ORIGINAL ARTICLE

Combined phallopexy and preputial advancement for the treatment of paraphimosis of unknown aetiology in 16 dogs

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Objectives: To report the medium- to long-term outcomes and complications of a larger case series of patients undergoing combined phallopexy and preputial advancement for treatment of paraphimosis of unknown aetiology.

Materials and Methods: *Retrospective case series*: Medical records of a single small animal referral centre were searched for male dogs treated for idiopathic paraphimosis with combined phallopexy and preputial advancement between January 2010 and October 2023. Data collected included signalment, presenting clinical signs, surgical technique, peri-/post-operative complications and outcome. Outcome was based on owner questionnaire.

Results: Sixteen dogs met the inclusion criteria and were included in the study. Median surgical time was 60 minutes (45 to 75 minutes) and there were no intraoperative complications. Two of the 16 (12.5%) dogs had major complications. One of the 16 (6.25%) cases had minor complications. Eight dogs (50%) had no recurrence of paraphimosis following surgery, three (18.75%) had some intermittent recurrence requiring no treatment, three (18.75%) had intermittent recurrence requiring occasional medical management but an improvement from presurgical condition and two dogs (12.5%) had no major improvement from pre-surgical condition.

Clinical Significance: In conclusion, preputial advancement and phallopexy can be used to treat paraphimosis refractory to medical management with reasonable levels of success leading to improvement in 87.5% (14/16) of dogs. However, complication rates and risk of recurrence are similar to those previously reported with phallopexy or preputial advancement alone.

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INTRODUCTION

Paraphimosis in dogs is an inability to completely withdraw the penis into the prepuce, causing constriction and desiccation of the exposed glans penis. Paraphimosis most commonly affects young, intact dogs (Somerville & Anderson, 2001). It may be associated with copulation, masturbation, trauma, penile haematoma, neoplasia, foreign bodies, pseudo-hermaphroditism, neurological deficits or constriction by preputial hairs (Fossum, 2018). Further causes of paraphimosis include a narrowed preputial orifice causing entrapment of the penis, scarring of adjacent or underlying tissue leading to contraction of the prepuce, a

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congenitally underdeveloped prepuce and an ineffectual retractor penis muscle (Pavletic, 2018). Dogs can present with acute or chronic forms of paraphimosis where varying lengths of the penis can be intermittently or permanently exposed. Acute presentation of paraphimosis can be due to constriction of the base of the penis leading to oedema and congestion and necrosis of the penis. Chronic paraphimosis can lead to drying or inflammation of the exposed tissue causing irritation and self-trauma (Papazoglou, 2001). In some cases, medical management can be considered, often copious lubrication of the exposed glans coupled with prompt penile replacement in the prepuce. This may allow for the preputial mucosa to recover and restore its natural lubrication properties (Pavletic, 2018).

Surgical treatment is indicated in cases of paraphimosis non-responsive or refractory to medical or conservative treatment. Previous studies have reported multiple surgical techniques for this condition. Preputial enlargement, narrowing and preputial lengthening are all techniques that may assist with control of paraphimosis but literature on these techniques is scant. Castration is always recommended as part of the treatment protocol in the intact dog (Somerville & Anderson, 2001). Literature suggests preputial advancement with or without myorrhaphy of the preputial musculature for dogs with congenitally shortened, hypoplastic prepuce or ineffectual preputial musculature (Papazoglou, 2001; Papazoglou & Kazakos, 2002; Pavletic, 2018). Phallopexy has been described as a surgical treatment, creating a permanent adhesion of the mucosa of the dorsal aspect of the penile shaft and the skin of the dorsolateral prepuce (Somerville & Anderson, 2001). With strangulation or necrosis of the penis, partial penile amputation has been described with or without preputial shortening as a salvage procedure (Ritson et al., 2023).

Although multiple techniques have been described, only one case report describes preputial advancement in combination with phallopexy as a single surgery for treatment of recurrent paraphimosis in one dog (Wasik & Wallace, 2014). This paper aims to report a larger case series to describe outcomes and complications.

MATERIALS AND METHODS

Study design and data extraction

This was a retrospective case series including only dogs undergoing both preputial advancement (PPA) and phallopexy for paraphimosis of unknown aetiology. Electronic records of client-owned dogs that presented to a single small animal referral centre between the dates of January 2010 and October 2023 were searched for the terms "phallopexy," "preputial advancement," "prepucial advancement" and "paraphimosis." A single operator performed the search in October 2023. Patients were excluded from the study if they underwent similar or comparable surgical techniques for reasons other than correction of paraphimosis of unknown aetiology (*e.g.* preputial neoplasia).

Data collected from the medical records included signalment, history, presenting clinical signs, physical examination findings, diagnostic procedures performed, treatments prior to surgery, post-operative care information (duration of hospitalisation, post-operative medicines dispensed), peri-operative and post-operative complications and outcome. Post-operative complications were defined as either major or minor according to the criteria recommended by Cook et al. (2010). Major complications were those requiring revision surgery or medical treatment; minor complications were those not requiring any medical or surgical treatment to resolve.

Follow-up data were obtained from clinical records and a telephone questionnaire completed by the owners. This was classed as short-term (up to 6 months after surgery), medium-term (6 to 12 months post-surgery) or long-term (more than 12 months after surgery). Owners were asked to subjectively grade the occurrence of the paraphimosis as always, often, rarely or never both before and after surgery. Outcome was assigned excellent (full resolution of clinical signs), good (improvement from pre-surgical frequency and severity of clinical signs requiring no further treatment), acceptable (improvement from pre-surgical frequency but requiring further medical treatment) or poor (no improvement or deterioration of condition). Where owner follow-up was not available, information was extracted from the clinical records.

Ethical approval was accepted by the CVS ethical review panel (Application 112).

Surgical procedure

All surgeries were performed by an ECVS diplomate or a resident directly supervised by an ECVS diplomate. Due to the long study period, the varying patient requirements and clinician preference, various anaesthetic protocols were utilised. Anaesthesia protocols, where recorded, varied but all used Methadone (Comfortan, Dechra, UK) and Acepromazine maleate (ACP, Elanco, UK) with or without medetomidine (Sedator, Dechra, UK) as a premedication. Induction anaesthesia was achieved using Propofol (PropoFlo, Zoetis, UK) to effect. Anaesthesia was maintained with isoflurane in oxygen.

Dogs were positioned in dorsal recumbency and the forelimbs were secured cranially. A wide surgical field including the whole ventral abdomen from the base of the xiphoid to the pelvic brim was clipped and aseptically prepared. Pre-operative surgical planning included marking the intended amount of abdominal skin to be resected (Fig 1). A U-shaped incision was made in the abdominal skin immediately cranial to the penis. The prepuce was undermined from the body wall and advanced to cover the penis. A second U-shaped incision was made to excise the redundant skin at an appropriate level. Surgical technique for myorrhaphy of the preputial muscles varied between surgeons and was not recorded in many dogs. Where recorded, this involved isolation of the paired preputial muscles as described by Papazoglou (2001). A piece of the preputial muscle was transected and the muscles reapposed using a horizontal mattress suture pattern. Subcutaneous sutures were placed, with or without inclusion of the fascia of the abdominal wall, with non-absorbable suture material to hold the advanced preputial skin in place. Closure was performed routinely with either non-absorbable skin sutures or absorbable intradermal sutures (Fig 2). Phallopexy was performed as

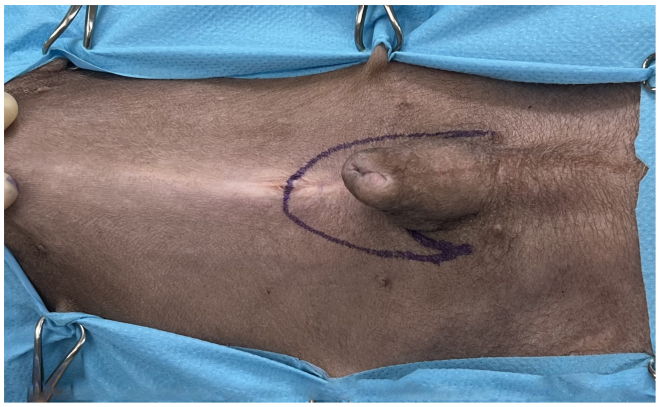

FIG 1. Photograph of pre-surgical planning of incision sites for preputial advancement.

FIG 2. Photograph of completed preputial advancement and planned incision site for phallopexy.

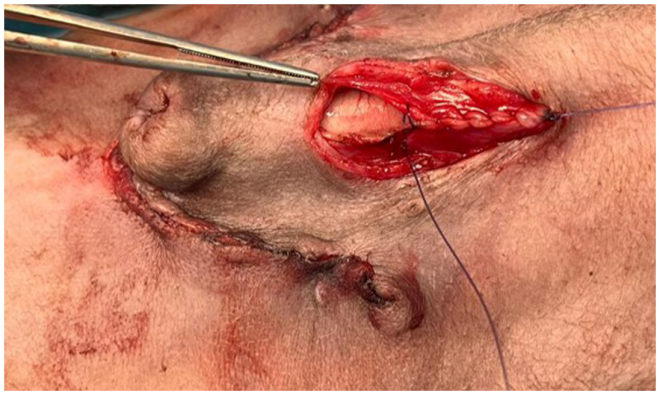

FIG 3. Photograph of ventral phallopexy procedure.

described by Somerville and Anderson (2001) via a full thickness incision in the preputial cavity, an incision made in the penile and preputial epithelium and a pexy performed with absorbable sutures (Fig 3). Where recorded, most patients underwent a dorsal phallopexy approach. The dog that had previously undergone a failed dorsal phallopexy had a ventral pexy. Where additional surgical procedures were carried out, they were included in the results.

RESULTS

Patient inclusion

Sixteen male dogs (15 neutered and one entire) met the inclusion criteria and were included in this study. Clinical data of the 16 dogs, including signalment, clinical examination findings, duration of the paraphimosis, length of the penile protrusion, complications and long-term follow-up/outcome, are presented in Table 1. Median age at time of surgery was 4.6 years (range 10 months to 11 years), and median bodyweight was 9.5 kg (range 4.3 to 18 kg). There were four crossbreeds, two Jack Russell terriers and one each of Toy poodle, French bulldog, springer spaniel, Havanese, Staffordshire Bull terrier, Bedlington terrier, Cavalier King Charles spaniel, Maltese, Petite Basset Griffon Vendéen and Papillon.

Reasons for presentation

Fourteen dogs presented with a history of multiple episodes of paraphimosis. Two dogs presented with no history of previous penile extrusion until current acute presentation. Five dogs had previously had surgery for their paraphimosis; three had preputial reconstruction, one had a previous phallopexy and one had a previous PPA. All previous surgeries were performed in first opinion practice. One dog had previously had an inguinal castration for cryptorchidism. One dog was receiving cephalexin prior to referral. None of the dogs were receiving any other drugs at the time of referral.

Examination findings

At time of consultation, seven dogs had evidence of penile protrusion while eight did not. Information was not recorded in one dog. Related physical findings varied. Twelve dogs had a reportedly normal clinical examination at time of consultation other than the reported paraphimosis. One dog had persistent overgrooming of his inguinal area suspected to be due to atopic dermatitis. One dog had been diagnosed with balanoposthitis with concurrent overgrooming of his hindquarters. One dog exhibited symptoms of brachycephalic obstructive airway syndrome but received no further treatment or investigation for this. One dog had a previous fibrocartilaginous embolism 2 years prior and had moderate chronic hindlimb weakness. Length of penis extruded, where reported, varied from 2 to 4 cm. Seven dogs exhibited signs of sexual behaviour or performed self-stimulation.

Investigation findings

Haematology and biochemistry findings were unremarkable in the four dogs where this was assessed in the referral practice. One dog with continued sexual behaviour had testosterone levels tested as he had had a previous inguinal castration; these were normal. Five dogs had a preputial scope that was reportedly normal. Eight dogs underwent abdominal ultrasound prior to surgery. Six dogs had no reported abnormalities. One dog had evidence of intestinal wall thickening and had an endoscopy for sampling during investigations, which diagnosed chronic lymphoplasmacytic inflammation. One dog

Table 1. Clinical data of 16 cases of paraphimosis of unknown aetiology treated with preputial advancement and phallopexy

Case number	Age (years)	Sex	Weight (kg)	Breed	Clinical signs (m)	Presenting signs	Relevant previous surgery	Concurrent treatment/ surgery	Post-op complications	Telephone follow-up	Recurrence	Ongoing treatment	Outcome
1	5.75	MN	5	Toy poodle	6	No current protrusion	Inguinal castration	None	Urine retention	Y	None	None	Excellent
2	0.8	ME	12.8	French Bulldog	3	No current protrusion, BOAS	None	Castration	None	Y	Rare	None	Good
3	4.6	MN	15	Springer spaniel	3	No current protrusion, balanoposthitis	None	None	None	Y	Rare	Occasional medical treatment	Acceptable
4	2.8	MN	9.5	Crossbreed	8	Penile protrusion and hyperaemia	Preputial reconstruction	None	None	Y	None	None	Excellent
5	3	MN	7.7	Jack Russell terrier	8	Penile protrusion and hyperaemia	None	None	V+ once	Y	None	None	Excellent
6	4.8	MN	7	Havanese	11	No current protrusion	Preputial reconstruction	None	Haemorrhage	Y	None	Phallopexy reversal	Excellent
7	4	MN	10.6	Crossbreed	11	Penile protrusion	None	None	Haemorrhage	Y	None	None	Excellent
8	6	MN	18	Staffordshire bull terrier	25	Penile protrusion	None	None	None	Y	None	None	Excellent
9	9	MN	11.5	Bedlington terrier	18	Penile protrusion	Preputial reconstruction	None	None	Y	Often	Medical management	Poor
10	1.2	MN	6	Cavalier King Charles spaniel	3	No current protrusion	Phallopexy	Preputial reconstruction	None	N	None	None	Excellent
11	2.8	MN	10.4	West Highland white terrier	18	No current protrusion, chronic atopy	None	None	None	N	Rare	Occasional medical treatment	Acceptable
12	1	MN	<10	Crossbreed	Chronic	No current protrusion	PPA	Preputial reconstruction	None	N	None	None	Excellent
13	8.7	MN	4.3	Maltese	Chronic	Not recorded, chronic enteropathy	None	None	None	N	Often	None	Poor
14	7	MN	5.5	Jack Russell terrier	12	Penile protrusion	None	Cystotomy – Transitional cell carcinoma	None	Y	Rare	Occasional medical treatment	Acceptable
15	5	MN	7	Crossbreed	Chronic	No current protrusion	None	None	None	Y	Rare	None	Good
16	11	MN	15	Petit basset griffon	4	Penile protrusion, hindlimb ataxia	None	None	None	Y	Rare	None	Good

N No, Y Yes

had a lesion found on ultrasound within the bladder measuring 1 cm × 0.5 cm and invading the bladder wall. The mass was located on the ventral aspect of the bladder, between the apex and trigone. This was subsequently diagnosed as a transitional cell carcinoma.

Clinical management (*i.e.* treatment administered)

All dogs included underwent preputial advancement and phallopexy under the same general anaesthetic. Two dogs had preputial myorrhaphy detailed within the surgical notes. Three dogs also underwent a preputial reconstruction under the same surgery. The specific procedure was reported in two dogs as narrowing of the preputial orifice in the ventral aspect of the ostium. One dog had a 30% reduction in size and the other was reportedly narrowed by 4 mm. The single entire dog was neutered. The dog with the bladder lesion found on ultrasound also underwent a partial cystectomy for removal of this (reportedly transitional cell carcinoma) but received no other treatment for this mass. Surgery was performed as described previously. Surgical time was available in 9/16 dogs with a median time of 60 minutes (range 45 to 75 minutes) including ancillary procedures.

Complications

No intraoperative complications were reported. Perioperative complications were reported in one dog having one episode of vomiting and diarrhoea that resolved while hospitalised. Median hospitalisation time was 2 days (range 2 to 4 days) and dogs were discharged when comfortable with discontinuation of opioid analgesia. According to surgeons' preference, 15/16 dogs received nonsteroidal anti-inflammatory drugs (NSAIDs) with or without paracetamol following discharge. The remaining dog was given Tramadol. Seven dogs received post-operative antibiosis (amoxicillin clavulanate or cephalexin) according to surgeon preference. No specific indication for antibiosis was reported.

Related post-operative complications were reported in three of the 16 dogs. One dog had one episode of vomiting following discharge that resolved without any treatment. Minor complications were reported in one dog who had occasional retention of urine within the prepuce chronically. Major post-operative complications were reported in two of the 16 dogs. One dog presenting with haemorrhage from within the prepuce, seroma and discomfort 5 days after surgery was hospitalised for analgesia and improved with no surgical intervention. This was presumed to be partial breakdown or irritation of the phallopexy site. The other dog experienced repeated episodes of haemorrhage following excitement or sexual arousal. Surgery was performed 3.5 weeks after initial surgery to remove the phallopexy sutures and clinical signs resolved.

Outcomes

Medium-term follow-up was available in one dog (244 days following surgery) and long-term follow-up in 11 dogs via owner questionnaire (917 to 2597 days post-operatively). The four dogs for which telephone follow-up was not available had long-term follow-up available via clinical history. Following surgery eight dogs had no recurring episodes of paraphimosis with owner follow-up available in six of these seven dogs. Eight dogs had recurrent episodes of paraphimosis. Where information was available via owner follow-up (6/8 cases with recurrence), four dogs had "rare" episodes and two dogs had "often" recurring paraphimosis. The other two dogs had reoccurrence of penis protrusion, one at an unreported time post-surgery, one 17 months after surgery and one 4 years after. Neither of these had repeated surgical treatment as reported at the time of last follow-up (435 to 1671 days).

For the 12 dogs where owner follow-up was available, outcome was assigned as described earlier. Where owner follow-up was not available, there was reported significant improvement despite recurrence in one case who was assigned an acceptable outcome and one case where it was unclear if there was improvement, and a poor outcome was assigned. Seven dogs had an excellent outcome, three dogs had a good outcome, three dogs had an acceptable outcome and two dogs had a poor outcome. No dog had repeat surgery for treatment of this condition.

Of the five dogs who had previous surgery for paraphimosis, one had recurrence of the paraphimosis post-revision surgeries and was therefore classified as poor. The owner considered there had been some improvement, but he still had regular paraphimosis episodes, though no further treatment was performed. One of the dogs who had had previous surgery (preputial reconstruction) had a major complication (haemorrhage with excitement) requiring removal of the phallopexy sutures.

DISCUSSION

Paraphimosis is a common condition seen in small animal practice that can mostly be managed with conservative treatments (Boothe, 2018). Some dogs fail to respond, necessitating surgical treatment. Temporary or permanent surgical enlargement of the preputial orifice has been described (Boothe, 2018) to alleviate issues caused by strangulation of the penile tissue; however, this will not alleviate problems due to insufficient preputial coverage.

In the dogs presented here, there was no penile necrosis or other abnormalities requiring salvage procedures, so partial penile amputation was not considered appropriate. Preputial advancement alone may not completely remove the risk of paraphimosis as balanoposthitis, erection and self-trauma can still occur. Careful consideration needs to be made regarding the inciting cause of paraphimosis and whether surgical intervention may reduce the risk of recurrent episodes. A previous small case series (three dogs) has described phallopexy alone to manage paraphimosis. This found good outcome in all dogs with no reported complications (Somerville & Anderson, 2001). A second study reporting preputial advancement for treatment of paraphimosis reported success in four of six dogs. The remaining two dogs had recurrence of paraphimosis 10 and 12 days post-operatively. In this series, dogs with >1.5 cm protruding had recurrence of their clinical signs. All these previous studies have limited case numbers

making it challenging to determine whether preputial advancement or phallopexy is the superior technique for recurrent paraphimosis. Pavletic (2018) reports that these techniques may be combined in more severe dogs. A single case report describes the use of a combined PPA and phallopexy for treatment of recurrent paraphimosis >1.5 cm with a successful outcome (Wasik & Wallace, 2014). This current study evaluated the outcome of a larger group of dogs requiring both PPA and phallopexy and found reasonable success with improvement in 81% of dogs.

Various preputial advancement methods have been reported in the literature for treatment of paraphimosis. Papazoglou (2001) reported a transection and myorrhaphy of the paired preputial muscles. Wasik and Wallace (2014) reported transection of the paired preputial muscles, without their reapposition. In the current study, myorrhaphy and reattachment of the paired preputial muscles were not recorded. Pavletic (2018) believes that shortening or imbrication of the preputial muscles is not required to correct paraphimosis and should not be attempted. It is unknown what effect this may or may not have had on the long-term outcome of preventing paraphimosis recurrence. Further research is required investigating the differences in outcome between dogs treated with and without myorrhaphy and myorrhaphy technique.

Further to this, Papazoglou (2001) incorporated a portion of the sutured preputial muscle into a tacking suture to the rectus abdominis muscle. This was presumably done to assist with securing the preputial muscles in a more cranial position. It is unknown what effect this had on outcome. Further research is required investigating the long-term effects of preputial advancement and myorrhaphy with or without incorporation of the rectus abdominis sheath into the suture of the myorrhaphy.

In the current study, all 16 dogs were either toy, small or medium breed dogs with ten of the 16 dogs below 10 kg. There is no literature suggesting a predilection of dogs related to a certain size being at a higher risk of developing paraphimosis. The breeds represented in our study would suggest that dogs under 10 kg are at a higher risk of requiring complex surgery to correct a paraphimosis.

As this was a retrospective study, investigations into the cause of the paraphimosis were not standardised. This may have resulted in underlying contributing factors to be missed, resulting in incomplete or ineffectual treatment. Seven of the dogs included in the study displayed sexual behaviour prior to referral. Only one dog underwent hormonal testing to investigate increased sexual behaviour. These behaviours can contribute to and worsen paraphimosis, so aetiologies should be considered during investigations.

The two major complications (12.5%) reported were related to the phallopexy procedure performed. The dog who had haemorrhage from within the prepuce and no further treatment had presumed partial breakdown of the phallopexy site to explain significant haemorrhage from within the prepuce. This resolved without further treatment. The second dog who experienced haemorrhage from within the prepuce had repeated episodes in the weeks following surgery following exhibition of sexual behaviours. The bleeding was presumed to be as a result of excessive force placed on the sutures of the phallopexy site during this motion because the penis is unable to move freely within the preputial sheath. Therefore, it was elected to reverse/remove the phallopexy. This patient had been with the same owner since a puppy and was known to have undergone a routine castration, thus prompting concern of a behavioural issue and as such was referred to a behaviourist once the phallopexy had been reversed. This contrasts with the study by Somerville et al. who reported no complications. However, the case numbers were significantly higher than in the study by Somerville, and the small number of dogs (three) reported previously likely contributes to the low complication rate reported.

No complications were specifically reported associated with the PPA procedure in comparison to the development of minor complications in the study by Papazoglou (2001) in one of six dogs (16.6%). The complication reported by Papazouglou was a small dehiscence of the centre of the PPA incision which was left to heal by secondary intention. We therefore found no significant increased complication rate in combination of PPA and phallopexy (18.75%) when compared with PPA alone (16.6%).

The minor complication reported in this case was that of mild urinary retention within the prepuce. This has not been reported in previous papers describing preputial advancement or phallopexy. As the goal of these surgeries is to permanently prevent extrusion of the penis, it could be considered that minor urine retention within the prepuce would be an unavoidable consequence of aggressive preputial advancement. This does not appear to cause significant problems, with this only reported in one case where the owner reported occasional dripping of urine from the prepuce immediately following normal urination. The owner reported the dog was not bothered by this, and it only occurred intermittently.

When considering medium to long-term outcome of the procedure, 50% of dogs (8/16) had no recurrence of paraphimosis, 18.75% (3/16) had some intermittent recurrence, 18.75% (3/16) had recurrence but an improvement from pre-surgical condition and two (12.5%) had no major improvement from pre-surgical condition. Overall, there was recurrence in 8/16 of the dogs (50%). Papazoglou reported 33% (2/6 dogs) recurrence with PPA alone, Somerville reported no recurrence (0/3) with phallopexy alone. It is challenging to draw comparisons between these outcomes and published outcomes of PPA or phallopexy alone due to small case numbers and short follow-up times in other papers. As found in this study recurrence occurred up to 4 years after the original surgery. To better understand and compare the different procedures, larger case studies of the other individual procedures would need to be performed. Unfortunately, we were not able to assess a cohort of dogs that had received one or other of phallopexy or PPA alone in order to draw accurate comparisons within this paper. A further larger case study investigating the outcomes of treatment of paraphimosis with phallopexy alone would be interesting to establish whether a combination of surgical techniques improves outcome.

One of the dogs with an "acceptable" outcome was the dog diagnosed with a bladder lesion on ultrasound prior to surgery. This dog was included in this study as the paraphimosis was

reportedly present for years prior to investigation and diagnosis of the mass. This dog improved with surgery but still had persistent waxing and waning episodes of prolapse. It is unclear whether there was any influence of the bladder mass on worsening of the paraphimosis prior to the owner seeking treatment. No further treatment was sought for the ongoing paraphimosis or for the bladder mass and he had recently passed away from causes unrelated to his bladder neoplasia or paraphimosis at telephone follow-up 6.5 years after the time of surgery.

All the cases in this study were performed at a referral hospital by specialist surgeons or residents under supervision. Five of the 16 dogs had undergone previous surgical procedures that had failed to correct the paraphimosis. It is possible that the dogs that presented to the hospital were more difficult to manage and required extensive surgical intervention to correct the paraphimosis. This may have also led to an increased complication rate following surgical intervention. However, only one of the complications occurred in a dog that had had previous surgery and only one of the poor outcomes. The other four dogs had excellent outcomes. The previous paper describing phallopexy on three patients that failed to respond to medical therapy had not undergone any previous surgery (Somerville & Anderson, 2001). The paper describing preputial advancement alone did not record if previous surgical procedures had been performed on any of their patients. This study, therefore, shows that PPA and phallopexy can be successful in dogs who have undergone previous surgical intervention. The authors suggest that the combined procedure of PPA with phallopexy should be considered in cases of recurrence where only PPA or phallopexy alone had been performed.

In conclusion, PPA and phallopexy can be used to treat idiopathic paraphimosis refractory to medical management with reasonable levels of success leading to improvement in 87.5% of dogs and possible reduced risk of recurrence.

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Author contributions

H. Badham designed the study, analysed and interpreted the data and wrote the manuscript. G. Cathrall collected and interpreted the data and revised the manuscript. E. Cockburn contributed to manuscript writing and editing. S. Das interpreted the results and contributed to and revised the manuscript. All authors read and approved the final version of the manuscript and are accountable for the work reported.

Conflict of interest

The authors have no conflicts of interest.

Data availability statement

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

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