

DOI 10.2478/v10181-011-0046-3

Short communication

Changes in the blood coagulation profile after ovariohysterectomy in female dogs

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Abstract

This study investigated changes in the coagulation profile of 10 healthy female dogs subjected to ovariohysterectomy. Blood samples were collected three times – before, directly after and 24 h after surgery. Plasma samples were analyzed to determine thrombin time (TT), prothrombin time (PT), activated partial thromboplastin time (APTT), fibrinogen content, D-dimer content and antithrombin (AT) III activity. The results revealed post-operative haemostatic system disorders related to prolonged APTT, higher fibrinogen and D-dimer concentrations and lower levels of AT III activity.

Key words: coagulation profile, ovariohysterectomy, dogs

Introduction

During surgical procedures, the clotting system is activated mainly by higher exposure of endothelial growth factors and simultaneous release of cytokines (Gupta et al. 2005). A postoperative drop in the patients' motor activity is also an important consideration as it may lead to venostasis and further endothelial damage. Surgical procedures are also accompanied by hemodilution which is one of the causes of thrombophilia. In humans, the above lowers the activity of antithrombin III and contributes to thrombophilia, venostasis and disseminated intravascular coagulation (DIC) (Anderson and Spencer 2003). In veterinary practice, coagulation disorders were observed as a consequence of surgical treatment of tumors in dogs, colic in horses and indigestion in cattle (Sobiech et al. 2008) and observed changes were indicative of thrombophilia which can lead to thrombosis and DIC.

Materials and Methods

The study was performed on 10 female dogs of various breeds, aged 7 to 9 years, which were subjected to routine ovariohysterectomy. The animals had been clinically healthy prior to the surgical procedure and housed and treated in accordance with the rules approved by the local Ethics Commission.

Ovariohysterectomy was performed under general anesthesia. The animals were premedicated with atropine sulfate (*Atropinum sulfuricum*, Polfa), 0.05 mg/kg of body weight, sc, and acetylpromazine maleate (Calmivet, Vetoquinol), 0.5 mg/kg, im. Anesthesia was induced with a combination of ketamine (Narkamon, SPOFA), 2 mg/kg, and diazepam (Relanium, Polfa), 0.5 mg/kg, iv. General anesthesia was induced with 2% isoflurane (Aerrane 100% Baxter) (maintained with 1.5% isoflurane), supplied with an oxygen/air mixture (30%) using a semi-closed circuit rebreather. Blood

Table 1. The mean values of coagulation parameters during ovariohysterectomy in dogs ($\bar{x} \pm SD$).

Examination	TT (s)	PT (s)	APTT (s)	Fibrinogen (g/l)	D-Dimer ($\mu\text{g/l}$)	AT III (%)
I	13.98 \pm 2.29	14.95 \pm 3.11	30.35 \pm 5.21	1.46 \pm 0.14	330.0 \pm 12.37	129.5 \pm 11.78
II	13.23 \pm 3.01	15.53 \pm 2.78	30.78 \pm 3.96	1.72 \pm 0.09	532.75* \pm 14.39	114.75 \pm 13.56
III	11.25 \pm 2.58	14.73 \pm 2.64	35.70* \pm 4.12	5.22** \pm 1.83	692.25* \pm 16.25	103.25* \pm 9.29

* – denote statistically important to $p \leq 0.05$

** – denote statistically important to $p \leq 0.01$

was sampled from the radial vein three times – one hour before surgery, directly after and 24 h after surgery. Changes in the optical density of the following coagulation factors were determined in the plasma by the chronometric method: thrombin time (TT), prothrombin time (PT), activated partial thromboplastin time (APTT), and fibrinogen. D-dimer levels and the activity of antithrombin (AT) III were determined with the use of the chromogen substrate method by relying on the colometric reaction kinetics at a wavelength of 405 nm. These parameters were determined with the use of a Bio-Ksel Coag-Chrom 3003 coagulometer and Bio-Ksel plasma kits. The results were verified statistically by the Newman-Keuls test with the use of Statistica 6.0 software to determine arithmetic means, standard deviations and the significance of differences between means at a confidence level of $p = 0.01$ and $p = 0.05$.

Results and Discussion

Changes in mean TT and PT in the studied animals were statistically insignificant during entire experiment (Table 1). Studies of dogs have revealed that TT is prolonged in response to serious operations and complications that pose a risk of disseminated intravascular coagulation (DIC) (Kummeling et al. 2006). TT values found in this study indicate that this parameter is not affected by the surgical procedure. Elevated PT values were observed in limb fracture surgeries in dogs, suggesting that surgical trauma activates fibrinolysis. In this study, ovariohysterectomy did not lead to changes in this parameter. In the third test APTT and fibrinogen concentrations were significantly elevated (Table 1). In a study of dogs, prolonged APTT was found during surgery (Kummeling et al. 2006), in particular when accompanied by liver dysfunctions lowering the synthesis of coagulation factors. Higher APTT observed after ovariohysterectomy could be related to surgical trauma, hemodilution caused by infusion solutions, and it points to the activation of the fibrinolysis system. A significant increase in fibrinogen levels found

after ovariohysterectomy was indicative of an acute-phase reaction to the inflammation and the activation of the clotting mechanism leading to thrombus formation. D-dimer concentrations were marked by a significant increase directly after surgery, and they continued to grow in the following 24 hours (Table 1). In dogs, D-dimer concentrations may increase due to metabolic disorders, inflammations and surgical trauma. This parameter is also one of few indicators of a prothrombotic state that leads to the intravascular coagulation syndrome (Stokol et al. 2000). In this study, a significant increase in postoperative D-dimer levels points to the activation of the fibrinolysis system in consequence of thrombophilia. A significant drop in the activity of AT III was observed 24 h after surgery (Table 1). Lower levels of proteolytic activity (including a drop in AT III activity) were observed as a result of the mobilization and faster depletion of coagulation factors. The postoperative drop in AT III activity was a negative phenomenon which points to the body's inability to compensate for haemostatic disorders. The results of this study suggest that due to postoperative changes in coagulation profile, antithrombotic therapy can be included in routine veterinary practice to minimize post-surgical complications.

References

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