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RESEARCH ARTICLE

Two Different Port Placement Models and Ovarian Pedicle Hemostasis Techniques in Laparoscopic-Assisted Ovariohysterectomy - Bitches

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ABSTRACT

A study was conducted on 12 bitches divided into two groups of six animals each to compare in terms of laparoscopic-assisted ovariohysterectomy techniques with three ports on the ventral midline (Group A) and two ports on paramedian and one port on midline (Group B). Ovarian pedicle haemostasis was achieved by endoclip application (Group C) or electro-cauterization (Group D) in six bitches of each group. The group combinations were denoted as AC, AD, BC and BD respectively. Surgeons' positions, access to ovary and uterus, portal introduction of instruments, endoclip application, electro-cauterization, duration of hemostasis and transaction of ovarian pedicle, total duration of surgery, total carbon dioxide utilization, intra-operative and post-operative complication were studied. Both the techniques employed for ovarian pedicle hemostasis were effective. Group BD port placement model did not necessitate change in position of the surgeon and assistant surgeon. The duration of surgery and carbon dioxide utilization was less in AC, followed by BD. We found that endoclip application in group A port placement model and electro-cauterization in group B port placement model was found to be the most appropriate procedure for laparoscopic-assisted ovariohysterectomy. Both the techniques employed for ovarian pedicle hemostasis were effective however; electro-cauterization technique was simple and quick to perform.

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INTRODUCTION

Laparoscopic-assisted ovariohysterectomy is a minimally invasive surgical procedure. This involves many types of machinery such as monitor, electronic CO_2 endoflator, light source, video camera, camera control unit and laparoscopic instruments with long shafts. Such man-machine environment created mental and physical challenges for the operating team. When changes were brought in surgeon's position, the ergonomic factors associated with the operating room set up varies causing stress to the surgeon while performing the surgery (Ramon Berguer, 1999). In Veterinary surgery, although the procedure for laparoscopic-assisted ovariohysterectomy has been established and clearly defined about what has to be done and what should not be done, now it is time to think about improving surgical comfort. That is to identify the laparoscopic procedure which is ergonomically more suitable to the surgeon, so that the surgeon can perform the surgery more efficiently at ease. This study was conducted to compare two different port placement models and to evaluate the effectiveness of ovarian pedicle hemostasis techniques during laparoscopic-assisted ovariohysterectomy. Hence, this study will help to evaluate and adopt a better surgical technique in clinical cases.

MATERIALS AND METHODS

Twelve (n=12) intact, healthy, young, non-pregnant female dogs, weighing 10-20 kg, referred to Small Animal Clinics-Out Patient-Surgery Unit for ovariohysterectomy, were subjected to this study. The twelve bitches were divided into two groups of six animals (n=6) each to compare laparoscopic-assisted ovariohysterectomy techniques with three ports on the ventral midline (Group A) and two ports on paramedian and one port on midline (Group B). These six bitches in each group were again randomly, equally reallocated to either of the two techniques of ovarian pedicle hemostasis i.e., endoclip application (Group C) and electro-cauterization (Group D). The group combinations were denoted as AC, AD, BC and BD respectively.

The laparoscopic operating instruments (KARL STORZ® GmbH & Co.KG, Tuttlingen, Germany) and a telescope (Telescope of 0°, 5 mm diameter and 29 cm length) were pre-soaked in 2.4% glutaraldehyde solution (Endomax, Manufacturer Bioshield, Mumbai, India) for 30 minutes in a stainless steel tray. Prior to use, the instruments were rinsed with sterile water and wiped dry with sterile gauze. The general surgical instruments were autoclaved at 121°C at 10 psi for 15 minutes. Pre-operatively, the dogs were fasted by withholding food for 12 hours and water for 6 hours.

All the animals were premedicated with Tramadol (2 mg/kg, im.), induced with Propofol (5mg/kg, iv.) and Diazepam (0.2 mg/kg, iv.), and maintained with 1.5-2% of isoflurane in a semi closed circuit anesthetic apparatus with oxygen. Ringer's lactate was infused and ceftriaxone (20 mg/kg, iv.) was administered as antibiotic. The dog was placed in dorsal recumbency and all the limbs were secured to the table. Mobile video cart with color monitor, video camera, insufflator and light source were kept on the cranial side of the dog. Electrosurgical unit was placed on the left side of the patient. The anesthetist's position was on the left side of the dog close to the anesthetic apparatus. Surgeon and assistant surgeon's position varied based on the port placement model and the ovarian pedicle hemostasis technique performed.

Veress needle was introduced 2-3 cm behind the umbilicus into the abdomen. Pneumoperitoneum was created using carbon dioxide endoflator at the rate of 1-2 ml/ min and the abdominal pressure was maintained at 10-12 mmHg. In group A, three ports were created along the midline of ventral abdomen (Fig. 1). The first port was made 5 cm cranial to umbilicus. Skin incision of 5-6 mm was made and Ternamian EndoTIP cannula (6 mm) was introduced into the abdominal cavity. The telescope (5 mm) was introduced through the port and it acted as camera port initially until all ports were made. Under the telescopic guidance, middle port was formed by extending the incision created for Veress needle 2 cm below the umbilicus. Similarly, 10 mm incision was made to create the caudal port 2-3 cm in front of the pubis and 10 mm trocar was introduced. Care was taken not to accidentally puncture the urinary bladder.

In group B, two paramedian ports (1 cm lateral to the row of tits behind umbilicus) and one port on ventral midline in the form of an inverted triangle were created (Fig. 2). The first port was made on the left paramedian region and 5 mm telescope was introduced into it. Under the telescopic guidance, the next paramedian port was made on the right side. Similarly, 10 mm incision was made to create the caudal port 2-3 cm in front of the pubis and 10 mm trocar was introduced. Click'line grasping forceps or Click'line curved dissecting and grasping forceps was introduced depending on the group and the ovarian pedicle to be handled.

Fig. 1: Port placement in Group A.

Fig. 2: Port placement in Group B.

In group AC and AD, both surgeon and assistant surgeon were positioned together on same side of the dog opposite to the ovarian pedicle involved (Fig. 3). Then, they both shifted to the left side of the dog for performing the procedure on the right ovarian pedicle. In group BC, the surgeon was positioned towards the left caudal end of the dog and the assistant surgeon was on the right side of the dog while handling the left ovary. Both the surgeon and assistant surgeon changed their position to the opposite side for handling the right ovary (Fig. 4). In group BD, the surgeon was positioned on the caudal end of the dog, directly facing the video monitor for both the ovarian pedicle and the assistant surgeon was on the right side of the dog (Fig. 5).

The patient was tilted to right lateral recumbency by 45° first to locate the uterine horn and the left ovarian proper ligament was grasped with Click'line grasping forceps and fixed by closing the ratchet. In group C, the reusable endoclip applicator loaded with endoclip was introduced through the caudal port and two endoclips were applied on the ovarian pedicle and then transected. In group D, electro-cauterization of the ovarian pedicle was achieved by placing the jaws of the Click'line curved dissecting and grasping forceps connected to electrosurgical unit through the monopolar connector pin.

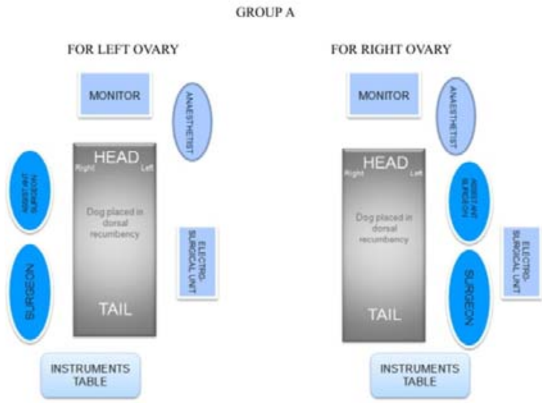

Fig. 3: Surgeons' position in group A for endoclip application (group AC) and electro-cauterization (group AD).

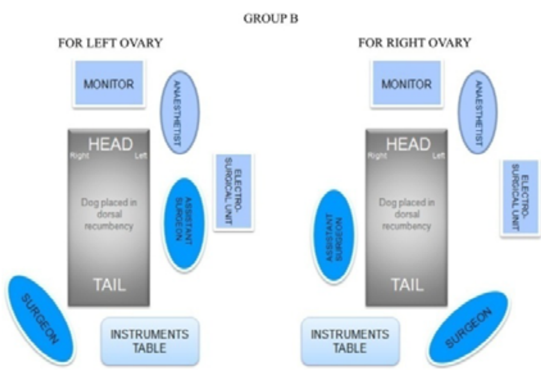

Fig. 4: Surgeons' position in group B for endoclip application (group BC)

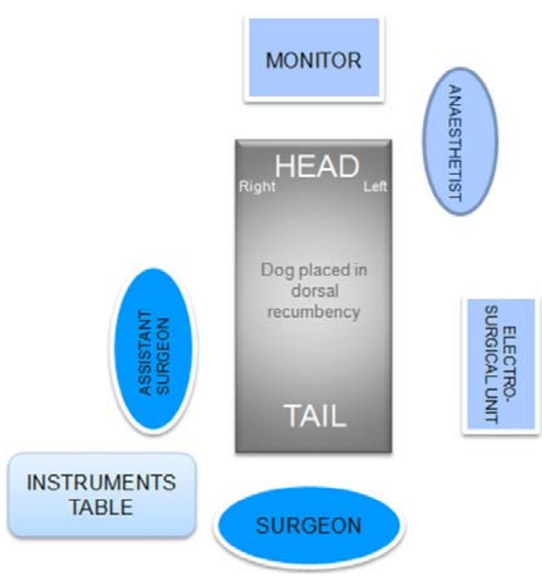

Fig. 5: Surgeons' position in group B for electro-cauterization (group BD) in both ovaries

The broad ligament and associated mesentery was gradually stripped down. The patient was then tilted to left lateral recumbency by 45^o and either endoclip application or electro-cauterization was performed on the right ovarian pedicle. After both the ovarian pedicles were freed after transection, proper ligament was grasped with Click'line grasping forceps through the caudal port and gentle traction was applied. With firm hold on the uterine horn with ovary, forceps and cannula were withdrawn from the abdomen. Gentle traction was applied to exteriorize the uterine body, the other uterine horn and ovary. The uterine body was then clamped, ligated using a transfixing suture and transected. The uterine stump was replaced into the abdomen and was deflated after all the cannula were removed. Muscles and subcutaneous tissue was sutured with PGA No.1-0 by one or two horizontal mattress. Skin incision was closed with silk by cross mattress suture. Post operatively; the port sites were dressed on alternate days with bandage for a week. Skin sutures were removed on the seventh post operative day.

Surgeons' position, access to ovary and uterus, portal introduction of instruments, endoclip application, electro-cauterization, duration of hemostasis and transection of ovarian pedicle, duration of surgery and total carbon dioxide utilization were recorded. Intra-operative and post-operative complication if any was recorded in all the groups. The data obtained were analyzed statistically with student't' test (Snedecor and Cochran, 1995).

RESULTS

The kidney and uterine horns served as landmark for locating the ovary and tilting of the dog laterally aided in better visualization of ovarian pedicle and its blood vessels. In Group BD alone, after grasping the proper ligament, the dog was brought back to dorsal recumbency to carry out the procedure. Triangulation of instrument to the ovarian pedicle was also better in group BD.

For both group combinations AC and AD, cranial port was utilized as camera port and for BD, caudal port was the camera port while handling both right and left ovarian pedicles (Fig. 6). For group combination BC, left paramedian port was used as camera port for left ovary and right paramedian port for right ovary. In AC, for endoclip application, Click'line grasping forceps (1×2 teeth) was introduced through the middle port to grasp the proper ligament, whereas in AD for electro-cauterization, it was introduced through caudal port. In group B, this grasping forceps was introduced through right paramedian port for grasping left ovary and left paramedian port for the right ovary for endoclip application (BC) in all animals. For electro-cauterization (group D), grasping forceps was introduced through the right paramedian port for all animals (BD) for both right and left ovary. Endoclip application was achieved through the caudal port in all animals of group A and B (i.e., AC and BD). Electro-cauterization of ovarian pedicle was convenient through the middle port in all animals (AD) and through left paramedian port in group BD for both right and left.

Two endoclips were applied to the ovarian pedicle to obtain hemostasis in all cases and transection was with scissors between them (Fig. 7). In case of prepubertal dogs, clip application was easier and transection was with scissors. In dogs which had whelped (BC), apart from endoclip application and electro-cauterization was additionally required (Fig. 8). In group B, crossing over of the endoclip applicator and Click'line grasping forceps (1×2 teeth) was observed while placing the endoclip to the right ovarian pedicle.

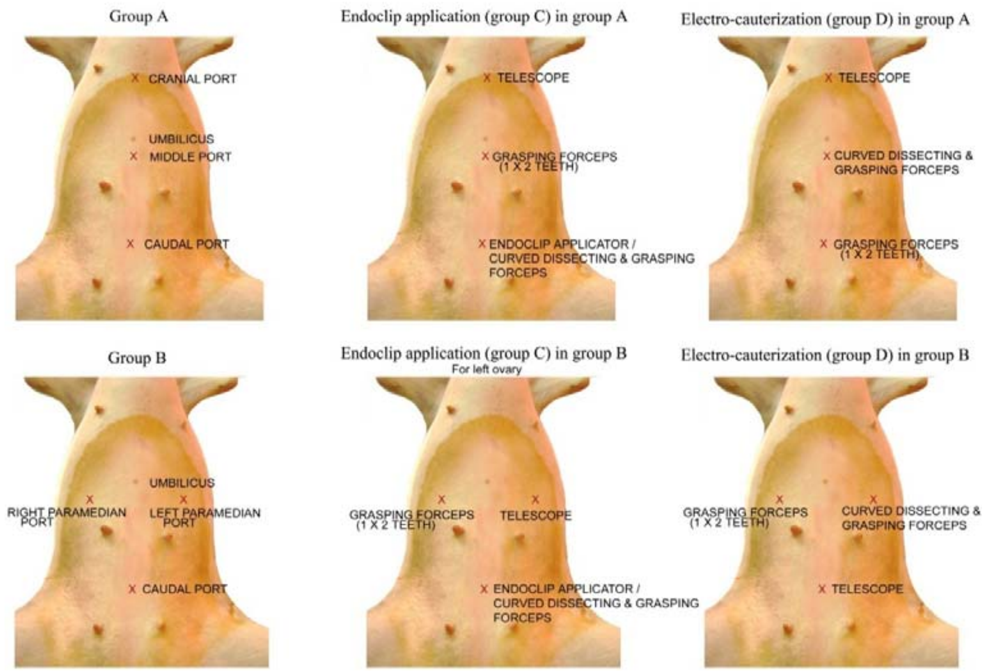

Figure 6: Portal approach for different groups and the instruments introduced through the ports.

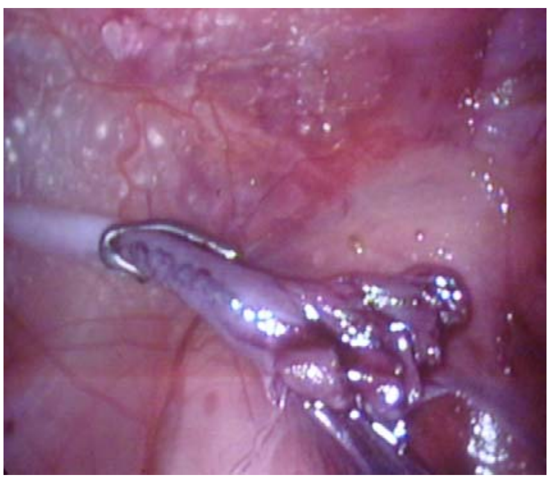

Fig. 7: Ovarian pedicle after transection with endoclip

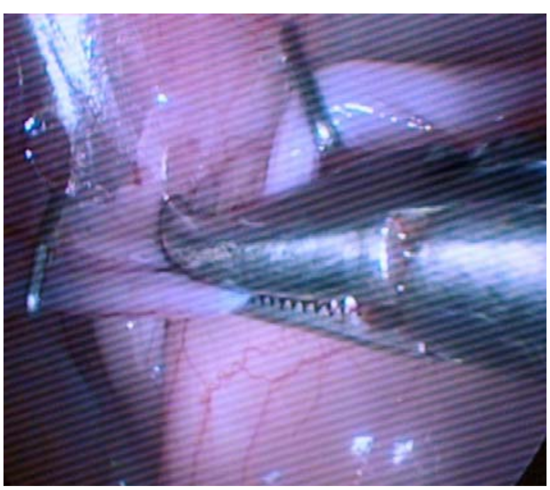

Fig. 8: Electro-cauterization between the end of the endoclip.

For electro-cauterization and resection of ovarian pedicle, a maximum monopolar coagulation current of 60 watts and cutting current of 105 watts was found effective. In dogs which had whelped, more fat deposition was noticed on the ovarian pedicle and the duration for applying the Click'line curved dissecting and grasping forceps was also increased.

The duration of hemostasis and transection of ovarian pedicle was calculated from the electro-cauterization or endoclip application of the both right and left ovarian pedicle until transaction. The mean total time taken in minutes in the group combinations AC was 25.00±4.58, AD was 21.33±2.03, BC was 28.67±2.40 and BD was 11.67±2.33. Mean total time taken in minutes in the overall group A, B, C and D were 23.17±2.39, 20.17±4.09, 26.83±2.46 and 16.50±2.57 respectively. Statistically, significant difference was noticed between group C and D and also between the group combination BD and all the other group combinations. The total duration of surgery was calculated from the first skin incision to pierce the Veress needle into the abdomen to the last skin suture. The mean total time taken in minutes to complete the procedure in the group combinations AC was 78.33±11.67, AD was 91.67±10.93, BC was 95±7.64 and BD was 82.33±12.47. Mean total time taken in minutes in the overall group A, B, C and D were 85±7.75, 88.67±7.13, 86.67±7.26 and 87.00±7.70 respectively. Statistical analysis showed no significant difference between four combinations and in between the groups.

The mean total carbon dioxide utilized in liters in laparoscopic-assisted ovariohysterectomy in different group combinations were 50.80±8.70 in AC, 79±8.89 in AD, 85±11.02 in BC and 77.33±12.99 in BD. Mean total carbon dioxide utilized in the overall group A, B, C and D were 64.90±8.41, 81.17±7.81, 67.90±9.89 and 78.17±7.05 respectively. Statistically no significant difference was found between the group combinations and among the groups.

In one case of group combination AC, uncomplicated bleeding from the uterine horn after accidental, iatrogenic traumatic injury to the horn, adjacent to proper ligament by Click'line grasping forceps (1×2 teeth) was noticed. In another case in group combination AD, mild erythema was noticed around the middle port and subcutaneous emphysema was noticed in the thighs which subsided eventually without treatment on second post operative day.

DISCUSSION

Freeman (1999) explained the location of surgeon, assistant, camera operator and the equipment in all the laparoscopic surgery performed. Thus, this parameter helped in identifying the ergonomically suitable port placement model for laparoscopic-assisted ovariohysterectomy. In this study, change in position of the surgeon and assistant surgeon occurred when the side (right or left) of the ovarian pedicle handled differed in group combination AC, AD and BC. Such changes lead to disturbance in handling the laparoscopic instruments as the light cable, connecting cord and camera cord got entangled mostly. Also, it took time for the surgeons to adapt and to refocus the new surgical field. These ergonomic problems were overcome in group combination BD, as the surgeon was positioned at the caudal end of the dog, in-line with the monitor which remained the same throughout the procedure. Such position also prevented the axial rotation of the spine of surgeon while performing the surgery and thereby reducing the stress to the surgeon (Van Det *et al.*, 2009). Accordingly, the duration of surgery was less and the port placement model in group combination BD was more comfortable to the surgeon and the operating team. Apart from this, Austin *et al.* (2003) reported paradoxical movements while handling the left side of ovarian pedicle, when the monitor was placed on the caudal end of the dog and the surgeons were on the sides as the laparoscopic instruments were pointing towards the cranial end of the dog. Such problems were also avoided in this study by placing the monitor cranially as suggested by Proot (2008).

Dogs were placed on dorsal recumbency and then tilted to right or left recumbency by 45^{o} and there was no need for Trendelenburg positioning of dogs. Nevertheless, there was access to ovary and uterus without hindrance of other organs in this position. Once the proper ligament was grasped by Click'line grasping forceps (1×2 teeth), the ratchet was closed. This caused adequate exposure of the ovarian pedicle and it was kept elevated by applying upward and caudal tension on the proper ligament, whereas Devitt *et al.* (2005) had applied transabdominal suspension sutures for the similar purpose. The hold on the target organ was not lost during the procedure until the ratchet was opened. Triangulation of instrument was very important in laparoscopic procedures to perform the surgery at ease (Davidson *et al.*, 2004). When the instruments were introduced through the paramedian port in group BD, the triangulation of instruments was better and the manipulation was done more comfortably. Exteriorization of the uterus and ovary was carried out through the caudal port in all the groups as the body of the uterus was easily accessible through this port which was cranial to the pubis.

The midline port model of group A for laparoscopic-assisted ovariohysterectomy was also followed by Monnet *et al*. (2008) and Mayhew and Brown (2007). In Group B, the imaginary line joining the three ports formed an inverted triangle (▼). Laparoscopic-assisted ovario-hysterectomy could be performed using group B (▼) model more conveniently, in order to expose the body of the uterus while exteriorization through the caudal port in front of the pubis. Mostly camera port was in the umbilical port (Mayhew and Brown, 2007) or in the cranial port (Monnet *et al*., 2008). In case of group combination AC and AD; cranial port was the camera port whereas for group combination BD, caudal port was the camera port. Though the camera port on the caudal end was quite unique from the other authors' procedure, visualization of uterine horn and ovary was sufficient to perform the procedure. No hindrance was observed with the other laparoscopic instrument's movement. When paramedian port was used as camera port in group combination BD, the direction and the diameter of the ovarian blood vessels in the pedicle was very clearly visible.

Primary port was created using Ternamian endoTIP in both group A and B, aiming to avoid damage to the intra-abdominal organs after insufflation. Though the port for Click'line grasping forceps (1×2 teeth) varied in all the group combination AC, AD, BC and BD, the proper ligament was grasped conveniently. There was no change in the port for this instrument between the ovaries except in BC. For electro-cauterization in group AD and BD, two kinds of grasping forceps connected to electrosurgical unit was used and instrument exchanges were minimal in this group saving time.

Hemostasis of the ovarian pedicle by applying endoclip was supported by certain authors (Dharmaceelan *et al.* 2000 and Mayhew and Brown, 2007). More time was spent on withdrawing the endoclip applier and reloading it for the next endoclip application. There was no crossing over of instruments when endoclip was applied in group B port placement model. In a case, after applying two endoclips on the right pedicle, transection was done with scissors between them, but slight bleeding was noticed from the pedicle. Thus, another endoclip was applied to the right ovarian pedicle to ensure hemostasis. In prepubertal dog, since the ovarian pedicle was smaller in size, clip application was easier and it did not warrant electro-cauterization. In dogs which had whelped, the diameter of the blood vessel was bigger and minor blood vessels originating from large ovarian pedicle required electro-cauterization after endoclip application for ensuring complete hemostasis.

Electro-cauterization of the ovarian pedicle was done with Click'line curved dissecting and grasping forceps. The jaws were kept grasping a small portion of pedicle until it turned white in the coagulation mode (stage of desiccation) followed by cutting mode (stage of vaporization). It was observed that whenever there was more fat deposition, it took more time for cauterization. When compared with other methods of pedicle hemostasis, electro-cauterization required less time (Dharmaceelan *et al.* 2000). Fumes created during electro-cauterization did not entirely conceal the anatomical details. When more fumes were noticed in two cases, vent in cannula was opened to let the carbon dioxide outside. Then the flow rate of carbon dioxide was increased to maintain pneumoperitoneum, eventually the objects appeared clear under telescopic vision.

In group A port placement model, the mean time taken in total duration of surgery for group combination AC was less than AD. In group B port placement model, it was the opposite i.e., the mean time taken in total duration of surgery for group combination BD was less than BC. Such a kind of result was quite different from the other authors. This was because they have compared only different ovarian pedicle hemostasis techniques like surgical wire ligature, sutures, bipolar vessel sealing device, harmonic scalpel and clip application but not port placement model (ergonomics). The duration of hemostasis and transaction of ovarian pedicle was least in the group combination BD when compared to other group combinations as the instrument exchanges were minimal. Significant difference was also noticed between endoclip application and electro-cauterization and electro-cauterization took significantly less time As the duration of surgery increased, the total carbon dioxide used for maintaining pneumoperitoneum also increased. Statistically, no significant difference was noticed between the groups. The duration of surgery for the first case in every group combination was more and it reduced in the subsequent cases.

Spleenic puncture or laceration was the most common intra operative complication reported during laparoscopic- ovariohysterectomy by Davidson *et al.* (2004), Hancock *et al.* (2005) and Mayhew and Brown (2007). This was avoided by piercing the Veress needle caudally, saline test and by using Termanian EndoTip for primary port creation. Next possible chance of haemorrhage was from the ovarian pedicle. Hemostasis of ovarian pedicle was better in both electro-cauterization and endoclip application. The bleeding from the uterine horn in one dog of group combination BC was due to accidental inclusion of uterine horn while grasping at the proper ligament with Click'line grasping forceps (1×2 teeth). This could have been avoided by the usage of atraumatic grasper. Post operative complication was minimal in laparoscopic- assisted ovariohysterectomy. In a case, mild erythema in the middle port and emphysema was noticed which subsided in two days without supportive therapy. Incision wound dehiscence or discharges or swelling was not noticed in any of the cases.

Conclusion

Thus, in the present study, both the techniques employed for ovarian pedicle hemostasis were found to be effective. However, electro-cauterization technique was simple and quick to perform when compared to endoclip application. Though there were two techniques of ovarian pedicle hemostasis in this study, the difference in duration among the four group combinations could be because of the all factors associated with ergonomics i.e., port placement, operation theatre layout, access to organs, portal approach, movement of surgeons, reproductive status of the dog, hemostasis technique and comfort of the surgeon to perform laparoscopic-assisted ovario-hysterectomy. Hence, the ergonomically suitable model among the two groups was group A for endoclip application and group B for electro-cauterization in laparoscopic-assisted ovariohysterectomy.

REFERENCES

Austin B, OI Lanz, SM Hamilton, RV Broadstone and RA Martin, 2003. Laparoscopic ovariohysteretomy in nine dogs. J Amer Anim Hosp Assoc, 39: 391-396.

Davidson EB, HD Moll and ME Payton, 2004. Comparison of laparoscopic ovariohysterectomy and ovariohysterectomy in dogs. Vet Surg, 33: 62-69.

Devitt CM, RE Cox and JJ Hailey, 2005. Duration, complications, stress and pain of open ovario-hysterectomy versus a simple method of laparoscopic-assisted ovario hysterectomy in dogs. J Amer Anim Hosp Assoc, 227: 921-927.

Dharmaceelan S, TN Ganesh and DWP Archibald, 2000. Laparoscopic sterilization in bitches: Comparison of three techniques. Indian J Vet Surg, 15: 65-68.

Freeman LJ, 1999. Minimally invasive surgery of the reproductive system, in: Veterinary endosurgery. Mosby, Inc. USA, pp: 6-8.

Mayhew PD and DC Brown, 2007. Comparison of three techniques for ovarian pedicle hemostasis during laparoscopic-assisted ovariohysterectomy. Vet Surg, 36:541-47.

Monnet E, P Lehermette and D Sobel, 2008. Rigid endoscopy: Laparoscopy, in: BSAVA manual of canine and feline endoscopy and endosurgery. BSAVA, England, pp: 167-171

Proot, 2008. Laparoscopy part 5: laparoscopic ovariectomy in the dog. UK Vet, 13: 19-22.

Ramon Berguer, 1999. Surgery and ergonomics. Arch Surg, 1134: 1011-1016

Snedecor GW and WG Cochran, 1995. in: Statistical Methods (7th ed.). Ames, Iowa: Iowa State University Press.

Van Det MJ, WJHJ Meijerink, C Hoff, ER Totte and JPEN Pierie, 2009. Optimal ergonomics for laparoscopic surgery in minimally invasive surgery suites: a review and guidelines. Surg Endosc, 23: 1279-1285.