

## Portal Vein Catheterization in Swine

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The portal vein may be catheterized to administer test substances free of the digestive processes or to withdraw blood samples prior to hepatic metabolism as well as blood flow studies. A complete description of the various techniques of catheterization has been published.<sup>1-4</sup> Reference should be made to the Intravascular Catheterization in Swine: General Principles fact sheet on this web site.

### Anatomic and Catheter Design Considerations

The short portal vein receives blood from the gastrosplenic, gastroduodenal, cranial, and caudal mesenteric veins. It divides into two branches at the caudal surface of the liver. It is closely associated with the underlying posterior vena cava, duodenum, pancreas and bile duct. The portal vein is thin walled and friable. The ventrocaudal portion of the vein close to the duodenum is usually the easiest site to dissect and catheterize. The area caudal to the bifurcation of the two branches entering the liver is the best site for the placement of the tip of a catheter.

The portion of the catheter to be placed inside the vein should be constructed of silicone and have preplaced suture beads glued in place 0.5-1.0 cm apart. The length of the catheter and the length from the tip of the catheter will be variable with the size of the pig and should be predetermined prior to the first surgery. The edges of the tip of the catheter should be tapered. These methods help to prevent erosion of the blood vessel postoperatively. The silicone portion of the catheter should be covered with a more rigid material such as polyethylene for the portion of the catheter that passes through the abdominal cavity and exits the dorsum to prevent kinking. The General Principles fact sheet should be consulted for techniques for exiting and securing a catheter to the skin.

### Celiotomy

With the pig in dorsal recumbency a midline incision is made from the xiphoid process to the umbilicus. The stomach, spiral colon and small intestine must be retracted laterally and caudally using wetted laparotomy packs and a self-retaining abdominal retractor. It is advisable to fast the pig from solid food for 24 hours to ensure emptying of the GI tract.

### Direct Approach

Direct insertion of the catheter into the portal vein is the best way to ensure that the tip of the catheter is in the proper location. Using this method, the vein is gently dissected with right angle forceps and elastic vessel loops are passed around the vessel. Care must be taken to avoid rupturing any of the branches of the vessel or damaging the pancreas during this maneuver. After the vessel loops are in place, a pursestring suture is preplaced in the ventral surface of the vein using 5-0 vascular suture. This segment of the vein is allowed to fill with blood by tightening the cranial loop first followed by the caudal loop. A stab incision is made in the center of the pursestring suture with a #11 scalpel blade. The tip of the catheter is advanced into the vein towards the liver and the cranial vessel loop is loosened to allow its passage to the proper location. Both loops are released as the pursestring suture is tightened. At least one suture bead should be inside the vein when the suture is tightened. Experience has shown that total occlusion of the portal vein for >15 minutes may lead to irreversible portal hypertension. If this procedure requires more time than that the elastic vessel loops should be periodically loosened to allow blood to flow through the vein.<sup>1</sup>

### Splenic Vein Approach

Using the same celiotomy approach, the splenic vein, which is the most central of the three veins of this organ, may be utilized to pass a catheter into the portal vein. This approach offers the advantage of ease of exposure,

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however, it is more difficult to determine proper placement of the catheter tip. That must be confirmed by either direct visualization or radiographic techniques. It is also possible for the catheter to advance into the wrong vein, kink or puncture the portal vein during placement. More rigid material than silicone may be required in order to advance the catheter and this more rigid catheter may cause postoperative erosion of the vessel wall.

In this method, the spleen is retracted caudally out of the abdomen and the splenic vein is dissected free from the splenic artery close to the hilum of the organ. This is the middle of the three major veins draining the spleen. The catheter must be passed slowly and guided with a finger on the tip of the catheter to ensure it follows the correct pathway into the portal vein. The catheter is fixed in place and exteriorized in the same manner as other abdominal catheters.<sup>1,3,4</sup>

## Intrahepatic Approach

The left branch of the portal vein may sometimes be located within the visceral surface of the left lateral liver lobe by palpation of a groove that corresponds to the entry of the branch into the liver parenchyma. The vein may be catheterized in a retrograde manner by passing a trochar into the vessel and then inserting the catheter. The tip of the catheter should be passed into the main part of the vein where it can be palpated to determine it is in the correct location. A catheter inserted in this manner must be sutured in place to the liver and care should be taken to prevent kinking.<sup>1,2</sup>

## Discussion

Complications of portal vein catheterization include erosion of the thin vessel wall, clotting due to low blood flow or contact of the tip with the vessel wall and extravasation of the catheter postoperatively. All of these complications can be reduced by proper catheter design and proper placement of stay sutures within the abdomen. Although most catheters cease to be functional after 4-6 weeks, it is possible have the catheters last for months in some animals. Discussions of the indications for portal vein catheterization and related topics such as hepatic hemodynamics are discussed in the reference.<sup>1-4</sup>

## References

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