ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 8.4
IJAR 2023; 9(5): 364-366
www.allresearchjournal.com
Received: 09-04-2023
Accepted: 16-05-2023

BP Ravikumar
Assistant Professor, Veterinary College, Vinobanagar, KVAFSU, Shivamogga, Karnataka, India

B Kavitha Rani
Department of Veterinary Gynaecology & Obstetrics, Veterinary College, Vinobanagar, KVAFSU, Shivamogga, Karnataka, India

S Ganga Naik
Assistant Professor, Department of Anatomy, Veterinary College, Vinobanagar, KVAFSU, Shivamogga, Karnataka, India

M Devaraj
Dean, Veterinary College, Vinobanagar, KVAFSU, Shivamogga, Karnataka, India

Corresponding Author:
BP Ravikumar
Assistant Professor, Veterinary College, Vinobanagar, KVAFSU, Shivamogga, Karnataka, India

Hydrocephalus and multiple cranial defects in a local cross-bred calf: A patho-morphological study

BP Ravikumar, B Kavitha Rani, S Ganga Naik and M Devaraj

DOI: https://doi.org/10.22271/allresearch.2023.v9.i5e.12081

Abstract
In a cross-bred cattle, a near term calf was born dead by caesarean section with a birth defect namely hydrocephalus. A detailed post mortem investigation into the defect showed presence of eight bony defects on the left side and five on the right side of the cranium. One of them had a marked meningocele on the right side in which there was accumulation of fluid just under the skin and the meninges through a large defect in the frontal bone. The brain tissue was atrophied and spinal cord hypoplasia and right maxillary hyperplasia was evident. This was a rare case of multiple anomalies with cranial osseous malformation with a communicating hydrocephalus, meningocele, spinal cord hypoplasia and unilateral maxillary hyperplasia.

Keywords: Cross-bred calf, hydrocephalus, multiple defects

Introduction
Hydrocephalus is an anomalous condition characterized by slow accumulation of cerebrospinal fluid in the subarachnoid spaces or the ventricles of the brain in the cranial cavity usually caused by an obstruction to the fluid drainage (Smith *et al* 1972: Sastry and Rama Rao, 2001) [6, 5]. There are two types of hydrocephalous normally, internal and external types. Accumulation of fluid in the ventricular space causing atrophy of the cerebral hemispheres is called as the internal hydrocephalus. Fluid accumulation in the subarachnoid space, sometimes through a defect in the bone, where there will be a covering with the skin and meningeal layers is called as the external hydrocephalus. Presence of both external and internal hydrocephalus is called a communicating hydrocephalus. Both the external and communicating type of hydrocephalus are uncommon in domestic animals (McGeady *et al*, 2006) [2].
Sometimes, the congenital defects can be propagated due to a defect in specific trait selection in which case they are usually inherited anomalies. In this line, hydrocephalus has been reported in Jersey calf (Vijayanand *et al*, 2009) [7] and Angus breed of cattle (Whitlock *et al*, 2008) [8]. Several etiologies have been implicated in the occurrence of congenital defects *viz*., the environmental factors comprising of nutritional deficiencies, endocrine disturbances, temperature variation in pregnancy, radiation, drugs, chemicals, toxic plants and infectious diseases (Roberts, 1971; Vijayanand *et al*, 2009) [4, 7]. It is documented that the causes of Hydrocephalus is obscure and probably related to an obstruction to the outflow of lymph, commonly seen by the blockage of the Foramen of Magendie, the slender aqueduct of Sylvius or the Foramen of Luschka, which are responsible for the flow of the fluid secreted by the choroid plexus from lateral ventricles to the third and then the fourth ventricles respectively (Smith *et al*, 1972) [6]. Slight displacement of the brain can also cause the blockage of the foramina causing hydrocephalus to occur. Neuropathic hydrocephalus documented in cattle (Whitlock *et al*, 2008) [8], has implicated the lethal autosomal recessive genetic defect (Vijayanand *et al*, 2009; Radostits *et al*, 2005) [7, 3] as the cause for hydrocephalus.
During caesarean section in a cross bred cattle experiencing dystocia, a calf was born dead which had completed full term. The calf showed gross anomaly of the head *viz*., hydrocephalus forming a visible large outpocketing under the skin located on the right frontal area.

Materials and Methods

The calf was subjected to gross pathomorphological study by a detailed systematic dissection of the entire body.

Results and Discussion

The calf that was relieved by caesarean in the Teaching Veterinary Clinical Complex, Veterinary College, Shivamogga., was in full term, but still born and had an unusually large head with an externally evident outpocketing on the right side of the face above the eye and the ear (Fig 1).

Fig 1: Still born calf having an unusually large head with an externally evident outpocketing on the right side of the face above the eye and the ear

The birth weight was approximately 13 kgs. The head of the calf was large, had a dished face, cranial doming with a right frontal projection made up of outpouched skin with soft fluid consistency. The outpouching was largest and measured approximately 10 cm x 12 cm in diameter with irregular shaped perimeter. There was another irregular soft area on the left frontal side without an outpouching, which measured 10 cm x 7 cm in diameter in a fronto-parietal orientation. Similarly, there was a soft area measuring 8.5 cm x 3 cm on the fronto-parietal area on the right side. Multiple soft areas without an outpouching were found in the parietal and frontal sides which were irregular, and their sizes were 4 cm x 3 cm, 4 cm x 5 cm, 7 x 6 cm etc (Fig 2).

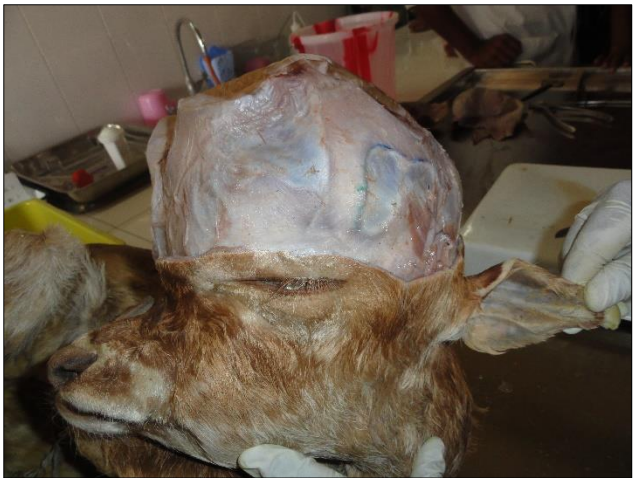

Fig 2: Cranial doming, defective bony plates and multiple soft areas without an outpouching found in the parietal and frontal sides which are irregular, and varying in size

The skin on the head was carefully incised and removed by blunt dissection. The largest outpouching had an externally projected subcutis *viz*., galea aponeurotica which was attached to the cranial meninges. The frontal bone was malformed and the outpocketing occurred through the spherical defect in the bone (Fig 3).

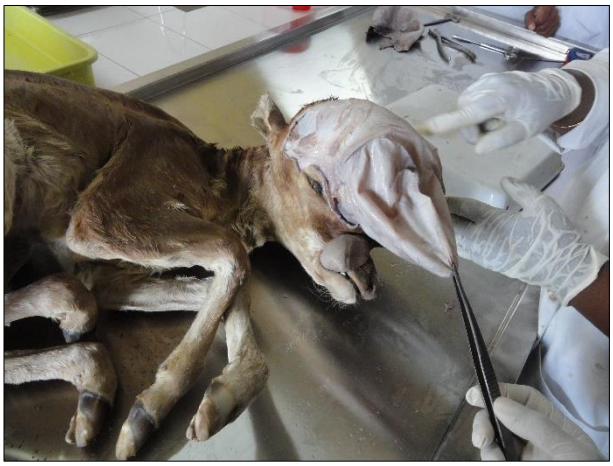

Fig 3: Malformed frontal bone with a large defect through which there was cranial meningocele with hydrocephalus

This anomaly can be termed as a hydrocephalus with cranial meningocele, characterized by herniation of the meninges through a large defect in the cranium (McGeady *et al*, 2006) [2]. It has been stated that hydrocephalus is a disease of the new born and the etiology is attributed to maldevelopment of minute drainage structures (Smith *et al*, 1972) [6]. It is documented that calves with Neuropathic hydrocephalus are born near term and can weigh 25-35 pounds at birth (Whitlock *et al*, 2008) [8].

Totally, there were eight defects on the left side and five defects on the right side in the cranium and only one large outpouching was seen on the right side due to pressure of the fluid under the meningo-aponeurotica layer.

The calf had multiple areas of incomplete defects at the skull sutures of the cranial bones, decipherable by palpation and further by dissection. The incision of the aponeurotica-meningeal layer yielded irregularly shaped and malformed cranial bones (Fig 4) which were irregular, thin and sometimes malleable.

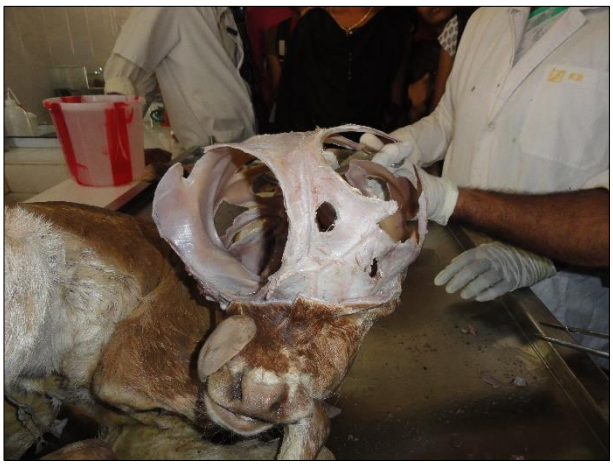

Fig 4: The calf had multiple areas of incomplete defects at the skull sutures of the cranial bones. Excision of the aponeurotica-meningeal layer yielded irregularly shaped and malformed cranial bones which were irregular, thin and sometimes malleable.

Several such defects were encountered in the frontal, parietal and the temporal bones together forming irregular bony plates which were loosely bridged, deformed and hypoplastic. In those areas, there was fusion of meninges and the aponeurotica layer, under which the fluid accumulation was visible externally, but there were no outpouching. Such hydrocephalus cases have been documented by earlier researchers where the head is markedly enlarged, and the bones are malformed and appear as loosely organized bony plates (Whitlock *et al*, 2008) [8]. It is recorded that the accumulation of fluid causes pressure on the developing cerebral hemispheres, which in turn exert pressure on the developing cranial bones which have not yet fused, causing a cranial doming and thinning of the bones (McGeady *et al*, 2006) [2].

Approximately 1600 ml of fluid was recovered from the head, which was clear, straw colored and watery in consistency. There was internal accumulation of the fluid as well as external. It is documented that a type of hydrocephalus called the "communicating hydrocephalus" is seen where the interference to the flow of the fluid lies in the subarachnoid drainage, in which the pressure atrophy also proceeds from the exterior of the brain (Smith *et al*, 1972; McGeady *et al*, 2006) [6, 2].

The cranial cavity had severely atrophied cerebrum almost reduced to a mere hollow rims. The cerebellum was hypoplastic, and the midbrain was also atrophied. Only a few parts of the brain was decipherable, *viz*., the third and fourth ventricles, the pons and medulla, olfactory bulbs, the optic chiasma, falx cerebri, tentorium cerebelli and the hypoplastic spinal cord. It is observed that essentially hydrocephalus leads to pressure atrophy of the cerebral parenchyma and that in internal hydrocephalus, due to an obstruction in the flow of fluids, the spaces enlarge gradually until the cerebral hemispheres are reduced to a mere hollow rims around the lateral ventricles (Smith *et al*, 1972) [6]. Recognizable brain tissue in not evident as the cranium is filled with fluid (Whitlock *et al*, 2008) [8].

The brain material altogether weighed around 110 g. Frandson *et al* (2006) [1] has stated that an Ox brain weighs around 16-17 ounces or 450 grams. In the present case, there was severe atrophy of the brain in whose place there was accumulation of cerebro-spinal fluid.

The examination of the vertebral column revealed hypoplasia of the spinal cord, loosely bound by the meninges and accumulation of fluid in the subdural spaces. Similar hypoplastic change in the spinal cord has been documented in Angus breed of cattle having hydrocephalus anomaly (Whitlock *et al*, 2008) [8].

The other facial and cranial deformities observed were the hyperplasia of the right maxillary bone. The occurrence of multiple cranial defects in bone formation have also been reported by earlier researchers (Radostits *et al*, 2005; Mc Geady *et al*, 2006; Vijayanand *et al*, 2009) [3, 2, 7].

References

1. Frandson RD, Wilke WL, Fails AD. Anatomy and Physiology of Farm Animals. 6th ed. Iowa: Blackwell Publishing; c2006.
2. McGeady TA, Quinn PJ, Fitzpatrick ES, Ryan MT. Veterinary Embryology. Oxford: Blackwell Publishing Ltd; c2006.
3. Radostits OM, Blood DC, Gay CC. Veterinary Medicine. 9th ed. London: Bailliere Tindall and Cox; c2005.
4. Roberts SJ. Veterinary Obstetrics and Genital Diseases. 2nd ed. New Delhi: CBS Publishers and Distributors; c1971.
5. Sastry GA, Rama Rao P. Veterinary Pathology. 7th ed. New Delhi: CBS Publishers and Distributors; c2001.
6. Smith HA, Jones TC, Hunt RD. Veterinary Pathology. 4th ed. Philadelphia: Lea & Febiger; c1972.
7. Vijayanand V, Gokulakrishnan M, Rajasundaram RC. Multiple congenital defects in a newborn calf – a case report. Tamilnadu Journal of Veterinary & Animal Sciences. 2009;5(4):161-163.
8. Whitlock BK, Kaiser L, Maxwell HS. Heritable bovine fetal abnormalities. Theriogenology. 2008;70:535-549.