Partial facial duplication (diprosopus) in a goat kid

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ABSTRACT

The anatomical and clinical features of a live-born diprosopic goat kid are described. The kid had two faces with two eyes each, two complete oral cavities and nostrils and two ears. Caudal to the neck, the kid grossly appeared normal. Both mouths of the kid showed synchronous suckling motions. Elevated respiratory and heart rates were recorded and the temperature was subnormal. Radiological examination showed a single trunk and vertebral column, normal limbs, two sets of jaws, three orbits, and contrast radiography revealed a single patent oesophagus. There was maxillary and mandibular duplication resulting in two faces. There was a cleft palate. The oropharyngeal regions of each face merged to form a single laryngopharynx and oesophagus. There was a single brain with hypoplasia of the cerebellum. The left and right cerebral hemispheres were fused rostrally, and there was duplication of the optic chiasma and the pituitary gland. The olfactory tract was absent and the superficial origins of most of the cranial nerves were not discernible.

Key words: cerebellar hypoplasia, cleft palate, diprosopus, goat, malformations.

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INTRODUCTION

Diprosopus, a term referring to a foetus with a single trunk, normal limbs, and varying degrees of facial duplication is an extremely rare malformation in both humans and domestic animals. However, a few cases of diprosopus have been reported in sheep[3,8], cattle[7], cats[1], horse[4] and chicken[12].

Cases of diprosopus in goats have not been reported, although several cases of congenital malformations in goats such as dicephalus[11] and multiple malformations[6] have been reported. The present paper reports the clinical, anatomical, radiological and necroscopic observations in a diprosopic goat kid presented alive at the University of Zimbabwe Veterinary Teaching Hospital.

CASE HISTORY AND DESCRIPTION

A live male indigenous small East African malformed goat kid was brought to the University of Zimbabwe Veterinary Teaching Hospital. The kid was the first offspring delivered at term and there was no dystocia encountered during delivery. The kid was brought to the hospital 20 hours after birth, and had been unable to rise since birth. Pedigree information about the dam and sire was not available.

On physical examination, the goat kid had a gross deformity confined only to the face, characterised by a dome-shaped skull, duplication of eyes, mouth and nostrils (Figs 1, 2). The medial eyes were partially fused and occupied a single orbit, and were blind. Two other lateral eyes were in the normal position, and these appeared to be functional, with normal menace test and pupillary reflex. There were double nostrils with one on either side of the head, ventral and lateral to the central eyes. A tongue protruded from each oral cavity. The left oral cavity had the lower lip deviated centrally. Vocalisation was heard from both mouths and the mouths' movements were synchronised during feeding or vocalisation. The kid was breathing through both pairs of nostrils. The two faces shared a medial cheek and normal-appearing ears were seen bilaterally, but no ears were present on the medial side. The goat kid had a normal swallowing reflex, and was successfully fed on warm milk and glucose via both mouths. Cranial reflexes were present. After feeding with milk and glucose, the kid was able to rise. However, it had limb incoordination. The respiratory and heart rates recorded were elevated and the temperature was consistently subnormal. On inspection of the area where the goats were grazing, no known or suspected teratogenic plants such as *Datura, Senecio* and *Veratrum* spp. were identified.

Radiographs of the head showed two sets of jaws, three orbits, and a normal single trunk and normal limbs. The vertebral column, ribs, sternum, abdomen and thoracic and pelvic limbs appeared normal.

Fig. 1: **Head of the diprosopic goat kid, showing a dome-shaped skull, two pairs of nostrils and partially fused eyes.**

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Fig. 2: **Head of the diprosopic goat kid, lateral view of the head showing one of the normal lateral eyes and two faces.**

Contrast radiography of the oral cavity, oropharynx and oesophagus was carried out using a barium swallow. The contrast radiographs revealed a single patent oesophagus. Forty hours after birth the kid had seizures and died, probably due to hypoglycaemia.

On necropsy each face had nostrils, an oral cavity and a protruding tongue. Two complete separate jaws were present although the medial lower jaws were shortened. There was a cleft palate in both the hard and soft palates. The oropharyngeal regions of each face merged to form a single laryngopharynx and a single oesophagus and there was a single trachea. The two tongues fused caudally, forming one body giving a Y-shape, and entered a single pharynx. The hyoid apparatus was wider than normal, probably reflecting the doubling of the lower jaws. There was no duplication of internal thoracic and abdominal organs.

On opening the skull, the kid had a single abnormal brain. Marked hypoplasia of the cerebellum was noticed. The left and right cerebral hemispheres were fused rostrally and the falx cerebri was not fully developed in that region. There was duplication of the optic chiasma and the pituitary. The olfactory tract was absent and the superficial origins of most of the cranial nerves were not discernible at that stage.

Microscopic examination of the brain showed cerebellar hypoplasia characterised by marked thinning of molecular and granular layers and severe loss of Purkinje cells and granular cell depletion. In the cerebral tissue, there was severe congestion, haemorrhage and neuronal degeneration.

DISCUSSION

Diprosopus is considered a symmetrical type of conjoined twinning. It is characterised by a single body and a spectrum of duplication of craniofacial structures. It is this characteristic duplication that makes the diagnosis specific for diprosopus twinning. Diprosopus ranges from isolated duplication of facial structures to complete doubling of all facial elements.

In this goat kid, duplication of the maxilla, mandibles, nose and nostrils and pituitary represented the major structural defects. The presence of four eyes in this case may lead to classify the anomaly into the sub-category of diprosopus tetraopthalmus. Unique features in this case included duplication of the optic chiasm, absence of the olfactory tract, fusion of the left and right cerebral hemispheres rostrally and hypoplasia of the cerebellum. In most cases of diprosopus described in humans, the most common additional feature found is anencephaly[10]. However, anencephaly was not present in this case and has also not been reported in cases of diprosopus in domestic animals, including sheep[3,8], and cattle[7].

There has been little research on the morpho-pathogenesis of diprosopus in humans and animals in the past. Theories of embryological mechanisms proposed as leading to diprosopus include forking of the notochord, partial doubling of the notochord, partial doubling of the prosencephalon and olfactory placodes, and duplication of the growth centres of the stomadeal plate[14]. In the present case of diprosopus in a goat kid, the mandibular and maxillary duplications could be explained by postulating a duplication involving the maxillary and mandibular prominences bilaterally as suggested in humans by Fearon and Mulliken[2].

In humans surgical intervention of some cases of diprosopus has been successfully performed[2,14]. In farm and companion animals, there are no reported cases available where surgical intervention was performed, probably because most of the cases died a few hours after birth or because of the high costs associated with surgery.

The aetiology or initiating cause of diprosopus is not well understood. Two possible initiators are exogenous factors or genetically encoded morphological errors. Exogeneous causes of facial anomalies include (1) factors causing environmental stress early in embryological development, such as hyperthermia and hypoxia[9], nutritional deficiencies and hormonal imbalances[16], (2) viral and toxoplasma infections[5,13] and (3) toxins, drugs and chemicals[15]. In the present case, the role of infectious agents, parasites and drugs could not be obtained because there were no records and history of husbandry of the dam and sire. Similarly the role of genetic factors could not be determined because of the absence of breeding history. Common teratogenic plants such as *Datura, Senecio* and *Veratrum* spp. which cause malformations in ruminants were ruled out in this case because no such plants were found during inspection of the grazing area. In conclusion, there is need for further studies to elucidate the aetiology and morphopathogenesis of facial malformation in domestic animals.

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