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Uretero-Nephroscopy Standardization in Mares with Air Insufflation

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ABSTRACT

***Background*:** Ureteroscopy allows visualization of urethral segments, bladder, and ureteral endings, aiding diagnosis and intervention in various conditions not always evident with other imaging methods. Equine ureteroscopy diagnoses urinary tract diseases like lithiasis, infection, neoplasia, or hematuria. Cystoscopic examination enables targeted interventions like ureteral sampling, bladder biopsy, and urolith fragment removal. This study outlines a technique using flexible retrograde endoscopy in mares, with air insufflation facilitating examination of the ureters and renal pelvis.

***Materials, Methods & Results*:** The study was carried out in 12 previously fasted (Food was withheld for 12 h and water was withheld for 6 h before the procedures healthy mares of different breeds (thoroughbred, Criollo and mixed breeds). These animals had an average weight of 439 kg, aged 3-17-year-old. The mares had no recent history of any disease and were considered healthy based on physical examination and routine hematological and biochemical examination. The procedures were carried out at the Veterinary Hospital of the Federal University of Paraná (UFPR), in the Large Animal Sector. The animals were physically restrained and had their tails covered with dressings and bandage material to maintain the perineal area clean. The genitalia and perianal region were washed with running tap water, after which the bladder was emptied by urethral catheter number 20. The mares were sedated and 15 min after sedation a flexible endoscope[1] with a diameter of 5 mm and length of 100 cm previously sterilized in ethylene oxide was introduced by the external urethral ostium an endoscope 5 mm in diameter flexible and 100 cm in length was inserted through the urethra into the bladder where the ureteral ostia were identified. With a flexible polyethylene probe containing atraumatic metallic tip, the catheterization of the ureters was performed to guide the insertion of the endoscope to the renal pelvis. The ureter and left kidney were inspected in 8 mares and the ureter and right kidney in 4 mares. No complication or discomfort was observed after the procedure. This study demonstrated for the first time the viability of ureterino-nephroscopy using air insufflation to dilate the ureters in standing mares using a novel diagnostic modality that also allows to perform therapeutic interventions in certain diseases that affect the equine ureters and kidneys.

***Discussion*:** Ureteroscopy was performed successfully in mares, which allowed observation to the renal pelvis, although there were some limitations, such as the length of the cystoscope, which was used. In one of the mares, it needed to be about 2 cm longer in order to reach the renal pelvis. The anatomical conformation of the bladder and the ureter of some of the mares prevented the ureteroscope from entering the ureter. In these cases, a metal tube was used, serving as a guide for the endoscope, suspending the bladder and allowing access to the ureter. Lastly, the non-cooperative behavior of one of the mares made it impossible to perform the examination, even with sedation and physical restraint. This animal had to be replaced in this investigation. In this investigation no ureteral or renal changes were found. The authors believe that if abnormalities were present, they would be easily noted, since the ureter and renal pelvis were straightforwardly evaluated and in its entirety.

Keywords: equine, ureteroscopy, diagnostic, kidneys, pyelonephritis.

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INTRODUCTION

Ureteroscopy has been gaining ground as a diagnostic technique in medicine and veterinary medicine [9]. The flexible ureteroscope is a major evolution of ureteroscopy, which gave rise to a new concept for diagnosis and retrograde intrarenal surgery [6]. Due to its flexibility visualizing the upper ureter and renal pelvis retrograde has become possible [7,14]. In addition, this procedure is indicated for patients with hematuria, dysuria, polyuria, polydipsia, urinary incontinence, chronic cystitis, trauma, suspicion of neoplastic disease and uroliths. In veterinary medicine ureteroscopy has become more accessible [2]. In humans, endoscopic examination of the ureter and renal pelvis has become a routine procedure for the evaluation of the upper tract in patients with lithiasis, infection, neoplasia or hematuria [5,6].

With the use of long and flexible endoscopes with small diameters, ureteropieloscopy is now a reality in horses, however it is imperative to have the knowledge of the normal endoscopic anatomy of the upper urinary tract of the equine [13]. The objective of this study was to describe and characterize a technique for access and visualization of the ureters and renal pelvis by means of flexible retrograde endoscopy in mares, with the use of air insufflation for the exam and passage of the endoscope in order to diagnose possible renal diseases, such as urolithiasis and pyelonephritis. To the best of our knowledge, this is the first investigation that characterizes the uretero-nephroscopy technique in mares with air insufflation.

MATERIALS AND METHODS

Materials

A total of 12 mares of different breeds (Thoroughbred, Criollo and mixed breeds), aged 3-17 years and weighing 350-545 kg were included. The mares had no recent history of any disease and were considered healthy based on physical examination and routine hematological and biochemical examination.

Procediment

Food was withheld for 12 h and water was withheld for 6 h before the procedures. The mares were placed in a restraint trunk. An area of 15 x 15 cm was shaved in the thoracolumbar region at the left 16th intercostal space (ICS) and the paralumbar fossa, for subsequent ultrasonography. The tail of the animals was wrapped, feces were manually evacuated from the rectal ampulla and the external genitalia and perianal region were prepared for the procediment. Bladder emptying was performed by urethral probing using a 20Fr catheter and then the animals were sedated with detomidine hydrochloride [Detomidin ®[2] - 0.02 mg/kg, I.V.].

After 15 min of the sedation, a flexible endoscope with a diameter of 5 mm and length of 100 cm previously sterilized in ethylene oxide[3] was introduced by the external urethral ostium. Once the urethra and bladder were inspected, compressed air was insufflated to allow identification of the ureteral ostium with its urine flow (Figure 1A). The procedure was performed through the left ureteral ostium in 8 animals and through the right in 4. A flexible probe of polyethylene with an atraumatic metallic tip and 2 mm diameter was introduced through the endoscope´s working channel to guide the progression of the endoscope in a retrograde direction through the ureters (Figure 1B) to the renal pelvis (Figure 1C, 1D, 2A, 2B and 2D). Upon reaching the renal pelvis, it could be observed that urine was released through the renal pelvis (Figure 2C) and into the ureter.

RESULTS

The uretero-nephroscopy with sedated mares in quadrupedal position was performed, allowing successful access to the renal pelvis. The procedure was performed with relative easiness thus proving to be a viable exam that can be carried out routinely, provided that suitable instruments and apparatus are available.

Considering that all mares were healthy, neither ureteral nor renal changes were found. We could also observe the absence of alterations in the superior urinary system of the animals used in this study, since the uretero-nephroscopy allowed a direct and amplified visualization of all the structures of the upper urinary system.

DISCUSSION

Although cystoscopy techniques are already well described in horses [10,15] the progression of the endoscope to the ureters (ureteroscopy) and kidneys in this species are new procedures. In the medicine, the retrograde nephroscopy is a common technique [3,8].

In the scientific literature there is only 1 report describing access to the renal pelvis in live mares, however the dilation of the ureter was achieved by infusing isotonic saline (10 mL/min) [13]. On our study, the ureters were dilated with air insufflation.

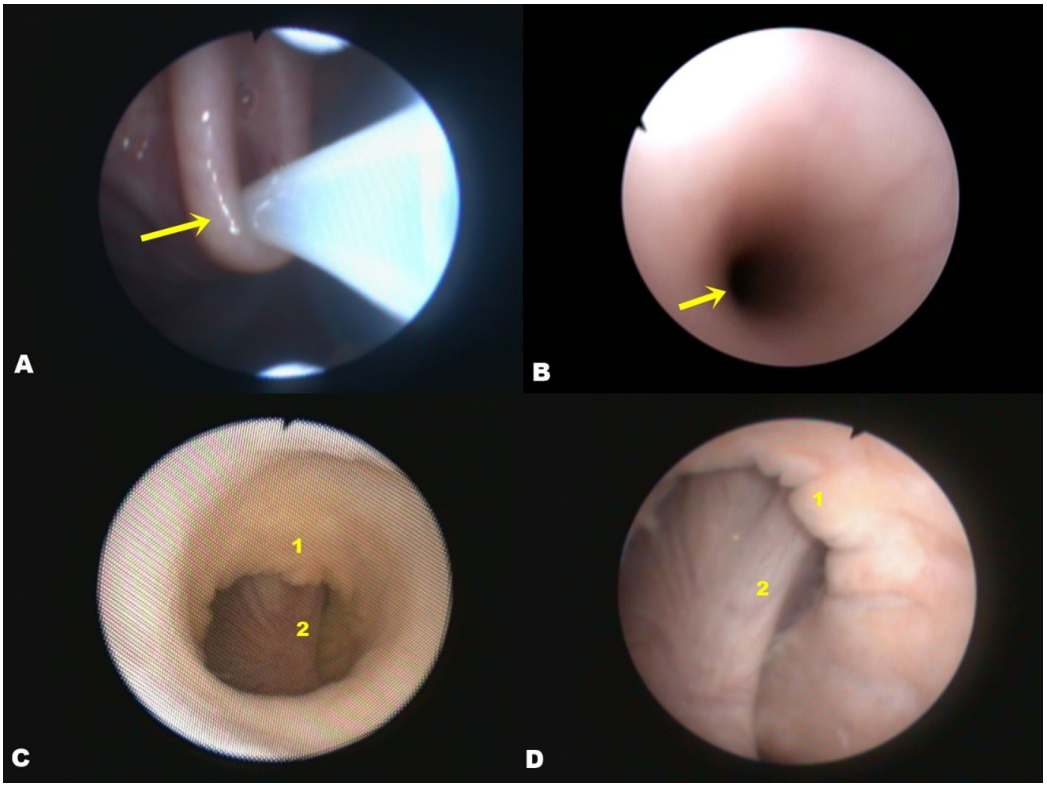

Figure 1. Selected images obtained during the uretero-nephroscopy procedure. A- Probing the ureteral ostium (arrow) with flexible polyethylene probe as a guide. B- Endoscopic observation of the lure of a ureter of a mare (arrow). C- Image of the renal pelvis, where it is possible to observe the region of the renal crest (1) and a renal pelvis in the center (2). D- Close-up of the renal pelvis (2) and renal crest (1).

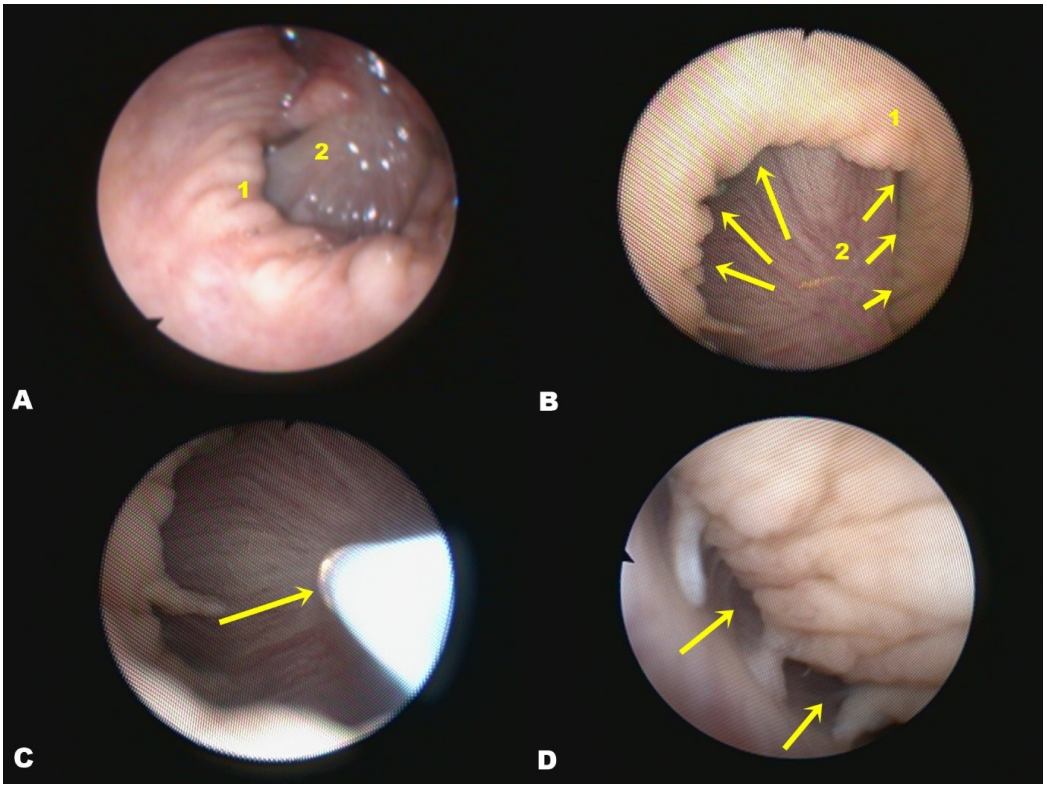

Figure 2. Selected images obtained during the uretero-nephroscopy procedure. A- Nephroscopy after air insufflation in the renal crest (1) and renal pelvis (2). B- Magnified image of the renal pelvis at the center (2) and the opening of the renal crest on the right and left of this (arrows). C- Polyethylene probe, with metal tip (arrow), used to cannulate the ureter. D- Opening of the renal crest (arrows).

No ureteral or renal changes were found in the animals evaluated in this study. Nonetheless, the authors believe that using the technique here described, the most common pathologic changes in the ureter and renal pelvis, including neoplastic changes, could be observed and documented [3,4].

Even though the objectives of this investigation were achieved, some limitations of the study need to be pointed out, such as the access of only 1 ureter in each animal, which was chosen randomly. The reason for choosing this option was that the procedure was never tried before and the possibility of causing injuries such as irritation, inflammation, stenosis or even rupture due to trauma to the ureter. This was actually requested by the Ethics Committee to decrease risks. Another drawback was the difficulty of reaching the renal pelvis in the largest mare investigated, since the length of the cystoscope used in this study was not long enough to reach it [1,11]. The cystoscope needed to be about 2 cm longer in order to reach the renal pelvis. However, the pelvis was observed in all its conformation. The different anatomical conformation of the bladder and ureter in 1 of the mares was also another obstacle, which prevented the ureteroscope from entering the ureter, requiring the use of a metallic tube as an external guide for the endoscope to suspend the bladder in order to facilitate the access. Lastly, the aggressive behavior of 1 of the mares made it impossible to perform the test, even with proper sedation and physical restraint. It is known that individual behavior hinders the performance of several procedures in horses in the quadrupedal position [12].

CONCLUSIONS

This study demonstrates the feasibility of performing nephroscopy in live mares in quadrupedal position, utilizing air insufflation for the dilation of the ureters and visualization of the structures for the first time, broadening the horizons for the methods currently used for the diagnosis and treatment of diseases affecting the equine ureters and kidneys.

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***Ethical Approval*.** This study was approved by Ethics Committee for the use of animals (CEUA) at the "Setor de Ciências Agrárias da Universidade Federal do Paraná (UFPR)" - Brazil, dated 27/05/2015, under protocol number 036/2015.

***Declaration of interest*.** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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