Theriogenology 85 (2016) 186–192

Contents lists available at ScienceDirect

Theriogenology

journal homepage: www.theriojournal.com

Transrectal ultrasonographic characterization of the accessory sex glands, pelvic urethra, and ureters in normal geldings

Maria Raymond Schnobrich [a], Regina Orstaglio Turner [b], Carolyn Niles Belcher [c], JoAnn Slack [b,*]

[a] Rood and Riddle Equine Hospital, Lexington, Kentucky, USA
[b] University of Pennsylvania School of Veterinary Medicine, New Bolton Center, Kennett Square, Pennsylvania, USA
[c] Coastal Resources Division, Georgia Department of Natural Resources, Marine Fisheries Section, Brunswick, Georgia, USA

ARTICLE INFO

Article history:
Received 13 November 2014
Received in revised form 2 September 2015
Accepted 3 September 2015

Keywords:
Ampullae of deferent duct
Prostate
Seminal vesicle
Bulbourethral gland
Seminal colliculus

ABSTRACT

Transrectal ultrasound of the internal urogenital tract may be used to aid in the diagnosis of reproductive tract and urinary tract pathology in both stallions and geldings. Abnormalities of the accessory sex glands of geldings are uncommon, although prostatic masses have recently been described in adult geldings presenting with dysuria, stranguria, and/or hematuria. The purpose of this study was to describe the normal ultrasonographic features and sizes of the accessory sex glands, caudal ureters, and pelvic urethra in clinically normal geldings. Eleven healthy geldings with no history of urogenital tract pathology were evaluated by a single observer experienced in ultrasound of the stallion accessory sex glands. The ultrasonographic appearance, relative anatomic relationships and sizes of the accessory sex glands, caudal ureters, and pelvic urethra were investigated using both rectal linear array and microconvex array transducers. Summary statistics including mean, standard error, confidence intervals, and range were calculated for each structure. There were no statistically significant differences in measurements between the left and right sides of paired structures or between measurements obtained with different transducers. Fluid was present in the seminal vesicles of 7 of 9 subjects. Midline cysts of the urethra as well as bulbourethral gland and prostatic cysts were identified. The normal reference ranges defined in this study will be useful in the clinical evaluation of geldings with suspected internal urogenital tract pathology.

1. Introduction

Transrectal ultrasound of the equine accessory sex glands is most often performed in the evaluation of stallions presenting for routine breeding soundness examinations, abnormalities of the ejaculate, or ejaculatory dysfunction [1–3]. Sonographic evaluation may also be performed in stallions with abdominal pain when seminal vesiculitis [4] or urogenital pathology is suspected. These sonographic evaluations are aided by previously described normal appearance and size reference ranges for the stallion accessory sex glands [5–7]. In geldings, pathology of the accessory sex glands is poorly described, being either clinically unapparent or unrecognized. However, a recent report describes prostatic cystadenoma and prostatic adenocarcinoma in two geldings and presumptive prostatic enlargement (cause unknown) in two geldings [8]. Suspected abnormalities of other accessory sex glands may be encountered during sonographic evaluation of the caudal urinary tract, which is often the more commonly suspected site of clinical problems and initial indication for transrectal ultrasound of a gelding. Although the normal sonographic

* Corresponding author. Tel.: +16109256692; fax: (912) 262-2318.
E-mail address: slackj@vet.upenn.edu (J. Slack).

0093-691X/$ – see front matter © 2016 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.theriogenology.2015.09.008

appearance of the caudal ureters, pelvic urethra, and ampullae of the deferent ducts has been described in four apparently healthy geldings [9], the size and echogenic character of the remaining accessory sex glands of geldings have not been described to our knowledge. Therefore, the first aim of our study was to describe the size and sonographic character of the caudal ureters, ampullae of the deferent ducts, seminal vesicles, prostate, bulbourethral glands, and pelvic urethra in healthy geldings.

The use of a high-frequency microconvex array transducer has been recommended to assess the caudal urinary tract [9]. Microconvex transducers have a smaller footprint and increased depth of penetration compared with rectal-linear transducers, and they can be easily rotated to obtain images in both longitudinal and transverse planes. However, the higher frequency of the rectal linear transducer may provide better resolution of the image and therefore more accurate measurements of small, superficial structures. In addition, some practitioners may only have access to a rectal linear array transducer. Therefore, the second aim of this study was to compare a 6.0 to 10-MHz microconvex array transducer with a veterinary 8.0 to 12-MHz rectal linear array transducer for their ability to visualize the internal genitalia and to compare measurements obtained by each transducer.

2. Materials and methods

2.1. Study design

The University of Pennsylvania Institutional Animal Care and Use Committee approved all procedures performed in this study. Eleven clinically normal geldings with no history or evidence of urinary or genital tract disease were examined. Study subjects included six Thoroughbreds, four Standardbreds, and one Warmblood gelding, ranging from 2 to 25 years of age (median = 10 years). Only geldings with a reliable history of routine castration were included in this study, although the exact age of castration was not available for all horses. All animals reported typical gelding behavior with no signs of stallion-like behavior. Animals were evaluated transrectally by B-mode ultrasound using a Viamo ultrasound machine (Toshiba Medical Systems Corporation, Shimoishigami, Japan). An 8.0 to 12-MHz veterinary rectal linear array transducer and a 6.0 to 10-MHz microconvex array transducer were used.

All animals were restrained by halter and cross-ties in standing stocks and sedated with detomidine hydrochloride (Pfizer Animal Health Div of Pfizer Inc, New York, New York), xylazine (Lloyd, Shenandoah, IA) and/or acepromazine maleate (Butler Schein Animal Health, Dublin, Ohio). Sedation protocols were tailored to the individual horse's temperament and not standardized. Feces were manually evacuated from the caudal rectum, and transrectal palpation of the internal reproductive tract was performed to locate the ampullae, urinary bladder, and pelvic urethra. After palpation, the caudal ureters, accessory sex glands, and pelvic urethra were examined in transverse and longitudinal planes using first the rectal linear array transducer and then the microconvex array transducer. Digital images of each structure of interest were stored for offline analysis. A single investigator (M.R.S.) experienced in sonographic evaluation of stallion accessory sex glands performed all examinations and measurements.

We attempted to obtain 24 separate measurements of the caudal internal urogenital tract for each animal using each transducer. Each measurement was performed in triplicate. These measurements included the following: (1) the external diameter and wall thickness of each ureter during its contracted state, measured in a transverse plane approximately 2 cm cranial to the ureterovesicular junction; (2) the maximal external diameter, wall thickness, and dorsoventral luminal diameter of each ampulla, measured in transverse plane; (3) the maximal dorsoventral external diameter, wall thickness, and dorsoventral luminal diameter of each seminal vesicle, measured in transverse plane; (4) the maximal dorsoventral height of the left and right prostatic lobes and prostatic isthmus; (5) the maximal craniocaudal length and dorsoventral height of each bulbourethral gland; and (6) the external diameter of the pelvic urethra approximately 1 cm caudal to the seminal colliculus, measured in a transverse plane. The examiner made every effort to avoid compression of these structures, while still maintaining adequate contact with the ventral rectal wall to produce a quality image. The echogenicity of the luminal contents of the ampullae and seminal vesicles was described as anechoic, hypoechoic, isoechoic, or hyperechoic relative to the wall echogenicity. The sonographic characteristics of the seminal colliculus were described, but no measurements were taken.

2.2. Statistical analysis

Data were examined for normality (Shapiro–Wilk test) and homogeneity of variance (Levene's test). Descriptive statistics (mean, standard error, range, and 95% confidence intervals) were calculated for each structure. Because repeated measures work best with balanced designs, subjects were culled from the analysis if only one side of a paired structure was measured or if a structure was not measured with both transducers. A two-factor experiment with repeated measures was used to examine whether measurement differences existed between paired structures or between transducer types. A single-factor repeated measures analysis was used to determine whether differences in measurements for single structures (prostatic isthmus and urethral width) existed between transducers. Repeated measure analyses were performed using PROC GLM in SAS 9.3. All analyses were evaluated at the 0.05 level of significance.

3. Results

The lumen diameters of the seminal vesicles and ampullae were not consistently observed in all subjects, and statistical analyses could not be performed. For the remaining structures, there were no significant differences between measurements of the left and right sides of paired structures with either transducer. There was no significant difference between measurements obtained by the linear array transducer compared with the microconvex array transducer for any structure. Therefore, the mean and