*Opis przypadku* *Case report*

# Atypical dentigerous cyst location in the equine neurocranium: evaluation of a minimally invasive extraction technique performed under stable conditions in the context of global literature

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Summary

**A dentigerous cyst (Latin: *cystisdentigerus*), also known as a follicular cyst, is a pathological condition noted in both medical and veterinary surgical practice. Clinical symptoms usually appear in patients before reaching maturity, although there are exceptions. The main thesis concerning the origin of this phenomenon indicates developmental disorders at the prenatal stage of organogenesis. The tooth bud tissue of the branchial arch shifts towards the temporal, frontal, ethmoid and maxillary bones.**

**The presence of a cyst, or rather a tooth bud, or tooth-like growths in its vicinity can present a number of non-specific pathological symptoms, depending on its location. These include the deformation and asymmetry of the cranial bones, sinusitis, secondary bacterial infections, and head-shaking syndrome. Diagnostic methods used in equine medicine include radiology, CT, and endoscopic examinations. Field practice has certain limitations. For example, it does not allow for the use of computed tomography, which does not preclude the performance of even complicated surgical procedures. The present article is an example of this. The mare underwent a clinical examination during which a regular, fluctuating swelling was diagnosed, extending from the base of the right auricle to the fronto-zygomatic region. The lesion was incised, the fluid inside was drained, and its interior was then palpated. A fistulous opening of about 4 cm in diameter was diagnosed in the frontal bone at the suture with the zygomatic bone. At the bottom of the fistula there was pathological tissue resembling the grinding surface of a cheek tooth. Detailed examinations were carried out using X-ray and an endoscope to plan the surgery to remove the pathological lesion: the tooth-like tissue from the frontal sinus. Due to the fact that the procedure was planned to be performed in a stable, the concept of sinus trephination was rejected and it was decided that surgical access would be through the cyst opening. The clinical examination of the described mare's oral cavity showed no clinical changes and the dental formula was characteristic of her age. The present article describes a case, unprecedented in literature, of the presence of a tooth-like tissue located at the border of the frontal sinus and the ethmoid bone. The treatment required surgical intervention, i.e. an osteotomy using orthopaedic drill bits, resulting in the patient regaining full function.**

**Keywords: dentigerous cyst, odontogenic cyst, tooth-like tissue, ectopic odontogenic tissue**

This paper has aimed to describe a surgical procedure for removing a tooth-like tissue located in the floor of the frontal sinus, penetrating deep into the skull towards the ethmoid bone (1). The lesion concerned represents an exception to the pathologies described earlier. Polish scientist-clinicians (29), who described similar cases in 2005, have significant experience in operating on this type of pathology. According to the cross-case publication by Schläpfer et al. (25), "dentigerous cysts are well-known congenital defects in horses, with the most common location for the cysts being the base of the ear (29), although other locations

have been described, including the maxillary sinus, the upper jaw and the mandible" (8, 20, 25). Bilateral odontogenic cysts are possible but rare (7, 16, 26). Odontogenic cysts can be clinically visible at birth or become visible later in life (7).

There is extensive literature on the subject of equine dentigerous cysts, with the first reports published in 1893 (6) and 1905 (19). These initial reports were followed by many retrospective studies, questionnaire surveys and case reports published in the 20th century (7, 10, 15, 18, 23). After 2000, a retrospective study (3) and several case reports (2, 8, 9, 11-14, 17, 21, 22, 24) were published. The literature also provides cases of dentigerous cysts in atypical locations. These cysts are usually congenital and often co-exist with ectopic or supernumerary teeth, especially in the aural or maxillary regions in horses. Interestingly, a recent retrospective study found that most cysts were located near the ear, but one case concerned the maxillary sinus, indicating that an atypical location is possible. CT imaging proved to be indispensable for both the diagnosis and the planning of surgical treatment (5, 25, 27). In another case described in veterinary literature, concerning a Quarter Horse, the presence of a dentigerous cyst associated with a supernumerary first premolar was found (Triadan 105). The unusual association of this tooth with the development of a cyst undermines the commonly accepted assumption that lesions of this type only occur in connection with certain types of teeth or their standard location (12). A Brazilian case report described a dentigerous cyst (polidontiaheterotópica) located in the temporal region of the horse's skull, in the vicinity of the right ear (21). Surgery revealed tooth-like structures embedded in the tissues, which confirmed the presence of the ectopic tooth tissue. This conclusion supports the hypothesis that structures of this kind can develop in atypical regions of the skull. A particularly interesting case is that of bilateral congenital cysts located in the frontal sinuses of a miniature horse (4). Although the report does not clearly confirm the presence of dental elements in the cysts, their location (frontal sinus) is atypical, and may suggest an ectopic dental origin, especially considering the young age of the animal (4). The cases described above are very interesting, yet the current case discussed below stands out significantly against their background.

## Case description

The procedure was performed in stable conditions. The owner declined treatment at a clinic and a computed tomography (CT) scan. The patient: A 14-month-old filly, weighing 600 kg, Polish Coldblood breed, kept on pasture. Lunged occasionally. Internal body temperature: 38°C, heart rate: 40 beats per minute, respiratory rate: 10 breaths per minute. Basic blood biochemical and morphological parameters were within normal limits. Regularly dewormed, vaccinated against influenza and tetanus. Appetite and thirst were normal. Body condition was good; the coat was shiny and lustrous. The horse shows no signs of pain. The history revealed episodic headshaking for several months. The owner attributed these signs to the presence of insects and post-weaning stress.

A month prior to reporting the case, head rubbing against wooden objects was observed. After a few days, a swell-

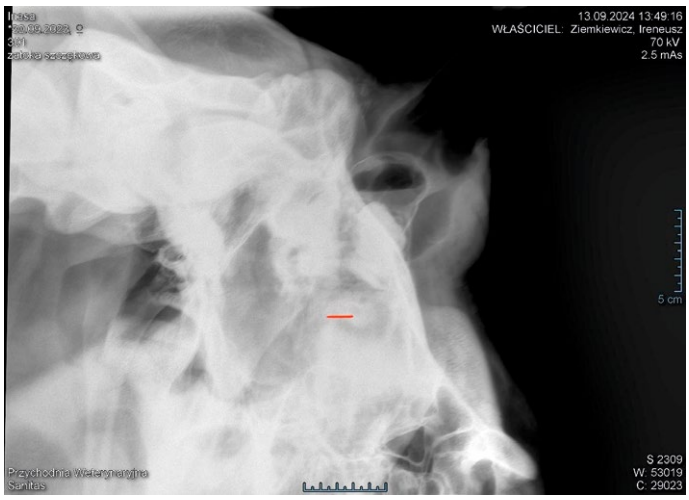


**Fig. 1. The red marker shows the mineralized structure**

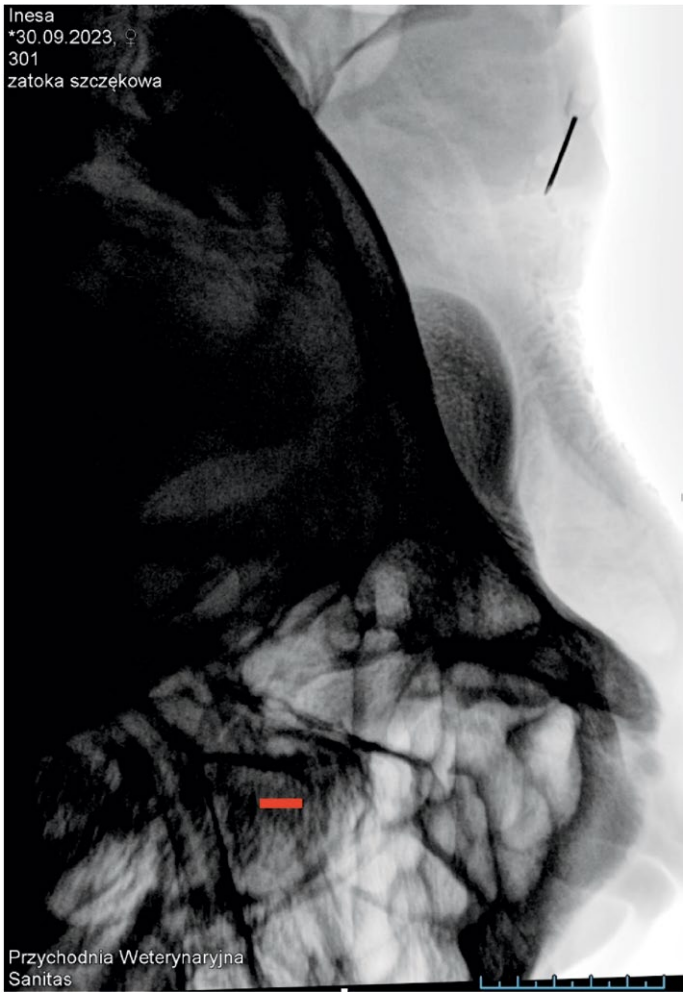


**Fig. 2. A negative roentgenogram showing an additional cone-shaped structure radiopaque similar to a molar tooth. At 2 o'clock on the right side, there is a shadow of an injection needle, indicating the prominence of the cyst**

ing emerged on the right side of the frontotemporal region, reaching up to the base of the ear. A few days before the visit, a lump the size of a nut emerged at a distance of approximately 4 cm from the base of the earlobe.

**Diagnostic imaging.** Prior to performing radiological examination, the animal was sedated using detomidine at 0.02 mg/kg BW and butorphanol at 0.02 mg/kg BW. After approximately three minutes, the radiological examination was carried out, followed by endoscopic examination.

The views obtained: oblique ML dorsolateral (Fig. 1, 2).

The roentgenogram proved to be not diagnostically useful enough.

An operative field was prepared for the endoscopic examination. The prominence of the frontoconchal region was incised to release the fluid it contained. An endoscope tube was inserted at the site of the fistula prominence and guided into the frontal sinus via the external frontal crest, covering a distance of approximately 12 cm.

In the floor of the sinus (Fig. 3), the presence of a tooth-like tissue protruding approximately 2 mm above its surface and resembling the occlusal surface of a molar was confirmed. Attempts to lever the endoscopically visualized structure with extracting forceps proved unsuccessful. After the examination, the wound was cleansed with a sterile fluid and covered with sterile gauze.

The removed lesion was assessed macroscopically. An endoscopic inspection of the sinus was then performed to confirm that the pathological condition operated on, i.e. the tooth-like tissue, was an irregular mineral mass embedded in the skull bone, and only part of it was visualized during the endoscopic and radiological examinations. The rest was embedded in bone connections and changed the image of the examined tissues of the middle nasal conchae and the frontal sinus.

A theory has been put forward that the tooth-like tissue operated on is a pathological, mineralized M3 tooth bud that was erupting in a frontal direction instead of in the maxillary direction.

It was decided to operate on the horse in a lying position.

An IV cannula was connected to the jugular vein, and a second dose of sedative medications (detomidine and butorphanol) was administered. After several minutes, ketamine (at 2 mg/kg BW) with propofol (at 0.2 mg/kg BW) was added. The horse was positioned for the surgery.

**The course of the surgery.** The operative field was prepared according to standard procedures.

For the extraction of the ectopic odontogenic tissue, the following instruments were prepared: a drill with an orthopaedic drill bit, threaded orthopaedic wires (2.5 mm thick and 15 cm long), an orthopaedic ruler (measuring device), Kocher forceps, and a needle holder. The use of orthopaedic gouges/chisels was abandoned due to the close proximity of the brain.

The access point was a channel in the frontal bone, eroded/hollowed out by the accumulating fistulous fluid. The aforementioned channel, approximately 4 cm in diameter, served as the access point to the operated tissue, through which the instruments were introduced.

The odontogenic tissue was drilled with two openings using orthopaedic drill bits. The procedure required precision in selecting the drilling points and controlling the rotational speed (not exceeding 3 revolutions per second). Threaded orthopaedic wires were then screwed into these openings. The procedure of drilling to weaken the connection was repeated, and the bone-odontogenic tissue connection was dissected. Several openings, weakening the connection, were drilled in the floor of the frontal sinus along the perimeter of the protruding lesion. The depth of these openings did not exceed 10 mm. The drill bit immersion depth was measured using an orthopaedic ruler.

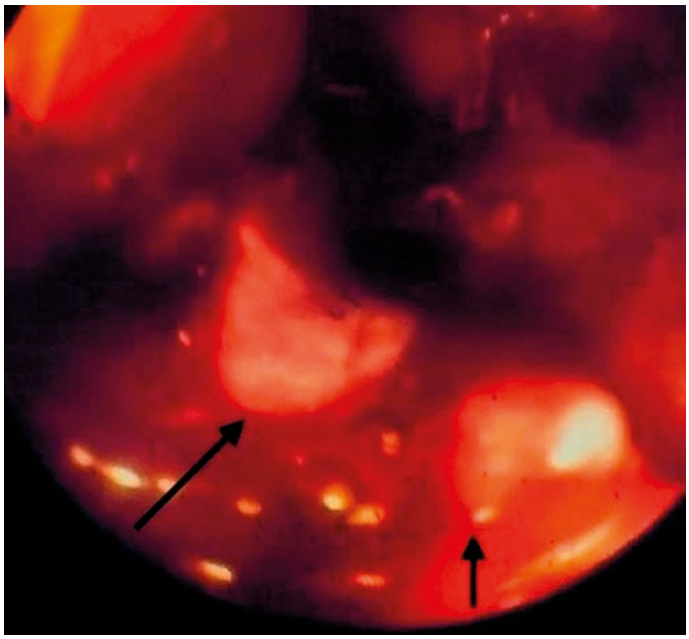

**Fig. 3.**

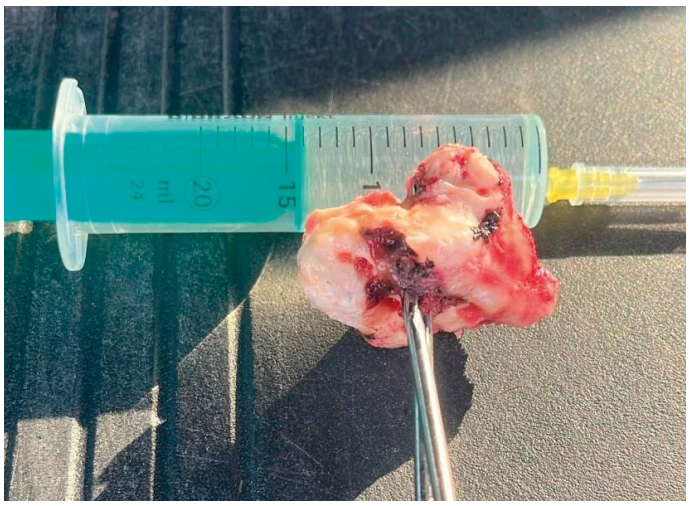

**Fig. 4.**

With the sinus surgically prepared, the odontogenic tissue was evacuated by performing pendulum-like movements with the previously installed/inserted Schanzorthopaedic wires. Slight bleeding was observed. After a moment, the operated tissue was removed from the operative field (Fig. 4). The tissue measured 38 mm × 25 mm was By irrigating the wound with 2 litres of 0.9% NaCl, clots and residues of the drilled tissue were removed.

**Postoperative treatment.** A seton containing penicillin and streptomycin was inserted into the wound. After two days, the seton was removed. It was recommended to rinse

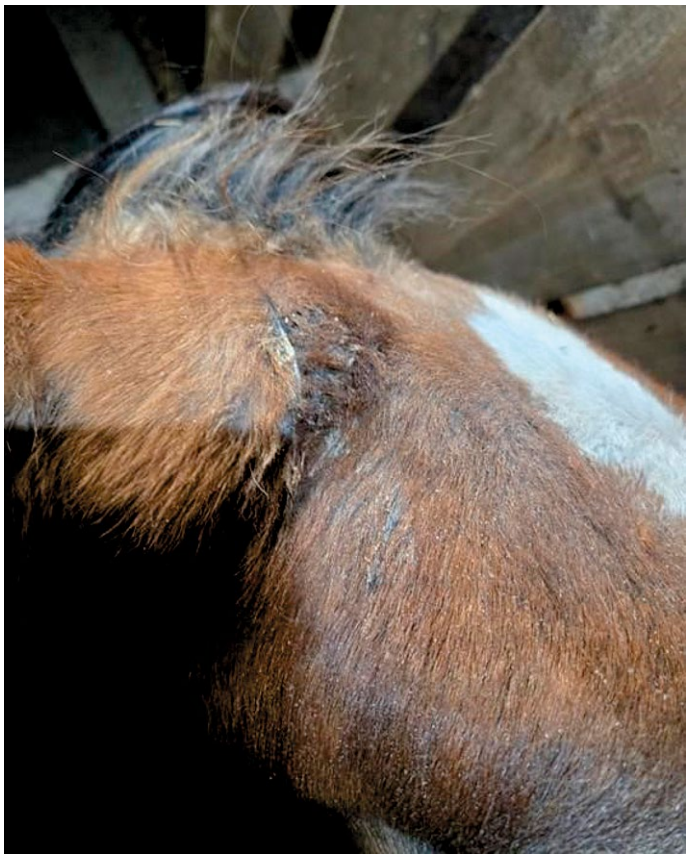

**Fig. 5.**

the wound with Ringer's solution containing penicillin and streptomycin for 7 consecutive days, twice a day, and with hydrogen peroxide solution.

On the day of the surgery, the patient was administered 50 mL of a preparation containing two types of penicillin and streptomycin (Benzylpenicillinumbenzathinum – 100,000 IU, Benzylpenicillinumprocainicum – 100,000 IU, Dihydrostreptomycinumsulfuricum – 200 mg/1 mL). It was recommended to continue administering this antibiotic every 48 hours for four more doses.

Additionally, flunixin was administered at a dose of 1.1 mg/kg of body weight (b.w.), and its administration was recommended for the next four days. For 7 days post-surgery, the internal body temperature was monitored, and the animal was kept under close observation and checked for signs of pain.

The choice of pharmacotherapy was based on the assessment of post-operative complication risk, veterinary regulations, and the owner's wishes. Despite the procedure being performed in stable conditions, no complications related to intraoperative infections occurred.

Approximately 20 days after the surgery, the wound had scarred over completely. After 30 days, no recurrence of symptoms was observed (Fig. 5).

## Results and discussion

The phenomenon of the occurrence of dentigerous cysts in horses is documented in the literature. Its occurrence is rare (according to the author's own observations, it is 1 : 1000). The most significant hazard associated with this condition is a consequence of random, uncontrolled movement of the mineralized mass within the skull. Its consequences include upper respiratory tract dysfunctions, sinusitis, impaired food intake, and skull deformities. The presence of pathological conditions of tooth buds can cause head-shaking syndrome, or a horse's general unwillingness to cooperate with the rider.

The most common locations of the lesions are provided in the table below, developed by Schläpfer et al. (25).

This case shows a rarely described location. Since the lesion was accompanied by a channel formed by the fistula fluid, it was possible to perform an endoscopic assessment. The risk of intraoperative and postoperative complications was assessed as high due to the strong fixation of the tooth-like tissue in the skull, in the immediate vicinity of the brain, and in close proximity to the ethmoidal conchae.

The use of orthopaedic drill bits instead of orthopaedic gouges proved to be an effective and ingenious solution that reduced the traumatisation of the area operated on. First, it did not require opening the frontal sinus. Second, it reduced the risk of uncontrolled penetration of the tool into the cranial cavity/brain. Third, it limited the risk of intraoperative infection of the sinus and surrounding tissues, which could otherwise prolong recovery.

The primary goal of using this surgical method was the precise, targeted drilling of holes around the

**TABLE 1** Patient signalment, results of physical examination and diagnostic tests (CT, radiography) in seven horses with dentigerous cysts.

| Case number | Breed | Age | Sex | Location of the dentigerous cyst | Draining tract | Swelling | Other clinical signs | Dental tissue present | Exostosis of the temporal bone | Firmly connected to the skull |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Icelandic horse | 2 | Female | Ear base left | Yes | Yes | – | Yes | No | No |
| 2 | Shetland pony | 10 | Male | Sinus maxillaris | No | No | Nasal discharge | Yes | No | No |
| 3 | Warm-blood | 11 | Female | Ear base right | Yes | No | Head tilt, head-shyness | No | Yes | Yes |
| 4 | Pony | 4 | Male | Ear base right | Yes | No | – | No | Yes | No |
| 5 | Icelandic horse | 12 | Male | Ear base right | No | Yes | – | Yes | No | No |
| 6 | Icelandic horse | 5 | Female | Ear base left | No | Yes | – | Yes | No | Yes |
| 7 | Icelandic horse | 4 | Male | Ear base left | Yes | No | – | No | No | No |

Abbreviation: CT, computed tomography.

ectopic odontogenic tissue to dissect it from the floor of the frontal sinus. Furthermore, it aimed to install a thin and stable instrument to remove the pathological structure embedded in the sinus without widening the surgical field. The orthopaedic length/offset ruler for controlling the drill bit immersion was a mundane yet extremely important tool, which was used to check the depth of penetration.

The presence of dentigerous cysts in the sinuses, require trepanation and hospital treatment. In some cases, especially when there is surgical access resulting from the course of the disease, performing the operation this way should be considered.

Fig. 6 shows the location of the described lesion on a skull example

The presented methodology has clearly demonstrated its effectiveness and is worth repeating.

**Fig. 6. Location of the described lesion on a skull example**

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