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A case of meningioencephalitis resembling listeriosis in a Nili Ravi buffalo calf

Adil Majid Bhat[1], Jagmeet Kaur[2], O.K. Baba[2], S.T.Singh[1], R.S.Grewal[1]*

[1]Directorate of Livestock Farms, [2]Department of Veterinary Pathology, College of Veterinary Sciences, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab

Abstract

The present case report describes meningioencephalitis resembling listeriosis in a 25 day old niliravi buffalo calf. The calf was found in the recumbent position with clinical signs of opisthotonus, nystagmus, muscle twitching and thrashing of limbs. The animal was having elevated rectal temperature, tachypnea, tachycardia and colour of mucous membrane was brick red. Menace reflex and pupillary light reflex were negative in both eyes. CSF analysis revealed turbidity, pleocytosis, increased specific gravity and total protein concentration. Cytology of CSF revealed mix of neutrophils and monocytes with predominance of monocytes. Culture of CSF on blood agar revealed no growth. Histopathology of meninges revealed meningitis with congestion, hemorrhage & infiltration of neutrophils and mononuclear cells. In brain stem there was encephalitis and microabscess formation in the vicinity of white matter. The meningioencephalitis was characterized by accumulation of mononuclear cells and few neutrophils resulting in meningitis with vasculitis and perivasculitis, and with extensive mononuclear cuffs within the neuroparenchyma. The findings of histopathology and clinical signs were strongly suggestive of meningioencephalitis due to *L.monocytogenes*. The case highlights the occurrence of nervous form of listeriosis in buffalo calves.

Keywords: Meningioencephalitis, Calf, Microabscess, *L. monocytogenes*

Meningioencephalitisis often considered as the complication of neonatal sepsis as similar organisms are responsible for both conditions. Gram negative bacteria especially *E.coli* is the commonly reported bacterial pathogen responsible for meningitis in neonatal calves (Cordy *et al*. 1984; Green *et al*. 1992; Scott and Penny, 1993; Ferrouillet *et al.*, 1998). Several bacteria like *Enterobacterspp*., *Salmonella spp., Streptococcus spp.* and *Listeria spp.* have been reported to cause meningioencephalitis in calves (Smith, 2015). Listeriosis has been reported to cause three clinical forms in domestic animals: septicemic form affects ruminants, pigs and birds (Jones *et al*., 2000); nervous form which presents as meningioencephalitis and reproductive form that causes abortion in sheep and cattle (George *et al.*, 2002). Only one clinical form of listeriosis is reported at one time and nervous form is usually associated with *Listeria monocytogenes* (Jones *et al*., 2000). *L. monocytogenes* is distributed worldwide and occurs mainly in temperate areas. The nervous form of listeriosis shows low morbidity and high mortality (Rissi *et al*., 2010). The encephalitic form of listeria has been reported in cattle, sheep and goats (Konradt *et al*., 2017) and in buffalo only one report is available about nervous form of Listeriosis (Prado *et al*., 2019). We here report a case of meningioencephalitis in a niliravi buffalo calf.

*Corresponding author: adil.majid724@gmail.com

Case History and Observations

A 25 day old buffalo calf of niliravi breed was found in the recumbent position at the calfpen with signs of opisthotonus and muscle twitching. The animal had normal milk intake and milkman had observed neck extension during milk feeding. The calf was born normally with birth weight of 38 kgs and was fed colostrum immediately after birth. The calf had history of diarrhea and had recovered after treatment with antibiotics and fluid therapy.

On physical examination the animal was conscious, recumbent with neck extended, had nystagmus, muscle twitching and thrashing of limbs. No abnormal discharge and faecal stains were observed. The animal had elevated rectal temperature (104 F), tachypnea (65 breaths per minute), tachycardia (150 beats per minute) and colour of mucous membrane was brick red. Menace reflex and pupillary light reflex were negative in both eyes.

Clinical pathology

A complete blood cell count (CBC) (Table 1), serum biochemistry (Table 2) and CSF analysis (Table 3) was done. Blood and CSF samples collected under asceptic conditions were submitted for culture. At necropsy samples from brain were collected in 10 % neutral buffered formalin for histopathology.

Table 1. Haematological parameters of a calf with neonatal bacterial suppurative meningitis

S.No	Parameter	Values
1.	Haemoglobin (g/dl)	13.5 g/dl
2.	Leukocytes	15, 300/ul
3.	Erythrocytes	8.64 X10^6/ul
4.	PCV (%)	34.2 %
5.	Platelets	336 X 10^6/ul
6.	Neutrophils	58 (8874)
7.	Lymphocytes	40 (6120)

CBC revealed absolute neutrophillic leukocytosis with mild left shift. Serum biochemistry revealed hypoproteinemia (5.1 g/dl), hypoalbuminemia (2 g/dl), hypokalemia (3.1 mEq/l), and hypochloremia (92 mEq/l).

Analysis of CSF revealed increased turbidity, pleocytosis, increased specific gravity and total protein concentration. On cytology, there was mix of neutrophils and monocytes with predominance of monocytes. Culture of CSF on blood agar revealed no growth.

Postmortem findings and histopathology

Autopsy revealed marked congestion of brain and thickening of meninges. Histopathology of brain revealed menigoencephalitis. Meningitis was characterized by congestion, haemorrhage& infiltration of neutrophils and mononuclear cells (Fig. 1). In brain stem, there was encephalitis and microabscess formation (Fig. 2) in the white matter along with spongiosis, and haemorrhages (Fig. 3). There was also neuronal degeneration characterized by satellotosis, gliosis and neuronophagia. In addition there was marked perivascular cuffing composed mainly of mononuclear cells consisting mainly of macrophages and lymphocytes (Fig. 4).

Table 3. Cerebrospinal fluid analysis of a calf with neonatal bacterial suppurative meningitis

S.no	Parameter	Values
1.	Color	Turbid
3.	Sp gravity	1.025
4.	Total protein (g/dl)	1 g/dl
5.	Na	147 mEq/l
6.	K	19.7 mEq/l
7.	Cl	104 mEq/l
8.	Mg	1 mg/dl
9.	Glucose	20 mg/dl

Table 2. Serum biochemistry of a calf with neonatal bacterial suppurative meningitis

S.no	Parameter	Values
1.	Bilirubin (0 – 0.8 mg/dl)	0.8 mg/dl
2.	AST (45 – 110 u/l)	135 u/l
3.	Total Protein (6.2 – 8.1 g/dl)	5.1 g/dl
4.	Albumin (2.3 – 3.9 g/dl)	2 g/dl
5.	GGT (4.9 – 26 u/l)	33 u/l
6.	BUN (7.8 – 25 mg/dl)	22 g/dl
7.	Creatinine (0.5 – 1.6 mg/dl)	2.1 g/dl
8.	Sodium (135 – 148 mEq/l)	136 g/dl
9.	Potassium (4.5 – 8 mEq/l)	3.1 mEq/l
10	Chloride (96 – 109 mEq/l)	92 mEq/l
11	Calcium (8.4 – 11 mg/dl)	11.5 mg/dl
12	Phosphorus (4.3 – 7.8 mg/dl)	8.4 mg/dl
13	Magnesium (1.7 – 3 mg/dl)	2.1 mg/dl
14	Glucose	89 mg/dl

Discussion

In this case report we discuss a case of meningioencephalitis resembling listeriosis in a niliravi buffalo calf. The disease is reported in ruminants of any group and the incidence is high upto age of three years (Gary and Killinger 1996). In the present case, the affected calf was 25 days old. The animal was found in lateral recumbency with extended neck, and the other clinical signs observed include fever, nystagmus, muscle twitching and thrashing of limbs. In both cattle and sheep, the clinical signs observed include lateral recumbency, limb paralysis, ataxia and ultimately death (Rissi et al. 2010; Margineda et al. 2012). Fever has been reported in early course of disease in cattle (Smith, 2005).

The case was acute in nature and diagnosis was done on the basis of cytological examination of CSF and histopathology of brain stem. The cytological evaluation of CSF revealed increased turbidity, specific gravity (1.025), total protein concentration (1 g/dl), white cell concentration (900/ul) and presence of large number of monocytes. The CSF protein concentration and specific gravity was found to be similar to reported in ovine (Scott, 1993) and bovine listeriosis (Rebhun and Delahunta, 1982). On cytology pleocytosis was observed with a mix of neutrophils and monocytes, with predominance of monocytes. Similar findings have been reported by Scott *et al*. (1993). CBC revealed neutrophilic leukocytosis. No significant changes were observed in serum biochemical

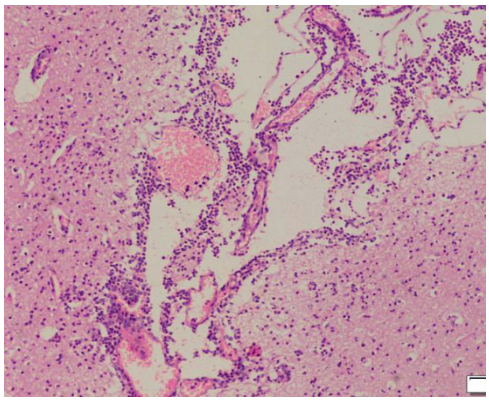

Fig. 1. Meningitis characterised by congestion, haemorrahage & infiltration of neutrophills and mononuclear cells. (H&E × 100)

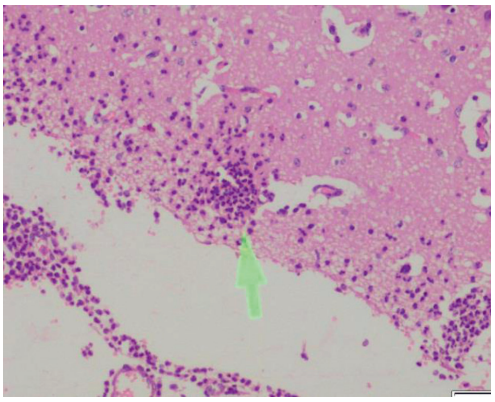

Fig. 2. Encephalitis and microabscess formation in the brain stem. (H&E × 200)

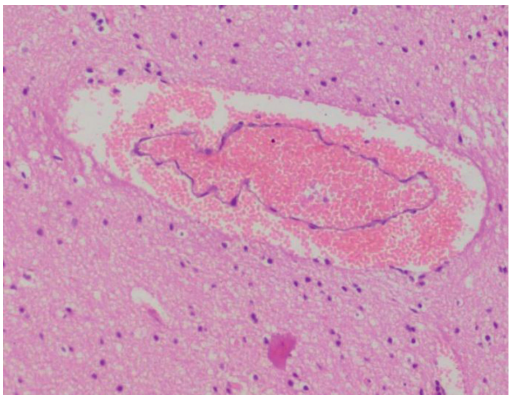

Fig. 3. Brain haemorrhage, leaking of RBC's in the perivascular space. (H&E × 400)

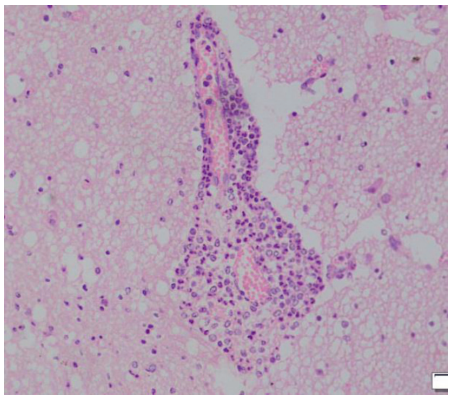

Fig. 4. Perivascular cuffing characterised by inflamatory cells including macrophages and lymphocytes present at the brain stem. (H&E × 400)

parameters.

The significant lesions present on histopathology were presence of microabscesses and perivascular cuffing in the brain stem. Similar lesions have been reported in meningioencephalitis associated with *Listeria monocytogens* in cattle (Oevermann *et al.,* 2010; Headley *et al*., 2013) and sheep (Rissi *et al.*, 2010; Headley *et al*., 2013).Neurologic form of listeriosis manifests as a multifocal brainstem disorder, diffuse meningoencephalitis or myelitis. The condition usually affects individual animals but occasionally can affect several members of a herd (Akpave and Ikhelova, 1992). Presence of microabscesses are considered pathognomonic of listeriosis and are composed of neutrophil infiltrates with varying number of macrophages. The type of cells in the microabscess help in assessment of progression of encephalopathy classifying the disease as acute when neutrophils predominate the cellular population and in cases with advanced progression macrophages are found abundantly (Oevermann *et al.,* 2010). In the present case, the microabscesses were composed of both macrophages and neutrophils. Oevermann *et al*. (2010) reported that microabscesses show presence of larger number of macrophages in cattle than sheep and goats. Prado *et al*. (2019) reported presence of large number of macrophages and multinucleated cells in a case of nervous Listeriosis in buffalo calf. The perivascular cuffs were mainly composed of mononuclear cells consisting mainly of macrophages and lymphocytes. Similar findings have been reported in cattle (Galiza *et al*., 2010, Margineda *et al*., 2012), small ruminants (Campero *et al*., 2002, Headley *et al*., 2013) and buffalo (Prado *et al*., 2019).

In India, *L. monocytogenes* and *L. ivanovii* has been recovered from milk samples of mastitic cattle and buffaloes. The recovery of pathogenic *L. ivanovii* isolate from faeces of buffalo with mastitis, could serve as a probable source of infection for the other animals (Rawool *et al*., 2007). There has been no

report of Listeriosis in buffalo calf. It was not possible to determine the source of infection but the farm has a history of abortion in pregnant animals. According to George (2002), listeriameningoencephalitis not related to feed are commonly associated with environmental contamination. In this case mothers milk could have been the source of infection, since excretion of *L.monocytogens* has been described in cattle milk after mastitis or abortion (Quinn *et al*., 2001).

In conclusion,the presence of neurological signs and histopathological findings are strongly suggest the present case as neurologic form of listeriosis. The findings in the present case report will be an important addition to literature existing on listeriosis in buffaloes.

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