New Perspectives on Diagnosis and Treatment of Progressive Ethmoid Hematomas

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The treatment approach for progressive ethmoid hematoma should be based on the primary site of the lesion. Noncontact photoablation of the base with a Nd:YAG laser, whether as a primary or adjunctive treatment, prevents recurrence in >80% of cases. Frequent reassessment and aggressive treatment while the mass is small is the key to managing recurrence. Author’s address: Department of Clinical Sciences, College of Veterinary Medicine, North Carolina State University, Raleigh, NC 27606. © 2002 AAEP.

1. Introduction

Progressive ethmoid hematoma (PEH) is a slowly expanding yet benign lesion of the ethmoid region and paranasal sinuses in horses. The etiology is unknown; it is presumed that the lesion begins with hemorrhage in the submucosa of the respiratory epithelium, causing the mucosa to stretch, thicken, and form a capsule around the slowly expanding hematoma.

The most consistent clinical sign is mild, usually intermittent serosanguineous or hemorrhagic discharge from one or both nostrils, depending on whether the lesion is unilateral or bilateral. Exercise may stimulate epistaxis. Respiratory stertor and exercise intolerance are not noted unless the PEH protrudes into the nasal passage. Other occasionally reported signs include facial swelling, head shaking, and foul odor from the nostril. As several other conditions can cause similar clinical signs, thorough evaluation is important in establishing a diagnosis and devising an appropriate treatment plan.

Treatment options include chemical ablation with intralesional formalin; transendoscopic snare removal; transendoscopic laser ablation via the nasal passage or trephine sinusotomy; and conventional surgical excision ± cryotherapy or laser ablation of the stalk or base via frontomaxillary sinus flap.

Reported recurrence rates are in the range of 20–50%, depending on the method of treatment, duration of follow-up, and type of follow-up (e.g., owner survey vs. endoscopic examination). For example, Rothaug and Tulleners recently reported a recurrence rate of 20% for PEH removed surgically via frontonasal bone flap, with intraoperative laser excision of the stalk of the hematoma. However, recurrence was defined simply as return of serosanguineous nasal discharge. The authors conceded that the recurrence rate could have been higher than 20%, as follow-up endoscopic examinations were performed in only 9 of 16 horses that did not exhibit return of clinical signs. It is possible that some of the remaining seven horses had recurrent
lesions, even though return of clinical signs was not reported at the time of follow-up.

The potential for recurrence is one of the most frustrating aspects of managing PEH. In fact, the expense of treatment and the possibility of recurrence (which would require repeated treatment) causes some owners to decline treatment. We have developed a protocol for managing PEH that takes an aggressive approach toward recurrence. This paper describes our basic procedures and the findings of a retrospective survey of 37 horses with a total of 44 PEH presented at the North Carolina State University College of Veterinary Medicine between 1986 and 1998.

2. Lesion Classification

Progressive ethmoid hematomas may be classified into four groups, based on the primary location of the mass (i.e., site of origin):

1. Ethmoid turbinates
2. Maxillary sinus
3. Sphenopalatine sinus
4. Any other location

Combinations of these groups also occur, as PEH may arise at more than one site in the same horse. Classification of the PEH is important because it influences the treatment approach (see below).

Ethmoid Turbinates

With this common presentation, the PEH originates in the ethmoid turbinate region. In our survey, 22 of 44 PEH (50%) were located in, and restricted to, the ethmoid area. A further 11 masses (25%) involved both the ethmoid area and the maxillary sinus.

Respiratory stertor is most common with PEH originating in the ethmoid area. As the hematoma enlarges it disrupts the ethmoid turbinates and protrudes into the nasopharynx, potentially impeding air flow. Of 17 horses in our survey with a presenting complaint of respiratory stertor, 16 horses had a PEH that involved the ethmoid area, either alone (10/16) or in conjunction with the maxillary sinus (6/16). In the remaining horse, the PEH originated in the maxillary sinus but had eroded through the floor of the sinus into the nasal cavity.

Maxillary and Sphenopalatine Sinuses

In our experience, the caudal maxillary sinus is a common site of origin for PEH. The sphenopalatine sinus (caudal and ventral to the ethmoid turbinate region) is a less common site. Typically, PEH originating in the sphenopalatine sinus invade the maxillary sinus as they expand, following the path of least resistance through the foramen linking these two sinuses, rather than eroding through the dense floor or wall of the sphenopalatine sinus.

Hematomas originating in either sinus may be small or large. Typically, no portion is observed on endoscopic examination of the nasal passages and ethmoid turbinate area. However, large PEH in the maxillary sinus may eventually disrupt the thin bony floor of the sinus, allowing extension of the mass into the nasal cavity and enabling the mass to be observed endoscopically. In our survey, the maxillary/sphenopalatine sinus was involved in 50% of cases, either alone (25%) or in conjunction with the ethmoid area (25%). The lesion extended into the nasal cavity in 4 of 11 cases (36%) of PEH involving the maxillary sinus alone.

Other Locations

PEH arising at any other site (e.g., the frontal sinus\textsuperscript{3,10}) are very uncommon. Although we have observed such cases, none of the 44 PEH in our survey originated at a site other than the ethmoid turbinates or maxillary/sphenopalatine sinus.

3. Diagnosis

Endoscopy

Endoscopic examination of the nasal passages and ethmoid turbinate area is the most common diagnostic technique used to evaluate the upper airway in horses with epistaxis or respiratory stertor. In many cases, the PEH is sufficiently large that the portion of the ethmoid turbinates normally visible endoscopically (the nasal ethmoid turbinates) is partially obscured by a mass that may protrude into the nasal passage (Fig. 1). These lesions appear greenish yellow to purplish red; flecks of blood and/or
purulent material may be present on the outer surface.

If the PEH is very small and located either deep within the ethmoid turbinate area or in the caudal maxillary or sphenopalatine sinus, endoscopic examination may reveal only a trickle of blood from the ethmoid region or middle nasal meatus. When blood is seen in the region of the ethmoid turbinates, close examination may reveal a small, dark mass in the most caudal aspect of the nasal ethmoid area.

In our experience, most PEH originating in the ethmoid turbinate area present as a large mass whose base is below the middle nasal ethmoid concha (Fig. 2). The origin of the PEH is determined by working the endoscope along the dorsal portion of the mass until the middle concha bone or the ethmoid turbinates are visualized. When we have been able to visualize these structures in this manner, the PEH has always been confined to the ethmoid region; we have yet to see any of these masses that involve the maxillary sinus.

Conversely, whenever the scope cannot be worked over or along the dorsal portion of the mass to a point where the ethmoid turbinates or portion of the middle concha can be observed, the PEH has almost always originated from with the maxillary sinus (Fig. 3). In such cases, the portion of the PEH that is visualized within the nasal passage has proven to be only a small portion of a large mass that has eroded through the floor of the sinus.

Endoscopy of the paranasal sinuses can be performed in the standing horse via trephine sinusotomy. Some clinicians use an arthroscope to examine the sinus cavity; however, a rigid arthroscope does not have enough flexibility to allow examination of all areas of the sinus.

Biopsy
Though biopsy of the mass can provide a definitive diagnosis, it is important to note that biopsy specimens collected transendoscopically may be inadequate. PEH have a thick capsule and most transendoscopic biopsy instruments cannot penetrate to sufficient depth to obtain a meaningful sample. Typically, all that is collected is the capsule, which primarily consists of respiratory mucosa. However, transendoscopic biopsy can be useful in ruling out other disease processes, such as tumors and granulomas. When it is necessary to establish a histologic diagnosis before surgery, transendoscopic snare removal of a portion of the mass should be attempted.

Radiography
Radiographically, PEH typically appear as a smooth, rounded soft-tissue density in the frontal and maxillary sinus and/or nasal passage. Additional radiographic findings may include fluid lines and/or opacities within the paranasal sinuses. Normal anatomical structures may prevent visualization of small PEH, so it is important to examine at least two radiographic views: a true lateral and a ventrodorsal view. Oblique views are helpful in some cases, particularly if bilateral lesions are suspected.
Radiography is necessary to determine the location and size of the PEH before surgery. This information is important in selecting the most appropriate surgical approach. However, radiography is of limited value for definitive diagnosis, as it merely indicates that some type of mass is present. Other diagnostic tools are necessary to differentiate between PEH, tumors, granulomas, and cystic structures.

Nuclear Scintigraphy
The value of nuclear scintigraphy is not in determining the origin or size of the PEH but in differentiating between PEH and other lesions, such as sinus cysts and carcinomas of the nasal passages, sinuses, or ethmoid turbinate area. On bone-phase scintigraphy, a PEH appears as a large, poorly defined “hot spot” within the sinus or ethmoid turbinate area. In contrast, sinus cysts appear as a well-defined, circular structure within the maxillary or frontal sinus. The center of the cystic structure is “cold” whereas the perimeter is “hot.” Carcinomas quickly invade surrounding bone, which is easily demonstrated with nuclear scintigraphy and differentiates these masses from PEH.

Computerized Tomography
Computerized tomography (CT) is the most useful imaging technique for determining the precise origin, shape, and size of the hematoma. It is far superior to flat-film radiography and nuclear scintigraphy. CT eliminates all superimposition of ocular, oral, and sinus structures that interfere with interpretation of routine radiographs.

Another great benefit of CT is that it reveals bilateral lesions (Fig. 4). In our survey, PEH was bilateral in 6 of 37 horses (16%). In cases of bilateral PEH, it is not uncommon to find a very large PEH filling the entire maxillary sinus and a portion of the nasal cavity on one side and a very small PEH on the opposite side. The small lesion may go undetected by using endoscopy or flat-film radiography, whereas it is readily apparent on CT images.

3. Treatment
The treatment approach is dictated by the size and location of the mass. Small PEH in the nasal ethmoid turbinate area are treated with transendoscopic photoablation by using a neodymium:yttrium-aluminum-garnet (Nd:YAG) laser. Larger PEH in this area require some type of debulking (intralesional formalin and/or transendoscopic snare) before laser ablation. PEH originating in the maxillary or sphenopalatine sinus are best approached surgically via trephine sinusotomy or frontomaxillary flap sinusotomy. While the nasal portion of masses that have extended through the floor of the sinus can be accessed transendoscopically by using a nasal approach, usually it is only a small portion of a much larger mass within the sinus. Recurrence is likely if the entire lesion is not removed and its base ablated.
Transendoscopic Nasal Approach

PEH originating in the nasal portion of the ethmoid turbinates are treated in the standing, sedated horse. We use a Nd:YAG laser transendoscopically in a noncontact (free fiber) manner to photoablate the mass (Fig. 5). By using the laser in a noncontact manner (with the tip approximately 1 cm from the surface of the PEH), we are able to photoablate the entire mass, including its base. As this approach requires large amounts of laser energy, it is done in stages, irradiating remaining portions of the mass every other day until the PEH is totally obliterated. For large PEH (≥3-cm diameter) the number of laser treatments is reduced by first debulking the mass with intrallesional formalin and/or transendoscopic snare.

The most difficult part of successfully resolving PEH in this manner is not removing the large mass protruding into the nasal passage but eliminating the base of the PEH within the ethmoid turbinate area. Once sufficient debridement has occurred and the ethmoid turbinates can be visualized endoscopically, irradiation is continued every other day until the origin of the lesion has been obliterated. Failure to ablate the base of the lesion would, we feel, increase the likelihood of recurrence (Fig. 6). As this procedure is performed on the standing horse, the treatment course can be completed on an outpatient basis, if the client chooses.

In our survey, 17 of 18 PEH originating in the ethmoid turbinate area that underwent treatment were managed by using this approach. The total number of laser treatments per horse ranged from 2 to 16, with a mean of 7.6 (median, 9) treatments. In 8 cases, the total number of treatments was ≤6; in the other 9 cases, the total number of treatments was ≥9. Follow-up times post-treatment ranged from 1–5 yr. Recurrence, as determined by endoscopic examination, was reported in only 3/17 cases (17.6%).

Trephine Sinusotomy

Laser irradiation of small (<3-cm diameter) PEH originating in the maxillary, sphenopalatine, or frontal sinus can often be performed endoscopically through a small trephine hole. Trephination can be performed on the standing horse by using sedation and local anesthetic. The ideal location for trephination is 2 cm medial and rostral to the medial canthus of the eye. Using this approach, the PEH is irradiated with the Nd:YAG laser as described above (i.e., every other day until the base is obliterated). As with a transendoscopic nasal approach, treatment can be performed on an outpatient basis. When the treatment course is completed, the trephine hole is left open to heal by second intention.

Frontomaxillary Flap Sinusotomy

Larger PEH that occupy the maxillary or other sinuses should be approached surgically, whether or not they have a nasal component. The horse is placed under general anesthesia and a bone flap is created 2–3 cm medial to the medial canthus of the eye, directly over the frontomaxillary foramen. A bone flap 4–5 cm wide and 6–8 cm long is usually sufficient to allow complete removal of a PEH that fills the entire maxillary and frontal sinus.

The capsule of the PEH is disrupted and the contents are removed. The entire capsule is then teased loose from the wall of the sinus and removed. Unless the PEH has already eroded into the nasal passage, a hole ~4 cm in diameter is made through the floor of the maxillary sinus to create a permanent opening between the sinus and the nasal cavity for later examination and treatment (Fig. 7). The lower corner of the bone flap is removed before the flap is replaced, to create a portal through which the sinus can be flushed postsurgery.

In most cases, hemorrhage is controlled by packing the sinus. The end of the packing material is exited through either the nasal cavity or the hole at the corner of the bone flap. The packing is usually removed on the fourth day postsurgery. The sinus is then flushed for 7–10 d. Two to three weeks after surgery (i.e., once the sinus mucosa has healed), the sinus is examined endoscopically, via the nasal passage, and any remnants of the PEH or any suspect tissue is photoablated. Treatment is repeated every other day, as described above, until the base of the lesion is obliterated.

In our survey, 20 of 22 cases of maxillary/sphenopalatine PEH were treated with photoablation following surgical removal of the mass via sinus...
flap. The number of postoperative laser treatments ranged from 1 to 9, with a mean of 2.5 (median, 1.5) treatments. The period of follow-up ranged from 1–4 yr. Recurrence, as determined by endoscopic examination, was reported in 4 of 22 cases (18.2%). In each of these four cases, the original PEH was large. In three of the four horses, the PEH involved both the maxillary sinus and the ethmoid turbinate area. In the remaining case the PEH involved only the maxillary sinus, but it extended into the nasal cavity.

4. Monitoring for Recurrence

Regardless of which treatment approach is used, a key component of our protocol is frequent monitoring for recurrence and aggressive treatment of any recurrent lesions while they are still small. In our experience, most PEH recur within 1 yr of removal, so patients are monitored frequently for the first 12 mo post-treatment. After completion of the initial treatment course, the horse is rechecked at 3 wk then every 3 mo for at least 1 yr.

Assessment includes endoscopic examination of the original lesion site (Fig. 8). Even with maxillary/sphenopalatine PEH, the site can be examined via a nasal approach in most cases, as the hole created in the floor of the sinus generally remains patent. (Creating this hole during frontomaxillary flap sinusotomy is thus an important step in managing sinus PEH long-term.) Laser ablation is performed on any suspect tissue found at any recheck. In the majority of cases, only one or two laser treatments are required to obliterate any recurrent lesions if performed when the mass is small. Treatment can be performed on an outpatient basis.

5. Discussion

While a variety of medical and surgical techniques can be used to debulk or resect a PEH, none prevents recurrence in 100% of cases, not even noncontact photoablation with the Nd:YAG laser. However, the laser is an effective tool for obliterating the base of the lesion and for treating recurrent lesions in the standing horse, provided the mass is identified and treated while it is small.

In our experience, best long-term results are achieved when the owner commits to thorough diagnostic evaluation (including CT) and to a program of frequent reassessment for at least the first 12 mo after removal of the lesion. Using CT, bilateral lesions are identified and removed during the initial treatment. In addition, CT may be a wise precaution before debulking of an ethmoid turbinate mass with intralesional formalin. A recent report described fatal complications of intralesional formalin in a horse whose cribiform plate had been damaged by a large PEH. Leakage of formalin through the cribiform plate resulted in extensive hemorrhage and necrosis of the olfactory bulb and frontal lobe of the brain.13

Frequent reassessment is important because it allows us to identify and treat any recurrent lesions while they are still small. Though this approach necessitates multiple endoscopic examinations, it

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Fig. 7. Endoscopic picture looking into the maxillary sinus (A) showing the heal edge of a surgically created opening (B) between the sinus and nasal pharynx just rostral to the ethmoid turbinate (C).

Fig. 8. Endoscopic picture with the arrow indicating the presents of a reoccurrence of a PEH within the maxillary sinus as seen from the nasal pharynx.
ultimately spares the horse repeated surgery should the PEH recur.

In summary, successful treatment of PEH begins with classifying the lesion according to its site of origin and selecting a treatment plan accordingly. Obliteration of the base of the lesion is important in limiting recurrence. Photoablation of the base with a Nd:YAG laser in a noncontact manner, whether as a primary or adjunctive treatment, prevents recurrence in ~82% of cases. Regardless of the method(s) used to remove the mass, frequent reassessment and aggressive treatment of any recurrence is important in the long-term management of PEH.

References