Repair of cleft palate in a calf using polypropylene mesh and palatal mucosal flap: a case report

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ABSTRACT: The soft palate plays a critical role in the oral and pharyngeal phases of swallowing. Congenitally cleft soft palates (palatoschisis) in calves are rare and pose a serious challenge for surgical correction due to high complication rates. The main obstacles to repairing palate defects are obtaining complicated access to the soft palate, and reducing the tension on the repair so that the sutures hold. A 21 day old female Simmental calf was submitted to our clinic with a history of frequent episodes of coughing and milk dripping from its nostrils after suckling. After clinical examination, a congenital cleft palate was diagnosed. Surgery was performed under general anaesthesia. First, lateral buccotomy was performed to improve the intraoral approach. The palatal defect was repaired using polypropylene mesh and palatal mucosal flap. An oesophageal tube was placed and anchored to the skin using a Chinese finger trap suture technique. Antibiotic treatment was continued through seven days and a transoesophageal feeding tube was fitted at the end of the surgery allowing the calf to be fed with milk during the postoperative period. Postoperatively, the caudal aspect of the repair broke down resulting in persistent mild bilateral nasal discharge. A combination of the two described techniques can be a good option for resolving palatal defects. However, adequate exposure and repair are still difficult to achieve and these approaches often result in serious postoperative complications.

Keywords: cleft palate; surgical treatment; calf

Clefts of the face are developmental disorders resulting from a failure of closure in facial processes such as the frontonasal, maxillary, and mandibular processes. The defects appear in the lateral or median site of the rostral face as cleft lips, jaws and palates (Baker et al., 1993). Some cases have been reported in cattle, but its incidence has been estimated to be very rare (Leipold et al., 1983; Noden and De Lahunta, 1985). In bovine foetuses, fusion of the facial fissure and palate takes place at day 34 and 56 of gestation, respectively. It may be possible that the critical period of exposure to teratogen coincides with the fusion of the facial fissure and/or palate in early embryogenesis (Evans and Sack, 1973). A cleft palate may occur singly, but in Charolais and Hereford cattle, a recessively inherited syndrome of arthrogryposis and palatoschisis exists (Leipold et al., 1974; Rousseaux, 1994). The soft palate plays a critical role in the oral and pharyngeal phases of swallowing, maintaining a seal with the tongue, bolus formation and protecting the airway from aspiration of food and fluid materials. It provides a physical barrier between the oral and nasal cavities (Kirkham and Vasey, 2002). The clinical signs of a cleft palate are usually observed either at birth or after suckling has commenced; they include postprandial bilateral nasal discharge, coughing and dysphagia (Semevolos and Ducharme, 1998). This deformity leads to failure of passive transfer, chronic lower airway infection in the form of aspiration pneumonia, unthrift, stunted growth, and chronic bilateral nasal discharge and regurgitation of milk, water and feed. A diagnosis may be achieved via oral examination, but upper airway endoscopy is the gold standard as it provides the best visualization of the palate (Tulleners et al., 2006). Treatment of a cleft palate involves surgical repair and careful management of diet, aspiration pneumonia and possible failure of passive transfer. The main obstacles to repair are obtaining adequate

access to the palate, and reducing the tension on the repair so that the sutures hold. There are very few published reports of successful repairs and both the approach and the repair have high incidences of complications (Keeling and Moll, 1995). The goal of this case report is the first to describe the surgical technique of using polypropylene mesh as a substitute for a palatal bone defect.

Case description

A simental female calf, 21 days old, weighing 41 kg presented with a history of nasal regurgitation of milk after nursing and bilateral mucoid nasal discharge. Her general body condition was poor, heart rate was 124/min and temperature was 41.2 °C. Physical examination revealed bilateral green mucoid nasal discharge with food particles which was more severe on the left side. Lung sounds were harsh when ausculted and were more severe cranioventrally. A complete blood count revealed leukocytosis and dehydration. An examination of the nasal cavity and nasopharynx confirmed the diagnosis of palatoschisis. For premedication, a combination of ketamine hydrochlorid 5 mg/kg *i.m.* (Narketan®, Vetoquinol, Switzerland), xylazine 0.2 mg/kg *i.m.* (Xylapan®, Vetoquinol, Switzerland) and butorphanol 0.03 mg/kg *i.m.* (Butomidor®, Richterpharma, Austria) were administered. After 10 min, an intravenous canula was placed in the auricular vein and Lactated Ringer solution was infused at a rate of 10 ml/kg/h. The rate was controlled by an infusion pump (BIOF 3000®, Biotron CO, South Korea). Amoxicillin clavunate 20 mg/kg *i.v.* (Augmentin®, GlaxoSmithKline,United Kingdom) was administered before and immediately after the surgery. During the anesthesia, ECG, pulse oxymetry and capnography (mainstream system) were performed. For induction, propofol 3 mg/kg *i.v.* (Propofol Abbott®, Abbott Laboratories, Spain) was administered. An endotracheal cuffed tube (*i.d.* 14 mm) was fitted and a mixture of oxygen (2 l/min) and isoflurane (first five minutes 3%, later 2%) was administered using the circle system. The animal breathed spontaneously during anaesthesia. Surgery lasted 80 minutes. The patient was placed in lateral recumbency and the neck was elevated to prevent potential aspiration of saliva and regurgitated food. The skin was prepared routinely and lateral buccotomy by skin and mucous membrane incision was performed to facilitate the intraoral approach (Figure 1). The mucosa of the hard and soft palates was incised at a distance from the edge which was the same width as the palatal defect. Starting at the lateral edge of the incision, the flap was elevated by a periostal elevator and rotated medially. On the opposite side only the edge of the palatal defect was cut out and undermined 1 to 2 mm. Holes at the bones edges were drilled with Kirschner wire (Figure 2). Four holes were drilled at each side of the palate and prolene mesh was cut out according to the shape of the defect (Figure 3). Using polyamide suture material (Dermalon 2-0) prolene mesh was sutured to the bone in a simple interrupted pattern at the eight points of fixation (Figure 4). The edges of the rotated flap and the edge of the mucosa of the opposite side was reconstructed using polyglyconate in a simple interrupted pattern. Lateral buccotomy was reconstructed in two layers. In the first layer, mucosal membrane was sutured using polyglyconate (Maxon 2-0) in a simple continuous pattern. In the second layer, skin was sutured using polyamide (Dermalon 2-0) in a simple interrupted pattern. An oesophageal tube was placed and anchored to the skin using the Chinese finger

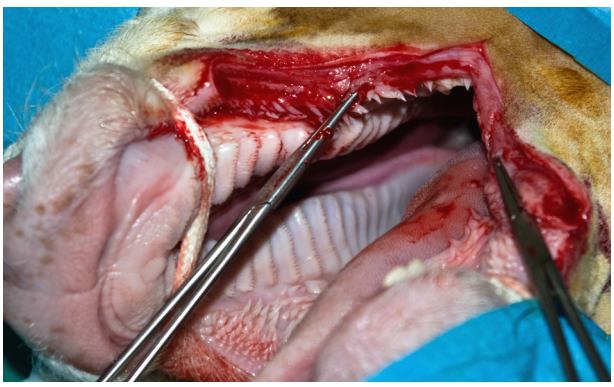

Figure 1. Lateral buccotomy of skin

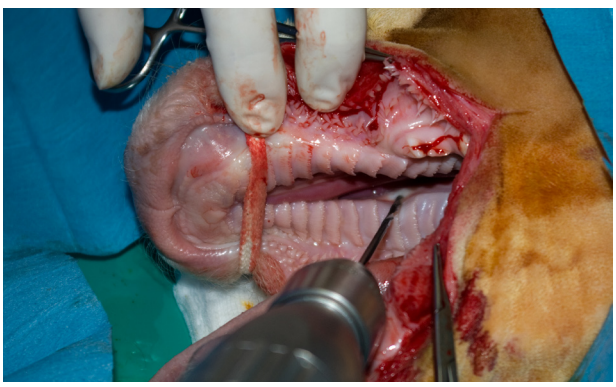

Figure 2. Drilling bone edges with Kirschner wire

Figure 3. Suture position in bone holes

Figure 4. Fixation of prolene mesh

Figure 5. Elevation of palatal mucosal graft

Figure 6. Transoesophageal feeding tube

trap suture technique. The patient was extubated 10 minutes later, when swallowing was observed. Butorphanol tartrate (Butomidor®, Richterpharma, Austria) was given at a dose of 0.03 mg/kg by an intramuscular route at four-hour intervals during the first eight hours after the surgery. Additional analgesia was ensured by ketoprofen administration (Ketofen 10%, Merial, France) in a dose of 1.5 mg/kg *i.m.* in 24 hours intervals over five days. Antibiotic treatment with procaine penicillin and dihydrostreptomicin (Sustrepen, Veterina, Croatia) was continued for seven days. The calf was fed with milk during the postoperative period (Figure 6.). Because of aspiration pneumonia, the owners decided to euthanize the calf after two weeks. Post mortem, 2 cm-long dehiscency was observed at the aboral end of the palate.

DISCUSSION AND CONCLUSIONS

The main difficulty in repairing cleft soft palates is surgical access. There are multiple potential surgical approaches that have been historically used to access the soft palate in order to repair it including intra-oral, bilateral buccotomy, pharyngotomy, mandibular symphysiotomy, and various combinations of above (Keeling, 1995). There are two types of cleft palate described in the literature: congenital and acquired. In domestic species, cleft palate is a multi-factorial disease. Studies in mice, dogs, cattle, and swine have suggested a heritable component to cleft palates and although there are no reports in the Literature, some sources suggest that up to 10% of cleft palates in horses are heritable (Szabo, 1989). The aetiology of congenital soft palate clefts in horses in unknown, but it has been shown to be a heritable trait in humans, Charolais cattle and Abyssinian cats (Leipold et all., 1969; Spence et al., 1976). There is also data suggesting spontaneous occurrence in rabbits, cats, dogs, and swine. Many factors have been associated with cleft palates in various species including corticosteroids, tranquilizers, maternal malnutrition, maternal respiratory hypoxia, actinomycin, alkylating agents, caffeine, ionizing radiation, and a variety of teratogens. Poisonous plants that have been implicated in cleft palate formation in cattle and swine include lupine, wild parsnip, poison hemlock, and wild tree tobacco (Szabo, 1989). The soft palate plays a criti-

cal role in the oral and pharyngeal phases of swallowing, maintaining a seal with the tongue, aiding in bolus formation and protecting the airway from aspiration of food and fluid materials. It provides a physical barrier between the oral and nasal cavities. The clinical signs are often present from birth, making diagnosis relatively easy, especially with more severe defects. Cleft defects in the soft palate lead to clinical signs including bilateral nasal discharge, regurgitation of milk, and dysphagia and are often present at birth or shortly after initiation of suckling. Defects in the soft palate predispose the foal to tracheal aspiration and subsequent aspiration pneumonia. Also, the inability to suckle effectively contributes to a failure of passive immunity in the foal leading to recurrent lower airway infection and a compromised immune system. Failure to correct these defects usually results in a failure to thrive and death from inanition and aspiration pneumonia (Kirkham and Vasey, 2002). The choice of method to use to repair these defects often depends on a number of different factors. The degree of severity of the defect often dictates which approach is employed and also factors related to the severity of post-operative complications and prognosis. In foals there are multiple potential surgical approaches that have been historically used to access the soft palate in order to repair it including intra-oral, bilateral buccotomy, pharyngotomy, mandibular symphysiotomy, and various combinations of these approaches. (Kirkham and Vassey, 2002). Factors relating to post-operative care and management include the availability of the proper surgical facilities to perform this difficult surgery, including radiographic equipment, the use of appropriate antibiotics for the prevention of infection and treatment of existing lower airway infection, and analgesics (non-steroidal anti-inflammatory drugs) to control postoperative pain, reduce inflammation, and recovery times. Post-operative nutritional management is controversial. The postoperative feeding regime that facilitates the best healing of the palate is still unknown. Feeding through a nasogastric tube is often the most recommended means, as it is relatively inexpensive, easily performed, and tolerated by the foal. There are many complications associated with cleft palate repair. The most common complication is dehiscence of the caudal aspect of the repair and other complications include oronasal fistula formation, palate dysfunction resulting in dysphagia, and chronic pneumonia (Bowman et al., 1982). Polypropylene mesh is often used in the repair of complicated hernia. The purpose of using polypropylene mesh in this case was to decrease tension at the edge of the sutured palatal flap. With low tension at the palatal flap edge, healing can be improved and the rate of postoperative complications can be decreased. When considering surgical repair, owners need to be made aware of the possible heritability of the condition, all the potential complications, the low rate of success, and the demanding nature of post-operative care and management. This article for the first time describes a combination of two surgical techniques for palatal defect repair in a calf. Polypropylene mesh was used as a possible substitution for palatal bone and mucosal flap provided a cover for the defect with mucous membrane. A drawback to this study is the absence of long-term follow-up.

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