



Phimosis in male dromedary camels: Clinical findings and changes in the hemogram, nitric oxide metabolites, and testosterone concentrations

Ahmed Ali ^{a,b,*}, Derar Derar ^{a,b}, Fahd A. Al-Sobyil ^a, Moustafa M. Zeitoun ^c, Khaled M.A. Hassanein ^d, Abdella Al-Howas ^a

^a Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Qassim University, Qassim, Saudi Arabia

^b Faculty of Veterinary Medicine, Department of Theriogenology, Assiut University, Assiut, Egypt

^c Department of Animal production, College of Agriculture and Veterinary Medicine, Qassim University, Qassim, Saudi Arabia

^d Faculty of Veterinary Medicine, Department of Pathology, Assiut University, Assiut, Egypt

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ABSTRACT

The objectives of this study were to elucidate the clinical findings in male dromedary camels with phimosis (PHI, $n = 43$) and to investigate the association of this syndrome with the hemogram, nitric oxide metabolites (NOMs), and testosterone concentrations. History and signalment were obtained, and a breeding soundness examination was performed. The penis was exteriorized after administration of a pudendal nerve block. Abnormal masses obtained from the prepuce and penis were prepared for histopathology. Blood samples for hemogram assessment were taken from the diseased animals and from 10 healthy control males. Total nitrates/nitrites were determined in sera using the Griess assay. Testosterone was estimated in sera using ELISA. Phimosis associated with detectable pathologic lesions, mainly including ulcerative posthitis and lacerated glans penis, was present in 34 (79.1%) of the 43 cases (PHI-P), whereas the remaining nine (20.9%) of the 43 cases had no noticeable lesions (PHI-N). The PHI-P group showed higher leukocyte counts ($P = 0.001$), especially neutrophils ($P = 0.0001$), and greater NOM concentrations ($P = 0.002$) than the PHI-N and control groups. However, testosterone concentrations did not differ among groups. In conclusion, PHI in the male dromedary camels was mainly associated with ulcerative posthitis and laceration of the glans penis. The presence of pathologic lesions in cases with PHI was associated with leukocytosis, neutrophilia, and high NOM concentrations.

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1. Introduction

Erection of the penis in males with a sigmoid flexure as seen in male camels, bulls, rams, and bucks depends on the relaxation of the retractor muscle of the penis and the pumping of blood into the corpus cavernosum penis [1]. When the relaxation is insufficient, the penile extension is

incomplete at the time of intromission [2]. In severe cases, this can lead to complete retention of the penis (phimosis, PHI). Preputial stenosis, penile adhesions, hematomas, peripreputial abscesses, and insufficient penile length have been reported as causes of PHI [2–4].

Blood is supplied from the distal end of the crura to the corpus cavernosum penis by two large vessels [5]. On sexual stimulation, active rhythmic contractions of the ischiocavernosus muscles force blood from the crura into the dorsal canal and subsequently into the cavernous spaces of the corpus cavernosum penis. The ischiocavernosus muscle contractions also cause occlusion of the small, thin-walled crural veins that drain blood from the

This study was conducted at Veterinary Teaching Hospital, Department of Veterinary Medicine, Faculty of Agriculture and Veterinary Medicine, Qassim University, Saudi Arabia.

* Corresponding author. Tel.: +966 16 3801480; fax: +966 16 3801360.

E-mail address: ahmedali77@hotmail.com (A. Ali).

corpus cavernosum penis. Thus, intracorporeal blood pressure rapidly increases and full erection is attained [1]. Stimulation of the nervous system also leads to the secretion of nitric oxide (NO), which causes the relaxation of the smooth muscles of the corpora cavernosa [6]. In addition, adequate concentrations of testosterone and an intact pituitary gland are required for the development of a healthy erectile system [6,7].

There are limited reports on the pathology of the male reproductive organs in Camelidae. Phimosis has most often been described as an idiopathic process, the result of a congenital small preputial opening, or the presence of lesions preventing exteriorization of the penis. The aim of this study was to document the clinical findings associated with cases of PHI and to investigate the association of hemogram, serum nitric oxide metabolites (NOMs), and testosterone concentrations with this condition in male dromedary camels.

2. Materials and methods

2.1. Animals

Male dromedary camels with a history of phimosis (PHI, inability to extend the penis from the preputial sheath, $n = 43$) were included in this study. The history and signalment including age, duration of condition, libido, mating ability, previous fertility, and illness or injury were recorded for each animal. The duration of the infertility problems ranged from one to 8 months. The males were aged between 6 and 16 years and weighed between 487 and 580 kg, with body condition scores (scale: 1–5) ranging from 3 to 4 [8]. The camels were examined at the Veterinary Teaching Hospital of Qassim University, KSA, during the rutting season (September to March). Most of the animals were left unconfined in open desert areas and fed mainly on alfalfa hay and barley concentrate. The number of males to females during the rutting season ranged from 1:15 to 1:25. Ten male dromedary camels with normal fertility were used as controls to compare the variations in blood parameters.

2.2. Breeding soundness examination

A breeding soundness examination was carried out as previously described [9]. Briefly, the males were restrained in sternal recumbancy, and a general physical examination was performed. The testes and epididymides were evaluated for size and consistency using visual inspection, palpation, calipers, and ultrasound. On the basis of reference values for male dromedary camels [10], the testes were classified as small ($<6 \times 3 \times 3$ cm), normal ($6-9 \times 3-4 \times 3-4$ cm), and large ($>9 \times 4 \times 4$ cm) according to dimensions of length, breadth, and depth, respectively. The internal genitalia were examined per rectum by ultrasonography using a B-mode scanner equipped with a 5-MHz linear-array transducer (Aloka SSD-500; Aloka Co., Ltd., Tokyo, Japan). The camels were then sedated with xylazine HCl Bomazine 10% (BOMAC Laboratories Ltd., New Zealand) 0.3 mg/kg body weight, intravenous. For examination of the prepuce and penis, a pudendal nerve block was applied [11]. Lidocaine 2% (~ 30 mL; Norbrook Laboratories, UK)

was administered using a 16-gauge needle in both sides at a point located lateral to the sacral region 12 cm cranial to the base of the tail and 7 cm lateral to the midline. The animal was then secured in lateral recumbancy for exploration of the prepuce and penis. Using a blunt metal rod, the prepuce was examined for injuries, lesions, swelling, edema and patency of the preputial orifice, and cavity. For safe exploration of the penis, long, blunt, bandage-wrapped forceps were used. Attempts were made to exteriorize the penis completely by unfolding the preputial layers. According to the clinical findings, the camels with PHI were subdivided into those with (PHI-P, $n = 34$) or without (PHI-N, $n = 9$) detectable pathologic lesions.

2.3. Histopathology

Tissue specimens were obtained from tumor-like structures at the tip of the prepuce in one animal and from a peri-penile swelling on the dorsum of the glans penis of another. The tissues were prepared for histologic examination by standard technique and stained with Hematoxyline and Eosin [12].

2.4. Hematology

Between 10 AM and 12 AM, two blood samples were drawn from the jugular vein of each animal before sedation, one in EDTA and the other in tubes containing no anticoagulant for serum harvesting. Within 30 minutes of collection, the whole blood sample was used for estimation of complete blood count using the VetScan HM5 (Abaxis, CA, USA). The serum from the other tube was separated by centrifugation for 10 minutes at $1200 \times g$ and immediately frozen for future analysis.

2.5. Nitrate/nitrite assay

The serum concentrations of total nitrates and nitrites were determined colorimetrically using the Griess assay as described by the manufacture (Sigma–Aldrich Co., MO, USA). The Griess assay mechanism is summarized as the azo coupling between diazonium species, which are

Table 1
Clinical findings in male dromedary camels with phimosis (PHI, $n = 43$).

Clinical findings	Frequency n (%)
Testicular and scrotal affections	
Large testicles	3 (7)
Large testicles with hematocele	2 (4.7)
Hydrocele	-
Preputial and penile affections	
Posthitis	12 (27.9)
Lacerated glans penis	4 (9.3)
Preputial edema	3 (7)
Preputial adhesion	2 (4.7)
Congenital narrow preputial orifice	2 (4.7)
Balanitis	2 (4.7)
Preputial abscess	1 (2.3)
Preputial squamous cell carcinoma	1 (2.3)
Penile fat necrosis	1 (2.3)
Preputial prolapse	1 (2.3)
Apparently normal	9 (20.9)

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