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Case Report

16 Slice Computed Tomographic Imaging of Bovine Hydrocephalus

A. Velavan[1], C. S. Arunaman[2], P. Selvaraj[3] and L. Nagarajan[4]

[1]Assistant Professor, Department of Veterinary Surgery and Radiology, Madras Veterinary College, TANUVAS, Chennai, INDIA
[2]Assistant Professor, Department of Clinics, Madras Veterinary College, TANUVAS, Chennai, INDIA
[3]Professor, Department of Veterinary Clinical Medicine, Madras Veterinary College, TANUVAS, Chennai, INDIA
[4]Professor and Head, Department of Veterinary Surgery and Radiology, Madras Veterinary College, TANUVAS, Chennai, INDIA

*Corresponding Author: velvetdr2003@gmail.com

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Abstract

A five day old female Jersey cross bred calf was presented with the history of no trauma, head pressing for the last 2 days. Neurological examination revealed quadriparesis and poor mental status but pupillary light reflex and menace reflexes were normal. Routine blood test and radiograph revealed normal study. The clinical suspicion was meningitis. Hence, Computerized Tomographic (CT) study of skull was planned to diagnose the lesion. Under fasting the animal underwent ketamine stun prior to CT procedure. CT images were acquired by 1mm slice thickness at the settings of 120 kV and 160 mAs using Toshiba 16 slices CT scanner. The CT images were reconstructed and interpreted as lateral ventricular area, height and volume were found to be abnormal. These were indicative of bilateral ventriculomegaly and hydrocephalus. Neurological diagnosis is always a clinical challenge in bovines but using CT, neurological diagnosis became easier as evidenced in this case study.

Keywords: CT, Calf, Hydrocephalus

Introduction

Computerized Tomography is widely used in small animal practice. In bovine practice, use of advance diagnostic techniques like Computed Tomography (CT) to evaluate neurological diseases and congenital malformations are limited (Tsuka *et al*., 2008). Numerous reports on diagnostic value of CT are available in small animal practice, whereas comparatively very limited reports are available in bovine practice (Lee *et al*., 2009). As animal owners look for advanced clinical investigations and treatment options for their animals, advanced diagnostic capabilities are increasingly being deployed for clinical care in bovine practice. This case documents on the CT examination of a hydrocephalus calf and its findings and interpretation.

Materials and Methods

Five-day old female Jersey crossbred calf was presented for referral opinion with the history of head pressing and inability to stand for the past 2 days. Neurological examination revealed quadriparesis and mental status; pupillary light reflex and menace reflex were normal. No history of trauma was reported. Complete blood count and serum biochemistry profiles were evaluated and they were within normal limit. Radiographic imaging was found to be normal and hence Computerized tomography study of skull was planned. Under fasting the animal underwent ketamine stun using Inj. Xylazine @ 0.05mg/kg bodyweight, Inj. Ketamine @1mg/kg bodyweight and Inj. Butorphanol 0.025mg/kg bodyweight before CT procedure. CT images were acquired by Toshiba 16 slices CT unit by positioning the calf in sternal recumbency on the CT table. Continuous CT images of skull were obtained with a slice thickness of 1mm at the settings of 120 kV and 160 mAs with window width 361 HU and window level 35 HU. The CT data were reconstructed and interpreted. Axial, sagittal, coronal, multiplaner reconstruction and 3D reconstruction were made for interpretation.

Results and Discussion

Bovine clinical practice is advancing at rapid pace. Modern diagnostics are increasingly being used by clinicians. Neurological disorders are quite common in field practice and are diagnostically very challenging and the owner requires early prognosis as it involves major economic decisions. As the owners are ready to spend higher costs for neonatal animals, they demand advanced clinical care and saving the life of neonates. In this study also the owner requested the best possible care and hence this CT study was undertaken. Bovine hydrocephalus was reported widely in cattle and in all major beef and dairy breeds including Jersey. (Leech *et al*., 1978). Many times, cases of bovine hydrocephalus go undiagnosed or reported incorrectly as abortion *etc.*, In Indian reports its importance is given as dystocia due to hydrocephalus (Tripathi *et al*., 2014); Dar *et al*., 2018). However, the affected calf and its further investigations are not getting expert attention they deserve. This study precisely addressed at gap and made efforts to study this congenital anomaly.

Clinical presentations of hydrocephalus affected calves are varied. Some affected calves are still born and many were born as premature. If live born, the calves may be recumbent, typically with their heads thrown back along the side of the body. They were weak and generally unable to rise, stand or nurse unaided (Usta and Distl, 2019). Such signs were observed in the calf too. While doming is the clinical clue for diagnosis it is always not appreciable. Doming may or may not be sufficiently developed to serve as a diagnostic feature. Calves with pronounced cranial enlargement usually die within 48 hours. Less severely affected calves may survive for several weeks or longer. (Usta and Distl (2019). Their diagnosis required advanced medical equipments and availability of such facilities are less. In this case 16 slice CT was used for diagnostic confirmation. Neurological examination of the calf indicated that there was involvement of central nervous system and a diagnosis of hydrocephalus confirmation it required CT study. The time required for CT scan was 5 minutes and the anesthesia time was 15 minutes which includes the time from preparation and positioning of the patient on CT table to recovery of the calf. In the CT image both the right and left lateral ventricles were measured. The length and height of left and right ventricles were 40 mm, 16.5 mm and 41.6 mm, 9.0 mm respectively.

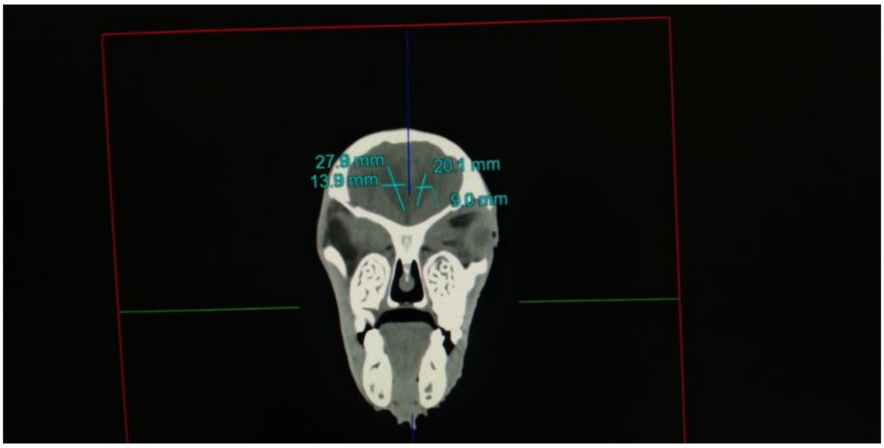

Figure 1: CT scan coronal section of calf head showing enlarged ventricles with height and length measurement

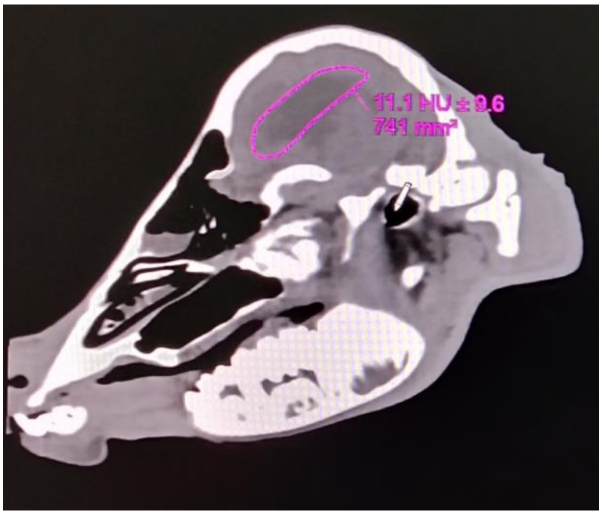

Figure 2: CT scan Sagittal section of hydrocephalus calf head showing enlarged ventricles with surface area measurement

The surface areas of left and right ventricles were 521 mm^2 and 308 mm^2respectively. Ventricular volume is derived by the multiplication of surface area by number of slices of ventricles. The left and right ventricular volumes were 10,941 mm^3 and 6,468 mm^3 respectively. Lee *et al.*, 2010) calculated the normal mean ±SD values for ventricular height, ventricular area and ventricular volume were 4.96 ± 1.56mm, 114.29 ± 47.68 mm^2 and 2,443.50 ± 1,351.50 mm^3. Compared to these values the presented calf having both the lateral ventricles is enlarged in length, breath and surface areas and confirmed hydrocephalus condition.

The reported incidence of congenital abnormalities was more in cattle than in other animals (Vanderson *et al.*, 1998). While many diagnostic challenges are there for congenital defects Computed Tomography is the diagnostic choice for both soft tissue and bone in head (Tharwat *et al.*, 2014). Gibbs and Tanenbaum (2018) defined the hydrocephalus as an active distension of the ventricular system of the brain resulting from inadequate drainage of CSF. The CT image data interpretation with regard to lateral ventricular surface area, length, height and volume were abnormal in the calf and indicated the bilateral ventriculomegaly and hydrocephalus. These CT finding of hydrocephalus correlated with the findings of Lee *et al.,* 2009) who observed that the CT findings were similar in calf, dog and human beings affected with hydrocephalus. In this study hydrocephalus was identified by CT. On the basis of this study we can conclude that CT is one of the important clinical tools to confirm the diagnosis of hydrocephalus in bovines.

The incidence of hydrocephalus in calves also calls for attention towards genetic testing and molecular testing, which are currently lacking in many regions of India. Infectious and nutritional factors also play a major role in hydrocephalus. Such testing also has to be undertaken. Prenatal infections such as Bovine Viral Diarrhoea also have roles in neurological abnormalities (Agerholm *et al.,* 2015) and such anomalies have to be screened and tested. However, such testing were not done in this case as owner was unwilling to do any further testing based on the given unfavourable prognosis. The calf was discharged and was lost for follow up. So, for no successful treatment strategy for hydrocephalus management in calves is available. Many of the affected calves die in the course of the time.

Conclusion

16 slice CT study findings of calf hydrocephalus were reported. Though clinical diagnosis is possible to certain extend, diagnostic confirmation required CT examination and it helped the owner to make informed decisions on their further care. Enlargement of both lateral ventricles in the CT assessment is confirmative of hydrocephalus condition.

Conflict of Interests

There is no conflict of interest.

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