Surgical Management of Perineal Hernias in Dogs

Maureen Mueller, DVM, DACVS
Veterinary Specialist
Sukhjit Singh Gill, DVM

Introduction

Perineal hernia (Fig. 1) is a common presenting condition in intact male dogs (1). The exact conditions that lead to its development are not fully understood, but it is likely multifactorial. It often warrants surgical intervention. Several surgical techniques have been described for the treatment of perineal hernias. Traditional herniorrhaphy is often not possible due to atrophy of levator ani and/or coccygeus muscles. The most commonly used technique is internal obturator muscle transposition which is often successful. However, additional techniques, including gluteal muscle transposition, semitendinosus muscle transposition, synthetic implants, and biomaterials, may be needed to augment internal obturator muscle transposition (2-9). Complicated perineal hernias, which involve rectal prolapse, bladder displacement, or prostate displacement, require additional procedures, such as colopexy, cystopexy, and vasopexy (10, 11). Castration is recommended in addition to herniorrhaphy to reduce the recurrence of perineal hernias (12, 13). A recent study recommended caudal scrotal castration in dogs with perineal hernias, as it eliminates the need for repositioning the animal and has a minor postoperative complication rate similar to that of prescrotal castration (14). This article will discuss anatomy, etiology, clinical signs and different surgical techniques used for the treatment of perineal hernia in dogs.

Figure 1. A large perineal hernia in a dog.
Anatomy of the pelvic diaphragm

The pelvic diaphragm is composed of the levator ani and coccygeus muscles (Fig. 2). The levator ani muscle extends from the floor of the pelvis to ventral aspect of the seventh caudal vertebra. The coccygeus is a thick muscle lying lateral to the levator ani muscle. It originates from the ischiatic spine on the pelvic floor and inserts ventrally on caudal vertebrae 2 through 5. The sacrotuberous ligament is a fibrous band running from the transverse process of the last sacral and first caudal vertebrae to the lateral angle of the ischiatic tuberosity rostral to the pelvic diaphragm. The sciatic nerve lies just cranial and lateral to the sacrotuberous ligament. The sacrotuberous ligament is a landmark for the tendon of internal obturator muscle and sciatic nerve. It can be inadvertently included in a suture or severed by an unaware surgeon. The internal obturator muscle is a fan-shaped muscle covering the dorsal surface of the ischium. It originates from the dorsal surface of the ischium and pelvic symphysis. Its tendon of insertion passes over the lesser ischiatic notch, ventral to the sacrotuberous ligament. The internal pudendal artery and vein and the pudendal nerve run caudomedially through the pelvic canal on the dorsal surface of the internal obturator muscle, lateral to the coccygeus and levator ani muscles. The pudendal nerve is dorsal to the vessels and divides into the caudal rectal and perineal nerve.

Figure 2. Anatomy of pelvic diaphragm: a, levator ani muscle; b, coccygeus muscle; c, gluteal muscle; d, internal obturator muscle; e, biceps femoris muscle; f, branch of caudal gluteal artery and caudal cutaneous femoral nerve; g, semitendinosus muscle; h, external anal sphincter; i, internal pudendal artery and nerve; j, caudal rectal artery and nerve; k, ventral perineal artery and nerve; l, sacrotuberous ligament; m, ischiocavernosus muscle.
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The superficial gluteal muscle and semitendinosus muscles are other muscles that are involved in the repair of perineal hernia. The superficial gluteal muscle is a flat, rectangular muscle, which extends between the sacrum and the first caudal vertebra proximally and the trochanter major distally. The superficial gluteal muscle is supplied by the caudal gluteal artery and innervated by tibialis nerve. The semitendinosus muscle is a thick muscle, which lies in the caudal part of the thigh and extends between the ischial tuberosity and proximal segment of the shank. The proximal half of the semitendinosus muscle is supplied by the caudal gluteal artery, and the distal half is supplied by the caudal femoral artery. This muscle is innervated by the gluteus caudalis nerve.

Etiopathogenesis

Predisposition

Perineal hernias occur most commonly in mature male intact dogs (1). Although they are rarely encountered in females, two separate case reports described a perineal hernia with bladder retroflexion in two young pregnant bitches. Increased intra-abdominal pressure related to pregnancy and relaxation of pelvic muscles caused by relaxin, were thought to be the causes in these bitches (15, 16). The higher incidence of perineal hernias in male dogs is not clearly understood. Some studies suggested that gender-related anatomic variations in females, such as their larger, broader, and stronger levator ani muscles, together with broader rectal attachments and larger sacrotuberous ligaments, make them less prone to perineal hernias (17, 18). These variations are correlated with the extra load that has to be accommodated by the muscles of the pelvic diaphragm during parturition (17). However, these gender-related variations are not consistent among different breeds (17, 19).

Mixed-breed dogs are commonly reported (1), as well as Boston terriers, miniature poodles, Bouviers, boxers, English sheep dogs, and Pekingese (12). As perineal hernias affect many short-tailed breeds, it was suggested that a structural weakness of the pelvic diaphragm could be secondary to underdevelopment of the levator ani and coccygeus muscles (18, 20). In a study that compared pelvic diaphragm muscles dissected from male short-tailed and long-tailed corgis, the authors found a trend for the weights of the muscles (as a proportion of the total thigh and perineal muscle weight) to be greater in long-tailed corgis (19). However, long-tailed breed dogs are also overrepresented in various studies of perineal hernias (1, 12).
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Perineal hernia occurs when the pelvic diaphragm muscles weaken, allowing intra-pelvic or intra-abdominal structures to move. The cause of pelvic diaphragm weakness is poorly understood. Possible causes include neurogenic atrophy of muscles of the pelvic diaphragm, tenesmus associated with chronic constipation or prostatic disease, rectal abnormalities, hormonal imbalance, and effect of relaxin on muscle fiber weakening (1, 21).

Pelvic diaphragm muscle atrophy

Atrophy of pelvic diaphragm is thought to develop as a result of weakening of the muscles of the pelvic diaphragm, especially the levator ani muscle (17, 18). An immunohistochemical study revealed destruction of muscle fibers, abnormal sized muscle fibers, increased expression of epidermal growth factor receptors, caspase-3 activation, and decreased expression of transforming growth factor-alpha in the levator ani muscle of dogs with perineal hernias, confirming atrophy of the levator ani muscle (22). Caspase-3 is a cysteine protease which when activated induces apoptosis in skeletal muscles, therefore, its increased expression in affected levator ani musculature suggests increased apoptosis. Upregulation of epidermal growth factor receptor suggests a compensatory effect for decrease in its ligand (EGF). Transforming growth factor-alpha has potential survival role in skeletal muscles, therefore, its decreased expression suggests muscle fiber degradation. A combined histological and electromyography study of the external anal sphincter, levator ani muscles, and coccygeus muscles in 40 dogs with perineal hernias revealed atrophy of these muscles, with the atrophy thought to be of neurogenic origin (23). The nerve damage was localized in the sacral plexus proximal to the muscular branches of the pudendal branches or in the muscular branches. A previous study reported that tenesmus resulting from prostatic enlargement may apply traction to the nerves of the sacral plexus (23).

Role of prostatic diseases

Prostatic disease can participate by enlargement, inflammation and pain by causing tenesmus and increasing pressure on the pelvic diaphragm. In one study, the prostate gland was within the hernial contents of 4 of 32 dogs (1). Prostatic disease may result in excessive straining, which can predispose animals to perineal hernias. A caudally displaced prostate gland and various anomalies, such as paraprostatic cysts, increases the pressure on the pelvic diaphragmatic musculature. A mineralized paraprostatic cyst was reported to be the source of tenesmus and a contributing factor in the development of a perineal hernia in an intact male dog (24).
Role of rectal abnormalities

Rectal abnormalities, such as rectal deviation, sacculation, and diverticulum, frequently coexist with perineal hernias (25). These conditions are thought to be the consequences of the perineal hernia rather than the cause, however, the presence of a rectal diverticulum or rectal obstruction may result in excessive straining. A barium study performed in 40 dogs with perineal hernias reported rectal deviation in all the dogs (1). According to one study, if these conditions are not corrected, they may lead to recurrence (25).

Role of sex hormones and relaxin

The hormonal role in perineal hernia has not been fully elucidated, but hormonal imbalances are likely important. No significant difference was found in serum testosterone and estradiol-17β concentrations in dogs with or without perineal hernias (26). Another study reported a lower number of androgen receptors with low sensitivity in the pelvic diaphragm muscles of castrated and intact dogs with perineal hernias as compared with castrated and intact normal dogs (27). This study also showed that androgen receptors were significantly upregulated within the levator ani and coccygeus muscles after castration in normal dogs, whereas there was no difference in these receptors in the castrated and intact dogs with perineal hernias. A retrospective study reported that the risk of recurrence was 2.7 times greater in intact dogs than in castrated dogs (28). Another study reported a reduction of 43% in the recurrence of perineal hernias in castrated dogs (12). Relaxin, a polypeptide hormone belonging to the insulin and insulin-like growth factor family, was first reported to cause relaxation of the interpubic ligament of female guinea pigs (29). Relaxin is thought to affect connective tissue components via its effect on collagen metabolism (29, 30). In males, the primary site of relaxin synthesis is the prostate gland, from which the hormone is secreted in the seminal plasma. It has been suggested that relaxin may leak from hypertrophied prostate glands, causing local muscle atrophy and softening of connective tissue, leading to perineal hernias (30). An in vivo study done to compare the expression of canine relaxin, relaxin-like factor, and relaxin receptors within the muscles of the pelvic diaphragm of dogs with perineal hernias and clinically normal dogs showed higher expression of relaxin receptors within the muscles of the dogs with perineal hernias (31). This suggests that relaxin might play a role in the pathogenesis of perineal hernias.
Clinical signs and diagnosis

Most common clinical presentation in patients with perineal hernias is a non-painful perineal swelling lateral to the anus. They may have other clinical signs which include constipation, obstipation, dyschezia, tenesmus, rectal prolapse, stranguria, anuria, vomiting and/or fecal incontinence (1, 32, 33). A study reported that 48% of dogs with perineal hernia were presented with perineal swelling and 15% with tenesmus (1). The herniation may be unilateral or bilateral. Occasionally, dogs with bladder retroflexion are presented with consequent urinary outflow obstruction and azotemia.

The definitive diagnosis of a perineal hernia is based on clinical signs and findings of a weakened pelvic diaphragm during a digital rectal examination (34). Other diagnostic tests include abdominal radiography (Fig. 3) and ultrasonography, which may help in evaluating the size of the prostate and determining whether the bladder is displaced into the hernia sac. Sometimes, cystourethrography is required to delineate the position of the bladder. An oral or a rectal barium study may be beneficial in demonstrating the position of the colon and rectum.

Pre-operative patient assessment and preparation

The patient should have a complete blood count, biochemistry, and urinalysis before surgical repair. Any abnormalities found during a physical examination or the laboratory evaluation should be thoroughly investigated. Stable patients should be fasted the day before the surgery. An enema is not recommended 24 h before the surgery because of potential contamination at the surgical site with liquid feces. Broad-spectrum antibiotics should be administered to decrease opportunistic pathogens. Anesthetics are administered according to the status of the patient. Epidural anesthetics are useful for supplementing intraoperative and postoperative analgesia. The fecal material should be manually removed from the dilated rectum after anesthetizing the patient, and the anal sac should be evacuated. The patient should be positioned in sternal recumbency, with its tail fixed over its back, its pelvis elevated.
and its hind legs padded. A gauze sponge is then placed in the rectum, and a purse-string suture is placed around the anus. A urinary catheter can be placed to facilitate identification of the urethra at surgery (34).

Surgical treatment

Surgery is the standard of care for perineal hernia in stable animals. Medical treatment will not resolve the hernia, but may alleviate or resolve clinical signs. Urinary bladder retroflexion and visceral entrapment require emergency surgery. Castration is recommended during herniorrhaphy to reduce the recurrence of perineal hernias. The most common surgical techniques used for the repair of a perineal hernia are traditional herniorrhaphy and internal obturator muscle transposition. Several techniques have been developed in recent years. These include superficial gluteal muscle transposition, semitendinosus muscle transposition, fascia lata grafts, placement of a synthetic mesh, use of canine or porcine small intestinal submucosa, and use of tunica vaginalis communis (2-9). Bilateral herniorrhaphy is possible, but it may result in greater postoperative discomfort and tenesmus. Therefore, staged procedures are recommended (10). Recurrences can occur and due to severe displacement of organs, pexy may be necessary. Pexy techniques performed in conjunction with herniorrhaphy include colopexy, vasopexy, and cystopexy. Colopexy may help prevent recurrent rectal prolapse after herniorrhaphy. Vasopexy may help prevent displacement of the bladder or prostate. Cystopexy helps to maintain the urinary bladder in its normal location, thereby preventing bladder retroflexion (10, 11).

Traditional herniorrhaphy

Traditional herniorrhaphy was first described in 1944. It utilizes external anal sphincter and any remnants of the levator ani or coccygeus muscles for primary repair. If the levator ani muscle is significantly atrophied (28, 35), then the sacrotuberous ligament can be included as a lateral component of the repair (35, 36). With appositional herniorrhaphy, it is sometimes difficult to close the ventral aspect of the hernia, resulting in a temporary deformity of the anus. This deformity can cause tenesmus and rectal prolapse. If bilateral hernias are present, then procedures should be staged 3–4 weeks apart to minimize tension (10). Postoperative complications associated with this technique include incisional infections, rectal prolapses, fecal incontinence, urinary incontinence, and wound seromas and they have been reported to occur in 29 to 61% of cases. The recurrence rates range from 10 to 46% (7, 37).
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Internal obturator muscle transposition

This technique utilizes dorsomedial transposition of the internal obturator muscle for the repair of perineal hernias (36, 38) (Fig. 4). The internal obturator transposition technique reduces tension on ventral sutures and thus reduces distortion of the external anal sphincter. The utilization of muscle tissue and associated additional blood supply may facilitate the healing process and prevent breakdown of repair site (39). Internal obturator transposition herniorrhaphy is recommended as the procedure of choice for more complex or bilateral hernias (40). With this technique, the internal obturator tendon can be transected to provide greater dorsal elevation of the flap and reduce tension on the suture line (41, 42). The overall complication rates range from 20 to 46% (9, 33, 37). Postoperative complications associated with this technique include wound seromas, wound infections, rectal prolapses, urinary incontinence, and flatus (42). The recurrence rates range from 0 to 33%. The recurrence of perineal hernia was reported as long as 1 year after repair by internal obturator muscle transposition in 27.4% of cases. Postoperative tenesmus is a risk factor for recurrence (43).

Figure 4. Internal obturator muscle transposition. A (i and ii) shows pelvic diaphragm with hernial defect: a, remnants of levator ani muscle; b, external anal sphincter; c, coccygeus muscle; d, hernial defect; e, internal obturator muscle; f, internal pudendal neuro-vascular bundle. C, Elevation of the internal obturator muscle from the ischiatic table. D, Dorsomedial transposition of the internal obturator muscle (arrow). Placement of sutures between the external anal sphincter and levator ani remnants/ coccygeus muscle, external anal sphincter and internal obturator muscle, and the coccygeus muscle and internal obturator muscle. Asterisk (*) shows ischiatic table.
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Synthetic mesh implants

Polypropylene mesh has been used alone or as an adjunct to other procedures for the treatment of perineal hernias (4, 5). Reported advantages of polypropylene include its strength and ease of handling. Synthetic mesh implantation involves suturing the polypropylene mesh to the coccygeus muscle dorsally and medially, to the sacrotuberous ligament laterally, to the internal obturator muscle ventrally, and to the levator ani and external anal sphincter muscle medially. One study reported that this technique resulted in a success rate of 92% (4). In a slightly modified version of the technique, the ventral aspect of the mesh is secured to the ischium through holes drilled in the ischium (5). The most significant complications observed with these techniques are suture sinuses (12.5%), which resolve after removing the offending suture (5). The repair of perineal hernias with the obturator transposition technique and polypropylene reinforcement in 59 dogs resulted in an overall success rate of 80.5% (44). The most severe complications reported in this study were incisional infection (5.6%) and resultant wound dehiscence (12.5%).

Superficial gluteal muscle transposition

Superficial gluteal muscle transposition involves transplanting the superficial gluteal muscle to reinforce the ischiorectal fossa (2, 32, 37). When used alone in the repair of perineal hernias, this technique did not produce desirable results (32, 37). The postoperative complication rates associated with this technique ranged from 15 to 58%, and the perineal hernia recurred in 36% of the animals (2, 32). A modified version of superficial gluteal muscle transposition allows the defect to be closed dorsolaterally by transecting the tendon of the muscle and rotating it 45 degrees caudal to the defect (32). The tendon is sutured to the internal obturator muscle fascia, the caudal border of the muscle is sutured to the external anal sphincter, and the cranial border is sutured to the sacrotuberous ligament. Transposition of both the internal obturator muscle and the superficial gluteal muscle together in the repair of 52 hernias in 44 dogs resulted in a strong pelvic diaphragm, fewer complications, and good long-term results (32, 37). The follow-up time in these studies study was 3 years. Only three dogs developed long-term complications, and the success rate was 89.74%.

Semitendinosus muscle transposition

This technique is used for ventral hernias, especially bilateral, or as a salvage procedure when other techniques have failed. The semitendinosus muscle is relatively superficial, has a
consistent blood supply, and is large enough to fill a hernia defect. The correction of one side of a bilateral hernia with this technique in six animals resulted in resolution of tenesmus in all the animals (3). Experimental use of semitendinosus muscle as ventral perineal flap in 10 crossbred dogs without perineal hernias caused no alterations in clinical gait examinations or in goniometrical and electroneuromyographical studies in pelvic limbs after surgery, but atrophy was detected by ultrasonography and morphological analysis (45). A modified technique of semitendinosus muscle transposition was recently described that involves unilateral transposition of the medial half of the longitudinally split semitendinosus muscle (46). This technique provides sufficient tension to ensure adequate ventral rectal support. When applied in 14 dogs with ventral perineal hernias, the technique resulted in the resolution of clinical signs in all the dogs, with transient low-grade lameness in the limbs of two of the dogs. The mean follow-up time in this study was 890 days, and no short-term recurrence was noted. However, long-term recurrence, together with tenesmus, was detected in two of the dogs (46).

Biomaterials

In recent years, significant advances have been made in the use of different biomaterials in the repair of perineal hernias. Biomaterials evaluated for the treatment of perineal hernias in dogs include canine small intestinal submucosa, porcine small intestinal submucosa, autologous tunica vaginalis communis, and fascia lata.

Porcine small intestinal submucosa

Like canine small intestinal submucosa, porcine small intestinal submucosa is composed mainly of intestinal submucosa (7). Studies have reported that it was biocompatible and resistant to infection, possessed predictable mechanical properties before implantation, and induced a response that results in regeneration of site-specific tissues (47, 48). Porcine small intestinal submucosa has been used for arterial and venous grafts, urinary bladder augmentation, and the repair of abdominal wall hernias (48, 49). Porcine small intestinal submucosa can be used alone as a primary repair, as a salvage procedure in cases of recurrence, or to augment another technique. An in vivo mechanical research study that compared porcine small intestinal submucosa with the internal obturator muscle transposition technique, showed porcine small intestinal submucosa to be as good as normal pelvic diaphragm and internal obturator muscle transposition herniorrhaphy (7).
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Canine small intestinal submucosa

Submucosa derived from canine intestine has been used in the repair of perineal hernia. As it is an allograft, it is associated with fewer complications as compared to xenografts and synthetic materials. It is also resistant to infection. Canine small intestinal submucosa consists primarily of an extracellular matrix, but it also contains factors involved in angiogenesis, cell migration, and cell differentiation. The use of canine small intestinal submucosa allografts derived from a cadaver in the treatment of perineal hernias in two dogs resulted in improvement in defecatory tenesmus, no signs of rejection or self-immune responses and no complications for 12 months after surgery (6).

Autologous tunica vaginalis communis

Tunica vaginalis communis is derived from the peritoneum, which is composed of mesothelium and connective tissue. It has been experimentally used as an autologous, homologous, or heterologous graft for reconstruction of urethral defects in rabbits, abdominal wall defects in rats, umbilical hernias in sheep, and urinary bladder wall defects in dogs (50, 51, 52). The application of autologous tunica vaginalis communis as a free graft in the repair of 11 perineal hernias resulted in no recurrence or discomfort during defecation and urination in 10 hernias followed up for a median time of 13 months (8). A histopathological examination of the opposing area between the graft and adjacent tissue revealed neovascularization and connective tissue ingrowth (8).

Fascia lata

Fascia lata grafts have been widely used in humans for the treatment of various disorders, such as male urinary incontinence (53), tendon rupture repair (54), and reconstruction of abdominal wall defects (55). Fascia lata grafts have been utilized in articular cranial cruciate ligament repair in dogs and in hip joint capsular tear repair after traumatic dislocation (56). They can be used for primary hemiorrhaphy, to augment another procedure, or for the treatment of recurrence after other procedures (9). Fascia lata grafts can be easily harvested with minimal morbidity of the donor site and can be easily implanted. Furthermore, when compared with synthetic grafts, the autogenous nature of the graft minimizes the risk of foreign body reactions and does not form a nidus for persistent infection. Fascia lata grafts used for the repair of perineal hernias in 15 dogs resulted in no recurrence within 5–20
months (9). Lameness in the donor limb was the most frequent but transient complication associated with this technique (9).

Pexy techniques

Cystopexy, colopexy, and vasopexy, in conjunction with castration, have been used as alternative therapies for the treatment of perineal hernias (11). Cystopexy, colopexy, vasopexy and prostatic omentalization, followed by herniorrhaphy with the internal obturator muscle flap or appositional technique, in 41 dogs resulted in the resolution of hernias in 37 dogs (10). Cystopexy and colopexy have been used as a sole treatment for perineal hernias to prevent the recurrence of bladder retroflexion and rectal prolapse (57) or as a preliminary procedure prior to definitive hernia repair (58). Vasopexy performed to correct retrodisplacement of the prostate gland and urinary bladder, in conjunction with herniorrhaphy, in nine dogs led to excellent outcomes (59). The complications involved with these techniques include tenesmus, colitis, constipation, and urinary incontinence (10, 11). A recent study showed that urinary bladder retroflexion was not associated with an increased rate of postoperative complications (60). This study also reported that laparotomy performed to correct bladder retroflexion and rectal prolapse in 21 dogs prior to internal obturator muscle transposition offered no clear advantage. Therefore, it was concluded that internal obturator muscle transposition alone was adequate for the repair of perineal hernias.

Postoperative care

In the immediate postoperative period, analgesic opioids and anti-inflammatory drugs are given to minimize postoperative discomfort. Oral analgesics, opioids, and nonsteroidal anti-inflammatory are continued at home for 5–7 days. Patients are also placed on a low-residue diet and stool softeners (lactulose) for long term. These also help to eliminate straining. Stool softeners are given for 8–12 weeks. Fluid therapy should be continued in uremic patients. Intravenous antibiotics are continued in the postoperative period for 24 h. As the use of antibiotics has been shown to decrease the rate of postoperative incisional infections (32), patients are often sent home with oral antibiotics for 7–10 days. Cold compresses are applied to the surgery site immediately after surgery to minimize hemorrhage and inflammation. The cold compresses are applied two to three times daily for 15 to 20 min during the first 48–72 h. After this period, warm compresses are applied to the surgery site two to three times daily for 15–20 min to reduce swelling and perianal irritation. An Elizabethan collar is placed to prevent the patient from licking or chewing the incision site until suture removal.

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Maureen Mueller, DVM, DACVS
Veterinary Specialist
VCA West Los Angeles Animal Hospital

Dr. Mueller received her Doctorate of Veterinary Medicine from Purdue University in 1997. This was followed by a one year rotating internship at Washington State University, School of Veterinary Medicine. She then completed her surgical residency in 2001 at the Animal Medical Center, New York, and was awarded her Diplomate status in 2002.

Dr. Mueller performs both soft tissue and orthopedic surgeries. She has a strong interest in Surgical Oncology which involves the removal of cancerous masses in pets. In challenging cases, this requires her to employ reconstruction techniques. She continues to strive to learn new techniques that enable her to remove these masses in challenging cases.
Dr. Sukhjit Singh Gill graduated with his bachelors of Veterinary Sciences from Punjab Agricultural University in India in 2000. He obtained his Masters of Science in Veterinary Biomedical Sciences from Western College of Veterinary Medicine in Saskatoon, Saskatchewan in 2005. Dr. Gill acquired his surgical Internships at the Las Vegas Veterinary Specialty Center (July 2013-July 2014) and Dallas Veterinary Surgical Center (July 2014-July 2015). Once he completed his internship program he joined VCA West Los Angeles Animal Hospital as a Surgical Resident.