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EVALUATION OF DIFFERENT SUTURING TECHNIQUES FOR CYSTOTOMY CLOSURE IN CANINES

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ABSTRACT

The experimental cystotomy was performed on 24 mongrel dogs, divided in to four groups *i.e.* group A, B, C and D comprising 6 dogs in each group. In group-A, cystotomy wound was closed in one layer by simple continues suturing pattern, in group-B, closure was made in two layers by simple continues and lembert suturing pattern and in group-C, cystomy incision was closed by one layer simple continues suturing pattern and two layers of inverting suturing patterns. Group-D was kept as control group. All three closure techniques were evaluated for leakage with the help of contrast radiography, ultrasonography, renal function tests and physiological parameters. Comparison of three techniques concluded that single-layer cystotomy closure is preferable in small animals because it ensure water tight closure with a good quality of wound healing and requires shorter time.

Key words: Cystotomy, Dogs, Suturing pattern, Sonography.

INTRODUCTION

Cystotomy is a surgical incision in to the urinary bladder which may be required for the removal of calculi, diagnosis and resection of tumors, refractory urinary tract infections, repair of ectopic ureters, for urinary diversions and ruptured urinary bladder (Brown, 2011).Varieties of suturing patterns are used for the closure of cystotomy wound. Suturing may be done in a single layer, which may include simple continuous suturing pattern (Stephen *et al.,* 2009) and simple interrupted suturing pattern (Mehl *et al.,* 2005) or it may be in a double layer which may include simple continues suturing pattern followed by cushing suturing pattern (Stone *et al.,* 1996), simple continues cushing suture (SCC) pattern followed by lembert suture (Beard, 2004) and cushing suture followed by lembert suture (Radasch *et al.,* 1990). The two layer closure is most commonly recommended for bladder closure in dogs and there is a prevailing idea that a final inverting layer is crucial to achieve a water tight seal (Abbas *et al.,* 2011), a one layer appositional closure technique is recommended for the cystotomy closure (Waldron, 2003). However, a three layer closure may be adjuncted in case of excessive hemorrhage from the bladder mucosa (Jens and Bjorling, 2001). Bladder wound attains 100% of normal tissue strength within 14-21days post operatively (Waldron, 2003) and 30 days are required for its complete re-epithelialization (Xie *et al.,* 2000).

The aim of the present study was to evaluate one-layer (simple continues sutures), two-layer (simple continues and continues lembert sutures) and three-layer (simple continues sutures and seromuscular layer by two layers, cushing suturing pattern overlapped by lembert sutures), closure techniques for cystotomy wound in dogs. Evaluation of the viability of these techniques was attained through physical findings, contrast radiography, ultrasonography and renal function tests.

MATERIALS AND METHODS

Study Site and Experimental Animals: The study was conducted at the research facility of Surgery Section, Department of Clinical Medicine and Surgery, University of Veterinary & Animal Sciences, Lahore. Experimental study was performed on 24 mongrel dogs divided in to four groups A, B, C and D comprising 6 dogs each. Their Mean age and weight was 1.48±0.44 years, 19.79±3.5 kg respectively. Dogs with normal physical, laboratory and sonographical findings were selected.

Patient Preparation and Anesthesia: The dogs were kept 8 to 12 hours off-feed and off-water prior to surgical procedure to achieve maximum anesthesia effect**.** The surgical site was clipped and shaved a day prior to surgery. All the dogs were administered Xylazine hydrochloride (Xylaz, Farvet) as a pre anesthetic at the dose rate of 0.1- 0.5 mg/kg intra muscular, (IM). Anesthetic induction was achieved with intravenous (IV) propofol @ 1-2.5 mg/kg (Pofol; Korea). After orotracheal intubation, anesthesia was maintained with isoflorane (Akhai Pharmaceuticals, Pakistan Ltd) in 100% oxygen.

Surgical intervention: A caudal midline celiotomy was performed and the bladder was identified and exteriorized manually. Urinary bladder was surrounded by moist laparotomy pads to reduce the peritoneal contamination.

In order to hold the bladder, the two stay sutures were placed 4cm apart at the dorsum of the bladder. A 3cm long cystotomy wound was created with the help of scalpel between the two stay sutures (Figure 1). The cystotomy wound was closed with a catgut suture material of size 2/0 according to the following techniques,

Group A: Cystotomy incision was closed in one layer by simple continues suturing pattern. Sutures were applied on seromuscular layer without penetrating the mucosa (Figure 2).

Group B: Cystotomy wound was closed in two layers by combined appositional and inversion type of suturing pattern. In the first layer mucosa was sutured by simple continues suturing pattern. In the 2nd layer seromuscular layer was closed by continues lembert suturing pattern.

Group C: In dogs of group C, Mucosa was sutured by simple continues suturing pattern and seromuscular layer was sutured in two layers by cushing suturing pattern overlapped by lembert suturing pattern.

Group D: Dogs were kept as control. Only laparotomy was performed without conducting the cystotomy. Various parameters of other groups were compared with control group.

Suturing Time: Suturing time was recorded from the placement of first suture over cystotomy wound to the placement of the last suture.

Evaluation of Suturing Techniques: Dogs were kept for period of four weeks. Suturing techniques used in this project were evaluated for leakage by physical examination, contrast radiography, ultrasonography and postmortem examination.

Evaluation through physical examination: Physical parameters included *i.e.* tachycardia, tachypnea, hematuria, dysuria, abdominal pain and vomiting. Abdominal cavity was regularly palpated for the presence of any fluid filled distention.

Evaluation through contrast radiography: All the dogs were evaluated through contrast radiography with an interval of one week during postoperative period.The water soluble iodine preparation, (Urografin 60%; Zydus, India) was used for contrast radiography and injected intravenously at dose rate of 10ml in each dog. The radiographs were taken post Urografin, in two planes *viz.* ventro-dorsal and lateral position.

Evaluation through Renal Function Tests: Renal function tests were conducted by serum chemistry analyzer (Semi-Automatic Clinical Chemistry Analyzer BAS-100, Labomed Inc. U.S.A.) to detect increase level of urea, creatinine, potassium ions and decrease level of sodium and chloride ions in blood, in order to check urinary bladder leakage. The blood was tested before and on 28th day post-surgery.

Evaluation through ultrasonography: Ultrasonography was also performed before the experimental surgery and with the interval of one week after surgery with the transducer of frequency 3.5MHz (Pie medical scanner 480, Netherland) in each dog. Postmortem was conducted at the end of experimental period after euthanasia. Urinary bladder was examined exteriorly for the presence of any adhesions and interiorly for the presence of any lesions, stones/ crystals hemorrhages and quality of healing at suture site.

RESULTS

Tachycardia and tachypnea was observed for two days after the experimental surgery in group-A, B & C but no tachycardia was observed in group-D. Hematuria was observed in two, out of six dogs in group-A but no hematuria was noticed in all the dogs of group-B and C. Dysuria was observed in all the dogs of group-A, B and C for the first 3 to 5 days. Abdominal pain was noted for the first three days of experimental surgery in all groups but the Vomiting was not noticed. There was no abdominal distention in all the groups. After one week of the experimental surgery dogs were normal without the signs of depression and anorexia. Suturing time was comparatively less for group A (1.38±0.81), where the cystotomy wound was closed in a single layer as compared to group B (2.03±0.36) and group C (2.75±0.16), in which the cystotomy wound was closed in two and three layers respectively (Table 1).

Radiological Findings: The contrast radiography revealed no leakage of contrast material from urinary bladder in to the peritoneum. Urinary bladder was filled with contrast material and appeared radio-opaque (Figure 3).

Renal function test: No remarkable changes in the values of blood urea nitrogen, Creatinine, K (potassium), Ca (calcium), Na (sodium) & Cl (chloride) ions were recorded. Before surgery and the day 28th post surgery, mean values for BUN, K, Creatinine, Ca, Na & Cl ions for group A, B & C were within normal range when compared to control group-D (Table 2).

Sonographical Findings: The sonographical findings revealed no leakage from urinary bladder of all the groups. Urinary bladder was scanned as an anechoic circular area having a well demarcated boarder line indicating the wall of urinary bladder (Figure 4).

Post Mortem Evaluation: Adhesions were present in all the animals between the cystotomy site and intestine, mesentery and falciform ligaments. In group-A dogs, the quality of healing was better than group B and C dogs. In

group A dogs, the mucosa at cystotomy site was healed with a very thin and fine scar, but in case of group-B and C dogs a well demarcated stricture was seen at the cystotomy site. No calculi or crystals were found in the bladder lumen of all the dogs.

FIGURES (EVALUATION OF DIFFERENT SUTURING TECHNIQUES FOR CYSTOTOMY CLOSURE IN CANINES)

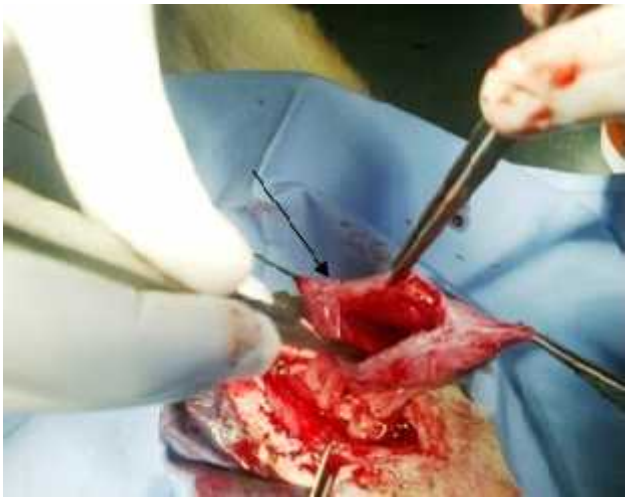

Figure 1. Cystotomy wound of 3cm

Figure 2. Closed Cystotomy wound by simple continues suturing pattern

Figure 3. Ventro-dorsal radiograph of urinary bladder urinary .Urinary bladder is evident as a radio opaque rounded structure between the two ilia, sacrum and the pubis.

Figure 4. Anechoic area indicating urinary bladder. Stars indicating the depth of urinary bladder.

Table 1. Suturing time for one layer, two layers and three layers closure of cystotomy wound.

GROUPS	n	Mean ± Std. Deviation	% of Total Sum
Group-A	6	1.38±0.81 min	22.5%
Group-B	6	2.03±0.36 min	33.0%
Group-C	6	2.75±0.16 min	44.6%
Total	18	2.05±0.75 min	100.0%

Table 2. Values for renal function tests obtained before and after surgery.

Groups		BUN mg/dl	BUN mg/dl	Crt mg/dl	Crt mg/dl	K mEq/L	K mEq/L	Ca mg/dl	Ca mg/dl	Na mEq/L	Na mEq/L	Cl mEq/L	Cl mEq/L
		Pre op	Post op 28	Pre op	Post op 28	Pre op	Post op 28	Pre op	Post op 28	Pre op	Post op 28	Pre op	Post op 28
A	**Mean**	13.5±	12.5±	0.93±	1.26±	4.23±	4.23±	9.10±	9.90±	144±	144.6±	102.6±	114.8±
	±SD	2.25	2.07	0.34	0.08	0.13	0.26	0.39	0.55	2.65	1.96	0.51	0.75
B	**Mean**	13.83±	13.0±	0.95±	1.35±	4.54±	4.5±	9.4±	9.7±	145.6	151.1±	106.1±	116.1±
	±SD	4.21	1.78	0.23	0.08	0.21	0.24	0.13	0.16	±2.7	3.5	3.8	2.04
C	**Mean**	15.6±	14.1±	0.93±	0.95±	4.3±	4.0±	9.61±	10.2±	146.1	149.6±	114±	118±
	±SD	3.5	1.47	0.25	0.17	0.52	1.58	0.29	0.5	±2.3	3.2	1.24	2.19
D	**Mean**	19.8±	17.5±	1.10±	0.78±	4.55±	4.11±	9.5±0	10.85±	149±	148.1±	113.1±	128.8±
	±SD	3.1	2.5	0.12	0.11	0.35	0.13	.18	0.30	3.89	3.4	1.19	6.17

BUN (blood urea nitrogen), Crt (creatinine), K (potassium), Ca (calcium), Na (sodium) and Cl (chlorine), pre op (pre operative), post op 28 (post operative day 28)

DISCUSSION

In the present study, two layer versus three layer closure techniques showed no hematuria in group B and C dogs. Three layers closure is recommended to control the hemorrhage but two layer closures can be as effective as three layer closures (Jens and Bjorling, 2001). Therefore these patters can be preferred for the control of hemorrhages because mucosa is sutured as a separate layer and it can effectively attenuate bleeding and the suturing time for two-layer closure is comparatively less than three-layer closure. Moreover, Two-layer cystotomy closure is preferred to close electrosurgical cystotomy incision and to prevent vesico-vaginal fistula instead of single-layer cystotomy closure (Soko *et al.,* 2004). Overall it was observed that entire suturing patterns provided good strong apposition and water tight closure. Results showed that bursting strength of the wall of urinary bladder is same for one-layer closure and two-layer closure (Brown, 2011). Objectives for suturing the cystotomy wound are repositioning of tissue planes, preservation of lumen diameter and avoiding the functional mutilation of urinary bladder (Seifman *et al.,* 2002). Inverting patterns provide leak proof serosal seals; adequate strength gain and best healing as compared with other techniques and these properties can be improved further by placing second inverting layer (Greenberg *et al.,* 2004). But current findings support that Suturing time for single layer closure was comparatively shorter than two and three-layer closure. Therefore one layer cystotomy closure had advantages compared with two and three layers cystotomy closure because it provides strong wound apposition in a comparatively short surgical time. Short surgical time is desirable because it reduces operative exposure of patient, minimize anesthesia time and consequently reduce the patient morbidity and mortality (Lillich and DeBowes, 1999). Ludovic *et al.,* 2005 demonstrated suturing time for single layer closure was significantly shorter than two layer closure and bursting strength was almost same for both single and double layers cystotomy closure when measured on day 10, but it was found to be lower for single layer cystotomy closure at the end of experimental period.

Conclusions: The results proved that single layer cystotomy closure technique (simple continues suturing pattern) has advantage over the two-layer and three-layer closure techniques in term of shorter suturing time, apposition of tissues and better healing of cystotomy wound. Two layers closure can effectively attenuate bleeding as performed by three layers closure technique.

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