



## A Survey on Congenital Head Malformations in Calves

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### ABSTRACT

Congenital malformations are structural and functional abnormalities that present at birth. Congenital head malformations were present in 231 (22 bovine and 209 buffalo) calves referred to Mansoura veterinary teaching hospital, beside private farm stations at Dakahleya Province, and during field training trips between October 2015 and December 2021. This survey was carried on for the awareness of scientists, veterinarians and animals' owners. Diagnosis of those abnormalities was based on history and clinical examinations that were dependent upon visual inspection and surgical exploration. Those head malformations include: anophthalmia (0.43%), enophthalmos (0.43%), unilateral and bilateral strabismus (squint) (1.72%), heterochromia iridis (86.58%), conjunctival dermoid cyst (0.86%), cheiloschisis (harelip) (0.43%), campylognathia (curved jaw) (3%), absence of external ear (anotia) (0.43%), nasal dermoid (0.43%), double tongue (0.86%), hydrocephalus (0.86%), diprosopus (double face) (0.86%), cranioschisis (0.86%), cyclopia (0.43%). Buffalo calves were found with more congenital head malformations than bovine calves. In bovine, mixed breed calves have higher incidence of head malformations compared to native. Surgical treatment was carried out for cases affected with conjunctival dermoid cyst, nasal dermoid, double tongue, cranioschisis. Congenital anomalies which cannot be corrected surgically but the animal will survive in a normal condition were: campylognathia (curved jaw), strabismus, heterochromis iridis and anotia.

**Keywords:** Buffalo, Bovine, Calves, Congenital, Head malformations, surgery.

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Congenital malformations may be caused by genetic or environmental factors or by interaction of both (Singh *et al.*, 1988). Mutant genes or chromosomal disturbances cause hereditary malformations (Blowey and Weaver, 1997). Malnutrition, contact with teratogenic viruses, and the use of drugs with teratogenic side effects are among the significant environmental factors propagating the development of neurological defects (Lopez and Wilson 2000).

Distl and Bähr (2005) reported in a survey that the occurrence rate of congenital malformations among cattle in Germany is 0.51%, where all the cattle under study were born through artificial insemination. The ocular malformations reported in cattle were congenital cataract, dermoid, congenital glaucoma, persistent pupillary membrane, corneal edema, anophthalmia and strabismus, while in buffalo heterochromia was the main one followed by strabismus (Ahmed *et al.*, 2000).

Bilateral convergent strabismus with exophthalmos (BCSE) is heritable and relatively of high incidence particularly in Holstein and German Brown cattle, it causes economic losses from the animals' decreased marked value and the fact that their progeny cannot be used as breeding animals (Distl and Gerst, 2000, and Vogt and Distl, 2002). Cranial meningocele is a congenital anomaly mostly seen in domestic animals, especially in cattle (Ayhan *et al.*, 2013).

Bilateral convergent strabismus with exophthalmos is an eye disorder affecting many breeds of cattle. The defect is heritable and relatively of high incidence particularly in Holstein and German Brown cattle (Distl and Gerst, 2000; Vogt and Distl, 2002 and Momke and Distl, 2007). BCSE causes economic losses from the animals' decreased marked value and the fact that their progeny cannot be used as breeding animals (Distl and Gerst, 2000). Moritomo *et al.*, (1995) reported that calves lacked eyeball had small sized eyelids and narrow palpebral fissures are

classified as anophthalmia, although a small cystic solid remnant of eyeball was buried in the mixture of vestigial extraocular muscles, lacrimal gland and adipose tissue of the orbit. Similar findings were recorded by this study in a native breed calf had unilateral anophthalmia. Cyclopia is a single centrally located eye or a single orbit with one or two fused eyeballs located in the median face (**Minoru and Katsumi, 1999; Schulze and Distl, 2006**).

Faulty differentiation of tissue during ocular development can produce a dermoid characterized by a mass of normal skin in an abnormal location. The anomaly occasionally develops along the eyelid margin and within the palpebral conjunctiva at the lateral canthus, although the temporal perilimbal conjunctiva and cornea are more typical locations (**Radostitis et al., 2007**). The clinical findings of heterochromia iridis, tapetum fibrosum hypoplasia and typical colobomata of the optic disc and nontapetal fundus were described in albino Hereford cattle.

The present study summarized the different congenital head malformations in calves and to evaluate the role of surgical management for treatment of the operable ones.

## **MATERIALS AND METHODS**

In this survey, congenital malformations at the head region were reported in 231 (22 bovine and 209 buffalo) calves either those animals examined at private farm stations at Dakahleya Province, Egypt or during field training trips beside those animals admitted to the surgery clinic of the Mansoura Teaching Hospital of the Fac. of Vet. Med. at Mansoura University between October 2015 and December 2021.

Diagnoses of those malformations were based on history and clinical examination that was dependent upon visual inspection and surgical exploration. In some cases, exploratory necropsy was performed for confirmation of the diagnosis and identification of the affected organ in some cases. Surgical treatment was performed when applicable dependent upon the nature of the lesions and their original site. Accordingly, surgical treatment was carried out for 7 cases affected with conjunctival dermoid cyst, nasal dermoid, double tongue, cranioschisis. Congenital anomalies which cannot be corrected surgically but the animal will survive in a normal condition were: campylognathia (curved jaw), strabismus, heterochromis iridis and anotia.

### **Surgical Treatment Conjunctival dermoids**

The calf was placed in right lateral recumbency and physically restrained. Xylazine hydrochloride

(Benox 0.4%, EIPICO, A. R. E.) was used for sedation of calves. This was followed by infiltration anesthesia using lidocaine Hcl 1% (Debocaine, El-nasr Pharma. chemicals Co. for Al-Debeiky Pharma-A.R.E.) injected into the conjunctiva under the mass using a 25-gauge needle.

Topical analgesia using Benoxinate Hydrochloride was also used. The mass was then grasped with toothed forceps, and a Halsted mosquito forceps was placed at the base of the mass at its junction with the palpebral conjunctiva for approximately two minutes. The mass was then excised using curved Metzenbaum scissors. The mass was placed in 10% formalin for histopathology. The forceps were removed and hemostasis was completed by direct pressure with 4 x 4 gauze sponge soaked in adrenaline for a few minutes, taking care to avoid abrading the cornea. Neomycin- bacitracin- polymyxin B ophthalmic ointment was then applied to the eye. The calf recovered uneventfully from the procedure. Broad spectrum antibiotics were injected for 5 successive days as well as flunixin meglumine (2.2 mg/kg B.W.) for 3 successive days.

### **Nasal dermoids**

The calf sedated with Xylazine hydrochloride (Benox 0.4%, EIPICO, A. R. E.) and placed in lateral recumbency with the effected side aseptically prepared.. The area was locally infiltrated with lidocaine Hcl 1%.The stalk was dissected with sterilized scalpel. Haemorrhage was controlled by ligation and adrenaline was sprayed to prolong haemostatic effect.. All tissues, glands, and fascia were removed along with the mass. Finally the wound was bandaged with sterile gauze.

### **Double tongue**

Double tongue was treated surgically with success by excision of one tongue and the protruded dentigerous cyst in a case and extra tissues in the other case. The calf sedated with Xylazine hydrochloride (0.1 mg/kg body weight). Linear infiltration with lidocaine Hcl 1% at the base of accessory tongue and at the base of outgrowth was done to provide local analgesia. Radical excision of the outgrowth was done by sharp incision followed by blunt dissection. Through and through sutures were placed at the attachment of the accessory tongue with the common base and glossectomy of the accessory tongue was done. Post-operatively, broad spectrum antibiotics and analgesics were administered. Antiseptic mouth washes were used for 10 days. The calf was given intravenous dextrose for first 3 days and drenched with dam's milk till dysphagia subsides.

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### **Cranioschisis:**

In case of cranioschisis, the calf restrained in sternal recumbency and operated under local infiltration anesthesia with Lidocaine HCl 1%. The frontal region was prepared for aseptic surgery and the skin was incised at the base of the sac. After separation of the skin, fluid filled meningeal membranes were noticed protruding out from the cranium through the frontal opening. The skin was closed as per standard procedures using braided silk. Post-operatively, pencyllin-streptomycin dosed at 10 mg/Kg body weight intramuscular injection once daily for 5 days and meloxicam dosed at 0.2 mg/kg body weight subcutaneously once daily for 3 days were given.

Animal showed uneventful recovery by second postoperative week. Healing was achieved with satisfactory recovery by the third postoperative week. However, the wound dehiscid at the proximal part of the post-operative site. The wound was then cleaned daily with antiseptic solution (betadine) until the granulation tissue appears. The calf was normal and suffered no neurological signs and the wound progressed to healing.

## **RESULTS**

Type of head malformations, number of cases, species and breeds were recorded and summarized (**Table 1**).

Table 1: showing breed, sex and number of newborn calves with head malformations

Congenital abnormalities in bovine calves	Species/Breed	Number	Incidence (%)
Anophthalmia	Holstein	1	0.43
Enophthalmos	native	1	0.43
Unilateral strabismus	mixed breed	2	0.86
Bilateral strabismus	mixed breed	2	0.86
Heterochromis iridis	buffalo	200	86.58
Ocular dermoid cyst	Holstein native	2	0.86
Double tongue	Holstein and mixed breed	2	0.86
Cyclopia	mixed breed	1	0.43
Parrot mouth (Brachygnathia inferior)	buffalo	2	0.86
Curved jaw (campylognathia)	buffalo	7	3
Cheiloschisis (harelip)	Holstein	1	0.43
Anotia	mixed breed	1	0.43
Nasal dermoid cyst	mixed breed	1	0.43
Hydrocephalus	Brown Swiss and mixed breed	2	0.86
Diprosorous (double head)	mixed breed	2	0.86
Meningocele	mixed breed	2	0.86
Cranioschisis	mixed breed	2	0.86
Total		231	100%

Bilateral anophthalmia was reported in one Holstein calf (0.43%). Physical examination revealed a complete absence of the left eyeball, which was replaced by a dark or black tissue (Fig. 1a). Conjunctival dermoids (Fig. 1b) was recorded in two cases (0.86%), one Holstein calf and one native calf. In the first calf, the dermoid arose at the medial canthus and it involved the palpebral conjunctiva and the third eyelid. It caused irritation to the animal, lacrimation and keratitis which were caused mainly by its location and long coarse hairs above the abnormal mass. The other case arose from the palpebral conjunctiva and contains fine hair directed outwardly away from the eye which suffered strabismus.. Surgical intervention was performed via excision of such masses.

A native breed calf was born blind (0.43%). The left eye was small and there was enophthalmos. The third eyelid was protruded, and the palpebral fissure was reduced in size. In the right eye, the upper and lower

eyelids were formed, and they had normal eye lashes but there was no palpebral fissure, and the eyeball was filled with undifferentiated tissue. No surgical intervention was performed in such cases.

Two mixed breed calves (0.86%) were affected with unilateral convergent (esotropia) strabismus (Fig. 1c). The affection was accompanied with exophthalmos with rotation of the eyeball inward and medially. This interfered with animals' vision and affected on their temperament.

Two newly born mixed breed calves (0.86%) were affected with bilateral convergent strabismus (Fig. 1d) with exophthalmos (BCSE). There was a permanent rotation of both eyeballs in an anterior medial direction. Heterochromia iridis was the most common malformations and was detected in 200 buffalo calves (86.58%) complete or partial, unilateral, or bilateral (Fig. 1e & f). The iris was bicolored and has a wide white ciliary zone and narrow bluish gray pupillary zone in complete form. While in partial forms, the heterochromic segment may be present elsewhere along the whole circumference of the iris.

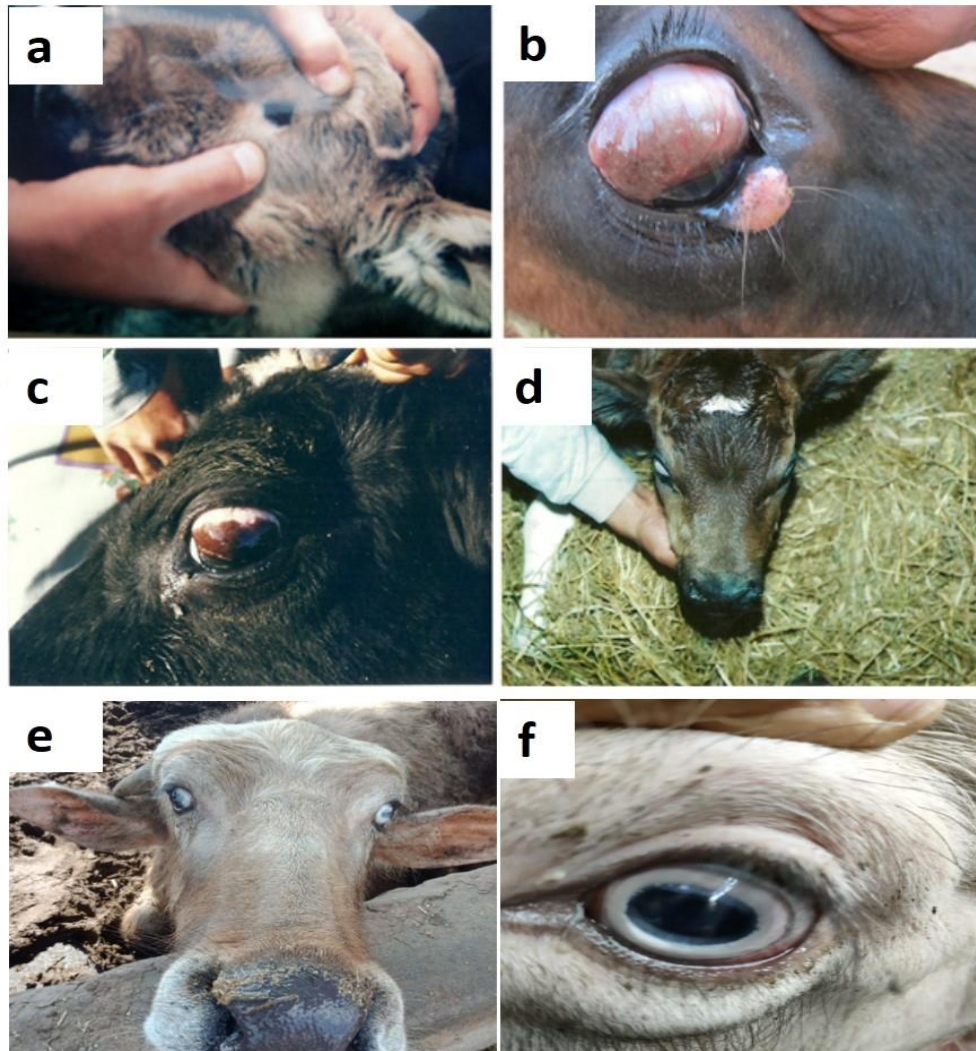


Fig. 1: Gross pictures showing congenital ocular malformations in bovine calves: anophthalmia (a), dermoid (b), unilateral strabismus (squint) with exophthalmos (c), bilateral convergent strabismus (d), heterochromis iridis (e&f).

Parrot mouth (*Brachygnathia inferior*) was seen in 2 buffalo calves (0.86%) (Fig. 2a). There was a noticeable shortening of the lower jaw while the upper was elongated. Meanwhile, curved jaw (*campylognathia*) was seen in 7 buffalo calves (3%) (Fig. 2b). Cheiloschisis (harelip) was recorded in one Holstein calf (0.43%) with a groove extends across the upper lip and nasolabial plate (Fig. 2c).

Congenital double tongue appeared in two calves (Holstein and mixed breed) (0.86%) in the form of two separate well-developed tongues fused at the root in an animal and small and normal tongue in another calf. It was



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associated with protrusion of buccal extra set dentigerous chick like-tissue from the commissure of the buccal cavity in a case that surgically excised after partial glossectomy (Fig. 2d,e,f).

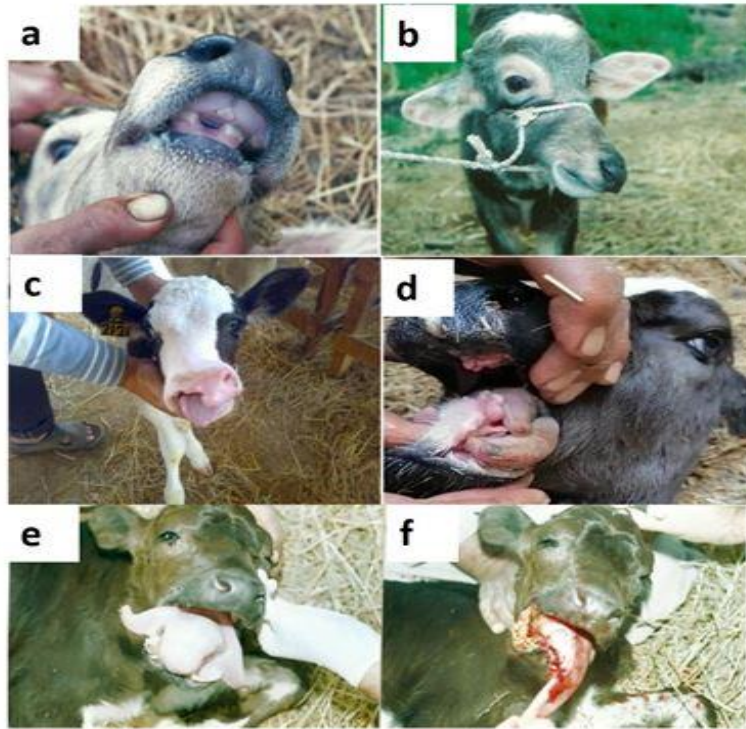


Fig. 2: Gross pictures showing congenital oral malformations in bovine calves: Brachygnathia inferior (parrot mouth) (a), campyloognathia (curved jaw) (b), cheiloschisis (harelip) (c) and two cases of double tongue in Holstein calf (d) and in mixed breed calf before (e) and after surgical intervention (f).

Two nasal dermoids were protruded from the right and left nose in a mixed breed calf (0.43%) (Fig. 3a) and they caused inspiratory noise. The animal can breathe normally following surgical excision of the masses. Unilateral anotia was recorded in one mixed breed calf (0.43%) characterized by complete absence of the auricle (Fig. 3b). Skin of the cheek smoothly passed over the aural area without definite elevation or depression.



Fig. 3: Gross pictures showing congenital nasal dermoid cyst (arrow) (a) and anotia (arrow) (b) in two mixed breed calves.

Hydrocephalus was observed in two calves Brown Swiss and mixed breed (0.86%), where there was bilateral extensive expansion of the skull (Fig. 4A-C). Excess fluid was present in the brain. Cranial meningocele (Fig. 4D) was recorded in two mixed breed calves. One calf was unable to lift its head and unable to suckle due to weight of the swelling in the head. Physical examination of the swelling revealed a fluid filled sac situated over the frontal bone. The cranial sac appeared to have about 10 cm stalk at its base. Further, the calf did not have any nervous signs. Aspiration of fluids from the cranial sac revealed clear colorless fluid. The swelling was diagnosed

as cranial meningocele and the owner refuse surgical intervention. The other calf suffered similar findings, but the swelling was minimal in size and the animal can suckle and grow in a satisfactory manner.

Diprosopus or double face was observed in two mixed breed calves (0.86%) (Fig. 4E). The animals have two oral cavities, 2 tongues, 4 eyes, 4 nostrils and 2 ears. The oral cavities are separate; each has upper and lower jaws. One animal survived up to 9 days; the other was born dead. A mixed breed calf (0.43%) suffered with cyclopia was born with one eye present in a centrally located orbit associated with prognathia (Fig. 4F). The tongue was directed outside and upwardly between the jaws against the left side of the head. The upper jaw was short while the lower one was normally developed. The animals died within 72 hours after labor.



Fig. 4: Gross pictures showing congenital head malformations: hydrocephalus in two calves Brown Swiss (A) and mixed breed (B). Coronal section of the skull in mixed breed calf showing dilated brain ventricles upon dissection (C). Meningocele (D), double head (E) and cyclopia (F) were seen in mixed breed calves.

Cranioschisis was recorded in two mixed breed calves (0.86%) (Fig. 5A-C). Small, bulged mass protruded from a defect in the frontal bone at the middle of cranial border of the frontal bone in a calf and at the dorsal border midway between the horns in the other calf. The defects were circular and about 3 cm in diameter.



Fig. 5: Gross pictures showing a case of cranioschisis in mixed breed calves before (A) and after surgical intervention (B) and another case of cranioschisis 45 days following wound dehiscence (C).



## DISCUSSION

This survey reported that different types of congenital head malformations were mostly observed in buffalo calves compared to the mixed breed calves. The most common congenital malformation was heterochromis iridis.

Ocular dermoids were recorded in two cases. They appeared as hairy dermal tissue with fine or coarse hair on the conjunctiva and medial canthus. Similar findings were reported by Gelatt (1991). Brachygnathia is a common ovine malformation (Dennis, 1993). Brachygnathia has been reported as part of the syndrome of generalized degenerative joint disease in Angus calves (Jayo *et al.*, 1987). Two cases of brachygnathism were recorded in this study. The growth of the calves was nearly normal. We reported cyclopia in one mixed breed calf in which a centrally located eye was present within an orbit associated with prognathia.

A similar case was reported in a buffalo calf by Karrouf *et al.* (2007) and in a kid by Mosbah (2008). Also atypical cyclopia in a brown Swiss cross calf was reported, where the most significant malformation was the presence of a median orbital-like opening that did not contain an eyeball (Ozcan *et al.*, 2006). Cranial meningocele was a common congenital defect in cattle (Ohba *et al.*, 2008). A similar condition was reported in a buffalo calf and Jersey calf in Tamil Nadu (Ayyappan *et al.*, 1996; William *et al.*, 2011) Meuse - Rhine - Yssel calf in Netherland (Back *et al.*, 1991) and Iranian calves (Kohli and Naddaf 1998).

The herniations of fluid filled meninges through cranial defects were related to suture lines and were almost always median and usually in the frontal regions and covered by skin (Maxie and Youssef, 2007). Meningocele has been described as a failure of the neural tube to fuse shortly after conception (Oliver *et al.*, 1987; Jubb and Huxtable 1993). Diprosopus has two oral cavities, 2 tongues, 4 eyes, 4 nostrils and 2 ears. A similar case was recorded in a buffalo calf (Ahmed *et al.*, 2000). Some defects like double face, double tongue formed as a result of tissue duplication. This duplication may be due to that each cell or group of cells of the early embryo is destined to produce, as it multiplies, a particular adult structure (Roberts, 1982).

## CONCLUSION

The congenital head malformations in calves can be classified according to the chance for their surgical correction and outcome following surgery into:

1- Congenital malformations that could be **corrected surgically and the animal may survive in a**

**normal condition** for long period of life. Example: dermoid cyst.

- 2- Congenital malformations which can be **corrected surgically to help the animal to survive for a limited period of time** until it is slaughtered. Example: double tongue and cranioschisis.
- 3- Congenital malformations which **cannot be corrected surgically and the animal will survive in a normal condition**. Example: campyloognathia (curved jaw), strabismus, heterochromis iridis and anotia.
- 4- Congenital malformations which **cannot be corrected surgically and the animal may survive with slight impediment**. Example: brachygnathism.
- 5- Congenital malformations which **cannot be corrected surgically and the animal was born dead or died within days after labor**. Example: bilateral anophthalmia, diprosopus, internal hydrocephalus and cyclopia.

## Declaration of Conflicting Interests:

The author of this manuscript stated there is no conflict of interest regarding the writing process or data analysis.

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