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Treatment of Bilateral Mandibular Fractures in a Goose (*Anser anser domesticus*)

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The maxilla and mandibular apparatus vary across class Aves. Order Anseriformes has a simple craniofacial hinge, although the anatomy of the articulating joints is still complex (Figure 1). Traumatic injury to the upper and lower bill is not uncommon in pet Anseriformes, with dog attacks being the most common, in the experience of the authors.

With both upper and lower bill trauma, simple non-displaced fractures have the best prognosis. Displaced fractures may heal, but the displacement may result in beak malalignment and future difficulties with prehension. Compound fractures involving bony exposure carry a much poorer prognosis due to infection and possible bone necrosis. Additionally, damage to the vascular supply can result in ischaemic necrosis of bone and overlying tissue. Trauma involving areas of articulation has a poorer prognosis. The articulations of the head and face generally require perfect anatomical position. Healing bony calluses can interfere with bill kinetics. Surgical approaches may cause iatrogenic damage and worsen the prognosis. Pecsics et al. (2017) highlight the attachment areas of the masticatory muscles (Figure 2). Fractures involving fulcrum points of muscle attachment in this area can be difficult to stabilise. Simple, unilateral, non-displaced fractures may be left to heal with appropriate analgesia, although the handling required to medicate or assist feed these animals may worsen the fracture by

Figure 1: Goose skull (from Maierl et al., 2016)

Figure 2: Bill Kinetics from Pecsics et al. 2017

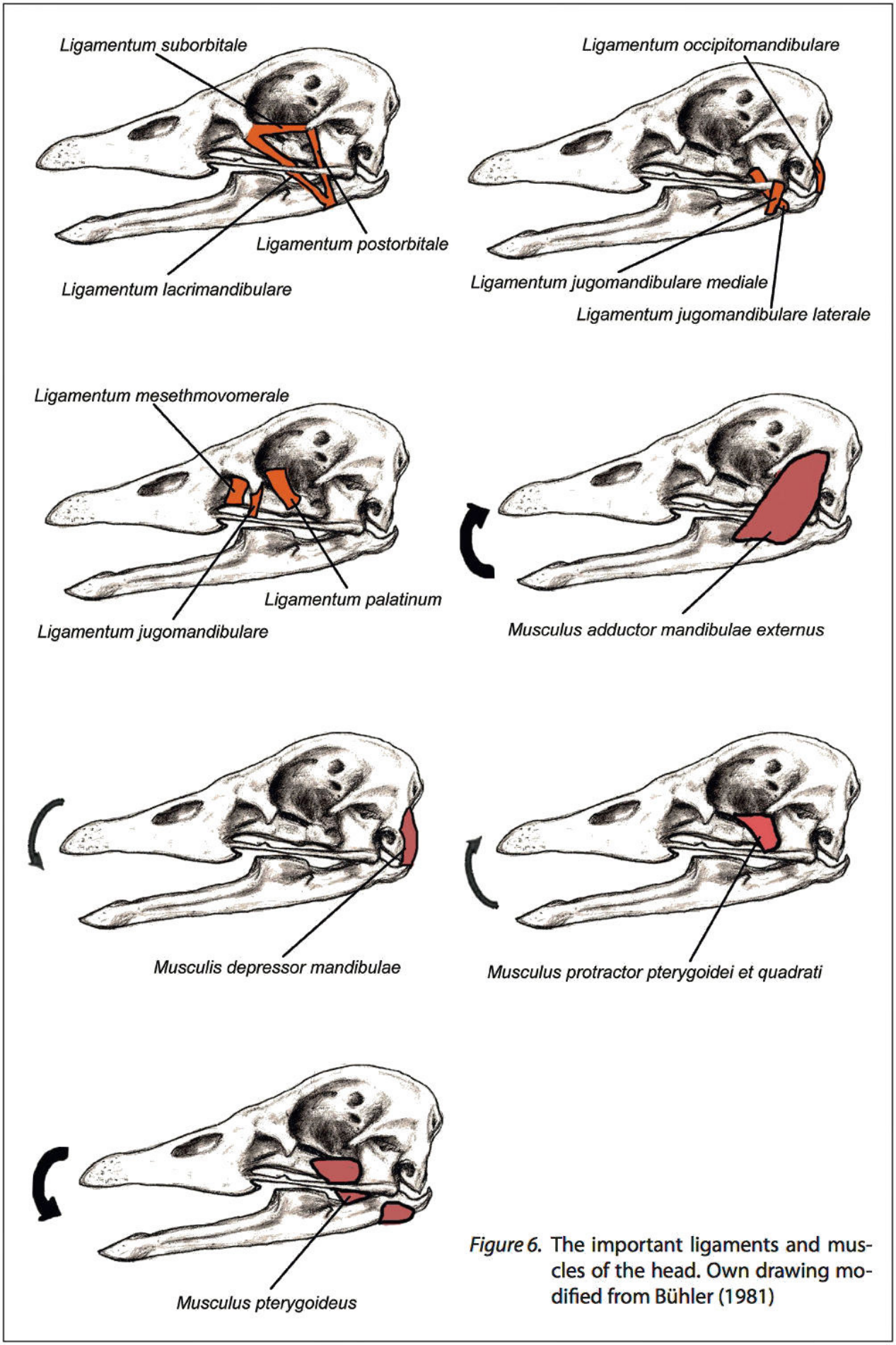

Figure 6. The important ligaments and muscles of the head. Own drawing modified from Bühler (1981)

causing displacement. An oesophageal feeding tube is an easy way to provide liquid sustenance and medication without having to handle the bill. Although taping the upper and lower bills together might appear to provide support, there are concerns with regurgitation and mucous accumulation in the mouth. If the tape slips, then the nares could be occluded.

Surgical repair techniques generally involve the placement of an external fixator apparatus. Adequate stabilization through thin bones can be challenging, and post-repair fixator trauma can occur. The pin tracts may also become infected. However, surgical repair is the only treatment possible when fractures are compound. Calvo et al. (2016) described a technique involving an osteogenic distractor in a mandibular malunion of a juvenile mute swan (*Cygnus olor*).

This case report details the conservative management of a goose with bilateral mandibular fractures, using an oesophageal feeding tube to provide medication and nutritional support.

Case Report

A 3.1kg adult female goose (*Anser anser domesticus*) presented as a referral from the local emergency centre, after being bitten on the head by the neighbour's small dog. The bird had received butorphanol at 2mg/kg IM (Butorgesic, Troy Laboratories) and an injection of amoxicillin/clavulanic acid at 125mg/kg IM (Clavulox, Zoetis).

On arrival, the bird was dull, and the right side of the face was very oedematous, making visualization of the right globe difficult. There was crepitus on palpation of the mandibles, although the maxillae appeared intact. Butorphanol was continued at the previous dose rate, given every 6 hours. After further stabilisation, which included subcutaneous fluids at 50ml/kg, the bird was anaesthetised with 5% isoflurane and 2L oxygen/minute via face mask. Once unconscious, the bird was intubated with a 3-0 endotracheal tube, and then maintained on 2-3% isoflurane at the same oxygen flow rate. Sporadic intermittent positive pressure ventilation was supplied throughout the procedure. Ventrodorsal and lateral radiographs were taken.

The ventrodorsal radiograph demonstrated bilateral mandibular fractures (red arrows Figure 3). The left mandibular fracture was displaced lingually, while the right mandibular fracture was more subtle. The swelling of the right facial area was further explored, and several puncture wounds were identified. These wounds were lavaged with saline and cleaned with chlorhexidine but not sutured. Recovery from anaesthesia was smooth.

The owner agreed with the recommendation of conservative treatment, so the goose was re-anaesthetised in a similar fashion later that afternoon, and placed into right lateral recumbency. After surgical preparation of an area in the proximal left cervical region, an oesophageal tube was placed, using a stab incision made over haemostats inserted orally. The end of a red rubber feeding tube was grasped, and withdrawn into the oral cavity and then out of the mouth. It was then retrograde inserted into the distal oesophagus. The tube was secured with a Chinese finger-trap suture, as well as sutures placed into a tape attached in butterfly fashion to the tube at the skin interface. The size of the tube was not recorded. No post-operative radiographs were taken.

Recovery from anaesthesia was again smooth. Medication included amoxicillin/clavulanic acid at 125mg/kg PO q 12 hrs for ten days (Noroclav 250mg Tablets, Norbrook); meloxicam at 1mg/kg PO q 12 hrs for five days (Loxicom 1.5mg/ml Oral Suspension for Dogs, Norbrook); 1mg/kg butorphanol q 6 hrs as needed (Butorgesic, Troy Laboratories). Tablets were crushed and administered in liquid via the oesophageal tube. Although the daily water requirements of this goose were estimated at 50ml/kg/day, giving (155ml daily), a higher volume was administered

Figure 3. Radiograph on presentation

to ensure that the tube was clear of feeding formula after each feed. The calculated caloric requirements of this goose were (from Quesenberry and Hillyer, 1994):

Maintenance Metabolic requirement severe trauma: Basal Metabolic Rate (BMR) x 2
BMR (non-passerine):
$78x(3.1^{0.75})$ =182.22 kcal/day
Actual maintenance metabolic requirement = 364.44 kcal/day

Unfortunately, the caloric density of the reconstituted hand-rearing formula was unavailable. However many commercial formulations have a caloric value of 1-2 kcal/ml (Quesenberry and Hillyer, 2016). A starting volume of 120-140ml per day, divided, was commenced, giving perhaps 240-280 kcal/day, and then the volume was titrated dependent on comfort and weight maintenance.

Twice daily, 60-70ml of warmed hand rearing formula (Neocare, Vetafarm) was administered into the oesophageal feeding tube over a few minutes, and followed with 60 ml warmed water, administered similarly. In the middle of the day, 70 ml of water was also administered via feeding tube.

The volume of the food and water administered was adjusted while the bird was hospitalised, as it exhibited some discomfort after larger amounts. This resolved with changes in feeding volume and speed of administration. On the third day after presentation, butorphanol was no longer required for analgesia and the facial swelling had receded, so the goose was discharged from hospital.

The bird removed the oesophageal tube three days after discharge, which was replaced within 24 hours, through the initial incision. A commercial oesophageal tube cover was then used to hold it in situ. This occurred at the local emergency centre.

Four days later, the goose had lost weight and now weighed 2.76kg. It was biting the owner with its beak. The owner was instructed to add a small amount of feeding formula to the midday water medication, as well as to increase the volume of feeding formula at morning and evening times. The owner was instructed to start to offer slurry formula feeding from a dish daily.

A further week later (three weeks after the initial insult), the goose was anaesthetised and repeat radiographs were taken. These showed bilateral bony calluses forming on each mandibular fracture. Movement of the lower bill under anaesthesia was good although there was a slight asymmetry to the right. The bird had a solid bite.

At the final revisit appointment, four weeks after the initial trauma, the bird was maintaining weight on its own. The bird had removed the oesophageal feeding tube a few days prior to the consultation, and continued to self-feed and have good movement of the bill.

Conclusion

This case demonstrates that good knowledge of anseriforme anatomy is important in giving owners an accurate prognosis for upper and lower bill trauma. Conservative management of some fractures can be successful, and the use of oesophageal feeding tubes can further improve prognosis.

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