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Disseminated Intravascular Coagulopathy of the Dog

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Abstract

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In the period between November 1995 and February 1997, a clinical study focused on disseminated intravascular coagulopathy (DIC) in the dog was conducted. Two objectives were established. The first objective was a prospective study to find an occurrence of this syndrome in dog emergency medicine. During that period, 7506 dog patients had come to the department of surgery with various problems, but only 11 dogs were diagnosed with an acute DIC. Four of these dogs died and two more were euthanased later on, due to poor prognosis of underlying condition. The second objective was reevaluation of some haematological factors and their reliability for both diagnosis and prognosis. We confirmed that monitoring of some specific haemostatic parameters, namely thrombin clotting time (TCT), Antithrombin (AT) activity, platelet count (PC) and level of fibrin degradation products (FDP`s) are crucial for both the diagnosis and prognosis quo ad vitam. We found that TCT and AT activity are factors highly reliable for prognosis and if both of them are out of limits 48 hours after beginning of the therapy, poor prognosis should be established.

Dog, haemostasis, thrombosis, intensive care

The first description of disseminated intravascular coagulopathy (DIC) comes from a lecture delivered by W. H. Seegers to the Cincinnati Academy of Medicine on April 18, 1950 and published in the Academy journal (Seegers 1950). Since then, syndrome of DIC has been well described in both human and veterinary literature. There are articles available for various animals in selected reports as published by Slappendel (1988) and Jain (1986).

In spite of many publications, we do not find incidence and prevalence of DIC in dogs. Clinical observation of this point of view could be helpful for veterinarians in daily contact with patients and, hopefully could shift this problem from laboratories to veterinary clinics.

The aim of our study is to establish the rules for an accurate monitoring of the therapy. Since intensive care is expensive and the owner often refuses additional therapy, whenever prognosis is questionable, it may be helpful to have some markers for efficacy of therapy in a short period of time.

The disease can be divided into acute and chronic and in various periods of DIC various systems of compensation play a role. As published by Bick and Adams (1974), there are multiple factors involved in the development of full scale DIC as follows:

1. Activation of fibrinolytic system and re-establishment of microcirculation via destruction of thrombi

2. Enhancement of synthesis of both coagulation factors and their inhibitors (e.g. Antithrombin).

3. Enhancement of haemopoietic activity.

It seems to be appropriate to classify DIC into 3 stages:

● Period of activation - well acting systems of compensation (compensated event, difficult for diagnosis, good prognosis for therapy).

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- Period of clinical manifestation (decompensation) - typically acute DIC.
- Period of delayed hyperfibrinolysis - hyperactivation of compensatory systems, e.g. "overshot of fibrinolysis".

According to several authors (Bick and Adams 1974; Bick 1988; Feinstein 1988), the most desirable timing for establishment of diagnosis is during the period of activation and, in this stage, FDP value and fibrinogen level are likely to be the most sensitive parameters for an early diagnosis. In the borderline of activation and clinical manifestation, we believe that evaluation of coagulation times, AT activity, FDP and fibrinogen levels should be helpful for an appropriate establishment of diagnosis (Bick 1982).

The pathogenesis of DIC has been under constant review ever since, but the present understanding suggests a dysregulation of normally equilibrated thrombosis and thrombolysis. In brief:

Tissue necrosis, inflammation, red cell or platelet damage, and antigen-antibody or endotoxin-induced endothelial damage initiates the coagulation process through thrombin generation (Hardaway 1966; Ryan 1976; Dodds 1989; Plunkett 1993; Maruyama et al. 2004). With the activation of the coagulation and fibrinolytic system - complement and prekallikrein-kininogen systems are simultaneously triggered in order to reestablish the balance (Owen and Bowie 1977; Dodds 1989). The systems then degrade both fibrinogen and fibrin, producing fibrinogen degradation products (FDP's), which prevent a soluble fibrin monomer against polymerization (Owen and Bowie 1977, Bick 1982). Uncontrolled bleeding is therefore a result of deficiency of coagulation factors, coming along with platelet depletion plus the anticoagulant properties of FDP's (Hardaway 1966; Ryan 1976; Green and Thomas 1994; Maruyama et al. 2004). Plasmin seems to be a very important substance in this system, because it acts in fibrin degradation with formation B_beta 15-42 and related peptides and D-dimer and also in degradation of other coagulation factors (Owen and Bowie 1977; Bick 1982; Stokol et al. 2000; Boisvert et al. 2001; Monreal 2003). The fluido-coagulation balance is basically a balance of two dominant mediators - thrombin and plasmin. If thrombin is dominant, thromboses occur, whereas if plasmin is dominant, haemorrhages will follow (Jain 1986).

Very important factor in inhibition of coagulation is Antithrombin (formerly known as Antithrombin III). It is an α2-glycoprotein (MW, 67 000) produced by the liver, with a half life of less than 48 hours. It involves many steps in coagulation cascade, as it acts against prekallikrein-kininogen system, against activated factors XII., XI., IX., X. and finally inactivates thrombin, forming thrombin-antithrombin complexes (TAT's). Thus, monitoring of Antithrombin has been expected to be efficient in management of DIC.

In this study, we paid special attention to correlation between changes of some parameters and clinical outcome of the disease. Our hypothesis was: AT activity and some other parameters should possess high reliability for prognosis in dogs, as it has been proven in humans.

Materials and Methods

Prior to clinical study, we compared historical haemostatic variables from literature (Jain 1986), with those obtained by our referral laboratory, Laboratory of Clinical Hematology in Brno Faculty Hospital. In literature, the following laboratory tests for all types of DIC can be found:

Based on the possibilities of the reference laboratory, we had chosen the following parameters for our clinical study: platelet count, APTT (activated partial thromboplastin time), TCT (thrombin clotting time), PT (prothrombin time), AT (antithrombin) activity, FBG (fibrinogen concentration) and FDP (fibrin degradation products) values. As the platelet count is well defined in veterinary hematology (200-500 $\times$ $10^3/\mu L$), calibration of the system concerned the other haemostatic parameters only. We had completed 29 clinically healthy dogs from volunteers (mostly students) for calibration samples obtaining. These dogs underwent basic clinical examination before being tested for the above stated hematological and biochemical indices. Four dogs were eliminated because of various biochemical alterations.

Prothrombin Time
APTT
Thrombin Time
Reptilase Time
Clotting factors by assay
FDP's level*
Protamine sulphate test*
Antithrombin level*
Platelet count*
Schistocytosis*
Leucocytosis
Platelet factor 4*
Beta-thromboglobulin
Fibrinopeptide A*
B-beta 15–42 level*
Plasminogen level*
Circulating plasmin presence*
Fibrinogen chromatogram
D-dimer by monoclonal antibody

Fig. 1. Laboratory parameters of acute DIC (Bick and Adams 1974).

* Most useful and reliable test at present

All blood samples were processed within three hours after obtaining.

Since November 1, 1995 until January 31, 1997, 7506 patients had come to the Department of Surgery at Veterinary and Pharmaceutical University, Brno, Czech Republic, with various problems. They underwent standard diagnostic and therapeutic procedures. Out of these patients, we included into the actual clinical study 64 dogs. The basic inclusive criteria were: (1) Unexpected complications of unknown origin – (2) general deterioration and short-term changes, (3) poor response to therapy and/or (4) poorly controlled capillary bleeding and disseminated haemorrhages throughout the body. We paid attention especially to serious underlying cause. The cases varied from car accidents with acute bleeding and symptoms of severe traumatic shock to several cases of ileus, syndrome GDV (gastric dilatation volvulus), neoplasia or rupture of the spleen, neoplasia of the liver, encephalomalatia secondary to hypothyroidism, chronic urolithiasis, postoperative septicemic status and acute traumatic uroperitoneum. The age ranged from 2 to 11 years. There were 38 males and 26 females in our study.

The diagnostic procedure consists of two phases: the phase-1 covers examination, focused to the underlying cause (with the first choice therapy), while in the phase-2 we performed a haemostatic tests. On the base of clinical evaluation and of phase-1, we preselected for the phase-two 64 above-mentioned patients.

The main laboratory-based criteria, we have chosen from literature (Bick 1988) were of increasing value: APTT, TCT, platelet count, fibrinogen level, Antithrombin activity and FDP`s and we dealt with the patients, with disorders in most of these parameters, in which clinical manifestation had indicated an acute stage of illness.

Forty-five patients (70% of 64) had no evidence of DIC, since their haemostatic profile remained physiological. Nineteen patients (30% of 64) showed some alteration in haemostatic profile, but only 11 (17% of 64) dogs met the diagnostic criteria of an acute DIC. These patients we treated symptomatically (Plunkett 1993) and efficacy of therapy was evaluated after 48 hours and 10 days, respectively, by repeating of haemostatic profile. Four of the dogs died, two dogs were euthanased within one month due to underlying illness (malignancy, hypothyroidism). Five dogs survived more than a year. The review of 11 clinical cases with diagnosis of acute DIC is shown in Table 1.

Our basic therapeutic plan relied on prompt and aggressive treatment of the inciting cause. It included fluid administration (Ringer or lactated Ringer solution, Infusia, ČR) 50 - 90 ml/kg - single dose, broad-spectrum antibiotic coverage and plasma expander supplementation. Standard heparin (Heparin, Léčiva, ČR) 50 IU/kg s.c. was used four times daily. Shock has been controlled by intravenous administration of dexamethasone sodium phosphate (Dexona, Cadila Healthcare, India) 2 mg/kg two times daily (Bick and Adams 1974). We monitored success/failure of therapy by measuring haemostatic parameters after 48 hours (Table 3) and 10 days (Table 4).

Endpoints

1. As a major endpoint for an acute DIC we consider surviving rate in 10 days as this is the most desirable outcome of therapy.

2. Second major endpoint was reevaluation of patient's haemostatic profile in 48 hours and 10 days after commencing the therapy and testing mutual relationships between groups of survivors and non-survivors after 10 days.

3. For group of chronic patients we did another testing of coagulation profile in 10 days (all survived) with the regard to returning parameters back to normal values.

4. As a secondary endpoint, we have taken relationship between alteration of haemostatic profile of chronic patient in 10 days and his clinical appearance (result of physical examination).

Statistical analysis

Data were tabulated and expressed as mean ± standard deviation (SD) and median. Ratio is accented either in per cent (%) or by simple multiplication of median (coagulation times). Predictive values of some specific parameters were determined by Mann-Whitney statistical analysis. P-value was set at 0, 05.

Results

The physiological values, measured by our laboratory differ from those, obtained from literature in some instances. APTT range is 11.64.± 1.54 s (9.5 - 10.5), PT is in range of 8.12 ± 0.48 s (6.4 - 7.4), TCT ranged in our settings 11.64 ± 1.28 s (5 - 10), AT activity is

Table 1
Review of patients with acute DIC

n	Breed	Age	Triggering process	Note
1	Doberman	4	GDV - splenic rupture	surgery, standard therapy, died in two days
2	Crossbred	7	splenic haemangiosarcoma	splenectomy and standard therapy
3	Foxterrier	10	ovaric carcinoma	ovariectomy, standard therapy, died in 24 hours
4	Dachshound	6	autocrash, polytrauma	standard therapy
5	Spaniel	11	liver carcinoma	liver lobectomy, standard therapy, euthanasia later on
6	German shepherd	5	autocrash, pneumothorax, severe bleeding	standard therapy
7	Bassethound	6	diaphragmatic hernia; content-liver lobe	hernial repair, standard therapy
8	Crossbred	7	intestinal intussusception	bowel resection, standard therapy
9	Poodle	12	circumscribed pancreatic carcinoma	pancreatic lobectomy, standard therapy - died in 36 hours
10	German shepherd	8	GDV - gastric necrosis	excessive partial gastrectomy, standard therapy
11	Welsh springer	6	chronic hypothyreosis	standard therapy, euthanasia later on due to general worsening

125.7±16.5% (89 - 108), fibrinogen concentration range is 2.257 ± 0.526 g/L (2 -4). FDP concentration remained in the range suggested by literature <10 μg/mL (Jain 1986).

According to our criteria, we have chosen 64 dogs, all patients of Department of Surgery, which represents 0.85% out of all 7506 patients. All 64 dogs underwent examination according to phase-1 and phase-two (complete haemostatic profile described in Materials and Methods). We have excluded 45 patients, even though these patients remained suspect and under close clinical observation for few days. However, their haemostatic profiles were found within limits established by our referral laboratory (see Table 1). In 19 patients (0.25% out of 7506) we observed some alteration in haemostatic parameters. We re-evaluated their haemostatic profiles very thoroughly, regarding also clinical manifestation and in 11 dogs (0.15% out of 7506) established the final diagnosis of an acute DIC (Table 1), while remaining 8 were considered as chronic.

Basic hematological profile and blood biochemistry, as well as acidobasic balance parameters were followed until the completion of therapy. As biochemical and hematological profile and acidobasic balance was overshadowed by express of underlying cause, the phase 1 examination appeared to be out of value for general picture of DIC.

Some attention was given to the occurrence of schistocytes in blood smears and their incidence was not found to be as consistent in the dog, as reported in human DIC data (Bick 1988).

Table 2 shows a review of clinical diagnoses in patients completed into a study. We saw no apparent correlation between the severity of clinical illness and the rate or degree of alteration of laboratory parameters pre-therapy or in 48 hours. However, we cannot assess the severity of end-organ damage by the microvascular thrombosis, which seems to be the most important factor for the prognosis *quo ad vitam* (Bick 1988). In contrast, excessive bleeding, the most visible of signs, was controlled in most cases, with little influence on the ultimate outcome.

Table 2
Hemostatic profile of acute patients – pretherapy

n	PC	APTT(sec)	TCT(sec)	PT(sec)	ATIII (%)	FBG(g/L)	FDPμg/ml)
1	163	26.6	14.8	14.4	39	0.39	>20
2	127	20.0	12.5	8.6	78	1.00	>20
3	87	34.7	18.5	21.7	41	0.64	>40
4	115	21.4	13.2	16.8	47	1.12	>20
5	93	28.2	16.6	10.2	52	0.71	>40
6	148	28.9	12.8	18.1	54	1.22	>20
7	112	17.8	13.5	14.1	69	1.05	>20
8	84	32.1	18.2	18.8	44	0.88	>40
9	91	27.2	16	15.4	48	0.91	>20
10	122	19.8	12.2	16.2	68	1.21	>20
11	95	28.4	14.3	17.3	44	0.43	>20
mean	**112.5**	**25.92**	**14.78**	**15.60**	**53.1**	**0.869**	
SD	**24.7**	**5.19**	**2.14**	**3.57**	**12.3**	**0.279**	
median	**112**	**27.2**	**14.3**	**16.2**	**48**	**0.91**	

Patients No. 1, 3, 8 and 9 from Table 2 died within first 48 hours after beginning of the therapy, and remained lost for further control. We recorded seven survivors within the short-time period. In 10 days, we observed significant improvement of some parameters in patients treated successfully. It was apparent that levels of AT activity ($p < 0.05$) and TCT ($p < 0.05$) in patients dying within two days revealed the most significant predictive value. Moreover, we observed some relationship (though not statistically significant) between fibrinogen concentrations, platelet count deviations and surviving, while FDP's seemed to be not so sensitive.

The mean APTT of patients with an acute DIC after pre-therapy sampling was 2.32 × compared to control group, while the mean APTT of chronic patients was only 1.41 × compare to control group. Seven patients with acute DIC had their APTT more than doubled compared to median of control group, while none of 8 chronic patients had APTT as high as two-fold compared to control group.

Finally, we checked the haemostatic profile in chronic patients (patient number 12 to 19) and compared values obtained pre-therapy with the tests performed in 10 days Table 4 and Table 5), reevaluating some parameters and their reliability for diagnosis, as well as prognosis. We have not found any specific correlations between laboratory values and the outcome of chronic DIC.

Discussion

Disseminated intravascular coagulopathy is probably less common in dogs than in humans, judging by the lack of clinical reports. To some extent, this may be due to shortage in documentation attributable to limited application of suitable diagnostic tests in emergency patients. Moreover, there is not an agreement concerning guidelines to proper establishing the diagnosis in the dog, so many cases may have ended up overlooked. Certainly, there are various reports of pathologic abnormalities in coagulation profile in dogs (Feldman 1981; Bateman et al 1999). Our data show that there is certain number (0.25%) of dog patients suffering from DIC, which can be identified and taken care of, as long as these dogs are lucky enough to get proper attention.

We agree with other authors (Bick and Adams 1974, Maruyama et al. 2004) as we confirmed the complex of parameters including APTT's, FDP's, fibrinogen concentration,

Table 3
Laboratory values obtained 48 hours after begining of therapy

n	PC	APTT(sec)	TCT(sec)	PT(sec)	ATIII (%)	FBG(g/L)	FDP μg/ml)
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	205	17.6	13.2	13.2	89	1.67	>20
3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	230	16.2	13.0	14.1	95	2.84	>20
5	165	20.4	14.6	9.4	84	1.53	>20
6	150	13.1	13.5	15.5	87	2.16	>20
7	97	26.5	16.2	16.4	74	0.80	>20
8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	135	13.3	9.7	15.2	105	2.23	>20
11	105	19.7	14.5	17.6	99	1.00	>20
mean	**155.3**	**18.11**	**13.53**	**14.49**	**90.4**	**1.747**	
SD	**45.5**	**4.31**	**1.86**	**2.47**	**9.5**	**0.666**	
median	**150**	**17.6**	**13.5**	**15.2**	**89**	**1.67**	

N/A.....not available

Table 4
Laboratory values obtained from acute patients after 10 days of therapy

n	PC	APTT(sec)	TCT(sec)	PT(sec)	ATIII(%)	FBG(g/L)	FDP μg/ml)
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	250	14.1	12.5	10.1	119	2.18	>20
3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	330	16.4	11.8	7.8	98	2.64	>20
5	180	17.4	13.1	8.1	108	1.62	>20
6	153	13.5	10.5	14.2	125	2.05	>20
7	135	15.2	14.8	9.9	88	1.35	>20
8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	258	11.2	9.7	11.2	130	2.43	>20
11	238	15.8	11.0	12.4	111	1.48	>20
mean	**220.6**	**14.80**	**11.91**	**10.53**	**111.3**	**1.964**	
SD	**63.3**	**1.91**	**1.60**	**2.12**	**13.8**	**0.456**	
median	**238**	**15.2**	**11.8**	**10.1**	**111**	**2.05**	

N/A.....not available

AT activity and platelet count to possess reliability for final diagnosis (regarding the clinical manifestation), but even better for monitoring of the therapy. As it has been stressed in previous studies (Bick and Adams 1974; Feldman 1981; Bick 1988; Feinstein 1988; Slappendel 1988; Green and Thomas 1994; Bateman et al. 1999), and the same is apparent from the data summarized in Table 2, the most predictive event in treatment of DIC remained success or failure of treating the triggering disease process. If an acute ileus, gastric volvulus, shock, or neoplasia, are treated successfully, there may be some hope for controlling of DIC, as well. The blood product replacement is of value in extending the therapeutic window. Thankfully, in surgical disease, the process is often aggressive, but therapeutic possibilities can be very efficient.

Table 5
Laboratory values obtained from chronic patients (no signs of bleeding)

n	PC	APTT(sec)	TCT(sec)	PT(sec)	ATIII (%)	FBG(g/L)	FDPμg/ml)
12	358	17.6	12.2	8.7	88	2.50	<10
13	213	16.5	18.1	11.2	97	3.05	<10
14	450	12.4	22.4	10.4	95	2.88	>10
15	312	11.8	16.5	9.6	78	1.88	<10
16	205	20.5	12.7	8.4	115	1.05	>20
17	230	19.7	14.6	13.1	105	2.20	>10
18	390	16.2	15.1	10.1	89	1.90	<10
19	280	17.3	14.4	9.8	103	2.60	<10
mean	**304.8**	**16.50**	**15.75**	**10.16**	**96.3**	**2.258**	
SD	**83.5**	**2.90**	**3.08**	**1.39**	**10.8**	**0.604**	
median	**296**	**16.5**	**14.9**	**9.95**	**96**	**2.35**	

Table 6
Control samples obtained from chronic patients after 10 days of therapy

n	PC	APTT(sec)	TCT(sec)	PT(sec)	ATIII (%)	FBG(g/L)	FDPμg/ml)
12	358	14.1	10.5	9.8	99	1.52	<10
13	213	13.9	11.2	10.4	105	1.88	<10
14	450	11.8	12.8	8.9	110	2.33	<10
15	312	15.2	14.9	9.9	92	1.67	<10
16	205	13.2	11.8	10.3	98	2.78	<10
17	230	10.1	12.1	8.7	89	3.44	<10
18	390	11.4	10.6	9.6	110	3.05	<10
19	280	12.7	11.6	10.2	109	2.23	<10
mean	**304.8**	**12.80**	**11.94**	**9.73**	**101.5**	**2.363**	
SD	**83.5**	**1.54**	**1.33**	**0.59**	**7.7**	**0.637**	
median	**296**	**12.95**	**11.7**	**9.85**	**102**	**2.28**	

Our therapeutical approach in most cases included administration of heparin, although it remains unclear whether or not the use of heparin without AT concentrate increases the risk of bleeding. Low-molecular weight heparin may have been more appropriate choice in view of some reports, that high molecular fractions of standard heparin have a platelet proaggregating effect (Bick 1988; Feinstein 1988; Owen and Bowie 1977). It also may be helpful to administer fresh-frozen plasma concentrate or cryoprecipitate instead of whole blood to provide better coagulation factors supplementation and to avoid microvascular haemolysis. However, standard blood banking in the forms available to physicians has always been a problem in veterinary medicine. Our solution in this study was to use plasma expander (Haemacoel) instead of whole blood. The use of hirudin, hirulog and other AT independent inhibitors should have also been explored, but it was clearly beyond the scope.

The most important step in the therapy is still the treatment of triggering disease (Ratnoff et al. 1955ab; Bick and Adams 1974; Feinstein 1988; Bateman et al. 1999). Obviously, it was our first step, as well.

In our study, we accepted slightly different values of haemostatic parameters, obtained by our referral laboratory, compared to those, suggested by literature (Jain 1986) and our clinical patients were compared with our values .

In most cases, the triggering process was very serious and potentially lethal for the patients. In such condition, it is always very difficult to pay full attention to one factor of

complication. Two patients had to be euthanased eventually, but it had nothing to do with DIC (Table 1).

Haemostatic values pre and 48 hours and 10 days post-therapy can only be interpreted as part of a complex and interactive system involving both the triggering phenomenon as well as resulting coagulopathy. We observe some marked changes in haemostatic values during therapy. It means, that monitoring of acute DIC may help guide therapy, even though clinical manifestation seem to be the single most important predictor of outcome. Platelet count, fibrinogen level and AT activity appear to reflect disease dynamics most accurately, however, in our settings, there was statistically significant correlation between death of four patients, changes in AT activity and thrombin clotting time values. These changes we expect to be manifest in all patients with clinical evidence of DIC. We can actually see improvement of these parameters in survivors.

Monitoring of AT activity, which is thought to possess less reliability in human medicine, due to supplementary therapy (Bick 1988; Feinstein 1988), is supposed to play a very important role in small animal emergency medicine. The similar reliability we have found in platelet count and fibrinogen concentration, as platelets and fibrinogen supplementation is also common in human medicine (Bick 1988; Feinstein 1988). The rather difficult interpretation of shift in FDP levels during the therapy can be possibly explained by the fact that FDP is complex of fragments, with different affinity to bind to various ligands. Therefore, with the multiple chemical properties, they are not same detectable at a time (Boisvert et al. 2001). According to literature (Feldman 1981; Stokol et al. 2000; Boisvert et al. 2001), monitoring of D-dimer only would be much more appropriate, as its reliability was reportedly close to 100% in some studies (Feldman 1981; Bick 1988; Stokol et al. 2000; Monreal 2003).

In our settings, because of difficulties with the transport of samples and products, monitoring was only possible in 48h and after 10 days, knowing that appropriate monitoring of therapy requires q 4 - 12 h sampling (Bick and Adams 1974). The efficacy of therapy is well seen in the charts.

Review of the chronic patients, with mild haemostatic alterations shows that the diagnosis can only be established as a complex of laboratory values and clinical observation (Ratnoff et al. 1955ab; Hardaway 1966; Bick and Adams 1974; Feinstein 1988; Green and Thomas 1994; Bateman et al. 1999). In acute DIC, FDP level, AT activity and a Platelet count appear highly reliable diagnostic predictors. Coagulation times are supposed to add only limited additional information. However, evaluation of APTT in our study seemed to be of value, if it prolongs twice or more compared to physiological mean.

In conclusion, our clinical observation disclosed that the syndrome of DIC seems to be not too frequent in veterinary clinics (just 0.15% of random patients) with the incidence of 146.5 cases for 100 000 patients. However, with quite a high mortality, it is usually very dangerous, for the patient potentially lethal condition.

A small group of patients with distinct diagnostic features of DIC will benefit from laboratory monitoring of their coagulopathy. Our study supports the use of Antithrombin activity and thrombin clotting time as reliable predictors, with fibrinogen level and platelet count to be a little bit less sensitive, while FDP concentration was not confirmed to be helpful for monitoring of the therapy (yet, it was still valuable as diagnostic criterion).

Future work will be focused on the clinical importance of some other parameters - mainly the molecular markers of hypercoagulation and hyperfibrinolysis, such as D-dimer.

Diseminovaná intravaskulární koagulopatie u psa

V období mezi listopadem 1995 a únorem 1997 byla na našem pracovišti vedena klinická studie zaměřená na etiopatogenezi a morbiditu syndromu diseminované intravaskulární koagulopatie (DIK) u psů. Pro studii jsme si stanovili dva postupné cíle. Prvním cílem bylo zjištění obecné míry rizika vzniku tohoto onemocnění v podmínkách klinické praxe. V rámci této

fáze jsme zjistili, že ze 7506 pacientů, kteří naši kliniku ve sledovaném období navštívili pouze u 11 jsme mohli stanovit konečnou diagnózu akutního DIK. Z těchto jedenácti případů čtyři psi navzdory intenzivní péči syndromu podlehli, zatímco dva další byli posléze utraceni z důvodu progrese původního onemocnění. Druhým cílem pak bylo přehodnocení významnosti dostupných hematologických parametrů s pokusem o stanovení diagnostického algoritmu současně s optimálním vyšetřovacím panelem pro monitoring progrese procesu a stanovení prognózy. Souhlasně s literárními prameny jsme zjistili, že především kombinace vyšetření TCT (thrombin clotting time), stanovení hladiny (či aktivity) AT (antitrombinu), provedené současně s rozpočtem krevních destiček a hladinou komplexu produktů degradace fibrinu (FDP) jsou pro stanovení diagnózy dostatečně senzitivní. Navíc jsou tyto vyšetřovací metody vysoce průkazné i pro stanovení prognózy. Podle našich výsledků, pokud je TCT a současně i hladina AT mimo fyziologické rozmezí ještě 48 hodin po nasazení terapie, je nutno vyslovit špatnou prognózu.

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