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Evaluation of Some Hematological and Biochemical Parameters Pre- and Post- Ovariohysterectomy in Dogs

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Abstract

The present study was conducted to identify the effect of ovariohysterectomy (OVH) on routine hematological and biochemical measurement variables in clinically healthy dogs and to determine whether these parameters could be used to identify any complication of this commonly performed surgery. Non-pregnant 8 healthy female dogs (1-3 years of age) were contained in the study. Blood samples were collected immediately before ovariohysterectomy and between 1 to 7 days throughout after OVH. Hematological parameters and levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatine kinase-myocardial band isoenzymes (CK-MB), C-reactive protein (CRP), cholesterol (CHOL), triglyceride (TG), high-density lipoproteins (HDL), and low-density lipoproteins (LDL) were determined. The statistical differences were found in the white blood cell count (WBC), red blood cell (RBC), AST, CRP, and TG levels between the pre- and post-operative. There were no significant differences of other biochemical parameters. The results of the study revealed that some hematological and biochemical parameters of healthy dogs are affected by anaesthesia and surgery.

Key Words: hematological parameters, biochemical parameters, dog, ovariohysterectomy

Köpeklerde Ovariohisterektomi Öncesi ve Sonrası Bazı Hematolojik ve Biyokimyasal Parametrelerin Değerlendirilmesi

Öz

Bu çalışma, klinik olarak sağlıklı köpeklerde ovariohisterektominin (OVH) hematolojik ve biyokimyasal parametrelerin rutin ölçümleri üzerine olan etkisini ortaya koymak ve bu parametrelerin sıklıkla yapılan bu ameliyatın herhangi bir komplikasyonunu tanımlamak için kullanıp kullanılamayacağını belirlemek amacıyla yapıldı. Çalışmada gebe olmayan 8 sağlıklı dişi köpek (1-3 yaş) kullanıldı. Kan örnekleri ovariohisterektomi yapılmadan hemen önce ve OVH sonrası 1 ile 7 gün arasında toplandı. Hematolojik parametreler ve aspartat aminotransferaz (AST), alanin aminotransferaz (ALT), kreatin kinaz- miyokard band izoenzimleri (CK-MB), C-reaktif protein (CRP), kolesterol (CHOL), trigliserid (TG), yüksek yoğunluklu lipoproteinler (HDL) ve düşük yoğunluklu lipoproteinler (LDL) seviyeleri belirlendi. Operasyon öncesi ve sonrası istatistiksel farklılıklar, beyaz kan hücresi sayımı (WBC), kırmızı kan hücresi (RBC), AST, CRP ve TG seviyelerinde bulundu. Diğer biyokimyasal parametrelerde anlamlı bir farklılık bulunmadı. Çalışmanın sonuçları, sağlıklı köpeklerin bazı hematolojik ve biyokimyasal parametrelerinin anestezi ve ameliyattan etkilendiğini ortaya koydu.

Anahtar Kelimeler: Biyokimyasal parametreler, hematolojik parametreler, köpek, ovariohisterektomi

INTRODUCTION

Ovariohysterectomy (OVH) is one of the surgical contraceptive techniques which commonly chosen by veterinary practitioners to control the animal population on the female dogs and cats. Also, applying the OVH is recommended to eliminate the risk of pyometra, mammary tumor, and unwanted pregnancy (1). Obviously, OVH has dangerous situation same as that any surgical process performed under general anaesthesia and necessitating laparotomy and organ removal. Even though the incidence of complications with the OVH operation is fairly very low in the healthy animals it still involves risks during the operation and problems of post-operation (2). As well known, anaesthesia and surgery can cause significant surgical stress which has negative effects on the body (3). Furthermore, effects of anaesthesia on cardiovascular system such as myocardial damage have observed (4). In order to evaluate the effect of anesthesia, hypothermia, tissues damage, post-operative pain and inflammation following OVH can be followed by examining the hematological and biochemical parameters.

White blood cell count (WBC) is commonly used after different surgical procedures in animals to assess the severity of the inflammation. Also, C-reactive protein (CRP) has been reported an important acute phase protein for evaluating the degree of post-surgical systemic inflammation and surgical trauma in dogs (5). On the other hand, elevated serum CRP concentration is associated with cardiovascular failure in dogs (6). When the myocardium is damaged, the level of enzymes, such as creatine kinase-myocardial band

isoenzymes (CK-MB), C-reactive protein (CRP), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) in the serum is elevated (7, 8).

This study was aimed to present the enlightening data about the change of hematological and biochemical blood parameters progression of recovery after surgery and to find out whether there is an adverse effect of anesthesia and surgery on healthy dogs.

MATERIAL AND METHOD

Ethical approval

This study was approved by the Siirt University Animal Research Local Ethics Committee (No:2019/02), prior to onset of the clinical investigations.

Animals and sample collection

Eight healthy female dog (1-3 years of age) were presented to the Department of Obstetrics and Gynecology, Faculty of Veterinary Medicine, Siirt University, for routine ovariohysterectomy. On clinical examination body temperature, respiratory rate, heart rate, capillary refill time, and mucous membrane colour were all within normal reference ranges. Post-operatively the rectal temperature, heart rate, and respiratory rate were recorded daily for as long as the patient was hospitalized. Blood samples took from a cephalic vein of the animals for analysis. The serum sample tubes without anticoagulant were kept in room temperature for 30 minutes, sera were separated at 1500 rpm for 15 min and stored at -20°C until analysed.

Hematological and biochemical analyzes

A fully-automated blood panel device (Mindray BC2800, China) was used to measure white blood cell count (WBC), red blood cell (RBC), hematocrit (Hct), hemoglobin (Hbg), mean corpuscular hemoglobin (MCH), platelet (PLT), and mean corpuscular volume (MCV) values in the sample tubes with an anticoagulant.

An auto-analyzer (Siemens, ADVIA 1800, Germany) using to determine cholesterol (CHOL), triglyceride (TG), high-density lipoproteins (HDL), low-density lipoproteins (LDL), creatine kinase-myocardial band isoenzymes (CK-MB), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and C-reactive protein (CRP) levels.

Surgical procedure

Pre-operative water and food restriction was performed 8 and 12 hours before, respectively. A venous catheter was applied in the cephalic vein prior the surgery. During the surgery, isotonic saline solution was infused via the cephalic vein. All dogs received a subcutaneous injection of meloxicam (Demelox©, Denova, Turkey, 0,2 mg/kg SC) immediately before they were prepared for surgery. Anaesthesia was pre-medicated with xylazine (Xylazinbio %2©, Bioveta, Turkey, 2 mg/kg IM); induced using ketamine (Ketasol %10©, İnterhas, Turkey, 8mg/kg IM). Following the standard aseptic preparation routine ventral elective ovariohysterectomy was performed by the same surgeon. Amoxicillin-clavulanic acid (Klavicure®, Teknovet, Turkey, 8.75 mg/kg IM) was used for 5 days. Duration of surgery was calculated approximately 17 min. Sutures of skin were healed on days 10.

Statistical analysis

All statistical analyses were calculated using SPSS (version 23.0, SPSS Inc, USA) statistical software. Kruskal - Wallis analysis of variance was used for general comparison of groups, while Mann - Whitney U Test was used for paired comparisons between groups. Results are given as mean ± SEM (Standard Error Mean). Differences were considered significant at $p<0.05$.

RESULTS

The results of hematological parameters were presented for female dogs before and after OVH in Table 1. WBC level ($P<0.05$) was found to increase one day after OVH and differences between the RBC levels were observed. However, Hgb, HCT, MCV, MCH, MCHC, and PLT levels were found to be not statistically different between days. The results of the biochemical parameters are shown in Table 2. The AST level was higher in the first day after OVH compared to the other days ($p<0.05$). Also, CRP levels had significant increase ($P<0.05$) one day after surgery. On the other hand, the levels of ALT and CK-MB did not differ between the days. The results of the serum lipid profile analysis are shown in Table 3. The HDL, LDL, and CHOL levels were similar, but the concentrations of TG was changed after the OVH.

DISCUSSION AND CONCLUSION

The blood chemistry measurement has elucidated important in the diagnosis and prognosis of diseases and the assessment of the progress of the treatment together with clinical findings. Nowadays, although many different anesthesia protocols have been developed, the combination of xylazine and ketamine continues to be frequently used in animal surgery. There have been some reports evaluation of cardiac damage related to anesthetic drugs both animal and human (4, 9). Moreover, surgery is well known as a procedure that associated with stress, pain, and changes of hemodynamics.

CK- MB has mainly been used as a marker for damage of skeletal muscle. Also, CK-MB is used as a cardiac biomarker to assess the myocardial damage which rises quickly after pathologies or surgery and go backs the baseline level within 24 to 48 hours (10). Unfortunately, cardiac troponin I, another specific cardiac biomarker (11), could not be evaluated in this study. Besides the CK-MB, AST, ALT and CRP have additional value for diagnosing cardiac issues in dogs (7, 8, 10). AST is a non-organ specific biochemical and muscle damage due to severe exertion or trauma and congestive heart failure can also be responsible for elevated AST in dogs. Many diseases may affect ALT, as well as non-liver conditions. In this study, the increase was observed in AST and CRP level after the OVH but no significant difference in the level of CK-MB and ALT. However, AST and CRP were also going down normal levels between day 2 and 7. Similarly with our data, previous studies have declared an increase in AST and CRP

Table 1. Results of some hematological parameters in dogs pre- and post-ovariohysterectomy (Mean ± SEM, n: 8)

	Days							
Parameters	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
WBC ($x10^9$/L)	13.96 ± 1.80 [a]	21.14 ± 2.28 [b]	18.32 ± 2.40 [bd]	14.79 ± 1.36 [ad]	13.46 ± 1.07 [ad]	12.68± 1.05 [a]	10.24± 0.62 [c]	11.71± 1.76 [ac]
RBC ($x10^{12}$/L)	6.35 ± 0.53 [ab]	5.74 ± 0.30[a]	6.80 ± 0.40[b]	6.49 ± 0.42 [ab]	6.30 ± 0.33[ab]	6.43 ± 0.41[ab]	6.43 ± 0.35[ab]	6.56 ± 0.28[ab]
HGB (g/dL)	14.29 ± 1.28	12.99 ± 0.95	15.09 ± 0.75	14.52 ± 1.10	14.39 ± 0.92	14.65 ± 1.04	14.46 ± 0.95	14.45 ± 0.77
HCT (%)	44.14 ± 3.65	40.30 ± 2.49	43.75 ± 3.87	39.26 ± 5.83	43.67 ± 2.11	43.29 ± 3.21	43.29 ± 2.17	43.45 ± 2.79
MCH (pg)	22.50 ± 0.52	22.35 ± 0.87	22.46 ± 0.68	22.30 ± 0.71	22.54 ± 0.55	22.74 ± 0.64	22.47± 0.56	22.36 ± 0.22
CRP (µg/mL)	0.24 ± 0.22[ab]	0.81 ± 0.20[a]	0.52 ± 0.08[ab]	0.39 ± 0.14[ab]	0.30 ± 0.10 [ab]	0.34 ± 0.12 [ab]	0.27 ± 0.13[b]	0.36 ± 0.10 [ab]

Values (Mean ± S.E.M.) with different superscripts (a and d) within the same column showed significant differences (P<0.05).

Table 2. The results of some biochemical parameters in dogs pre- and post-ovariohysterectomy. (Mean ± SEM, n: 8)

	Days							
Parameters	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALT (U/lt)	22.62 ± 2.81	24.37 ± 2.47	26.62 ± 2.72	25.37 ± 3.01	21.87 ± 3.30	23.00± 2.14	20.87± 2.18	20.50± 2.24
AST (U/lt)	34.37 ± 10.60[a]	63.50 ± 14.36[b]	36.75 ± 5.60[ab]	32.37 ± 3.96 [a]	30.00 ± 2.54[a]	25.75 ± 2.36[a]	24.00 ± 1.41[a]	24.37 ± 1.92[a]
CK-MB (U/lt)	242.57 ± 56.74	206.37 ± 46.98	150.12 ± 23.10	140.87 ± 25.17	173.25 ± 49.91	193.25 ± 65.38	154.50 ± 49.51	207.12 ± 43.85

Values (Mean ± S.E.M.) with different superscripts (a and b) within the same column showed significant differences (P<0.05).

Table 3. The results of some serum lipid parameters in dogs pre- and post- ovariohysterectomy. (Mean ± SEM, n: 8)

	Days							
Parameters	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Chol (mg/dL)	215.87 ± 7.73	205.25 ± 6.46	221.50 ± 5.96	222.50 ± 8.234	215.25 ± 10.57	219.12 ± 11.36	214.37 ± 8.21	215.12 ± 9.06
Trig (mg/dL)	53.12 ± 5.63a	74.25 ± 8.66 ab	78.75 ± 7.75b	65.37 ± 7.60 ab	68.75 ± 6.74 ab	76.62± 6.17 b	84.12± 18.46 b	80.50± 10.83 b
LDL (mg/dL)	27.05 ± 4.04	24.50 ± 5.02	29.37 ± 5.48	31.00 ± 5.94	29.62 ± 5.23	29.87 ± 5.82	29.50 ± 5.41	31.37 ± 1.81
HDL (mg/dL)	157,86 ± 9,73	137,25 ± 6,04	148,50 ± 6,14	150,87 ± 6,38	146,12 ± 7,23	148,25 ± 6,30	141,00 ± 8,77	146,00 ± 5,71

Values (Mean ± S.E.M.) with different superscripts (a and b) within the same column showed significant differences (P<0.05).

activity during 24 h after surgical operation and then decrease (12, 13). Therefore, the increase in the level of AST and CRP after OVH can be related to the temporary detrimental effect of surgery or anesthesia. Even though some authors have declared that cardiovascular effects of ketamine (14), a novel study concluded in healthy dogs to evaluate effects of ketamine continuous infusions were not resulting with myocardial injury (15). Even though blood samples were taken during the 7 days after the operation to evaluate the effect of anesthesia protocol on the cardiovascular system in this study, did not find statistically significant differences for CK-MB level. Also, other non-specific cardiac biomarkers did not permanently increase.

In addition, systemic inflammation would temporarily increase when ovariohysterectomy was applied, WBC was found high during the first two days after OVH in this study. Previous studies indicate that CRP levels were elevated more rapidly than WBC levels, for this reason, CRP might also be used to a sensitive and priority marker to evaluate systemic inflammatory disease than WBC (16). Although the rapid rise of CRP could not be measured by taking blood at short hour intervals after the operation, similar to other studies, CRP levels returned to normal values on the second postoperative day (13, 16). However, WBC took longer to return to normal reference level. In this case, it is recommended that CRP and WBC levels should be evaluated together before deciding on prognosis and to begin antibiotic treatment.

The results presented in the current study showed that the TG level was significantly increased in the dogs after OVH while LDL, HDL, and CHOL levels were normal. Increased triglyceride concentrations are a physiological and transient condition which observed in dogs after a meal, and these higher concentrations typically fall again within 7-12 hr (17). Differences in levels of TG between the pre- and post-operative would be explained with the restriction of food before the surgery.

Collectively, no continuous significant changes on hematological and biochemical variables were determined between pre- and post-ovariohysterectomy in dogs. However, further studies, especially long-term evaluations, are required to characterize more accurately the putative cardiotoxicity of surgery and anesthesia in healthy dogs after the ovariohysterectomy.

Conflict of Interest

The author declares no conflicts of interest related to this report.

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