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Histopathological evaluation of chromic catgut polyglycolic acid polyglactin 910 and polydioxanone sutures for laparotomy wound closure in canine

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Abstract
The study was conducted in 24 clinical cases which were presented for ovariohysterectomies in dogs. The animals were randomly divided into four groups of six animals each (group I, II, III and IV). In dogs of group I, II, III and IV animals laparotomy wound was closed with Chromic catgut, Polyglycolic acid (PGA), Polyglactin 910 (PG910) and Polydioxanone (PDS) suture respectively. Biopsy was collected before suturing (zero day) and on 14th day after suturing for histopathological examination. Studies revealed an increasing order of inflammatory reaction with PDS followed by PG910, PGA and Chromic catgut suture. Laparotomy wound healing studies indicated that PDS was the preferred absorbable suture material in long term wound healing over PG910, PGA and Chromic catgut suture.

Keywords: Laparotomy, suture, absorbable, histopathological

Introduction
Sutures are probably the materials used widely in all fields of surgery. Sutures serve to maintain tissue approximation until a wound attains sufficient tensile strength to prevent dehiscence during normal physiological activity (Wallace *et al*., 1970) [13]. Suture materials may be classified according to their behaviour in tissue (absorbable or nonabsorbable), their structure (monofilament or multifilament) or their origin (synthetic, organic or metallic) (Fossum, 1997) [3]. Absorbable sutures are those that undergo degradation and rapid loss of tensile strength within 60 days. Catgut has been the most commonly used suture material for visceral organs however, synthetic absorbable sutures are now being widely accepted (Kobayashi *et al*., 1981) [4]. Polyglycolic acid suture is a braided multifilament polymer of glycolic (hydroxyacetic) acid. Absorption is by hydrolysis, not phagocytosis, presumably through esterase activity (Stashak and Yturraspe., 1978) [10]. Polyglactin 910 is a braided synthetic fiber composed of glycolic and lactic acids in a ratio of 9:1 (Craig, 1975) [2]. Polyglactin 910 coating of polyglactin 370 and calcium sterate gives polyglactin 910 excellent handling and smooth tying properties (Moy *et al*., 1991) [7]. Polydioxanone is polymer of paradioxanone available as a monofilament (Ray, 1981) [9].

Materials and Methods
The present study was conducted in 24 clinical cases of canine which were presented to the Department of Surgery and Radiology, Veterinary College Bidar and Agriculture Product Marketing centre (APMC) Hospital Bidar for ovariohysterectomy. The animals were randomly divided into four groups of six animals each (group I, II, III and IV). Animals were premedicated with atropine sulphate @ 0.045 mg/kg body weight i/m. Xylazine hydrochloride @ 1 mg/kg and ketamine @ 10 mg/kg mixture in a single syringe administered as single induction bolus and anesthesia maintained with incremental doses of xylazine - ketamine anesthesia by i/v route given 'to effect'. The animals were placed in left lateral recumbency. The surgical site was prepared as per standard procedure. The site of incision was drapped. Oblique incision was made at surgical site (three finger width caudal to the last rib and ventral to lumbar transverse process) the right flank laparotomy was done. The right uterine horn was located by means of the index finger, through this right ovary, uterine bifurcation and the left ovary were subsequently approached, ligated and removed from the stump using three artery forceps.

Abdominal wall closed with routine procedure *viz*., peritoneum and transverse abdominus muscle closed by simple continuous suture pattern, obliques abdominus internus and obliques abdominus externus muscle together by interrupted suture pattern, using chromic catgut no 1, PGA no1, PG 910 no 1 and PDS no 1. in group I, II, III and IV respectively. Skin wound was approximated by simple interrupted suture using nylon suture material. Post-operatively ceftriaxone sodium was administered @ 25 mg/kg body weight i/v b.i.d, anti- inflammatory meloxicam @ 0.2 mg/kg i/m to all dogs for three days. Surgical wound was dressed on alternative days using povidone iodine ointment till satisfactory wound healing was observed. Obliques abdominus externus muscle biopsy was collected before suturing (zero day) and on 14th day after suturing by 5mm punch biopsy method at the site of suture under xylazine – ketamine anesthesia. The biopsy fixed in 10% NBF for histopathological examination.

Results and Discussion

Histopathology of obliques abdominus externus muscle biopsy collected on 0 day showed normal muscle fibers without any inflammatory reaction (plate1). Histopathology of obliques abdominus externus muscle biopsy collected on 14th day in group I animal showed extensive fibroblast proliferation and collagen deposition with moderate infiltration of the mono nuclear cells (plate 2) and neovascularisation with deposition of collagen surrounding the suture area with severe mononuclear cell infiltration. In group II animal showed cellular infiltrate predominated neutrophils surrounding the suture (plate 3) and group III animal showed very mild inflammatory reaction surrounding the suture material with collagen deposition (plate 4) wheras, group IV animal showed very rare inflammatory cell and granulation tissue with new blood vessels (plate 5). The chromic catgut elicited maximum inflammatory response followed by polyglycolic acid, polyglactin 910 and polydioxanone. The polydioxanone and polyglactin 910 elicited very minimal inflammatory reaction. These results are in agreement with several earlier worker (Bennet *et al.* 1997; Wainstein *et al*., 1997; Molea *et al.*, 2000; Nary fiho *et al.* 2002; Thiede *et al*., 2002 and Kosan *et al*., 2008) [1, 12, 6, 8, 11, 5].

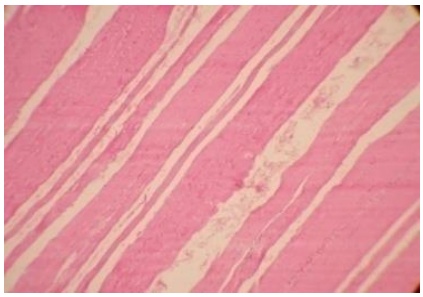

Plate 1: Photomoicrograph of abdominal muscle biopsy sample taken during laparotomy (0 day) showing normal muscle fibers without any inflammatory reaction. H&E, X10

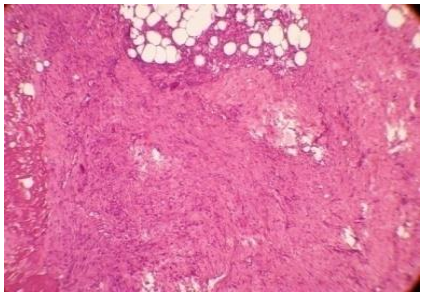

Plate 2: Photomicrograph of abdominal muscle biopsy sample taken on 14th post- operative day in a group I animal showing extensive fibroblast proliferation and collagen deposition with moderate infiltration of the mono nuclear cells. H&E, X10

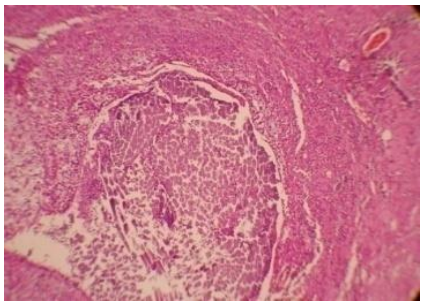

Plate 3: Photomicrograph of abdominal muscle biopsy sample taken on 14th post- operative day in a group II animal showing cellular infiltrate predominated neutrophils surrounding the suture. H&E, X10

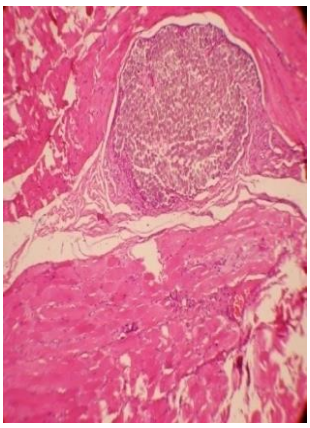

Plate 4: Photomicrograph of abdominal muscle biopsy sample taken on 14th post- operative day in a group III animal showing very mild inflammatory reaction surrounding the suture material with collagen deposition. H&E, X10

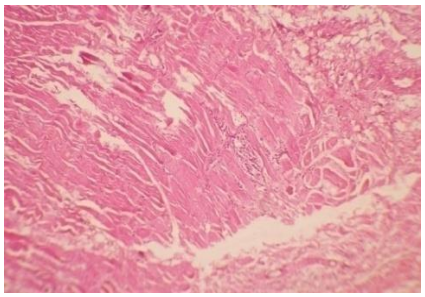

Plate 5: Photomicrograph of abdominal muscle biopsy sample taken on 14th post- operative day in a group IV animal showing very rare inflammatory cell and granulation tissue with new blood vessels. H&E, X10

Conclusion

Polydioxanone caused less inflammatory reaction, followed by polyglactin 910, polygyolic acid and chromic catgut in laparotomy wound closure in canine.

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