

Large Animal VETERINARY Rounds

FEBRUARY 2002
Volume 2, Issue 2

Now available
on the Internet
www.canadianveterinarians.net/larounds

AS PRESENTED IN THE ROUNDS OF THE DEPARTMENT OF LARGE ANIMAL CLINICAL SCIENCES
OF THE WESTERN COLLEGE OF VETERINARY MEDICINE, UNIVERSITY OF SASKATCHEWAN

Guttural pouch diseases in the horse

James Carmalt MA, VetMB, MRCVS

The incidence of primary guttural pouch disease is low, affecting 0.18% and 0.45% of equine cases admitted to the Western College of Veterinary Medicine in 2000 and 2001, respectively. However, it often has major adverse consequences for the individual horse or its herd mates. As the availability of endoscopy improves and better drug therapies evolve, guttural pouch disease is becoming easier to diagnose and treat. The incidence at the WCVM may be higher than the published literature since we routinely examine guttural pouches during airway endoscopy. The unique and intricate relationship of blood vessels and nerves make the guttural pouch susceptible to serious and sometimes fatal clinical conditions. This issue of *Large Animal Veterinary Rounds* reviews the pathogenesis associated with this disease in the neurovascular tissues and the common diseases of this unique structure (Table 1).

The anatomy of the equine guttural pouch

General

Guttural pouches are air-filled diverticuli of the auditory tubes. Horses possess the largest guttural pouch of any species.⁶⁻⁸ They are located in the caudal area of the head. The pouches extend from the roof of the pharynx to the base of the skull and from the atlanto-occipital joint to the pharyngeal recess. Many theories have been postulated as to the function of the pouch. Recent evidence demonstrates that the equine guttural pouch has an important function in brain cooling.⁹ The total volume of each pouch is approximately 600 ml and is divided into two compartments (medial and lateral) by the stylohyoid bone that articulates dorsally with the petrous temporal bone. The stylopharyngeus muscle can be seen as a thin strip of tissue over the most rostral part of this bone (Figure 1).

Medial compartment

This comprises roughly two-thirds the total volume. The glossopharyngeal (CRN IX), vagus (CRN X), and hypoglossal (CRN XII) nerves travel in a fold of mucosa lying caudomedial to the internal carotid artery. The sympathetic trunk, craniocervical ganglion, cranial laryngeal nerve (branch of CRN X), and the accessory-spinal nerve (CRN XI) travel in another mucosal fold that is intimately associated with the artery in most horses. The pharyngeal branches of CRN IX and X travel in a rostroventral direction along the lateral and medial walls of the medial compartment until interdigitating in a plexus of nerve fibres covering the surface of the floor of the medial compartment (Figure 2). Under the floor of the medial compartment, the swelling of the retropharyngeal lymph node can be appreciated. The nerve plexus serves to innervate the soft palate and thus any pathological process in this compartment has the potential to affect pharyngeal function.

Lateral compartment

In the smaller lateral compartment, the external carotid artery passes from craniomedial to caudolateral, bifurcating into the superficial temporal and the maxillary arteries. The maxillary-facial vein is present and the facial nerve (CRNVII) exits the skull via the stylomastoid foramen traveling across the dorsal surface of the lateral pouch.



WCVM
WESTERN COLLEGE OF
VETERINARY MEDICINE



Department of Large Animal
Clinical Sciences
Western College of Veterinary Medicine

Jonathan M. Naylor, DVM, Diplomate ACVIM
(Editor)

Reuben J. Mapletoft, DVM, PhD (Head)
Ken Armstrong, DVM, Professor Emeritus
Sue Ashburner, DVM
Jeremy Bailey, BVSc, Diplomate ACVS
Spence M. Barber, DVM, Diplomate ACVS
Albert D. Barth, DVM, Diplomate ACT
Frank Bristol, DVM, DACT, Professor Emeritus
Ray Butler, DVM, Professor Emeritus
Troy Butt, DVM, MVetSc
John Campbell, DVM, DVSc
Claire Card, DVM, DACT
Terry D. Carruthers, DVM, PhD
Bill Cates, DVM, Professor Emeritus
Chris Clark, VetMB, MVetSc
Peter B. Fretz, DVM, Diplomate ACVS,
Professor Emeritus
Paul Greenough, DVM, Professor Emeritus
Jon Gudmundson, DVM, Diplomate ABVP
Jerry Haigh, DVM, Diplomate ACZM
Eugene D. Janzen, DVM, MVS
Steve Manning, DVM, Diplomate ACT
Colin Palmer, DVM, Diplomate ACT
Andre Palasz, MSc, PhD
Lyllal Petrie, BVMS, PhD
O.M. Radostits, DVM, Diplomate ACVIM
C.S. Rhodes, DVM, MSc
Fritz J. Schumann, DVM, MVetSc
Joseph M. Stookey, PhD
Hugh G.G. Townsend, DVM, MSc
Cheryl Waldner, DVM, PhD
David G. Wilson, DVM, Diplomate ACVS
Murray R. Woodbury, DVM, MSc

Western College of Veterinary Medicine
Department of Large Animal Clinical Sciences

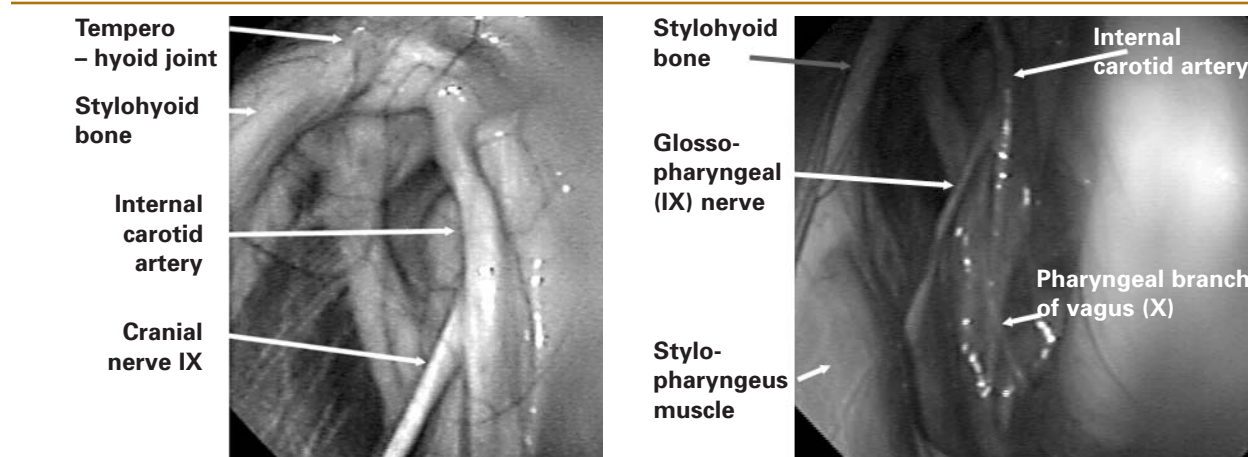
52 Campus Drive
University of Saskatchewan
Saskatoon, Saskatchewan S7N 5B4

The editorial content of *Large Animal Veterinary Rounds* is determined solely by the Department of Large Animal Clinical Studies, Western College of Veterinary Medicine



The Canadian Veterinary
Medical Association recognizes
the educational value of this
publication and provides
support to the WCVM for
its distribution.

Figures 1 and 2: Normal anatomy of the pouch. Examination of the guttural pouch should be a routine component of every upper airway endoscopy, irrespective of the initial reason for the procedure.



Case 1: Guttural pouch empyema

A 10-year-old thoroughbred gelding was presented to the ambulatory service of the WCVN with a 6-week history of cough and nasal discharge, primarily associated with eating. On physical examination, there was evidence of a bilateral, foul-smelling, nasal discharge. Auscultation of the trachea and thorax revealed no abnormal lung sounds, even after the use of a rebreathing bag. There was no evidence of dyspnea or pyrexia, and cough could not be elicited by tracheal or laryngeal compression.

The horse was restrained, not sedated, and an endoscope was passed up the ventral meatus. There was grade III lymphoid hyperplasia with persistent dorsal displacement of the soft palate. Feed material was present in the dorsal pharyngeal recess and throughout the length of the trachea. The endoscope was placed into the right guttural pouch, but no abnormalities were detected. Examination of the left pouch, however, revealed the presence of two chondroids, approximately 4 cm in diameter. A snare catheter was passed through the biopsy portal of the endoscope and the chondroids were sectioned several times.

Following this, an artificial insemination pipette was prepared with a 45° bend 3 cm from the tip. In the past, this was achieved by heating the catheter, but newer catheters can be bent cold. The catheter was passed up the ipsilateral nostril and its passage monitored by the endoscope in the contralateral nostril. Placement of the catheter in the ventral meatus and grasping gently allows rotation of the catheter as it follows the contours of the conchae into the nasopharynx. At this point, a firm grasp allows direction of the tip into the guttural pouch opening. A common mistake is to allow the catheter to slip into the middle meatus; this makes entry into the pouch more difficult. Sometimes it helps to keep the endoscope in the ipsilateral nostril and pass the catheter ventral to it; this keeps the catheter ventral.

The catheter was connected to a fluid pump and high-volume lavage (3.6 liters per pouch) using warmed lactated Ringer's solution at a rate of 1.5 liters/min was performed. This

created a powerful jet of fluid, lifting debris from the mucosal surface and distending the pouch. The distention exerted sufficient force to expel the relatively large, deformable, inspissated material. Some authors,¹⁰ however, do not believe that lavage is successful, perhaps because they do not use a high-pressure pump. Following this procedure, an endoscopic examination of the pouch confirmed clearance of the debris.

The horse was placed on a course of trimethoprim-sulpha antibiotics for potential aspiration pneumonia and discharged into the care of the owner. The animal was re-examined 10 days later and endoscopy confirmed the soft palate was in the correct anatomical location and functioned normally during swallowing maneuvers. Endoscopy of the guttural pouches revealed an absence of pathology.

Discussion

Empyema of the guttural pouches, with associated chondroid formation, is most commonly seen in young horses.¹¹ Although many theories have been postulated as to the etiology of this condition, *Streptococcus* species are by far the most common pathogens isolated from affected pouches. There is also substantial evidence that the pouches can be reservoirs of *Streptococcus equi* infection for months, if not years, following infection. This may be an important mechanism allowing *S equi* to persist in the population. Irritant drugs, fracture of the stylohyoid bone, and congenital stenosis of the pharyngeal orifice have been suggested as contributory factors, but this has not been confirmed.¹²

Diagnostic modalities include clinical examination, radiography, and upper airway endoscopy. In a recent review of empyema, there were no significant differences between the results of endoscopy and radiography for detection of empyema, with or without, chondroids.¹¹ However, endoscopy as part of a complete airway examination will allow direct visualization of the contents as well as the lining of the guttural pouch.

Endoscopy of the nasopharynx often reveals a grade 2-3 lymphoid hyperplasia with evidence of discharge from the affected pharyngeal orifice. There may also be dorsal collapse of the pharyngeal wall. Entry into the guttural pouches is

Table 1: Diseases of the guttural pouch and common clinical signs

Empyema

- Uni- or bilateral mucopurulent nasal discharge (with or without odor)
- Submandibular lymph node enlargement
- Parotid pain
- Dysphagia
- Asymptomatic infections occur, commonly associated with *Streptococcus equi*

Mycosis

- Spontaneous uni- or bilateral epistaxis
- Nasal discharge
- Abnormal head extension
- Dysphagia
- Horner's syndrome^{1,2}
- Head shaking³
- Ocular changes⁴
- Facial nerve paralysis^{1,2}
- Lingual hemiplegia⁵
- Occasional asymptomatic infections occur

Tympany

- Large, fluctuant swelling in the parotid/laryngeal region
- Unilateral or bilateral
- Signs of discomfort with frequent swallowing motions
- Dysphagia or dyspnea

Neoplasia

- Dyspnea
- Mucopurulent to hemorrhagic nasal discharge

Cysts

- Hard swelling in the guttural pouch region
- Diagnosis on endoscopy

Longus capitis muscle rupture

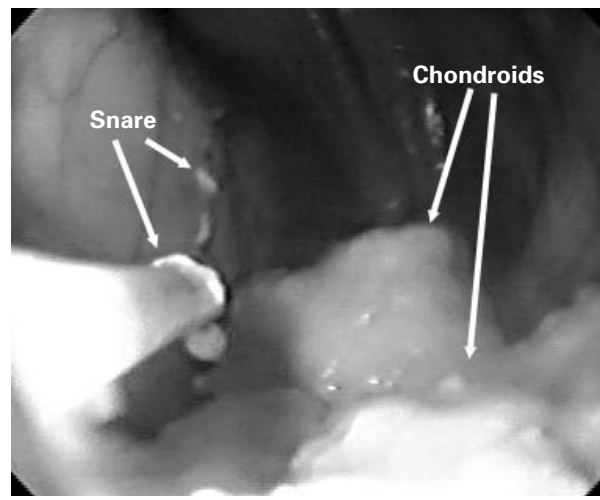
- History of acute trauma
- Spontaneous uni- or bilateral epistaxis

usually without difficulty, but in chronic cases, fibrosis of the orifice may have occurred necessitating the use of a Chambers' mare catheter to bluntly open the adhered tissue.

Treatment

Treatment options include guttural pouch culture and lavage,^{13,14} endoscopic or surgical chondroid removal, as demonstrated in the case above. Local antibiotic therapy can be used cautiously since retention times are variable and drug instillation may induce further inflammation. There is no information in the literature indicating whether the duration of treatment affects the rate of resolution, although repeated lavage is commonly reported.^{11,12} At the time of writing, the author has only had to treat horses once with the high-volume lavage technique. This negates the need for chronic therapy, the placement of irritating retention catheters,¹⁵ and repeated lavage. As demonstrated above, this treatment modality can also be successful for the removal of soft chondroids after undergoing snare dissection intrapouch (Figure 3).^{13,14} The use of acetyl-cysteine has been reported,¹⁶ but it was evaluated in a non-blinded, non-quantitative, controlled trial and no benefit over saline was seen.

Figure 3: Guttural pouch chondroids



Dysphagia associated with guttural pouch disease^{17,18} is thought to be due to damage to the glossopharyngeal (IX) and possibly the vago-sympathetic trunk and vagus (X) nerves. The swallowing reflex involves an afferent supply from mechanoreceptors in the mucosal wall of the pharynx (IX) and from the rostral larynx (cranial laryngeal nerve, a branch of vagus (X)). The efferent arm of the reflex involves the pharyngeal nerve, a branch of the vago-accessory complex that supplies all the muscles of the pharynx, apart from the stylopharyngeus muscle, and the recurrent laryngeal nerve that controls the reflex closure of the glottis.¹⁹ In most cases of empyema, treatment of guttural pouch pathology results in the resolution of neuropraxia and associated dysphagia.

In chronic empyema, chondroids may become too hard to be removed by snare and lavage. In these cases, conventional surgical therapy is necessary.

Case 2: Guttural pouch mycosis

A 13-year-old, 400 kg quarter horse mare was referred with a tentative diagnosis of esophageal choke. There was bilateral feed material and foul-smelling, mucopurulent discharge from the nares. Thoracic auscultation with use of a rebreathing bag did not reveal any thoracic abnormalities. Endoscopic examination of the upper respiratory tract under sedation revealed feed material in the ventral and middle meati of both nasal cavities and the nasopharynx. The soft palate was displaced dorsally. The larynx was asymmetrical with grade 4 right laryngeal hemiplegia. A small amount of feed material was seen on the ventral floor of the trachea.

Examination of the left guttural pouch revealed a fungal mass firmly attached to the dorsal surface of the internal carotid artery and the underlying neural structures. Surgical intervention was not an option due to financial constraints, so medical treatment was performed.

Treatment

The guttural pouches were treated by local instillation of a 1.7% enilconazole solution via the endoscope on a daily basis. The horse was discharged following 10 days of treatment after

which time there was significant improvement in the soft palate and laryngeal function. The fungal plaque was reducing in size and no epistaxis had occurred.

A follow-up examination was performed 3 weeks after discharge. On endoscopy, the soft palate was in the correct position, but displaced during swallowing and was not replaced. There was no asynchrony in the movement of the arytenoid cartilages. Entry into both guttural pouches revealed no abnormalities and the horse was discharged without further treatment.

Discussion

Fungal infection of the guttural pouch was first described in Italy (1868) by Rivolta.²⁰ In subsequent publications the organisms were identified as *Aspergillus*, *Corallium*, and *Penicillium*.²¹ Buer tried to experimentally create a mycotic infection of the pouch, initially by injecting fungal colonies into the mucosal lining and also after inflaming the lining with exposure to alcohol, carbolic acid, and hay dust.²² None of these proved successful. There is no age or sex predilection.^{21,23} Although gutturo-mycosis is uncommon in the young horse, it has been reported in three foals under 6 months of age²⁴ and in one foal of 3 months.²³

Mycotic infections of the guttural pouch cause a variety of clinical/neurological signs, depending on the location of the fungal plaque and the anatomical structures affected. These include epistaxis, muzzle deviation (facial nerve paralysis), keratoconjunctivitis sicca, laryngeal hemiplegia, and dysphagia. The pathophysiology of dysphagia in these cases involves invasion of the perineurium of the glossopharyngeal or hypoglossal nerves leading to temporary or permanent neural damage.

There is conflict in the literature regarding the prognosis for the return of soft palate function.^{17,34} One report suggests a hopeless prognosis, but Cook found that 7 of 11 horses with dysphagia recovered.²⁴ The remaining 4 were euthanised for intractable dysphagia. The time period from onset to recovery ranges from 3 to 14 months.³⁵

Aspergillus fumigatus,²⁵ is the most commonly isolated fungal element, but other *Aspergillus* species have been reported.²⁶⁻²⁸ Other rare fungi include *Candida*, *Penicillium*, and *Mucor*.^{29,30} Fungal growth appears to have a predilection for the caudodorsal part of the medial pouch overlying the internal carotid artery²¹ or the lateral wall of the lateral compartment.³¹ Due to the highly invasive nature of the organism, significant extension of the lesion and epistaxis may occur.^{21,32,33}

When episodes of epistaxis have occurred, treatment using surgically-induced thrombosis of the affected vessel by a variety of techniques, has been described. These techniques have had variable success.³⁶⁻³⁸ The most successful and commonly reported approach to the treatment of epistaxis associated with guttural pouch mycosis is the surgical occlusion of the affected artery, with or without postoperative topical and/or systemic treatment with

an antifungal agent. Agents used include thiabendazole, iodides, miconazole, nystatin, and natamycin.^{32,34,39} A relatively new imidazole derivative, enilconazole, has been used to treat canine nasal aspergillosis⁴⁰ and two cases of equine guttural pouch mycosis.^{41,42}

The additional value of medical treatment is difficult to ascertain because of the lack of controlled clinical trials. The problem associated with pouch catheterization and blind fluid instillation is the likelihood that the instilled solutions do not contact the fungal plaque. This can be overcome by nebulizing the agent, using an aerosol device to achieve an adequate period of contact between the drug and the fungal mass and thus achieving effective therapy.⁴³ The author's preferred procedure to overcome this problem, is daily endoscopically guided treatment if it can be performed without undue restraint and if exsanguination is not a concern.

Guttural pouch tympany

This condition is rare and most commonly considered a congenital abnormality since it primarily affects young foals. There appears to be a sex predilection, with fillies being more commonly affected.⁴⁴ The etiology of the condition is not known.

Tympany of the guttural pouch is an accumulation of a large volume of air within the pouch that appears to be the result of the altered function of the pharyngeal orifice, acting as a one-way valve. This may be due to scarring, thickening of the mucus membrane, an abnormal plica salpingosa or another undetermined problem.

Diagnosis is based on clinical examination, endoscopy, with or without radiography, or percutaneous gutturocentesis. The latter technique should be performed with great care, as there is risk of damage to nervous and vascular tissues. Endoscopic examination can reveal a collapse of the dorsal pharyngeal wall and compression of the nasopharynx as the lateral walls are moved medially by the distention of the pouches. Once within the pharyngeal orifice, careful passage in a caudodorsal direction will allow visualization of the plica salpingopharyngea. This membranous structure marks the rostral extent of the eustachian tube. The J-shaped structure leaves the lateral wall of the pharyngeal orifice and crosses the midline halfway up the pharyngeal opening forming a continuous ventral connection between the medial lamina of the eustachian tube and the lateral wall of the pharynx. Passage of the endoscope beyond this point may result in air escaping from the pouch and resolution of the external clinical signs. Once within the pouch, retroflexion of the endoscope allows visualization of the caudal aspect of the plica, the insertion of the levator veli palatini muscle, and the rostromedial face of the guttural pouch.

Evacuation of trapped air by endoscopy, percutaneous centesis, or by indwelling catheterization is only temporary and in most cases, surgical correction is necessary. The technique chosen depends on whether the problem

is uni- or bilateral and also on the presence of surgical expertise and equipment. Excision of the plica salpingopharyngea, salpingopharyngeal fistulation (creation of a fistula between the pouch and the nasopharynx), or fenestration of the medial septum, are valid treatment options. The first two options allow air to move from the affected pouch back into the nasopharynx, while the latter moves air from the affected to the normal pouch allowing egress via the normal pharyngeal orifice. External fistulation of the guttural pouch has also been reported in a case of bilateral involvement⁵ however, bilateral salpingopharyngeal fistulation or plical trimming will result in a better cosmetic result.

Excisional surgeries can be performed using sharp dissection or more recently, using Nd:YAG lasers. However in the case of lasers, the presence of thermal necrosis in an area rich in neuro/vascular tissue is a concern.

Guttural pouch neoplasia, cysts, and miscellaneous conditions

Tumours of the guttural pouch are rare. Squamous cell carcinomas, round cell sarcomas, hemangioma, fibroma, and melanoma have been reported.⁴⁵⁻⁵⁰ Squamous cell carcinoma is the most common; clinical signs include dyspnea and mucopurulent to hemorrhagic nasal discharge. The prognosis for resection and cure of carcinoma in the guttural pouch is poor since it is generally inaccessible and the tumour margins are poorly defined.

Cystic structures in the guttural pouch have been described.⁵¹ In one case report, there was a firm swelling over the area of the right guttural pouch. Endoscopy showed an ovoid, polyp-like mass protruding from the opening of the right pouch. The cyst was debrided under general anesthesia and the horse made an uneventful recovery. Under histological examination, the lining of the cyst was similar in appearance to paranasal sinus cysts that are typically detected in young horses. The pathogenesis of this condition is not known, but embryologically the eustachian tubes, middle ear, and mastoid cells are comprised of the first pair of branchial arches. There may be abnormal retention of first branchial arch apparatus remnants, leading to the formation of branchial cysts. Hemorrhage into the guttural pouch has also been reported associated with rupture of the longus capitis muscle.⁵² This is extremely rare and has been associated with acute trauma and as a sequel to guttural pouch mycosis.⁵³

Summary

As the availability of endoscopy improves and better drug therapies evolve, it is becoming easier to diagnose and treat guttural pouch disease. Routine examination of the guttural pouches during endoscopic examination of the upper respiratory tract in horses may account for the increasing incidence. This enables the clinician to detect

sub-clinical disease before the onset of serious clinical signs. Chondroid dissection within the pouch and high-volume saline lavage as well as the development of newer antifungal drugs is allowing the clinician to treat guttural pouch disease in horses with increasing confidence and success.

James Carmalt, MA, VetMB, MRCVS. After graduating from the University of Cambridge, UK, Dr. Carmalt completed a large animal medicine internship at the Western College of Veterinary Medicine before going into practice in Tasmania, Australia. He is currently in the second year of a 3-year equine practice residency.

References

1. Cook WR. Observations on the aetiology of epistaxis and cranial nerve paralysis in the horse. *Vet Rec* 1966;78:396-405.
2. Cook WR. The clinical features of guttural pouch mycosis in the horse. *Vet Rec* 1968;83:336-345.
3. Lane JG, Mair TS. Observations on headshaking in the horse. *Equine Vet J* 1987;19:331-336.
4. Hatziozios BC, Sass B, Albert TF, et al. Ocular changes in a horse with gutturomycosis. *J Am Vet Med Assoc* 1975;167:51-54.
5. Kipar A, Frese K. Hypoglossal neuritis with associated lingual hemiplegia secondary to guttural pouch mycosis. *Vet Pathol* 1993;30:574-576.
6. Turner HN. Contributions to the anatomy of the tapir. *Proc of Zool Soc (London)* 1850:102-106.
7. Brandt JF. Bericht über eine Abhandlung, Untersuchung der Gattung Hyrax in anatomischer und verwandtschaftlicher Beziehung. *Bull Acad Imp Sci (St. Petersburg)* 1863;5:508-510.
8. Hinchcliff R, Pye A. Variations in the middle ear of the mammalia. *J Zool (London)* 1969;157:277-288.
9. Baptiste KE, Naylor JM, Bailey J, et al. A function for guttural pouches in the horse. *Nature* 2000;403:382-383.
10. Barber SM. Diseases of the guttural pouches. In: Colahan P, Merritt A, Moore JG, Mayhew IG, eds. *Equine Medicine and Surgery*. 5th ed. St. Louis, MO: Mosby Inc; 1999: 501-512.
11. Judy CE, Chaffin MK, Cohen ND. Empyema of the guttural pouch (auditory tube diverticulum) in horses: 91 cases (1977-1997). *J Am Vet Med Assoc* 1999;215(11):1666-1670.
12. Freeman DE. Diagnosis and treatment of diseases of the guttural pouch (Part 1). *Comp Cont Ed Pract Vet Suppl* 1980;11(1):S3-S11.
13. Adkins AR, Yovich JV, Colbourne CM. Nonsurgical treatment of chondroids of the guttural pouch in a horse. *Aust Vet J* 1997;75(5):332-338.
14. Seahorn TL, Schumacher J. Nonsurgical removal of chondroid masses from the guttural pouches of two horses. *J Am Vet Med Assoc* 1991;199(3):368-369.
15. Wilson J. Effects of indwelling catheter and povidone-iodine flushes on the guttural pouches of the horse. *Eq Vet J* 1985;17: 242-244.
16. Bentz BG, Dowd AL, Freeman DE. Treatment of guttural pouch empyema with acetylcysteine irrigation. *Eq Pract* 1996;18(9):33-35.
17. Howarth S, Lane JG. Multiple cranial nerve deficits associated with auditory tube (guttural pouch) diverticulitis: three cases. *Eq Vet Ed* 1990;2(4):206-209.
18. Modransky PD, Reed SM, Barbee DD. Dysphagia associated with guttural pouch empyema and dorsal displacement of the soft palate. *Eq Pract* 1982;4(8):34-38.
19. Lane JG, Howarth S. The auditory tube diverticulum (ATD) in health and disease: Neurological considerations. *Eq Vet Ed* 1990; 2:210-213.
20. Rivolta S. Ulcera nella saccoccia gutturale prodotta e mantenuta una crittogama in un cavallo. *Il Medico Veterinario* 1868; 3:215-224.
21. Cook WR. Observations on the aetiology of epistaxis and cranial nerve paralysis in the horse. *Vet Rec* 1966;78:396-405.

22. Buer AW. Skand VetTidskr 1942;32:593 (as cited in Cook, #2).
23. Ryan JA, Modransky PD, Welker B. Guttural pouch mycosis in a 3-month-old foal. *Equine Pract* 1992;14:21-22.
24. Cook WR. The clinical features of guttural pouch mycosis in the horse. *Vet Rec* 1968;83:336-345.
25. Guillot J, Ribot X, Cadore J, et al. L'aspergillose des poches gutturales des équides. *Bull Soc Vet Prat de France* 1996;80:141-162.
26. Johnson JH, Merriam JG, Atleberger M. A case of guttural pouch mycosis caused by *Aspergillus nidulans*. *Vet Med Small Animal Clin* 1973;68:771-774.
27. Rawlinson RJ, Jones RT. Guttural pouch mycosis in two horses. *Aust Vet J* 1978;54:135-138.
28. Gresti de A, Barone P, Perniola N. Un caso di micosi delle tasche gutturali causato da *Aspergillus ochraceus*: diagnosi e terapia [A case of guttural pouch mycosis caused by *Aspergillus ochraceus*: diagnosis and therapy.] *Ippologia* 1993;4:81-86.
29. Grabner A. Diagnose und therapie der luftstäckmykosen des pferdes. *Tier Praxis* 1987;Suppl 2:10-14.
30. Freeman DE, Ross MW, Donawick WJ, et al. Occlusion of the external carotid and maxillary arteries in the horse to prevent hemorrhage from guttural pouch mycosis. *Vet Surg* 1989;18:39-47.
31. Smith KM, Barber SM. Guttural pouch hemorrhage associated with lesions of the maxillary artery in two horses. *Can Vet J* 1984;25:239-242.
32. Greet TRC. Outcome of treatment in 35 cases of guttural pouch mycosis. *Equine Vet J* 1987;19:483-487.
33. Jacobs KA, Fretz PB. Fistula between the guttural pouches and the dorsal pharyngeal recess as a sequela to guttural pouch mycosis in the horse. *Can Vet J* 1982;23:117-118.
34. Church S, Wyn-Jones G, Parks AH, et al. Treatment of guttural pouch mycosis. *Equine Vet J* 1986;16:121-124.
35. Lane JG. The management of guttural pouch mycosis. *Equine Vet J* 1989;21(5):321-324.
36. Owen R, McKelvey WAC. Ligation of the internal carotid artery to prevent epistaxis due to guttural pouch mycosis. *Vet Rec* 1979;104:100-101.
37. Hardy J, Robertson JT, Wilkie DA. Ischemic optic neuropathy and blindness after arterial occlusion for treatment of guttural pouch mycosis in two horses. *J Am Vet Med Assoc* 1990;196:1631-1634.
38. Walmsley JP. A case of atlanto-occipital arthropathy following guttural pouch mycosis in a horse. The use of radioisotope scanning as an aid to diagnosis. *Equine Vet J* 1988;20:219-220.
39. Lane JG. The combination of surgery and medication with imidazole derivatives for the treatment of mycotic infections. *Proc Ass Vet Clin Pharm Therap* 1980;4:82-86.
40. Sullivan M, Sharp NJ. Treatment of nasal aspergillosis in the dog. *Vet Rec* 1988;122:447.
41. van Nieuwstadt RA, Kalsbeek HC. Luchtzakmycose: Lokale behandeling via een permanente catheter met enilconazol. [Air sac mycosis: topical treatment using enilconazole administered via indwelling catheter]. *Tijdschr Diergeneeskd* 1994;119:3-5.
42. Davis EW, Legendre AM. Successful treatment of guttural pouch mycosis with Itraconazole and topical Enilconazole in a horse. *J Vet Int Med* 1994;8(4):304-305.
43. Cook WR. Diseases of the Auditive Tube Diverticulum (Guttural Pouch). In: Robinson NE, ed. *Current therapy in equine medicine-2*. Toronto: WB Saunders Company; 1987:612-618.
44. McCue PM, Freeman DE, Donawick WJ. Guttural pouch tympany: 15 cases (1977-1986). *J Am Vet Med Assoc* 1989;194:1761-1763.
45. Trigo FJ and Nickels FA. Squamous cell carcinoma of a horse's guttural pouch. *Mod Vet Pract* 1981;62:456-459.
46. Tuckey JC, Hilber BJ, Beeton S, et al. Squamous cell carcinoma of the pharyngeal wall in a horse. *Aust Vet J* 1995;72:227-229.
47. McConnico RS, Blas-Machado U, Cooper VL, et al. Bilateral squamous cell carcinoma of the guttural pouches and the left middle ear in a horse. *Eq Vet Ed* 2001;13:225-228.
48. Baptiste KE, Moll HD, Robertson JL. Three horses with neoplasia including growth in the guttural pouch. *Can Vet J* 1996;37:499-501.
49. Greene HJ, O'Connor JP. Haemangioma of the guttural pouch of a 16-year-old thoroughbred mare: clinical and pathological findings. *Vet Rec* 1986;118:445-446.
50. Merriam JG. Guttural pouch fibroma in a mare. *J Am Vet Med Assoc* 1972;161:487-489.
51. Hance SR, Robertson JT, Bukowiecki CF. Cystic structures in the guttural pouch (auditory tube diverticulum) of two horses. *J Am Vet Med Assoc* 1992;200(12):1981-1983.
52. Sweeney CR, Freeman DE, Sweeney RW, et al. Hemorrhage into the guttural pouch (auditory tube diverticulum) associated with rupture of the longus capitis muscle in three horses. *J Am Vet Med Assoc* 1993;202(7):1129-1131.
53. Knight AP. Dysphagia resulting from unilateral rupture of the rectus capitis ventralis muscles in a horse. *J Am Vet Med Assoc* 1977;170:735-738.

**Editor's Note:
Increased Need for Vitamin A Supplementation?**

From Drs C. Waldner and T. Clark

We have seen pathological changes consistent with Vitamin A deficiency in several cases of abortion and stillbirths. The drought in the prairie regions of Canada means that some cattle will have been on Vitamin A deficient diets for many months. While adult cattle are quite resistant to deficiency, the fetus and growing animals are not. Signs of Vitamin A deficiency include abortion, premature births and poor growing calves. Vitamin A deficiency is also a cause of reproductive failure. In feeder and replacement cattle, typical signs are poor growth, blindness, ataxia, or convulsions. Consider advising your clients about the need for Vitamin A supplementation. It is most likely to benefit animals fed non-green forage eg, only straw and old bleached forage, for several months without a vitamin supplement.

Upcoming Meetings

29 May-1 June 2002

The 20th Annual ACVIM Forum

Dallas, Texas

Website: www.acvim.org

6-8 June 2002

**The Western College of Veterinary Medicine
June Conference**

Saskatoon, SK

Contact: WCVM, U of S, Cont. Vet. Ed.

Tel.: (306) 966-7267

Fax: (306) 966-7274

Change of address notices and requests for subscriptions are to be sent by mail to P.O. Box 310, Station H, Montreal, Quebec H3G 2K8 or by fax to (514) 932-5114 or by e-mail to info@snellmedical.com. Undeliverable copies are to be sent to the address above.

This publication is made possible by an educational grant from

Schering-Plough Animal Health