USING VASCULAR PLUGS FOR GUTTURAL POUCH HEMORRHAGE
Jan F. Hawkins, DVM, DACVS
Dan Hogan, DVM, DACVIM (cardiology)

Guttural pouch mycosis (GPM) is the most common cause of life threatening hemorrhage associated with the guttural pouch. Surgical management of GPM has been well described by numerous authors and has included simple ligation, placement of Fogarty venous thrombectomy catheters, embolization coils, and vascular plugs. In 2009, we reported on the use of transarterial nitonol vascular plugs for vascular occlusion of arteries within the guttural pouch affected by guttural pouch mycosis (Delfs, Hawkins, Hogan, JAVMA 235:189-193).

Surgical technique: The diagnosis of GPM is readily made with the history of acute epistaxis and endoscopic examination of the interior of the guttural pouch. The surgical team consists of an equine surgeon and a cardiologist experienced in interventional peripheral vascular techniques. Horses are routinely prepared for general anesthesia and surgery and placed into lateral recumbency with the affected side up. The head and cranial aspect of the neck are positioned on an acrylic table to allow transmission of the fluoroscopic beam. Fluoroscopy is required to guide catheter placement for deployment of the vascular plugs. In addition to fluoroscopy a videoendoscope is inserted into the interior of the guttural pouch as an additional “check” to make sure the plug is being inserted into the correct artery. Arterial access is performed by a cut down over the common carotid artery. A 10-cm incision is made dorsal to the jugular vein and the vein is retracted ventrally. The omohyoid muscle is bluntly divided to expose the common carotid artery. Once the carotid sheath is identified it is very important to identify the recurrent laryngeal nerve to avoid iatrogenic injury. The nerve is bluntly dissected from the carotid artery and a Penrose drain is positioned around the artery. Using the Penrose drain for traction a vascular access needle is inserted into the artery. A guide wire of 15-20 cm is inserted into the needle and a 7-F introducer and dilator set is placed over the guide wire, leaving the introducer in place. The introducer includes a hemostasis valve with a side port for injection. The introducer is secured with a 3-0 monofilament suture to minimize the risk for accidental removal. Once the introducer is positioned an angiogram is performed with a hand injection of contrast material. The angiogram is used to definitively identify the bleeding artery. However, it has not been uncommon that no identifiable bleeding (leaking of contrast medium) can be observed. When this occurs the endoscope within the guttural pouch can be crucial in ensuring that the right artery is being occluded. The surgical team must be familiar with the vascular anatomy to ensure accurate identification of the bleeding artery and vascular plug placement. Once the bleeding artery is identified vascular plug placement begins. We use Amplatzer® vascular plugs manufactured by St. Jude Medical Corporation. The first step of plug placement is insert a 4-F angled diagnostic catheter through a 75-cm, 5-F vascular sheath and both are inserted through the 7-F vascular access sheath in the common carotid artery. The diagnostic catheter and flexible guide wire are advanced beyond the noncardiac side of the arterial hemorrhage site. Successful catheter placement is confirmed with the endoscope positioned in the guttural pouch. A 10-12 mm vascular plug is then deployed on the noncardiac side of the bleeding vessel. The vascular sheath is withdrawn so that an additional plug can be inserted on the cardiac side of the bleeding vessel. We position the vascular plugs in the same position as previously described by David Freeman for Fogarty venous thrombectomy catheters. Of the horses we have treated with vascular plugs we have had one instance where we unable to
position a vascular plug on the noncardiac side of the bleeding maxillary artery. This vessel was subsequently occluded with a Fogarty venous thrombectomy catheter as previously described by Freeman. Once both vascular plugs have been positioned an angiogram is repeated to confirm satisfactory occlusion of the affected artery. Following the final angiogram the 7-F vascular sheath is removed and the carotid artery is closed using 5-0 polyglactin 910 in a purse string or simple interrupted suture pattern. The omohyoideus muscle, SQ, and skin are closed in a routine fashion.

**Postoperative management:** Intravenous antimicrobials and anti-inflammatories are administered for a minimum of 48 hours and then discontinued. Horses are monitored for any evidence of epistaxis. Postoperative epistaxis has not occurred in any of the horses we have treated with vascular plugs. However, it is not unusual for serosanguinous nasal discharge to occur following surgery as the blood clot undergoes lysis within the affected guttural pouch. Subjectively the resolution of mycotic plaques following vascular plug placement occurs within 30 days following surgery. No treatment with anti-fungals has been needed in any of the cases we have treated. No long term complications have occurred following vascular plug placement.

**Discussion:** Nitinol vascular plugs are used instead of embolization coils for the following reasons: only 1 plug is needed on each side of the bleeding vessel to occlude the affected vessel while multiple embolization coils are required for the same purpose, vascular plugs can be retrieved following deployment while embolization coils cannot, finally, appropriately sized vascular plugs are unlikely to become dislodged because of the radial tension they exert on the vessel wall. The cost of the vascular plugs is similar to the cost associated with multiple embolization coils. The disadvantage of using vascular plugs is that specialized equipment and the expertise of an interventional cardiologist are required to perform this procedure. Although this is no different from when embolization coils or Fogarty catheters are placed by an experienced surgeon. Fluoroscopy and angiography are essential for accurate identification of blood vessels before occlusion to ensure vascular anomalies and aberrant blood vessels are not involved and for accurate placement of the vascular plug(s). The use of vascular plugs are an effective method for treatment of epistaxis secondary to GPM and have numerous advantages over Fogarty venous thrombectomy catheters and embolization coils.