

# Treatment of guttural pouch mycosis with salpingopharyngostomy

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The case report by Rowe *et al* (2023) published in this issue describes a case of bilateral guttural pouch mycosis in a 9-month-old thoroughbred colt that was diagnosed due to unusual severe neurologic abnormalities including neck pain and abnormal head carriage. There was no evidence of hemorrhage in this case and therefore the colt was treated with debridement of the mycotic plaques, topical enilconazole, and ultimately a salpingopharyngeal fistula in the dorsal pharyngeal recess to inhibit the growth of the mycosis. The treatments were successful, and the colt went on to race.

The guttural pouch is an diverticulum of the auditory tube that is found in ungulates possessing an odd number of toes, including the horse.<sup>1</sup> The guttural pouches are susceptible to fungal and bacterial infections and the intimate association of the pouches with major arteries and nerves makes such infections potentially life-threatening. While the purpose of the guttural pouch is an area of speculation among equine researchers it is thought that cooling the blood before it reaches the brain especially during exercise is an important function.<sup>1</sup> The cooling of the blood is achieved by a large air filled space separated from the internal carotid artery by only a thin membrane. Therefore, any locally invasive disease within the guttural pouches can have dire consequences.

Fungal infection of the guttural pouch occurs rarely but, due to its anatomical position in relation to many neurovascular structures of the head, even mild disease can result in fatal hemorrhage and neurological sequelae.<sup>2</sup> Obtaining a positive culture from these cases can be difficult however the most commonly isolated fungal species is *Aspergillus fumigatus*.<sup>2</sup> The warm, dark, and humid environment of the guttural pouch may predispose it as a site of fungal infection. Jukic *et al* showed that the oxygen and carbon dioxide partial pressures within the guttural pouch vary significantly between horses and that they remain relatively static throughout the respiratory cycle in a normal guttural pouch.<sup>3</sup> This inter-horse variation may explain the seemingly random distribution of horses that are affected by guttural pouch mycosis. Additionally the individual differences may contribute to the less aggressive phenotype that resolves without treatment in 15-28 days that is seen in the experimentally induced *Aspergillus* guttural pouch mycosis model.<sup>4</sup> The case described in this report may have been complicated by the mixed infection cultured from the guttural pouch of both *Aspergillus fumigatus* and *Streptococcus equi subsp. zooepidemicus*.

Salpingopharyngostomy is the creation of a fistula between the pharynx and the guttural pouch and has been described as a treatment for guttural pouch mycosis.<sup>3,5-7</sup> The theory behind this procedure is that it opens the guttural pouch to the fluctuating change of respiratory gases and temperatures of the respiratory tract. Jukic *et al* demonstrated that following salpingopharyngostomy there was no difference in the mean partial pressures of oxygen and carbon dioxide within the guttural pouch however, the variability of the pressures was significantly increased with the partial pressures oscillating with the respiratory pattern.<sup>3</sup> This introduction

of varying gas levels may change the environment within the guttural pouches making them less hospitable to fungal growth and allowing for faster resolution of the infection. In this case, due to the bilateral nature of the disease the authors created a single salpingopharyngostomy in the dorsal pharyngeal recess to gain access to both guttural pouches simultaneously. Creating a bilateral opening is easily created and can even be made larger and more likely to remain patent by ablating part of the septum between the two pouches.

*Aspergillus* species are highly aerobic and can grow in most oxygen environments. However, they are also capable of growing at low oxygen tension and growth under these conditions may affect their pathogenicity by allowing secretion of virulence factors.<sup>8</sup> Hyperbaric oxygen treatment of *A. fumigatus* biofilms *in vitro* resulted in decreased biofilm proliferation by over 50%, though the effect was transient with growth re-establishing at 6 hours post treatment.<sup>9</sup> In human medicine, individuals with invasive fungal infections caused by *Aspergillus spp.* are routinely treated with hyperbaric oxygen therapy in addition to surgical debridement and anti-fungal medications.<sup>10</sup> Though there is a lack of controlled evidence to support this therapeutic in fungal infection, the complications are minimal and it is thought to improve the efficacy of neutrophils and macrophages by meeting their increased oxygen demands when clearing infections.<sup>11</sup> Additionally increased oxygen may improve the quality of the collagen matrix being created during the healing process.<sup>11</sup>

An additional therapeutic that might have been helpful in this case prior to salpingopharyngeal fistulation is topical oxygen therapy (TOT) which has been recently published by Lepage *et al* for use as an adjunct treatment in epistaxis cases following transarterial coil embolization (TACE) or as a primary treatment in non-bleeding cases.<sup>12</sup> Part of the rationale behind pursuing additional treatment options by this group is the percentage of horses that fail to completely resolve the neurologic sequelae of the disease which has been reported at 50%.<sup>13</sup> When examining the issue of recurrent epistaxis following TACE the survival rate is 84% which places this high level of persistent neurological abnormalities into sharp relief. Dysphagia particularly can be severe enough to necessitate euthanasia even in the face of successful hemorrhage management. Certainly, dysphagia can be reversible as in the case published by Whitehead *et al* that was managed successfully with topical anti-fungals, carotid occlusion and esophagostomy but it can be a lengthy process that not all owners or patients will tolerate.<sup>14</sup>

Guttural pouch mycosis does not lend itself to aggressive surgical debridement given the closely associated vessels and nerves to the mycotic plaques, however the somewhat enclosed environment of the guttural pouch may be an advantage for TOT. Lepage *et al* treated cases with TOT 4 times per day at 15 L/min for 1-2 weeks by placing an indwelling catheter into the affected guttural pouch and leaving it in place as much as possible for the duration of hospitalization. During treatments the horses were restrained with their heads at the height of the withers to decrease the opening of the guttural pouch orifice to maintain a closed high oxygen environment, though swallowing would still result in transient openings of the orifices.<sup>12</sup> Following a minimum of two treatments the fungal plaques were seen to begin regressing. Additionally the reported resolution or significant improvement of 10/12 neurologic disorders is encouraging compared to the 9/18 cases of resolution reported in a larger retrospective study on TACE.<sup>13</sup>

It is unlikely TOT and salpingopharyngostomy would have any additive effect if done concurrently since it is unlikely the higher oxygen tension could be achieved with the fistula. The two procedures could be considered in series with the salpingopharyngostomy created after initial TOT. The advantage of the salpingopharyngostomy alone is that it is a single treatment without the need for further treatments or hospitalization. Furthermore, while Jukic *et al* showed some variations in partial pressures of gas in horses with salpingopharyngostomies there was not significant variation in temperature or humidity. The horses were housed in a controlled environment during short sampling periods in that study and variations may be greater if horses with salpingopharyngostomies are not housed in an environmentally controlled condition.

Some of the clinical signs of this case report are difficult to attribute directly to the mycosis infection and there was confounding evidence of bacterial infection and other treatments. Regardless, guttural pouch mycosis can result in severe and possibly fatal disease as it almost did in this case report. Salpingopharyngostomy is an alternative treatment strategy to traditional medical treatment that should be considered in horses with guttural pouch mycosis.

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