

Surgical treatment of perineal hernias in male dogs: the correlation between castration, recurrence and urinary incontinence

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TABLE OF CONTENTS

Table of contents	1
Abstract	2
1. Introduction	3
1.1. <i>The pelvic diaphragm</i>	3
1.2. <i>Perineal hernia</i>	4
1.2.1. <i>Etiology</i>	4
1.2.2. <i>Clinical signs</i>	5
1.2.3. <i>Treatment</i>	5
1.3. <i>Aim of the study</i>	5
2. Literature study	7
2.1. <i>Pathogenesis</i>	7
2.2. <i>Recurrence of perineal hernias</i>	8
2.3. <i>Urinary incontinence</i>	9
2.3.1. <i>Urinary incontinence in dogs with a perineal hernia</i>	9
2.3.2. <i>Urinary incontinence in neutered dogs without a perineal hernia</i>	10
3. Material and methods	11
3.1. <i>Case selection</i>	11
3.2. <i>Data collection</i>	11
3.3. <i>Statistical analysis</i>	11
4. Results	12
4.1. <i>Population of the study</i>	12
4.2. <i>Recurrence of perineal hernias</i>	15
4.2.1. <i>Comparison of recurrence between neutered and intact dogs</i>	17
4.2.2. <i>Statistical analysis</i>	17
4.3. <i>Urinary incontinence</i>	17
4.3.1. <i>Statistical analysis</i>	18
5. Discussion	19
6. References	21
7. Attachments	24
7.1. <i>Attachment I: Survey</i>	24
7.2. <i>Attachment II: Records neutering status</i>	29
7.3. <i>Attachment III: Records perineal hernia</i>	32
8. Acknowledgements	35

ABSTRACT

Objectives: Perineal hernias are most common in intact male dogs. Surgical repair of the hernia is the recommended method of treatment. There is a suspicion that recurrence of perineal hernias after herniorraphy is associated with neutering status of the dog. The effect of castration on preventing recurrence of perineal hernias has been described in several studies. The obtained results were inconclusive. Perineal hernias can cause a great variety of clinical signs. Studies regarding the correlation between herniorraphy and castration in relation to the occurrence of urinary incontinence are limited. This study was set up to investigate if the incidence of recurrence of perineal hernias after herniorraphy differs significantly between castrated and intact male dogs and if the incidence of urinary incontinence after castration and herniorraphy is significantly higher than the incidence of urinary incontinence after castration without perineal hernia surgery. Finally, we made an effort to confirm the expectation that neutered male dogs with a perineal hernia are predisposed for urinary incontinence.

Material and methods: In this retrospective study the medical records of all male dogs surgically treated for a perineal hernia at the Department of Clinical Sciences of Companion Animals of Utrecht University between January 2005 and June 2015 were reviewed. Patient owners were contacted by telephone and asked to fill in a digital survey regarding the follow-up period.

Results: 113 male dogs were surgically treated for a perineal hernia at the Department of Clinical Sciences of Companion Animals of Utrecht University between January 2005 and June 2015. Eight dogs (7.1%) remained intact during the entire follow-up period. Sixteen dogs (14.2%) were neutered prior to the first herniorraphy, 65 dogs (57.5%) during the surgery and 6 (5.3%) after surgery. Only one of the dogs was chemically neutered. In 17 dogs (15%) neutering status was unknown. Recurrence occurred in 25 dogs (22.1%). Recurrence was seen in 17% of the neutered dogs and 62.5% of the intact dogs. Statistical analysis showed that the difference between both groups was significant ($P = 0.009$). Information regarding urinary incontinence was available for 64 dogs. Urinary incontinence was seen in eight of these dogs (12.5%). Six dogs were neutered prior to the occurrence of urinary incontinence. The remaining two dogs were intact at the time of first occurrence of urinary incontinence. Statistical analysis showed no significant association between neutering status and the occurrence of urinary incontinence ($P = 0.312$).

Conclusion: The incidence of recurrence of perineal hernias after herniorraphy is significantly higher in intact male dogs compared to neutered male dogs. There is no significant association between occurrence of urinary incontinence after herniorraphy and neutering status. Urinary incontinence may be more common in neutered dogs with perineal hernia than in healthy neutered dogs, but a prospective study with a control group is necessary to confirm this theory.

1. INTRODUCTION

1.1 The pelvic diaphragm

The pelvic diaphragm is the caudal border of the pelvic cavity. The paired musculus coccygeus and musculus levator ani form the pelvic diaphragm.¹⁻³ The musculus coccygeus is a thick muscle situated at the lateral side of the diaphragm. It originates from the ischiatic spine cranial to the internal obturator muscle. It crosses the medial section of the sacrotuberous ligament and inserts on the second through fifth caudal vertebrae at the lateral side of the tail.¹⁻² Bilateral tightening of this muscle leads to a downward motion of the tail, whereas a unilateral tension causes a lateral flexion. The coccygeus muscle is innervated by the ventral branches of the third sacral nerve.¹ The musculus levator ani is located craniomedially to the coccygeus muscle. It has a broad origin from the medial region of the iliac shaft to the pelvic symphysis. Both parts of the muscle pass the internal obturator muscle dorsally and insert at the seventh caudal vertebra.¹⁻² A bilateral tension on the musculus levator ani presses the tail downwards. Unilateral tightening brings the tail in a craniolateral position for defecation. Ventral branches of the third sacral and first caudal nerve innervate the levator ani muscle.¹ The tone of both muscles is of great importance for maintaining the position of the pelvic organs.²

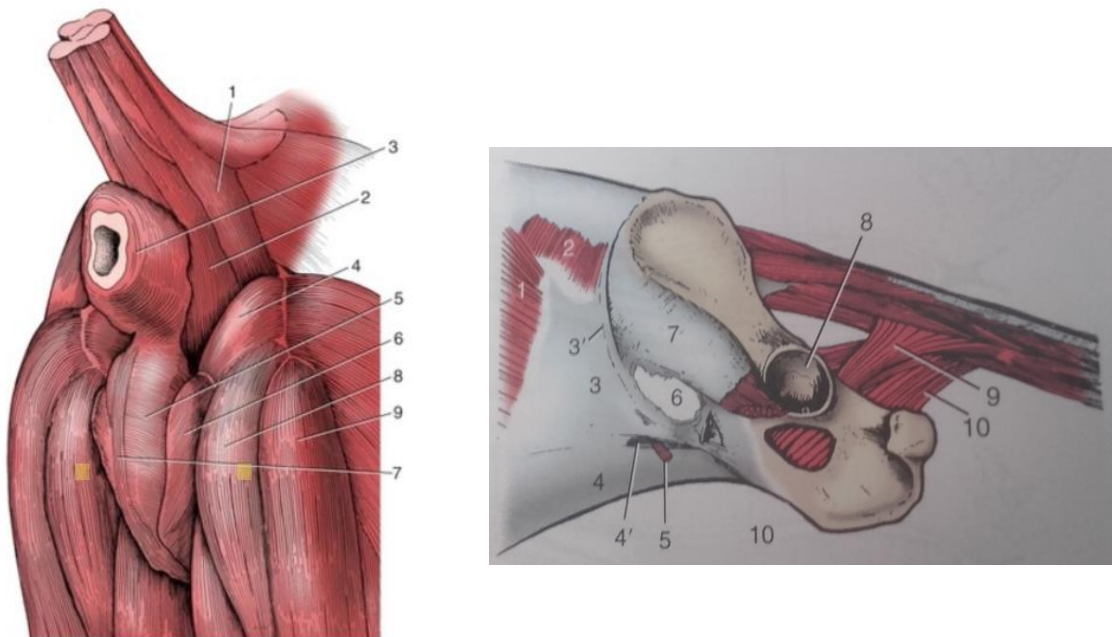


Fig 1 + 2: The muscles of the perineal region of the male dog.²

The musculus coccygeus is represented by number 1 (Fig 1) and number 9 (Fig 2). The levator ani muscle is pointed out by number 2 (Fig 1) and number 10 (Fig 2). Other muscles of the perineal region shown in figure 1 are the external anal sphincter (3), the m. obturator internus (4), the m. bulbospongiosus (5), the m. ischiocavernosus (6), the penile retractor (7), the m. semimembranosus (8) and the m. semitendinosus (9).²

1.2. Perineal hernia

Weakening or atrophy of the muscles of the pelvic diaphragm can lead to formation of a perineal hernia. The cause of this weakening is still unclear. However, there are suggestions that male hormones, straining and a disturbed innervation of the nerves are possibly involved.³⁻⁶ Four different types of perineal hernias can be distinguished based on their location. The caudal hernia is situated between the musculus levator ani, the musculus obturator internus and the external anal sphincter. The sciatic hernia is located between the sacrotuberous ligament and the musculus coccygeus. A herniation between the levator ani muscle and the coccygeal muscle is called a dorsal perineal hernia. In ventral hernias the separation of muscles is between the musculus ischiourethralis, musculus bulbocavernosus and musculus ischiocavernosus.⁴

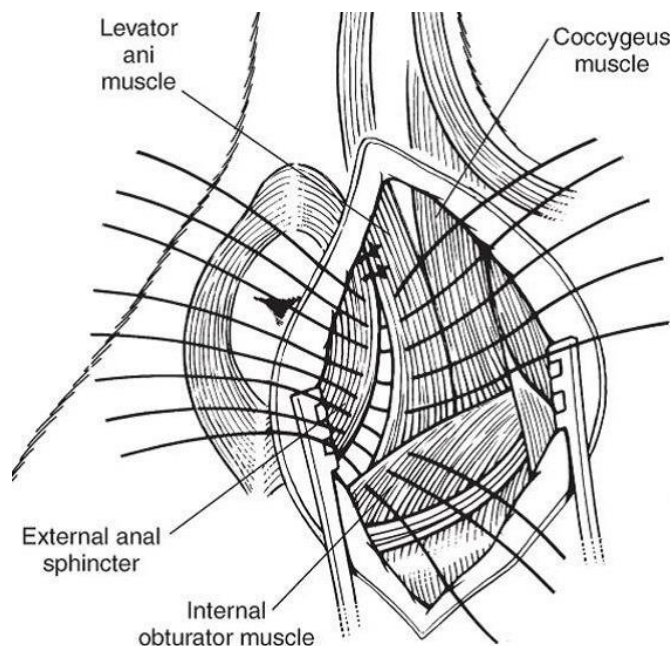


Figure 3 shows a caudal perineal hernia, the most common type in male dogs. The herniation is visible between the external anal sphincter, the musculus levator ani and the internal obturator muscle.⁴

Perineal hernias can either be unilateral or bilateral.^{4,6} In some cases fatty tissue or abdominal organs such as the bladder, prostate, intestines or rectum dislocate and protrude into the hernial sac. This can lead to obstruction or strangulation of the herniated organ.⁴⁻⁶

Fig 3: *The caudal perineal hernia.*⁴

1.2.1. Etiology

Perineal hernias have been diagnosed in humans, dogs, cats and other domestic animals. In people perineal hernias are uncommon. Predisposing factors for humans are the female gender, pregnancy and previous surgery of the rectum or perineum.⁶ Perineal hernias are rarely seen in cats. Male cats are more frequently affected than females. The perineal hernia is most common in dogs. Intact male dogs compose up to 93% of the cases.^{4,5} Most of these dogs are over 5 years old with an average of 10 years. The Boston terrier, boxer, corgi, collie, kelpie, dachshund, Old English sheepdog, pekingese and poodle are thought to be predisposed breeds. Other predisposing factors are short tails and straining due to constipation, diarrhoea and disorders of the lower urinary tract and prostate.⁴⁻¹⁰ According to some studies the right side is affected more often. However, this theory has not been definitively confirmed.⁷ Perineal hernias in female dogs are less frequent and usually caused by trauma.^{4,6}

1.2.3. Clinical signs

Perineal hernias can cause a wide variety of clinical signs. The most frequently identified symptoms are a unilateral or bilateral swelling lateral to the anus, constipation, obstipation, tenesmus, dyschezia, fecal incontinence and rectal prolaps. When an organ has herniated into the hernial sac, obstruction of strangulation can lead to signs of shock, urinary tract obstruction and post renal uremia. Incarceration of the bladder can cause difficulty urinating and ultimately bladder atony or necrosis, which can lead to urinary incontinence.^{4,7} The diagnosis is made based on the clinical signs and rectal examination. Radiography and ultrasonography can be helpful in establishing whether prostate, small intestines or urinary bladder are protruded into the hernia.⁴

1.2.4. Treatment

Medical treatment is usually applied for treating or preventing the occurrence of clinical signs as constipation and dysuria. Laxatives, enemas and high-fiber diets can provide a normalisation of defecation. An incarcerated urinary bladder can be decompressed by cystocentesis or catheterisation. Predisposing factors, such as lower urinary tract infections, benign prostate hyperplasia, prostatic cysts, abscesses and prostatitis, can be treated medically or surgically. However, this is not sufficient for the long-term treatment. Herniorrhaphy is always recommended.⁴ The traditional (anatomic reapposition) and internal obturator transposition techniques are most commonly used. The second technique is more difficult to execute, but has some advantages opposed to the traditional method. It causes less anal deformity and less tension on the sutures, which makes this the preferred surgical technique for perineal hernia repair.^{6,7,11,12}

1.3. Aim of the study

There have been multiple studies that investigated the role of castration in preventing (recurrent) perineal hernias. Unfortunately, no definite conclusion has been established. According to Burrows and Harvey (1973) castration had no effect on the incidence of recurrence or the development of a perineal hernia on the contralateral side.⁶ Four years later Harvey came to the same conclusion.¹³ Another study performed by Hayes (1978) concluded that the risk of recurrence was 2.7 times greater in non-castrated males.^{4,7,11}

Urinary incontinence is more commonly seen in castrated dogs than in intact dogs. Woldberg (2014) suggested in a thesis that the perineal hernia is a predisposing factor for developing urinary incontinence after castration. Urinary incontinence was present in 9 of 60 dogs (15%) after herniorrhaphy, although in 3 dogs incontinence had already started before the surgery. In the same study 6 out of 9 dogs that showed urinary incontinence after herniorrhaphy were neutered prior to the surgery. Castration in dogs without perineal surgery less commonly leads to urinary incontinence (0.8%).⁴ Additional research is necessary to determine the relation between castration after herniorrhaphy and urinary incontinence.

The first aim of this study is to investigate if the incidence of recurrence of perineal hernias after herniorraphy differs significantly between castrated and intact male dogs. In accordance with previous publications regarding the effect of castration in healthy male dogs, neutered male dogs with a perineal hernia are expected to be predisposed for urinary incontinence compared to intact male dogs with this disease. Our second aim is to confirm this expectation and to confirm if the incidence of urinary incontinence after castration and herniorraphy is significantly higher than the incidence of urinary incontinence after castration without perineal hernia surgery.

2. LITERATURE STUDY

2.1. Pathogenesis

Perineal hernia formation is caused by weakening or atrophy of the muscles of the pelvic diaphragm. Multiple factors involved with the pathogenesis have been described. One of these factors is the anatomy of the tail. Both the levator ani muscle as the coccygeus muscle play an important part in movement of the tail. Constant wagging of the tail leads to strengthening of the pelvic diaphragm muscles. Lack of tail movement in short-tailed breeds could predispose them for developing a perineal hernia.⁷

Besides anatomical differences, hormonal influences are also suggested to be involved with the pathogenesis. Intact male dogs are more commonly affected than neutered dogs. Mann et al. (1989) compared the serum testosterone and estradiol 17- β concentrations between dogs with and without perineal hernia. No significant differences were found.¹⁴ However, in another study by Mann et al. (1995) the presence of androgen and estrogen receptors in the levator ani en coccygeus muscle were analyzed in dogs with perineal hernia and compared to a control group of intact adult male dogs without perineal hernia. These measurements were repeated two months after orchiectomy in control dogs. The results showed a significant lower amount of androgen receptors in dogs with perineal hernia compared with the control group prior to castration. Further, two months after orchiectomy the androgen receptors were increased in the control dogs compared to the measurements before orchiectomy.¹⁵ This indicates that castration could be helpful in preventing the occurrence of perineal hernia.

Two more recent studies investigated the role of the hormone relaxin in the pathogenesis of perineal hernias. The main location for relaxin production in male dogs is the prostate. Niebauer et al. (2005) performed immunohistochemistry on the prostate of intact dogs with and without perineal hernia. The prostate of healthy control dogs contained less relaxine than the prostate of dogs with perineal hernia. Relaxin immunostaining in neutered dogs with prostatic atrophy was weak or absent. This suggests that the reduction in relaxin expression is possibly involved with the reduction in the recurrence rate of perineal hernias after castration.¹⁶ Merchav et al. (2005) studied the expression of relaxin, relaxin receptor LRG7 and relaxin-like factor in the muscles of the pelvic diaphragm. The expression of relaxin receptor LRG7 turned out to be significantly higher in dogs with perineal hernia. No significant difference in relaxin expression was found, most likely due to measurements in the pelvic diaphragm muscles instead of the prostate.¹⁷ Both studies indicate that relaxin could be involved in the development of perineal hernias.

Pérez-Gutiérrez et al. (2011) compared the quantity of epidermal growth factor receptor (EGFR), transforming growth factor-alpha (TGF- α) and active caspase-3 in the levator ani muscle between dogs with perineal hernia and control dogs. The results showed a lower expression of TGF- α in dogs with a perineal hernia than in control dogs, whereas EGFR and active caspase-3 were higher.¹⁸ More studies are necessary to determine whether these factors play a role in perineal hernia pathogenesis.

Finally, the influence of nerve damage on the development of perineal hernia has been described. Sjollem et al. (1993) performed electromyography of the levator ani and coccygeus muscles in 40 dogs during herniorrhaphy. In 87.5% of these dogs the EMG revealed four types of spontaneous potentials. Histology of levator ani muscle biopsies uncovered that all atrophied muscles showed spontaneous potentials. This led to the conclusion that atrophy of pelvic diaphragm muscles is most likely of neurogenic origin.¹⁰

2.2. Recurrence of perineal hernias

Recurrence of perineal hernias is one of the possible complications after herniorrhaphy. The second hernia can occur on the previously operated side or the contralateral side. The recurrence rates differ greatly between studies (3% - 46%) and multiple factors have been implicated to affect these rates. Experience of the surgeon, surgical technique and neutering status are frequently mentioned.^{5,6,11-13,19-25} Regarding the effects of neutering, alternating results have been published. Burrows and Harvey (1973) concluded that there was no significant distinction in recurrence of perineal hernias after herniorrhaphy between neutered and intact male dogs.⁶ Four years later Harvey came to the same conclusion.¹³ The results of the largest study to date, with an experimental group of 771 dogs, were completely opposite. Hayes et al. (1978) found that the risk of recurrence was 2.7 times higher among intact dogs compared to neutered dogs ($p < 0.01$).⁵ A study performed by Bellenger (1980) found a total recurrence rate of 15.4%. In 4 out of 26 dogs the perineal hernia recurred. The recurrence rate was 25% for intact dogs and 8.3% in neutered dogs.⁸ Weaver and Omamegbe (1981) found similar results with 21.8% and 12.5% respectively.²¹ Unfortunately, in both studies the differences between neutered and intact dogs were not significant. The study executed by Hardie et al. (1983) mentioned a low recurrence rate of 4.8%. The extremely high recurrence rate for intact dogs (100%) was due to the fact that only one intact dog was included in the study.²³

Other studies that investigated the recurrence rate of perineal hernias after herniorrhaphy (Orsher 1986; Sjollema and van Sluijs 1989; Hosgood et al. 1995; Maute et al. 2001; Brissot et al. 2004; Szabo et al. 2007; Grand et al. 2013; Woldberg 2014; Shaughnessy et al. 2015) did not differentiate between neutered and intact dogs. Table 1 summarizes the recurrence rates found in different studies of canine perineal hernia. When feasible, a distinction between intact and neutered dogs was made.

Reference	Number (#) of dogs	Recurrence rate (%) all dogs	Recurrence rate (%) intact dogs	Recurrence rate (%) neutered dogs
Burrows & Harvey (1973)	72	46.0%	45.0%	43.0%
Harvey (1977)	54	37.5%	38.5%	35.7%
Hayes (1978)	771	31.5%	47.8%	22.2%
Bellenger (1980)	35	15.4%	25.0%	8.3%
Weaver & Omamegbe (1981)	101	18.9%	21.8%	12.5%
Hardie et al. (1983)	42	4.8%	100.0%	2.4%
Orsher (1986)	31	33.0%	-	-
Sjollema & van Sluijs (1989)	100	5.0%	-	-
Hosgood et al. (1995)	100	8.0%	-	-
Maute et al. (2001)	32	21.9%	22.2%	20.0%
Brissot et al. (2004)	41	10.0%	-	-
Szabo et al. (2007)	59	12.5%	-	-
Grand et al. (2013)	41	10.0%	-	-
Woldberg (2014)	60	3.0%	-	-
Shaughnessy et al. (2015)	34	20.5%	-	-

Table 1: Summary of the results regarding recurrence rates in several studies of canine perineal hernia.

Table 1 shows a high diversity of recurrence rates ranging from 3% to 46%. In all studies the recurrence rate for intact dogs was higher than for neutered dogs. In only one of these studies the results were significant (Hayes 1978).⁵ This suggests that the perception that neutering affects the recurrence rate of perineal hernias is a realistic possibility, but additional research is necessary to confirm this theory.

2.3. Urinary incontinence

2.3.1. Urinary incontinence in dogs with a perineal hernia

Urinary incontinence may have different causes. Important causes of incontinence in adult male dogs are urethral sphincter mechanism incompetence after castration, bladder atony after urethral obstruction or bladder retroflexion in dogs with perineal hernia, urge incontinence and congenital abnormalities.

Reference	Number (#) of dogs	UI (%) all dogs	UI (%) intact dogs	UI (%) neutered dogs
Burrows & Harvey (1973)	72	15%*	-	-
Harvey (1977)	54	7.4%	-	-
Bellenger (1980)	35	8.6%	-	-
Orsher (1986)	31	6.5%	-	-
Sjollema & van Sluijs (1989)	100	5.0%	-	-
Hosgood et al. (1995)	100	4.0%	-	-
Maute et al. (2001)	32	3.0%	-	-
Brissot et al. (2004)	41	36%	-	-
Szabo et al. (2007)	59	6.8%	-	-
Woldberg (2014)	60	15%	5.0%	10.5%
Shaughnessy et al. (2015)	34	5.9%	-	-

Table 2: Summary of the results regarding urinary incontinence (UI) after herniorrhaphy in male dogs.

* = Combined percentage for all urinary problems.

Several studies reported urinary incontinence as a complication after perineal herniorrhaphy. The occurrence rates vary between 3% and 36%. The 15% rate reported by Burrows and Harvey (1973) included all urinary problems and mainly consisted of anuria due to retroflexion of the bladder. The exact rate for urinary incontinence is unknown in this study.⁶ In another study performed by Harvey (1977) a urinary incontinence rate of 7.4% was mentioned.¹³ The following three decades more studies reported the occurrence rates of urinary incontinence after perineal hernia surgery and these rates were comparable to those previously established.^{3,8,9,13,19,20,24,25} Brissot et al. (2004) is an exception with an urinary incontinence rate of 36% (15 dogs). In half of the dogs the urinary incontinence was irreversible. Bilateral perineal hernia was diagnosed in 8 dogs, prostatic disease in 9 dogs and retroflexion of the bladder in 6 dogs. Urine dribbling was significantly associated with bilateral herniorrhaphy. However, no significant association between urinary incontinence and prostatic disease or bladder retroflexion was found.¹¹ Only one study (Woldberg 2014) differentiated between urinary incontinence in neutered and intact dogs. In this study, urinary incontinence after herniorrhaphy was established in 15% (9/16) of the dogs. In 3 dogs the incontinence started prior to the surgery. In 6 dogs urinary incontinence occurred as a long-term complication.

One of these dogs was surgically castrated prior to herniorrhaphy. Five dogs were chemically castrated at time of the surgery. One of the chemically castrated dogs was surgically castrated three years after surgery. The urinary incontinence started after the orchiectomy. Six of the nine dogs were castrated prior to the occurrence of urinary incontinence.³ Unfortunately, no statistical analysis was performed.

2.3.2. Urinary incontinence in neutered dogs without perineal hernia

Acquired urinary incontinence after castration with no indication of perineal hernia is most prevalent in bitches.²⁷ Approximately 20% of neutered bitches is affected.²⁸ In intact bitches urinary incontinence occurs in less than 1%.²⁹ Male dogs, either neutered or intact, are seldomly affected.²⁷ An occurrence rate of 0.8% in healthy neutered male dogs has been reported.³⁰

Coit et al. (2008) investigated the effect of neutering on urinary bladder function in male and female dogs. The results showed a significant reduction in sensitivity of the bladder to carbachol, a muscarinic receptor agonist, after neutering in both genders. The percentage of collagen in the bladder wall was only increased in neutered bitches. This led to the conclusion that the increased amount of collagen in the bladder wall possibly predisposes bitches to develop urinary incontinence after neutering. The contrastive results between male and female dogs suggest that multiple mechanisms are involved in changes in bladder function after castration.²⁷

The possible difference in occurrence of urinary incontinence after castration between male dogs with and without perineal hernia indicates that perineal hernia could predispose for developing urinary incontinence after neutering. The amount of available research supporting this theory has been very limited. The current study is designed to determine whether the difference in occurrence rate of urinary incontinence is significant.

3. MATERIAL AND METHODS

3.1. Case selection

The medical records of all animals surgically treated for a perineal hernia at the Department of Clinical Sciences of Companion Animals of Utrecht University between January 2005 and June 2015 were obtained from the patient registration system Vetware. Animals included in this study were neutered or intact male dogs from different breeds. These dogs had to be surgically treated for a perineal hernia at the Department of Clinical Sciences of Companion Animals of Utrecht University. The minimal follow-up period was set at one year after the first surgery. Animals that did not meet these criteria were excluded from participation in this study.

3.2. Data collection

A literature study was carried out to determine the current available scientific information regarding perineal hernias and the correlation between castration, recurrence of perineal hernias and urinary incontinence. Secondly, the medical records of all male dogs surgically treated for a perineal hernia at the Department of Clinical Sciences of Companion Animals of Utrecht University were analyzed retrospectively. The medical records were assessed for the description of the dog, clinical history, follow-up period and post-operative complications. Additionally, the patient owners were contacted by telephone and asked to fill in a survey containing several questions concerning neutering status, recurrence of the perineal hernia after surgery and the occurrence of urinary incontinence after the surgery (*attachment 1*). The owners received the survey by email or by post, depending on their own preference. When contacting the owners was unsuccessful, the set of information for this patient was stated as incomplete and only the information available from the medical records was included in the study.

3.3. Statistical analysis

Fisher's exact test was used to assess (1) if the incidence of recurrence of perineal hernias after herniorraphy differs significantly between castrated and intact male dogs and (2) if the incidence of urinary incontinence after castration and herniorraphy is significantly higher than the incidence of urinary incontinence after castration without perineal hernia surgery. Furthermore, the hypothesis is tested (3) if the incidence of urinary incontinence in castrated dogs with a perineal hernia is higher than 0.8%, which is reported in castrated dogs without perineal hernia.^{30,31}

Fisher's exact test is comparable to the chi-squared test and can be used to compare two nominal variables. Fisher's exact test is more accurate than the chi-squared test when the expected numbers are small.

Data were entered into a 2x2 contingency table and assessed with SPSS. Result were considered significant when $P < 0.05$.

4. RESULTS

4.1. Population of the study

Breeds

In total 116 animals received surgical treatment for a perineal hernia between January 2005 and June 2015 at the Department of Clinical Sciences of Companion Animals of Utrecht University. Out of these 116 animals, 113 were male dogs from different breeds (*Table 1*). Two female dogs and one cat were excluded from the study.

Breeds	Number of dogs (#)	Percentage (%)
Crossbred	26	23.0
Maltese	22	19.5
Dachshund	10	8.9
Shetland Sheepdog	6	5.3
German Shepherd	5	4.4
Border Collie	4	3.5
Jack Russell Terrier	4	3.5
Rottweiler	3	2.7
Bouvier des Flandres	2	1.8
Coton de Tuléar	2	1.8
Nova Scotia Duck Tolling Retriever	2	1.8
Poodle	2	1.8
Yorkshire Terrier	2	1.8
American Bulldog	1	0.9
American Staffordshire Terrier	1	0.9
Australian Shepherd	1	0.9
Beagle	1	0.9
Bearded Collie	1	0.9
Belgian Malinois	1	0.9
Dutch Shepherd	1	0.9
Epagneul Breton	1	0.9
German Pointer	1	0.9
Grand Basset Griffon Vendéen	1	0.9
Icelandic Sheepdog	1	0.9
Labrador Retriever	1	0.9
Old English Sheepdog	1	0.9
Pekingese	1	0.9
Perro de Aqua Español	1	0.9
Pyrenean Shepherd	1	0.9
Rhodesian Ridgeback	1	0.9
Shih Tzu	1	0.9
Siberian Husky	1	0.9
Small Münsterländer Pointer	1	0.9
Stabyhoun	1	0.9
Staffordshire Bullterrier	1	0.9
Weimaraner	1	0.9

Table 3: Distribution of breeds.

Table 3 shows a great variety of different breeds. Both large and small breeds were affected. The Maltese appeared to be explicitly overrepresented comprising nearly twenty percent (19.5%) of all dogs. The dachshund seemed to be more commonly affected than other breeds (8.9%) as well. Most of the dogs referred for perineal hernia surgery were crossbred (23%). Eleven crossbred dogs were of unknown origin. The other 15 dogs were mixed Maltese (5), German shepherd (4) and several types of terriers (6).

Age

The median age of the dogs was 10 years with a range from 3 years and 10 months up to 13 years and 6 months at time of the first surgery.

Neutering status

Surgical castration was performed on 87 dogs (77%). Most of the surgical castrations (65) were executed simultaneously with the first herniorrhaphy. Sixteen dogs were neutered prior to the first perineal hernia surgery. In 3 dogs castration was performed after herniorrhaphy and in 2 dogs during the second perineal hernia repair. The moment of castration in the last dog was unknown. One dog was chemically neutered with a deslorelin implant after the first herniorrhaphy. Treatment was repeated when the dog showed signs of pain due to benign prostate hyperplasia. Eight dogs (7.1%) remained intact during the entire follow-up period. For 17 dogs (15%) no records about their neutering status were available.

Figure 4a shows the distribution of neutering status at the end of the follow-up period for all 113 male dogs surgically treated for a perineal hernia. Figure 4b gives an overview of the distribution between the different moments of castration.

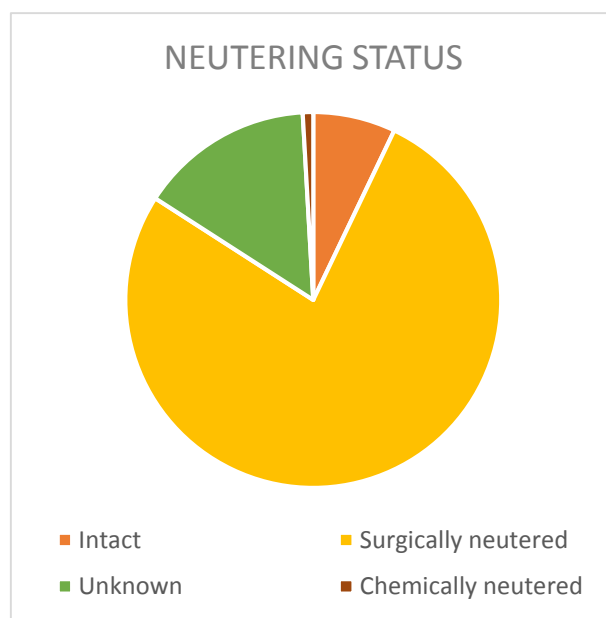


Fig 4a: Neutering status at the end of the follow-up period for all male dogs (113) surgically treated for a perineal hernia at the Department of Clinical Sciences of Companion Animals of Utrecht University.

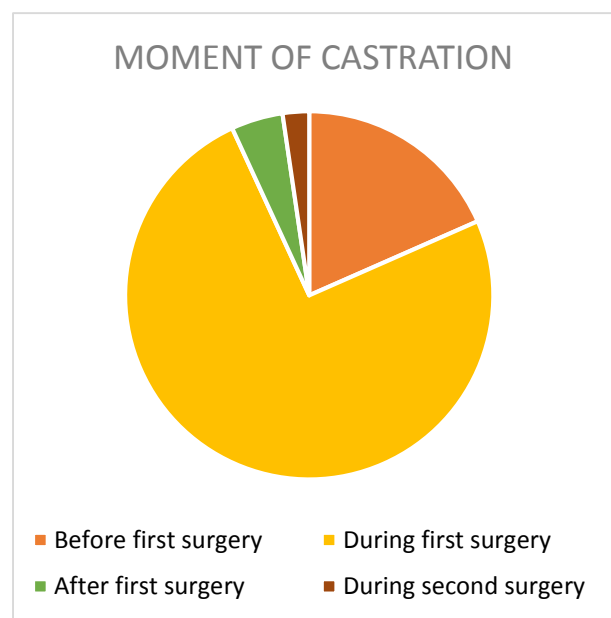


Fig 4b: Moment of castration for all neutered dogs (88) included in the study.

Clinical signs

Information about the manifestation of clinical signs before herniorraphy was obtained by the digital survey. In total 64 owners participated in this study. A broad spectrum of clinical signs associated with perineal hernia motivated these owners to visit their veterinarian. The most frequently observed clinical sign was dyschezia, which occurred in 76.2% of the dogs. Other problems regarding defecation were tenesmus (54%), painful defecation (28.6%) and hematochezia (11.1%). None of the owners mentioned the occurrence of fecal incontinence. Abnormal function of the urinary tract occurred less often. Dysuria and urinary incontinence were seen in respectively 3 (4.8%) and 2 (3.2%) dogs. Swelling of the perineal region was noticed in 34.9% of the dogs. A small number of dogs showed signs of general illness, such as lethargy (9.5%) and anorexia (6.3%). One owner mentioned flattening of the feces, which was most likely due to benign prostate hyperplasia.

Figure 5 lists the occurrence of clinical signs as perceived by the owners prior to herniorraphy.

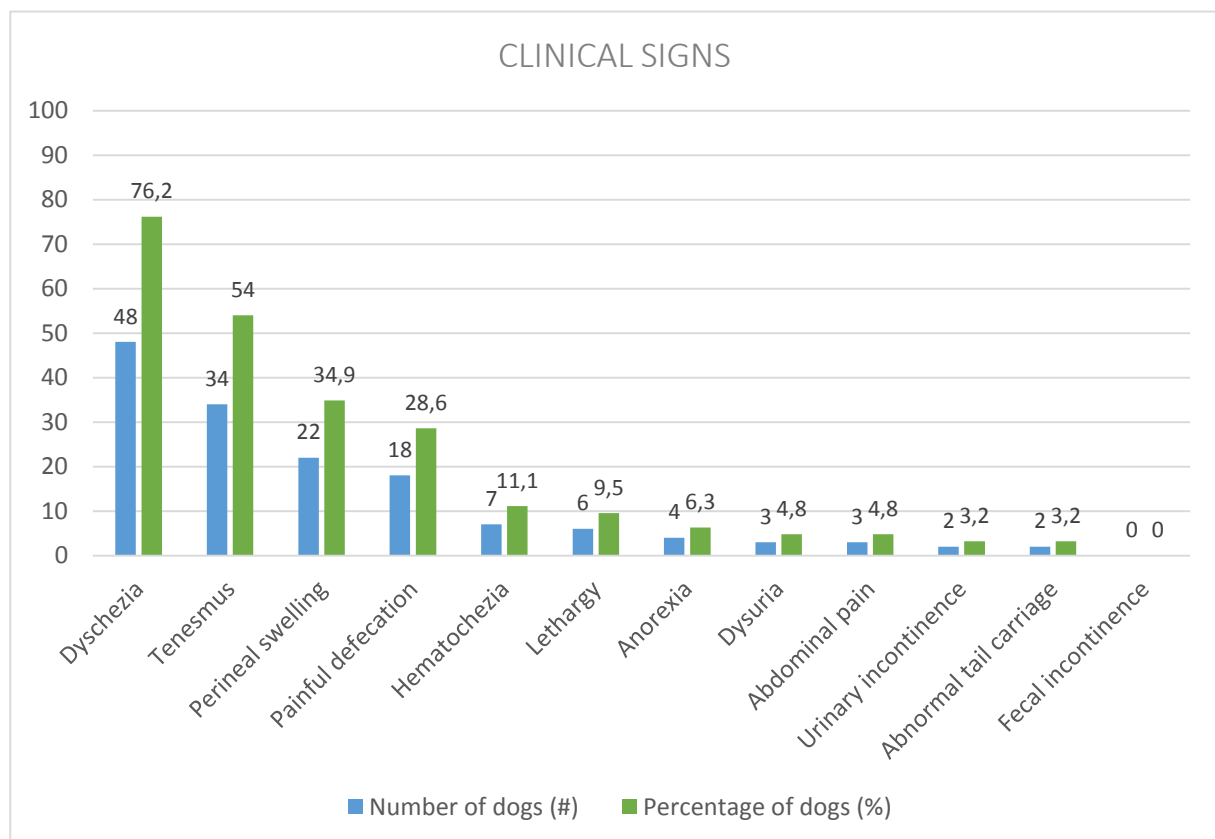


Fig 5: Occurrence of clinical signs associated with perineal hernia as perceived by patient owners.

Primary perineal hernia

The location of the initial perineal hernia was determined for all 113 male dogs surgically treated at the Department of Clinical Sciences of Companion Animals. In 38.9% of the cases the hernia was located at the right side (44/113). The left side was affected in 27 dogs (23.9%). A perineal hernia on both sides was diagnosed in 37.2% of the dogs (42/113). These results are summarized in figure 6.

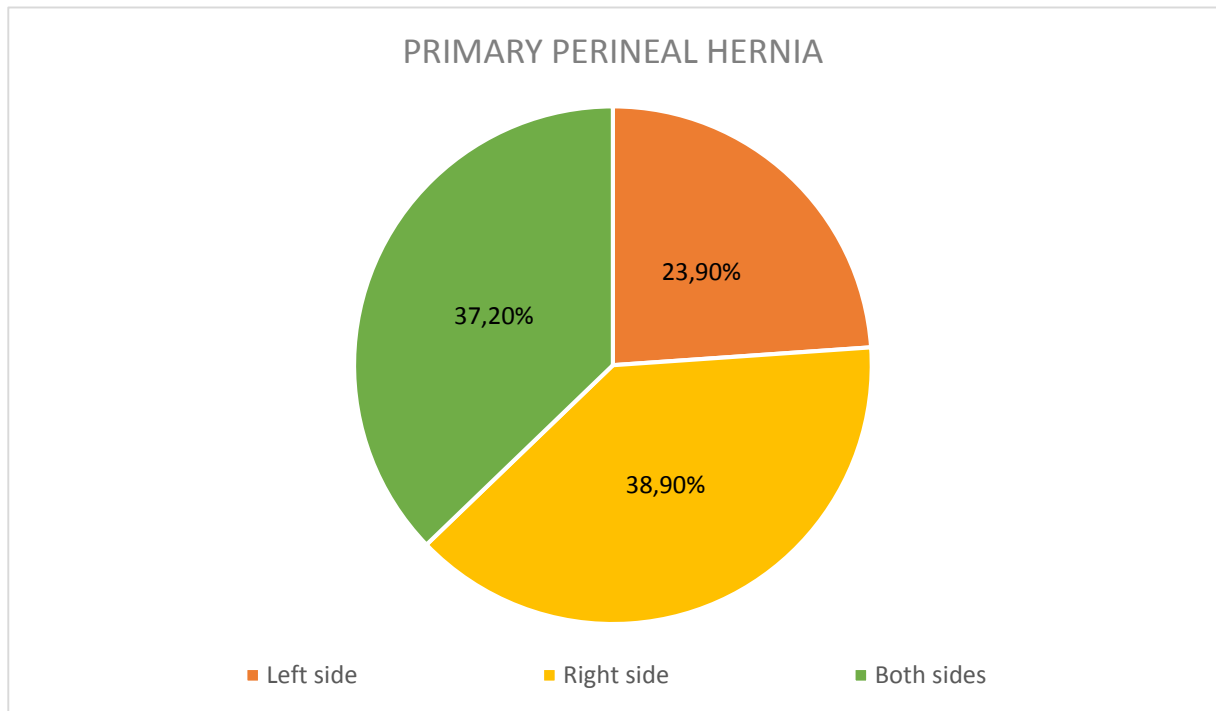


Fig 6: Location of the primary perineal hernia.

4.2. Recurrence of perineal hernias

Data regarding the recurrence of perineal hernias after herniorraphy were obtained by reviewing the medical records of all 113 male dogs. Further, the surveys filled out by the patient owners (64 in total) were checked for additional information. Recurrence was defined as a new occurrence of a perineal hernia after previous surgical treatment. No distinction was made between recurrence on the ipsilateral or contralateral side of the initial hernia. Recurrence occurred in 25 dogs (22.1%).

First recurrences were equally divided between the left (9) and the right side (8). In five dogs recurrence was diagnosed on both sides. In one of these dogs the initial hernia was also located on both sides. The hernia in the other four cases was initially located on either the right (3) or left (1) side. The location was unknown for three dogs due to the fact that the owners could not remember the location of the second hernia and no information was available in the medical records.

Eleven (44%) of the recurrent perineal hernias occurred on the ipsilateral side of the initial hernia. The contralateral side was affected in 7 dogs (28%). Sixteen percent of the recurrences was located on both sides.

Figure 7a and 7b show the distribution between the different locations of the first recurrent perineal hernia.

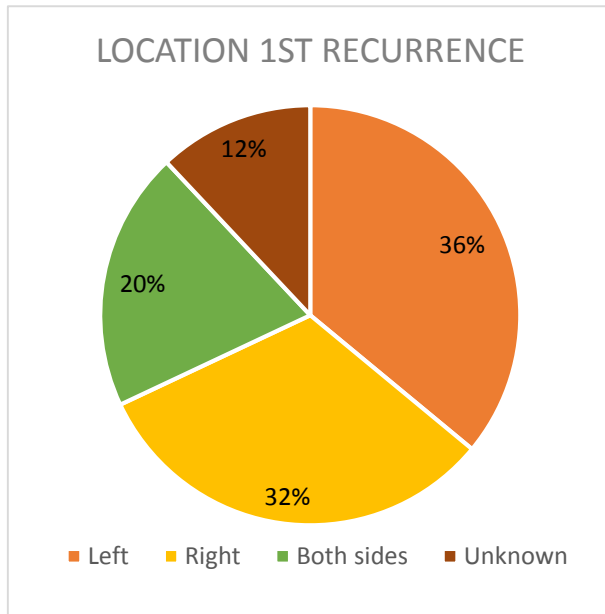


Fig 7a: Location of the second perineal hernia.

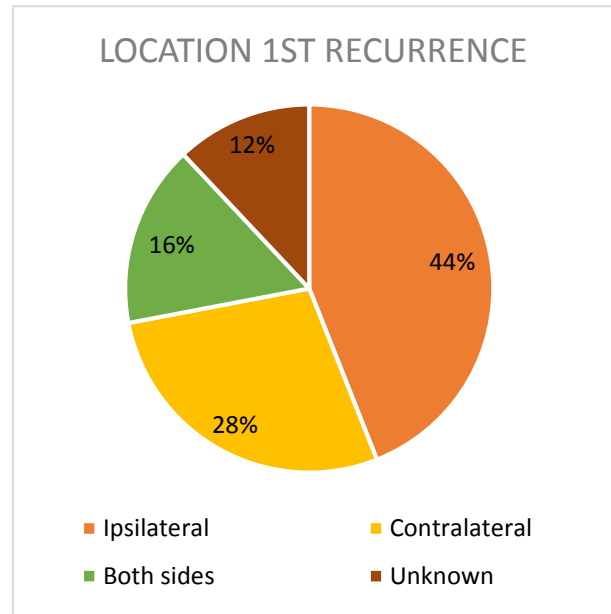


Fig 7b: Location of the second perineal hernia compared to the first.

In 4 dogs (16%) the perineal hernia recurred a second time after the second herniorrhaphy. In 3 dogs (75%) the third hernia was located at the right side. In the other dog both sides were affected. The three recurrences on the right side were all located ipsilateral compared to the first and second perineal hernia.

Figure 7c and 7d show the distribution between the different locations of the second recurrent perineal hernia.

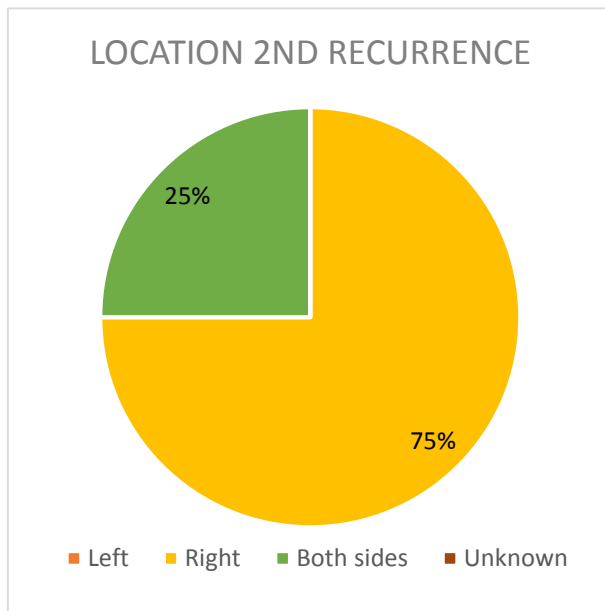


Fig 7c: Location of the third perineal hernia.

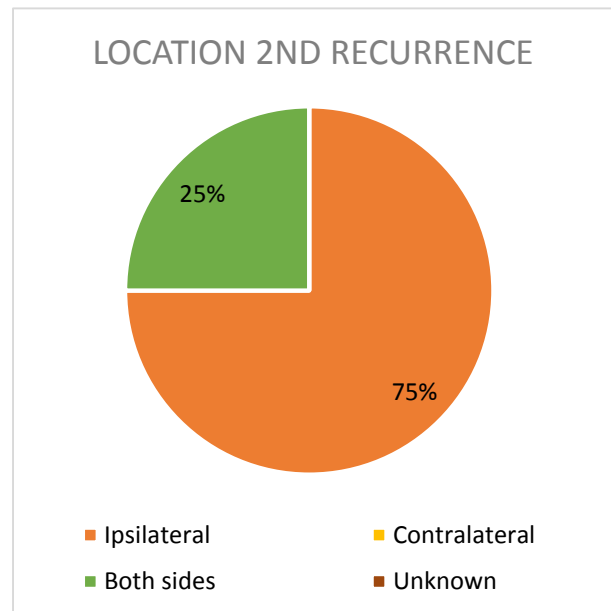


Fig 7d: Location of the third perineal hernia compared to the first.

4.2.1. Comparison of recurrence between neutered and intact dogs

The neutering status was known for 96 dogs. Eight dogs remained intact during the entire follow-up period. In five of these dogs (62.5%) recurrence of the perineal hernia was seen at least once. The other 88 dogs were neutered, of which 87 surgically and one chemically. Fifteen of these dogs (17%) were affected by recurrence of the perineal hernia. For the remaining 5 dogs that showed recurrence, neutering status was unknown.

Concluding, of the 25 dogs that were affected by a recurrent hernia 5 dogs (20%) were intact, 15 (60%) were neutered and in 5 (20%) the neutering status was unknown. Figure 8 summarizes these results.

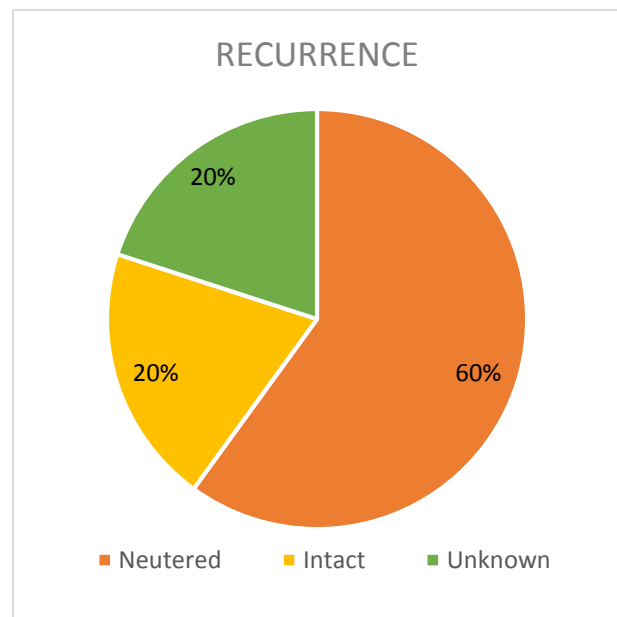


Fig 8: Summary of data regarding recurrence and neutering status.

4.2.2. Statistical analysis

	Recurrence	No recurrence	Total
Neutered	15	73	88
Intact	5	3	8
Total	20	76	96

A Fisher's exact test was performed to determine if the incidence of recurrence of perineal hernias after herniorrhaphy differs significantly between castrated and intact male dogs. Analysis of the

obtained data led to the conclusion that there is a significant difference in recurrence between neutered and intact male dogs ($P = 0.009$).

4.3. Urinary incontinence

Data regarding urinary incontinence in dogs that were surgically treated for a perineal hernia were available for 64 dogs. Fifty-six of these 64 dogs were neutered. Eight dogs showed urinary incontinence. In three dogs (37.5%) the urinary incontinence started prior to the first herniorrhaphy. Two of these dogs (25%) were still intact when the urinary incontinence first occurred. The other dog was already neutered. In the remaining 5 dogs (62.5%) urinary incontinence occurred after herniorrhaphy. All of these dogs were neutered prior to the first occurrence of urinary incontinence. Figure 9 summarizes these results.

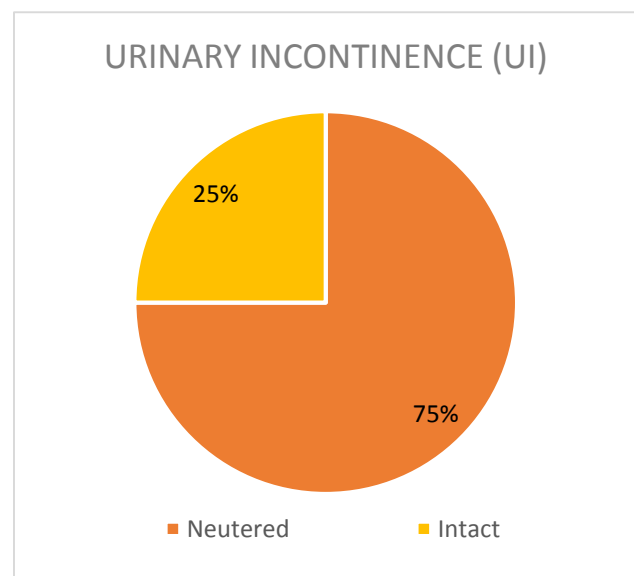


Fig 9: Neutering status at first appearance of UI.

The owners were asked to rate the severity of the urinary incontinence with a number between 0 (no loss of urine) and 10 (continuous loss of urine). The severity ranged from 3 to 10 (mean = 7.1 and sd = 2.14). Figure 10 gives an overview of the exact distribution.

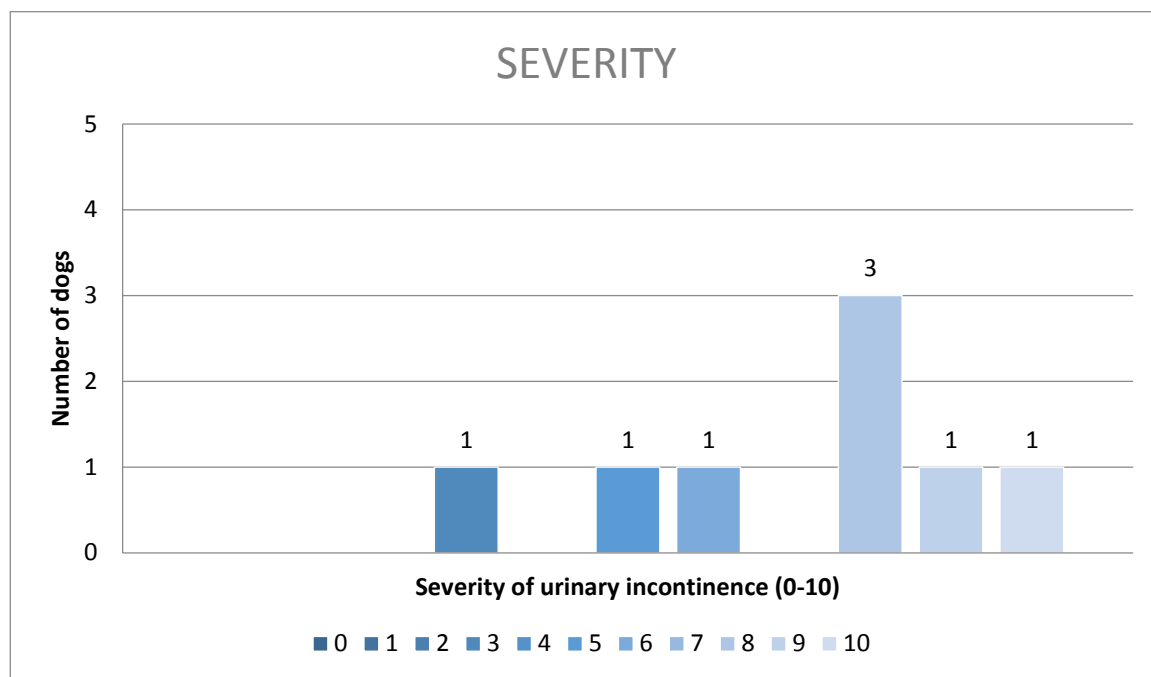


Fig 10: Distribution of severity of urinary incontinence.

Four dogs received medicinal treatment for the urinary incontinence. In three of these dogs the urinary incontinence improved after treatment. Severity did not change in the other dog. Four dogs were left untreated. Three of these dogs had less severe urinary incontinence, ranging from 3 to 6. One dog with continuous loss of urine (10) was also untreated, but wore a diaper indoors.

4.3.1. Statistical analysis

A Fisher’s exact test was used to determine if the incidence of urinary incontinence after castration and herniorrhaphy is significantly higher than the incidence of urinary incontinence after herniorrhaphy without castration. The Fisher’s exact test showed that there is no significant difference in occurrence of urinary incontinence between neutered and intact male dogs that underwent perineal hernia surgery (P = 0.312). The proportion of incontinence in the castrated dogs with a perineal hernia was 10.9%. When comparing this proportion with the reported proportion in castrated dogs without perineal hernia of 0.8% there is a significant difference (P < 0.001).

	<i>Urinary incontinence</i>	<i>No urinary incontinence</i>	<i>Total</i>
Neutered	6	49	55
Intact	2	7	9
Total	8	56	64

5. DISCUSSION AND CONCLUSION

Perineal hernias are seen in several species, but intact male dogs are most commonly affected. Surgical repair of the hernia is the treatment of choice. Unfortunately, recurrence of the perineal hernia after herniorraphy is regularly seen. This study investigated the difference in recurrence between intact and neutered male dogs. The results showed a higher incidence of recurrence in intact male dogs (62.5%) compared to neutered dogs (17%). The null hypothesis that the incidence of recurrence of perineal hernias after herniorraphy differs significantly between castrated and intact male dogs was accepted ($P = 0.009$). Several factors are involved with the reliability of this conclusion. A pro of this study is the large research population. However, there was an extensive difference in population size comparing neutered (88) and intact dogs (8). Perhaps, a more equal distribution would lead to a different conclusion.

Previous studies have extensively researched the effects of castration on the recurrence of perineal hernias after herniorraphy, which led to alternating results.^{5,6,8,9,11-13,19-25} The recurrence rates ranged from 3% to 46%. This study reported a similar rate of 22.1%. Some of the former studies differentiated between recurrence in neutered and intact dogs. All publications reported a higher recurrence rate for intact dogs than neutered dogs. These rates ranged from 22% to 48% in intact dogs (one study with a rate of 100% was excluded due to a research population of 1) and 2.4% to 43% in neutered dogs. In only one of these reports the results were significant (*Hayes et al. 1978*). However, the exceedingly large research population of this study (771 dogs) suggests that the results are very plausible. In our study, the intact dogs showed a recurrence rate of 62.5%, which appears to be higher than the rate in previous publications. No apparent reason was established. The recurrence rate in neutered dogs was comparable to those of other studies (17%).

This study also explored if the incidence of urinary incontinence after castration and herniorraphy is significantly higher than the incidence of urinary incontinence after herniorraphy without castration. Unfortunately, this hypothesis had to be rejected. This is probably due to the small research population. Further research with a larger research population is necessary to determine if the incidence of urinary incontinence after herniorraphy significantly differs between intact and neutered dogs.

Since the research population of this study did not contain any dogs without perineal hernia, it was impossible to confirm whether urinary incontinence is more common in neutered male dogs with perineal hernia than in neutered male dogs without perineal hernia. The occurrence rate of urinary incontinence in neutered dogs in this study (10.9%) is much higher compared to the occurrence rate found in neutered male dogs without perineal hernia (0.8%) by *Maarschalkerweerd et al. 1997*.³ The difference between these proportions is significant ($P < 0.001$). This indicates that neutered male dogs with perineal hernia are more commonly affected by urinary incontinence than neutered male dogs without perineal hernia. However, these are results from two separate studies and no definitive conclusion can be made based on these results. To confirm this theory, a prospective study is necessary and a control group consisting of neutered male dogs without perineal hernia should be included.

Another unfavourable aspect of this study is the retrospective study design. In some cases a decade had past since the last surgery, which might cause problems with remembering the exact events. This could be prevented by performing a prospective study.

Previous studies regarding urinary incontinence in dogs with perineal hernia are scarce. A few studies determined the occurrence rate of urinary incontinence in dogs with perineal hernia (range is 3% to 36%), but no differentiation between neutered and intact dogs or the primary cause of urinary incontinence was made.^{6,8,9,11,13,19,20,24,25} The results of this study were similar, reporting a total occurrence rate of 12.5%. Another study performed by Woldberg (2014) did differentiate between neutered and intact male dogs, which led to a neutered to intact ratio of 2:1.³ The current study showed comparable results with a ratio of 3:1.

In conclusion, the incidence of recurrence of perineal hernias after herniorraphy is significantly higher in intact male dogs than in neutered male dogs. There is no significant association between occurrence of urinary incontinence after herniorraphy and neutering status. Urinary incontinence seems to be more common in neutered dogs with perineal hernia than in healthy neutered dogs, but more extensive research is necessary to confirm this theory.

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7. ATTACHMENTS

7.1. Attachment I: Survey

Universiteitskliniek voor Gezelschapsdieren
Yalelaan 108
3584 CM UTRECHT

Onderwerp: onderzoek naar de hernia perinealis bij de reu.

Patiëntnummer: _____

Naam van uw hond: _____

Geachte heer/mevrouw,

De afdeling Chirurgie van de Universiteitskliniek voor Gezelschapsdieren doet onderzoek naar de relatie tussen castratie, urine-incontinentie en het opnieuw optreden van een perineale hernia na eerdere chirurgische behandeling van deze aandoening bij reuen. Door navraag te doen bij eigenaren van eerder behandelde patiënten wordt geprobeerd een relatie tussen deze problemen aan te tonen.

Uit onze gegevens is gebleken dat uw huisdier in de periode 1-1-2005 t/m 31-5-2015 bij de Universiteitskliniek voor Gezelschapsdieren is geopereerd aan een perineale hernia. Wij zouden het zeer op prijs stellen als u de tijd zou willen nemen om bijgevoegde enquête in te vullen. Dit zal ongeveer 10 minuten van uw tijd in beslag nemen. Met de resultaten van het onderzoek hopen wij in de toekomst honden met deze ziekten nog beter te kunnen behandelen.

Bij vragen of problemen met het invullen van de enquête kunt U contact opnemen via onderstaand e-mailadres.

Bij voorbaat dank.

Met vriendelijke groet,

S.R. Brenker
Coassistent Universiteitskliniek voor Gezelschapsdieren
Email: s.r.brenker@students.uu.nl

De enquête ontvangen wij graag uiterlijk 15 juli 2016 retour. De ingevulde versie kunt U zonder postzegel in bijgevoegde envelop opsturen.

Vragenlijst

Patiëntnummer: _____

In de periode 1-1-2005 t/m 31-5-2015 is uw huisdier bij de Universiteitskliniek voor Gezelschapsdieren geopereerd aan een perineale hernia. Hieronder volgen enkele vragen met betrekking tot de symptomen, de perineale hernia, castratie en urine-incontinentie.

1. Welke symptomen zijn voor u aanleiding geweest om een bezoek te brengen aan de dierenarts?

- | | | |
|--|--|---|
| <input type="checkbox"/> Zwelling naast de anus | <input type="checkbox"/> Bloed bij de ontlasting | <input type="checkbox"/> Afwijkende staartstand |
| <input type="checkbox"/> Moeite met plassen | <input type="checkbox"/> Pijn bij het poepen | <input type="checkbox"/> Buikpijn |
| <input type="checkbox"/> Moeite met poepen | <input type="checkbox"/> Urine-incontinentie | <input type="checkbox"/> Niet eten |
| <input type="checkbox"/> Persen op de ontlasting | <input type="checkbox"/> Fecale incontinentie | <input type="checkbox"/> Sloomheid |

2. Aan welke zijde was de perineale hernia gelokaliseerd?

- Links
- Rechts
- Beiderzijds

3. Is de perineale hernia na de operatie nog eens teruggekomen?

- Ja
- Nee

Indien U deze vraag met nee heeft beantwoord, kunt U verder gaan met vraag 4.

3a. Hoelang na de eerste operatie kwam de perineale hernia terug?

- Minder dan 6 maanden
- 6 maanden – 1 jaar
- 1 jaar – 2 jaar
- Langer dan 2 jaar

3b. Aan welke zijde was de perineale hernia deze keer gelokaliseerd?

- Links
- Rechts
- Beiderzijds

3c. Welke behandeling is vervolgens ingesteld?

- Geen behandeling ingesteld
- Een tweede operatie is uitgevoerd bij de Universiteitskliniek voor Gezelschapsdieren
- Een tweede operatie is uitgevoerd bij een andere dierenkliniek
- Er is besloten tot het uitvoeren van euthanasie

Geschatte datum: ____ - ____ - _____

Indien er geen tweede operatie is uitgevoerd, kunt U verder gaan met vraag 4.

3d. Is de perineale hernia na de tweede operatie een derde keer teruggekomen?

- Ja
- Nee

Indien U deze vraag met nee heeft beantwoord, kunt U verder gaan met vraag 4.

3e. Hoelang na de tweede operatie kwam de perineale hernia terug?

- Minder dan 6 maanden
- 6 maanden – 1 jaar
- 1 jaar – 2 jaar
- Langer dan 2 jaar

3f. Aan welke zijde was de perineale hernia nu gelokaliseerd?

- Links
- Rechts
- Beiderzijds

4. Is uw hond ooit gecastreerd? Hierbij moet U denken aan zowel chirurgische als medicamenteuze vormen van castratie.

- Ja
- Nee

Indien U deze vraag met nee heeft beantwoord, kunt U verder gaan met vraag 5.

4a. Op welke wijze is uw hond gecastreerd? Indien uw hond medicamenteus is gecastreerd, kunt U dan ook aangeven welk middel hiervoor is gebruikt?

- Chirurgisch
- Medicamenteus
 - Suprelorin (implantaat)
 - Tardak of Vetadinon (injectie)
 - Onbekend

4b. Wanneer heeft de castratie plaatsgevonden?

- Vóór de eerste operatie voor een perineale hernia
- Gelijktijdig met de eerste operatie voor een perineale hernia
- Na de eerste operatie voor een perineale hernia
- Gelijktijdig met een tweede operatie voor een perineale hernia
- Na een tweede operatie voor een perineale hernia

Geschatte datum: ____ - ____ - ____

4c. Indien uw hond medicamenteus is gecastreerd, is deze behandeling ooit herhaald en hoe vaak?

- Nee
- Ja, _____ keer

5. Heeft uw huisdier ooit last gehad van urine-incontinentie?

- Ja
- Nee

Indien U deze vraag met nee heeft beantwoord, kunt U verder gaan met vraag 6.

5a. Op welke moment is de urine-incontinentie voor het eerst opgetreden in relatie tot de operatie voor de perineale hernia?

- Vóór de eerste operatie voor een perineale hernia
- Na de eerste operatie voor een perineale hernia
- Na de tweede operatie voor een perineale hernia

Geschatte datum: ____ - ____ - _____

5b. Indien de urine-incontinentie vóór de operatie is opgetreden, in welke mate is de ernst van de urine-incontinentie dan veranderd na de operatie?

- Verminderd
- Onveranderd
- Verergerd

5c. Op welk moment is de urine-incontinentie voor het eerst opgetreden in relatie tot de castratie?

- Voor de castratie
- Na de castratie

5d. Indien de urine-incontinentie vóór de castratie is opgetreden, in welke mate is de ernst van de urine-incontinentie dan veranderd na de castratie?

- Verminderd
- Onveranderd
- Verergerd

5e. Is er ooit een oorzaak vastgesteld voor de urine-incontinentie? Zo ja, welke?

- Nee
- Ja

Indien U deze vraag met nee heeft beantwoord, kunt U verder gaan met vraag 5g.

5f. Zo ja, wat is de oorzaak voor de urine-incontinentie geweest?

- Verminderde werking van de sluitspier
- Aandrangsincontinentie (bijv. ten gevolge van een infectie of blaasstenen)
- Verlamde blaas
- Aangeboren afwijking van de urinewegen
- Onbekend
- Anders, namelijk: _____

5g. Is er ooit een behandeling ingesteld voor de urine-incontinentie?

- Ja
- Nee

5h. Zo ja, welke behandeling is er ingesteld?

- Medicamenteus, namelijk: _____
- Chirurgisch, namelijk: _____

5i. Hoe heeft deze behandeling de mate van urine-incontinentie veranderd?

- Verbeterd
- Onveranderd
- Verslechterd

5j. Hoe zou U de mate van urine-incontinentie omschrijven? Denk hierbij aan het moment waarop de urine-incontinentie het ergst was en geef de mate van incontinentie aan met een cijfer van 0-10.

0 = geen incontinentie
10 = continu urineverlies

0 1 2 3 4 5 6 7 8 9 10

6. Is uw hond op dit moment nog in leven?

- Ja
- Nee

6a. Indien uw hond niet meer in leven is, kunt U dan aangeven wanneer uw hond is overleden en wat de oorzaak is geweest?

Datum van overlijden: ____ - ____ - ____

Oorzaak van overlijden: _____

7. Overige vragen en/of opmerkingen kunt U hieronder vermelden.

Hartelijk dank voor het invullen van deze enquête. Indien U op de hoogte wil worden gehouden van de resultaten van het onderzoek kunt U dit hierboven aangeven.

7.2. Attachment II: Records neutering status

# Vetware	Breed	Neutered	TOC	MOC
0412021	Maltese	Yes	2	S
0500072	Rottweiler	Yes	N/A	S
0501090	Yorkshire Terrier	Yes	1	S
0501301	Maltese	Yes	1	S
0501843	Maltese	Yes	2	S
0301805	Maltese	Yes	1	S
0505044	Crossbred	Yes	3	S
0505955	Weimaraner	N/A	N/A	N/A
0507210	Bouvier des Flandres	N/A	N/A	N/A
0508088	Crossbred	Yes	1	S
0508909	Beagle	Yes	4	S
0507968	Poodle	Yes	4	S
0509518	Maltese	Yes	2	S
0510088	Border Collie	Yes	2	S
0510771	Crossbred	N/A	N/A	N/A
0510668	German Shepherd	Yes	2	S
0510342	Maltese	Yes	2	S
0600028	Crossbred	No	N/A	N/A
0601138	Dachshund	N/A	N/A	N/A
0601429	Poodle	Yes	2	S
0602319	Maltese	N/A	N/A	N/A
0602240	Shetland Sheepdog	Yes	2	S
0408023	Dachshund	No	N/A	N/A
0603178	Crossbred	Yes	2	S
0603172	Maltese	Yes	2	S
0603313	Rottweiler	Yes	2	S
0603930	Rhodesian Ridgeback	No	N/A	N/A
0606533	Border Collie	Yes	2	S
0607766	Crossbred	Yes	2	S
0608764	Belgian Malinois	Yes	2	S
0609744	Crossbred	Yes	2	S
0300279	Pekingese	Yes	2	S
0610186	Australian Shepherd	Yes	2	S
0610188	Icelandic Sheepdog	Yes	2	S
0700256	Crossbred	Yes	1	S
0700595	Maltese	Yes	2	S
0609767	Maltese	Yes	2	S
0700861	Crossbred	Yes	2	S
0702380	Maltese	Yes	2	S
0702517	Bouvier des Flandres	N/A	N/A	N/A
0704784	Dachshund	Yes	1	S
0705475	Border Collie	Yes	2	S
0705896	Maltese	Yes	1	S
0706101	Crossbred	N/A	N/A	N/A
0706768	Border Collie	Yes	2	S
0706743	German Shepherd	Yes	2	S

# Vetware	Breed	Neutered	TOC	MOC
0708866	Crossbred	Yes	2	S
0708880	Dachshund	Yes	2	S
0709528	Maltese	Yes	2	S
0205976	Jack Russel Terrier	Yes	2	S
0801371	Border Collie	Yes	1	S
0803447	Crossbred	Yes	2	S
0803592	Dutch Shepherd	Yes	2	S
0308180	Old English Sheepdog	Yes	2	S
0807154	Maltese	N/A	N/A	N/A
0807045	Rottweiler	Yes	1	S
0808091	Crossbred	Yes	3	C
0808616	Maltese	Yes	2	S
0808751	Border Collie	Yes	2	S
0809405	Pyrenean Shepherd	No	N/A	N/A
0900460	German Shepherd	N/A	N/A	N/A
0900720	Crossbred	No	N/A	N/A
0215038	Crossbred	Yes	2	S
0903898	Crossbred	Yes	2	S
0905619	German Pointer	Yes	2	S
0901887	Grand Basset Griffon Vendéen	No	N/A	N/A
0908397	Crossbred	No	N/A	N/A
0908098	Crossbred	Yes	2	S
0908668	Dachshund	Yes	1	S
0708511	German Shepherd	Yes	2	S
0910005	Maltese	Yes	2	S
0802943	Maltese	Yes	2	S
1000299	Dachshund	Yes	2	S
1000882	Kleine Münsterländer	Yes	2	S
1001378	German Shepherd	Yes	1	S
1001995	Maltese	N/A	N/A	N/A
1002787	Crossbred	Yes	2	S
1002934	Epagneul Breton	N/A	N/A	N/A
1004735	Crossbred	Yes	2	S
1004909	Dachshund	Yes	2	S
1007359	Coton de Tuléar	Yes	1	S
1008750	Stabyhoun	Yes	1	S
1001190	Shih Tzu	N/A	N/A	N/A
1101603	Shetland Sheepdog	Yes	1	S
1103552	American Staffordshire Terrier	Yes	2	S
1107838	Crossbred	N/A	N/A	N/A
1107913	Nova Scotia Duck Tolling Retriever	Yes	1	S
1100792	Staffordshire Bull Terrier	N/A	N/A	N/A
0702575	Dachshund	No	N/A	N/A
1111268	Perro de Agua Español	Yes	3	S
1200413	Maltese	Yes	2	S
1200591	Maltese	N/A	N/A	N/A
1201541	Maltese	Yes	2	S
1202436	Maltese	Yes	2	S

# Vetware	Breed	Neutered	TOC	MOC
1203187	<i>Crossbred</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1204973	<i>Border Collie</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1204784	<i>American Bulldog</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
1206356	<i>Nova Scotia Duck Tolling Retriever</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1207328	<i>Siberian Husky</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1210716	<i>Crossbred</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1211833	<i>Jack Russel Terrier</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1306775	<i>Crossbred</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1309398	<i>Jack Russel Terrier</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1310815	<i>Crossbred</i>	<i>Yes</i>	<i>3</i>	<i>S</i>
1404234	<i>Dachshund</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1404739	<i>Crossbred</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1408863	<i>Yorkshire Terrier</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1411078	<i>Collie</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
1500177	<i>Labrador Retriever</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1300977	<i>Bearded Collie</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1411742	<i>Coton de Tuléar</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1502216	<i>Dachshund</i>	<i>Yes</i>	<i>2</i>	<i>S</i>
1306085	<i>Jack Russel Terrier</i>	<i>Yes</i>	<i>1</i>	<i>S</i>

N/A = not available; TOC = time of castration; MOC = method of castration; 1 = prior to the first surgery; 2 = during the first surgery; 3 = after the first surgery; 4 = during the second surgery; S = surgically; C = chemically.

7.3. Attachment III: Records perineal hernia

# Vetware	Age PH (1)	Loc. PH (1)	Rec. (1)	TBPH 1 + 2	Loc. PH (2)	Rec. (2)	TBPH 2 + 3	Loc. PH (3)
0412021	10Y 9M	R	N/A	-	-	-	-	-
0500072	-	R	Yes	-	R	Yes	< 6M	R
0501090	9Y 11M	R	N/A	-	-	-	-	-
0501301	8Y 8M	B	N/A	-	-	-	-	-
0501843	9Y 1M	L	N/A	-	-	-	-	-
0301805	10Y 6M	B	N/A	-	-	-	-	-
0505044	4Y 1M	B	No	-	-	-	-	-
0505955	8Y 2M	B	N/A	-	-	-	-	-
0507210	8Y 9M	R	N/A	-	-	-	-	-
0508088	8Y	R	N/A	-	-	-	-	-
0508909	6Y 7M	R	Yes	> 2Y	B	-	-	-
0507968	8Y 4M	B	Yes	6M - 1Y	L	Yes	< 6M	R
0509518	11Y 1M	B	No	-	-	-	-	-
0510088	9Y 8M	R	No	-	-	-	-	-
0510771	7Y 2M	R	N/A	-	-	-	-	-
0510668	6Y 7M	B	No	-	-	-	-	-
0510342	11Y 4M	L	Yes	< 6M	R	No	-	-
0600028	11Y 7M	B	No	-	-	-	-	-
0601138	10Y 9M	B	N/A	-	-	-	-	-
0601429	10Y 2M	B	No	-	-	-	-	-
0602319	11Y 8M	B	N/A	-	-	-	-	-
0602240	9Y 11M	R	Yes	> 2Y	N/A	No	-	-
0408023	12Y 3M	L	Yes	< 6M	L	No	-	-
0603178	6Y 7M	L	Yes	>2Y	L	-	-	-
0603172	11Y	L	No	-	-	-	-	-
0603313	10Y	L	N/A	-	-	-	-	-
0603930	6Y 3M	R	Yes	1 - 2Y	B	No	-	-
0606533	8Y 2M	B	N/A	-	-	-	-	-
0607766	8Y 3M	R	Yes	> 2Y	R	-	-	-
0608764	8Y 11M	R	No	-	-	-	-	-
0609744	10Y	B	No	-	-	-	-	-
0300279	4Y 4M	B	N/A	-	-	-	-	-
0610186	5Y 8M	B	No	-	-	-	-	-
0610188	11Y	R	N/A	-	-	-	-	-
0700256	8Y 1M	R	No	-	-	-	-	-
0700595	9Y 9M	B	No	-	-	-	-	-
0609767	10Y	B	N/A	-	-	-	-	-
0700861	6Y 1M	L	N/A	-	-	-	-	-
0702380	8Y 6M	R	No	-	-	-	-	-
0702517	7Y 8M	L	N/A	-	-	-	-	-
0704784	7Y 7M	R	No	-	-	-	-	-
0705475	6Y 6M	R	N/A	-	-	-	-	-
0705896	10Y	B	No	-	-	-	-	-
0706101	11Y 1M	L	N/A	-	-	-	-	-
0706768	9Y 3M	B	No	-	-	-	-	-
0706743	6Y 9M	R	Yes	< 6M	R	No	-	-

# Vetware	Age PH (1)	Loc. PH (1)	Rec. (1)	TBPH 1 + 2	Loc. PH (2)	Rec. (2)	TBPH 2 + 3	Loc. PH (3)
0708866	10Y 8M	B	No	-	-	-	-	-
0708880	10Y 8M	L	N/A	-	-	-	-	-
0709528	8Y 7M	R	Yes	< 6M	R	No	-	-
0205976	9Y 7M	B	N/A	-	-	-	-	-
0801371	8Y 11M	B	No	-	-	-	-	-
0803447	7Y 8M	B	N/A	-	-	-	-	-
0803592	7Y 7M	L	Yes	6M - 1Y	R	No	-	-
0308180	9Y 2M	B	N/A	-	-	-	-	-
0807154	10Y 9M	L	N/A	-	-	-	-	-
0807045	13Y 6M	B	No	-	-	-	-	-
0808091	5Y 11M	B	No	-	-	-	-	-
0808616	8Y 8M	B	N/A	-	-	-	-	-
0808751	11Y 1M	R	N/A	-	-	-	-	-
0809405	13Y 6M	R	No	-	-	-	-	-
0900460	11Y 8M	R	N/A	-	-	-	-	-
0900720	5Y 6M	B	No	-	-	-	-	-
0215038	10Y 1M	B	No	-	-	-	-	-
0903898	11Y 5M		N/A	-	-	-	-	-
0905619	7Y 11M	L	No	-	-	-	-	-
0901887	9Y 6M	R	Yes	1 - 2Y	L	No	-	-
0908397	10Y 6M	L	No	-	-	-	-	-
0908098	10Y 4M	L	N/A	-	-	-	-	-
0908668	5Y 4M	L	Yes	< 6M	L	No	-	-
0708511	7Y 11M	R	No	-	-	-	-	-
0910005	3Y 10M	R	Yes	1 - 2Y	R	Yes	> 2Y	R
0802943	11Y 9M	R	No	-	-	-	-	-
1000299	12Y 8M	R	No	-	-	-	-	-
1000882	4Y 10M	R	N/A	-	-	-	-	-
1001378	8Y 2M	B	No	-	-	-	-	-
1001995	7Y 9M	L	N/A	-	-	-	-	-
1002787	10Y	R	N/A	-	-	-	-	-
1002934	8Y 6M	R	N/A	-	-	-	-	-
1004735	8Y 1M	B	No	-	-	-	-	-
1004909	9Y 1M	B	No	-	-	-	-	-
1007359	6Y 1M	R	Yes	1 - 2 Y	B	No	-	-
1008750	8Y 3M	R	No	-	-	-	-	-
1001190	6Y 11M	B	Yes	< 6M	B	Yes	N/A	B
1101603	12Y 7M	L	No	-	-	-	-	-
1103552	10Y 9M	R	N/A	-	-	-	-	-
1107838	-	L	Yes	-	B	-	-	-
1107913	6Y 6M	R	Yes	< 6M	L	No	-	-
1100792	8Y 1M	R	Yes	6M - 1Y	L	-	-	-
0702575	12Y 5M	L	No	-	-	-	-	-
1111268	10Y 6M	R	No	-	-	-	-	-
1200413	7Y 3M	B	N/A	-	-	-	-	-
1200591	11Y 2M	B	N/A	-	-	-	-	-
1201541	11Y 8M	R	No	-	-	-	-	-
1202436	6Y 5M	R	Yes	1 - 2Y	N/A	-	-	-

# Vetware	Age PH (1)	Loc. PH (1)	Rec. (1)	TBPH 1 + 2	Loc. PH (2)	Rec. (2)	TBPH 2 + 3	Loc. PH (3)
1203187	6Y 7M	L	No	-	-	-	-	-
1204973	6Y 8M	R	Yes	< 6M	L	-	-	-
1204784	7Y	B	Yes	< 6M	L	-	-	-
1206356	8Y 1M	L	No	-	-	-	-	-
1207328	8Y 4M	R	N/A	-	-	-	-	-
1210716	11Y 6M	B	No	-	-	-	-	-
1211833	10Y	L	No	-	-	-	-	-
1306775	10Y 10M	R	No	-	-	-	-	-
1309398	11Y 6M	B	No	-	-	-	-	-
1310815	12Y 6M	L	No	-	-	-	-	-
1404234	10Y 4M	L	Yes	< 6M	R	No	-	-
1404739	9Y 9M	R	No	-	-	-	-	-
1408863	7Y 2M	B	Yes	< 6M	N/A	No	-	-
1411078	12Y 6M	L	N/A	-	-	-	-	-
1500177	10Y 9M	B	No	-	-	-	-	-
1300977	7Y 4M	R	N/A	-	-	-	-	-
1411742	12Y 10M	R	No	-	-	-	-	-
1502216	9Y 5M	B	N/A	-	-	-	-	-
1306085	10Y 10M	L	No	-	-	-	-	-

Loc. PH (1) = location of initial perineal hernia; Rec. (1) = first recurrence; TBPH 1 + 2 = time between first and second perineal hernia; Loc. PH (2) = location of second perineal hernia; Rec. (2) = second recurrence; TBPH 2 + 3 = time between second and third perineal hernia; Loc. PH (3) = location of third perineal hernia; R = right side; L = left side; B = both sides, N/A = not available.

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