Modified semitendinosus muscle transposition to repair ventral perineal hernia in 14 dogs

Manuscript entitled "Modified semitendinosus muscle transposition to repair ventral perineal hernia in 14 dogs"

Word count 2840

Summary

Objectives. To describe a modified technique of semitendinosus muscle transposition for the repair of ventral perineal hernia.

Methods. Retrospective review of case records of dogs with ventral perineal hernia that were treated by transposing the medial half of the longitudinally split semitendinosus muscle of one limb. The transposition of the internal obturator muscle was used when uni- or bilateral rectal sacculation was also present in addition to ventral perineal hernia; colopexy and vas deferens pexy were also performed.

Results. Fourteen dogs were included. In addition to ventral perineal hernia, unilateral and bilateral perineal hernia was also present in five and six of the dogs, respectively. The mean follow-up time was 890 days. Ventral perineal hernia was successfully managed by the modified semitendinosus muscle transposition with minor complications in all the dogs included in the study.

Clinical Significance. Despite the small number of dogs included, the unilateral transposition of the medial half of the longitudinally split semitendinosus muscle consistently supported the ventral rectal enlargement in perineal hernia without obvious adverse effects.

Keywords

Dog, longitudinally split semitendinosus muscle, ventral perineal hernia.

Introduction

Perineal hernia (PH) occurs because of weakness and separation of the pelvic diaphragm (Aronson, 2012) resulting in rectal sacculation or dilatation (Niles and Williams, 2005). Many factors may contribute to the degenerative changes of the pelvic diaphragm, including tenesmus (Head et al. 2002; Aronson, 2012), pelvic musculature variations (male vs. female) (Aronson, 2012), hormone influence (Mann et al. 1989; Mann et al. 1995; Merchav et al. 2005; Niebauer et al. 2005), and pelvic muscles atrophy due to neuropathy (Sjollema et al. 1993). The transposition of the internal obturator muscle (TIOM) is the most commonly recommended procedure to re-establish the pelvic diaphragm (Hardie et al. 1983). Other techniques have also been described (Burrows and Harvey, 1973; Spreull and Frankland, 1980; Stoll et al. 2002; Bongartz et al. 2005; Szabo et al. 2007; Lee et al. 2012; Pratummintra et al. 2013). In cases of PH with major rectal sacculation, PH recurrence, retroflexed bladder and/or prostate herniation, herniorrhaphy may be combined with colo-, cysto- and vas deferens pexy (Bilbrey et al. 1990; Brissot et al. 2004). PH may recur, especially in cases with muscle atrophy and/or ventral perineal hernia (VPH) (Orsher, 1986). VPH, often associated with bilateral PH, is a rectal sacculation between the ischiourethralis, bulbocavernosus, and ischiocavernosus muscles (Aronson, 2012). It represents a considerable challenge to the surgeon. If the degree of ventral sacculation is small, suturing the elevated obturator flap as far medially as possible is often satisfactory (Niles and Williams, 2005). Larger ventral rectal defects can be managed with the semitendinosus muscle transposition (SMT), as reported in two cases (Chambers and Rawlings, 1991).

It has been the authors' experience that standard SMT was not optimal for VPH repair. Subsequently an alternative to the full SMT through the median separation of the semitendinosus muscle (SSMT) was developed that appeared to be more useful and successful. The aim of this study was to describe this new technique and to report its efficacy and clinical outcome in a population of dogs affected with VPH. It was hypothesized that the SSMT would be successful in

treating VPH.

Materials and Methods

Inclusion Criteria

Medical case records of dogs undergoing VPH repair with SSMT were reviewed (2007-2013). Only complete records with signalment, history, clinical presentation, treatment modalities, intra- and post-operative complications and a minimum of 6 months follow-up were included.

Pre-surgical evaluations

Work-up included a complete physical examination, blood cell count and serum chemistry profile, urinalysis, abdominal, scrotal, and, if needed, perineal (for bladder retroflection and/or prostate herniation) ultrasound. Diagnosis of VPH was reached by rectal digital and perineal palpation, always performed by the same surgeon (PB). When ventral rectal sacculation was still present after colopexy and TIOM, SSMT was performed to give ventral rectal support.

Anaesthesia and Pain Management

After methadone administration (0.2 mg/kg intramuscularly (IM)) (Eptadone, Molteni Farmaceutici), anaesthesia was induced with propofol (4-8 mg/kg intravenously (IV) administered to effect) (Fresenius, Kabi) and maintained with isoflurane in oxygen. Analgesia was provided with target-controlled infusion of fentanyl (Fentanest, Pfizer). Pre-operative cefazolin (22 mg/kg IV) (Cefazolina, TEVA) was administered at anaesthesia induction, then every 90 minutes until completion of surgery.

Animal preparation and positioning and ancillary procedures

The skin of the abdomen, perineum, scrotum, tail base and thigh of one limb were clipped; rectum and anal sacs were digitally emptied and the urethra catheterized. When uni- or bilateral rectal sacculation/dilatation with marked rectal enlargement because of faecal accumulation was detected at pre-operative rectal digital exploration, colopexy and vas deferens pexy were also performed. For colopexy and vas deferens pexy or orchiectomy, dogs were placed in dorsal recumbency and the abdominal and scrotal skin aseptically prepared. At the end of the abdominal surgery, the dogs were positioned in sternal recumbency, with the pelvic limbs hanging over the edge of the surgical table (de Mello Souza and Mann, 2013). At this point, before herniorrhaphy, the decrease of rectal sacculation as a result of colopexy was evaluated by digital exploration. The tail was fixed over the back and a purse-string suture was placed around the anus; then perineum, tail base and caudal thigh were aseptically prepared. In all the unilateral PH cases, the limb opposite the lateral rectal defect was clipped; the right limb was systematically prepared in all other cases (VPH only or bilateral PH).

Colopexy, vas deferens pexy, orchiectomy and herniorrhaphy were performed during the same anaesthesia. Colopexy consisted of descending colon cranial traction and left flank, 3-4 cm long, incisional musculo-muscular suture (Williams, 2012); for vas deferens pexy each vas deferens was sutured to itself after passing it caudo-cranially through an ipsilateral abdominal wall muscular tunnel (Aronson, 2012); 3/0-2/0 monofilament absorbable material (glycomer 631, Biosyn, Tyco Healthcare) was used for both procedures.

Perineal Herniorrhaphy

Lateral PHs were repaired by TIOM (elevated with periosteum) (Aronson, 2012) and VPHs by SSMT (see later). When combined with TIOM, SSMT was performed after completion of TIOM. Herniorrhaphy was always performed by the same surgeon (PB).

The skin incision was continued from the ventral end of TIOM incision or, if not combined with TIOM, approximately 3 cm lateral to the tail base, extending ventrally toward and across the midline up to the opposite ischiatic tuberosity. The incision was then continued distally along the contralateral caudal thigh, up to the popliteal area. In contrast to SMT, in which the entire muscle is transected proximal to the popliteal lymph node (Chambers and Rawlings, 1991), the semitendinosus muscle was first isolated, then longitudinally and bluntly split in two parts with scissors, sparing both the proximal and distal vascular pedicles (proximally caudal gluteal artery and distally distal caudal femoral artery) (Figure 1). Then only the medial part of the muscle was transected distally, proximal to the popliteal lymph node (Figure 2). The distal stump was sutured to the intact lateral muscular half, whose fascia was opposed with a simple continuous suture (Figure 3). The transected split muscle was rotated medially, passing ventral to the anus up to the opposite lateral perineum (Figure 3, 4). The distal end of the flap was sutured to either the coccygeus muscle and/or the sacrotuberous ligament (Figure 3, 4), the medial border of the flap to the ventro/lateral aspect of the external anal sphincter, while the lateral border to the internal obturator muscle (elevated in case of TIOM), ischiourethralis and bulbospongiosus muscles (taking care to avoid the urethra) and fascia of the dorsal border of the ipsilateral ischiatic tuberosity (Figure 3, 4). A 3/0-0 monofilament absorbable suture material was used (glycomer 631, Biosyn) in an interrupted pattern. Drains were not used.

A rectal examination was performed after procedure completion to assess the reestablishment of rectal wall support and to ascertain that no sutures had penetrated the rectal lumen.

Post-operative care

All dogs received buprenorphine post-operatively (10 µg/kg 6-8-hourly, subcutaneously (SC)) (Temgesic, Schering-Plough Spa,) for 48-72 hours. Metronidazole (10 mg/kg 12-hourly, per os (PO)) (Flagyl, Zambon) and amoxicillin/clavulanic acid (22 mg/kg 12-hourly, PO) (Amoxicillina/ac clavulanico, TEVA) were administered for 7-10 days. Carprofen (2.2 mg/kg 12-hourly, PO)

(Rimadyl, Pfizer) was given for 7 days. An Elizabethan collar was placed. At discharge, owners were advised to feed the dog with a low-residue diet for the first 30 days.

Follow-up

Dogs were re-examined for early and late post-operative complications and long-term outcome. For long-term follow-up (≥ 6 months), attention was focused on PH recurrence, determined both by clinical signs and digital rectal examination. Tenesmus, faecal and/or urine incontinence, rectal prolapse and lameness were classified as transient or persistent when present for less or more than 6 postoperative months, respectively.

Physical, rectal and limb function were evaluated at 7, 15 and 30 days from hospital discharge. Thereafter, the dogs were re-revalued by the referring veterinarians every 3 months in the first postoperative year and every 6 months thereafter. When PH recurrence was suspected or lameness noted, the dogs were re-checked by the surgeon (BP).

Results

Signalment - Clinical Findings

Fourteen dogs were included. Median age was 9 years (range 6-14; mean 9.2); median weight was 22 kg (range, 7-37; mean 21.1). All the dogs were male. The affected breeds as well as clinical signs at presentation (mean duration 153.5 days, range 95-201, median 159.5) are reported in Table 1. Preoperatively, none of the dogs showed pre-existing orthopaedic problems.

Previously performed surgeries and abdominal ultrasound findings are reported in Table 1.

At presentation, in addition to VPH (Figure 5), 3 dogs had a left-sided PH, 2 a right-sided PH, and 6 a bilateral PH (Table 1).

147 *Ancillary procedures*

148 Colopexy and vas deferens pexy were performed just before herniorrhaphy in 6 dogs (Table 1). The
149 preoperatively diagnosed paraprostatic cyst (Table 1) was treated by partial cyst wall resection and
150 omentalization. Orchiectomy was performed simultaneously to herniorrhaphy in 6 dogs (Table 1).
151 Histology of all testicles removed was available and revealed an interstitial cell tumour in one dog
152 (Table 1). Histology of the enlarged prostate on a tissue sample collected during abdominal surgery
153 revealed benign prostatic hyperplasia (Table 1).

154

155 *Perineal Herniorrhaphy*

156 In 5 and 6 dogs (Table 1) unilateral and bilateral TIOM was performed, respectively. Right (1, 2, 5,
157 6, 7, 9, 10, 11, 12, 13, 14) or left (3, 4, 8) SSMT was performed.
158 Postoperative digital rectal examination confirmed the resolution of PH in all the dogs and the
159 absence of sutures penetrating the rectal wall.

160

161 *Complications*

162 Partial wound dehiscence occurred in 3 dogs (Table 1) at the dorsal aspect of the SSMT incision;
163 healing was achieved on a twice-a-day sterile saline solution wound cleaning basis; antibiotics
164 (amoxicillin/clavulanic acid, 22 mg/kg 12-hourly, PO; metronidazole, 10 mg/kg 12- hourly, PO)
165 were continued for 10 days. Some swelling at the caudal thigh and perineum was observed in all
166 cases; spontaneous resolution occurred within the first post-operative examination (7 days). Post-
167 operative limb function appeared normal in 11 dogs; in two dogs (n. 7, 8) a persistent (≥ 6 months)
168 grade I (subtle, intermittent weight-bearing lameness) (Anderson et al. 2002) painless lameness was
169 evident. Neurological and orthopaedic examinations performed post-operatively were normal.

Post-operative tenesmus occurred in all dogs. It was transient (spontaneous resolution within 7-15 days) in 12 cases and long lasting but intermittent (>6 months) in 2 dogs (Table 1). Rectal prolapse occurred in 1 dog (Table 1), despite colopexy and herniorrhaphy; this was treated 1 month after herniorrhaphy by partial rectal amputation (Aronson, 2012).

Outcome

Median follow-up time was 833 days (range 582-1237; mean 890). No PH recurrence was detected at 7, 15 and 30 days. A long-term PH recurrence with recurrence of tenesmus and perineal swelling was detected on rectal examination in 2 dogs (Table 1), at 731 and 527 days, respectively. Recurrence occurred bilaterally (Table 1) or on the opposite site from SSMT (Table 1). Owners refused further treatment. VPH never recurred. At the time of writing 11 dogs are still alive (median 914; range 582-1237 days); 1 dog (n. 2) was lost to follow-up after 731 postoperative days, and 2 dogs (5, 9) died of unrelated causes (hit by a car, old age) after 724 and 1133 days, respectively.

Discussion

It was hypothesized that SSMT would be useful to treat VPH in dogs. In the present study, all 14 dogs clinically affected with VPH were successfully treated with SSMT. Recurrence occurred in two dogs, but only on the lateral component of their PH.

Factors negatively influencing the outcome of surgical repair include bilateral and ventral rectal sacculation (Burrows and Harvey, 1973; Orsher and Johnston, 1985), previous surgeries (Brissot et al. 2004), marked rectal faecal impaction (Brissot et al. 2004) and concurrent prostatic disease (Brissot et al. 2004). Eight out of 14 dogs in this study had already been surgically treated elsewhere for PH on one or multiple occasions, one dog had an enlarged prostate, and one had a paraprostatic cyst; marked rectal sacculation with faecal accumulation was present in all cases.

TIOM is the recommended treatment for PH with lateral rectal sacculation (Szabo et al. 2007) but

difficulties in restoring the pelvic diaphragm have been reported because of muscle atrophy, VPH or PH recurrence after TIOM (Burrows and Harvey, 1973; Hardie et al. 1983; Orsher, 1986). In cases of VPH, the defect can be only partially repaired by suturing the two internal obturator muscles at the midline (Chambers and Rawlings, 1991), while a ventral rectal support has been successfully provided by semitendinosus muscle transposition (Chambers and Rawlings, 1991).

The semitendinosus muscle has most of the features required for a vascularized muscular transposition flap (Mortari et al. 2005). To the authors' knowledge, no large case series dealing with SMT for VPH repair in dogs has been published so far. The procedure is reported in some veterinary surgical textbooks (Niles and Williams, 2005; Aronson, 2012), and it has been published as an experimental work (Mortari et al. 2005) and as a case report in two dogs (Chambers and Rawlings, 1991).

In this study, it was proposed to transpose the muscle to fill in the ventral perineal defect according to a modified technique based on the unilateral transposition of the medial half of the longitudinally split semitendinosus muscle. The rationale to modify the standard SMT was that in some dogs (not presented here) having a thick semitendinosus muscle, redundancy did not allow a proper tension to ensure an adequate ventral rectal support, while the modified technique resulted in a subjectively better result, and it became the preferred technique at the authors' institution in selected cases. In particular, the post-operative rectal examination of the dogs treated by SSMT revealed subjectively a consistent ventral rectal support in all cases; furthermore, the lateral support was subjectively much stronger when SSMT was combined with TIOM on the same side.

Colopexy and vas deferens pexy were performed during the same anaesthetic procedure for herniorrhaphy. According to previous studies (Brissot et al. 2004), colopexy contextually to herniorrhaphy partially resolved the rectal deviation also in this study, thus making herniorrhaphy easier. When judged appropriate, vas deferens pexy was useful for stabilizing both the prostate gland and bladder neck (Bilbrey et al. 1990).

220 Partial surgical wound dehiscence was observed in 3 dogs (21%). This is commonly observed after
221 PH repair (4-26%) (Orsher, 1986; Hosgood et al. 1995; Brissot et al. 2004; Szabo et al. 2007; Niles
222 and Williams, 2005). A higher incidence is reported after semitendinosus muscle transposition
223 (40%) because of faecal contamination and extensive surgical dissection (Mortari et al. 2005). The
224 cause of dehiscence was not further investigated in the present study because second intention
225 healing was easily achieved.

226 Normal limb function has been reported by Mortari et al. (2005) after complete semitendinosus
227 muscle transposition. In the present study, limb use did not appear to be subjectively affected by the
228 procedure in all but two dogs (14%), in which a persistent grade I and painless lameness was noted.
229 In these two dogs, preoperative limb function was normal; when these dogs were re-evaluated for
230 this slight lameness, both neurological and orthopaedic examinations were normal.

231 A long lasting but intermittent tenesmus was observed in two dogs (14%). Tenesmus is a reported
232 complication after perineal herniorrhaphy (8-44%) (Hosgood et al. 1995; Brissot et al. 2004; Szabo
233 et al. 2007; Grand et al. 2013). Causes of persistent post-operative tenesmus have not been exactly
234 determined. Rectal deformations associated with persistent recto-colitis, colo-rectal hypomotility
235 due to long-term straining and a possible influence of colopexy have been suggested (Hosgood et al.
236 1995).

237 PH recurrence occurred in two dogs (14%); it was evident bilaterally in one dog and on the side
238 opposite to previous SSMT in the other. However, in both dogs, the ventral rectal support was still
239 present at rectal examination. Recurrence is a reported complication after perineal herniorrhaphy
240 with TIOM (10-20%) (Niles and Williams, 2005; Brissot et al. 2004; Szabo et al. 2007; Grand et al.
241 2013). A higher risk of recurrence and worse prognosis has been associated with bilateral, ventral
242 and complicated hernias (Orsher, 1986; Brissot et al. 2004).

243 Rectal prolapse occurred in one dog (7%) after herniorrhaphy. This complication can develop after

reconstruction of the pelvic diaphragm in cases of both bilateral and ventral PH (9-17%) (Hosgood et al. 1995; Bongartz et al. 2005; Aronson, 2012). Partial rectal amputation was needed and curative in this dog.

In a previous study electromyography showed that the transposed semitendinosus muscle was still able to contract, but atrophy was detected by both ultrasonography and morphological analysis within its distal part (Mortari et al. 2005). Neither ultrasound nor electromyography was performed in the present study. Nevertheless, the low number of recurrences recorded suggests that, if atrophy was present, it did not prevent SSMT from functioning as a support to the rectum.

The long-term results presented in this retrospective case series suggest that a) the semitendinosus muscle can be safely longitudinally split, b) the transposition of half of the muscle was enough to adequately fill in the ventral pelvic diaphragm defect, c) the SSMT achieved long term support of the ventral aspect of the rectum.

This study provides evidence that SSMT can be used to sustain the rectum ventrally in case of severe VPH, but further studies involving more dogs are warranted. It is also believed that a comparison with dogs treated by transposing the entire muscle (standard SMT technique) may be useful.

References

1. Anderson, G. M., Lewis, D. D., Radasch, R. M., et al. (2002) Circular external skeletal fixation stabilization of antebrachial and crural fractures in 25 dogs. *Journal of The American Animal Hospital Association* **39,** 479–498.
2. Aronson, L. R. (2012) Rectum, Anus and Perineum. In: Veterinary Surgery Small Animal. Eds K. M. Tobias and S. A. Johnston. Saunders, Philadelphia. pp 1564-1600.
3. Bilbrey, S. A., Smeak, D. D., DeHoff, W. (1990) Fixation of the deferent ducts for retrodisplacement of the urinary bladder and prostate in canine perineal hernia. *Veterinary Surgery* **19**, 24–27.
4. Bongartz, A., Carofiglio, F., Balligand, M., *et al*. (2005) Use of autogenous fascia lata graft for perineal herniorrhaphy in dogs. *Veterinary Surgery* **34**, 405-413.
5. Brissot, H. N., Duprè, G. P., Bouvy, B. M. (2004) Use of laparotomy in a staged approach for resolution of bilateral or complicated perineal hernia in 41 dogs. *Veterinary Surgery* **33**, 412-421.
6. Burrows, C. F., Harvey, C. E. (1973) Perineal hernia in the dog. *Journal of Small Animal Practice* **14**, 315–332.
7. Chambers, J. N., Rawlings, C. A. (1991) Applications of a semitendinosus muscle flap in two dogs. *Journal of The American Veterinary Medical Association* **199**, 84-86.
8. de Mello Souza, C.H., Mann, T. (2013) Perineal hernias. In: Small Animal Soft Tissue Surgery. Ed E. Monnet. Wiley-Blackwell Saunders, Ames-Iowa. pp 286-296.
9. Grand, J.G., Bureau, S., Monnet, E. (2013) Effects of urinary bladder retroflection and surgical technique on postoperative complication rates and long term outcome in dogs with perineal hernia: 41 cases (2002-2009). *Journal of The American Veterinary Medical Association* **243**, 1442-1447.

10. Hardie, E. M., Kolata, R. J., Earley, T. D., *et al.* (1983) Evaluation of internal obturator muscle transposition in the treatment of perineal hernia in dogs. *Veterinary Surgery* **12**, 69-72.

11. Hosgood, G., Hedlund, C. S., Pechman, R. D., *et al*. (1995) Perineal herniorrhaphy: perioperative data from 100 dogs. *Journal of The American Animal Hospital Association* **31**, 331-342.

12. Lee, A. J., Chung, W. H., Kim, D. H., *et al.* (2012) Use of canine small intestinal submucosa allograft for treating perineal hernias in two dogs. *Journal of Veterinary Science* **13**, 327-330.

13. Mann, F.A., Boothe, H.W., Amoss, M.S., *et al.* (1989) Serum testosterone and estradiol 17-beta concentration in 15 dogs with perineal hernia. *Journal of The Veterinary Medical Association* **194**, 1578–1580.

14. Mann, F.A., Nonneman, D.J., Pope, E.R. *et al*. (1995) Androgen receptors in the pelvic diaphragm muscles of dogs with and without perineal hernia. *American Journal of Veterinary Research* **56,** 134-139.

15. Merchav, R., Shamay, A., Feuerman, Y. *et al*. (2005) Expression of relaxin receptor LRG7, canine relaxin, and relaxin-like factor in the pelvic diaphragm musculature of dogs with and without perineal hernia. *Veterinary Surgery* **34**, 476-481.

16. Mortari, A. C., Rahal, S. C., Resende, L. A., *et al.* (2005) Electromyographical, ultrasonographical and morphological modifications in semitendinosus muscle after transposition as ventral perineal muscle flap. *Journal of Veterinary Medicine. A, Physiology, Pathology, Clinical Medicine* **52**, 359-365.

17. Niebauer, G.W., Shibly, S., Seltenhammer, M., et al. (2005) Relaxin of prostatic origin might be linked to perineal hernia formation in dogs. *Annals of the New York Academy of Science* **1041,** 415-422.

18. Niles, J. D., Williams, J. M. (2005) The large intestine and rectum. In: BSAVA Manual of canine and feline abdominal surgery. Eds J. D. Niles and J. M. Williams. BSAVA, Gloucester. pp. 125-167.

19. Orsher, R. J., Johnston, D. E. (1985) The surgical treatment of perineal hernia in dogs by transposition of the obturator muscle. *The Compendium on Continuing Education* **7**, 233-239.

20. Orsher, R. J. (1986) Clinical and surgical parameters in dogs with perineal hernia. Analysis of results of internal obturator transposition. *Veterinary Surgery* **15**, 253-258.

21. Pratummintra, K., Chuthatep, S., Banlunara, W., *et al.* (2013) Perineal hernia repair using an autologous tunica vaginalis communis in nine intact male dogs. *Journal of Veterinary Medical Science* **75**, 337-341.

22. Sjollema, B.E., Venker-va Haagen, A.J., van Sluijs, F.J., *et al*. (1983) Electromyography of the pelvic diaphragm and anal sphincter in dogs with perineal hernia. *American Journal of Veterinary Research* **54**,185-190.

23. Spreull, J. S. A., Frankland, A. L. (1980) Transplanting the superficial gluteal muscle in the treatment of perineal hernia and flexure of the rectum in the dog. *Journal of Small Animal Practice* **21**, 265-278.

24. Stoll, M. R., Cook, J. R., Pope, E. R., *et al*. (2002) The use of porcine small intestinal submucosa as a biomaterial for perineal herniorrhaphy in the dog. *Veterinary Surgery* **31**, 379-390.

25. Szabo, S., Wilkens, B., Radasch, R. (2007) Use of polypropylene mesh in addition to internal obturator transposition: a review of 59 cases (2000-2004). *Journal of The American Animal Hospital Association* **43**, 136-142.

26. Williams, J. M. (2012) Colon. In: Veterinary Surgery Small Animal. Eds K. M. Tobias and S. A. Johnston. Saunders, Philadelphia. pp 1542-1563.

Table

Table 1. Signalment, clinical signs at presentation, ultrasound examination findings, treatment modalities and outcome of the 14 dogs included in the present retrospective case series.

Figure legends

Figure 1. Intraoperative view of the blunt dissection of the semitendinosus muscle from the adjacent structures.

Figure 2. The muscle is longitudinally and bluntly split in two parts, in this modified technique. The medial part of the muscle is then transected distally, close to the popliteal lymph node (dotted black line), the lateral half remains intact in its anatomic position.

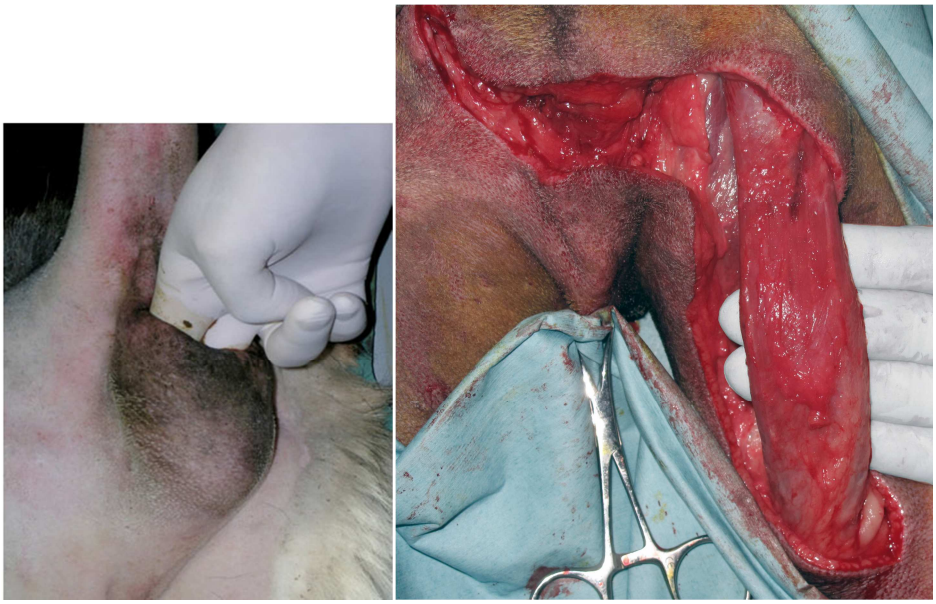
Figure 3. Intraoperative view of the medial rotation of the split muscle, passing beneath the anus up to the lateral perineum of the opposite site.

Figure 4. Schematic artwork of the surgical technique proposed in the present paper. The transected medial part of the split muscle is rotated medially, passing beneath the anus up to the lateral perineum of the opposite site. After rotation, the distal end of the muscle is sutured to the coccygeus muscle and/or to the sacrotuberosous ligament. The medial border of the muscle is sutured on both the lateral aspects of the anus to the ventro/lateral aspect of the external anal sphincter, while its split border is sutured to the internal obturator muscle (elevated in the case of TIOM), the ischiourethralis and bulbospongiosus muscles (on the sagittal plane), the fascia of the dorsal border of the omolateral ischiatic tuberosity and the perineal fascia.

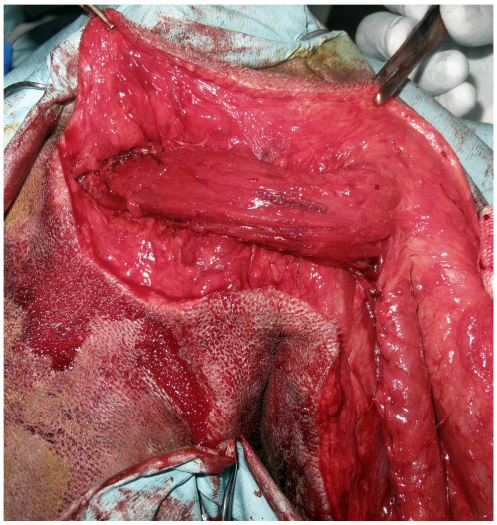
Figure 5. Clinical evidence of severe ventral rectal sacculation at digital rectal examination.

Case n°	Breed	Weight (Kg)	Age (yy)	Sex	Clinical signs at presentation	Previous surgery (herniorrhaphy and ancillary procedures)	Ultrasound examination findings	PH Side	Current surgery	Follow up (days)	Post surgical complication	PH recurrence
1	Mixed	7	9	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	COLP, OR, DEFP, L R TIOM	NR	V	R SSMT	1033	persistent tenesmus	N
2	Mixed	10	9	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	OR, R L SPH	NR	L, R, V	COLP, DEFP, R SSMT, L R TIOM	731	none	Y, L and R
3	Maltese	8	10	MI	Tenesmus, dyschezia with fecal impaction, perineal swelling	N	Enlarged prostate	R, V	OR, DEFP, COLP, L SSMT, R TIOM	1237	none	N
4	Pekingese	8	9	MI	Tenesmus, dyschezia with fecal impaction, perineal swelling	N	NR	R, V	OR, L SSMT, R TIOM	1133	persistent tenesmus	N
5	Mixed	35	7	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	L TIOM, OR, OM prostatic abscess	NR	R, L, V	R SSMT, R L TIOM	724	none	N
6	Mixed	32	10	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	COLP, DEFP, OR, L R TIOM	NR	V	R SSMT	1024	post operative rectal prolapse	N
7	German Shepherd	34	8	MI	Tenesmus, dyschezia with fecal impaction, perineal swelling	N	Testicular tumor	R, L, V	COLP, DEFP, R SSMT, L R TIOM, OR	582	wound dehiscence, slight lameness	N
8	American bull dog	22	7	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	OR, COLP, DEFP, R L SPH	NR	R, L, V	R SSMT, R L TIOM	708	wound dehiscence, slight lameness	Y, L
9	Siberian Husky	25	14	MI	Tenesmus, dyschezia with fecal impaction, perineal swelling	N	Paraprostatic cyst	L, V	OR,COLP,DEFP, R SSMT, L TIOM, paraprostatic cyst OM	1133	none	N
10	Collie	22	8	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	L SPH, OR	NR	L, V	R SSMT, L TIOM	752	wound dehiscence	N
11	German Shepherd	33	9	MI	Tenesmus, dyschezia with fecal impaction, perineal swelling	N	NR	R, L, V	OR, COLP, DEFP, R SSMT, R L TIOM	1142	none	N
12	Hovawart	37	9	MI	Tenesmus, dyschezia with fecal impaction, perineal swelling	N	NR	R, L, V	OR, COLP, DEFP, R SSMT, R L TIOM	914	none	N
13	Maltese	12	14	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	L SPH, OR	NR	L, V	L TIOM, R SSMT	713	none	N
14	Bolognese	11	6	MC	Tenesmus, dyschezia with fecal impaction, perineal swelling	R L TIOM, COLP, OR, DEFP	NR	V	R SSMT	639	none	N

M: Male; C: castrated; I: intact; L: left; R: right; V: ventral; SSMT: split semitendinosus muscle transposition; COLP: colopexy; OR: orchiectomy; DEFP: vas deferens pexy; TIOM: transposition internal obturator muscle; OM: omentalization; PH: perineal hernia; SPH: standard herniorraphy by simple muscle apposition; NR: nothing relevant; N:no; Y:yes



365



366

367

368