

STUDIES ON GAMBEE AND LEMBERT PATTERNS FOR CLOSURE OF SMALL COLON ENTEROTOMIES IN EQUINE

By

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SUMMARY

Small colon enterotomies were performed in nine adult healthy horses through the antimesenteric teniae and adjacent to the teniae. Gambee and Lembert sutures were used for closure of the enterotomies in both locations. Vicryl was used as a sole suture material for both patterns. This comparative study proved that lembert suture was easier, faster, and better than gambee suture concerning efficacy of technique and the healing process.

required enterotomy (Foerner, 1982; Stashak, 1982; McIlwraith, 1984; Boles, 1985). The enterotomies had been made parallel to the long axis of the small colon, either through the antimesenteric teniae or adjacent to the teniae in the sacculum (Foerner, 1982; Stashak, 1982; McIlwraith, 1984; Boles, 1985).

Several satisfactory techniques were developed for enterotomy closure; everting pattern (Ott et al., 1968), inverting pattern (Dean et al., 1985) and appositional pattern (Stashak, 1982). Closure was performed using a variety of suture materials (Dean and Robertson, 1985; Hanson et al., 1988).

INTRODUCTION

Obstruction of the small colon of the horse had been caused by fecal impaction (Merritt et al., 1975; Tennant, 1975), foreign bodies (Boles and Kohn, 1977; Gay et al., 1979), enteroliths (Tate and Donwick, 1978; blue and Wittkopp, 1981), incarceration and adhesions (McIlwraith, 1984), occlusive verminous arteritis of the caudal mesenteric artery (Keller and Horney, 1985), and intraluminal haematoma (Spires et al., 1981; Huskamp, 1982; Pearson and Waterman, 1986). Concurrently, (White et al., 1985) recorded in a survey that 4.2% of cases with small colon obstruction requiring surgery with a mortality rate of 35%. The surgical intervention of such cases

The present study was designed to compare between an appositional pattern (Gambee) and inverting pattern (Lembert) for healing of small colon enterotomies using vicryl (Polygalactin 910).

MATERIAL AND METHODS

Nine adult horses weighing 300-450 kg and aged from 7-15 years were used. All horses were clinically normal. Twelve hours before surgery, food was withheld and antitetanic serum (3000 I.U) was subcutaneously injected. Gentamycin sulfate (1.8mg/kg i.m, tid) and procain penicillin G (22.000 I.U./kg, i.m, bid) were administered

two hours before surgery and continued for 3 days post-surgery.

All animals were anaesthetized for midline laparotomy by administration of xylazine Hcl (2.2 mg/kg), butorphanol tartarate (0.1 mg/kg) and chloral hydrate 10% (4 gm/50 kg) intravenously. Supportive fluid therapy formed from 8-12 liter of normal saline and lactated ringer solution was started as soon as anaesthesia was induced. After surgical preparation, a 50 cm length of the colon was exteriorized via a 15 cm ventral midline incision. Four enterotomies (5-10 cm length) were performed in two locations (in the center of antimesenteric teniae and the sacculum adjacent to the teniae). Gambee and Lembert patterns were used in each location.

The animals were divided into three groups, each group encompassed three horses. They were euthanized on days 3 (Group 1), 10 (Group II), and 50 (Group III). Necropsy was done for evidence of adhesion, leakage or obstructions and for taking specimens for histopathological examination. The specimens were fixed in 10% buffered formalin, passed in diluent of alcohol, embedded in paraffin, sectioned and stained with hematoxylin (Carleton et al., 1967).

RESULTS

All horses developed intestinal motility 4-6 hours post operatively and returned to full feed after 12 hours. No signs of abdominal discomfort were noticed in any of the horses and all abdominal incisions healed without complications. More intra-operative haemorrhage occurred with enterotomies performed adjacent to the teniae. Suturing the incisions made through the teniae was more easily accomplished because of thicker teniae margins. Closure of the mucosa by Gambee suture increased the surgery time.

At necropsy, it was noticed that enterotomy the sacculum resulted in narrowing of lumen. Adhesions were not a feature elsewhere in the abdomen.

Histopathological findings showed at 3 days inflammatory reactions in all specimens. The reaction was more or less similar in severity and distribution and started mainly in the serosa. The serosa was thick and expanded due to presence of fibrin networks, excessive neutrophils and vascular dilation (Fig. 1a). The tunica muscularis was also similar and suffered from necrotic changes (Fig. 1b). The submucosa showed hyperaemia, large quantities of fibrin exudate, foci of haemorrhages especially in the adjacent teniae sutures (Fig. 1c). The mucosa was ulcerated and covered by fibrinous exudate with living and dead neutrophils (Fig. 1d). Moreover, the mucosa adjacent to the cut edges suffered from necrotic changes.

At 10 days, the healing process was clearly appeared and started mainly in the serosa. In Gambee teniae suture, there was newly formed granulation tissue with vascular buds involving parts of serosa and submucosa. The tunica muscularis showed narrow bands of fibroblast proliferations between its muscle fibers (Fig. 2). In some specimens, there were small focal areas of remaining sutures intermingled with fibrin networks and neutrophils. Furthermore, the submucosa revealed a subsided inflammatory reaction manifested by slight vascular dilation, few fibrin and inflammatory cells. The mucosa in most cases was completely regenerated.

In Lembert adjacent teniae suture, the granulation tissue exhibited myxomatous degeneration. Large areas of remaining suture fibers intermingled with fibrin threads and neutrophils were also seen in the serosa, muscularis and submucosa (Fig. 2). The submucosa also revealed severe vascular dilation and multiple areas of haemorrhages with

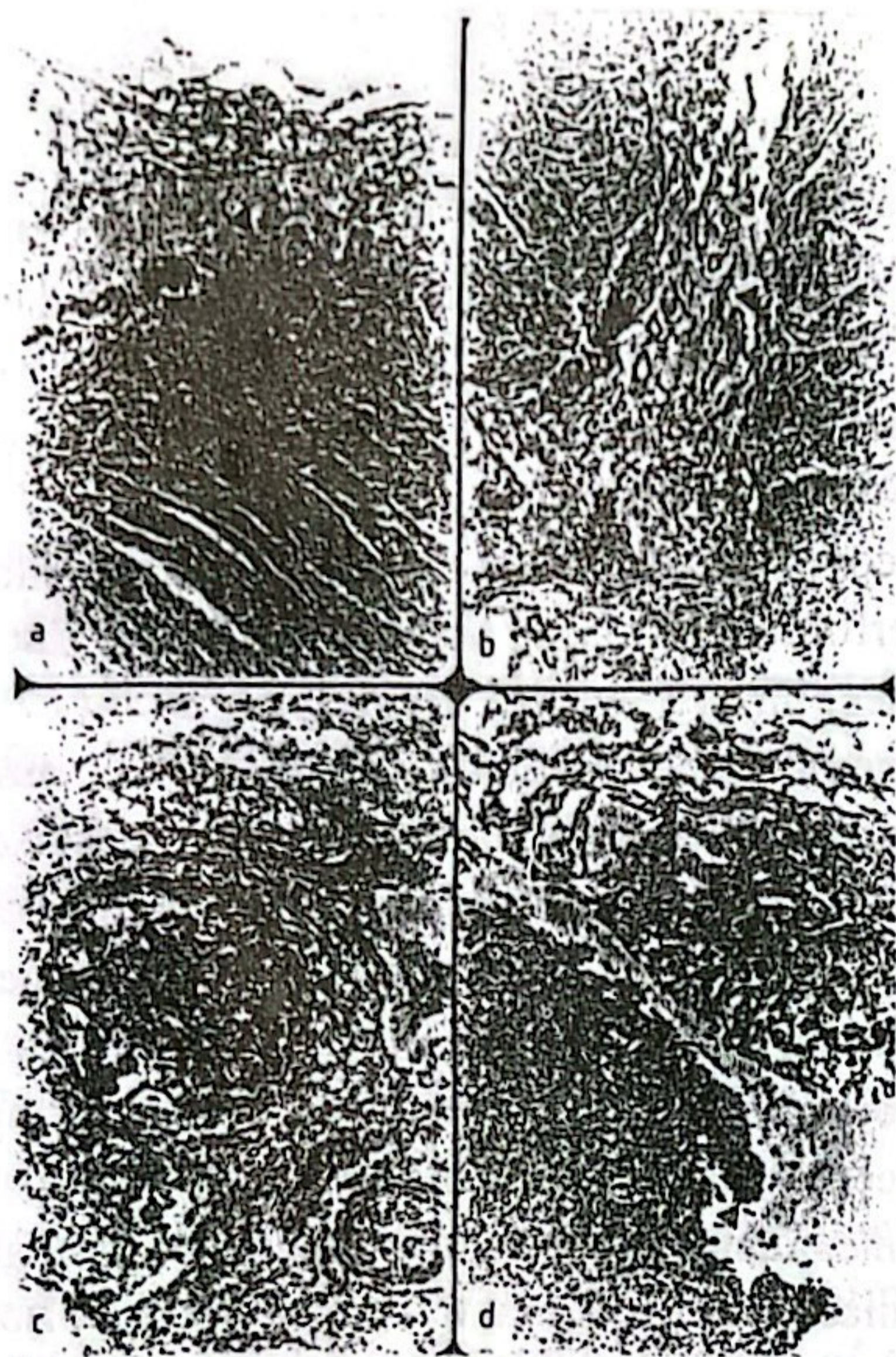


Fig. 1a: The serosa showing fibrin network rich in neutrophils and vascular dilation 3 days Gambiae teniae (H & E X 100).
b) The suture tract, notice exudate rich in fibrin threads, and neutrophils. 3 days Gambiae adjacent teniae (H & E X 100).
c) The submucosa showing thrombosis of some blood vessels 3 days Lembert teniae (H & E X 100).
d) The mucosa is ulcerated and covered by fibrin rich in neutrophils 3 days Lembert adjacent teniae (H & E X100).

haemosiderin pigment. The mucosa in most cases was not regenerated.

In Lembert teniae suture, the serosa over the area of junction was highly expanded due to presence of young granulation tissue with capillary loops (Fig. 2c). The direction of granulation extended and merged to construct the continuity of the reunited tunics. The inflammatory reactions was not detected in most cases. Construction of the mucosa could also be noticed.

In Lembert adjacent teniae suture, the serosa over the area of junction was occupied by young granulation tissue which extended and constructed the reunited tunics. In most cases, this granulation tissue was highly vascular and contained multiple

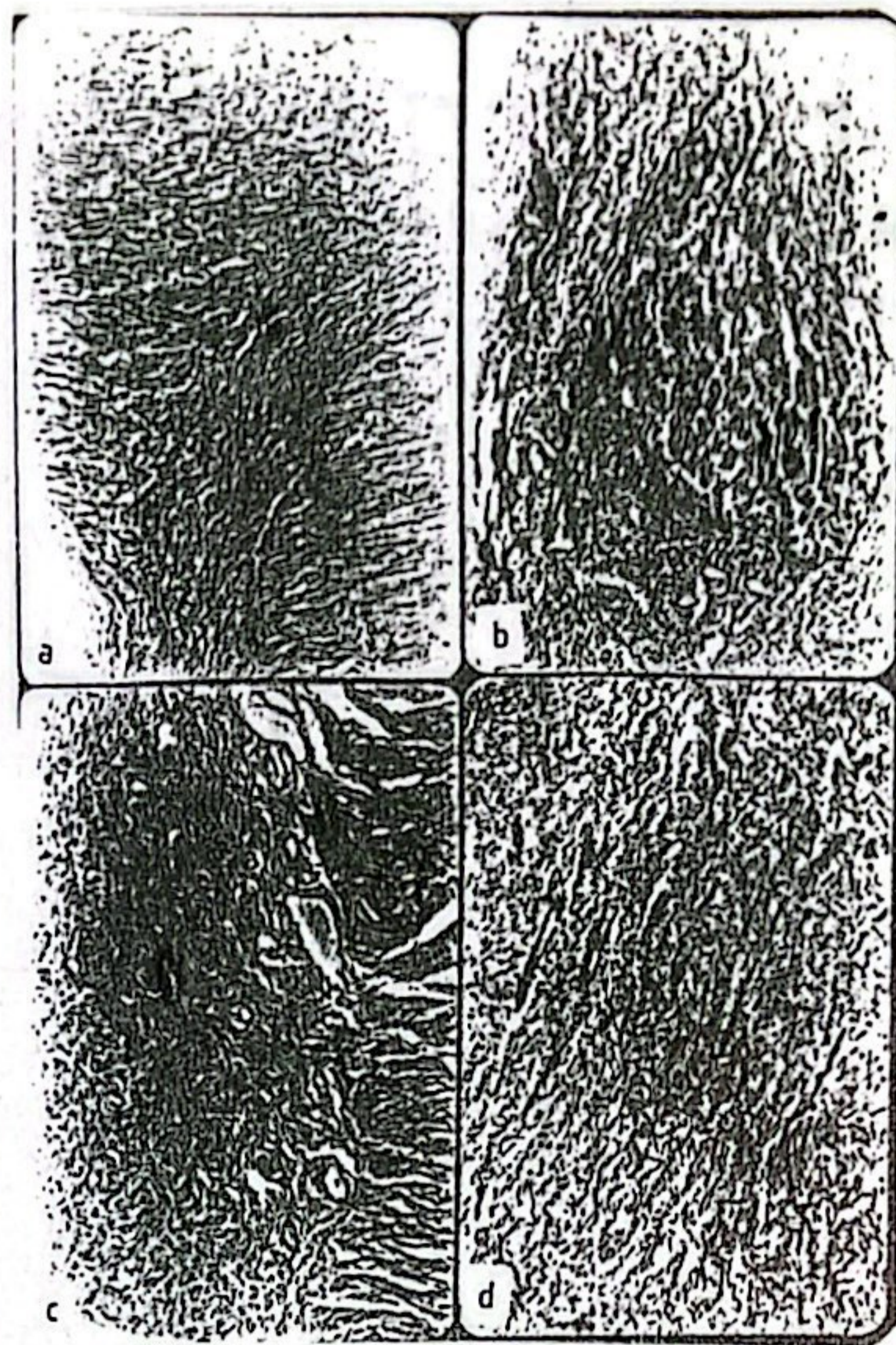


Fig. 2a: The tunica muscularis showing a narrow band of fibroplasia 10 days Gambiae teniae (H&E X 100).
b) The suture tract, notice the unabsorbed suture fibers intermingled with fibrin networks and neutrophils 10 days Gambiae adjacent teniae (H & E X 100).
c) The serosa showing young granulation tissue with capillary loops 10 days Lembert teniae (H&E X 100).
d) The wound area showing highly vascular and haemorrhagic granulation tissue 10 days Lembert adjacent teniae (H & E X100).

foci of haemorrhages (Fig. 2d). The submucosa was still showing vascular dilation, oedema and foci of haemorrhages. The mucosa in most cases was reconstructed.

At fifty days, it was evident that the granulation tissue restored the serosa, muscularis and submucosa, while the mucosa was clearly regenerated. In Gambiae teniae suture, some vicryl fibers were unabsorbed and enclosed by collagen fibers studied with leucocytes (Fig. 3a). The tunica muscularis was replaced by fibrous connective tissue (Fig. 3b). In Gambiae adjacent teniae, some vicryl fibers were intact and attacked by leukocytes and others were fragmented. Haemorrhagic areas were presented especially in the serosa.

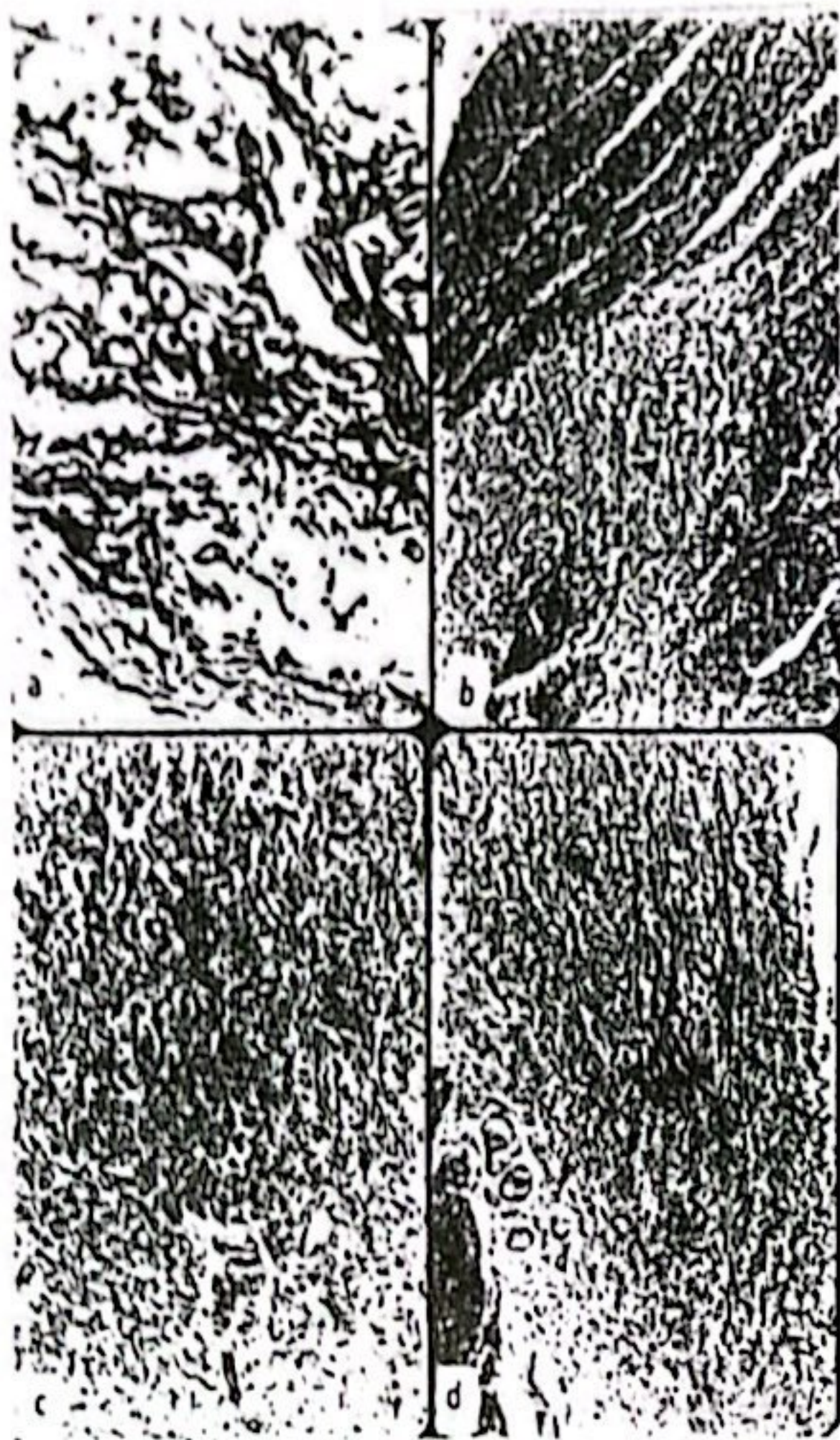


Fig. 3a: The suture tract showing fragmented vicryl suture surrounded by fibrous connective tissue 50 days Gambee teniae (H & E X 400).
b) The tunica muscularis showing area of fibrous connective tissue 50 days Gambee adjacent teniae (H & E X 100).
c) The suture tract showing complete absence of vicryl suture fibers and replaced by fibrous connective tissue 50 days lembert teniae (H & E X 100).
d) The suture tract showing degenerated muscle fibers surrounded by connective tissue 50 days lembert teniae (H & E X 100).

In lembert teniae suture the vicryl fibers were absorbed in some cases (Fig. 3c). The tunica muscularis was completely replaced by connective tissue, leaving degenerated muscle fibers (Fig. 3d). The submucosa was completely fibrosed, and the mucosa was completely regenerated. In lembert adjacent teniae suture, some vicryl fragments were present. The tunica muscularis and submucosa were fibrosed while areas of haemorrhage were still noticed. The mucosa appeared completely regenerated.

DISCUSSION

Enterotomies performed adjacent to the teniae resulted in more intraoperative haemorrhage due

to severance of the larger blood vessels in the wall of the colon. Moreover, closure of enterotomies in the teniae is more easier because of thicker tissue margins (Beard et al., 1989b). It was recommended that enterotomies should not be performed through the teniae due to lack of vascularity, while Beard et al. (1989a), demonstrated adequate circulation across the teniae in the descending colon of the horse. Although more haemorrhage occurred at the incision site adjacent to the teniae, all incisions healed without complications. These incisions required more time during closure for arresting of bleeding and resulted in greater reduction of the lumen diameter than those performed through the teniae. This explained to be resulted from fibrosis across the sacculation reducing the distensibility of the bowel (Beard et al., 1989b). The obstruction and leakage were not evident in any of the specimens. The histopathologic examination revealed subsided inflammation in the gambee teniae suture and absence of inflammation in the lembert teniae suture at 10 days, while inflammation and haemorrhage were noticed in the gambee adjacent teniae and lembert adjacent teniae suture.

The significance of suturing the mucosa in a separate layer is unclear. Beard et al., (1989b) mentioned that suturing the mucosa as a separate layer achieves earlier closure of the bowel and prevents eversion of the mucosal edges, thereby facilitating closure of the seromuscular layer. Jansin et al. (1981) mentioned that the rate of healing of mucosa that is not sutured is directly related to the accuracy of the apposition of the submucosal layer, and in instances of perfect submucosal apposition, unsutured mucosa will heal as early as 10 days post operatively. In this study, it was proved histopathologically that almost all mucosa were regenerated 10 days post operatively in both gambee teniae and lembert teniae sutures. The presence of oedema in some stages of the adjacent teniae suture may be due

disruption of venous and lymphatic drainage (Archer et al., 1988). The presence of neutrophils and hemorrhage observed in enterotomies adjacent to the teniae suture may be due to disruption of venous and lymphatic drainage (Archer et al., 1988). The presence of neutrophils and hemorrhage observed in enterotomies adjacent to the teniae indicate presence of the inflammation. Presence of vicryl in the histologic section was due to more time required for its absorption.

In conclusion: This study suggests that enterotomies made through the teniae are superior to those made adjacent to the teniae, as determined by the maintenance of the lumen diameter, ease of closure, and minimal interruption of the blood supply. Closure of the mucosa in gambee suture offers no advantage for healing besides it requires more time for application and for healing of the intestinal wall.

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