



Review Article

Application of Various Techniques in Localizing Retained Testes in Horses Before Cryptorchidectomy



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ABSTRACT

Thorough clinical evaluation of cryptorchid horses and localizing the retained testis before surgery has great clinical value. Doing so will minimize unnecessary complications and prolonged anesthesia time from exploratory surgery in search of a retained testis in horses or the necessity to repeat invasive surgical procedures using a different approach. Heavy sedation and placement in stocks is recommended before the clinical evaluation. After the visual inspection of the inguinal region for the presence of previous surgeries, percutaneous inguinal ultrasound examination is often performed to visualize the testis or epididymis retained in the inguinal canal or at the external inguinal ring. The caudal abdomen and lateral aspect of the flank can also be systemically scanned in search for abdominal testes. Some veterinarians prefer to perform the palpation per rectum of all cryptorchid horses to determine if the vas deferens is entering the vaginal ring. This method helps in distinguishing between complete abdominal and incomplete abdominal cryptorchidism, but does not allow for the determination of the exact location of the retained testis. To visualize and measure retained testes, transrectal ultrasonography can be used. Since the majority of abdominal testes in stallions are found near the vaginal rings or urinary bladder, the ventral abdomen is scanned in a sweeping, medial to lateral, motion. The ultrasonographic tracing of the ampulla of the vas deferens per rectum is the author's preferred method of detecting retained testes in horses. More than one diagnostic method is often used in the most challenging cases.

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1. Introduction

Cryptorchidism is the most common developmental defect in horses [1], which has been defined as “the retention of one or both of testes along the normal path of descent into the scrotum” [2]. The prevalence of this defect in the general population of horses is approximately 2%–8% [3], but it is higher in certain families with many affected individuals [4] or in particular breeds such as Swedish-born Icelandic horses [5]. Close to 9% of yearlings of this breed are cryptorchids. Quarter horses, Percherons, Saddlebred,

and ponies are also overrepresented among cryptorchid horses [1]. These observations strongly suggest a genetic component in the development of equine cryptorchidism.

Eleven DNA copy variants (nine gains and two losses) were recently uniquely found in bilaterally cryptorchid horses, which further confirms this theory [6]. Furthermore, the results of several genetic studies suggest that a complex polygenic inheritance may be involved in the etiology of this condition [4,7]. Recently, the low to moderate heritability of cryptorchidism in Swedish-born Icelandic horses has been shown [5]. However, more specific investigations on large populations of various horse breeds have to be performed before equine cryptorchidism is determined to be heritable. Furthermore, one should not forget about numerous genetically unrelated factors that may cause errors in testicular descend in horses, such as

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fetal exposure to endocrine disruptor agents [3], formation of testicular teratoma or cystic dilation [8], testicular ischemic necrosis [9], and so forth.

While the retained testis may be located anywhere between the caudal pole of the kidney and the external inguinal ring, three distinct groups of cryptorchids have been defined: complete abdominal cryptorchids (testis and epididymis within the abdomen), partial abdominal cryptorchids (testis in the abdomen and epididymis in the inguinal canal), and inguinal cryptorchids (testis and epididymis in the inguinal canal) [10]. Approximately 8%–15% of equine cryptorchids are bilateral, and the remaining cryptorchid horses have only one testis retained [1,11]. There is no prevalence for the left or right testis to be retained; however, left-retained testes are more likely to be abdominal in the light horse breeds, but not in the ponies [11,12]. Retained testes do not develop normally due to the higher temperature of the abdomen and the inguinal canal; moreover, they are hypoplastic and do not produce sperm. Therefore, bilateral cryptorchid horses are sterile [13].

The removal of a retained testis in horses may pose a challenge to a surgeon. The most difficult cases are horses with strong stallion-like behavior, but with no scrotal testes and with no available history regarding prior surgery. These horses may be geldings with no testicular tissue at all, but with retained sexual behavior, bilateral cryptorchids, or unilaterally castrated cryptorchids.

Unnecessary surgery in search of a possibly retained testis or testes should not be performed until the presence and location of testicular tissue has been confirmed. Several endocrine assays or tests for cryptorchidism in horses are currently available. High serum concentrations of testosterone or estrone sulfate, an increase in testosterone concentration after the administration of human chorionadotropin [14–16], or high serum concentrations of Anti-Müllerian hormone (AMH) [13,17] are consistent with testicular tissue. It has recently been suggested that the strongest scientific evidence exists for using an AMH assay to test for equine cryptorchidism [18]. The palpation of the inguinal region, rectal palpation, percutaneous ultrasonography of the inguinal region, caudal abdomen, and the lateral aspect of the flank as well as transrectal ultrasonography have successfully been used to determine the location of retained testes in horses before cryptorchidectomy [19–22].

Controversy still exists regarding the real value versus the risks of an extensive evaluation performed on young cryptorchids, which are not accustomed to being restrained for a prolonged period of time or being rectally palpated [23]. A rectal tear or an injury to the operator may occur during these procedures. However, initial rectal palpations and ultrasound evaluations of young mares are just as difficult and potentially dangerous, even though they are routinely done by veterinarians.

The obvious benefit of knowing the exact location of the retained testis is to be able to choose the best surgical technique and most appropriate surgical site. Approximately 11% of all cryptorchidectomies ($n = 157$) performed in the Large Animal Hospital, University of Florida between 2008 and 2015 without the identification of the retained testes before surgery had to be converted from abdominal

to inguinal ($n = 15$) or from inguinal to abdominal ($n = 2$) (unpublished data). Only a slightly lower number of necessary conversions of surgical methods for cryptorchidectomies (8%; 5 of 60) were reported in the Ontario Veterinary College [24]. Furthermore, two to three attempts (separate surgeries) to remove retained testes have been reported in horses with cryptorchidism caused by the failure of the regression of the cranial suspensory ligament [25]. Unnecessary conversions of surgical methods, extensive manipulations within the abdominal cavity, and prolonged anesthesia time could have been avoided if the exact locations of the retained testes were known before these surgeries.

The author of this manuscript strongly believes that the benefits of the accurate detection of the retained testis or testes before cryptorchidectomy in horses outweigh the risks. The goal of this article is to discuss the various methods used to locate cryptorchid testes in horses, including the clinical experiences of the author.

2. Visual Examination and Palpation of the Inguinal Region

The clinical examination of each horse suspected of cryptorchidism begins with the visual inspection of the scrotal and/or inguinal region. While this evaluation may not be revealing, certain clues can be obtained, such as postsurgical scars, the presence of one descended testis, and the lack of a scrotum but a small bulge present at the external inguinal ring. Deep palpation of the inguinal region is performed next. Sedation with xylazine or detomidine is recommended [2] to induce the relaxation of the cremaster muscle [2,23] and to facilitate the examination. For better safety, the horse may be placed in stocks or the ipsilateral hindlimb could be flexed and abducted [2]. Three to four fingers can be placed into the external inguinal ring of an average sized colt, which allows for the palpation of the epididymis or the retained testis within the most distal portion of the inguinal canal [2]. This is not an easy task, however, since subcutaneous tissue or fat can be easily confused with small and flaccid testes or the epididymis. The large bulb of the gubernaculum can also be palpated in very young colts, for up to 3–4 weeks after birth, which can be misleading [26]. The epididymal tail is often palpated at the external inguinal ring or within the inguinal canal in incomplete abdominal cryptorchids. The differentiation between the testis and epididymis is difficult and can rarely be done by manual palpation alone. Therefore, manual palpation is often followed by ultrasound evaluation to visualize characteristic testicular or epididymal structures, which contributes to an accurate diagnosis.

3. Ultrasound Evaluation of the Inguinal Region

For ultrasound evaluation, the animal is placed in stocks and heavily sedated, using a combination of $\alpha 2$ -agonist and an opiate [19,20] such as xylazine or detomidine and butorphanol. The skin is saturated with 70% ethyl or isopropyl alcohol and/or ultrasound gel is liberally smeared on the inguinal area. A linear or curvilinear transducer is placed in a longitudinal orientation, over the external

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