Assiut Vet. Med .J. Vol 44 No. 88. January 2001

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BOVINE EPHEMERAL FEVER IN ASSIUT GOVERNORATE: CLINICAL, LABORATORY AND THERAPEUTIC STUDIES

(With 5 Tables and 7 Figures)

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(Received at 12/12/2000)

حمى الثلاثة أيام في الأبقار بمحافظة أسيوط
دراسات إكلينيكية ومعملية وعلاجية

عرفات صادق سيد ، علي حسن صديق ، عبدالرحمن أحمد علي

مع بداية صيف عام ٢٠٠٠ أصيبت الماشية في جمهورية مصر العربية بمرض حمى الثلاثة أيام وظهر المرض بصورة وبائية وإنتشر في معظم محافظات الجمهورية مما أدى إلى حدوث خسارة إقتصادية كبيرة. إنتشر المرض في محافظة أسيوط وإمتد ليشمل باقي محافظات الجنوب وذلك إمتداداً لظهوره في الدلتا. أصاب المرض الأبقار الفريزيان والمحلية، كما ظهر أيضاً في بعض حالات الجاموس. تمثلت الشكوى الرئيسية في حدوث إرتفاع حاد ومفاجئ لدرجة حرارة الجسم لمدة ٢-٥ أيام مع زيادة إفراز وإرتجاع اللعاب ورشح أنفي تراوحت حدته مابين المصلى الشفاف إلى المخاطي أو المخاطي الصديدي، كما لوحظ تعثر في خطى الحيوان وإختلال في حركته ، تلاها تدهور في الصحة العامة له. أظهر الفحص الإكلينيكي أن هناك العديد من الأعراض المصاحبة للمرض مثل وجود أمفزيما تحت الجلد بدرجة بسيطة إلى شديدة متسعة في مناطق الرأس والرقبة والظهر وقد إمتدت أحيانا إلى مابين الضلوع، كما شوهد وجود أوديما أسفل الفك السفلي إمتدت إلى اللباب والرقبة والصدر وبين الضلوع أحياناً. لوحظ وجود تورم وتصلب بالعضلات والمفاصل وعتامة في قرنية إحدى أو كلتا العينين وكذلك تضخم في بعض الغدد الليمفاوية. أوضحت الدراسة زيادة في معدلات الإصابة بإلتهاب الضرع وكذلك حدوث بعض حالات الإجهاض في الأبقار المصابة بالمرض. بعض الحالات المصابة شفيت تلقائياً خلال اليوم الثاني إلى الرابع (٥-٨%) بينما عانت أكثر من ٧٥% من الحالات من مضاعفات مرضية تمثلت في صعوبة في التنفس وكحة وزرقة الأغشية المخاطية. عدد قليل من الحالات فقدت شهيتها تماما للأكل والشراب وإمتثلت للرقاد وظهر عليها علامات الجفاف والخمول منتهية بالنفوق. بلغت نسـبة الإصابة في الأبقار الفريزيان إلى ٤٥,٥ % وفي الأبقار المحلي٥٥,١ % وفى الجاموس ٠,١٥ %، بينما وصلت نسبة النفوق إلى ٩,٧٦ % في الأبقار الفريزيان

وإلى ٢,١٩ % في الأبقار المحلية ولم تسجل حالات نفوق في الجاموس. لوحظ وجود حشرة التابانس بكثرة في أماكن تواجد الحيوانات وعلى الأبقار المصابة وشوهدت الحشرة وهي تمتص الدماء من الأبقار المحمومة لفترة تستغرق ١-٢ دقيقة تاركة الحيوانات تنزف الدماء على سطح الجلد. وبتشريح الحيوانات النافقة لوحظ وجود إحتقانات وإلتهابات رئوية وأمفزيما في الرئتين وتسربات هوائية في الأغشية البلورية ، ونزف نقطي في أغشية التامور والبلورا والبريتون. شوهدت الأمفزيما بكثرة تحت الجلد في مناطق الظهر والرقبة وبين الضلوع، كما لوحظ أيضا وجود تورمات وإحتقان وأوديما في العضلات. أظهر الفحص الدموي زيادة في عدد كريات الدم البيضاء الكلية والمتعادلة في الحالات الحادة والحالات التي كانت تعاني من مضاعفات مرضية. كانت مؤشرات زيادة تركيز الدم والجفاف واضحة في الحالات التي تعرضت لمضاعفات مرضية وتمثلت في صورة زيادة نسبية في حجم الكريات المصمتة وكريات الدم الحمراء. كما أوضحت النتائج وجود زيادة معنوية في مستويات البلوروبين والأسبرتات أمينوترانسفريز والالانين أمينوترانسفريز والكرياتينين فوسفوكاينيز والبولينا في كل الحالات المرضية. تمثل العلاج في إستخدام المضادات الحيوية ومركبات السلفا ، مضادات ارتفاع الحرارة ، مضادات الإلتهاب الغيرستيرويديه و فيتامين ج . كذلك تم علاج نقص السوائل والجفاف بإستخدام محاليل الإرواء وقد أدى هذا العلاج إلى تحسن جيد في صحة الحالات الحادة ، أما الحالات التي كانت تعاني من الرقاد أو الأمفريما الشديدة تحت الجلد كانت الإستجابة بها قليلة أو منعدمة.

SUMMARY

An outbreak of bovine ephemeral fever had occurred in most of the Egyptian Governorates, during summer, 2000 resulting in a great economic losses in cattle herds. The disease appeared in Assiut Governorates and spreading downward to the rest of Upper Egypt as an extension to its appearance in Lower Egypt. Foreign and native breeds of cattle as well as buffaloes were variably affected. The main complains were sudden fever, excessive salivary secretion, stiff gait and locomotor disturbances. The clinical examination revealed variable degrees of subcutaneous emphysema at the regions of head, neck and back and mild to moderate subcutaneous edema especially at the regions of the intercostal muscles, dewlap and intermaxillary space. Rigidity of the skeletal muscles, uni or bilateral corneal opacity and enlargement of the joints and lymph nodes were also observed. Mastitis were found to be increased in the affected cases of Friesian and native cows. The vector *Tabanus* fly was seen sucking blood from the feverish animals leaving the animal bled. Morbidity rate reached to 45.5 % in Friesian cattle, 55.1 % in native cattle and 0. 15 % in buffaloes. The mortality rate reached 9.76 % in Friesian cattle, 2.19 % in native cattle and no deaths were noted in buffaloes. Some animals recovered spontaneously during the

first 2-4 days representing about 5-8 % of affected animals, however, more than 75 % of affected cases developed signs of respiratory distresses. Anorexia, lameness and recumbency were the main signs observed in complicated cases. Necropsy findings revealed pulmonary congestion, pneumonia, interstitial emphysema, peticheal hemorrhages on the serosal membranes and subcutaneous emphysema. Swelling, redness, congestion and edema in the texture of the skeletal muscles were also evident. The results of blood examination revealed neutrophilic leucocytosis in acute and complicated cases. Indices of hemoconcentration and dehydration in complicated cases were evident by the relative increase in the levels of PCV and RBCs. Significant increase in serum levels of bilirubin, AST, ALT, CPK and urea were found in acute and complicated cases. Immediate therapeutic approach with antibiotic, sulfonamide, antipyretic, non steroidal antiinflammatory, vit. C and the correction of fluid loss proved good response and improvement of acute cases. Recumbent cases and/ or those with marked subcutaneous emphysema showed little or no response to therapy.

Key words: *BEF, Bovine, Ephemral, Fever.*

INTRODUCTION

Bovine ephemeral fever (BEF) is a non contagious viral disease of cattle and water buffaloes, characterized by acute fever, stiffness, and lameness. The disease is transmitted by insect vectors and caused by insect-borne unnamed *Rhabdovirus* (Doherty et al., 1972). The incidence of the disease in various countries was described by Burgess (1971). BEF occurs enzootically on the African continent, in most of Asia, East India, and in Australia (Henning, 1956; Acktar et al., 1967 and St George, 1981 & 1988). It spreads by the biting insect vectors both biologically (Burgess, 1971) and mechanically, when the host has a high titers of circulating virus (Standfast and Dyce, 1972). The insect vectors are not confined to one species, however the virus was found to be experimentally grown in species of *culicoides and mosquitoes* (Doherty et al., 1972 and Davis and Walker, 1974). The dynamics of transmission depend on the vector's abundance, distribution, host preference, and susceptibility to infection (Standfast and Dyce, 1972).

The disease occurred mainly in cattle, however about 10-15 % of domesticated and water buffaloes were also affected (St George et al.,

1977). The morbidity rate is usually about 35-100 % depending on the factors favoring the spread of infection such as season, wind movements, rainfall, distribution of susceptible cattle, and vector populations (Murray, 1970; Newton and Wheatley, 1970; Burgess, 1971 and Standfast et al., 1973). The authors stated that the disease occurred in summer and autumn and spread according to wind directions. Morbidity rate of 5-10 % with case fatality of 1 % in enzootic areas were reported (St George, 1980).

This work aimed to study the incidence, breed susceptibility, nature of the insect vectors, morbidity and mortality rates of the BEF among Friesian and native cattle as well as buffaloes in Assiut Governorate. Sequence of the clinical signs, important hematological and biochemical changes associating the disease and therapeutic trials have been also aimed.

MATERIALS and METHODS

1- Disease history and epidemiological data:

This work was carried out between July and November, 2000 in three different districts around Assiut Governorate during the outbreak of the BEF. The study included the epidemiology of the disease with special reference to breed susceptibilities, ages, localities, morbidity and mortality rates (table 1) according to Radostits et al. (1994).

2- Animals selected for investigations (Table. 2):

A total number of 118 animals of both sexes were selected for clinical and laboratory investigations. 96 animals were diseased (40 Friesian and 56 Native cattle) and 22 animals were healthy and kept as control (12 Friesian and 10 Native cattle). Their ages varied from 2-12 years old. The selected animals were belonging to Banni Morr Governmental dairy farm (Holstein Friesian) and private farms in Abnoub, and Sedfa districts (Native cattle). Careful clinical examination of these animals were carried out according to Rosenberger (1990) and Radostits et al. (1994).

3- Blood samples and adopted methods:

About 2 ml whole blood were collected in a dry clean glass vials containing EDTA for estimation of total erythrocytic count (RBCS, T/1) packed cell volume (PCV, %), hemoglobin (Hb, g/1), total and differential leucocytic count, mean corpuscular volume (MCV, fl), mean corpuscular hemoglobin (MCH, pg) and mean corpuscular hemoglobin concentration (MCHC, mg/dl). Blood cell counts were carried out by

means of Abott automatic cell counter 1700. Differential leucocytic count was carried out according to Coles (1986).

About 10 ml whole blood were collected without anticoagulant for obtaining blood sera for determination of aspartate aminotransferase (AST, U/l), alanine aminotransferase (ALT, U/l), creatinine phosphokinase (CPK, U/l), total bilirubin (µmol/l) total protein (g/1), albumin (g/1), blood urea (mmol/1), serum calcium (Ca, mmol/1), inorganic phosphorus (P, mmol), and magnesium (Mg, mmol/1). These parameters were estimated spectrophotometrically by means of test kits supplied by Boehringer Mannheim Diagnostica- Germany.

4- Postmortem examination:

Postmortem examination of dead animals was carried out with special reference to the involved organs and tissues such as muscles, lungs, subcutaneous tissues, and other visceral organs.

5- Therapeutic trials:

Ancillary and symptomatic treatment has been focused to reduce the deterioration of the condition and composed mainly of:

- Antipyretic agents: Novalgin and non steroidal anti-inflammatory (e.g. phenyl-butazone) were used twice daily until the fever subside.
- Antimicrobial: Enrofloxacin and Sulfadimidine 33.3 % were administered once daily for 3-5 days.
- Large doses of fluid therapy such as i.v. injection of dextrose and normal saline.
- Large doses of Vit. C / once daily for 3-5 days.

6- Statistical analysis:

The obtained data were analyzed for obtaining mean, SD and analysis of variance using a software computer program (Spsswin, 1995).

RESULTS

1- History and disease prevalence (Table 1 & 2):

The outbreak of the disease had occurred between July and November, 2000. There were a dramatic spread of the disease from the north to the south of Egypt. Morbidity rates reached 45.5 % in Friesian cattle, 55.1 % in native cattle and 0.15 % in buffaloes. The rate of deaths varied according to the time of therapeutic interference and hygienic managmental aids. It was reached about 9.76 % among Friesian cattle and 2.19 % in native breed. The diseased buffaloes showed good response to therapy and no deaths were encountered. *Tabanus* fly was

observed sucking blood from the feverish animals for about 1-2 minutes, leaving the animal bled.

2- Clinical picture:

The severity of the clinical signs were more evident among adult Friesian cattle, however, in native cattle and buffaloes, the clinical signs and outcome of the disease were less serious. Calves under one year old showed no signs of the disease. Animals of high body condition score (good to very good nutritional status) expressed a severe and prolonged signs, however thin animals expressed signs of lesser extent. Sudden fever (40.5-42°C) was the first signs observed. Anorexia, fall in milk yield, slight to moderate serous nasal discharge that become mucoid in the next few days, scant to profuse salivation and conjunctivitis with lacrimal discharge were evident in the first 24 hours. There was a rigidity of the skeletal muscles of the shoulder, back, fore limbs and hind limbs in association with polyartheritis resulting in stiff gait and the animals were reluctant to move. Harried respiration, signs of dyspnoea and cough were evident in the next 3-5 days. Mild to severe subcutaneous emphysema in the areas of head, neck, back and intercostal spaces were observed in 10 % of the exposed adult Friesian cattle and 2-3 % of the native breed (Fig. 1 & 2). The clinical findings observed on the affected Friesian and native cattle as well as on buffaloes were illustrated in table 3 and fig. 1-7.

3- Postmortem findings:

Postmortem examination revealed peticheal hemorrhages on the epicardium, pleura and peritoneum of the affected animals. Interstitial emphysema of the lung was clearly evident in all dead cases (Fig. 7). Myositis was observed in most of the muscle, especially those of the back and neck, represented by swelling, redness, congestion and edema in the texture of the muscles. Subcutaneous emphysema and peticheal hemorrhage were noted on the surrounding tissues. Heart cavities were found empty with little petichae on the endocardium. Congestion and enlargement of the liver, gall bladder and spleen were noted.

4-Laboratory findings:

Leucocytosis, neutrophilia and lymphopenia were markedly evident in the acute and complicated cases of cattle. Significant increase in values of RBCS, PCV and MCV with significant decrease in MCH and MCHC were markedly noticed in the complicated cases of Friesian cattle. Significant increase in the levels of serum bilirubin, urea and activities of AST, ALT and CPK were noticed in acute and complicated

cases. The results of hematological and biochemical findings are illustrated in tables 4 & 5.

5-Therapeutic trials:

Good response and rapid improvement were observed in the acute cases. Recumbent cases and/or those with huge subcutaneous emphysema showed little or no response to therapy.

DISCUSSION

There was a dramatic spread of bovine ephemeral fever in Egypt during year 2000, if compared with the previous reports after MacFarlane and Haig (1955) and Henning (1956). In Egypt the last outbreak of BEF had occurred with a limited severity at 1991 (Hassan et al., 1991 and Soheir, 1994). The severity of the disease and the increased morbidity and mortality rates in this outbreak in foreign and native cattle, may be attributed either to the presence of a new strain of the virus, or due to the increased virulence of the known strain (Burgess, 1971). Hot weather and high spread of insect vector may facilitate rapid transmission of the disease (Standfast and Dyce, 1972) that explain the seasonality of the disease. In this study the vector *Tabanus* fly was claimed to play an important role in the transmission of the disease (fig. 5), as the fly was seen sucking blood from the feverish animals for 1-2 minutes and leaving the animal bled (Fig. 3). The disease was diagnosed in cattle and the virus was identified during this outbreak in Delta Governorates (Zaghawa et al., 2000)

Drooling of saliva may be either due to the direct effect of the virus in the lining epithelium of the oral cavity and salivary glands or due to that the affected animals are not able to swallow and extends their head down that agreed with the reports of Basson et al. (1970) and Burgess and Spradbarow (1977). Myositis and arthritis may be the cause of stiffness of gait, incoordination and subsequent lameness and recumbency, as that described by Hill and Schultz (1977) and St George et al. (1995).

The causes of the observed subcutaneous emphysema were not actually understood, however, it may results from the occurring interstitial lung emphysema (Fig. 7), that may escape beneath the pleura, then into the mediastinum and then through fascia into the subcutaneous tissues (Burgess and Spradbarow, 1977 and Hungerford, 1990). Edema of the subcutaneous tissue especially in intercostal muscles and

intermandibular spaces were seen in 2-5% of the affected foreign breads and in 1-3 % of the native ones, resembling those stated by St George (1988). Enlargement of the superfecial subcutaneous lymphnodes was seen in some animals. Up to the 5^{th} –7^{th} day, some animals become depressed, dehydrated, and may be recumbent as that described by Hill and Schultz, (1977).

The incidence of mastitis was increased in the affected animals reaching about 4-5 % in the foreign breads (Fig. 6) and 0- 3 % in the native cases, resulting in severe drop of milk production. The previous reports of MacFarlane and Haig (1955) and Theodoridis et al. (1973) stating that the BEF virus predisposed the udder to secondary infection with bacteria and affecting the leucocyte barrier of the udder. Abortion was reported in foreign and native cattle in about 0.5-2% of affected cases. Few animals recovered spontaneously and most of cases recovered gradually with the intensive therapeutic interference.

The cause of the increase in mortality rate could be attributed to many factors, among of which the secondary bacterial infection, aspiration pneumonia after regurgitation of ruminal contents, or following lateral recumbency (Andrews et al., 1992) in addition to other stress factors that may be present in our livestock, such as nutritional deficiency, inadequate management and parasitic infestation. Extravasation of fluids and subsequent dehydration could be also contributed to increase the rate of deaths in this work (Burgess, 1971 and St George, 1988). The disease was also observed among the buffaloes in this investigation with morbidity rate about 0.15% and no deaths were reported, supporting the previous report of Young (1979).

The gross postmortem lesions were, enlarged edematous lymph nodes, dilatation and engorgement of visceral blood vessels, accumulation of fluid in the pericardium, pleura and peritoneum and inflamed joints, that agreed with the previous report of Mackerras et al. (1940) and Hill and Schultz (1977). Inflammation and focal necrosis of skeletal muscles, especially those of quadriceps and longus coli muscles and edema in the subcutis and fascia were evident. Interstitial and interlobular emphysema of the lungs were markedly seen especially in the foreign breeds and were related mostly to the subcutaneous emphysema. Pulmonary congestion and lobular pneumonia were seen in most of complicated dead cases. Similar findings were previously reported (Mackerras et al., 1940; Basson et al., 1970; Inaba, 1973 and Hungerford, 1990).

Neutrophilia and lymphopenia with normal leucocytic count in some cases and leucocytosis in others were considered an early alteration of differential leucocytic count that resemble the findings of Young and Spradbarow (1990) and St George et al. (1995). The leucocytosis with neutrophilia may be attributed to the secondary bacterial infection, that were evident in lungs, pleura, udder, joints, muscles and other affected tissues (Mackerras et al., 1940; Inaba et al., 1968 and Radostits et al., 1994). Lymphopenia could be attributed to either the viral infection and/or the associating stress of the disease (Coles, 1986).

Significant decrease in levels of RBCs, Hb and MCHC and significant increase in MCV were evident in acute cases of Friesian cattle, reflecting macrocytic hypochromic anemia in these animals. Macrocytosis is usually transient and is commonly observed in animals suffering hemolytic anemia (Coles, 1986). On the other hand, Henson and McGuiree (1971) hypothesized that the anemia associated with viral infection occurred as a consequence of the initiation of a series of immunological events culminating in hemolysis and premature removal of the synthesized cells from the circulation. It thus appears probable that viral activation of an immunological mediation system may result in erythrocyte destruction.

Extravasation of fluids in the edematous areas and the drooling of saliva in addition to the complete loss of appetite for feed and water were the main causes of the hemoconcentration and consequently shock and deaths. Indices of hemoconcentration and dehydration in complicated cases were evident by the relative increase in the levels of PCV and RBCs that mask the occurring anemia. The previous reports of Mackerras et al. (1940); Achtar et al. (1967) and St George (1981) support these findings.

The increased levels of bilirubin reflect either the involvement of liver tissues and/or hemolysis of red blood cells in the affected cases. The increased serum levels of AST, ALT and CPK are mainly attributed to the involvement of liver with the occurring myositis and subsequent stiffness of gait and recumbency in such conditions. AST and CPK activities are increased in muscle damage and their levels in blood are the most common indices of muscular affection (Radostitis et al., 1994). On the other hand, the increased levels of blood urea of the diseased cases may be attributed to the effect of the hemoconcentration and dehydration which result in renal ischemia and azotemia. Insignificant changes in serum Ca and Mg were obtained supporting the previous

report of Young and Spradbrow (1990). Significant decrease in serum P was observed only in complicated cases that could be attributed to prolonged recumbency before death (Radostits et al., 1994).

It could be concluded that the outbreak of BEF has been recognized in foreign and native breeds of cattle as well as buffaloes in a varying degrees. Morbidity rate reached up to 45.5 % and 55.1 % in Friesian and native cattle respectively, however the severity of the clinical signs and rate of deaths were more higher and worst in adult Friesian than native cattle and in fat cows and bulls than thin ones. The high spread of the disease in this study could be attributed to the wide spread of insects in the hot summer season. *Tabanus* fly was identified as the main insect vector of the disease in this work. Immediate therapeutic approach with antibiotic, sulfonamide, antipyretic, non steroidal anti-inflammatory, vit. C and correction of fluid loss proved good response and improvement of acute cases. Recumbent cases and/or those with marked subcutaneous emphysema showed little response to therapy.

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Tab. 1: Incidence of Bovine Ephemeral Fever among cattle and Buffaloes at Assuit Governorate.

Aspect of examination	Holstein Friesian*	Native cattle**	Buffaloes***	Total
No. of exposed animals	450	11100	2700	14250
Affected cases	205	6115	4	6324
Morbidity rate %	45.5	55.1	0.15	44.38
Deaths	20	134	0	154
Mortality rate (%)	9.76	2.19	0	2.44

* : The Holstein Friesian cattle were examined at Bani mor Governmental farm.
** : The native cattle were examined at two localities following to Abnoub and Sedfa cities and representing north and south of Assuit Governorate.
*** :The Buffaloes were examined at El-Dewair Village, Sedfa city Assuit Governorate

Tab. 2: Species, sources and numbers of the animals selected for investigations.

Localities	Bani mor		Abnoub		Sedfa	Total
Species	Diseased	Healthy	Diseased	Healthy	Diseased	Diseased & healthy
Holstein	40	12	-	-		52
Native	-	-	25	10	31	66
Total	40	12	25	10	31	118

Tab. 3: Summary of the most important clinical signs observed during the outbreak of the disease.

Signs	Holstein Friesian	Native cattle	Buffaloes
Fever	41-42 C°	40-41.5 C°	40-42 C°
Nasal discharge	Seromucoid - purulent	Seromucoid	Serous
Conjunctivitis	evident		
Salivation	Profuse	Moderate	
Pulse	Markedly increased	Increased	Increased
Respiration	harried & Dyspnoeic		harried
Lacrimation	Little	Little- excessive	excessive
Enlargement of L Nodes	mild	-	-
Dyspnoea	evident on the 3rd -5th day in 30-50 %		-
Stiff gait	marked in 75 %		little
Polyartheritis	marked	little	-
Corneal opacity (uni/or bilateral)	1-2 %	about 0.5 %	-
Diarrhea	1-5 %	0-2 %	1 %
Subcutaneous emphysema	evident in 10 %	evident in 2-3%	-
	covering the whole back, head, neck sides and intercostal spaces		-
Subcutaneous edema	evident in 2-5%	evident in 1-3 %	-
Rigidity of the muscles	70-75 % of cases especially longus coli muscle, muscles of neck and hind quarters and other muscles		-
Mastitis	4-5 %	0-3 %	-
Laying down & Recumbency	evident on the 5th day and on complicated untreated cases		-
Abortion	0.5 - 1 %	0-2 %	-
Dehydration	evident on the 5th day upward especially on those lacking appetite		not evident

Tab. 4: Means ± SD values of PCV, Hb, RBCs, MCV, MCH, MCHC, total and differential leucocytic count in the studied cases.

Animals		Holstein			Native cattle	
Condition	Unit	Acute cases	complicated cases	Healthy	Acute cases	Healthy
PCV	%	36.3 ± 6.6 ^{ns}	74.4 ± 19.1$^{**\uparrow}$	33.4 ± 4.1	31.8 ± 5.7^{ns}	34.7 ± 5.1
RBCs	T/l	4.3 ± 0.8$^{**\downarrow}$	9.4 ± 0.83$^{**\uparrow}$	7.5 ± 2.0	6.4 ± 1.98^{ns}	6.8 ± 1.6
Hb	g/l	87.8 ± 14.5$^{**\downarrow}$	102.8 ± 18.5	119.7 ± 25.0	90.4 ± 20.0$^{**\downarrow}$	125.3 ± 25.2
MCV	f/l	85.2 ± 5.6$^{**\uparrow}$	88.6 ± 4.5$^{**\uparrow}$	44.9 ± 6.5	53.26 ± 19.3^{ns}	51.8 ± 5.4
MCH	pg	21.3 ± 3.0	12.7 ± 2.3$^{*\downarrow}$	16.2 ± 1.78	14.7 ± 6.0^{ns}	19.0 ± 3.0
MCHC	mg/dl	24.8 ± 3.6$^{***\downarrow}$	13.8 ± 2.4$^{***\downarrow}$	35.6 ± 3.7	28.5 ± 5.3$^{**\downarrow}$	35.9 ± 2.8
T. WBC	G/l	8.6 ± 1.86$^{**\uparrow}$	15.4 ± 6.5$^{***\uparrow}$	6.6 ± 2.3	8.1 ± 2.4$^{*\uparrow}$	6.3 ± 1.4
Imm. N.	%	3.2 ±1.8$^{**\uparrow}$	3.8 ± 0.8$^{**\uparrow}$	1.25 ± 1.42	7.5 ± 3.6$^{**\uparrow}$	2.36 ± 2.15
M. N.	%	47.78 ± 11.7$^{**\uparrow}$	61.0 ± 18.1$^{***\uparrow}$	35.15 ± 13.5	45.7 ± 15.2 $^{*\uparrow}$	30.14 ± 5.7
Lymph.	%	40.92 ± 11.4$^{**\downarrow}$	29.0 ± 15.6$^{**\downarrow}$	56.2 ± 13.9	40.5 ± 14.36$^{*\downarrow}$	62.4 ±8.2
Mono.	%	4.6 ± 2.5 ^{ns}	4.2 ± 2.2^{ns}	5.3 ± 4.16	3.3 ± 2.5^{ns}	3.0 ± 2.9
Eos.	%	3.5 ± 2.5 ^{ns}	2.0 ± 1.9	2.1 ± 2.15	3.0 ± 3.7 ^{ns}	2.1 ± 1.3

Tab. 5 : Means ± SD values of serum total bilirubin, AST, ALT, CPK, Urea, Ca, P, Mg, Total protein, Albumin in the studied cases.

Animals	Unit	Holstein friesian			Native cattle	
Condition		Acute cases	Complicated cases	Healthy	Acute cases	Healthy
T.bilirubin	µmol/l	$15.89 \pm 4.4^{***\uparrow}$	$25.4 \pm 31.7^{***\uparrow}$	5.22 ± 2.7	$20.22 \pm 8.68^{***\uparrow}$	4.0 ± 1.5
AST	U/l	$59.33 \pm 93.7^{***\uparrow}$	$117.6 \pm 43.4^{***\uparrow}$	11.55 ± 5.22	$37.0 \pm 20.0^{***\uparrow}$	9.9 ± 2.5
ALT	U/l	$35.5 \pm 14.94^{***\uparrow}$	$39.6 \pm 14.8^{***\uparrow}$	10.1 ± 5.1	$28.6 \pm 9.0^{***\uparrow}$	7.6 ± 1.2
CPK	U/l	$296.9 \pm 285^{***\uparrow}$	$777.2 \pm 573^{***\uparrow}$	33.3 ± 18.47	$292.9 \pm 242^{***\uparrow}$	20.1 ± 6.9
Urea	mmol/l	$37.6 \pm 16.1^{***\uparrow}$	$43.0 \pm 14.2^{***\uparrow}$	20.1 ± 11.2	$36.1 \pm 18.1^{***\uparrow}$	11.2 ± 5.6
Ca	mmol/l	8.0 ± 2.0^{ns}	7.9 ± 2.0^{ns}	8.8 ± 2.1	9.2 ± 2.3^{ns}	9.0 ± 1.5
P	mmol/l	3.89 ± 1.3^{ns}	$2.7 \pm 1.1^{*\downarrow}$	4.7 ± 1.2	4.25 ± 1.6^{ns}	4.4 ± 1.4
Mg	mmol/l	3.05 ± 0.6^{ns}	3.6 ± 0.5^{ns}	3.2 ± 0.43	2.6 ± 0.64^{ns}	2.8 ± 0.6
T.Protein	g/l	77.94 ± 13.9^{ns}	83.5 ± 14.7^{ns}	71.04 ± 15.7	81.7 ± 25.8^{ns}	73.3 ± 18.2
Albumin	g/l	30.21 ± 4.0^{ns}	32.9 ± 5.8^{ns}	31.32 ± 11.8	34.0 ± 6.7^{ns}	39.3 ± 5.9
Globulin	g/l	47.76 ± 14.9^{ns}	50.5 ± 14.1^{ns}	40.82 ± 7.3	47.3 ± 23.2^{ns}	35.3 ± 12.7
A/G		$0.7 \pm .25^{ns}$	0.7 ± 0.3^{ns}	0.76 ± 0.28	0.92 ± 0.46^{ns}	1.2 ± 0.3

T/l = Terra/liter (10^{12}), G/l = Giga/liter (10^{9}), f/l= femitol/liter (10^{-15}/l pg = picogram (10^{-12})
* = P <0.05, ** = P<0.01, *** = P<0.001 ns: non significant

Fig. 1: Drooling of saliva, nasolacrimal discharge and huge subcutaneous emphysema in the neck, back and intercostal spaces.

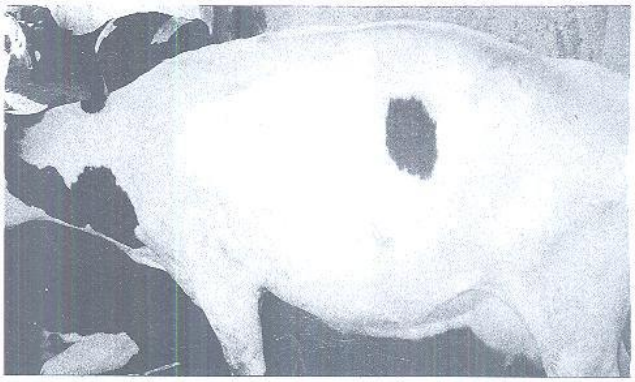

Fig. 2: Arching of the back, stiffness of the gait and marked subcutaneous emphysema on the back, sides of the neck and head of affected animal.

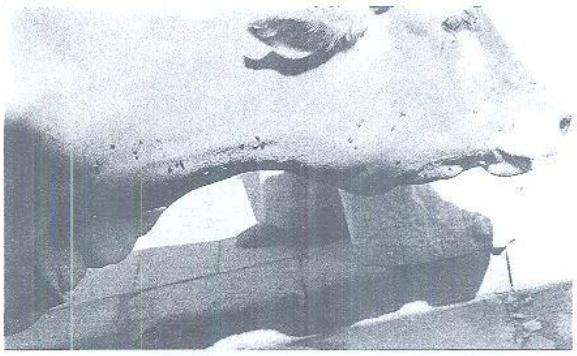

Fig. 3: Engorgement of jugular vein, respiratory embarrassment and edema of submandibular spaces, muscles of head, neck and extending to dewlap. Overcrowding of insect vector (*Tabanus* fly) sucking blood of a native cow.

Fig. 4: Sunken eye as a signs of profound dehydration and mucopurrulent nasal discharge in a recumbent cow.

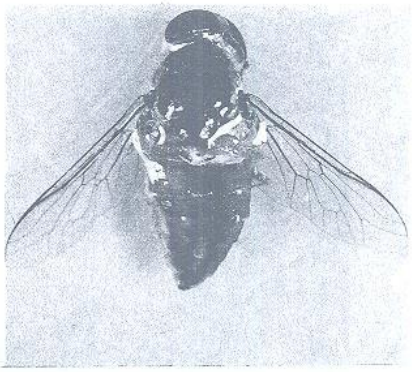

Fig. 5: The insect vector *Tabanus* fly (Dorsal view).

Fig. 6: Acute mastitis associating bovine ephemeral fever.

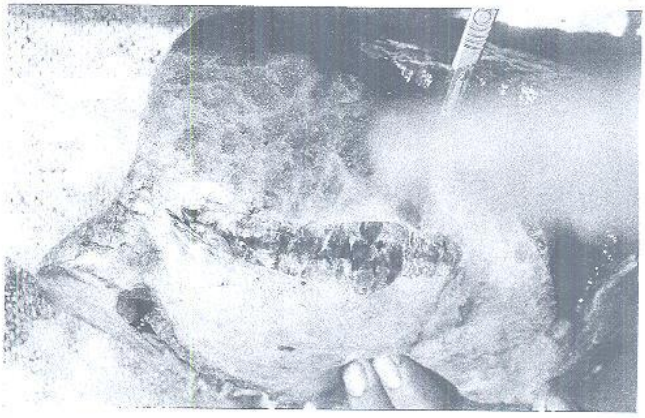

Fig. 7: Extensive interstitial emphysema, congestion and patches of grey hepatization of the lung from dead Friesian cow.