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Computed Tomographic Findings in Calves with Head Affections

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Abstract: In this study, three calves with hydrocephalus, cerebellar hypoplasia and otitis media were examined by computed tomography (CT). In the 3 calves, hematology and serum chemistry profiles were performed. CT imaging of the skull was performed under deep sedation. In the calf with hydrocephalus, CT images showed bilateral ventriculomegaly and a cyst-like intracranial hypodense lesion. The calf died 12 hr after admission to the hospital. Postmortem examination showed an enlarged and soft cranium, distended ventricles with cerebrospinal fluid and thinned cerebral tissue. In the calf with cerebellar hypoplasia, CT examination showed a decreased cerebellar size. Based on the owner's request, the calf was euthansed 24 hr after admission. On postmortem examination, the cerebellum was very small, tough and leathery. In the calf with otitis media, CT examination revealed a large, irregular, diffuse para-aural soft tissue swelling with multiple calcifications of the wall of the right external ear canal, enlargement of the tympanic bulla with soft tissue obliteration and osteolysis of the tympanic bulla wall and petrous bone. CT examination of the calves with head affections indicated that the procedure is an effective non-invasive means of identifying head lesions in these animals.

Key words: Calves · Computed Tomography · Hydrocephalus · Otitis Media · Cerebellar Hypoplasia

INTRODUCTION

Computed tomography (CT) is essentially cross-sectional images, with image production being a function of the absorption of x-ray photons by tissues. In contrast to radiography, individual structures can be imaged without overlap of other tissues and internal soft tissue architecture is visible. In these days, CT is increasingly being used in veterinary diagnosis due to greater accessibility of the equipment, advances in treatment options and increase of owner expectations. However, CT is an expensive procedure that requires careful patient selection and should be used to supplement, rather than replace, conventional diagnostic tools [1-3].

Also CT has become increasingly important in veterinary medicine for the diagnosis of disorders in both companion and production animals [4-13]. There are numerous reports on the diagnostic value of CT in small animal practice, but there are comparatively few published reports on the use of CT in cattle [10, 13, 14]. This paper describes the CT findings in three Holstein calves with hydrocephalus (case 1), hypoplasia of the cerebellum (case 2) and otitis media (Case 3).

MATERIALS AND METHODS

Calves and CT Protocol: The three calves were examined at the Veterinary Teaching Hospital, Rakuno Gakuen University, Hokkaido, Japan. The calves were maintained

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under the *Laboratory animal Control Guidelines* of Rakuno Gakuen University, which basically conform to the *Guide for the Care and Use of Laboratory Animals* of the National Institutes of Health in the USA (NIH publication No. 86-23, revised 1996).

CT imaging of the skull was performed without contrast medium under deep sedation with 2% xylazine (0.1 mg/kg IV, Rompun, Bayer HealthCare, Germany). Image acquisition was obtained using a single-slice helical CT scanner (Legato DUO, GE-Yokogawa Medical Sys., Tokyo, Japan) at settings 80 kV and 130 mA in contiguous views and transverse CT images were obtained. The images were processed, reconstructed and formatted on imaging film [13].

Hematological and Biochemical Analyses: From each calf, two blood samples were collected by puncture of the jugular vein. A complete blood count (hematocrit, hemoglobin, total and differential leucocytes) was carried out on an EDTA sample using an automated veterinary hematological analyzer (Vet Scan HM5, ABAXIS, Hungary). After centrifugation of the second blood sample, serum samples were collected and frozen for future analysis of clinical chemistries. Commercial kits were used to determine the serum concentrations of total protein, albumin, calcium, phosphorus, total bilirubin, total cholesterol, triglycerides, phospholipids, free fatty acids, glucose, urea nitrogen, creatinine, β-hydroxy butyric acid, sodium, potassium and chloride. The serum activities of aspartate aminotransferase, γ-glutamyl transferase, pancreatic amylase, lipase, creatine kinase and lactate dehydrogenase were also measured. An automated biochemical analyzer (Biosystems A15, Spain) was used for measurement of all serum parameters. Serum protein fractions were determined by electrophoresis.

RESULTS

Case 1, 24 hr newly born female Holstein calf, was presented dull with head-pressing, the cranium was domed, both eyes protruded with nystagmus and was unable to stand. On neurological examination, the mental status, papillary light reflex and menace response were normal. Except for leukocytosis (19,600 cells/µL, reference range 5,000-12,000 cells/µL), complete blood count and serum biochemistry profile were within normal limits. On the CT images of the calf, bilateral ventriculomegaly and a cyst-like intracranial hypodense lesion was observed (Figure 1). The calf died 12 hr after admission to the hospital. Postmortem examination showed an enlarged and soft cranium, distended ventricles with cerebrospinal fluid and thinned cerebral tissue (Figure 2).

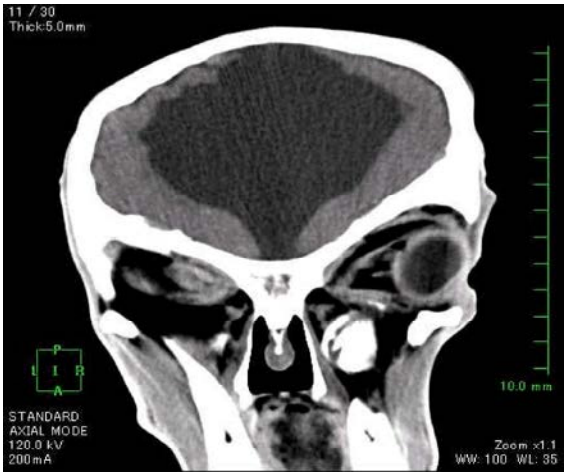

Fig. 1: Computed tomographic findings in a calf with hydrocephalus. Bilateral ventriculomegaly and a cyst-like intracranial hypodense lesion were observed.

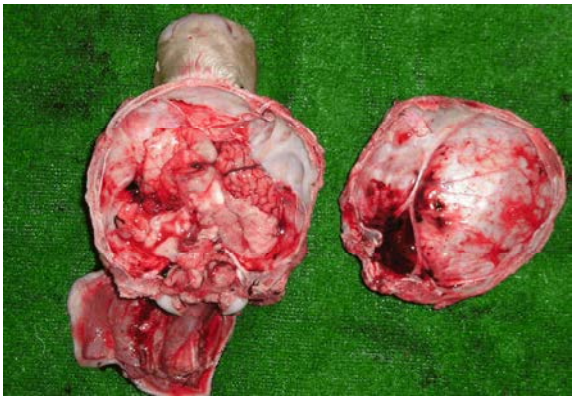

Fig. 2: Postmortem findings in a calf with hydrocephalus. Enlarged and soft cranium, distended ventricles with cerebrospinal fluid and thinned cerebral tissue were found.

Case 2, a three month of age, male Holstein was presented conscious but with a wide and apart legs. If assisted to stand and pushed to walk, the calf sways with great tendency to fall. Head tremor was the most obvious sign in this calf. Complete blood cell count and serum biochemistry profile were within normal limits. In this calf, CT examination showed a decreased cerebellar size (Figure 3). Based on the owner's request, the calf was euthansed 24 hr after admission. On postmortem examination, the cerebellum was very small, tough and leathery (Figure 4).

Fig. 3: Computed tomographic findings in a calf with cerebellar hypoplasia. A decreased cerebellar size was detected.

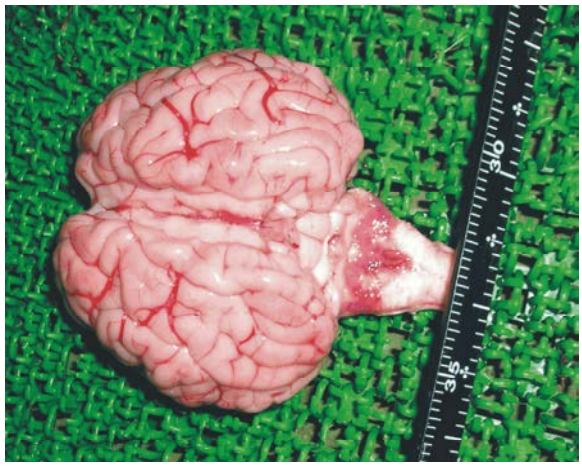

Fig. 4: Postmortem findings in a calf with cerebellar hypoplasia. The cerebellum was very small, tough and leathery.

Case 3 a one month of age, male Holstein was presented with clinical signs of dullness, inappetance and unilateral purulent discharge from the right ear. The most obvious sign in this calf was head rotation, drooping of the right ear and walking in circles. Complete blood count findings included leukocytosis (18300 /µL; reference value 4000-12000 /µL) with neutrophilia (10256 /µL; reference value 600-4000 /µL). Abnormalities identified from the chemistry profile included hyperprotenaemia (8.2 g/dL; reference value 6.7-7.5 g/dL) and hyper γ-globulinaemia (3.5 g/dL; reference value 0.8-1.1 g/dL). CT examination revealed a large, irregular, diffuse para-aural soft tissue swelling with multiple calcifications of the wall of the right

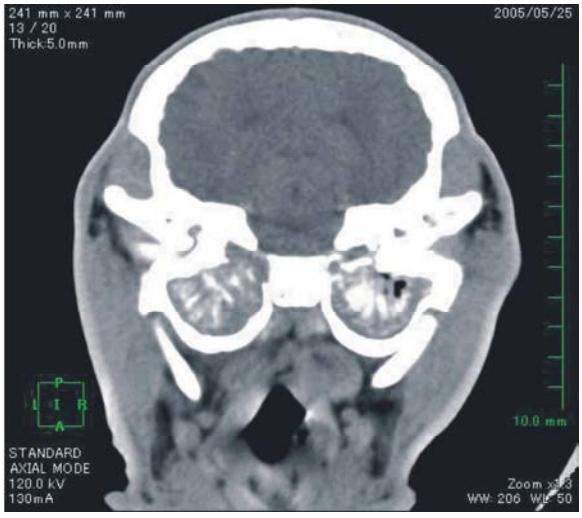

Fig. 5: Computed tomographic findings in a calf with otitis media showing distention of the bony areas surrounding the bulla and exudates in the bulla.

external ear canal, enlargement of the tympanic bulla with soft tissue obliteration and osteolysis of the tympanic bulla wall and petrous bone (Figure 5). The calf was treated with oxytetracyclin (Terramycin LA; Pfizer, 10mg/kg IM) and flunixin meglumine (Finadyne; Schering-Plough Animal Health, Segre, France, 1.1 mg/kg IV) for 10 days. The tympanic mucosa was punctured and the right ear was irrigated with an antiseptic solution and locally with procaine penicillin (Sandoz, Austria, 20000 iu/kg). The calf was discharged after one month and a telephone-based follow-up revealed that the calf made a full recovery

DISCUSSION

In large animal practices, although radiography research is routinely performed, CT studies are seldom carried out. The diagnostic value of CT in production animals such as cattle may be identical; the reports of the use of CT in cattle are few [11].

Computed tomography is the diagnostic procedure of choice for the evaluation of both bone and soft tissue structures of the head [2, 3, 13]. Our results of CT examination in cattle affected with actinomycosis enabled making a good prognosis depending on presence of bony abnormalities. This was supported by the favorable response of the cattle to treatment. Thus, CT of the mandible or maxilla, although costly, is a suitable technique for investigating lumpy jaw in cattle. By CT images, the site and nature of the lesion could be recognized at various planes of examination.

Therefore, rapid and accurate establishment of the reference images for the CT features of bovine skull will support greatly rapid and proper diagnosis of bone deformity in such species.

In this study, in case 1, fluid-containing, bilateral ventriculomegaly, cyst-like intracranial hypodense lesions due to hydrocephalus were identified by CT. On the CT images, the lesions appeared hypodense with CSF. The CT findings of hydrocephalus and intracranial arachnoid cysts in the cattle were similar to those in dogs [15]. In case 2 with cerebellar hypoplasia, a decreased cerebellar size was identified by CT. The CT findings of cerebellar hypoplasia were in agreement to those recently reported [9]. In case 3 with otitis media, a large, irregular, diffuse para-aural soft tissue swelling, enlargement of the tympanic bulla with soft tissue obliteration and osteolysis of the tympanic bulla wall and petrous bone were identified by CT. The CT findings of otitis media were similar to those reported in dogs [16] and in cattle [9]. In this calf with otitis media, tympanic bullae with increased fluid density, indicative of otitis media, were also identified. Radiographic and CT evaluations of otitis media in cattle have been reported [14, 15]. Although the radiographic findings of tympanic bullae in cattle are specific, radiography is not a sensitive diagnostic tool for otitis media [15]. CT is more sensitive than conventional radiography, because CT provides detailed information about the bony structures in the middle ear [8, 14]. Furthermore, antemortem diagnosis of otitis media is expected to be economically useful, since the condition can be treated relatively easily with medication. Conclusively, CT examination of the calves with head affections is an effective non-invasive means of identifying head lesions in the calves.

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