

Diagnostic applications of ultrasonography to stallion's reproductive tract

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Abstract

Although ultrasound evaluation of the reproductive tract of stallions was introduced to veterinary practice long ago, this examination is not always conducted during routine breeding soundness evaluation. The objective of this study was to investigate the clinical relevance of routine ultrasound evaluation of the stallion's reproductive tract. Breeding soundness evaluation of 113 stallions was performed, including ultrasonography of external and internal genitalia. Various pathological conditions were detected using this technique, with the most frequent being varicocele, thickened vaginal tunics and cystic structures. Varicocele and thickened vaginal tunics were associated with decreased quality of semen, while cysts of the epididymal head, urethra and uterus masculinus were frequently associated with ejaculatory problems. These findings suggested that routine ultrasound evaluation of breeding stallions may be very helpful in detecting pathological conditions that may impact their reproductive career.

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1. Introduction

Ultrasound examination of the stallion reproductive tract was described and introduced into veterinary practice many years ago. This technique is an excellent diagnostic tool for investigating various pathological disorders of the scrotum and of the internal genitalia of the stallion [1–4]. However, even though ultrasound equipment is widely available and

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used routinely to examine the reproductive tract of mares, ultrasound examination of stallions is performed much less frequently, typically when there is a problem that requires reliable diagnosis. The goal of this study was to investigate application of ultrasonography in routine evaluation of breeding stallions.

2. Methods

One-hundred-and-thirteen stallions were evaluated for breeding soundness as a part of a larger study investigating various causes of fertility problems in horses. The stallions were 3–22-year-old and nine breeds were represented (Silesian, Arabian, Anglo–Arab, Thoroughbred, Oldenburg, Malopolski, Wielkopolski, Hanovarian, and Ardennes). The stallions were housed at six different facilities in Poland. A total of 100 stallions were enrolled in active breeding programs while the remaining 13 were experiencing fertility problems. A minimum two semen samples were collected from stallions using a Missouri model artificial vagina, while the stallions mounted a mare in estrus. After separating and discarding the gel fraction, determining the volume, color and consistency of semen, approximately 2 mL of raw semen was placed in a small tube for analysis of concentration and morphology of sperm. Total and progressive motility of spermatozoa were assessed in the raw semen using a microscope equipped with a warming stage (Nikon, Alphashot-2, Japan). Concentration of spermatozoa in semen was determined using a hemocytometer. Spermatozoal morphology was determined using phase-contrast microscopy under 1000 $\times$ magnification.

Both scrotal testes and spermatic cords of each stallion were evaluated by manual palpation and then with B-mode ultrasound (PieMedical 200, Maastricht, Netherlands) equipped with a 5/7.5 MHz linear transducer. Transrectal ultrasound examination of accessory sex glands, ampullae, and pelvic urethra was also performed on each stallion. All detectable abnormalities were recorded and prints of their images were saved using a video printer (Mitsubishi P-91, Japan). The same operator performed all the ultrasound evaluations and in some cases evaluation was performed multiple times and included additional methods, such as color Doppler evaluation, electron microscopy of spermatozoa, or histopathological evaluation of testes and epididymides after castration.

3. Results

The results of this study are summarized in Tables 1–3. Various structural abnormalities of the reproductive tract were identified using ultrasonography. Varicocele and thickened vaginal tunics were diagnosed most frequently in both groups. Both of these conditions were associated with decreased semen quality, even though only 4 of 19 affected stallions had severe fertility problems. Varicocele appeared ultrasonographically as irregular echolucent areas, usually on the periphery of the spermatic cord, with no signs of pulsating blood flow. The average size of the varicocele was 15.5 mm (range, 8–24 mm). In one case, the central vein and its smaller branches were dilated while the veins within the pampiniform plexus were only slightly enlarged. The mean progressive motility of sperm in the second ejaculate of stallions with varicocele was 31% (5–75%) and the mean percent

Table 1

Reproductive pathologies of breeding stallions diagnosed by ultrasound evaluation (number of evaluated stallions; total $n = 100$)

1	Varicocele	9
2	Thickened vaginal tunics	6
3	Hydrocele	5
4	Cyst of head of epididymis	6
5	Cyst of pelvic urethra	6
6	Cyst of uterus masculinus	6
7	Cyst of the tail of epididymis	3
Total		41

Table 2

Reproductive pathologies of stallions with fertility problems, diagnosed by ultrasound evaluation ($n = 11$)

1	Varicocele	2
2	Thickened vaginal tunics	2
3	Cyst of uterus masculinus	1
5	Cyst of tail of epididymis	1
6	Enlarged lumen of ampullae	1
Total		7

Table 3

Reproductive pathologies diagnosed using various diagnostic methods, including ultrasonography

1	Seminal vesiculitis	1
2	Testicular tumor	1
3	Adenomyosis of epididymis	1
Total		3

of morphologically normal spermatozoa was 55% (24–80%). There were various morphological abnormalities of spermatozoa present in collected semen; the most frequently occurring defect was distal droplet.

Stallions with thickened vaginal tunics were evaluated multiple times and poor quality of semen was confirmed. Three of these stallions were castrated and various degrees of degeneration of seminiferous epithelium were identified histopathologically. Similar morphologic defects of spermatozoa were identified in semen of all of these stallions by electron microscopy, including damage of the cell membrane, swelling of midpieces, chaotic arrangement of mitochondria, and immature germ cells. These three stallions were evaluated just after they came back from a race track and were closely related (half-brothers).

One stallion with hydrocele had decreased semen quality. Six stallions with cysts of the head of epididymis showed ejaculatory problems. These stallions required additional stimulation during semen collection (increased temperature of AV and/or hot compress on the base of the penis). Interestingly, four of these stallions were closely related (half-brothers from the same sire).

Of seven stallions with cysts of the uterus masculinus, five had ejaculatory problems, two had poor quality of semen in both ejaculates, and one had very high sperm concentration and total sperm number. One stallion had both (cyst of the head of the

epididymis as well as cyst of the uterus masculinus) and had very pronounced ejaculatory problems. This individual was evaluated multiple times, always showed strong libido, normal copulatory behavior, strong urethral pulses with tail flagging, but often “empty ejaculation” (no ejaculate at all) or a few very weak ejaculatory jets. His semen had poor quality (motility and morphology) but he was able to successfully breed a few mares per season after multiple breedings.

Cyst of the pelvic urethra was identified in six stallions. One of these had ejaculatory problems (additional stimulation during semen collection). One stallion had hemospermia, and other three stallions had poor quality of semen.

Stallions with cyst of the tail of the epididymis did not show any problems with ejaculation. Enlarged lumen of ampullae was associated with temporarily increased concentration of sperm in the ejaculate and very high number of tailless heads. Another four cases with similar changes in semen were identified, but ultrasound evaluations of ampullae were not remarkable.

Ultrasound was also used in diagnosing seminal vesiculitis, testicular tumor and adenomyosis of the epididymis (Table 3). However, in all these three cases ultrasonography was helpful but not crucial for diagnosis.

4. Discussion

Clinical application of ultrasonography in veterinary medicine is widely known and a majority of veterinary practitioners use this technique on a daily basis. Stallions, however, are examined much less frequently than mares and many pathological conditions of their reproductive tract are not detected. Our study showed that many stallions have structural abnormalities of their reproductive tract, detected by ultrasound evaluation, some of which may affect their reproductive career. Unfortunately, detailed information on the actual fertility of the majority of evaluated stallions is lacking. One hundred stallions were used for breeding various numbers of mares, and 13 were rejected from breeding programs due to severe fertility problems. The majority of these stallions were evaluated previously at least once. Based on the results of our previous and current evaluations breeding programs were adjusted to the fertility potential of the individual stallions. Stallions with permanent changes, such as thickened vaginal tunics were eliminated from breeding programs and stallions with decreased semen quality associated with varicocele were used for breeding only limited numbers of mares.

Stallions with ejaculatory problems associated with cysts of the reproductive tract were used for semen collection and artificial insemination. Stud managers were instructed that additional stimulation during semen collection may be necessary.

All of the listed above pathologic conditions of the stallion reproductive tract were previously described but clinical significance of some was not reported. Our work showed that there may be an association between cysts of the stallion reproductive tract and ejaculatory problems, and between varicocele and poor semen quality.

The results of this study suggest that routine evaluation of the reproductive tract of stallions should include ultrasound examination of internal and external genitalia. The results of these exams may be helpful in selecting appropriate methods of semen collection

and in interpretation of semen evaluation results. More frequently conducted ultrasound evaluation of stallion genitalia will also bring more valuable information on the clinical significance of some abnormalities of the stallion reproductive tract that previously were believed to cause no problems.

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