P-ISSN: 2304-3075; E-ISSN: 2305-4360
International Journal of Veterinary Science
www.ijvets.com; editor@ijvets.com

Research Article

A Brief Study on Hematological, Sero-Biochemical and Microbiological Results of Umbilical Lesions in Calves

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Article History: Received: March 31, 2017 Revised: April 22, 2017 Accepted: April 25, 2017

ABSTRACT

This study aimed to evaluate some hematologic, sero-biochemical parameters and microbiological culture results of umbilical lesions in calves. Holstein breed, six calves (n=6) at different age were presented with the complaint of umbilical lesions at different times. Clinical parameters of the cases were recorded, and umbilical lesions were diagnosed following to clinical and ultrasonographical examinations. The encountered pathologies were omphaloarteritis and omphalourachitis in three cases, omphalophlebitis in a case, ulcerous omphalitis in a case and omphalophlebitis and polyarthritis in a case. Peripheral blood samples were collected and then some hematological and sero-biochemical parameters were analyzed. The microbiological samples were taken from umbilical lesions for culture. Blood sample analyses revealed the systemic inflammatory response syndrome and microbiological culture results pointed out enteric bacteria (*Escherichia coli, Proteus spp., Pseudomonas putida, Pseudomonas stutzeri, Providencia stuartii, Proteus mirabilis)*. As a conclusion, it may be emphasized that a brief hematological, sero-biochemical evaluation as well as local microbiological culture results of the umbilical lesions have valuable information both determination of the prognosis and evaluation of the healthy status of the calves.

Key words: Hematologic, Sero-biochemical, Microbiologic, Umbilical infection, Calves

INTRODUCTION

The umbilicus of the calves consists of amniotic sheath, urachus, umbilical vein and a pair of umbilical arteries that these latter structures are often referred as umbilical remnants (Rotimi and Duerden, 1981; Ozaydin *et al.*, 1998; Ozba *et al.*, 1999; Fubini and Ducharme, 2004; Faradonbeh and Faradonbeh, 2016). Although umbilical remnants birth without any infection, infection of these remnants often occur in the neonatal period due to the environmental contamination (Rotimi and Duerden, 1981; Ozba *et al.*, 1999; Fubini and Ducharme, 2004; Faradonbeh and Faradonbeh, 2016). Because immune system of the neonates is not well developed, some opportunist pathogens, particularly colonize the skin and mucous membranes, can have main role for occurring of the umbilical infections (Rotimi and Duerden, 1981).

Infection of the umbilicus and its associated structures occurs commonly in newborn farm animals (Radostits *et al.*, 2006; Faradonbeh and Faradonbeh, 2016). The encountered umbilical infections are omphalitis (phlegmonosa, apostematosa), omphalophlebitis, omphaloarteritis, umbilical abscess and infection/ abscession of the urachus (Geishauser and Grunder, 1992; Hathaway *et al.*, 1993; Ozaydin *et al.*, 1998; Ozba *et al.*, 1999; Fubini and Ducharme, 2004; Radostits *et al.*, 2006; Ozdemir Salci and Salci, 2012). These infections can progress to liver and/or the other organs (joints and meninges), and responsible as a starting point for metastatic infections leading to generalized septicemia/ bacteremia (Hathaway *et al.*, 1993; Ozba *et al.*, 1999; Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012).

Hematological analysis of the calves with umbilical problems should be planned to determinate general body condition before application of treatment protocols (Radostits *et al.*, 2006). Systemic inflammatory response syndrome (SIRS) is a complex series of events that this may occur in veterinary patients due to infectious or non-infectious causes. The diagnostic criteria for SIRS or sepsis include temperature, heart rate, respiratory rate and white blood cell counts. Increasing of the parameters is recognized as SIRS or sepsis (Randels, 2013). Thus, a sepsis scoring has been developed to identification of the

Cite This Article as: Salci H, Ozdemir Salci ES, Ozakin C and Seyrek Intas K, 2017. A brief study on hematological, sero-biochemical and microbiological results of umbilical lesions in calves. Inter J Vet Sci, 6(2): 86-89. www.ijvets.com

sepsis in animals (Radostits *et al.*, 2006; Randels, 2013). Despite the wide range bacteria isolated from the umbilical lesions (Fubini and Ducharme, 2004; Radostits *et al.*, 2006), *Arcanobacterium pyogenes* and *Escherichia coli* are more common in calves (Fubini and Ducharme, 2004). Some omphalophlebitis cases cause to hepatic disturbance and the microbiological culture results of both umbilical lesions and hepatic nodes usually show the same isolations (Hathaway *et al.*, 1993; Ozdemir Salci and Salci, 2012; Faradonbeh and Faradonbeh, 2016). Considering to these literature knowledge, this study aimed to evaluate some hematologic, sero-biochemical parameters and microbiological culture results of umbilical lesions in calves.

MATERIALS AND METHODS

Animals

Totally, 6 Holstein breed calves (n=6) had umbilical remnant pathologies were materials of the study. All calves were presented to our clinics at different times with the complaint of umbilical pathologies occurred at the early stage after parturition.

Examinations

In the clinical examinations, temperature, heart rate, respiratory rate of the calves were recorded, an umbilical swelling was inspected. Deep palpation of the abdominal region helped the suspected infective pathologies of the umbilical remnants as well as the omphalitis. Exact diagnoses were made based on the ultrasonographical examinations. All cases were operated under general anesthesia and diagnoses of the cases were also confirmed by intraabdominal exploration.

Sampling and analysis

Blood samples of the calves were taken from jugular vein to the 3 ml sterile sodium EDTA and 9 ml serum vacuum tubes. Hematologically, white blood cell (WBC) and hematocrit (Hct) were analyzed by an automatic analyzer (Vetscan® HM5, Abaxis, Germany), and total protein levels were measured by hand refractometer (Atago®, USA).

For hepatic function tests, the blood samples were centrifuged at 5.000 cycles for 5 minutes, and serum were separated for sero-biochemical analysis. Alanine aminotransferase (ALT), aspartate aminotransferase (AST), Gamma glutamyl transferase (GGT) and bilirubin levels were measured using an analyzer and its diagnostic kits (Reflotron® Plus System, Roche Diagnostics Ltd., Switzerland).

Microbiological samples were obtained by sterile swaps from the umbilical region with aseptic technique. Swaps were sent to microbiology laboratory after swaps were dropped to a tube contenting Stuart Transport medium. Samples were cultured at 35ºC and aerobic conditions after incubation of 5% sheep blood agar and Eosin Methylene Blue agar. Cultures were evaluated in terms of growth at 24 and 48th hours of incubation. After assessment of the morphologic and Gram color features, the determined colonies were detected using Gram positive and negative panels in BBL Crystal Identification Systems (Becton-Dickinson, Sparks, USA).

RESULTS

The ages of the calves were between 1 week and 3.5 months. The diagnosed pathologies were omphalitis ulcerosa, omphaloarteritis, omphalophlebitis, omphalourachitis and polyarthritis that these pathologies were either single or together in the calves (Table 1). The mean and standard deviations of the clinical parameters included 39.41±0.76 temperatures, 140.33±23.67 heart rates and 56.66±24.84 respiratory rates (Table 2).

In the hematological parameters, although HCT and TP values were within normal limits, the parameter of WBC was high or near the reference ranges in the calves. The sero-biochemical parameters were within references ranges (Table 2). Microbiologically, the culture results of the umbilical samples revealed enteric origin bacteria (Table 1).

DISCUSSION

In the prenatal period, umbilical cord responsible to blood exchange and transfer of metabolic wastes in allantois membrane between the fetuses and mum (Ozba *et al.*, 1999; Ozdemir Salci and Salci, 2012; Faradonbeh and Faradonbeh, 2016). Following to parturition, the rest of the umbilical vena and amniotic membrane are out of the body, and these parts are vulnerable to contamination of environmental microorganisms. Thus, antisepsis of the umbilical remnants is necessity (Rotimi and Duerden, 1981; Ozba *et al.*, 1999; Fubini and Ducharme, 2004; Faradonbeh and Faradonbeh, 2016). Considering to importance of the umbilical lesions in newborn farm animals, some hematologic, sero-biochemical parameters and microbiological culture results of umbilical lesions was investigated in presented cases.

Before surgical decision, clinical examinations should be completed for differential diagnosis (Geishauser and Grunder, 1992; Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012; Hendrickson and Baird, 2013). Diagnosis of the umbilical remnant infections should be done based on the anamnesis and physical examination findings (Geishauser and Grunder, 1992; Ozba *et al.*, 1999; Ozdemir Salci and Salci, 2012). Deep palpation of the abdominal region may reveal enlarged and infected umbilical remnants (Ozba *et al.*, 1999; Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012). An infected enlarged umbilical vein courses dorsocranially toward the liver, and the infected urachus or umbilical arteries course caudodorsally toward the urinary bladder and internal iliac arteries (Ozaydin *et al.*, 1998; Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012). It is well known that there is a correlation between the clinical and ultrasonographical findings of the umbilical structures (Fubini and Ducharme, 2004). Radiological and ultrasonographical investigations should be performed to detect the pathological parts of the umbilical remnants for exact diagnosis (Ozba *et al.*, 1999; Radostits *et al.*, 2006). In the clinical examinations, umbilical swelling and deep abdominal palpation pointed out the umbilical remnant pathologies. It is in fact that ultrasonographical examinations had advantage to the clinical examinations and exact diagnosis was made in the cases based on the clinical and ultrasonographical results.

Table 1: Umbilical pathologies and microbiological culture results of the cases

Case No.	Signalments	Umbilical Pathology(ies)	Microbiological results
1	Holstein, male, 2-month-old	Omphaloarteritis, Omphalourachitis	*Escherichia coli*
2	Holstein, male, 3.5-month-old	Omphaloarteritis, Omphalourachitis	*Proteus spp.*
3	Holstein, male, 20-day-old	Omphalitis ulceroza	*Pseudomonas putida, Pseudomonas stutzeri*
4	Holstein, female, 3-month-old	Omphaloarteritis, Omphalourachitis	*Escherichia coli*
5	Holstein, male, 1-week-old	Omphalophlebitis	*Providencia stuartii, Escherichia coli, Proteusmirabilis*
6	Holstein, female, 20-day-old	Omphalophlebitis, Polyarthritis	*Proteus spp, Escherichia coli*

Table 2: Clinical examination, hematological and sero-biochemical analysis results of the cases

Parameters	Case No							
	1	2	3	4	5	6	M±STDV	REF
Temperature (ºC)	39.7	38	39.6	40.3	39.4	39.5	39.41±0.76	38.8-39.4
Heart rate (bpm)	120	168	140	170	128	116	140.33±23.67	100-150
Respiratory rate (breaths/min)	40	32	44	88	48	88	56.66±24.84	50-75
WBC ($x10^3$)	11.9	16.8	11.5	19.4	10.5	50.3	20.06±15.21	4-12
HCT (%)	27.7	29.3	27	20.7	26	28	26.45±3.02	24-48
TP (g/dl)	7.8	9.6	7.1	9.5	7.9	7.2	8.18±1.1	6.3-8.9
ALT (U/l)	7.09	10.9	5.41	2.65	9.2	4.37	6.6±3.08	4-11
AST (U/l)	7.43	49.7	8.84	10.5	34.5	20.6	21.92±16.98	39-79
GGT (U/l)	17.3	56.9	37.8	30.3	33	22.3	32.93±13.87	14-40
Bilirubin (mg/dl)	0.614	0.738	0.647	0.5	0.618	0.5	0.6±0.09	0.1-0.4

WBC: White blood cell, **HCT:** Hematocrit, **TP:** Total protein, **ALT:** Alanine aminotransferase, **AST:** Aspartate aminotransferase, **GGT:** Gamma glutamyltransferase, **bpm:** beats per minute, **M:** Mean, **STDV:** Standard deviation, **REF:** References

The urachus is the most frequently infected umbilical remnant associated with umbilical masses (Geishauser and Grunder, 1992; Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012). Omphaloarteritis is the least common infection of one or both umbilical arteries (Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012). Omphalophlebitis localize the umbilical vein and extend the entire length of the vein and involve the liver, which leads to multiple liver abscess, septicemia and bacteremia (Geishauser and Grunder, 1992; Hathaway *et al.*, 1993; Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012). These infections may have concurrent infectious disease such as septic arthritis, osteomyelitis, pneumonia, peritonitis or bacteremia (Fubini and Ducharme, 2004; Radostits *et al.*, 2006; Ozdemir Salci and Salci, 2012; Faradonbeh and Faradonbeh, 2016). As umbilical lesions, omphalitis ulcerosa, omphaloarteritis, omphalophlebitis and omphalourachitis were diagnosed in the calves. However, these pathologies were either single or together in the calves. Polyarthritis was the secondary encountered infections. It was considered that polyarthritis was resulted from the umbilical lesion (metastatic form of the umbilical infection).

Umbilical pathologies may be treated by surgical techniques (Geishauser and Grunder, 1992; Ozaydin *et al.*, 1998; Radostits *et al.*, 2006; Ozdemir Salci and Salci, 2012). In some cases, before some surgical approaches, laboratory test may not be performed due to economic reasons (Hendrickson and Baird, 2013). However, hematocrit (HCT), total protein (TP) and complete blood count (CBC) should be measured routinely to evaluate the general status of the patient (Radostits *et al.*, 2006; Willard and Tvedten, 2012; Hendrickson and Baird, 2013). The hematological analysis may indicate the neutrophil-lymphocyte reversals and other some parametric differences (Fubini and Ducharme, 2004; Radostits *et al.*, 2006; Willard and Tvedten, 2012). Omphalophlebitis may result in leukocytosis (Geishauser and Grunder, 1992). Hepatic function test indicate the hepatic problems (Willard and Tvedten, 2012). In clinical examination, visual assessment of the patients and controlling of the vital parameters is crucial to estimate the body condition for SIRS (Randels, 2013). Localized infections with or without signs of systemic illness may include septic diseases (Radostits *et al.*, 2006; Willard and Tvedten, 2012; Randels, 2013). In this study, in addition to clinical parameters, WBC, HCT, TP and some hepatic function test were evaluated to assess the general body condition and liver status in the calves. Temperature, heart rates, respiratory rates and WBC parameters of the cases were high or near the reference value that these increasing of the parameters observed the SIRS in the cases. HCT and TP values were relatively in the reference values. Hepatic function tests were within reference ranges that these results did not parallel to clinical parameters and WBC. We concluded that localized umbilical infections led to SIRS but did not affect the intraabdominal organs (not sepsis).

Sterile swabs are the only practical method for sampling the umbilical region of newborns infants. For this purpose, commercially available cotton-wool swabs are used in veterinary practice (Rotimi and Duerden, 1981). Here, sampling form the umbilical regions were made by using of sterile swabs. The swaps were dropped a transport medium to prevent the possible contamination and then taken to the microbiology laboratory. Bacterial infections of the umbilical remnants result from insufficient hygienic measures, which is necessary for umbilical remnants after parturition (Ozaydin *et al.*, 1998; Faradonbeh and Faradonbeh, 2016). Microbiological results of the cases revealed that all isolated microorganisms were enteric origin bacteria that these results were considered fecal contamination of the umbilical remnants. *Staphylococcus aureus* is the most common isolate from the umbilical region. It represents 50% of isolates on the first day and remains the predominant cultivable species (Rotimi and Duerden, 1981; Faradonbeh and Faradonbeh, 2016). *Escherichia coli, Proteus, Enterecoccus, Streptococcus* and *Staphylococcus* species may be identified in the umbilical

cord infections (Fubini and Ducharme, 2004; Ozdemir Salci and Salci, 2012; Faradonbeh and Faradonbeh, 2016). *Clostridium tetani* and the other microorganisms cause the seconder infections (Ozdemir Salci and Salci, 2012). In the presented study, *Escherichia coli* and *Proteus* species were the most common isolated bacteria.

As a conclusion, it may be emphasized that a brief hematological, sero-biochemical evaluation as well as local microbiological culture results of the umbilical lesions have valuable information determination of the prognosis for the evaluation of the healthy status of the calves.

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