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Duplicity of the right renal vein in *Puma concolor* (*Carnivora: Felidae*): a case report

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ABSTRACT

The numerical variations of the renal pedicle are important for surgeons and radiologists, although these variations are not so commonly reported in veterinary medicine. The present study aims to describe the duplicity of the renal vein in a puma's cadaver, discussing the clinical-surgical implications of this anatomical variation. The animal was fixed with formalin solution, injected with colored latex and dissected. Two renal veins were found draining the right kidney: the first, craniodorsal, presented 2.80 cm in length and the second, caudoventral, presented 2.64 cm in length. The right renal artery was single and measured 3.79 in length. In the left kidney, both artery and vein were single, presenting 3.04 cm and 2.91 cm long, respectively. The numerical variations of renal veins should be considered in the execution of surgical, radiological and experimental procedures to prevent errors being made by absence of knowledge of the possibility of existence of double renal veins, both in domestic and wild animals.

Keywords: anatomical variation, feline, kidney, puma, renal vein

INTRODUCTION

The medicine of wild and exotic animals is an area of veterinary medicine of great relevance, since dogs and cats are no longer the only ones sought as pets. Today, the search for specialized veterinary services has increased greatly, whether for the care of unconventional pets, but also of free-living animals.

The *Puma concolor*, also known as puma, mountain lion or cougar [1], is the second largest felid in the Americas and the most widely spread in the continent. It hunts medium-sized vertebrates, such as peccaries, deer, spotted pacas, and coatis, having an important role in the ecosystems. The cougar lives from nine to sixteen years in natural conditions, and up to twenty years in captivity [2].

Understanding the congenital abnormalities of the renal pedicle is important for surgeons and radiologists. Although these anomalies are not so commonly reported in veterinary medicine, their knowledge is necessary prior to the execution of vascular procedures involving the renal pedicle, avoiding confusing their unusual appearance with the pathological, through the diagnostic imaging.

Numerical variations in the renal veins were characterized in the dog [3] in the Cat [4] and in the southern tiger cat (*Leopardus guttulus*) [5]. According to Satyapal et al. (1995) [6], the incidence of multiple renal veins in human beings is ten times higher in the right antimer (26%) than in the left (2.6%). However, Soares et al. (2014) [7] analyzed 50 samples of human cadavers and did not observe a percentage difference in the incidence of multiple renal veins between the antimers.

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In domestic mammals, both the right and left renal veins drain their contents into the caudal vena cava [8]. However, the number, course and place of drainage of these vessels are sometimes controversial. Anatomical variations of the renal veins are occasionally found in radiological and routine dissections of the abdominal region [9].

Santos-Sousa et al. (2016) [9] noted that in the left kidney of a rabbit, the renal vein did not drain its contents into the caudal vena cava as it usually does; in this case, the left renal vein did not maintain any communication with the caudal vena cava and suffered anastomosis with the cranial abdominal vein.

Despite the increase in basic and applied research involving wild animals, when consulting the literature, it is verified that the information pertaining to the renal veins, especially its numerical variations and drainage sites, remain scarce in these animals.

The present study aims to describe the duplicity of the renal vein in a puma's cadaver, focusing on the possibilities of clinical-surgical implications of this anatomical variation.

CASE REPORT

The specimen described in this report belongs to the project titled: "Basic and applied research in morphology of wild and exotic animals" approved by the Ethics Committee of the Federal Rural University of Rio de Janeiro (018/2017 CEUA-UFRRJ).

During the dissection activities carried out in the Laboratory of Teaching and Research in Morphology of Domestic and Wild Animals (LEPeMADS) of the Department of Animal and Human anatomy of the Federal Rural University of Rio de Janeiro, it was observed a numerical variation in the right renal vein in a cadaveric specimen of an adult female puma, donated by the CETAS/IBAMA to the LEPeMADS.

The cadaver was identified and positioned in right lateral decubitus. Then the thorax was opened and dissected for evidence of the thoracic aorta, in which a number 6 urethral probe was introduced. Thus, the arterial system was "washed" with a physiological solution of NaCl (0.9%), and then fixed with 10% formaldehyde solution. After, it was injected in the probe an aqueous solution (dilution 1:1) of Petrolátex S-65 (refinery Duque de Caxias-REDUC- Petrobras, Duque de Caxias-RJ) mixed with the dye (Vinyl Chess ®).

Afterwards, the cadaver was immersed in a low-density polyethylene box with a capacity of 500 liters, containing 10% formaldehyde solution for the completion of the fixation process and latex polymerization.

Seven days later after latex injection, the specimen was rinsed in running water, followed by opening and dissection of the peritoneal cavity to highlight the kidneys. With a digital caliper of the Eda® brand, the renal measurements (length, width and thickness) were obtained as well as the length of the renal veins.

The right kidney measured 5.51 cm long, 3.35 cm wide and 3.50 cm thick. The right renal artery presented 3.79 cm long. Two renal veins were found; the first, craniodorsal, presented 2.80 cm in length and the second, caudoventral, presented 2.64 cm in length (Figure 1).

The left kidney measured 5.39 cm long, 3.22 cm wide and 3.36 cm thick. The renal artery presented 3.04 cm long. The renal vein was single, measuring 2.91 cm in length.

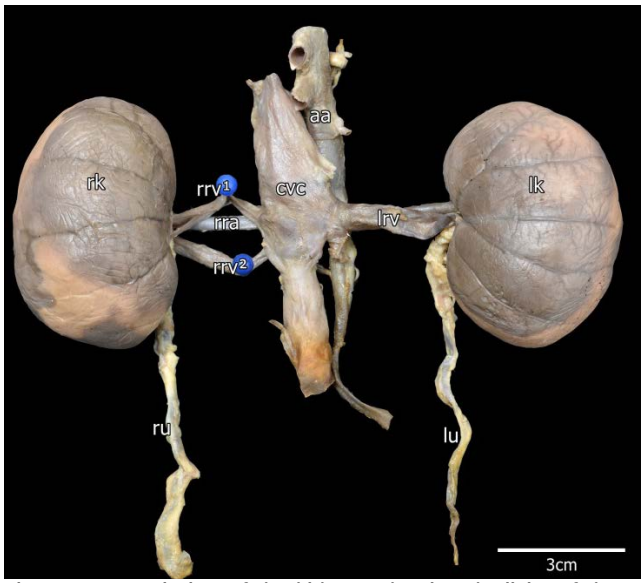

Figure 1: Ventral view of the kidneys showing duplicity of the right renal veins of an adult, female, *Puma concolor*. rk: right kidney - lk: left kidney - rrv: right renal veins (¹craniodorsal, ²caudoventral) - lrv: left renal vein - cvc: caudal vena cava.

DISCUSSION

In studies carried out on human cadavers of men and women, Duques et al. (2002) [10] observed that the left renal vein was double in only 8.9% (n = 3) of the cases, while in 91.1% (n = 31) was single, similar to that observed by Bouzouita et al. (2015) [11], who found single renal vein in 88% of cases (n = 63) and double in 11% (n = 8) (Five right kidneys and three left).

Hassan et al. (2017) [12] found in seven human cadavers (11%) several renal variations, among which: in the right antimer, a triple renal vein, a quadruple renal vein and a double renal vein; and in the left antimer, a double and triple renal vein.

The duplicity of the renal veins is not restricted to domestic animals; reports were made in southern tiger cat (*Leopardus guttulus*) and Ocelot (*Leopardus pardalis*) [5].

In a study carried out by Reis and Tepe (1956) [3] in 500 mongrel dogs (287 males and 213 females) the presence of double right renal veins occured in 1% (n = 5), while the left renal vein was single in all specimens, differing from the results found by Fagundes et al. (1990) [13], whose duplicity was found only in the left kidney.

The complexity of vascular variations can change the technical possibilities of surgical procedures and, according to Uzmansel et al. (2014) [14], the perfect understanding of renal vascular anatomy provides efficiency and safety in surgical and radiological procedures. Therefore, any abdominal surgery requiring mobilization or hemostatic control of the renal vessels requires a systematic search for possible anatomical vascular variations.

The dissemination of the findings of anatomical variations is important for veterinary medical practice involving domestic and wild animals and should be carried out as a form of awareness of the professionals, contributing to the success and improvement of different clinical surgical protocols.

Renal transplant can be a therapeutic alternative in cats with a final stage of renal failure. In this Bouma et al. (2013)[15] reinforce that the requirements for vascular anatomy of the collected kidneys are specific to ensure the success of the surgery. If there is a single renal artery, with a prior branch length of at least 0.5 cm, the arterial anastomosis is more successful. If the vascular pedicle has more than one vein, the vein with the largest length and diameter is reserved for the anastomosis.

CONCLUSIONS

In short, numerical variations of renal veins should be considered in the execution of surgical, radiological and experimental procedures to prevent errors being made by absence of knowledge of the possibility of existence of double renal veins, both in domestic and wild animals.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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RESUMO

Duplicidade da veia renal direita em

Puma concolor (Carnivora: Felidae): relato de caso

As variações numéricas do pedículo renal são importantes para cirurgiões e radiologistas. Embora, essas variações não sejam tão comumente relatadas em medicina veterinária. O presente estudo tem como objetivo descrever a duplicidade da veia renal em um cadáver fêmea de *Puma*, focando nas possibilidades de implicações clínico-cirúrgicas dessa variação anatômica. O animal foi fixado com solução de formalina, injetado com látex colorido e dissecado. Duas veias renais foram encontradas para o rim direito; a primeira, craniodorsal, apresentou 2,80 cm de comprimento e a segunda, caudoventral, apresentou 2,64 cm de comprimento. A artéria renal direita era única e mediu 3,79 cm de comprimento. No rim esquerdo, tanto a artéria quanto veia renal eram únicas e mediram 3,04 cm e 2,91 cm de comprimento, respectivamente. As variações numéricas das veias renais devem ser consideradas na execução de procedimentos cirúrgicos, radiológicos e experimentais para evitar erros cometidos pela falta de conhecimento da possibilidade de existência de veias renais duplas, tanto em animais domésticos quanto silvestres.

Palavras-chave: variações anatômicas, felino, rim, *puma*, veia renal