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Effect of vessel sealant for open ovariohysterectomy in bitches with pyometra

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Abstract

The study was carried out to find the effect of bipolar electrothermal vessel sealant device on surgical time, blood loss and intraoperative complication during open ovariohysterectomy of pyometra affected bitches. The present study results showed, mean surgical time (minutes) for haemostasis of left and right ovarian pedicle was 02:44±00:27, 02:18±00:27 with bipolar Vessel sealant device and 4:41±00:40, 05:06 ± 00:51 with conventional suture ligation respectively. The mean blood loss from the ovarian pedicle in milliliter was 2.008±0.152 with suture ligation and 0.000 with EBVS without any complication. Based on this study reports we conclude that electrothermal bipolar vessel sealant device was effective and safe with reduced the surgical time and blood loss without any complication.

Keywords: Bitch, haemostasis, ovariohysterectomy, pyometra, vessel sealant

Introduction

Electrothermal bipolar vessel sealer is a modification of electrosurgical technologies [1] was developed for use in both open and laparoscopic surgery to overcome the other systems like bipolar electrosurgical energy and ultrasonic thermal energy, they will sealed the vessels only up to 2 mm and also take long time, but EBVS system has been used to seal large tissue bundle and vessel up to 7 mm diameter within a shorter period [2]. EBVS method was used in place of suture, clips and other ligation methods to reduce the complications. The system detect the types of tissue within the forceps jaws by micro processor present in the instrument jaws and deliver the appropriate amount of pressure and energy near to seal the vessels, after sealing is completed the audio signal from the generator produced [3].

Janseen *et al.* (2012) [4] reported that number of haemostatic technique and device has been developed, but vessel sealing device preferred for both open and laparoscopic procedure because this will reduces the cost indirectly by reducing the blood loss and shortening the surgical procedure without any complication compared to other haemostatic technique like conventional suture ligation, clips and also this system was easy to use, reliable and no difficulties were noted during the application and the device was easily placed on vessels and achieves haemostasis approximately within 20 sec [5].

Materials and Methods

Twenty four (N=24) bitches presented to the Madras Veterinary College Teaching Hospital, Small Animal Surgery Unit with a history pyometra were selected for this study and subjected to standard ovariohysterectomy by either conventional suture method (N=12) (plate 2) and or by vessel sealant method (N=12) (plate 3). The following parameters were recorded intra-operatively. The parameters were surgical and procedural time, inclusive of following, time taken for ligation of left and right ovary, total surgical time; intraoperative blood loss and intraoperative complication and the seal were intra-operatively assessed subjectively. At the end of surgery the removed portion of the ovarian pedicle collected in 10 % buffered formalin, stained with haematoxylin-eosin staining and examined under microscope to ensure the sealing of vessels and tissues sealed by electrothermal bipolar vessel sealant.

Statistical analysis

All the recorded data was tabulated and analyzed statistically as per the standard procedure

Results and Discussion

Time Taken for Ligation/ Sealing of Left and right Ovarian Pedicle

The Mean±S.E value for ligation/ sealing of left and right ovarian pedicle in minutes were 03:06±00:25, 3:52±00:33 and 01:42±00:18, 01:42±00:21 respectively (Table 1).

From the current study it was concluded that the time taken for sealing of ovarian pedicle was less compared to conventional suture ligation. This result drew adequate support from the findings of Schwarzkopf *et al.* (2014) [6] who concluded that ovarian pedicle haemostasis achieved by vessel sealant was significantly faster (2.22±0.58 minutes) than by placement of suture ligation (4.10±1.13 minutes). These results also concurred with the findings of Watts (2018) [7] who stated that surgical time for haemostasis of ovarian pedicle achieved with electrothermal bipolar vessel sealant was less compared to conventional suture ligation. Ease of handling, precise electrical output, and accurate haemostasis could have reduced the time taken for sealant in comparison with conventional method.

Total surgical time

The Mean ± S.E value for total surgical time in minutes were 38:09 ± 02:16 and 28:49 ± 01:56 in Group I and Group II respectively (Table 1). Comparatively less time was taken to complete the surgery in the Group where vessel sealant device was used compared to conventional ligation. Reduction in surgical time in the present study was in concurrence with the findings of Hagen *et al.* (2005) and Lakeman *et al.* (2012) [2, 8] who found that time taken for hysterectomy with electrothermal bipolar vessel sealant was less compared to conventional suture ligation. Mayhew *et al.* (2007) and Guedes *et al.* (2017) [9, 10] also found that surgical time with vessel sealant in laparoscopic surgery were less compared to suture, clips and laser. This result was also supported by Monarski *et al.* (2014) and Da Mota Costa *et al.* (2016) [11, 12] who found that ligation technique was a time consuming procedure.

In general, overall surgical time may be prolonged where there is a challenge in achieving the haemostasis due to deep anatomical position of ovaries, large blood vessel supplying ovaries and uterus, since most frequently they are obscured by fat, Watts (2018) [7] opined that inexperienced surgeon, large matured obese bitches, would probably increase the overall surgical time in addition to the time taken for either encircling or trans-fixation of the suture material for effective ligation. The above difficulties were not encountered in the present study due to surgeon's expertise. Moreover the time taken to ligate the ovarian pedicle through conventional suture technique was over come through usage of vessel sealant device.

Intra operative blood loss from the ovarian pedicle

The mean blood loss from the ovarian pedicle in milliliters was 2.008 ± 0.15 and 0.00 in Group I and Group II respectively (Table 2) through gravimetric method. Gravimetric method was performed to assess intra-operative haemorrhage since it was accurate and applicable in clinical setting as opined by Lee *et al.* (2006) [13].

In the present study the mean blood loss from the ovarian pedicle was absent with no incidence of rebleeding post-sealing with vessel sealant of ovarian pedicle compared to conventional suture ligation. This finding was not in accordance with the findings of Hagen *et al.* (2005) and Hefni

et al. (2005) [8, 14] who stated that there was no significant difference in blood loss between conventional suture ligation and vessel sealant method. However the findings of minimal intra-operative haemorrhage was in concurrence with findings of Ahire *et al.* (2016) [15] who recorded less haemorrhage in hemorrhoid surgery with vessel sealant device than the suture ligation method. Takada *et al.* (2005) and Prokopakis *et al.* (2005) [16, 17] stated that occurrence of rebleeding was rare after application of vessel sealant. Similar finding were recorded by Sengupta *et al.* (2001) [18] and Eroglu *et al.* (2007) [3, 18]. This could be due to molding and fusing of collagen and elastin within the vessel intrinsic to vessel wall that cannot be dislodged.

Subjective Assessment of Seal

Nine cases among twelve cases where vessel sealant was used appeared transparent with the heavy contracture of adipose tissue away from the forceps and remaining three cases appeared brown with moderate contracture of adipose tissue from the electro surgical forceps. This appearance of translucency was considered as a sign of optimal seal according to Kennedy *et al.* (1998) [19] as was observed in this study also change of colour of the ovary pedicle after application of vessel sealant device to obtain good haemostasis was prime indication for the surgeon. In the present study much of the white adipose tissue contracted away from the forceps and big vessel contracted become brown in color. Therefore adipose tissue in obese and mature animals did not interfere with the haemostasis as also observed by Watts (2018) [7] Complication

Vessel Sealant Device

In the present study no complications were observed during application of vessel sealant. This finding was in accordance with findings of Schwarzkopf *et al.* (2014) [6] who stated that vessel sealant technique had minimum complication. Thermal injury due to excessive application, generation of surgical smoke and burn due to contact of electrosurgical forceps to the skin were avoided through placement of moistened swabs between the skin and electrosurgical forceps as followed by stated by Watts (2018) [7] and also supported by finding of Mayhew *et al.* (2007) [9] who stated that complication were minimum with vessel sealing device in laparoscopic surgery compared to suture and clips.

Suture Ligation Method

The present study revealed that out of 12 cases where ovarian pedicles were ligated by conventional suture, one case had intra- operative haemorrhage from the right ovarian pedicle after repositioning the pedicle back into the abdomen which might be due to slippage of suture and increased body weight. In addition it was stated that intra-operative haemorrhage occurred more commonly during ovariohysterectomy due to rupture of the right ovarian pedicle than left ovarian pedicle as opined by DeTora *et al.* (2011) [20] which was also encountered in our present study.

Other common causes observed in retrospective studies were insufficient knot tying, large fat filled pedicle in overweight animals and insufficient laparotomy incision resulting in reduced exposure, identification and traction of the right ovarian pedicle Adin (2011) [21]. However these complications were avoided through precise laparotomy incision to facilitate adequate traction of the right ovarian pedicle and sufficient knot tying technique like modified transfixing knot followed

by triple clamp method as opined by Howe (2006) and Leitch *et al.* (2012) [22, 23].

Histopathological Assessment of Seal

Histopathological study revealed minimal coagulative necrosis with partial or complete occlusion of vessels lumen with eosinophilic coagulum (plate 4). The vessel wall showed minimal degeneration, vacuolization, absence of nuclear details of muscle and elastic fibers in the tunica media with reduction and degeneration of collagen fibers in the tunica adventitia. This partially concurred with the results of

Devriendt *et al.* (2017) [24]. These findings also corroborated with Kennedy *et al.* (1998) [19] who stated that seal microscopically appeared as preserved internal elastic lamina with crossing over of collagen bundles over the former lumen (plate 5) and Santini *et al.* (2006) [25] who found that the sealed part appeared securely fused vessel wall with minimal degeneration of surrounding tissues.

The histopathological results of the sealed tissue samples revealed adequate seal of the tissue and hence it can be hypothesized that the ovarian pedicle tissue would have also been sealed within the animal also.

Table 1: Mean±S.E of surgical and procedural times in minutes of Group – I and Group – II

Procedural time	Mean ± S.E		t-value
	Time (minutes)		
	Conventional suture ligation	Vessel sealant device	
Time taken for removal left ovary	03:06±00:25	01:42±00:18	2.736*
Time taken for to removal of right ovary	3:52±00:33	01:42±00:21	3.299**
Total time taken to complete the surgery	38:09 ± 02:16	28:49 ± 01:56	3.126**

* - Significant at P<0.05

** - Significant at P<0.01

Table 2: Mean±S.E of Blood loss from the ovarian pedicles of Group – I and Group – II

Blood loss from the ovarian pedicle (mL)	Mean ± S.E		t-value
	Conventional Suture Ligation (group-I)	Vessel Sealant Device (group-II)	
	2.008 ± 0.15	0.000 ± 0.00	13.214**

** - Significant at P<0.01

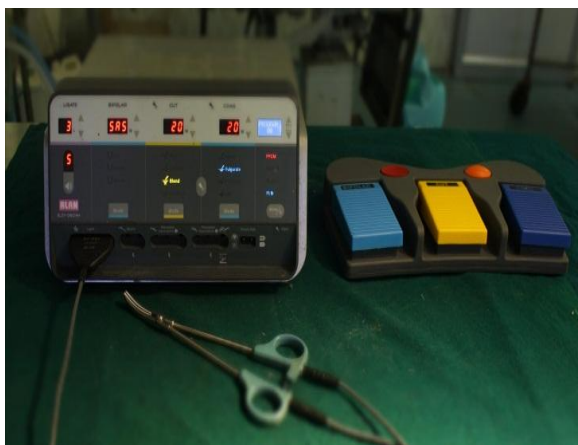


Plate 1a: Vessel Sealant Device with foot Pedal

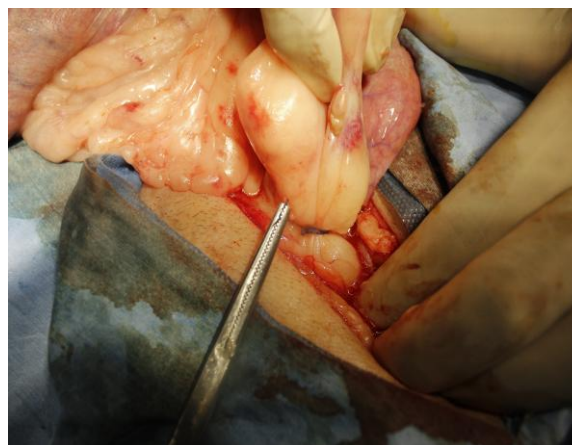


Plate 2: Ligation of Ovarian Pedicle



Plate 1b: Sealing of Ovarian Pedicle with Vessel Sealant



Plate 3: Sealing of Ovarian Pedicle with Vessel Sealant

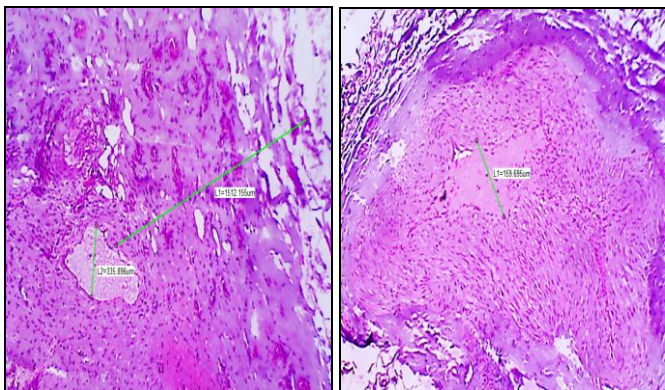


Plate 4: Histopathological Examination of Seal Occlusion of vessel lumen with eosinophilic coagulum

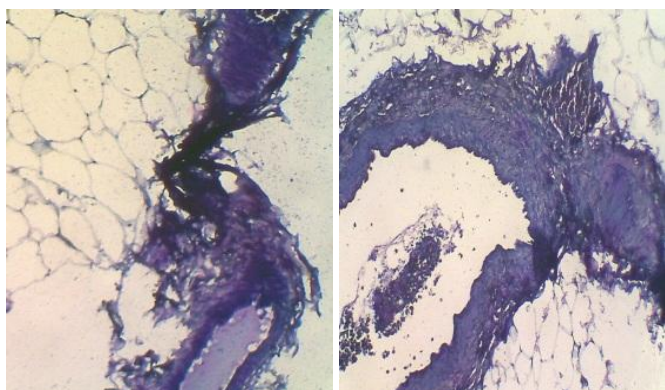


Plate 5: Occlusion of vessel lumen with collagen bundle (Collagen bundles were cross over the former lumen (fusion of collagen within the vessel wall))

Conclusion

Vessel sealant device is safe and effective for open ovariohysterectomy of pyometra bitches with less surgical time, minimal haemorrhage without complication as compared other techniques

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