Research Article

A Comparative Analysis of Open and Closed Anal Sacculectomy Performed on Dogs

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Abstract | The anal glands are paired structure in dogs which require the surgical removal in various diseased conditions . The current study was designed to compare the efficacy of open and closed method of anal sacculectomy for better outcomes in respect of post-operative complications in dogs. The study was performed on 16 adult dogs of either sex or breed with 1 to 3 years of age presented at University Outdoor Clinic which required anal sacculectomy. All the animals were categorized into two equal groups i.e. group-A and group-B. Group A underwent open anal sacculectomy and group 2 closed anal sacculectomy. To compare surgical techniques, various hemato-biochemical, physiological parameters and post-operative complications were evaluated. The data was analyzed by applying t-test using SPSS-20 version. There was a no significant difference between both groups with respect to vital signs and hematology profile. However, seroma, abscess, stricture of anal sacs, urine incontinence, wound dehiscence and fistula formation was observed more in group A of open anal sacculectomy compared to group B of closed anal sacculectomy. It was concluded that closed technique is somewhat superior in post-surgicaloutcomes than open sacculectomy in terms of post-operative complications.

Keywords | Anal Sacculectomy, Hematology, Vital Signs, Dogs

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INTRODUCTION

The anal glands are paired, small glands located near the anus at 4 and 8-o clock and covered by internal and external sphincter muscles. The internal lining of these glands secrete a liquid which is helpful in easy defecation (Abeysurya et al., 2010). The perineum is supported by lateral border of sacrotubrous ligaments which extend from first coccygeal vertebrae on dorsal side and ventrally, it originates from left and right ischial tuberosity. Anal sacs are composed of levator ani and coccygeal muscles which originate from pelvic floor and embedded on caudal vertebral region (Jung et al., 2016). Theblood is supplied by perineal, caudal haemorrhoidal and the caudal gluteal artery while innervation isby perineal nerve and terminal branch of pudendal nerve (Paydar et al., 2015).

Physiologically, when stool is passed through anus, sphincter muscles squeeze anal sacs and force contents onto the surface of the stool, thus lubricate and promote defecation. These secretions also contained pheromones which helps a dog to mark the territory. The problem occurs when sac secretions are not appropriate (Culp, 2012).

Most common anal sac anomalies include impaction, sacculitis, neoplasia, fistula, anal furunculosis and abscess. Exact cause of anal sac ailments is still unknown but stool consistency, pudendal nerve dysfunction, weight and glandular hyper secretion are some of the reasons considered for occurrence of anal sac disease. Exterior parts of anal region get contaminated during defecation which leads to anal sac inflammation, infection, fistulae, abscess and ultimately retention of anal sacs contents which require surgical intervention (Saglam et al., 2008). Presenting signs in anal gland tumors are constipation, polyuria, regional lymph nodes enlargement, impedance and lethargic body conditions (Bergeron et al., 2021).

Open standard and modified techniques are most practiced techniques for anal sacculectomy (Baines and Aronson, 2018). Closed technique for anal sacculectomy has also been in practice for quite long. Closed technique aims to keep anal sac completely intact with no exposure of secretory lining (Scarff, 2010). The current study was designed to compare the efficacy of open and closed method of anal sacculectomy for better outcomes in relation to abscess, stricture and seroma formation, fecal incontinence and wound dehiscence after surgical resection of anal sacs in dogs.

MATERIALS AND METHODS

The current experimental study was done on 16 adult dogs of either sex or breed with 1 to 3 years of age presented at University Outdoor Clinic which require anal sacculectomy. All the animals were categorized into two equal groups i.e. group-A and group-B. Group-A was labeled as A1-A8 and open sacculectomy was performed in group A to remove the infected anal glands. Dogs in group B were labeled as B1-B8 and resection of infected glands was performed by closed sacculectomy technique in group B.

Their body weight of dogs was ranged from 20-40 kg. The study was accomplished according to the rules and regulation inscribed by Ethical Review Committee (ERCULA) with reference number of 218/2020 at University of Veterinary and Animal Sciences (UVAS), Lahore, Pakistan. Study was carried out at Surgery Department, UVAS Lahore. All procedures and possible complications were thoroughly explained to animal owners and consent was obtained.

To compare surgical techniques, parameters including physiological parameters such as vital signs (body temperature, pulse and respiration), hematology (RBCs, WBCs and Hb count), post surgical complications such seroma formation, abscess formation, stricture formation, fecal incontinence, wound dehiscence and fistula formation were evaluated. Contrast radiography was done to evaluate fistula formation. The images were obtained by using contrast media i.e. sodium diatrizoate and meglumine diatrizoate (Gastrografin®, Berlimed SA, Spain) @5-7ml per rectal (Greco et al., 2023). Radiography was performed at Pet Center, UVAS, Lahore by using digital x-ray machine (Collimator Type R-20J-2015 SHIMADZU CORPORATION).

Hematology was performed on described days. For this purpose 1ml Blood was collected in vacutainer BD® added with anticoagulant Ethylene Diamine Tetra-acetic acid (K2 EDTA) from cephalic vein of dog for CBC. Samples were analyzed at University Diagnostic Lab (UDL ISO/IEC 17025 LAB NO. 033), University of Veterinary and Animal Sciences, Lahore using hematology veterinary analyzer (Evos Vet. CBC Analyzer-2004). Hematology was performed to evaluate blood anomalies e.g. anemia,dehydration and systemic infections.

Parameters were checked at day 1, 7, 14, 21, and 28 while radiography was performed at day 14 and 28 post-surgery. The anal site was clipped by a clipper (AIRBORS®, USA) and also shaved with disposable razor (Gillette Match®) a day before surgery. The dogs were kept off-feed and off-water 6-8 hours before surgical procedure in order to avoid vomiting and to attain maximum results of anesthesia.

Anal site was disinfected by using povidone-iodine surgical scrub (Pyodine®, brooks Pharma). Further the surgical site was disinfected with 70% ethanol (DURVET®, Ltd.) and covered with sterile, disposable drape (Surgicare-A®, Cardinal Health) to cut down the germ contamination.

All the dogs were injected a pre-anesthetic dose of Xylazine hydrochloride (Xylaz®, FARVET) at the dose rate of 0.5- 2.2 mg/kg intramuscularly. The dogs were anesthetized by using combination of (Xylazine @2.2mg/kg + Ketamine @15mg/kg + Atropine @0.04mg/kg). Maintenance of anaesthesia was achieved by intravenous administration of propofol @ 1-2.5 mg/kg (Gobifol). Hydrating fluid (Dextrose 5%) and Transamine @10-20mg/kg as hemostatic agent was given through intravenous route Quesenberry and Carpenter (2011).

In closed method, anal sac was excised at the base without entering into lumen of sac (MachPhail, 2008). A vertical incision was given to expose the anal sac, cleared from surrounding tissues and separated from external sphincter muscles with blunt scissor. Anal sac duct was ligated before resection with simple interrupted suture pattern using 3/0 polyglactin 910 (Vicryl® Ethicon) (Slatter, 2017).

In the open method of anal sac resection, both anal sac

duct and orifices were removed (MachPhail, 2008). Anal sac was located by grooved director, cleared from surrounding tissues and separated from external sphincter muscle with blunt scissor. Anal sac was retracted caudally then dissected from surrounding tissues. Then anal sac duct and duct orifice was removed. Anal sac duct was ligated before transection with simple interrupted suture pattern using 3/0 polyglactin 910 (Vicryl® Ethicon) (Slatter, 2017).

The Subcutaneous layers was closed using 2/0 polyglactin 910 (Vicryl® Ethicon) by simple continuous suture pattern. The skin was secured with interrupted pattern using 2/0 Silk (Silk® Ethicon).

After surgery, dogs were shifted to the recovery room to monitor any post-operative complication. Each animal was administrated with Non-Steroidal Anti-Inflammatory drug, diclofenac sodium (Dicloran® SAMI Pharmaceuticals) @1mg/kg intramuscularly BID, for 5 days to minimize post- operative pain. The data was analyzed by applying t-test using SPSS-20 (Daniel, 2022).

RESULTS

At 1st day, mean body temperature in dogs of Group A was 104.02±0.3 and at 28th day it returned to 101.88±0.6. At 1st day, mean body temperature in dogs of Group B was 104.2±0.4. and at 28th day it remained up to 101.88±0.2. Statistically, non-significant difference was found between group A and B from day 1 to day 21 ($p \geq 0.05$). However, there was a significant difference between two groups at 28th day ($p \leq 0.05$).

At 1st day, mean pulse rate in dogs of Group A was 101.62±5.2. At28th day, it was 80.75±10.3. At 1st day, mean pulse rate in dogs of Group B was 98.25±5.8 and at 28th day it was stabilized at 88±6.9. Statistically, non-significant difference was found between Group A and B from day 1 to day 28($p \geq 0.05$).

At 1st day, mean respiration rate in dogs of Group A was 30.12±2.2. At 7th day and at 28th day, it was 24.12±1.8. At 1st day, mean respiration rate in dogs of Group B was 28.62±1.4. At 28th day, it was 23.25±1.1. Statistically, non-significant difference was found between Group A and B from day 1 to day 28($p \geq 0.05$).

At 1st day, mean TLC in dogs of Group A was 20.82±4.2. At 7th day and at 28th day, it was 13.63±1.4. At 1st day, mean TLC in dogs of Group B was 15.95±0.2. At 28th day, it became 8.92±1.3. Statistically, non-significant difference was found between Group A and B from day 7 to day 28 ($p \geq 0.05$). However, there was a significant difference between two groups at day 1 ($p \leq 0.05$).

At 1st day, mean RBCs in dogs of Group A was 6.96±0.8. At 7th day and at 28th day, a slight increase was noted as 7.01±0.8. At 1st day, mean RBCs in dogs of Group B was 6.92±0.7. At 28th day, a slight increase was noted as 6.96±1. Statistically, non-significant difference was found between Group A and B from day 1 to day 28($p \geq 0.05$).

At 1st day, mean Hemoglobin (Hb) in dogs of Group A was 14.65±2. At 28th day, a slight increase was noted as 14.37±1.9. At 1st day, mean Hemoglobin in dogs of Group B was 14.96±1.6. At 28th day, a slight increase was noted as 14.36±1.9. Statistically, non-significant difference was found between Group A and B from day 1 to day 28 ($p \geq 0.05$). Comparative mean values of body temperature, pulse rate, respiration rate, WBCs, RBCs and Hb of group A and group B are shown in Table 1 and 2.

Seroma formation was found in 2 animals (A1, A5) of group A. It was seen at second week and continued till day 14 while it was seen only in 1 dog (B3) of Group B at day 7 which recovered spontaneously. Broken sutures and seroma formation at day 7 after open sacculectomy is shown in Figure 1.

Abscess formation was seen in five animals of group A. It was noted at day 7 in dogs A1, A3, A6,A7, A8 and at day 14 in dog A4. By appropriate intervention, it healed within one week period inall dogs except A7 and A8, which took 2 weeks to heal. In group B, abscess formation was seen in 3 animals (B2, B4, B6) at day 7 which recovered till day 14. In group A, three dogs showed stricture formation from day 7 and continued till end of trial. It was noted mild in one animal (A3) and moderate in two dogs (A7, A8) till day 21, and at day 28 it was mild, moderate and mild in dog A3, A7, A8 respectively. In group B, 2 dogs (B2, B4) showed stricture from first week till day 28. This stricture was mild in nature.

In group A, 3 dogs showed fecal incontinence which was mild in nature. Two animals (A1, A4) presented the signs from day 7-28 while one dog (A3) showed signs from day 1-14 and later recovered from situation. In group B, fecal incontinence was absent in two dogs (B2, B4). In dog B2, incontinence was mild from day 7 to day 28, while in B4 it was noted mild on day 14 and 21 which recovered onwards. In group A, moderate wound dehiscence was found in two dogs (A7, A8) and mild in one dog A3at day 7. At day 14, it was noted as moderate in dog A7, while mild in dogs A3 and A8. At day 21, it was mild in dogs (A7, A8) and absent in A3. At day 28, no dehiscence was noted in any animal. In group B, mild dehiscence was seen in dogs B2 and B4 at day 7 and 14. Onwards, no dehiscence was seen in any individual till end of study. Dehiscence formation at day 14 after open sacculectomy is shown in Figure 2.

Table 1: Comparative Mean Values of Various Parameters of Group A (Open Sacculectomy), n=8

Time (Days)	Mean±S.D					
	Body Temperature (°F)	Pulse Rate (Beats per min)	Respiration Rate (Breadth per min)	Red Blood Cells (10^{12}/L)	White Blood Cells (10^{9}/L)	Hemoglobin (g/L)
1	104.2±0.3	101.6±5.2	30.1±2.2	20.8±4.2	6.96±0.8	14.65±2
7	102.5±0.2	84.8±6.8	25.4±1.4	17.9±2.5	6.99±0.8	14.15±1.9
14	101.9±0.3	84.3±8.8	23.5±1.6	16.1±1.8	7.00±0.8	14.27±1.9
21	101.7±0.5	85.4±10.4	25.1±1.4	14.6±1.6	6.99±0.8	14.35±1.8
28	101.9±0.6	80.8±10.3	24.1±1.8	13.6±1.4	7.01±0.8	14.37±1.9

Table 2: Comparative Mean Values of Body Temperature of Group B (Closed Sacculectomy), n=8

Time (Days)	Mean±S.D					
	Body Temperature (°F)	Pulse Rate (Beats per min)	Respiration Rate (Breadth per min)	White Blood Cells (10^{12}/L)	Red Blood Cells (10^{9}/L)	Hemoglobin (g/L)
1	104.2±0.4	101.6±5.2	28.6±1.4	15.9±0.2	6.92±0.7	14.96±1.6
7	102.1±0.4	84.8±6.8	25.6±1.5	12.7±1.9	6.96±0.9	14.26±1.8
14	101.6±0.3	84.6±8.8	24.9±1.8	10.9±1.9	6.88±0.9	14.22±1.9
21	101.8±0.1	85.4±10.4	24.1±1.2	9.8±1.6	6.95±1.0	14.32±1.8
28	101.9±0.2	80.8±10.3	23.3±1.1	8.9±1.3	6.96±1.0	14.36±1.9

Figures: All figures showing complications after open sacculectomy (Group A) n=8; Total Groups 2, n=16

Figure 1: Broken sutures and seroma formation at day 7 after open sacculectomy (Group A)

Figure 2: Dehiscence formation at day 14 after open anal sacculectomy (Group A)

Contrast radiography revealed fistula formation in only one dog of group A (A8) at day 14 and 28while no animal in group B showed fistula formation. Fistula formation after 28 day of open sacculectomy by contrast radiography is shown in Figure 3.

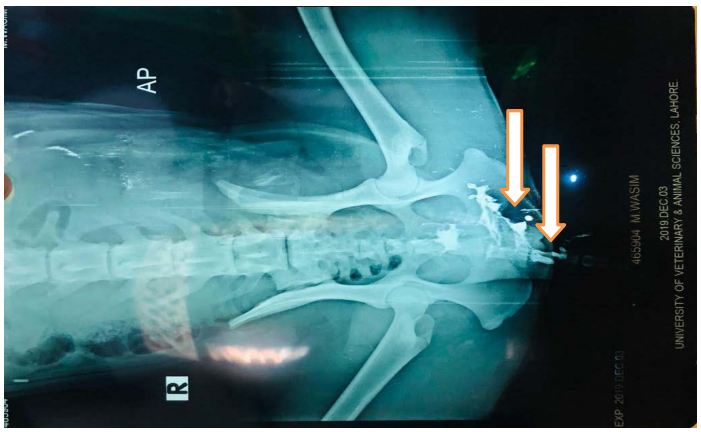

Figure 3: Fistula formation after 28 day of open sacculectomy by contrast radiography

DISCUSSION

The purpose of the study was to evaluate the post-operative complications and effects of open versus closed anal sacculectomy in dogs. In the study, two of the surgical procedures were evaluated to provide practitioners a best and safe technique for anal sac disorders. In both procedures various parameters were recorded and evaluated i.e. TPR, hematology and other post-operative parameters includ-

ing seroma, abscess, stricture formation, fecal inconsistency and dehiscence of surgical site. The diseases of anal sac in dogs need surgical correction for management of anal sac disorders (Charlesworth et al., 2014).

Most common clinical signs include impaction, sacculitis, abscess and even development of neoplasia (Corbee et al., 2021). In the study both open vs. close method were evaluated for their effectiveness at day 1,7, 14, 21 and 28. The topographic approach on anal site was denoted in the study was similar to the approach denoted by (MacPhail, 2008). Body temperature, pulse rate and respiration rate were recorded to evaluate general status of health. Upon statistical analysis, TPR were found non-significant between groups. However, mean body temperature was elevated in both groups at day1which returned to normal gradually. It was noted as normal response of body post-surgery. The observation and presentation of temperature was coincided with (Fraser et al., 2008). The pulse and respiration rates remained stable but in upper limits at 1st day post surgery and were noted normal later on.

Various blood parameters were investigated to understand the effects of surgical procedures on overall health. Statistically, non-significant difference was present between groups in terms of WBCs, RBCs and Hemoglobin (Heng et al., 2021). WBCs count was noted significant at day 1 between the groups but there was no significant difference on later days. Initially WBCs levels were elevated in both the groups but in later stages these gradually decreased but remained in upper limits. The RBCs and Hb count decreased initially but returned to normal in the 1st week post-surgery (Lee et al., 2023).

Physical parameters like seroma, abscess and stricture formation, fecal incontinence and dehiscence were evaluated separately in each group. Upon analysis, seroma formation was seen intwo animals of group A and one dog of group B which indicates seroma formation was not associated with other post-operative complications (Majeski et al., 2017). Abscess formation was more in open sacculectomy (5/8) than closed sacculectomy (3/8). Abscess formation persisted prolonged in opensacculectomy than closed sacculectomy (Bowlt et al., 2013). Seroma formation recorded but statistically it was non-significant between the groups. It indicates seromacan occur anywhere regardless of surgical technique. The similar outcomes were reported in a dog (Choi et al., 2018). Incidence rate of stricture and development of fecal incontinencewas higher in open anal sacculectomy (4/8) than closed anal sacculectomy (2/8). Both of these complications were more serious and persisted for longer period. The findings coincide with (Ragni, 2012). Wound dehiscence was more severe in open sacculectomy (3/8) than closed sacculectomy (3/8). These findings were similar with (Ragni, 2012).

Contrast radiography was performed using sodium amidotrizoate-meglumine amidotrizoate (Gastrografin® Bayer) contrast reagent. Upon reading of radiographs fistula was seen only in dog A8 of group A at day 14 and 28 while none of the individuals in group B exhibited fistula formationduring whole study period.

CONCLUSION

From all trial outcomes it was concluded that vital signs and hematological analysis are approximately close to each other in both techniques but incidence rate of post-operative complications like seroma, abscess and stricture formation, fecal incontinence and dehiscence are more in open anal sacculectomy than closed one. So it can be suggested that closed technique is slightly superior in post-surgical outcomes than open sacculectomy. Closed anal sacculectomy could be used as a better technique as compared to open anal sacculectomy for veterinary surgeons.

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CONFLICT OF INTEREST

There is no conflict of interest.

NOVELTY STATEMENT

To the best of our knowledge, no comprehensive research has been published comparing open and closed anal sacculectomy with respect to the study parameters discussed in this paper.

AUTHORS CONTRIBUTION

Fazal Ur Rehman and Saeeda Fatehullah worked on the research idea, conducted the research and wrote the research paper, Ayaz Qadir, Suleman Ahmad, and Siddique Usman assisted in text formating, Muhammad Asif, Mukhtiar Ahmed, Sunaina Rafi, and Muhammad Mohsin assisted in post-operative care, Ayesha Amanullah, Faisal Shahzad, and Hasnain Raza assisted in data collection.

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