Conlan's Sinus Crisis

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Introduction:

A significant majority of the equine skull is composed of large air-filled cavities referred to as the paranasal sinuses. These sinuses accommodate the maxillary premolar and molar tooth roots (upper cheek teeth), facilitate passage of facial nerves, and extend around (above and below) the horse's eyes and end around the facial crest[1]. The respiratory mucosa of these sinuses continually produces a layer of mucus that is moved by mucociliary transport caudally towards the nasopharynx, where it is normally swallowed. The drainage pathways of the paranasal sinuses are very narrow spaces (1-2mm wide) and even a mild degree of inflammation of the mucosa lining the sino-nasal apertures may obstruct them. If excessive amounts of secretions are produced, normal mucociliary clearance will be overcome and sinus secretions and/or exudate will then flow down into the nasal cavity[4]. This will commonly result in nasal drainage which is normally the first clinical sign appreciated by owners when their horse is suffering from sinusitis. Sinusitis refers to inflammation or infection of one or more of the paranasal sinuses, and it is the most encountered disease of the paranasal sinuses. It is classified as either primary or secondary, and acute or chronic. Primary sinusitis is defined as an infection in the sinus, usually bacterial in origin, which results in a buildup of pus within the sinus. Primary sinusitis is typically the result of an infection in the upper respiratory tract, and it is most frequently caused by Streptococcus species of bacteria[1].

Primary sinusitis is diagnosed when there is no detectable predisposition to a bacterial sinus infection other than possible antecedent respiratory infection[4]. Secondary sinusitis refers to sinus inflammation that is secondary to other disorders including mycotic infections, dental disease, sinus cysts, neoplasia, ethmoid hematomas, or trauma. The last four upper cheek teeth are most likely to cause a secondary sinusitis due to dental disease, as these tooth roots are

contained within the maxillary sinuses. An infection of a tooth root leading to chronic secondary sinusitis will be the focus of the discussion, but before diving deep into the "tooth roots" of this case, lets review a little bit about equine sinus anatomy. The horse's head has uniquely adapted itself and developed six pairs of paranasal sinuses—the frontal, sphenopalatine and maxillary sinuses, and the dorsal, middle and ventral conchal sinuses. The maxillary sinus is the largest paranasal sinus and is divided into two parts (rostral and caudal) by a thin septum[1]. The ventral conchal sinus drains over the infraorbital canal into the rostral maxillary sinus via the concho-maxillary opening and the secretions of both compartments then drain via the naso-maxillary opening (aperture) of the rostral maxillary sinus. The conchofrontal, ethmoidal, and sphenopalatine sinuses all drain into the caudal maxillary sinus, and all five compartments then drain via the caudomaxillary sinus sino-nasal ostium[4].

History and Presentation:

A 17-year-old Hanoverian gelding presented to the Mississippi State University College of Veterinary Medicine Equine Service for persistent nasal drainage. At the time of presentation, the patient had been suffering from chronic intermittent nasal drainage (primarily from the right nostril) for approximately one year duration that continued after molar 111 and 211 extraction was performed by his primary veterinarian. After minimal improvement in his clinical signs, the gelding was referred for further diagnostic imaging and evaluation. Aside from his persistent nasal drainage, his owners reported that he was still competing normally in his hunter jumper discipline and no other respiratory signs had been appreciated.

Upon presentation, physical exam was unremarkable. He weighed approximately 1305 lbs (591 kg) with a body condition score of 5/9 (5 being ideal). His vital parameters were normal with a heart rate of 40 beats per minute, respiratory rate of 16 breaths per minute, and rectal

temperature of 99.4 degrees Fahrenheit. His oral mucous membranes were pink and moist with a capillary refill time of less than two seconds. No murmurs or arrhythmias were heard on auscultation, and he had normal bronchovesicular sounds with no crackles or wheezes appreciated. He had normal gastrointestinal motility in all four abdominal quadrants and normal digital pulses were appreciated on all limbs. All palpable lymph nodes were soft and symmetrical. No nasal drainage was noted on presentation from either nostril. The remainder of his physical examination was within normal limits.

The primary clinical signs of sinusitis include unilateral mucopurulent or purulent nasal discharge and ipsilateral submandibular lymphadenopathy caused by the infective process[4]. On presentation, there were no signs of lymphadenopathy, and his nasal drainage was mostly described as serous and primarily unilateral from his right nostril per his owners.

Diagnostic Approach:

In any case presenting with unilateral nasal drainage the first step towards diagnosis is performing a full physical examination. If poor dentition or dental disease is thought to be attributing to the problem, a detailed examination of the oral cavity can often give invaluable information on the cause of sinusitis[4]. A dental speculum is an essential device that enables visual and digital examination of the teeth without injury to the operator's arm[5]. The horse is normally placed under standing sedation to facilitate relaxation and ease of oral examination. If any abnormalities are found during oral examination the most common next step for diagnostic evaluation is to evaluate the skull and sinuses with radiographs.

Radiographic changes may be present in the apices of the 08–11 maxillary cheek teeth in cases of dental sinusitis. These changes include widening of the periodontal space, loss of lamina

dura (‘cortex’ of alveolus) and blunting of roots (if developed). More chronic dental sinusitis cases may also have periapical radiolucent halos surrounded by an area of sclerosis. Computed tomography (CT) and magnetic resonance imaging (MRI) are increasingly being used to obtain detailed images of the complex and overlapping structures of the equine head and thus can help make an early and accurate diagnosis of sinus disorders. CT allows superior visualization of bony structures; soft tissue structures and therefore paranasal cavities and sinus disorders are ideal applications for CT scanning[4].

Based off records from the referring veterinarian, a CT scan was scheduled to assess the sinuses and maxillary cheek teeth which were thought to be the underlying cause for the sinusitis. This assessment was necessary for surgical planning and required general anesthesia. The CT scan reported the caudal buccal root of the right first maxillary molar (tooth 109) to have focal permeative lysis of the lingual aspect of the tooth root with widening of the periodontal ligament space and sclerosis of the adjacent alveolar bone. The tooth roots of the right first maxillary molar were also blunted and foreshortened. These findings were interpreted as a tooth root abscess with associated tooth root lysis of the right first maxillary molar (tooth 109) with subsequent rostral maxillary and ventral conchal sinusitis. There was also abnormal anatomy of the right dorsal and ventral conchae and widening of the meati appreciated. This was interpreted to reflect ongoing chronic sinusitis which coincided with the chronicity of the condition described by the owners and referring veterinarian. Given the history and CT findings, the main differential remained to be secondary sinusitis and surgery to remove the infected tooth was scheduled for the following day.

Pathophysiology:

Because the teeth of horses are constantly erupting and wearing, horses are predisposed to the development of particular forms of dental disease. Early signs of acquired dental disease are often subtle or inapparent; thus, veterinarians are commonly presented with a horse in which disease of a tooth or its periodontium has progressed to the point that overt signs of dental disease such as nasal discharge, facial swelling, poor mastication, and even weight loss are apparent. As bacteria invade periapical tissues, different sequelae may occur depending on the location of the diseased tooth. In some cases, a balance may be established between the infection and the host defenses, and periapical infection becomes chronic and remains localized.

More frequently, hydrostatic pressure within the periapical abscess rises, causing exudate to track through the cancellous bone of the mandible or maxilla; and eventually, exudate perforates the bony cortex. After the infection perforates the cortex, soft tissue inflammation ensues, and swelling becomes evident. Extension of periapical infection into the cortical bone overlying a premaxillary tooth (whose apex lies rostral to the maxillary sinuses) produces facial swelling, whereas periapical infection of a maxillary molar whose apex resides within the paranasal sinuses, results in empyema of the paranasal sinuses and unilateral purulent nasal discharge unaccompanied by facial swelling[3].

Treatment:

Regardless of whether the sinusitis is primary or secondary, the goal of treatment is to treat the underlying cause and to restore the horse's natural sinus drainage mechanisms. Primary sinusitis is most resolved with treatment of underlying upper respiratory disease, systemic antimicrobial therapy, and sinus lavage. If the pus inside the sinus becomes inspissated, common treatment options include sinus trephination or sinusotomy. In cases of secondary sinusitis

caused by dental disease, the affected tooth may be removed under standing sedation or general anesthesia. The tooth socket is typically flushed and packed with a non-absorbable material after removal to prevent recontamination of the sinus[1]. Given the location and chronicity of the periapical infection it was necessary to perform tooth repulsion with a rostral maxillary sinus bone flap approach.

The gelding was placed under standing sedation with detomidine. His forehead was clipped from the area above the eye distally to the muzzle on both sides. It was sterilely scrubbed with dilute betadine and alcohol and then draped. A three-sided incision was made on the right side of his forehead that began at the level of the medial canthus that was approximately 6 cm (horizontal) by 9 cm (vertical) by 6 cm. A scalpel, bone chisel and mallet were used to create the bone flaps, also 6 cm by 9 cm by 6 cm. A bone chisel was used to enter the right maxillary sinus cavities. The sinus cavities contained some mucopurulent material and were copiously lavaged with sterile saline. The right first maxillary molar (tooth 109) was removed using a tooth punch and mallet. The alveolar socket of the removed molar was packed with Technovit (an acrylic powder packing material). The sinus was thoroughly lavaged with lactated ringers solution and then packed with sterile gauze. The periosteum was closed with a simple continuous suture pattern using 2-0 PDS. The skin was closed with skin staples. Intraoperative skull radiographs were taken throughout the procedure to guide cheek tooth repulsion and ensure no dental fragments remained. Once recovered from sedation the patient was returned to his stall where he continued to recover from surgery uneventfully. Minimal hemorrhagic nasal drainage was noted the first day post-operatively but resolved the following morning after cotton packing was removed and the right maxillary sinuses were lavaged with 2 L of lactated ringers solution. Further management for sinusitis may be required depending on complications following

different tooth repulsion techniques, which will be discussed in the next section of this presentation. The patient was kept comfortable with intravenous flunixin meglumine administered twice daily for 5 days after the procedure. He also was administered Uniprim (trimethoprim-sulfadiazine) orally twice daily to treat his periapical abscess post-operatively and remained on this medication for an additional two weeks after his discharge 3 days later.

Discussion:

The most common way to resolve secondary sinusitis associated with dental disease is to remove the affected tooth that serves as an infection nidus. Because the equine premolars and molars have compound roots and, particularly in young adults, long reserve crowns, cheek tooth extraction in horses can be challenging and carries a significant risk for intra- and post-operative complications. Complications include cheek tooth fragmentation and incomplete removal of all dental fragments; damage of adjacent cheek teeth; persistent dental sinusitis; delayed alveolar granulation, resulting in trapping and subsequent putrefaction of food in the open alveolus; damage to the alveolar bone, resulting in sequestration and/or osteomyelitis; incisional infection; fistulation (orosinus, oronasal, or orocutaneous); regional nerve damage (facial, infraorbital, or mandibular nerve); hemorrhage (e.g. laceration of the palatine or mandibular artery); and parotid duct injury[2].

Reported complication rates vary considerably among studies, from less than 4% to over 70%, but generally they are lowest for oral extraction in the standing horse and highest for repulsion of maxillary cheek teeth under general anesthesia. One study compared different methods of cheek tooth extraction including oral extraction; repulsion of maxillary cheek teeth into the oral cavity; maxillary trephination or maxillary sinus bone flap; repulsion of mandibular cheek teeth into the oral cavity by trephination or ventral mandibular approach; and lateral

buccotomy (maxillary or mandibular cheek teeth). It was found that the incidence of post-operative complications was lowest for oral extraction than for any of the surgical extraction methods included in the study[2].

In this same study, it was noted that the sinus bone flap approach in conjunction with tooth repulsion reported to have the most incidence of post-operative sinusitis; however, this technique was also often elected due to the chronicity of the sinusitis and lack of response to other treatment regimens (similar to this case presentation) therefore increasing the risk of post-operative complications. Chronic sinusitis revealed chronic granulation tissue and bacterial sequestration, based on culture of debrided tissue. In the early part of the study, this may have erroneously led surgeons to use a sinusotomy as the primary means of treating the sinusitis and removing the affected cheek tooth under general anesthesia. The current method of choice would be to extract the tooth orally and treat the sinusitis standing using a minimally invasive technique. In the patient population evaluated in this same study oral extraction was associated with the lowest incidence of post-operative complications; it was also the most economical method of cheek tooth extraction. However, oral extraction was not always successful and in 60 cases was not even attempted due to the surgeon's preference. General anesthesia was elected in several cases to complete oral extraction because of the inability to remove all dental fragments in the standing horse[2].

Case Outcome:

Slight hemorrhagic unilateral nasal discharge was appreciated from the right nostril post-operatively, however, this resolved after the cotton packing in the sinus was removed and the rostral and caudal maxillary sinuses were lavaged with 2 L of LRS fluids one day post-operatively. This procedure was performed every 24 hours while hospitalized. The patient was

scheduled to undergo a follow-up dental examination 2-3 months after discharge by his primary veterinarian. At this time, if the Technovit dental plug was still in place where his original tooth 109 had been, his primary veterinarian would remove it.

His owners were instructed to restrict him to a stall or small paddock until his staples were removed (14 days post-operatively). After this time, he could return to his normal turnout and exercise regime. This case is a great example of the importance of thorough equine dental examinations utilizing oral speculums. Without this vital part of the equine physical examination combined with utilizing skull radiographs, the nasal discharge corresponding to the patient's chronic dental disease could have been misdiagnosed. Although this case was eventually handled at a specialty referral level, this same case presentation could be diagnosed and treated in large animal general practice especially in a situation where referral was not an economical option for the patient.

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