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Examination of the cryptorchid horse, treatments and laparoscopic castration

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The term cryptorchid refers to a non-descending testis. It is mostly a unilateral condition, but sometimes both testicles have failed to descend.

If the testis and epididymis are both intra-abdominal, the horse is referred to as a complete abdominal cryptorchid.
If the epididymis but not the testis has descended into the scrotum, the horse is referred as a partial or incomplete abdominal cryptorchid.
If the testis and epididymis are retained within the inguinal canal the horse is referred to as an inguinal cryptorchid.

Work up – Physical examination:

Firstly it is vital to sedate the animal in order to ensure good relaxation of the cremaster muscle. Some horses may appear to be cryptorchid, but once sedated the testis will be nicely visible within the scrotum.
In both inguinal and abdominal cryptorchids there will not be a testicle visible on the affected side. However, one should look very closely for castration scars, because it may be possible that the horse has had a unilateral castration, or an attempt to castrate the horse was made, but the testicle was left in place. A good case history is very important.
If the owners have bred the horse themselves, and they are sure no previous castration attempts were made, then there has to be a retained testicle present (either inguinal or abdominal).

The second part involves palpation of the scrotum and the inguinal canal. A deep palpation of the inguinal canal should be performed. With inguinal cryptorchids, the testis can often be palpated within the inguinal canal. Abduction of the hind limb can sometimes be of assistance in palpating the inguinal canal. It should be noted that the penis and subcutaneous fat in the inguinal region could sometimes be mistaken for an inguinal testis.

The third part involves a rectal examination. The vaginal ring or internal inguinal ring should be palpated per rectum. In stallions the vaginal ring is large, and 1 or 2 fingers can be inserted into it. A rectal examination is not necessary if the diagnosis of an inguinal
cryptorchid can be made by external palpation. Some young stallions are difficult to palpate. Adequate sedation and administration of a smooth muscle relaxant (Buscopan IV or Propantheline Bromide IV) prior to examination can greatly facilitate palpation of the vaginal ring.

If there is no vaginal ring present, it is 100% certain that the horse is an abdominal cryptorchid. If the vaginal ring is present and the ductus deferens and blood vessels are palpable as a string through the vaginal ring, the horse can either be an inguinal cryptorchid or a castrated gelding. A partial or incomplete abdominal cryptorchid is difficult to differentiate from an inguinal cryptorchid.

**Ultrasound examination:**

The use of transabdominal ultrasonography to locate errant testes has been shown to have a sensitivity of 97.6%, with 100% specificity. (Schaumburg MA et al, EVJ 2006 May;38 (3):242-5.). It is a reliable, safe and effective technique, allowing for an immediate and precise diagnosis of cryptorchidism in horses of all ages, size and temperament. Secondly, it enhances selection of an appropriate surgical approach for removal of the testes.

**Hormonal assays:**

Occasionally, measurement of testosterone in plasma or serum is required, in order to find out whether stallion-like behavior is due to a retained testicle. Stallions and cryptorchids have a significantly higher concentration of testosterone in serum and plasma than geldings. In general the basal concentration of testosterone in castrated horses is < 40 pg/ml, with that of entire stallions being > 100 pg/ml. However some stallions exhibit a low basal testosterone level. A hCG stimulation test results in a rise in testosterone concentration in response to hCG injection (only in stallions, and is thus a more accurate test than measuring basal testosterone levels alone. Horses can be classified as cryptorchids if the concentration of testosterone after hCG stimulation test (6000-12000 IU IV, 2nd blood sample taken 30-120 min following hCG administration), is > 100 pg/ml, or as a gelding if the concentration in both samples is less than 40 pg/ml.

**Surgery:**

Once the horse is diagnosed as a cryptorchid, the appropriate surgical technique can be selected.

**Inguinal cryptorchids**

The horse is positioned in dorsal recumbency. A skin incision of ± 5 cm is made over the external inguinal ring. Only the skin and subcutaneous tissue is sharply incised with a scalpel blade, all other dissection is by blunt finger dissection only. Sharp dissection should be avoided at this time to reduce bleeding and accidental incision of larger blood vessels. The vaginal tunic is easy recognizable within the inguinal canal. This vaginal tunic is grasped with a forceps and a small incision is made to expose its contents. The
epididymis and testis should both be present. If the horse has already been castrated, a stump of the spermatic cord will be found within the inguinal canal.

In partial abdominal cryptorchids, only the epididymis is present within the inguinal canal, with the testis still present within the abdomen. Gentle traction on the *proper ligament* (see figures below), which connects the tail of the epididymis with the caudal pole of the testis, will result in exteriorization of the retained testicle. In some cases the retained abdominal testicle is too large to be pulled safely through the vaginal ring (internal inguinal ring). If this is the case, the vaginal ring can be stretched, by introducing a maximum of 1 to 2 fingers through the vaginal ring. At no time should the vaginal ring or internal inguinal ring be incised. This can lead to further tearing of the vaginal ring during recovery resulting in a strangulating inguinal hernia.

**Abdominal cryptorchids**

Several surgical techniques are described to remove a complete abdominal testis, namely an inguinal approach, a para-inguinal approach, and a laparoscopic approach. In our experience an inguinal approach is the most elegant way, allowing removal of both inguinal and abdominal testis in almost all cases. If for some reason an abdominal retained testis cannot be removed, the surgeon can still convert to a para-inguinal approach.

A laparoscopic approach is a very smart way of removing an abdominal testis without disruption of the vaginal (internal inguinal) ring. Once the horse is diagnosed as an intra-abdominal cryptorchid, one should choose which technique is preferred, which of course will also depend on the experience of the surgeon.

**Inguinal approach to remove an abdominal testis:**

The inguinal approach is similar to removing an inguinal testis as described above, the difference being that no vaginal tunic or testis/epididymis will be encountered in the inguinal canal.

**The key to this technique is to locate the vaginal process,** which in abdominal cryptorchids lies inverted within the abdominal cavity together with the testis and epididymis. The trick is to evert this vaginal process into the inguinal canal by gentle traction on the *scrotal ligament* (see figures below), which is an extension of the * gubernaculum testis*. This scrotal ligament attaches the vaginal process to the scrotum. It can only be recognized when gentle and blood free blunt finger dissection is performed at the margin of the external inguinal ring. Gentle traction will cause eversion of the vaginal process in the inguinal canal and a white structure, the size of a fingertip, can be recognized deep within the inguinal canal. This is the vaginal process and can be grasped with a forceps. Malleable retractors are very helpful to increase visualization deep down in the vaginal canal. A small incision is made in the vaginal process, which then exposes the epididymis. Gentle traction on the epididymis and the *proper ligament* (ligamentum proprium connecting epididymis and testis) will result in exteriorizing the testis. As described above the internal inguinal ring can be stretched slightly using 2 fingers, but it should never be incised or stretched greater than this, in order to avoid inguinal herniation.
Once testis and epididymis are exteriorized, an emasculator can be positioned on the spermatic cord and the cord is ligated. The contra-lateral testis is removed via an inguinal approach, and the subcutaneous tissue and skin closed in a routine way.

**The para-inguinal approach:**

This approach is only used in our hospital when the vaginal process cannot be located by the technique described above. The inguinal approach is then converted into a para-inguinal approach.

A 4 cm incision is made through the skin 2-3 cm medial and parallel to the external inguinal ring. The aponeurosis of the external oblique muscle is incised, the internal abdominal oblique muscle is split in the direction of the fibers and peritoneum is bluntly penetrated with 2 fingers. The epididymis, ductus deferens and gubernaculum testis can often be found close to the vaginal ring. Pulling on these structures will result in exteriorizing the epididymis and testis. In very few occasions the testis cannot be found, in which case the incision can be enlarged to accommodate a hand intra-abdominally. The abdominal muscles and aponeurosis should be sutured with a 5 to 8 metric resorbing suture. Subcutaneous tissue and skin are closed routinely.

**The laparoscopic approach:**

The advantages of the laparoscopic castration of an abdominal cryptorchid are:

- Better visualization resulting in easier and fast localization of the abdominal testis.
- No disruption of the internal inguinal/vaginal ring, therefore minimizing risk of evisceration.
- Early return to exercise (only 3 small flank incisions).
- Can be performed on the standing horse (no general anesthesia required).

The disadvantages:

- Expense of the equipment and often more expensive surgery.
- Experienced and properly trained surgeon needed to avoid complications such as accidental puncture an intestine or blood vessel.

Laparoscopic removal of an abdominal testis can be performed on the standing horse or alternatively with the horse positioned in dorsal recumbency. We perform all cryptorchidectomies on the standing horse. Occasionally general anesthesia is required if the stallion is too dangerous and cannot be controlled with sedation within the stocks.

Food is withheld for 24 hours. Horses are sedated and restrained in standing stocks. Two instrument portal sites in the paralumbar fossae are locally desensitized using 2% mepivacaine. The scope portal is located between the 17th and 18th rib. Following trocar
and laparoscope insertion, the ipsilateral testicle, mesorchium, and ductus deferens are easy to identify. The testis is located by inspecting the area around the internal inguinal ring. The mesorchium is easy to identify and pulling on this cord will reveal the testis and epididymis. The mesorchium is desensitized with local anaesthetic. The cranial mesorchium is coagulated with bipolar electrosurgical forceps (Lina or LigaSure). The mesorchium, ductus deferens, and ligament of the tail of the epididymis are then transected in a cranial to caudal direction using laparoscopic scissors. Once the testis is freed, the transected mesorchium is inspected for hemorrhage and the testis is removed through one of the instrument portals, which is slightly enlarged. If the testes are retained bilaterally, the retained contra lateral testis is removed similarly through the opposite paralumbar fossae. The left abdominal testis is passed to the right and both testes are then removed through the right paralumbar fossae. We do not see the need in exteriorizing the abdominal testis through the abdominal wall for ligation as has been described.

The contra-lateral inguinal, or normally descended testis can be castrated through one of the two following procedures.

- The testis is removed by a standard standing castration technique, or by a short acting general anesthesia.
- The spermatic cord of the normal descended or inguinal retained testis is coagulated with bipolar electrosurgical forceps (Lina or LigaSure) or ligated intra-abdominally and completely transected. This results in necrosis of the testis within the scrotum. However after intra-abdominal transection of the entire spermatic cord, 5.6% of inguinally retained and 3.4% of normally descended testes fail to become completely necrotic, as a result of an alternate blood supply via the cremasteric and/or external pudendal artery. Therefore, laparoscopic castration without orchidectomy cannot be recommended as a 100% safe method for castration of inguinal cryptorchids and normal stallions, and owners should be properly informed about this complication (Voermans et al, Equine Vet J. 2006 Jan;38(1):35-9, Bergeron JA et al, J Am Vet Med Assoc. 1998 Nov 1;213(9):1303-4, 1280).
Laparoscopic view of the right internal inguinal ring viewed from right and viewed from left in the standing horse. Note the filled bladder in the left picture. Normal internal inguinal ring (vaginal ring) showing the mesorchium (spermatic cord) and ductus deferens entering the inguinal canal. Those 2 structures can be palpated on a rectal examination.
**ligamentum propria (proper ligament)** is a short and firmly attaches the tail of the epididymis to the caudal pole of the testis.

**Epididymal ligament (from tail epididymis to vaginal tunic)**
**Abdominal retained testis**

- ligamentum propria (proper ligament)
- In cryptorchids: ELONGATION of this proper ligament (5-30cm)
- Epididymal ligament (from tail epididymis to vaginal tunic)

**Abdominal retained testis with inguinal retained epididymis**

- The most common alteration is elongation of the proper ligament of the testis
- Long stretched epididymis is mistaken for a small sized testicle
**Surgical anatomy of the testis**  

**Scrotal ligament**

- **Epididymal ligament**  
  (from tail epididymis to vaginal tunic)
- **Ligamentum propria (proper ligament)**

Scrotal ligament is a fibrous band that attaches the vaginal process to the scrotum.

The scrotal ligament is a very important landmark to locate the vaginal process, follow it to remove an abdominal testis by an inguinal approach.
Surgical approach to abdominal cryptorchids: inguinal - paramedian- laparoscopy

**Inguinal approach:**

the most difficult situation occurs when the vaginal process is inverted

- Find the scrotal ligament
- This will lead you to the vaginal process
- Gentle traction will evert the vaginal process
- Proceed as explained before