The device is flushed daily with saline. Flushing or filling the balloon device with hygroscopic or hypertonic solutions may result in the occlusal balloon closing spontaneously due to the infiltration of body fluids. These catheters may be maintained for months if the sampling ports are implanted subcutaneously and meticulous aseptic technique is utilized.

Selected References

1. Swindle MM: Surgery, Anesthesia and Experimental Techniques in Swine. Ames, IA: Iowa State University Press, 1998.