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## Bilateral proptosis and fracture of medial wall of orbit diagnosed with computed tomography in a puppy

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### Abstract

A two-month-old female German shepherd puppy was presented with a history of bilateral proptosis after dog bite. It was recumbent having severe pain and epistaxis from left nostril. Optic nerve and rectus muscle of the right eye were severed. Optic nerve of left eye was intact, but the ocular muscles were damaged with no pupillary light reflex. Hence, right eye was enucleated and permanent tarsorrhaphy was done. Left eyeball was repositioned and temporary tarsorrhaphy was performed. Computed tomography of the skull revealed blow-out fractures of the pars orbitalis segment of the frontal bone which forms the left medial orbital wall. Fracture of zygomatic bone and medial orbital wall extending to the floor was found on the right side. 3D reconstructed image clearly revealed marked displacement of Pars orbitalis fracture fragment in the left eye, compressing the cerebrum. Due to excessive trauma and poor prognosis, it didn't survive beyond two weeks.

**Keywords:** proptosis, orbit, fracture, dog, computed tomography, tarsorrhaphy

### 1. Introduction

Orbital trauma is an emergency condition which includes orbital fractures, proptosis, and rupture of the globe in dogs. Proptosis is defined as forward displacement of the globe with palpebral margin entrapment behind the equator (Gilger *et al.*, 1995) [5]. Trauma due to road traffic accident and dog bites are the most prevalent cause of proptosis which may also affect other organs besides the eye. It requires rapid assessment of the situation as well as immediate medical and surgical therapy. Oren *et al.*, (2019) has documented proptosis for 13 years and has reported only one dog with bilateral proptosis. Thus, this case study of bilateral proptosis with fracture of medial wall of orbit is a rare condition. Computed Tomography (CT) imaging provided key information regarding the fracture of the medial wall of orbit without superimposition of bones.

### 2. Case history and observation

Two months old female German shepherd puppy was presented with a history of fight with another adult dog and got both the eyes proptosed. The puppy was recumbent with severe pain. On physical examination, it had pale mucous membrane and temperature was 37 °C. Epistaxis was noticed from the left nostril and it had mild respiratory distress. Right eye was proptosed and deflected dorsally, medial and ventral rectus muscle, inferior oblique muscle was avulsed, and optic nerve was already damaged completely (Fig. 1). Pupil was dilated and there was no pupillary light reflex. Optic nerve of the left eye was intact, and the ocular muscles were damaged the same way as the right eye with no pupillary light reflex.

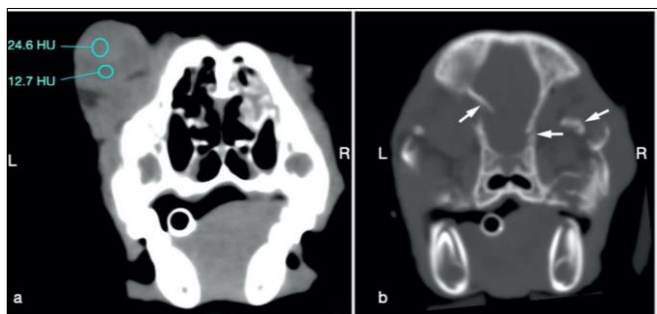


**Fig 1:** Bilateral proptosis of the eyeball

### 3. Diagnosis

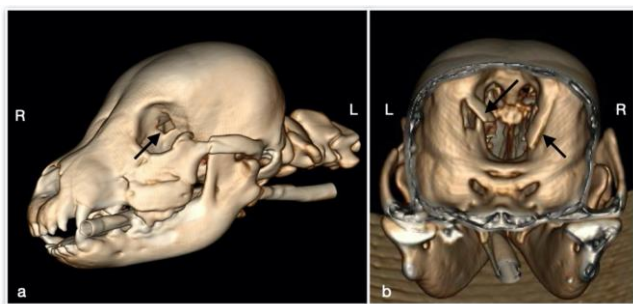
Thoracic radiograph showed normal lung field and cardiac silhouette. There were no visible fractures in the skull radiograph in lateral and dorso-ventral view. Complete haematology and serum biochemistry profile was analysed. Haemoglobin-5 g/dL, PCV-14.8%, RBC-2.44 million/cumm, WBC-41900 cells/cumm, neutrophil-80%, lymphocyte-15%, monocyte-4% and eosinophil-1%. Blood urea nitrogen-14.86 mg/ dL, creatinine-0.16 mg/ dL, glucose-71 mg/ dL, ALT-31 IU/ l, ALP- 422 IU/ l SAP-79 IU/ l, total protein-3.1 g/dL, albumin-1.6 g/dL and globulin-5.10 g/dL.

Skull computed tomography was planned after the recurrence of proptosis of the left eye ball after 6<sup>th</sup> post-operative day. CT scan was performed under general anaesthesia, induced with propofol. In soft tissue window, proptosis of left eyeball could be visualized, with normal Hounsfield unit values of anterior chamber and posterior chamber, as 24.6 HU and 12.7 HU respectively (Fig. 2a). In bone window, bilateral blow-out fracture of Pars orbitalis segment of the frontal bone which forms the medial orbital wall of eye were noticed (Fig. 2b).



**Fig 2:** Proptosis of left eyeball in soft tissue window (a); fracture of pars orbitalis of frontal bone on left and right orbit and fracture of zygomatic bone in right orbit (b)

Post processing of the 3D reconstructed image clearly showed the marked displacement of Pars orbitalis fracture fragment in left eye, compressing the cerebrum (Fig. 3). On right side, fracture line was noticed extending from medial orbital wall up to the orbital floor.



**Fig 3:** Blow-out fracture of Pars orbitalis segment of the frontal bone (a); fracture line extending from medial orbital wall to the orbital floor (b)

### 4. Treatment

The dog was premedicated with butorphanol @ 0.2 mg/kg body weight (BW), induced general anaesthesia using Propofol @ 3 mg/kg BW intravenously and intubated with endo-tracheal tube no. 4. Anaesthesia was maintained with 1-1.5% Isoflurane. Under general anaesthesia, the puppy was placed on sternal recumbency. Both the eyes were prepared aseptically. Right eye was enucleated and permanent

tarsorrhaphy was done. Left eyeball was repositioned and temporary tarsorrhaphy was performed.

Post-operatively, fluid therapy with antimicrobial agent Ceftriaxone @ 20mg/ Kg BW IV, mannitol @ 2 gm / Kg slow IV, ringer's lactate @ 10ml/ Kg BW IV, prednisolone@ 1mg/ Kg BW IM was administered. No discharge was noticed on the surgical site and sutures were intact. There was no respiratory distress and started taking food. But head tilt was noticed on the 6<sup>th</sup> post-operative day following treatment. Elizabethan collar was accidentally removed by the puppy and sutures of the temporary tarsorrhaphy of the left eye was not found intact and hence got proptosed again. As the optic nerve was not intact, permanent tarsorrhaphy was planned after taking computed tomography scan. Due to excessive trauma and poor prognosis, it didn't survive beyond two weeks.

### 5. Discussion

Bilateral proptosis is rare in non-brachycephalic breed of dogs. Fractures of the orbital floor and the medial orbital wall are also rare in dogs. Oren *et al.*, (2019) reported that testing of direct and indirect PLR is a simple and significant prognostic indicator. Betbeze, (2015) [1] reported that proptosis with either non-visible pupil (corneal desiccation or hyphema), scleral rupture or avulsion of more than three extraocular muscles are indicators of poor prognosis. As this puppy also had avulsion of more than three extraocular muscles, enucleation was done first for the right eye. For the left eye, as the optic nerve and three extraocular muscles was found avulsed after one week, enucleation was done with permanent tarsorrhaphy. Small, nondisplaced fractures heal on their own and do not need surgical reduction and fixation whereas, small and displaced bone pieces must be surgically removed, while big, unstable fractures may necessitate internal fixation (Spiess, and Pot, 2013) [8]. Thus, the removal of the fracture fragment was not necessary in this dog.

The orbit is composed of five bones, rim is formed by the frontal, lacrimal, and zygomatic bones and floor of the orbit being partially formed by the sphenoid and palatine bones (Evans and De Lahunta, 2013) [3]. Laterally, the orbit is formed by a fairly extensive supraorbital ligament. Spiess, and Pot (2013) [8] reported that frontal, temporal, and zygomatic bones are most commonly involved in fractures. Gaillard and Murphy, (2021) [4] reported that orbital floor fractures were caused by a direct blow to the central orbit from a fist or ball. Due superimposition of skull bones, fracture of the orbit was not evident in radiograph. Rapid interdisciplinary diagnostics and therapy is critical for early detection and prevention of irreversible functional loss.

Computed Tomography (CT) imaging provided key information regarding the fracture of the orbit. CT is preferred because of its fast examination, reduced cost when compared to magnetic resonance imaging (MRI) and assessment of bones without superimposition as in the case of radiography (Vali *et al.*, 2021) [9]. Boroffka *et al* (2011) [2] has documented CT diagnosis of multiple fracture in 3-month-old dog involving frontal, lacrimal, maxillary, palatine and zygomatic bone similar to this dog. Three dimensional reconstruction of the computed tomography is of great help in diagnosing these fractures. The superficial planes may be peeled off to reveal deeper pathology after reconstruction of CT images (Ram *et al.*, 1998) [7]. This technique is used to demonstrate dense intracranial lesions by cutting away part of the overlying skull bones. In this dog, this technique aided in

visualising the fracture of pars orbitalis segment of the frontal bone very clearly in 3D reconstruction.

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