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Modified semitendinosus muscle transposition to repair bilateral perineal hernias in dogs

Técnica de transposição modificada do músculo semitendinoso na reparação de hérnia perineal bilateral em cães

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ABSTRACT: Perineal hernia (PH) resulting from a weakness and tear of the pelvic muscles of the diaphragm. Repair of the pelvic muscles by surgical repositioning is the curative treatment. To report a modified technique of semitendinosus muscle transposition for perineal hernias treatment. Eleven male dogs were prospectively enrolled to repair perineal hernias incorporating contralateral semitendinosus muscle transposition. The transected muscle was rotated medially through the subcutaneous tunnel ventral to the anus up to the opposite lateral perineum. Ten dogs were neutered and 01 was intact. The mean age was 10.45 years and the mean body weight was 18.52 kg. Five dogs had been previously submitted to perineal herniorrhaphy. Partial wound dehiscence occurred in two dogs. Postoperative complications related to the technique were presented in 7 of 11 dogs. Unilateral recurrence was detected in 8 of 11 dogs. The small number of samples, the absence of a control group and the heterogeneity of breeds make it difficult to reach significant conclusions. The transposition of the semitendinosus muscle through the subcutaneous tunnel is feasible to repair perineal hernias. The technique was unable to reduce complications and recurrence rates. However, provides evidence that can be used to repair cases of bilateral and ventral perineal hernias in dogs.

KEYWORDS: perineal hernias, dogs, flap, muscle transposition.

RESUMO: A hérnia perineal (HP) resulta de uma de fraqueza e ruptura dos músculos do diafragma pélvicos. O reparo dos músculos pélvicos por reposicionamento cirúrgico é o tratamento curativo. O objetivo do trabalho é relatar uma técnica modificada de transposição do músculo semitendinoso para tratamento de hérnias perineais em cães. Onze cães machos foram selecionados prospectivamente para reparar suas hérnias perineais utilizando a transposição do músculo semitendinoso contralateral. O músculo contralateral foi seccionado e rotacionado medialmente através de um túnel subcutâneo ventral ao ânus até o períneo lateral oposto. Dez cães eram castrados e 01 inteiro. A média de idade foi de 10,45 anos e o peso corporal médio foi de 18,52 kg. Cinco cães já haviam sido submetidos à herniorrafia perineal. Ocorreu deiscência parcial da ferida em dois cães. As complicações pós-operatórias relacionadas à técnica ocorreram em 7 dos 11 cães. A recidiva unilateral foi detectada em 8 dos 11 cães. O pequeno número da amostra, a ausência de um grupo controle e a heterogeneidade das raças dificultaram a obtenção de conclusões significativas. A transposição do músculo semitendinoso pelo túnel subcutâneo é viável para correção de hérnias perineais. A técnica não foi capaz de reduzir complicações e taxas de recidivas relatadas. No entanto, fornece evidências que podem ser utilizadas para reparar casos de hérnias perineais bilaterais e ventrais em cães.

PALAVRAS-CHAVE: hérnias; cães; retalho; transposição muscular.

INTRODUCTION

Perineal hernia (PH) is an acquired condition, that results in progressive weakness, failure, and rupture of the pelvic diaphragm muscles (Benardé et al., 2018; Gill; Barstad, 2018) resulting in protrusion of abdominal or retroperitoneal organs into the subcutaneous perineum (Baines; Aronson, 2018; Gill; Barstad, 2018). The rate of prevalence has been reported to range from 0.1% to 0.4% (Lee et al.,2012). Perineal deformation is apparent and can be unilateral or bilateral (Baines; Aronson, 2018; Gill; Barstad, 2018). PHs are unilateral in 47

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to 66% of cases with the right side more frequently affected (59 to 84%) (Baines; Aronson, 2018).

A variety of surgical reconstruction techniques have been described to repair perineal hernias, including appositional herniorrhaphy (Baines; Aronson, 2018), transposition of internal obturator muscle (Shaughnessy; Monnet, 2015) superficial gluteal (Carbonell Rosselló et al., 2023), semitendinosus (Morello et al., 2015) and the use of graft techniques or implants based on synthetic mesh (Szabo; Wilkens; Radasch, 2007), fascia lata (Bongartz et al., 2005; Guerios; Monteiro; Silva, 2017), porcine small intestinal submucosa (Stoll et al., 2002), canine small intestinal submucosa (Lee et al.,2012), and autologous tunica vaginalis (Pratummintra et al., 2013; Guerios; Orms; Serrano, 2020). Additional procedures, such as colopexy, vas deferens pexy, and cystopexy, may be performed via laparotomy (Benardé et al., 2018; Lee et al., 2012; Grand, Bureau, Monnet, 2013).

Despite having success with these surgical techniques, there are several clinically relevant complications including perianal fistulas, rectal prolapse, incisional infection, urinary incontinence, fecal incontinence, neurapraxia, seroma, and recurrence of perineal hernia (Benardé et al., 2018; Gill; Barstad, 2018; Grand, Bureau, Monnet, 2013; Shaughnessy; Monnet, 2015). Studies report overall complication rates range from 29% to 61% with primary herniorrhaphy (Frankland, 1986; Hayes; Wilson; Tarone, 1978; Stoll et al., 2002; Weaver; Omamegbe, 1981). Conversely, overall complication rate with internal obturator transposition ranges from 20% to 46% (Bongartz et al., 2005; Burrows; Frankland, 1986; Harvey, 1973; Weaver; Omamegbe, 1981;). Recurrence rates range from 10% to 46% with primary herniorrhaphy and 0% to 33% with internal obturator transposition (Brissot; Dupré; Bouvy, 2004; Grand, Bureau, Monnet, 2013; Hosgood et al., 1995; Shaughnessy; Monnet, 2015).

Large or recurrent ventral perineal hernias are challenging to repair and are associated with higher reoccurrence rates (Raffan, 1993). In addition, repeated attempts at repair are complicated by the loss of local soft tissues with sufficient strength for suture placement (Burrows; Harvey, 1973). Semitendinosus muscle transposition (SMT) was first described for the correction of large ventral rectal defects of recurrent perineal hernias in two male dogs (Chambers; Rawlings, 1991). Potential changes in semitendinosus muscle structure following experimental transposition in dogs have been investigated (Mortari et al., 2005). Subsequently, an alternative to the full SMT through the median separation of the semitendinosus muscle (SSMT) was developed (Morello et al., 2015).

Case reports have been described performing surgical corrections of the pelvic diaphragm using semitendinosus muscle transposition for the repair of perineal hernia with affected ventral perineum (Chambers, Rawlings 1991; Mann; Constinescu, 1998;). There is no knowledge of the rate of complications associated with semitendinosus muscle transposition when used in a significant number of animals. The objective of this article was to report the complications, and recurrence associated with modified semitendinosus muscle transposition for correction of perineal hernia in dogs.

Study design

Eleven male dogs with bilateral ventral perineal hernia were prospectively enrolled to repair the pelvic diaphragm using semitendinosus muscle transposition as advised by other authors (Chambers; Rawlings, 1991). This study had the approval of the Bioethics Committee (protocol Nº. 1138/2007) and signed owner consent was obtained in all cases. Signalment (breed, age, sex and neuter status), clinical signs (type and duration), and previous surgical procedures related to the perineal hernia were recorded for each patient. The diagnosis was based on physical examination and rectal digital examination. In addition, radiography and ultrasonography of the caudal abdominal and perineal regions, complete blood count (CBC), and serum chemistry were performed.

Surgical technique

The skin area from the ventral abdomen, scrotum, and perineum including the medial and lateral side of the thigh and the stifle were clipped and aseptically prepared with a combination of chlorhexidine gluconate and alcohol. The anesthetic protocol was formulated based on each individual medical patient's condition. A rectal examination was performed to empty the caudal rectum, the rectum was packed with a gauze sponge, and the anus was sutured with a temporary purse-string suture with monofilament non-absorbable material.

All intact patients were castrated using an open pre-scrotal approach. After completion of these steps, the dogs were placed in sternal recumbent at the end of the surgical table, with the tail fixed in dorsiflexion over the back and the pelvic limbs abducted, placed over a pad.

The skin was dorsoventral incised over the hernia, at a lateral distance of 1-2 cm from the anus, beginning near the tail base and extending just ventral to the midpoint between the ischial tuberosity and the pubis. The hernial sac was identified after blunt dissection of the subcutaneous tissues, after that was incised and the herniated organs were reduced into the pelvic or abdominal cavity through the muscular defect. The external anal sphincter muscle combined with levator ani and coccygeus muscles laterally and the external anal sphincter and internal obturator muscle ventrally were apposed prior to SMT.

A skin incision starting at the lateral herniorrhaphy incision was prolonged distally along the caudal aspect of the opposite pelvic limb until the level of the popliteal lymph node. The semitendinosus muscle was carefully dissected to prevent injury to the proximal neurovascular pedicle; the distal caudal femoral artery was located and ligated with 4-0

nylon. The semitendinosus muscle was then transected at the level of the popliteal lymph node and the stump was sutured in a cruciate mattress pattern to control bleeding and prevent local postoperative fluid accumulation. The transected muscle was rotated medially through the subcutaneous tunnel ventral to the anus up to the opposite lateral perineum (Figure 1). The distal end of the flap was sutured to the pelvic diaphragm muscles. A 3-0 monofilament non-absorbable suture material (nylon) was used in an interrupted pattern. Muscle transposition was performed from the less to the more severely affected side. A digital rectal exam was performed at the end of the surgery in all dogs for evaluation of the pelvic diaphragm reconstruction. A simple continuous pattern (3-0 monofilament non-absorbable nylon) was used to close the subcutaneous tissue over the graft, and the skin was apposed with an interrupted pattern (3-0 monofilament non-absorbable nylon). The purse string was removed.

Postoperative evaluation

All dogs were evaluated at 72 hours, 7, 15, 30 and 60 days from hospital discharge. Post-operative antibiotic, analgesic and anti-inflammatory treatment were prescribed taken into account the individuals cases. Follow-up attention was focused on postoperative complications related to perineal hernia including tenesmus, fecal and/or urine incontinence, rectal prolapse and lameness, strangury, hematochezia, dyschezia, fecal impaction, and recurrence. Perineal hernia recurrence was diagnosed as a novel perineal hernia on the side of the perineal hernia repair by clinical signs (constipation, obstipation, dyschezia, tenesmus, rectal prolapse, strangury, or anuria) digital rectal examination and image exams.

Figure 1. Intraoperative view of the medial rotation of the semitendinosus muscle (*), passing through the subcutaneous tunnel (#) ventral to the anus up to the lateral perineum of the opposite side.

Statistical analysis

Descriptive statistics were calculated for all variables. Continuous explanatory variables assessed included age, and body weight. The categorical variables assessed were sex, neuter status, duration of clinical signs, complications and recurrence.

RESULTS

Eleven male dogs with perineal hernia were included. Ten were neutered (90.9%) and 01 were intact (9.1%) at the time of presentation. The mean age was 10.45±2.33 years and the mean body weight was 18.52 ±12.46 kg. Five dogs (45.45%) had been previously submitted to perineal herniorrhaphy. The affected breeds details as well as age and weight range are represented in Table 1. Duration of clinical signs before presentation ranged from 1 to 730 days. All 11 dogs presented perineal swelling, 9 (81.81%), tenesmus, 9 (81.81%), dyschezia and 5 (45.45%) dysuria. Three (27.27%) dogs had a retroflexed urinary bladder, two (18.18%) dogs had a prostate and one (9.9%) dog had a small intestine found within the hernias at the time of surgery. All dogs had rectum deviation.

Complications

Partial wound dehiscence occurred in two dogs (18.18%). In dog Nº. 1, dehiscence occurred at the dorsal aspect of the SMT and in the other dog at the ventral aspect of the SMT incision, healing was achieved on a twice-a-day sterile chlorhexidine shampoo and saline solution wound cleaning basis. Postoperative complications related to the perineal hernia occurred in 8 (72.72%) of 11 dogs. This included long-lasting tenesmus and dyschezia (n=7), and rectal (n=1) prolapse. Acupuncture treatment combined with dietary management based on stool softeners and increased fiber content was advised for patients presenting with difficulty in passing stools beyond 60 days after surgery.

Table 1. Clinical characteristics at presentation of the dogs.

Dog	Breed	Age (Years)	Weight (Kg)
1	Sheepdog	10	24.0
2	Crossbreed	14	13.0
3	Crossbreed	11	17.5
4	Poodle	12	6.1
5	Crossbreed	10	14.0
6	Rottweiller	5	31.7
7	Dachshund Cross	11	7.2
8	Rottweiller	9	48.6
9	Poodle	12	9.4
10	Crossbreed	12	18.8
11	Crossbreed	9	13.4

Unilateral recurrence was detected in 8 (72.72%) of 11 dogs. In two dogs the recurrence occurred in the dorsal region of the ischiorectal fossa, in the other dogs the recurrence occurred in any lateral side within the 90-day follow-up period. Table 2 presents the complication rate associated with semitendinosus muscle transposition repair of perineal hernia in dogs.

Radiographic and ultrasonographic assessment within 30, 60, and 90 days of surgery revealed correct bladder and bowel location (i.e., within the abdominal cavity) in all patients. Prostate size decreased following castration in dogs presenting with prostatomegaly prior to surgery. Final appearance following semitendinosus muscle transposition and skin closure at 30 days of follow-up in Figure 2.

DISCUSSION

This is the first report to evaluate the efficacy of modified whole semitendinosus muscle transposition for the correction of bilateral and ventral perineal hernia in dogs. The age and sex status of affected dogs in the present study were consistent with previous reports (Morello et al., 2015; Shaughnessy; Monnet, 2015; Stoll et al., 2002; Swieton et al., 2020; Tobias; Crombie, 2022), however, the present study included a higher proportion of castrated males (BENARDÉ et al., 2018; Morello et al., 2015; Tobias; Crombie, 2022). Mean body weight was 10.45, similar to previous studies (Morello et al., 2015; Wallace et al., 2021). Crossbreed was the most commonly affected breeds as observed by other authors (Benardé et al., 2018; Carbonell Rosselló et al., 2023; Cinti; Rossanese; Pisani, 2021; Swieton et al., 2020).

Table 2. Complication rates following semitendinosus muscle transposition in dogs with perineal hernia

Complication	Number of dogs	Rate (%)
Partial wound dehiscence	2	18.18
Tenesmus and dyschezia	7	63.63
Rectal prolapse	1	9.09
Unilateral recurrence	8	72.72

Figure 2. **A**, Immediate postoperative appearance after skin closure and **B**, Full recovery (30 days follow-up), following semitendinosus muscle transposition with showing wound healing with no recurrence of the hernia.

Semitendinosus muscle transposition is indicated in dogs diagnosed with chronic, recurrent (Chambers; Rawlings, 1991; Mann; Constantinescu, 1998) or ventral perineal hernias (Morello et al., 2015), and constitutes an alternative perineal hernia repair method in dogs. In the present study all dogs had ventral PHs and five dogs presented recurrent perineal hernias justifying to transpose the muscle to fill the ventral perineal defect based on the unilateral transposition semitendinosus muscle through the subcutaneous tunnel ventral to the anus as indicated by the authors above (Chambers; Rawlings, 1991; Mann; Constantinescu, 1998; Morello et al., 2015).

The SMT-modified technique was proposed to transpose the muscle to fill in the perineal defect based on the contralateral transposition of the semitendinosus muscle through midsagittal subcutaneous tunneling. Reconstruction using semitendinosus muscle and medial half semitendinosus muscle transposition (Morello et al., 2015) have been associated with the rate of dehiscence of 40% and 21.4% respectively due to the large incision required. The rationale for modifying the standard SMT was that a smaller skin incision reduces surgical dissection, being a faster and easier surgical option with a minor risk of complications.

Contralateral muscle flap transposition may be impaired by post-transection muscle shortening; therefore, the transection was performed at the level of the popliteal lymph node as recommended (Morello et al., 2015; Mortari et al., 2005). On the other hand, some dogs have a thick semitendinosus muscle, and redundancy does not allow proper tension to ensure adequate ventral rectal support (Morello et al., 2015). In this study, the transection shortening of the left semitendinosus muscle prevented right-sided hernia correction due to insufficient muscle length in one chondrodystrophic patient. Additionally, one dog had thick semitendinosus muscle, and in both dogs (18.8%) occurred partial wound dehiscence.

Tenesmus is a commonly reported complication after perineal herniorrhaphy ranging range from 8% to 44% (Brissot; Dupré; Bouvy, 2004; Cinti; Rossanese; Pisani, 2021; Grand, Bureau, Monnet, 2013; Morello et al., 2015; Szabo; Wilkens; Radasch, 2007). In our study, 45% of the dogs had long-lasting tenesmus and dyschezia after surgery, this rate is according to previous reports. Rectal prolapse is reported to occur in cases of both bilateral and ventral perineal hernia (9–17%) (Bongartz et al., 2005; Hosgood et al., 1995; Morello et al., 2015). Rectal prolapse occurred in one dog (9%) after herniorrhaphy in this study, similarly observed in cases of bilateral and ventral in previous reports.

Recurrence is a reported complication after perineal herniorrhaphy (10–27.4%) (Brissot; Dupré; Bouvy, 2004; Heishima et al., 2022; Morello et al., 2015; Shaughnessy; Monnet, 2015; Swieton et al., 2020). Contrary to reported authors the recurrence rate observed in this study was 72.72%. The higher rate of recurrence in this study may be attributable to the variation

among different dog breeds with different length and thicknesses of semitendinosus muscle. Therefore, long-pedicled muscle flaps can cause partial fibrosis, vascular impairment and necrosis (Geerdes et al., 1997). Accessibility and pattern of vascular supply are also important factors of the muscle flap (Kim et al., 2023).

The main limitation of the present study include the small sample size, which makes it more difficult to reach significant conclusions. Additionally, the heterogeneity of breeds in the study makes it difficult to standardizer length and thick of muscle and predict complications. The lack of a control group limited the ability to compare our outcomes with previous techniques.

CONCLUSION

Perineal hernia repair based on the unilateral transposition of the semitendinosus muscle through the subcutaneous tunnel ventral to the anus is feasible in dogs with bilateral and ventral perineal hernias. However, in the condition under the study the technique was unable to reduce complications and recurrence rates in dogs with bilateral and ventral perineal hernias. This study provides evidence that modified semitendinosus muscle transposition through the subcutaneous tunnel can be used to repair cases of bilateral and ventral perineal hernias, but further controlled studies involving more dogs are warranted.

AUTHOR CONTRIBUTIONS

P.M.L.B., A.J.S. Contributed conception and design of the study. P.M.L.B., T.C.A.A. Wrote the original draft of the manuscript. G.F.Q. Provided critical revision. J.M.M., D.T.F. Contributed by assisting in surgeries and critical care of animals. All authors contributed to the article and approved the submitted version. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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