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# Haematobiochemical Changes and Postoperative Complications following Elective Ovariohysterectomy in Dogs

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*Received: 16 December 2014 Accepted: 2 January 2015 Published: 15 January 2015*

## Abstract

Ovariohysterectomy was performed via ventral midline clinical cases in dogs (n=35) to present haematobiochemical changes and postoperative complications of elective ovariohysterectomy under dexmedetomidine basal anaesthesia in dogs. Total Leukocyte count and Haemoglobin concentration decreased, whereas, glucose increased significantly. There was a no significant change in neutrophil count, packed cell volume, creatinine, insulin and cortisol. Complications were observed in seven out of thirty five animals. Intra-abdominal haemorrhage was observed in three, abdominal wound dehiscence in 3 animals and ovarian remnant syndrome occurred in one dog. Stress response to surgeries was obtunded dexmedetomidine induced basal anaesthesia.

***Index terms***— ovariohysterectomy, complications, dogs, stress response, dexmedetomidine.

## 1 Introduction

lective sterilisation of female dogs is one of the most common procedures performed in veterinary practice accomplished by removing both the ovaries and uterus (ovariohysterectomy) or by removing the ovaries alone (ovariectomy) but ovariohysterectomy has historically been recommended. It is generally performed for population control, prevention of diseases of the reproductive tract, and elimination of undesirable behaviours associated with hormonal cycling. Mammary tumours are the most common tumours in female dogs, with an overall incidence of 3.4% out of which 41% to 53% of mammary gland tumours are reportedly malignant and metastasis is common [1,2 ]. An important time-dependent benefit of elective sterilisation in female dogs is the decreased incidence of mammary gland tumours [3]. Elective ovariohysterectomy also reduces incidence of endometrial hyperplasiapyometra complex and uterine neoplasia. However, there are many post operative complications reported with ovariohysterectomy, the incidence ranging from 6.2% to 20.6%. The aim of this study was to record the most common complications associated with ovariohysterectomy.

## 2 II.

Material and methods a) Climatic Condition and Experimental Animals Geographically, Bareilly U.P is located at 28°10?N 78°23?E in northern India, at an altitude of 166 m above mean sea level. Bareilly has extreme climate changes, temperatures range from 4 °C to 44 °C.

The study was conducted on healthy dogs presented to a Referral Veterinary Polyclinic for elective ovariohysterectomy. Complete history of the animal including breed, age, parity and stage of oestrous cycle was recorded. Clinical examination of the animals included general condition, colour of gingival mucous membrane, heart rate, respiratory rate and rectal temperature. Venous blood samples were collected aseptically in dry syringes for estimation of haemoglobin, packed cell volume, total leukocyte count, differential leukocyte count, urea nitrogen, glucose and creatinine.

# 3 b) Procedure

The animals were fasted since the previous day in the context of elective surgery. Pre-emptive analgesia and prophylactic antibiotic were administered in all the animals. Surgery was carried out under general anesthesia. Ventral abdomen was prepared for aseptic surgery and mid line incision (via Linea Alba) starting from the umbilicus and extending few centimetres towards pubis was given to provide direct approach and access to the uterine horns and facilitated prehension of the ovaries. The bladder was retracted laterally; one of the horns was exposed and followed cranially up to the ovary bursa. The ovary was grasped and supensory ligament cut (when possible with ease) and a window was created in broad ligament around ovarian artery and vein. The ovarian blood vessels were crushed with hemostat and ligature of absorbable suture material was tied and hemostat was removed, simultaneously, so that the ligature comes into the groove created by hemostat. Two clamps (hemostats) were then placed between this ligature and the ovary E and the pedicle was sectioned between the two. Hemostat near to ligature was removed and the quality of the hemostats checked; the long ends of the suture material on the ovarian pedicle were cut. The ovarian pedicle was held throughout the procedure with a hemostat.

The broad ligament was torn the middle above the uterine artery. This was followed by sectioning of the uterine cervix after ligation of the uterine arteries and veins separately as well as by trans-fixation suture. The cervix was crushed with artery forceps and another hemostat was placed just above the first and the cervix sectioned with a scalpel between the two hemostats. The sutured stump was returned to the abdominal cavity after checking the quality of hemostats. Peritoneum and Linea Alba were sutured with interrupted pattern and subcutaneous connective tissue with simple continuous pattern, using PGA. Finally, the skin was sutured mattress sutures using nylon. The wound was then disinfected with antiseptic solution and protected with gauze bandage and adhesive tape.

Intravenous fluid therapy was administered with isotonic saline perioperatively. The animals were then placed on antibiotic and analgesic therapy for at least 5 days after surgery. The sutures were removed after 10 days in uncomplicated cases.

# 4 c) Statistical Analysis

All data were summarised using descriptive statistics and values reported as mean ±SE. Continuous variables were then categorised to facilitate analysis. Dependent variable was alive (yes/no). Significance was P<0. 05.

# 5 III.

# 6 Results and Discussion

Thirty five healthy dogs were presented for elective ovariohysterectomy. All animals at the admission were in the age of 6 months to 9 years but 28 dogs were 1 to 3 years old. The most common breeds presented for neutering were Spitz and Pomeranian. The intensity breeds presented may be because of the popularity of such small breeds in the local area. Most of the animals were presented during their pro-oestrus or oestrus phases and the surgery performed few weeks later. Other owners had preset plan to spay their dogs and some among them believed female dogs should have a litter before being spayed. Hygiene issues and the nuisance created by the dog during pro-oestrus and oestrus stages subjected the owners to opt for spaying during these stages. Some owners (apart from these 35 owners) didn't report after taking the scheduled date, may be due to their concern about the risk in anesthesia and surgery for their pet, cost of the surgery and post operative care.

Complications that have been reported secondary to ovariohysterectomy in the dog and cat include hemorrhage, ovarian remnant syndrome, stump pyometra, stump granuloma, fistulous draining tracts, eunuchoid syndrome, accidental ureteral ligation, and oestrogen responsive urinary incontinence [4,5]. In the previous reports, surgical complication rates associated with ovariohysterectomy in healthy dogs and cats have been reported to range from 6.2% to 20.6%. In the present study, complications were observed in seven out of thirty five animals (7/35). Intra-abdominal hemorrhage is one of the most common complications secondary to an ovariohysterectomy, and can even result in death of the patient if severe [5]. Intraabdominal hemorrhage was observed in total of three dogs and it occurred only after releasing the ligated ovarian pedicle and cervical stump back into the abdominal cavity. In one animal hemorrhage was observed only during surgery and there was no oozing of blood though incision line after closing the abdomen. Hemorrhage can occur from the ovarian pedicle, uterine pedicle or from the broad ligament but in this study source of location of the bleeding was not ascertainable. Hemocoagulase was sprayed locally as well administered intravenously which successfully controlled the hemorrhage. In another animal there was little oozing of blood through incision line after closure of abdominal cavity which decreased progressively till it stopped after 12 (next day) hours and in the third animal little oozing continued up to 24 hrs. Post operative intra abdominal hemorrhage in these cases was confirmed by abdomenocentesis. In these two animals hemocoagulase administration as well as abdominal pressure bandage was applied till blood stopped oozing through incision line. Hemocoagulase is isolated from venom of Bothrops atorox or Bothrops jararaca contains two different types of enzymes acting on blood coagulation; of which one has thrombin like action and the other one has thromboplastin like effect. It acts by conversion of fibrinogen to fibrin polymer and promotes the interaction of platelets with fibrin clot to coagulate the blood [6]. Abdominal pressure bandage successfully stopped postoperative bleeding in ovariohysterectomy [7].

Abdominal wound dehiscence was observed in 3 animals, out of which two were Spitz and one Labrador. Wound dehiscence is one among the common complications of surgical wounds, involving the breaking open of the surgical incision along the suture. Problems associated with incisional healing following ovariohysterectomy, is sometimes far exceeding the incidence of intraoperative hemorrhage [7]. Malnourishment, sudden increase in abdominal pressure, infection, Obesity, diabetes and hypersensitivity to catgut can be the various factors causing suture dehiscence. These wounds were derided and sutured again. One Spitz in which abdominal suturing done with catgut was presented with wound dehiscence, instead of PGA, was presented three times and every time re-sutured with PGA. Third time all the catgut was removed; edges derided and sutured using PGA. The wound healed successful.

Ovarian remnant syndrome occurred in one dog. The dog developed the clinical signs of pro-estrus and oestrus signs like vaginal discharge, vulvar swelling, behavioural changes and even mated with a dog. Residual ovarian tissue most commonly results from incomplete resection of the ovary during the initial surgery or fragments of ovarian tissue can become revascularized through the mesentery or omentum, maintaining functional status indefinitely [8,9]. This complication is usually attributable to surgical error. Techniques that may predispose to ovarian remnant syndrome include inadequate exposure of the ovarian pedicles resulting in poor visualisation, inaccurate placement of clamps or ligatures, or accidental separation of a portion of the ovary with subsequent loss of the tissue in the abdomen. This syndrome has been observed even after ovriohysterectomies carried out by experienced veterinarian [8,9]. This syndrome results into signs of pro-estrus, oestrus, and (rarely) false pregnancy and cornification of vaginal epithelial cells during pro-estrus or oestrus demonstrated on cytology as well [10].

# 7 a) Haematobiochemical parameters

Haematobiochem ical parameters on admission are summarised in table 1. The stress response to surgery is characterized by increased secretion of pituitary hormones and activation of the sympathetic nervous system [11]. Release of corticotrophin from the pituitary stimulates cortisol secretion from the adrenal cortex. In the pancreas, glucagon is released and insulin secretion may be diminished. Blood glucose concentrations increase after surgery begins. Haematology shows alteration under stress. PCV decreased nonsignificantly ($p>0.05$ and Hb decreased significantly ($p<0.05$). The decrease in haemoglobin and PCV levels might be due to due to shifting of fluids from the extravascular compartment to the intravascular compartment in order to maintain the cardiac output in the animals [12], haemodilution in response to fluid therapy [13] and due to dexmedetomidine which has been shown to preserve blood flow to the most vital organs (brain, heart, liver and kidney) at the expense of organs like skin and pancreas [13]. Similar findings were also observed in earlier studies [14,15]. TLC decreased significantly in the postoperative period from the baseline; however, there was a negligible change in neutrophils count. Negligible changes in neutrophils count can be attributed to dexmedetomidine, which directly (inhibiting neuroendocrine response) or indirectly (sedation and analgesia) obtund the stress response when administered systemically. A significant decrease in TLC might be due to haemodilution.

There was nonsignificant ($p>0.05$) decrease in plasma creatinine concentration. Preservation of blood supply to vital organs by dexmedetomidine [13] and continuous intravenous fluid infusion might have been responsible for adequate renal blood flow and enough glomerular filtration rates to decrease plasma creatinine values but maintaining it near the baseline. Insulin also decreased, although, nonsignificantly ($p>0.05$). The decrease in insulin concentrations may be partly by alpha-2 adrenergic inhibition of beta cell secretion. In addition, there is a failure of the usual cellular response to insulin, the so called 'insulin resistance', which occurs in the perioperative period [16].

Cortisol concentrations have been associated with a variety of surgical procedures conducted under anaesthesia in dogs [17,18]. Dexmedetomidine obtunds stress response and a delayed ACTH and cortisol response has been recorded in previous studies in dogs undergoing ovariohysterectomy in which medetomidine had been administered preoperatively [19]. In this study cortisol increased but nonsignificantly. Dexmedetomidine prevented the extreme rise in cortisol levels by directly (inhibiting neuroendocrine response) or indirectly (sedation and analgesia) obtunding the stress response. Blood glucose concentrations increased significantly ($p<0.05$) over base values in post operative period. Blood glucose level increases just after the start of surgery due to cortisol and catecholamine mediated gluconeogenesis and glycogenolysis as well as due to decreased peripheral use of glucose [16]. The usual mechanisms that maintain glucose homeostasis are ineffective during perioperative period. Alpha-2 agonists have been reported to induce an increase in serum glucose by suppressing insulin release, stimulating glucagon release [20,21].

# 8 IV.

# 9 Conclusion

From the present study it can be concluded that Complications after ovariohysterectomy has been seen in surgeries carried out by experienced surgeons. Surgeons must be prepared for such complications. Stress response to surgeries was obtunded to a greater extent by dexmedetomidine when given as a component of basal anaesthesia. This prevented the stress related neutrophilia and extreme increase in cortisol concentration. Blood glucose levels still increased significantly due to direct effects of dexmedetomidine on pancreas. Blood supply to vital organs

like kidney was well maintained by dexmedetomidine and fluid therapy and thus prevented the extreme changes in creatinine in blood.

V.

# .1 Acknowledgements

The authors are thankful to the staff in polyclinic IVRI for their kind help.

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[Table 1: Mean (± SE) haematobiochemical profile before and after elective ovario-hysterectomy in healthy dogs] *Table 1: Mean (± SE) haematobiochemical profile before and after elective ovario-hysterectomy in healthy dogs*,

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