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A clinical study on the surgical management of cranial meningocele in a crossbred jersey calf

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Abstract
A seven-day-old female Jersey crossbred calf with cranial meningocele to the size of a baseball was presented to Veterinary Polyclinic, Mannarkkad, Kerala. The deformity was operated under xylazine anesthesia. The hernial ring was towards the medial suture line of the frontal bone. The cranial defect was corrected by apposing with the meningeal membranes to the cranium. The protruding extra meningeal membranes were removed. The surgical wound was closed using braided silk in simple interrupted pattern and post-operative care was given. Animal had an uneventful recovery.

Keywords: Calf, congenital deformity, cranial meningocele, meningeal membranes, surgical correction

Introduction
Congenital is the descriptive term indicating the condition prevailing from birth [1]. Deformities in structure and function, which are present at birth, are congenital deformities [2]. Environmental factors, genetic factors, or a combination of both are considered to be factors in congenital malformations [3]. Chances of congenital deformities are high in animals having 4–8 weeks of pregnancy at the time of infection [4]. Meningocele of the skull is a congenital deformity, observed as fluid-filled swellings in the median part of the skull cap. The intracranial material protrudes through a spontaneous cavity, such as the anterior fontanelle [5]. Meningocele is the condition where only cerebrospinal fluid (CSF) exists in the meningeal swelling [6].

Materials and Methods
The study includes the congenital disorder reported in a calf presented to the Veterinary Polyclinic, Mannarkkad, Palakkad, Kerala, India.

History and clinical observations
A seven-day-old, 20 kg weighing female Jersey crossbred calf with swelling on the forehead was presented to Veterinary Polyclinic, Mannarkkad, Kerala (Fig.1). The calf was born at full term. Physical examination revealed a turgid, fluid-filled swelling situated towards the cranium of the head, spreading from the middle third of the forehead to few centimetres above the ear, which altered the normal activities of the animal. Aseptic puncture by 18 gauge needle, on its dependent portion, permitted drainage of clear and colorless fluid (Fig.2). Deep palpation after drainage revealed an elliptical median opening on the skull. Surgical correction was carried out to solve the problem.

Surgical Procedure
The swelling and surrounding areas were aseptically prepared and draped for the surgery (Fig.3). The calf was premeditated intramuscularly using xylazine at 0.01 mg/kg body weight. The calf was placed in sternal recumbency and an elliptical skin incision was made on the base of protruding sac and dissected through the interior to reach the meningeal membranes (Fig.4). The sac was found protruding from the cranial defective opening. The cranial defect was corrected by apposing with the meningeal membranes to the cranium. The protruding extra meningeal membranes were removed. The surgical wound was closed using braided silk in a simple interrupted pattern (Fig.5). The animal was given Streptopenicillin and Meloxicam injections as post-operative care. The post-operative treatment was continued for a week. The suture was removed on the 10th postoperative day (Fig.6).

Fig 1: Animal presented with the condition

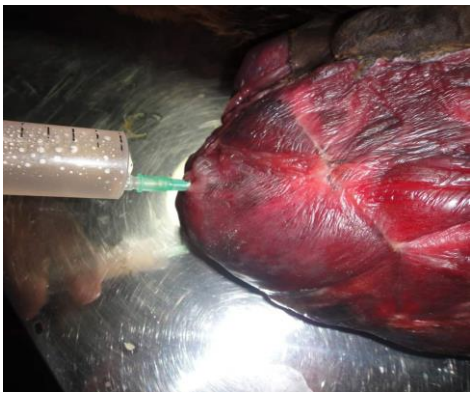

Fig 2: Aspiration of fluid from the site of swelling

Fig 3: Surgical preparation of the site

Fig 4: Incision and examination over the site

Fig 5: Suturing of the surgical site

Fig 6: The recovered animal presented on 10th postoperative day

Results and Discussion

Recurrence was not observed in the calf after 3 and 6 months, and hence it is being assumed that the animal had an uneventful recovery. The congenital abnormalities occur in all animal species worldwide. Clinically they are easy in diagnosis, but it's difficult to determine their cause [7]. The different genetic and environmental factors like autosomal recessive genes inheritance, poor nutritional status, contact with teratogenic chemical and biological agents, some trace elements, phytotoxins, irradiation, hyperthermia have been associated with the developmental defects [8]. Even though congenital defects are more common in central nervous system (CNS), muscular system, and gastrointestinal system, they are also less frequently reported in the urogenital system, eye, and skin [9]. The localization for CNS defects is commonly seen as frontal, occipital, midfrontal, or parietal [10, 11]. It has been reported that defects concerning to cranial congenital anomalies in cattle are encountered in different forms like meningocele or meningoencephalocele [12]. In the present case, cranial meningocele in a one-week-old Jersey crossbred calf was defined with physical-pathological findings. This congenital condition has also been reported in different breeds of other species like horses, pigs, dogs, lambs, and cats including human beings which may be due to defective ossification of the skull with secondary herniation of preformed intracranial tissue [13]. The herniation of fluid-filled meninges through cranial defects are related to suture lines, almost median, and usually in the frontal regions covered by skin [14]. In the present case also the meningocele was related to the frontal suture line and covered by a normal skin layer.

The other reason could be the primary defect of the neural tube from the embryonic ectoderm and resulting in a cardinal failure of development of the skeletal encasement [15]. The neural tube is a hollow, embryonic structure that gradually develops into the central nervous system, comprising the brain and spinal cord. This in turn creates a space through which cerebrospinal fluid, brain tissue, and the membrane covering the brain (meninges) protrude into a pouch -like formation [16]. Such calves are unable to raise their head and suckle due to the weight of the swelling as observed in the presented case. Physical examination of the swelling reveals a fluid- filled sac situated over the frontal bone close to the nuchal's crest. The concentration of different components in the fluid aspirated from the present study (Table 1) was in agreement with the literature data [17].

Table 1: Protein concentration, total and differential cell counts in the CSF sample of study.

Measurement	Fresh CSF median (min - max)
Total protein (mg/L)	751 (18-28,084)
Total cells (L)	38.0×10^6 (11.9×10^6 – $12,310.0 \times 10^6$)
Differential cell count	
Neutrophils (%)	4.0 (0.0 - 97.0)
Mononuclear cells (%)	94.0 (3.0 - 101.0)
Monocytes (%)	50.0 (1.0 – 96.0)
Lymphocytes (%)	22.0 (1.0 – 73.0)

The condition can be diagnosed by the physical examination but, the nature and extent of involvement of meninges and the magnitude of the defect in the cranial vault have to be assessed by diagnostic methods like radiography, computed tomography and magnetic resonance imaging, which were not performed in this case due to owner's financial limitations. Treatment includes excision of the sac by elliptical incision near the base and connecting the hernia cavity to the peritoneal cavity through a tube subcutaneously [16]. The surgical procedure followed in the present case was similar to that of William *et al*., [15] who treated a cranial meningocele by surgical correction after draining the fluid in the sac. The calf presented could walk properly after surgery and was active and alert.

Conclusion

Non-recurrence of meningocele in calf might be due to the progressive closing of the defect during its growth. But, spotting the etiology for the defect was not possible, since there are many including genetic and environmental factors. The present case was classified as meningocele both anatomically and pathologically. Congenital defects like meningocele need to be treated as earlier as possible to increase the chance of survivability of the animals.

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