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Equine Cryptorchidism

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SUMMARY

Equine cryptorchidism is examined by a review of the literature. Possible causes of testicular retention as they relate to normal testicular descent are proposed. Current methods of cryptorchidectomy are compared and a parainguinal method, as performed in the Large Animal Clinic at Iowa State University, is examined for its comparative advantages and disadvantages.

INTRODUCTION

Cryptorchidism is a term used to describe the congenital condition in which one or both testicles fail to descend into the scrotum. Horsemen refer to this condition as ridgling, rig, or original.¹⁰ This condition can be bilateral or unilateral and the retained testicles can assume several positions: all testicular structures can be retained in the abdomen (abdominal cryptorchid), the tail of the epididymis and some variable amount of spermatic cord can be in the inguinal canal (partial abdominal), the testicle can be in the inguinal canal (inguinal cryptorchid or high flanker) or the testicle can be subcutaneous, either along side the prepuce or in the femoral triangle.^{4,17,19,25} This latter condition is often referred to as an ectopic testicle but, by the above definition, is still categorized as a cryptorchid testicle.⁴ The vaginal process, that fold of peritoneum which later becomes the vaginal tunics, is always developed and is either inverted into the peritoneal cavity or everted into the inguinal canal, depending upon the extent of testicular retention and fibrosis of the gubernaculum.^{1,4,17,19,22}

The cryptorchid stallion is considered an

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undesirable animal for several reasons. These animals usually have a disagreeable temperament, ranging from nervousness and irritability⁴ up to complete uselessness due to vicious behavior.¹⁷ Even more importantly this trait is highly heritable and cryptorchid horses can be fertile, especially unilateral cryptorchids.^{4,11,12,16,17}

ETIOLOGY

The causes of equine cryptorchidism can be better understood if we briefly examine the embryological development and events leading up to a normal testicular descent. The equine gonad becomes differentiated into a testis by 5½ weeks of gestation.¹⁶ The gubernaculum can be detected by 6½ weeks and is already surrounded by the outgrowth of peritoneum which will eventually be the vaginal process.¹⁶ By approximately four months of gestation, a hypertrophy, unique to the equine testis, is evidenced by the great increase in interstitial cells.¹⁶ This increase is caused by an elevated estrogen level in the mare.³ At eight months, as this hypertrophy continues, the testicle is approximately adult size and could not possibly descend through the inguinal canal.⁴ During the last month of pregnancy, however, the maternal hormonal levels change and the interstitial cells degenerate, causing up to a 40% reduction in testicular mass.^{3,4,16} At the same time, the now well-developed gubernaculum begins to undergo fibrosis and shrinkage due to the same hormonal changes and thus applies traction on the testicle to pull it through the inguinal canal.^{3,4,16} The epididymis precedes the testicle into the canal and some authors feel that this plus insufficient fibrosis explain the occurrence of partial abdominal cryptorchids.^{3,4,16} Intra-abdominal pressure is also thought to contribute to the descent.^{4,16}

The right testicle is the smaller of the two and

therefore tends to precede the left into the scrotum.^{4,16} This size difference persists and may allow the right testis to slip back into the inguinal canal more easily in the early neonatal period as well.⁴ This is a possible cause of inguinal cryptorchidism. During the first two weeks of neonatal life the internal inguinal ring constricts and fibroses substantially, thus the testicle is essentially trapped in its position at that time, whether it is intra-abdominal or extra-abdominal.^{4,16}

A failure anywhere in this complex process of hypertrophy, atrophy, and fibrosis could result in cryptorchidism. Most abdominal cryptorchids appear to be arrested at the five month fetal stage¹⁶ but the gubernaculum continues to fibrose normally.

There have been several studies on which side of the body has the greatest incidence of retention and whether abdominal or inguinal retention is more common. Most authors agree that side distribution is approximately equal with the left side being perhaps slightly more common. It is universally agreed, however, that abdominal cryptorchids are predominantly left-sided (up to 75%) and inguinal cryptorchids are predominantly right-sided (approximately 60%).¹⁹ This incidence has been explained by Smith,¹⁶ and separately by Collier,⁴ using the embryological events of normal descent discussed above.

Cox *et al*⁵ showed that inguinal cryptorchids were more common in yearlings and 2-year olds, while in older horses, abdominal cryptorchidism was more commonly diagnosed. This data suggests that some inguinal cryptorchid testicles will descend as late as 2 to 4 years of age especially in Welsh ponies.^{4,5} This late descent is undesirable though, and may be the cause of testicular hypoplasia in Welsh ponies.⁵

DIAGNOSIS

Diagnosis of an equine cryptorchid is not always straightforward and simple. A history of adequate observation of the testicles in the scrotum or of earlier surgical intervention will definitely aid in the diagnosis. The history can be deceiving, however, since often the owner may not recall correctly which side was operated on. It has been suggested that some inguinal cryptorchids can be externally palpated better after tranquilization or even light anesthesia.^{11,17} If there is any doubt as to whether the animal is cryptorchid or not, it is best to prepare for a cryptorchidectomy.

Rectal examination can be a very helpful diagnostic aid. The goal of the rectal exam should be to determine whether the testicle is retained abdominally or inguinally, but the testicle itself can rarely be palpated.^{1,14,19} Therefore, one must attempt to palpate structures that are consistently present. Adams¹ recommends palpation for the ductus deferens by following it back from the genital fold to the internal inguinal ring. If the vas deferens enters the internal inguinal ring then it can be assumed that the testicle is inguinal; if it doesn't, it can be assumed that it is abdominal.¹ This is not entirely true, however, since it does not consider the case of partial abdominal retention.¹⁹ Some feel that this technique is difficult to master,^{10,14} while others report excellent results. One study had an 88% success rate, higher if partial abdominal cryptorchids are excluded.²² Another method is to simply palpate for the patency of the internal inguinal ring¹⁴ or, more accurately, the vaginal ring.²⁵ If this ring is everted into the inguinal canal, again we have an inguinal or, at worst, a partial abdominal cryptorchid.¹⁴ If the vaginal ring is inverted into the peritoneal cavity, indicating a true abdominal cryptorchid, then it will act as a flap valve over the internal inguinal ring, and this opening will not be palpable.¹⁴ No matter which technique is used, a rectal exam can yield valuable information and should be performed.

The internal inguinal ring is located approximately 10 cm anterior and lateral to the femoral canal. The femoral canal is located by following the anterior border of the os pubis laterally until the pulse of the femoral artery can be palpated.¹ A normal internal inguinal ring should be approximately 1–2 cm in diameter and the vas deferens is located at the caudomedial aspect of the ring.¹⁴ Comparing the suspect ring to the contralateral ring can be very helpful, especially if the animal has one normally descended testicle.¹⁴

Another method of diagnosis, especially helpful in those animals in which previous castration has been attempted, is to measure the plasma testosterone and testosterone response to exogenous hormonal stimulation.^{4,7,8,13,21} Plasma testosterone levels are different in true geldings and cryptorchids but this alone cannot reliably be used to detect testicular tissue in the animal due to variations among individuals.^{7,8} A rise in plasma testosterone levels after HCG administration

is detectable within 25 minutes, due to its interstitial cell-stimulating effects, and is a definitive test for presence of testicular tissue. This test can be performed by simply drawing a pre-treatment blood sample to establish basal levels of plasma testosterone which, according to Cox *et al*⁷ will range from 65–1600 pg/ml in horses with testicular tissue and 11–20 pg/ml in true geldings; then administer 12,000 IU HCG via IV injection, wait one hour and draw another blood sample.^{7,8,13} These paired samples are submitted to a laboratory for analysis of testosterone levels in the plasma. A significant increase in the post-HCG sample is conclusive evidence of testicular tissue remaining in the animal.^{7,8} Remnants of only epididymal tissue gives no such response. This fact tends to refute the popular belief that a horse “cut proud” (ie. epididymal remnants) will continue to act like a stallion.⁸

TREATMENT

Proper treatment of cryptorchidism is surgical castration. Hormonal therapy or unilateral castration of a normal descended testicle to induce testicular descent are not recommended. As was stated earlier, the response to endogenous hormones has already taken place during embryological development and no further response can be expected.^{4,16} Unilateral castration will cause testicular hypertrophy of the remaining testis, but if the testicle is abdominal, this will only make its eventual removal more difficult.¹⁶ Even if the retained testicle were inguinal, it would not guarantee a descent. The trait is highly heritable as well, which is a further indication that a bilateral castration should be performed.

The question of age at castration is often a consideration, because the owner is hoping for a late descent. Delaying castration until puberty is only going to make the animal harder to manage and most practitioners feel that the horse should be castrated at an early age.^{3,4} Cox *et al*⁵ showed that testicular descent can be delayed up to 2 to 4 years of age in ponies but that these testicles are atrophied, and again, if the animal should be fertile, its offspring will have similar problems.

Cryptorchidectomies are categorized into two main methods: via laparotomy or via inguinal approach. The inguinal approach is further broken down into invasive or non-invasive technique which, simply stated, refers to whether or not the hand is introduced into the

abdominal cavity.^{1,4,11,12,22} The laparotomy approach can differ in the point of initial incision: paramedian or paralumbar fossa. The techniques, advantages, and disadvantages of the various approaches will be considered separately.

The inguinal approach requires general anesthesia and dorsal recumbency of the animal. The animal is then rolled 15° toward the unaffected side to present the best field for the affected side.^{1,11,17,23} The inguinal area is clipped and scrubbed thoroughly, the rear limbs are draped in shrouds, and a sterile drape placed over the surgical site. This surgical preparation is very important, especially if the peritoneum is to be perforated. The abdominal fluid often exudes from the wound, flooding the inguinal area, and then flows back into the wound and re-enters the abdominal cavity.¹⁷

A 10–12 cm incision is made over the external inguinal ring down through skin and fascia. Blunt dissection should then be used to approach the external inguinal ring in order to avoid severing branches on the pudendal vein which courses through this area.^{1,4,12,17,22} The inguinal canal is then thoroughly examined for evidence of the testicle, tail of the epididymis or inguinal extension of the gubernaculum testis, which is the embryologic structure that becomes the scrotal ligament in the normal animal. If any of these structures are found, traction should be applied to them in an effort to deliver the remaining testicular structures.^{1,4,11,23} If none of these structures can be located, the testicle must be abdominal, unless evidence of previous castration is found. At this point, either one finger or some suitable surgical clamp must be introduced into the inguinal canal to locate the vaginal process, which will always be present.¹⁶ Adams¹ and others^{4,22} recommend using a sponge forceps to grasp the vaginal process and pull it up into view. Others recommend introducing one or two fingers into the canal and penetrating the vaginal process, thus invading the abdominal cavity.^{10,11,12,17} In either case, the goal is to locate the gubernaculum testis and, using gentle traction, pull the testicle up to and eventually through the inguinal canal. Dilation of the internal inguinal ring may be necessary and can be done manually by slowly stretching it with the fingers.^{1,3,11,17,21,23} Surgical extension of this ring caudomedially may be necessary. Once all testicular structures have been properly identified, an emasculator is used to perform the

castration in the usual manner. If the spermatic cord is too short to raise all structures adequately, an ecraseur or deep clamping and scissors can be used as an alternative method of transection.^{1,4} Packing sterile gauze in the inguinal canal for 24–48 hours is recommended by some authors,^{1,10,11} while others feel it is only necessary in cases of excessive surgical trauma.^{4,17} If the area is packed, caution should be taken to avoid direct contact of the intestines with the gauze, and a rectal exam to ensure no herniation or adhesions have occurred is recommended.^{1,11} The skin may be sutured, using a simple interrupted pattern with 5-cm ends on the knots for ease of removal,¹ or the wound may be left open to drain if there is no danger of herniation.^{1,17} The external inguinal ring can be closed using #2 catgut, polyglycolic acid^a, or polyglactin^b suture in a simple interrupted or simple continuous pattern, staggering the suture placement in the aponeurosis of the external abdominal oblique muscle. This method of closure is strong and reliable, thus the older practice of packing gauze in the inguinal space has been abandoned by some surgeons.²⁴ Allowing the animal to recover from anesthesia with the affected side down will put less stress on the suture line as the animal rises.²³ Aftercare consists of tetanus prophylaxis, antibiotics if indicated, and exercise to reduce swelling and promote drainage.^{1,4,22}

Several abdominal approaches have been proposed including median, paramedian, high flank (paralumbbar fossa), and pararectal.⁶ The flank laparotomy and suprapubic paramedian laparotomy will be discussed here. A flank laparotomy can be performed in lateral recumbency or standing in stocks if adequately restrained.⁴ A paramedian laparotomy requires general anesthesia and dorsal recumbency similar to the inguinal approach.^{2,6} Both of these techniques mandate a definitive diagnosis of abdominal cryptorchidism or a preliminary surgical exploration of the inguinal canal. An inguinal testicle approached from the inside can not be withdrawn back through the internal inguinal ring due to the earlier mentioned postnatal fibrosis.^{1,4,16}

The flank is entered through an 8–10 cm transverse skin incision, followed by the grid technique to enter the abdominal cavity.^{4,20}

^aDexon—Davis & Geck, Inc., division of American Cyanamid Co., Danbury, CT.

^bVicryl—Ethicon, Inc., Somerville, NJ.

The paramedian incision is made at the level of the preputial orifice, 8–10 cm off midline and parallel to the rectus abdominis fibers,^{2,6} The entire hand is introduced into the abdominal cavity and the testis is sought at or near the internal inguinal ring, or by tracing the ductus deferens from the neck of the bladder dorsally, or by “fanning” the hand about in the abdomen until the testicle falls into it.⁶ All of these methods have their shortcomings and the lack of easily-located landmarks is one of the key disadvantages of these techniques.

Once located, the testicle is elevated out of the incision and emasculated as previously described for the inguinal approach. If a bilateral cryptorchidectomy is attempted through a single incision some difficulty in finding and retracting the contralateral testicle can be expected. Closure of the grid layers may not be necessary.^{6,20} Skin closure is routine. Danger of evisceration is minimized by using the flank laparotomy but the strength of the closure of a paramedian incision leaves little risk of evisceration here as well.^{6,20} Postoperative care is similar to the inguinal approach, except stall rest for 14–21 days is generally recommended.

An alternative approach used at ISU, actually a combination of the above procedures, was described by Dollar⁹ and separately by Williams²⁶ in 1912. The animal is anesthetized and placed in dorsal recumbency as described for an inguinal approach. An 8–10 cm skin incision is made over the external inguinal ring and the inguinal canal is approached and explored as previously described for an inguinal approach.^{9,26} If no structures are located in the inguinal canal, a parainguinal incision is made 4–6 cm craniomedial to the external inguinal ring and long enough to introduce two fingers.⁹ A grid technique can be used to separate the fibers of the various muscle layers and then a blunt stab during inspiration will gain access to the abdominal cavity very near, but without disrupting, the internal inguinal ring.⁹ By introducing one or two fingers into the abdominal cavity and sweeping them across the internal inguinal ring, some testicular structure will be located, most probably the tail of the epididymis or the gubernaculum testis. Gentle traction on this structure will deliver the remaining testicular structures into the incision for emasculation. If a cystic testicle is located and cannot be satisfactorily drained, this incision can safely be enlarged without disrupting

the internal inguinal ring.⁹ Closure is with any suitable absorbable suture (eg. No. 1 or 2 chromic catgut, polyglycolic acid, or polyglactin).

Postoperative care is similar to the inguinal approach and few complications need be anticipated, due to the strength of closure using the fibers of the aponeurosis of the external abdominal obliques and due to the lack of surgical disruption of the internal inguinal ring.⁹

DISCUSSION

The main disadvantage of the laparotomy approaches is the requirement for accurate diagnosis, even to the point of surgical exploration of the inguinal canal.⁶ This requires preparation of two surgical sites plus repositioning the animal during surgery for the flank approach.²⁰ The main disadvantage of the inguinal approach is the difficulty faced in removing abdominal testicles through the shrunken and fibrotic internal inguinal ring. This becomes even more of a problem when dealing with cystic testicles or teratomatous structures which, although rare, can be the cause of retained testicles in the horse.^{1,15,18}

The parainguinal approach satisfactorily circumvents these disadvantages while retaining the better qualities of these procedures. It provides excellent access to the internal inguinal ring after a thorough search of the inguinal canal, without repositioning the animal or disrupting the internal inguinal ring. This procedure also offers the adaptability to deal with unforeseen complications (eg. cystic testicles or teratomas) while still maintaining a strength of closure that minimizes the risk of post-operative herniation. The disadvantages of this procedure are that it requires general anesthesia, dorsal recumbency and, being an invasive procedure, proper attention to asepsis. These disadvantages are minor and unavoidable, even shared with the other methods, and are far outweighed by its advantages.

CONCLUSION

Equine cryptorchidism is a common problem for practitioners and, with the continuing rise in the population of pleasure horses in the United States, this condition will be seen more frequently. Proper diagnostic techniques and a good knowledge of the surgical anatomy of this area are the only tools required to successfully treat this condition.

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