Research Article

Hematological and Serum Biochemical Indices in Calves with Navel Ill

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Abstract | The research has been conducted to determine the changes in haematological and serum biochemical attributes in calves affected with navel ill. Peripheral blood was collected from affected and healthy calves, and serum was separated for biochemical evaluation. In term of haematological profile, Hb and TEC were decreased whereas PCV and TLC were elevated compared to healthy calves. Some leading enzymes such as ALT, AST, ALP, LDH, CK were elevated in affected calves than their healthy counterparts. Creatinine, BUN, LDL, HDL, cholesterol and triglyceride were also elevated remarkably. Mild alterations of electrolytes such as Na^+, K^+, Cl^- and Ca^{+2} were also observed. The results demonstrated that navel ill may compromise vital organs which should be promptly treated once diagnosed. To prevent infection, navel area should be dipped with mild antiseptic and monitored regularly.

Introduction

Bangladesh is blessed with abundant livestock resources and comprises 24.238 million cattle, 1.486 million buffalo, 26.267 million goats, and 3.537 million sheep (DLS, 2019). However, calf mortality is one of the most critical constraints of cattle industry development in Bangladesh (Alam *et al.*, 2005; Rahman *et al.*, 2005). In commercial farming, besides getting a calf per dam per year, it is recommended to ensure the survivability of newborn animals. But, unfortunately, most of the animals die at a young age due to different infectious diseases and surgical disorders (Islam *et al.*, 2006; Juyena *et al.*, 2013; Hoda *et al.*, 2018) and navel infection is one of them (Russel *et al.*, 2020). Navel ill is an infection of the umbilicus that basically occurs in newborn farm animals. It is a disease of young calves, usually less than a week of age, and in 90% of cases, the umbilicus and navel cord dry up by four days of age (Mee, 2008). It occurs due to infections entering via the umbilical cord at, or soon after, birth. This infections can result in a range of signs depending on where the bacteria spread to the body. In some calf infection spreads from the navel to the liver, causing a liver abscess (Biss *et al.*, 1994). The occurrence of this condition is mostly associated with poor hygienic maintenance of maternity pen, prolonged residency of newborn calf in unhygienic maternity pen, lack of adequate and early intake of good quality colostrum and immediate navel antisepsis after parturition (Mee, 2008). It has been observed that in newborn calves that previously had a

failure of transfer of maternal immunity during fetal life, navel infection may act as a source of infection leading to septicemia (Naik *et al.*, 2011; Patel *et al.*, 2019).

In Bangladesh, several studies have been conducted on the surgical disorders in bovine calves (Alam and Rahman, 2012; Noman *et al.*, 2013; Jaman *et al.*, 2018) but those were mostly confined to prevalence study. Therefore, the present research work has been designed to evaluate the haematological and serum biochemical changes in calves affected with navel ill.

Materials and Methods

Experimental animals
Animal diagnosed with navel ill at Veterinary Teaching Hospital (VTH), Bangladesh Agricultural University (BAU), Mymensingh from January 2019 to May 2019 were considered as experimental animals.

Haematobiochemical examinations
Collection of blood sample: Before collection of peripheral blood from healthy or navel ill patients, the jugular region was aseptically prepared with povidone-iodine. Blood sample was collected with 10 ml disposable plastic syringe. About 5ml blood was collected from each calf, and 3ml was transferred in a vacutainer without anticoagulant (clot activator tube) for serum separation and remaining 2ml was transferred in a vacutainer containing EDTA and this was later used for routine blood test.

Routine blood examinations: Blood samples collected from the calves with anticoagulant (EDTA) were analyzed for the determination of total erythrocyte count (TEC), total leukocyte count (TLC), packed cell volume (PCV), Hb concentration. These were done in surgery laboratory of the Department of Surgery and Obstetrics, BAU.

Serum biochemical examinations: Blood samples collected in clot activator tube were centrifuged at 3000 rpm for 15 minutes. Serum was collected in an Eppendorf tube using micropipette for biochemical analysis of Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), Alkaline Phosphatase (ALP), Creatinine, Creatinine Kinase (CK), Blood Urea Nitrogen (BUN), Lactate Dehydrogenase (LDH), Low Density Lipoprotein (LDL), High Density Lipoprotein (LPL), Cholesterol, Triglyceride (TG), electrolytes like Na^+, K^+, Ca^{+2}, Cl^-. Those biochemical tests were done by Microlab Bio-chemistry Analyzer (Germany) through kinetic Method.

Statistical analysis
The data were calculated and presented as mean ± SE. The unpaired t-test was done using Graph Pad Prism software version 6 to analyze the data, and P<0.05 or less was considered statistically significant.

Results and Discussion

Status of blood profile in affected calves
The changes in the routine blood profile are presented in Table 1. In this study, it was observed that the mean values of the different haematological parameters were significantly changed in navel ill calves. The mean values of Hb and TEC were significantly decreased in navel ill calves than those of healthy counterparts. On the other hand, the mean values of PCV was increased non-significantly in navel ill patients. But values of TLC were increased significantly (P<0.05) in infected calves.

Table 1: *Status of blood parameters in healthy and affected calves.*

Parameter	Healthy calves	Calves with navel ill
Hb (gm/dL)	10.43 ± 0.233	7.733 ± 0.176***
PCV (%)	37.87 ± 0.924	38.10 ± 1.069 NS
TEC (106/mm3)	8.910 ± 0.067	7.700 ± 0.309*
TLC (103/mm3)	9.640 ± 0.190	13.42 ± 0.885*

±: Standard Error; NS: Non-Significant; *: P≤0.05; **: P≤0.01; ***: P≤0.0001.

Changes in serum biochemical markers in calves with navel ill
The changes in the hepatic enzymes of two groups are shown in Table 2. In this study, we observed that the mean values of ALT and AST were significantly (P<0.05) increased in navel ill calves compared to those of healthy animals. On the other hand, mean values of ALP was also elevated in the patient group, but that was not at significant level.

We observed that the mean values of creatinine and BUN were significantly increased in navel ill calves than healthy. The values of the enzymes indicating muscular dysfunction like LDH and CK were significantly increased in the calves with navel ill (Table 2).

Table 2: *Status of serum biochemical enzymes in healthy and affected calves.*

Parameters	Healthy calves	Calves with navel ill
ALT (IU/L)	5.083 ± 0.538	7.097 ± 0.448*
AST (IU/L)	3.353 ± 0.015	3.620 ± 0.085*
ALP (IU/L)	81.53 ± 0.649	85.63 ± 1.510 NS
Creatinine (mg/dL)	1.303 ± 0.009	1.530 ± 0.053*
BUN (mg/dL)	8.987 ± 0.054	10.43 ± 0.415*
LDH (IU/L)	995.2 ± 3.192	1237 ± 24.67***
CK (IU/L)	51.46 ± 0.733	55.32 ± 0.708*
LDL (mg/dL)	85.19 ± 1.057	94.74 ± 1.036**
HDL (mg/dL)	67.12 ± 0.763	74.98 ± 1.676**
Cholesterol (mg/dL)	157.8 ± 1.293	174.1 ± 1.256***
Triglyceride (mg/dL)	96.27 ± 0.979	99.06 ± 2.032 NS

±: Standard Error; NS: Non-Significant; *: $P \leq 0.05$; **: $P \leq 0.01$; ***: $P \leq 0.0001$.

The changes in the lipid profile of two groups were also evaluated where we found that the mean values of lipid profile were significantly varied among navel ill and healthy calves. The mean values of LDL, HDL and cholesterol were increased significantly ($P<0.05$) in navel ill patients than those of healthy animals. On the other hand, triglyceride was non-significantly elevated in these patients.

Status of body electrolytes in navel ill calves

The changes in the electrolytes in calves with navel ill are shown in Table 3. We found that the mean values of Na^+, K^+, Cl^- and Ca^{2+} were non-significantly elevated in the calves diagnosed for navel ill.

Table 3: *Status of electrolytes in healthy and affected calves.*

Parameters	Healthy calves	Calves with navel ill
Na^+ (mmol/L)	141.7 ± 0.633	142.8 ± 0.786 NS
K^+ (mmol/L)	4.740 ± 0.141	5.103 ± 0.015 NS
Cl^- (mmol/L)	100.3 ± 0.555	101.9 ± 0.569 NS
Ca^{++} (mg/dL)	9.730 ± 0.149	11.23 ± 0.879 NS

±: Standard Error; NS: Non-Significant.

Umbilical infection is one of the most common diseases in newborn calves, occurring in 1.3% (Svensson *et al.*, 2003) to 29.9% of newborn calves (Hathaway *et al.*, 1993) and it is detrimental to the general condition and health of the calf (Mee, 2008). Navel or joint ill usually occurs in calves less than one week of age, as a result of inflammation, due to infection of the tissues of the umbilicus after parturition in dirty environment (Blowey and Weaver, 2011). The tissue of umbilicus gets infected by bacterial contamination soon after parturition in contaminated environment (Anderson, 2004). Besides the local infection and inflammation, bacteria can spread by hematogenous dissemination into joints, lungs, kidneys, and other organs, causing severe complications, increased mortality (Wieland *et al.*, 2017). Clinically, Navel ill manifest as the swellings of the umbilical stalk with associated septicaemia and possibly haematogenous septic polyarthritis ("Joint Ill") (Anderson and Rings, 2008). Affected animals usually show pyrexia, swollen, painful navel exuding foul smelling creamy-white pus (Blowey and Weaver, 2011).

Little information is available about the effect of umbilical infections, particularly navel ill on the haematological and serum biochemical profile in bovine calves. Hence, our primary objective was to investigate the influence of umbilical infection on haematobiochemical changes in this species.

During the study period, we found that the level of TLC and PCV were elevated which might be due to bacterial infection. On the other hand, TEC and Hb were decreased in the patient group. We observed an increase in hepatic enzymes (ALT, AST, ALP) in navel ill calves. Similar results have been reported by Ghanem *et al.* (2012) in diarrhoeic buffalo calves. This result might be attributed to pathological affection of the liver and digestive tract (Ghanem *et al.*, 2012). The significant increase in ALP level might be due to damage of intestinal mucosa, progressive inflammatory process, and release of the intestinal fraction of the enzyme to blood circulation (Kleczkowski *et al.*, 2008).

An increased level of LDH in navel ill calves was recorded. It may be due to muscle cell permeability or muscle cell damage. Increased cell permeability or cell damage of skeletal muscle may occur during restrain and operational manipulation of animals which may lead to hyperactivity of muscle enzymes (Callegari *et al.*, 2017). We observed an increased level of LDL, HDL, cholesterol, and triglyceride in navel ill calves, which may be due to muscle damage, hepatic damage, less feed intake, loss of immunity.

Increase of creatinine, BUN, CK were observed in affected calves. The increase in serum BUN levels might be attributed to deficit in renal blood perfusion

(glomerular filtration rate) and reduced urine formation (Jain, 1993). It could also attributed to excessive production of urea by catabolism of body proteins in severe toxic conditions (Ashraf, 2007).

Slightly higher concentrations of electrolytes (Na$^+$, K$^+$, Cl$^-$ and Ca^{+2}) in affected calves were recorded. This could be attributed to the intentional increased feeding of colostrum to affected neonates than healthy calves.

Conclusions and Recommendations

Navel infections are potentially a key contributing factor to the high morbidity and mortality rates in calves because some vital organs become compromised following navel infection. Navels should be checked on a regular basis to reduce infection. In addition, future in-depth studies should be conducted to determine a more accurate representation of the prevalence and severity of navel infections at the farm level.

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Author's Contribution

Md. Gulam Rabbany Rassel: Conducting the research, data acquisition. Kazi Afsana Homayra Orchy, Md. Moshiur Rahman Khan: Writing manuscript. Marzia Rahman: Critical revision of manuscript. Md. Mahmudul Alam: Design of the study, writing manuscript, final approval, accountability.

Conflict of interest
The authors have declared no conflict of interest.

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