







# Clinical and surgical aspects of hypospadias and urethral diverticulum in goats

## *Aspectos clínicos e cirúrgicos de hipospádia e divertículo uretral em caprinos*

Huber Rizzo<sup>1\*</sup> , Kayo Eduardo de Andrade Lima<sup>2</sup> , Jerônimo Hugo de Souza<sup>2</sup> ,  
Danielle Pimentel Ribeiro<sup>3</sup> , Rummenigge José de Oliveira Nascimento<sup>2</sup> ,  
Karoline Antunes de Albuquerque<sup>3</sup> 

**ABSTRACT:** Hypospadias is the imperfect closure of the external urethra of the male which results from the incomplete fusion of the urogenital folds and abnormal openings of the penile urethra. The urethral diverticulum is the abnormal dilatation of the urethra, and can be of multifactorial origin and related to genetic, endocrinological and environmental factors. The objective of this article is to report on the clinical and surgical treatment of two cases of hypospadias and one case of urethral diverticulum in goats raised as pets, originated from cross breeding polled pairs. In Case 1 the hypospadias was characterized by two orifices on the ventral portion of the penis, separated by a 2 cm interruption of the urethra, and in Case 2 by an orifice on the ventral portion in the region of the urethra. In both cases there was an accumulation of urine in the middle ventral region of the foreskin, leading to distension of the skin. Both cases were successfully treated by urethrostomy and partial penectomy with fixation of the proximal urethral ostium to the skin. In Case 3, the animal was seen at ten days of age with presence of a diverticulum in the preputial region, however, the animal returned for new care only after four months due to urethral obstruction and died as a result of advanced azotemia. Surgical treatment of hypospadias, when performed before the development of azotemia associated with urinary retention, has been shown to be efficient, and post-operative care is important.

**KEYWORDS:** Congenital defects; polled; penectomy; urethra; urogenital.

**RESUMO:** Hipospádia é o fechamento imperfeito da uretra externa do macho, resultado da falha de fusão das pregas urogenitais e da formação incompleta da uretra peniana e o divertículo uretral é a dilatação anormal da uretra, podendo ser de origem multifatorial e relacionada a fatores genéticos, endocrinológicos e ambientais. O objetivo desse artigo é relatar o tratamento clínico-cirúrgico de dois casos de hipospádia e um de divertículo uretral em caprinos criados como animais de estimação, oriundos de cruzamentos de casal mocho. No Caso 1 a hipospádia era caracterizada por dois orifícios ventrais ao pênis, separados por uma interrupção de 2 cm da uretra e no Caso 2 por um orifício na face ventral na região da uretra, em ambos os casos ocorreu o acúmulo de urina na região média ventral do prepúcio levando a distensão da pele. Os dois casos foram tratados com sucesso através da uretostomia e penectomia parcial com fixação do óstio uretral proximal a pele. Já no Caso 3, o animal foi atendido com dez dias de vida com presença de divertículo na região prepúcia, no entanto retornou para novo atendimento somente após quatro meses devido obstrução uretral, causando quadro grave de azotemia e a morte. O tratamento cirúrgico da hipospádia, quando realizada antes do desenvolvimento de azotemia associado a retenção urinária, mostrou-se eficiente, sendo importante atenção os cuidados pós-operatórios.

**PALAVRAS-CHAVE:** Defeitos congênitos; mocho; penectomia; uretra; urogenital.

## INTRODUCTION

While urethral diverticulum is the abnormal dilatation of the urethra, hypospadias is the imperfect closure of the external urethra in male, resulting from the incomplete fusion of the urogenital folds and abnormal openings of the penile urethra,

mainly affecting goats, followed by sheep, cattle and bubalines (MISK; MISK; SEMIEKA, 2013). Affected goats may present only hypospadias (ALMUBARAK et al., 2016), or associated with other congenital anomalies, such as absence of urethral process (MARTINEZ et al., 2011), ectopic penis (AKASH;

<sup>1</sup>Departamento de Medicina Veterinária, Universidade Federal Rural de Pernambuco, Recife/PE, Brasil

<sup>2</sup>Programa de Residência em Área Profissional da Saúde em Medicina Veterinária, Universidade Federal Rural de Pernambuco, Recife/PE, Brasil

<sup>3</sup>Programa de Pós-Graduação em Medicina Veterinária, Universidade Federal Rural de Pernambuco, Recife/PE, Brasil

\*Corresponding author: hubervet@gmail.com

Received: 07/06/2022. Accepted: 04/27/2023

HOQUE, 2021), underdeveloped penis, absence of preputial orifice (RAJASHRI et al., 2016; HRISTOV; STOIMENOV, 2020), urethral diverticulum (SYLLA et al., 2019; QAYYUM et al., 2020; SURYAWANSHI; ULEMALE, 2022) and hermaphroditism (AL-ANI et al., 1998).

The etiology is not yet fully elucidated, and may be multifactorial and related to genetic, endocrinological, and environmental factors. Hypospadias can be classified based on the location of the urethral opening into glandular, penile, scrotal, and perineal. This location and the coexistence of other developmental changes will direct the best treatment that can be performed conservatively, not being recommended to treat animals without life-threatening clinical signs (MARTINEZ et al., 2011; RAJASHRI et al., 2016), or surgically by different techniques (AL-ANI et al., 1998; AKASH; HOQUE, 2021; BELGE; YAYGINGÜL; DERINCEGÖZ, 2022; SURYAWANSHI; ULEMALE, 2022).

The aim of this study is to report on the clinical and surgical treatment of two cases of goats with penile hypospadias and one case of death due to urethral diverticulum.

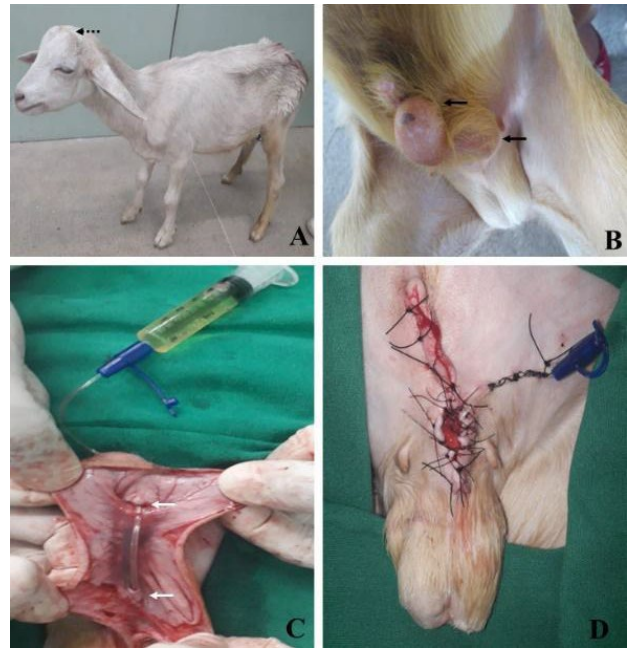
## CASE REPORT

The cases reported were seen in the routine of the Large Animal Ambulatory of the Veterinary Medicine Department of the Rural Federal University of Pernambuco (AGA/DMV/UFRPE), during the second semester of 2021. The animals belonged to different guardians who had in common the raising of goats as pets, not for production purposes but as companions. The animals were the result of cross breeding polled goats, which consecutively had protuberances in the head region, characteristics of a polled animal (Figure 1A).

### Case 1

A seven-month-old cross-breeding goat, weighing 10 kg, raised in Caaporã/PB, with a history of urine accumulation since birth in the mid-ventral region of the foreskin, leading to skin distension, leaving the region with a circular bipartite shape, with a diameter of approximately 8 cm (Figure 1B). To eliminate the accumulated urine, the guardian pressed the region, in order to eliminate the urine via preputial ostium. The need for this procedure became more frequent along the growth of the goat, leading to dysuria and hematuria three days ago, which made the guardian look for the AGA/DMV/UFRPE due to pain and irritation at the site.

During the physical examination of the penis, it was only possible to expose the glans, which was normal; the rest of the penis was adhered to the foreskin. For examination of the urethra, the urethral process was sectioned to pass a silicone urethral probe no. 4. When penetrating about 5cm of the urethra, the probe entered the sacculation developed in the ventral region of the foreskin, allowing the elimination of urine, however not proceeding further towards the base of



Source: author's collection.

**Figure 1.** Case 1 - A seven-month-old cross-breeding goat, weighing 10 kg, with hypospadias due to the absence of part of the penile urethra: (A) Polled goat (arrow), (B) Urine accumulation in the foreskin, with diverticulum formation in the ventral region, (C) orifices probe at the base of the urethra (arrows), due to interruption of the urethra, and (D) post-surgical correction of hypospadias, with penile amputation and fixation at the base of the foreskin, with urethral probing.

the penis. Analysis of the fluid collected by the probe revealed a pale yellow, clear urine, pH 9, density 1.020, presence of occult blood (++) , Red cells (10-17/field), leukocytes (0-3/field) and sloughed (1-2/field) and squamous epithelial cells (15-28/field). The ultrasound examination performed with a Mind ray M5 VET device with a 3.5MHz convex transducer showed a distended urinary bladder, normal kidneys and presence of fluid in the foreskin.

Since this was a possible case of penile hypospadias, we opted for surgical intervention by opening the distended region of the foreskin to inspect the entire penis. The animal was sedated (0.1 mg/kg of 2% xylazine hydrochloride + 0.5mg/kg diazepam IV) and submitted to locoregional (paravertebral between T13 and L3) and local anesthesia (parallel to the incision line) with 1% lidocaine hydrochloride. With the patient in dorsal decubitus, the skin was sectioned and the ventral region of the foreskin was opened, and two urethral orifices were identified, opening ventrally to the penis, separated by a 2cm interruption, which prevented the urine from passing through all its interior (Figure 1C). Urethrostomy and partial penectomy was performed with fixation of the proximal urethral ostium to the skin, through an elliptical incision in the final 2/3 of the foreskin, divulsion of the subcutaneous tissue and sectioning of the penis at the line of the proximal orifice of the urethral malformation. The suture was zig-zag pattern with polyglactin 0 in the subcutaneous and wolf suture

with nylon 0 in the skin. A number 4 urethral probe was also inserted, fixed to the skin of the abdomen with 2-0 nylon and a “Roman sandal” suture (Figure 1D). At the end, the animal was castrated with burdizzo, after applying 1ml of 1% lidocaine hydrochloride inside each spermatic cord.

In the postoperative period four applications of 0.1ml/kg oxytetracycline hydrochloride 20% long-acting every 48 hours, 2.2mg/kg flunixin meglumine for three days, 25 mg/kg dipyrone for two days (every 12 hours) all intramuscular were administered, maintenance of the urethral probe for three days, cleaning of the wound with chlorhexidine 2%, 0.9% sodium chloride solution and the topical use of allantoin (2g) and zinc oxide (2g) ointment twice a day. Since the animal had no history of vaccination for clostridiosis, an application of lyophilized anti-tetanus serum (5,000 IU) was administered subcutaneously. The suture was removed ten days after surgery, with the animal showing normal urine flow through the penis.

## Case 2

Four-month-old cross-breeding goat, weighing 9.2kg, raised in Igarçu/PE. The animal was acquired three months ago and after one week, it was noticed the formation of sacculation near the foreskin, which when filled and distended, drained urine through a fistula, naturally formed due to pressure, until it was emptied (Figure 2A). After noticing the closing of this



Source: author's collection.

**Figure 2.** Case 2 - A four-month-old cross-breeding goat weighing 9.2 kg with hypospadias due to a fistula in the ventral region of the urethra. (A) Stenosed preputial orifice and sacculation in its ventral region, (B) penile exposure after incision of the foreskin, with hypospadias point probing, (C) ventral penile amputation ventral to urethral fistula followed by suturing the penis to the skin of the abdomen, and (D) post-surgical correction of hypospadias, with penile amputation and fixation at the base of the foreskin, with urethral probing.

fistula and urine accumulation, with consequent irritation and skin sensitivity, the guardians sought assistance at the AGA/DMV/UFRPE. During the clinical examination the animal was in station and vocalizing due to pain. In the examination of the urogenital tract, it was not possible to expose the penis, which was more caudal than normal, and consecutively the urethral probing. There was a sacculation in the foreskin in its ventral region, which after being punctured with a needle (40x12mm), urine was obtained, which was later confirmed with the ultrasound images (Mindray M5 VET 3.5MHz convex transducer), which also showed the presence of a penis inside the sacculation. Hematological and biochemical examination revealed leukocytosis with neutrophilia and elevated fibrinogen (Table 1).

The animal was referred to the surgical center and was submitted to the same anesthetic protocol as Case 1. Due to the presence of the penis inside the foreskin and the possibility of its lateral deviation, a circular incision was made 1cm below the preputial ostium, followed by a rectilinear incision through the base of the sacculation. With this procedure it was possible to release the entire penis and inspect it. An orifice was located on its ventral side in the region of the urethra. We probed the orifice (probe no.4) and concluded that this was the urine drainage point from the penis to the foreskin (Figure 2B). With the probe in the urethra, a triangular incision with an inverted base was made near the ostium, and the penis was excised. In the urethra, an incision was made for its open skin fixation, followed by subcutaneous approximation, dermorrhaphy, maintenance of the urethral probe, castration with burdizzo and post-surgical treatment as in Case 1, except the pattern of skin sutures and probe fixation in a simple and separate way (Figures 2C and D).

## Case 3

An approximately ten-day-old cross-breeding goat, weighing 5kg, raised in Carpina/PE, born from a triplet birth, the only one with the presence of urethral diverticulum in the ventral region of the foreskin with accumulation of urine associated with elimination via preputial ostium and diverticulum wall. On examining the region, it was noted that the penis was underdeveloped and there were no testicles or scrotal pouch externally. Surgery was suggested to correct the condition; however, the guardian decided not to perform it at that moment due to its age, but to schedule it for the next month's according to the clinical evolution of the malformation.

After four months, the patient, weighing 10.2 kg, returned to the AGA/DMV/UFRPE, because it presented possible urinary retention for at least 24 hours, causing great discomfort. On clinical examination the goat presented apathy, signs of discomfort and pain, staying in decubitus sometimes, slightly hyperemic mucous membranes, dehydration, horizontal nystagmus that progressed to vertical, pupils in mydriasis and



**Table 1.** Hematological and biochemical values of goats with hypospadias associated or not with urethral diverticulum, measured at the time of clinical care at the AGA/DMV/UFRPE.

Parameters	Case 1	Case 2	Case 3	Reference values (PUGH et al., 2021)
Red blood cells ( $\times 10^6$ mm <sup>3</sup> )	15,2	21,8	22,6	8,0 - 17
Hematocrit (%)	25	28	40	22 - 36
VCM (fL)	16,5	12,9	17,7	15 - 26
Leukocytes ( $\times 10^3$ $\mu$ L)	22,40	35,35	45,40	4,0 - 13
Segmented Neutrophils % ( $\mu$ L)	58 (12.992)	80 (28.280)	76 (34.504)	30 - 48 (1400 - 8.000)
Eosinophils % ( $\mu$ L)	4 (896)	-	-	1 - 8 (0 - 900)
Lymphocytes % ( $\mu$ L)	36 (8.064)	17 (6.010)	20 (9.080)	50 - 70 (2.000 - 9.000)
Monocytes % ( $\mu$ L)	2 (448)	3 (1.061)	2 (908)	0 - 4 (0 - 500)
Total proteins (g/dL)	5,8	6,8	8,4	6,0 - 7,5
Fibrinogen (mg/dL)	200	600	800	100 - 500
Urea (mg/dL)	51,1	41	92	17 - 42
Creatinine (mg/dL)	0,9	0,9	3,8	1,0 - 1,82

mouth tremors, sialorrhea, with rectal temperature of 37.9°C. In the evaluation of the urogenital system, a distended sacculation was observed in the ventral region of the foreskin (Figure 3C), and its section was performed in the ventral region to drain the retained urine. After the clinical evaluation and the hematological and biochemical tests performed, a picture of azotemia, dehydration with an infectious process (leukocytosis with neutropenia) and active inflammation as a consequence of urinary retention were identified (Table 1). In order to stabilize the patient for further surgical treatment, ringer's lactate solution (500ml/IV), flunixin meglumine (0.4mg/kg/IM), dexamethasone (0.5mg/kg/IV), 25% glucose (10ml/IV), vitamin B1 (0.2mg/IV), oxytetracycline hydrochloride (mg/kg/IM), and morphine (0.2mg/kg/SC) were administered, but the animal died.

## DISCUSSION

The goats in the report had varying degrees of urogenital anomalies, as had other reports, however the clinical signs at the time of care resemble being a fluid-filled sacculation ventral to the penile area with urine dripping through a fistula or preputial ostium, which with manual pressure occurs elimination of urine through the preputial ostium (ALMUBARAK et al., 2016; SYLLA et al., 2019; AKASH; HOQUE, 2021). Both in cases of simple orifices (Case 2) (SURYAWANSHI; ULEMALE, 2022), and the absence of part of the urethra (Case 1) (ALMUBARAK et al., 2016) will lead to extravasation and retention of urine in the foreskin causing its ventral region to dilate.

The diagnosis of the reported cases was by means of clinical signs and complementary examinations such as ultrasonography,



Source: author's collection.

**Figure 3.** Goat with urethral diverticulum, underdeveloped penis and absence of scrotum and testicle (A) at ten days and (B) at four months.

centesis, urinalysis and blood count (ALMUBARAK et al., 2016; BELGE; YAYGINGÜL; DERINCEGÖZ, 2022; SURYAWANSHI; ULEMALE, 2022), and the contrasted radiography technique can also be performed (MISK; MISK; SEMIEKA, 2013). Hematological and biochemical tests are important for the pre-surgical evaluation, since this is an invasive procedure that can lead to hemorrhage due to the sectioning of the corpus cavernosum, in addition to a considerable period of the animal under anesthesia (BELGE; YAYGINGÜL; DERINCEGÖZ, 2022). In these cases it was not possible to perform cytogenetic analysis to search for possible chromosomal alterations, as in the study described by Martinez et al. (2014), however it is suspected that there is a relationship between the observed changes and the fact that these

animals come from a cross between polled animals reported by the guardians in all three cases (CORREIA et al., 2001).

The treatment can be conservative, if the animal has an orifice that allows the elimination of urine (RAJASHRI et al., 2016), or surgical when there is retention leading to dysuria, strangulation and vocalization due to pain (SYLLA et al., 2019; QAYYUM et al., 2020; BELGE; YAYGINGÜL; DERINCEGÖZ, 2022). In these cases intervention is recommended because this condition may lead to urethritis and/or cystitis evolving to even bladder rupture in malformations associated with aplasia of the penis and/or absence of preputial ostium (MISK; MISK; SEMIEKA, 2013). In the goats of the report leukocytosis and hyperfibrinogenemia were observed that if postponed could cause death, as occurred in Case 3.

The surgical technique is performed according to the malformation and location of the hypospadias. Al-Ani et al. (1998), in Shami goats with hypospadias associated with hermaphroditism and accumulation of urine in the inguinal region near the scrotum, perineal urethrostomy was the choice. In cases of hypospadias and diverticulitis one can perform diverticulectomy with urethral suturing using vicryl 2-0 with simple continuous sutures (SURYAWANSHI; ULEMALE, 2022), vicryl 4-0 with simple separate sutures (BELGE; YAYGINGÜL; DERINCEGÖZ, 2022) or polyglycolic acid 2-0 (ALMUBARAK et al., 2016), with no case of stenosis. In the reported cases we opted for removal of the excess prepuccial skin and penile amputation ventral to hypospadias, as reported in one-day-old goat (AKASH; HOQUE, 2021). This technique avoids the risk of later urethral stenosis and/or adherence of the penis to the skin. The fixation and maintenance of urethral probe in the post-surgery was important for the prevention of stenosis of the urethra and/or its orifice, and was shown to be effective for three days in the goats in the reports, as well as in two-month-old Alpine goat (SYLLA et al., 2019), and could extend up to ten days, being removed along with the sutures (BELGE; YAYGINGÜL; DERINCEGÖZ, 2022). Due to its possible genetic character and in order for the animal to reduce its libido and stimulate penile exposure, castration was performed via burdizzo, due to the thin spermatic

cord of the goats, avoiding yet another surgical wound in the case of performing orchiectomy as carried out by Sylla et al. (2019).

The good evolution of the surgical wound should be attributed to the way in which the animals are raised, kept more attentively and closely to the guardians because they were treated like pets, as reported by Sylla et al. (2019) who recommended the same technique used in the report for the treatment of hypospadias in pet goats, however its application is questioned routinely in production-oriented farms because it is a malformation that may be associated with others that are incompatible with life afterwards, in addition to the cost benefit in productive terms and the attention required with postoperative care.

In Case 3 it is believed that due to the age of the animal, the alteration presented was similar to that described by Belge, Yaygingül and Derincegöz (2022), in a nineteen-day-old cross-breeding goat, which was a thin-walled, fluid-filled transparent structure located in the ventral midline associated with the foreskin, a characteristic of urethral diverticulum. The fact that having postponed surgical treatment in the first visit led to a picture of urinary retention with development of dehydration, leukocytosis, hyperfibrinogenemia and azotemia identified in the hematological and biochemical exams that were incompatible with a surgical intervention.

## CONCLUSIONS

Surgical treatment of hypospadias in goats can be successfully performed by amputation and fixation of the penis to the skin, followed by castration. It is recommended for animals kept as pets and/or has post-operative support for wound care to avoid urethral obstruction, wound infection, and/or ascending into the urinary tract. With the increase in the breeding of goats as pets, especially in metropolitan regions, the demand of the population for veterinary care is expanding in order to maintain the life of the animal, without taking into account its productive and reproductive potential. It is important to prevent this type of situation, advising the guardians not to crossbreed with polled goats, which can cause the birth of offspring with urethral malformations that may be incompatible with life.

## REFERENCES

- AL-ANI, F.K. et al. Occurrence of congenital anomalies in Shami breed goats: 211 cases investigated in 19 herds. **Small Ruminant Research**, v.28, p.225-232, 1998.
- ALMUBARAK, M. et al. Penile urethral hypospadias with two fistulae and diverticulum in a Saanen kid. **Case Reports in Veterinary Medicine**, v. 2016, Article 6534062, p.1-3, 2016.
- AKASH; HOQUE, M. A case report on surgical management of hypospadias in a day-old goat kid. **International Journal of Livestock Research**, v.11, n.2, p.175-178, 2021.
- BELGE, A.; YAYGINGÜL, R.; DERINCEGÖZ, O.Ö. A case of penile urethral diverticulum in a male crossbreed kid. **Turkish Journal of Veterinary Research**, v.1, n.6, p.33-36, 2022.

CORREIA, T.M. et al. Estudo preliminar de alterações anátomo-histológicas em caprinos intersexuais sem cornos da raça Serrana. **Revista Portuguesa de Ciências Veterinárias**, v.96, n.539, p.153-156, 2001.

HRISTOV, K.; STOIMENOV, A. Hypospadias in small ruminants: a case report. **Tradition and Modernity in Veterinary Medicine**, v.5, n.1, p.58-61, 2020.

MARTINEZ, A.C. et al. Hipospádia e ausência de processo uretral em caprino (*Capra hircus*) - relato de caso. **Revista Brasileira de Ciência Veterinária**, v.18, n. 2/3, p.111-113, 2011.

MISK, N.A.; MISK, T.N.; SEMIEKA, M.A. Diagnosis and treatment of affections of the urethra in male ruminants: a review of 403 cases. **International Journal of Veterinary Medicine: Research & Reports**, v.2013, article ID 715907, p.1-10, 2013.

PUGH, D.G. et al. **Sheep, Goat, and Cervid Medicine**. 3rd Edition. London: Elsevier 2021, 576p.

QAYYUM, A. et al. Surgical intervention of hypospadias associated with urethral diverticulum in a male goat kid: a case report. **Agrobiological Records**, v.1, p.31-33, 2020.

RAJASHRI, M. et al. Hypospadias and associated congenital genital defects in a Jamnapari kid (*Capra hircus*): a case study. **International Journal of Science, Environment and Technology**, v.5, n.5, p.3405-3408, 2016.

SURYAWANSHI, R.V.; ULEMALE, A.H. Surgical repair of urethral diverticulum with penile urethral hypospadias in two Osmanabadi kids. **Haryana Veterinarian**, v.61, p.139-140, 2022.

SYLLA, L. et al. Urethrostomy in an Alpine kid secondary to congenital penile urethral diverticulum. **Large Animal Review**, v.25, p.153-156, 2019.

