Treatment of canine perineal hernia with a fascia lata graft is noninferior to the elevation of the internal obturator muscle: a prospective randomized trial of 66 dogs

Tuuli M. Åhlberg, DVM*; Kati Salla, DVM, PhD; Outi M. Laitinen-Vapaavuori, DVM, PhD, DECVS; Sari H. Mölsä, DVM, PhD, DECVS

Department of Equine and Small Animal Medicine, Faculty of Veterinary Medicine, University of Helsinki, Helsinki, Finland

*Corresponding author: Dr. Åhlberg (tuuli.ahlberg@helsinki.fi)

OBJECTIVE
To compare the recurrence rate after herniorrhaphy of canine perineal hernia (PH) using elevation of the internal obturator muscle (EIOM) or fascia lata graft (FLG) and assess how clinical signs related to defecation evolve during 12 months postoperatively.

ANIMALS

METHODS
Dogs were randomized into 2 groups (EIOM = 36; FLG = 30) applying 2 stratification factors: preoperative bladder location and the defecation signs score (DSS). Follow-up visits were at 2 weeks and 3, 6, and 12 months postoperatively. The main outcome, the recurrence of PH was evaluated by rectal examination. We evaluated the noninferiority of FLG to EIOM from the difference in recurrence proportions between the techniques (95% CI), comparing the CI with a pre-defined noninferiority margin (15%). To evaluate defecation signs, the DSS was calculated from the owner questionnaire and assessed with a linear mixed model (P < .05 significant).

RESULTS
In 63 dogs attending the 12-month follow-up, the recurrence rate was 8.8% (3/34) in the EIOM and 10.3% (3/29) in the FLG group. The CI (–11.94% to 14.99%) was below the pre-defined margin, indicating the noninferiority of FLG. After surgery, the DSS decreased (P < .001), remaining low during the follow-up.

CLINICAL RELEVANCE
FLG was non-inferior to EIOM when considering recurrence. The DSS decreased postoperatively and complications were uncommon. FLG is a useful alternative for the treatment of canine PH.

Keywords: fascia lata graft, elevation of the internal obturator muscle, herniorrhaphy, recurrence, dog

Perineal hernia (PH) is a condition of mainly older intact male dogs in which the perineal muscles atrophy and separate, allowing the rectum and pelvic organs to deviate into the perineal area.1–3 Symptoms include perineal swelling, straining, and tenesmus.4,5 The condition is typically chronic, with bouts of acute constipation, increasing in severity over time and significantly affecting the dog’s quality of life.5,6

Several surgical techniques for PH repair exist, the most common being elevation of the internal obturator muscle (EIOM) with its various modifications.4,5,7–10 Other muscle transposition techniques include the superficial gluteal and,11 for ventral PH, the semitendinosus muscle technique.12 Autologous grafts, such as fascia lata (FLG) or tunica vaginalis communis, and exogenous materials, such as synthetic polypropylene mesh can be used.13–15 Colopexy, vasopexy, and cystopexy are intended to relieve bladder retroflexion and rectal abnormalities, but require an abdominal approach.16,17

No single technique has consistently been shown to prevent hernia recurrence. For EIOM, the recurrence rate varies between 0% and 21.4%.5,8,10,17–19 Promising techniques have been introduced; for example, dogs treated with FLG were without recurrence in 1 study.13 Other materials, such as polypropylene mesh and porcine small intestinal submucosa, have been successfully used, however, cost and availability may be a concern.20 The time from surgery to recurrence is typically under 6 months but
can exceed a year, with the reasons for recurrence being unclear.7,13,16,17,21

Recurrence has been evaluated prospectively for single techniques only.7,13,22 Reported recurrence rates were mostly based on owner questionnaires instead of clinical examinations, reducing the reliability of the reported outcomes.13,14,16 No recurrence was found on rectal examination in 31 dogs surgically treated for PH after a minimum follow-up of 24 months.22

Other measures by which the surgical outcome can be evaluated include complications and persistent clinical signs.7,16,17 Scoring systems were used in several studies to evaluate these postoperative defecation and urinary signs (eg, tenesmus, constipation, and urinary incontinence).18,19,22 Short-term complications, such as wound infection, seroma, rectal prolapse, and fecal incontinence, have also been described.4,10,22,22

Our objective was to prospectively compare the outcomes in dogs randomly assigned for herniorrhaphy using either the EIOM or FLG technique during a follow-up of 12 months. Comparison of recurrence was the main objective and in addition we evaluated clinical signs related to defecation. Our hypotheses were that PH repair with FLG would not be inferior to EIOM regarding the recurrence rate, and severity of postoperative defecation signs would decrease but not disappear completely.

Methods

This research was ethically approved by the Finnish national Project Authorization Board: ESAVI/4467/04.10.07/2017. Owners gave written consent for their dogs to participate in the study and could withdraw without repercussions.

Animals

This prospective clinical study included dogs with naturally occurring uni- or bilateral PH, referred for surgery to the Veterinary Teaching Hospital of the University of Helsinki from March 2017 to December 2020. It is part of a larger research project assessing the etiology and treatment of canine PH.22,24 All dogs underwent a physical examination and assessment of the complete blood count and serum biochemistry. Diagnosis of PH was based on rectal examination. The periurethral diaphragm was assessed laterally on both the left and right sides and categorized as “normal” (support comparable to a normal diaphragm), “loose” (support weaker than normal but no palpable PH), or “PH” (hernial opening palpated rectally). Possible rectal dilation was assessed, with a subjectively increased circumference and decreased tonus considered as dilation (no/yes).

Only dogs with lateral PH underwent herniorrhaphy. In the case of bilateral PH, the subjectively larger hernia was treated first, followed by the second herniorrhaphy aimed 2 to 4 weeks later. Dogs that had previously undergone surgical treatment for PH or had an American Society of Anesthesiologists physical status rating of 4 or 5 were excluded.

Randomization and defecation signs score

Dogs were randomly assigned for herniorrhaphy with either EIOM or FLG using 2 stratification factors: bladder location on rectal examination (normal, retroflexed) and the preoperative defecation signs score (DSS). As an exception, dogs with patellar luxation were treated with EIOM due to the risk of FLG harvest destabilizing the patella. The researchers were blinded to the randomization list created by an impartial statistician.

The DSS was developed for this study to evaluate clinical signs associated with defecation (Supplementary Material S1). It was based on an owner questionnaire including 6 defecation signs: tenesmus, defecating small quantities at a time, problems evacuating the bowel, prolonged positioning for defecation, constipation, and thickened stool. Each sign was given a numerical value from 0 to 3 (absent, less than once a week, weekly, and daily), and the sum was calculated, with a maximum of 18. Possible missing values were accounted for with the following calculation:

\[
\text{Patient score} = \frac{\text{Total score possible} - \text{number of missing values} \times 3}{\text{Total score possible}}
\]

For stratification, 2 groups were formed using the following chosen DSS cut-off values: mild (≤10) and severe (>10) signs.

Surgical procedures

A standard anesthesia protocol was prospectively designed and optimized if needed by an anesthesiologist. Before surgery, all dogs received IV sulfadoxine/trimethoprim (15 mg/kg). General anesthesia was conducted with sevoflurane in oxygen and epidural ropivacaine.

All surgical procedures were carried out by the same ECVS-diplomate (SHM). The dogs underwent standard preparation for surgery and prescrrotal closed castration if intact. Hernia contents were recorded (none, rectum, fat, fluid, bladder, and prostate). After herniorrhaphy, the extent of hernial coverage was subjectively described as poor (insufficient coverage with significant tension in suture lines), moderate (fair coverage with some tension in suture lines), or good (excellent coverage with no/minimal tension in suture lines).

The EIOM technique described by Orsher and Johnston was modified as follows.7 After internal obturator muscle elevation, its tendon was transected. Altogether, 3 to 5 simple interrupted polydioxanone (2-0 or 3-0) sutures attached the internal obturator to the coccygeus and external anal sphincter, as well as the external anal sphincter to the coccygeus. The levator ani was incorporated in the sutures if identified. Where the condition of the coccygeus was poor, the sacrotuberous ligament was included in the sutures. The anal gland was probed to avoid misplacing sutures.

The FLG technique described by Bongartz et al. was slightly modified.13 The fascial defect left after graft harvest was not closed. The FLG was attached with simple interrupted polydioxanone 2-0 or 3-0 sutures, with the first suture attaching the FLG to the coccygeus or the ventral sacrocaudal muscle. A further 3 to 5 sutures were placed along the coccygeus, 5 to 7 between the graft and the external anal sphincter, and 3 to 5 sutures to the obturator muscle.
and/or ischial periosteum. When in place, the graft was taut and supported the pelvic diaphragm.

After each procedure, the subcutaneous tissue was closed with a simple continuous and the skin with an intradermal continuous pattern using 3-0 or 4-0 polydioxanone.

Postoperative management and early complications
For postoperative analgesia, dogs received IV meloxicam (0.2 mg/kg) at the end of the surgery and, based on the short form of the Glasgow Composite Pain Scale, IV methadone (0.2 mg/kg) if needed. Dogs were hospitalized overnight unless restricted by the dogs’ temperament or owner refusal. Evaluation of early complications occurred the following day, including signs of wound redness/bruising or swelling (no/yes), lameness (no/yes, and if yes, the grade on a scale from 0 to 4), or decreased static weight bearing assessed subjectively (no/yes).

After discharge, the dogs received oral meloxicam (0.1 mg/kg once daily for 5 to 6 days), sulfadoxine/trimetoprim (30 mg/kg twice daily for 5 days), and lactulose (twice daily continuously). Oral tramadol was prescribed (2 mg/kg up to 3 times daily) as a rescue analgesic. Dogs were required to use an Elizabethan collar.

Outcome measures, short- and long-term complications, and persistent clinical signs
Clinical outcomes were assessed at 2 weeks, as well as 3, 6, and 12 months after the surgical procedure. For dogs with bilateral PH, the 2-week follow-up took place after each surgery. However, if bilaterality was evident during the first surgery, contralateral surgery was planned 2 weeks later with the 2-week follow-up conducted on the same date. Ensuing follow-up visits were scheduled at 2 weeks and 3, 6, and 12 months after the latter surgery. At each visit, dogs were evaluated and owners questioned concerning short- and long-term complications, the DSS, and persistent clinical signs. All preoperative and control visits including rectal examinations were carried out by the same PhD researcher with a degree in veterinary medicine (TMÅ).

The main outcome, recurrence of the hernia, was defined as a loss of support provided by the surgical procedure as discovered on rectal palpation. Perineal diaphragm support and any rectal dilation was assessed as before surgery. The DSS was assessed as described earlier.

Short-term complications, assessed at the 2-week follow-up, included evaluation of surgical wounds (healed, suture reaction, seroma, infection), rectal prolapse (no/yes), lameness (no/yes, and if yes, the grade on a scale from 0 to 4), or decreased static weight bearing (no/yes), and possible patellar luxation (no/yes, and if yes: graded I to IV). The owner-reported postoperative incidence of urinary or fecal incontinence was noted (no/yes).

Long-term complications (ie, complications occurring more than 2 weeks after surgery) and persistent clinical signs (ie, signs that had been present before but also continued after surgery) were assessed at the 3-, 6-, and 12-month follow-ups. These included tenesmus, constipation, blood or mucus in the feces, urinary incontinence, and perineal swelling (no/yes).

Data analysis
Statistical analysis was performed with standard software (SPSS Statistics, version 27.0.1; IBM Corp; and SAS, version 9.4; SAS Institute Inc). The sample size was calculated for a noninferiority trial comparing the recurrence rate following FLG and EIOM with a binary outcome (0 = no recurrence, 1 = recurrence). The prevalence of PH is estimated at around 0.4% and the recurrence rate at 10%. The margin for noninferiority was pre-defined at 15%. A sample size of 60 to 70 dogs would provide 72% power, deemed sufficient to prove noninferiority. The difference in proportions of recurrence between the 2 techniques (with a 1-sided 95% CI according to the Farrington–Manning method23) was calculated and the CI compared with the pre-defined noninferiority margin of 15%. In cases of recurrence, factors such as preoperative castration status, the DSS, and surgical findings were explored.

The DSS was assessed using a linear mixed model with restricted maximum likelihood estimation, comparing the change in DSS over the 12-month follow-up. The fitted model included fixed effects for the time point and dog as the random effect. Using least square means (with 95% CI), the change from preoperative DSS was estimated for each time point.

Descriptive statistics were calculated as percentages (n/N) or as medians (IQR; range) and compared categorical variables between techniques using the Pearson χ² test. Continuous demographic variables were compared using an independent samples t test. P values < .05 were considered statistically significant.

Results
The inclusion criteria were met by 66 dogs. The most common breeds were as follows: mixed (n = 9), Coton de Tulear (8), Dachshund (5), and Shetland Sheepdog (3). The median age was 7.8 years (IQR, 3.27; range, 4.6 to 11.6 years), and weight was 12.6 kg (IQR, 15.1; range, 4.2 to 38.0 kg).

Altogether, 54.5% (36/66) of the dogs underwent surgery with the EIOM and 45.5% (30/66) with the FLG technique. Castration was performed in 89.4% (59/66), while 7 dogs were already neutered (EIOM = 5, FLG = 2). Two dogs had bladder retroflexion before surgery (EIOM = 2). Neither age nor weight differed between surgical groups (P = .221).

The most common breeds were Coton de Tulear (n = 6) and mixed (5) in the EIOM, and mixed (4) and Dachshund (3) in the FLG group.

Of the 66 dogs, 27 had unilateral and 39 bilateral PH, with a total of 105 hernia repairs (Figures 1 and 2).
In dogs with bilateral PH, 56.4% (22/39) were in the EIOM and 43.6% (17/39) in the FLG group. Most unilateral hernias (70.4%; 19/27) were right sided, with 52.6% (10/19) in the EIOM and 47.4% (9/19) in the FLG group. Only 29.6% (8/27) of unilateral PH were left sided, equally distributed between groups.

The contralateral side was operated using the same technique, with a median of 20 days (IQR, 21; range, 8 to 170 days) between surgeries. Of the dogs

---

**Figure 1**—Flowchart of findings on rectal examination (normal, loose, or hernia) after unilateral perineal hernia surgery of male dogs (n = 27) at 2 weeks and 12 months postoperatively between 2017 and 2021. The techniques used were elevation of the internal obturator muscle (EIOM) and fascia lata graft (FLG).

**Figure 2**—Flowchart of findings on rectal examination (normal, loose, or hernia) after bilateral perineal hernia surgery of male dogs (n = 39), assessed separately for both sides at 2 weeks and 12 months postoperatively between 2017 and 2021. The techniques used were EIOM and FLG.
with bilateral PH, 35.9% (14/39) initially presented as unilateral and were diagnosed as bilateral at the 2-week follow-up. Only 1 dog originally diagnosed as unilateral developed PH on the opposite side at 3 months. After undergoing surgery, it remained in the study for a further 12 months. The owners of 2 dogs with bilateral PH refused contralateral surgery as they were without clinical signs (DSS = 0), and these dogs were treated as unilateral in this study. Neither had recurrence of the surgically treated hernia.

The most common hernia content was fat from the pelvic cavity in 81.9% (86/105), followed by a deviated rectum in 36.2% (38/105), interstitial fluid in 24.8% (26/105), prostate in 11.4% (12/105), and bladder in 1.9% (1/105) of surgeries. The contents did not differ between surgical groups (P = .02). The coverage of the hernia provided by the techniques was good in 71.3% (67/94) of surgeries, being 57.1% (28/49) in the EIOM and 86.7% (39/45) in the FLG group. There was a difference between surgical groups (P = .006). Intraoperative complications included hemorrhage (FLG = 1; EIOM = 1) and suture placement in the anal gland, noticed during surgery and removed (FLG, 1).

Early, short-, and long-term complications

In 41.9% (44/105) of surgeries, the dogs were hospitalized until the following day and underwent assessment of early complications. Of these surgeries, 59.1% (26/44) were with the EIOM and 40.9% (18/44) with the FLG technique. The most common early complication was mild or moderate redness/bruising around the surgical incision site, occurring in 61.5% (16/26) of the EIOM and 61.1% (11/18) of the FLG surgeries (P = .977). Surgical incision site swelling occurred in 42.3% (11/26) of the EIOM and 72.2% (13/18) of the FLG surgeries (P = .050). None of the wounds required further treatment. The FLG group underwent a separate wound assessment of the graft harvest site, with mild redness/bruising occurring in 33.3% (6/18) and swelling in 11.1% (2/18).

The day after surgery, mild lameness most likely due to the FLG harvest occurred in 2 dogs. One treated bilaterally was lame after both surgeries. Two other dogs in the FLG group had decreased static weight bearing of the operated limb.

All 66 dogs attended the 2-week follow-up. There were 3 dropouts during the study: 1 left the country before 12 months (FLG) and 2 were euthanized (EIOM), 1 for suspected prostatic cancer (before the 3-month follow-up), and 1 for non-hernia-related reasons (before the 6-month follow-up). All 3 had unilateral PH and none had signs of recurrence on exiting the study. At the 3-month follow-up, physical and rectal examinations were done to 93.8% (61/65) of dogs and questionnaires were answered by 96.9% (63/65) of owners, as 2 dogs could not attend the follow-up due to the COVID-19 pandemic, but the owners filled out the questionnaire. At 6 months, 96.8% (62/64) of dogs and at 12 months all 63 dogs still in the study attended the follow-up.

At the 2-week follow-up, the most common short-term complication was self-resolving seroma, occurring in 10.3% (6/58) of surgeries in the EIOM and 12.8% (6/47) in the FLG group. Suture reactions occurred in 2.9% (3/105) and wound inflammation in 3.8% (4/105) of surgeries. All wound complications were superficial. Only 1 dog in the FLG group displayed lameness and none of the previously unaffected dogs developed patellar luxation. One dog developed rectal prolapse 12 days postoperatively, requiring treatment with a purse-string suture (EIOM = 1). Fecal incontinence occurred in 3 dogs (EIOM = 1; FLG = 2) resolving before the 3-month follow-up. As a long-term complication, ie, not present before surgery, urinary incontinence occurred in 1 dog (FLG).

Recurrence of PH

The recurrence rate at the 12-month control visit was 9.5% (6/63), 8.8% (3/34) in the EIOM, and 10.3% (3/29) in the FLG group (Supplementary Table S1). Assessing noninferiority, the difference in proportions between techniques was 1.52%, 95% 1-sided CI (–11.94, 14.99). Using the pre-defined noninferiority margin of 15%, the FLG was noninferior to the EIOM (Table 1).

Six dogs had recurrence of PH, with a total of nine recurring hernias (unilateral n = 3; bilateral, 3). The mean age, breed distribution, castration status, and intraoperative hernia content of fat (n = 7), rectum (4), fluid (2), and prostate (1) in the original surgeries were comparable with the total study population. Hernial opening coverage was considered good in all but 1 dog, in which this was moderate. The hernia was reoperated unilaterally in 1 dog and bilaterally in 1 (Table 1; dogs 4 and 6), while the rest were treated conservatively.

Excluding dogs with recurrence, when the surgically repaired perineal diaphragms were evaluated

Table 1—Recurrence rate over a 12-month follow-up period in male dogs with perineal hernia between 2017 and 2021, including the difference between 2 surgical techniques: elevation of the internal obturator muscle (EIOM) and fascia lata graft (FLG).

<table>
<thead>
<tr>
<th>Time point</th>
<th>RR EIOM % (n/N)</th>
<th>RR FLG % (n/N)</th>
<th>Risk difference</th>
<th>90% Lower CL</th>
<th>90% Upper CL</th>
<th>Noninferiority limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n = 66)</td>
<td>8.33 (3/36)</td>
<td>10.00 (3/30)</td>
<td>1.67</td>
<td>-11.31</td>
<td>14.64</td>
<td>15.00</td>
</tr>
<tr>
<td>3 mo (n = 65)</td>
<td>2.86 (1/35)</td>
<td>3.33 (1/30)</td>
<td>0.48</td>
<td>-10.51</td>
<td>11.46</td>
<td>15.00</td>
</tr>
<tr>
<td>6 mo (n = 64)</td>
<td>8.82 (3/34)</td>
<td>3.33 (1/30)</td>
<td>-5.49</td>
<td>-16.91</td>
<td>5.93</td>
<td>15.00</td>
</tr>
<tr>
<td>12 mo (n = 63)</td>
<td>8.82 (3/34)</td>
<td>10.34 (3/29)</td>
<td>1.52</td>
<td>-11.94</td>
<td>14.99</td>
<td>15.00</td>
</tr>
</tbody>
</table>

CL = Confidence limit. RR = Recurrence rate.

---

2021, including the difference between 2 surgical techniques: elevation of the internal obturator muscle (EIOM) and fascia lata graft (FLG).
at the 12-month follow-up, support was normal in 74.5% (76/102) and loose in 16.7% (17/102). Of the unilateral repairs, the operated side was normal in 79.2% (19/24) of dogs (Figure 1), while bilateral repairs were normal in 61.5% (24/39; Figure 2). There was no difference between surgical techniques in perineal diaphragm support at 12 months ($P = .311$).

The rectum was considered dilated preoperatively in 87.7% (50/57) of dogs, being 89.7% (26/29) in the EIOM and 85.7% (24/28) in the FLG group. Postoperatively, dilation was found in 69.2% (36/52) of dogs at the 2-week, 87.9% (51/58) at the 3-month, 73.7% (42/57) at the 6-month, and 89.8% (53/59) at the 12-month follow-up. Dilation of the rectum did not differ between surgical techniques at 12 months ($P = .759$).

DSS and persistent clinical signs

The DSS contained missing data if the owner reported “not sure” for any given question. For the preoperative questionnaire, 65.2% (43/66) of owners gave full answers, 27.3% (18/66) reported 1, 4.5% (3/66) reported 2, and 1.5% (1/66) reported 3 and 4 “not sure” answers. For the 12-month follow-up, 85.7% (54/63) gave full answers for the DSS, with 11.1% (7/63) reporting 1 and 3.2% (2/63) reporting 2 “not sure” answers.

The median preoperative DSS was 9.6 (IQR, 5.5; range, 0 to 16.0), decreasing postoperatively ($P < .001$) and remaining decreased during the entire follow-up period (Figure 3). The estimated change from the pre-operative DSS was –9.02 (CI, –10.09 to –7.94) at 2 weeks, –8.48 (CI, –9.54 to –7.41) at 3 months, –7.97 (CI, –9.05 to –6.88) at 6 months, and –7.71 (CI, –8.78 to –6.65) at 12 months, and it did not differ between post-operative time-points ($P = .343$).

Persistent clinical signs were uncommon throughout the follow-up period (Figure 4). Tenesmus decreased from 59.7% (37/62) preoperatively to 6.3% (4/63) at 12 months postoperatively, 2 of which had hernia recurrence. Preoperative constipation occurred in 41.1% (23/56), decreasing to 3.3% (2/61) at 2 weeks but increasing again to 11.3% (7/62) at 12 months. One of these dogs had recurrence and others reported having constipation less than once a week. In dogs with urinary incontinence, 3 had symptoms preoperatively and were classified as persistent clinical signs (EIOM = 2, FLG = 1). One did not require treatment, while 2 received daily phenylpropanolamine. The owners reported giving lactulose in 69.8% (44/63) of dogs, administered occasionally or up to twice daily.

Discussion

This is the first randomized prospective follow-up study comparing the outcome of 2 surgical techniques for the repair of PH in male dogs. The aim of the study was to investigate the use of FLG and compare it with EIOM, currently the most common technique for PH repair. FLG is a more recently introduced technique, with 2 published studies on 12 and 5 dogs. Fascial tissue is a commonly used graft material, since it is stronger than muscle and less likely to cause infection or rejection than synthetic materials. In dogs, FLG has clinically been used for repairing cranial cruciate ligament ruptures and urethral defects. Based on our clinical experience, the FLG technique

Figure 3—Line graph of the mean (± SE) defecation signs score (DSS) ranging from none to severe (0 to 18) in male dogs surgically treated for perineal hernia (n = 66), evaluated preoperatively and at 2 weeks and 3, 6, and 12 months postoperatively between 2017 and 2021.

Figure 4—Line graph of owner-reported persistent clinical signs in 63 male dogs surgically treated for perineal hernia reported preoperatively and at 2 weeks and 3, 6, and 12 months postoperatively between 2017 and 2021.
is relatively simple to perform, not requiring specialized equipment, and takes only 15 to 20 minutes to harvest the graft.

The major concerns with the FLG are the need for an additional approach to the thigh and possible lameness resulting from the fascial defect. Contrary to previously reported lameness in 10/12 dogs, only 4/30 dogs in our study showed transient lameness or changes in static weight bearing. Unlike in the previous study, we refrained from closing the remaining fascia after FLG harvest, which may have decreased tension and discomfort.13 Due to concern over further destabilizing the patella, dogs with patellar luxation were excluded from the FLG group. As the distal edge of the graft harvest site remained relatively far from the stiffe joint and none of the dogs developed patellar luxation, this measure was perhaps overcautious.

To our knowledge, this is the first study to assess the ability of surgical techniques to cover the hernial opening. Although EIOM provides a thick and strong coverage, elevating the obturator muscle is sometimes challenging, and closure of the dorsal part requires apposition of the coccygeus and external anal sphincter. This potentially causes tension in the repair, although elevation is improved by severing the tendon.3,9 Despite coverage assessment being very subjective, we found FLG to provide significantly better coverage of the hernial opening than EIOM, and it could thus be considered especially for large hernias.

At the 12-month follow-up, the recurrence rate was 8.8% in the EIOM and 10.3% in the FLG group. Although the only other FLG study had a 0% recurrence rate, our findings are in accordance with previous studies with larger populations and longer follow-up periods.15,16,17 Noninferiority of the FLG technique to the EIOM technique was demonstrated, making FLG a promising alternative, especially in cases of reherniation where the single-incision techniques have failed. In addition to the surgical technique, other factors that may affect recurrence rates include the experience of the surgeon, the suture material used, and the extent of perineal muscle atrophy.1,7 All dogs in our study underwent surgery by 1 ECFS-diplomate using slowly absorbable monofilament sutures. We decided not to report the condition of the perineal muscles or size of the hernia, since these measures were challenging to reliably evaluate.

Persistent postoperative clinical signs despite a lack of recurrence have been reported in several studies (eg, postoperative tenesmus in up to 26.5% of dogs).4,8,22 However, when these clinical signs have been quantified using scoring systems, reported scores have tended to be low.4,13,22 As dogs with PH display a wide spectrum of clinical signs, specific scoring systems and regular assessment of signs are needed. For our DSS, we aimed to include comprehensive evaluation of defecation-related clinical signs and used frequency to reflect their severity. In addition, we assessed the signs at regular intervals for a year. As was expected after surgical PH correction, the DSS decreased significantly after surgery. Interestingly, it also remained low throughout the follow-up period, with most dogs free of or only occasionally presenting clinical signs.

Approximately 60% of dogs in our study had bilateral PH, which is similar to other studies.4,5 Preventive bilateral repair for dogs with unilateral PH was recommended in 1 study.22 In our study, only 1 dog developed a hernia on the contralateral side during the follow-up, questioning the necessity of this preventive measure.

On rectal examination at 12-months, the pelvic diaphragm of the operated side was found to be loose in approximately 17% of dogs, questioning whether rectal support was adequate. Although the DSS was slightly higher in these dogs than in dogs with normal support, this difference was not significant. Of the operated hernias, only 2 loose sides at 2 weeks developed into a hernia by 12 months. However, as the number of affected dogs was low, drawing conclusions is difficult. Although the diagnosis of hernia itself on rectal examination is straightforward, differentiating between normal and loose can be challenging and subjective. When the unoperated side of unilaterally affected dogs was assessed, 11 were loose at 2 weeks, decreasing to 2 at 12 months. Postoperative swelling of the operated side and initially firm support of the repair at 2 weeks postoperatively made the contralateral side feel loose. Based on these findings, we propose that dogs undergo an additional assessment 1 to 3 months postoperatively to evaluate the need for further intervention.

Interestingly, the rectum was assessed to be dilated in approximately 90% of dogs at the 12-month follow-up, independent of the technique used. This is clinically relevant, as although the perineal diaphragm felt normal in most dogs, the rectum itself remained dilated. In PH, chronic constipation and feces accumulation may cause pressure and stretching of the rectal wall. These changes might be irreversible, leading to reduced contractility, feces accumulation, and persistent clinical signs. There was no significant difference in DSS between dogs with and without dilation, despite being slightly higher in dogs with dilation. Dogs in this study received lactulose in approximately 70% of cases, with administration ranging from occasional to twice daily. In dogs with rectal dilation, lactulose can ease defecation, which may have influenced the DSS values. Thus, lactulose could be recommended especially for dogs with rectal dilation after PH surgery.

Complications were uncommon and similar in both surgical groups. The most common short-term complication was a self-resolving seroma of the perineal surgical wound (11.4%), similar to other studies (8.3% to 19.1%).8,10,13 Wound infection rates in previous studies have ranged from 6% to 45%,4,5,8 but in our study, only mild inflammation was diagnosed in 4% of surgeries. Fecal incontinence, previously reported in up to 15% of PH dogs, with nerve damage speculated as the cause, temporarily occurred in 3 dogs at the 2-week follow-up.1,5,6 One dog had transient rectal prolapse, which is below the 4% to 12% incidence reported in other studies.4,13 Urinary incontinence occurred in 6% of dogs at 12 months, being similar to other studies. It was classified as a persistent clinical sign in 3 dogs and a complication in 1. Although incontinence has previously been
associated with bladder retroflexion, in this study it occurred in only 2 dogs, neither of which had urinary incontinence postoperatively.16,17

One major limitation of our study is that the DSS developed for this study has not been validated. Description of defecation signs may vary significantly between owners, with certain signs, such as constipation and tenesmus, carrying an additional risk of overlap. These limitations mean that comparing results between dogs may not be reliable. Therefore, we assessed how the DSS changed during the follow-up period for each dog, maintaining the same evaluator (owner) and additionally refraining from using the DSS to compare techniques. Another limitation is the incomplete randomization into the surgical groups, since dogs with patellar luxation were placed in the EIOM group. This resulted in an unbalanced number of dogs in the 2 groups. Retrospectively patellar luxation could have been an exclusion criterion, however, as patellar luxation is common in small breeds, this would have extended the recruitment time significantly. Some parameters, such as rectal dilation or hernia coverage, are relatively subjective to evaluate. However, all dogs were evaluated by the same person and more objective methods are lacking. Furthermore, not all dogs attended all follow-up visits, exacerbated by the COVID-19 pandemic, leading to missing data. However, the calculated sample size was achieved, with only 3 dropouts during the 12-month follow-up. Finally, the aimed stratification based on bladder retroflexion was not fulfilled, as only 3.0% of dogs were affected. We suspect bladder retroflexion cases were treated as emergencies and therefore not referred to our study. Defecation signs are considered 1 of the main indicators of disease severity, which, in the absence of bladder retroflexion, another important indicator, should be sufficient for stratification.7,8

In conclusion, we confirmed our hypothesis: PH repair with FLG is noninferior to EIOM regarding recurrence. Clinical signs decreased, however, did not disappear completely. Complications were mainly transient and persistent clinical signs uncommon. However, in most dogs, the rectum remained dilated during the follow-up.

Acknowledgments

The authors thank Junnila, JYT, for assisting with the statistical analysis.

Disclosures

The authors have nothing to disclose. No AI-assisted technologies were used in the generation of this manuscript.

Funding

The authors have nothing to disclose.

References

29. Paatsama S. Ligament Injuries in the Canine Stifle Joint: A Clinical and Experimental Study. Veterinary College; 1952.

Supplementary Materials

Supplementary materials are posted online at the journal website: avmajournals.avma.org.