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CASE REPORT

Colic signs caused by an unilateral abdominal seminoma in a Friesian stallion

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Summary

This case report describes the diagnosis and surgical treatment of a 12-year-old Friesian stallion that presented with colic and was diagnosed with an unilateral abdominal seminoma. The diagnostic work-up included haematology, blood chemistry, rectal examination and ultrasonography before the tentative diagnosis of a neoplastic intra-abdominal testicle was made. The mass was removed surgically and diagnosed as a seminoma via histopathology. Regular follow-up was performed since suspected metastasis was seen on transrectal ultrasonography and laparoscopy. Unfortunately, the patient was subjected to euthanasia 18 months post-surgery due to clinical deterioration. Post-mortem examination was performed and confirmed the cause of clinical deterioration was due to metastasis of the previously removed seminoma. Colic is, to the author's knowledge, rarely seen in stallions with an abdominal testicular neoplasm, in contrast to humans and dogs.

KEYWORDS
horse, abdominal cryptorchid, colic signs, laparoscopy, seminoma

INTRODUCTION

Cryptorchidism is the most common congenital abnormality of the genitourinary tract in horses. Interestingly, however, the incidence of neoplasia of abdominal testes is unknown. Most stallions are castrated at a young age, especially when cryptorchid, thus limited data are available on the prevalence of testicular tumours in horses. Several neoplasms have been described, three of which have been associated with cryptorchidism: teratomas, seminomas and interstitial (Leydig) cell tumours (Brinsko, 1998; Gelberg & McEntee, 1987; Schumacher, 1999; Valentine, 2009). Occasionally case reports are published, and most of the time the tumour appears to have caused no clinical signs and is therefore regarded as an incidental finding (Pasolini et al., 2016; Rijkenhuizen et al., 2018). Emaciation as a chronic debilitating condition is described in horses with testicular neoplasia (de Lange et al., 2015; Pratt et al., 2003), as well as lameness (Schambourg et al., 2006), lethargy, colic (Parks et al., 1986; Vaillancort et al., 1979) and occasionally respiratory signs such as a cough, nasal discharge and dyspnoea (Pratt et al., 2003; Schumacher, 1999). Diagnosing a seminoma of an abdominal testicle as the primary cause of colic can be challenging.

This report describes the clinical examination of a stallion referred with colic. The patient was managed with surgical exploration and was found to have a seminoma, leading to unilateral orchidectomy. Unfortunately, metastasis of the tumour had already occurred, resulting in euthanasia of the stallion 18 months later.

CASE HISTORY

A 12-year-old Friesian stallion was presented to the Equine Clinic Bodegraven for a recent episode of colic.

The stallion had a mild colic episode the day before the examination at the clinic, characterised by pawing and laying down. Vital signs were within normal limits, besides the heart rate (HR) of 44/min. Abdominal palpation per rectum was not performed by the veterinarian at home. The horse was treated with spasmolytic drugs (butylscopolamine + betamizole (Buscopan® Compositum)[3] 0.2 mg/kg bwt scopolamine butylbromide +25 mg/kg bwt metamizole sodium). The horse recovered after treatment, however the owner requested an additional examination at the clinic. According to the owner, the horse never had any previous colic episodes.

CLINICAL FINDINGS

Physical examination

The stallion's vital signs (respiratory rate (RR) 8 breaths/min, HR 36 beats/min, rectal temperature 37.8° Celsius) and body condition score were within normal limits and the horse showed no signs of colic at the time of presentation. The right testicle was descended and of normal size, position and consistency. The left testicle could not be palpated in the scrotum nor in the inguinal region, thus an abdominal testicle was suspected. Abdominal palpation per rectum revealed a lobulated mass caudal to the left kidney and a nearby fibrous strand-like structure coursing ventrally within the abdomen. Palpation of this strand appeared to cause the stallion some discomfort. The iliac lymph nodes were not increased in size.

Clinical pathology

Haematology revealed a packed cell volume (PCV) of 34.8% (rr 30–47%) and a white blood cell count (WBC) of 9.5×10^9/L (reference range (rr) 4–10×10^9/L). Blood chemistry values were within normal limits, except for a slightly elevated aspartate aminotransferase (AST) 395 IU/L (rr 175–340 IU/L) and glucose 7.5 mmol/L (rr 3.6–6.1 mmol/L).

Diagnostic imaging

Transrectal ultrasonography (7.5 MHz rectal probe, Esaote Benelux, MyLabDelta®) revealed a hyperechoic lobulated mass (7×8 cm) (Figure 1) caudal to the left kidney and an adjacent linear soft tissue, band-like structure of approximately 25 mm in width, accompanied by congested vessels. At transabdominal ultrasonography (6.5 MHz convex probe Aloka Prosound SSD Alpha 10, Hitachi Medical Systems BV), the lobulated mass could not be visualised on the left side of the abdomen. However, a heterogenous, diffusely hyperechoic mass of approximately 20×14 cm was observed on the right side of the ventral abdomen (Figure 2). This heterogenous mass was not visible with transrectal ultrasonography. The gastrointestinal tract was also examined and was normal in appearance. There was no sign of excessive abdominal fluid and no other significant ultrasonographic findings were seen within the abdomen and thorax. The right descended testicle was normal at palpation and ultrasonography. A tentative diagnosis of a twisted, neoplastic, left abdominal testicle was made and surgical management was advised.

SURGERY

Standing laparoscopy

Prior to laparoscopy, the horse underwent a restrictive feeding schedule for 3 days to allow for improved intra-abdominal visualisation and to reduce the risk of the perforation of viscera (Zebeli et al., 2015). Preoperatively, nonsteroidal anti-inflammatory drugs (meloxicam (Metacam®, Boehringer Ingelheim International GmbH) 0.6 mg/kg intravenous (iv)) as well as antibiotics (gentamicin (Gentaject®, Dopharma Research BV) 6.6 mg/kg bwt iv, Benzylpenicillin natr®, Eurovet Animal Health BV, 20.000 IU/kg bwt iv) were administered. The stallion was sedated with detomidine (Domidine®, Eurovet Animal Health BV, 0.015 mg/kg bwt iv) and received morphine (Morfine HCL®, Centrafarm BV, 0.1 mg/kg bwt iv) for additional analgesia. A constant rate infusion of detomidine (5 mg in 500 cc NaCl) was administered and the rate was adjusted as necessary during the procedure. A urinary catheter was placed for bladder decompression.

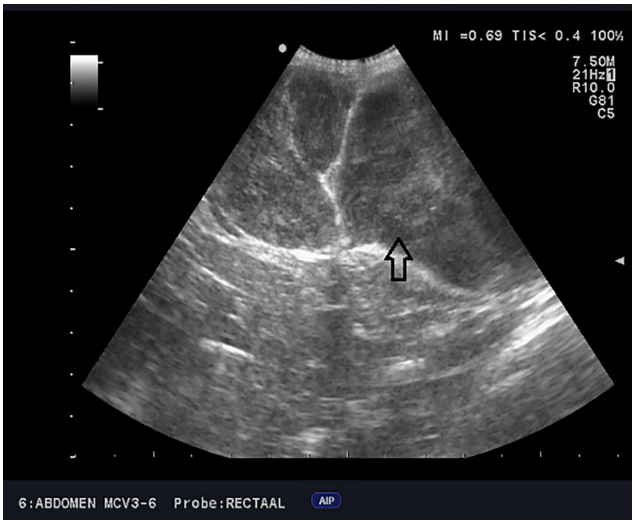

FIGURE 1 Transrectal ultrasonography using a 7.5 MHz rectal probe (MyLabDelta®, Esaote) revealing a hyperechoic lobulated mass (arrow) with a size of 7×8 cm, caudal to the left kidney. Cranial is to the left.

After routine preparation of the surgical site, the left flank was infiltrated with a local anaesthetic (lidocaine hydrochloride 2%, Lidocaine 2% + Adrenaline®, Alfasan Nederland BV) at the sites of the laparoscope and instrument portals. The laparoscopic portal was made 2 cm caudal to the last rib and dorsal to the internal oblique abdominal muscle, using a 10 mm trocar. The abdomen was distended to a maximal intra-abdominal pressure of 6 mm Hg using a carbon dioxide insufflator (Storz®, Karl Storz Endoscopie Nederland BV, flowrate 7–8 L/min). Under laparoscopic supervision, an instrumental portal was made using a 10 mm trocar approximately 4 cm caudal and 10 cm distal to the laparoscopic portal.

Abdominal exploration revealed a twisted left spermatic cord with congested vessels (Figure 3). A small amount of clear, pale, yellowish abdominal fluid was present. Caudal to the left kidney a retroperitoneal mass was seen (Figure 4). Careful palpation with a Babcock forceps (10 mm) revealed this mass to be firm. The twisted mesorchium was grasped and an attempt was made to pull the testicle into the field of view; this manoeuvre appeared to cause slight discomfort to the horse. This attempt proved unsuccessful because the mass was too heavy.

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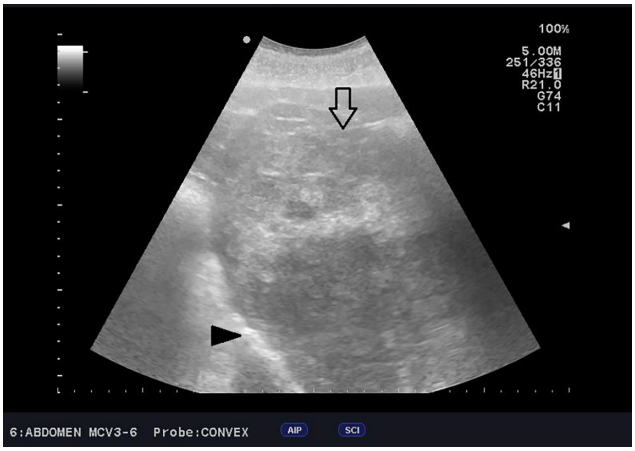

FIGURE 2 Transabdominal ultrasonography on the right side of the abdomen using a 6.5 MHz convex probe (Aloka Prosound SSD Alpha 10, Hitachi Medical Systems BV) (dorsal is to the left). A heterogenous, diffusely hyperechoic mass of approximately 20 × 14 cm was observed (arrow). The echogenic band surrounding the mass is seen as well (arrowhead).

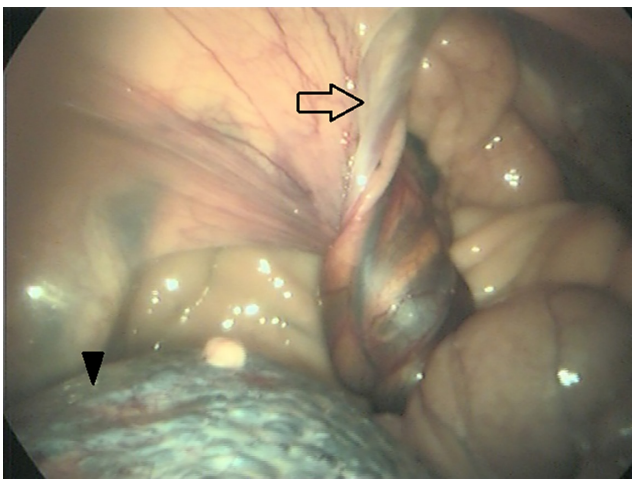

FIGURE 3 Laparoscopic view: a twisted spermatic cord with congested vessels is seen (arrow). Cranial to the spermatic cord, the spleen is visible at the bottom of the image (arrowhead). Cranial is to the left.

Due to the estimated large size and the inability to visualise the suspected neoplastic abdominal testicle, the decision was made to ligate and transect the spermatic cord in the standing horse and to remove the testicle in dorsal recumbency through a ventral midline laparotomy. The mesorchium was anaesthetised with 5 mL lidocaine injected using a laparoscopic needle. The spermatic cord was double ligated (Polyglactin 910, Vicryl USP2, Ethicon®, Johnson & Johnson Medical GmbH) and transected between the two ligatures with a vessel sealing system (10 mm LigaSureTM® Force Triad5, Medtronic). No haemorrhage was observed from the spermatic stump and the testicular mass was left in situ. The abdominal cavity was allowed to deflate and the trocars were removed. The skin of the laparoscopic and instrumental portals was

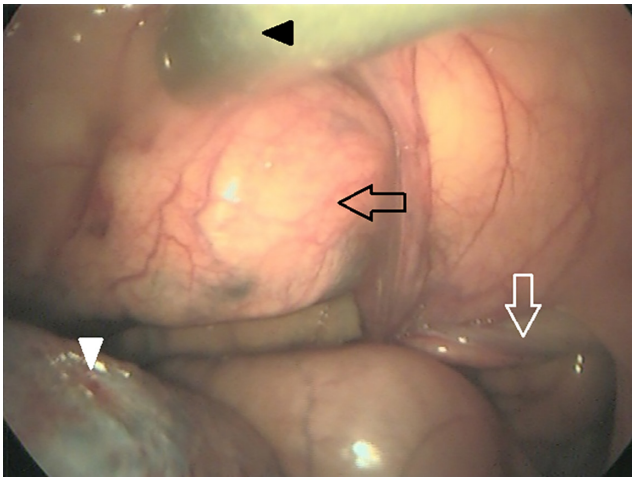

FIGURE 4 Laparoscopic view: a retroperitoneal mass (arrow) caudal to the left kidney is seen, proven to be firm after careful palpation with the Babcock forceps (arrowhead). Caudal to this mass, the twisted spermatic cord is visible (white arrow). Ventral to the retroperitoneal mass, the spleen is visible (white arrowhead). Cranial is to the left.

sutured routinely (Polyglecaprone 25, Monocryl USP 2-0 Ethicon®, Johnson & Johnson Medical GmbH).

Ventral laparotomy

Ventral laparotomy was scheduled directly after the standing laparoscopic surgery. The time between the end of the laparoscopic portal closure and anaesthetic induction was 11 minutes. Detomidine (0.015 mg/kg bwt iv) was continued as a premedication. Anaesthesia was induced with ketamine (Anesketin®, Eurovet Animal Health BV, 2.2 mg/kg iv) and midazolam (Midazolam®, Aurobindo Pharma BV, 0.1 mg/kg iv) and maintained via inhalant anaesthesia with isoflurane (IsoFlo®, Zoetis BV) in 100% oxygen. A constant rate infusion of detomidine (0.01 mg/kg/h) was also administered. Pulse oximetry, ECG and an intra-arterial pressure line were monitored. The horse was positioned in dorsal recumbency and an incision of 30 cm was made through the ventral midline after aseptic preparation. The retroperitoneal mass behind the left kidney, seen at transrectal ultrasonography, was confirmed to be firm to palpation. The now free testicular mass was easily located in the abdominal cavity almost directly beneath the ventral midline incision.

A disposable surgical drape (120 × 120 cm, Kruuse polyethylene 100%) was used to extract the free-lying mass. A complete abdominal examination was performed including the palpation of viscera. No evidence was found of adjacent masses or other significant findings within the abdomen. The incision was closed in 3 layers routinely (Polyglycolic Acid, 6 USP Kruuse® and Polyglecaprone 25 Monocryl 1 Ethicon®, Johnson & Johnson Medical GmbH) and an abdominal bandage was placed. The excised testicular tumour (25 × 15 × 10 cm) had a weight of 4.3 kg and an irregular surface (Figure 5); it was submitted for histopathological evaluation.

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Postoperative management

Recovery was unremarkable. Meloxicam (0.6 mg/kg iv) and antibiotics (gentamicin 6.6 mg/kg bwt iv) and procaine benzylpenicillin (Procapen®, AST Pharma BV, 20 mg/kg bwt intramuscular (im)) were administered for a total of 5 days postoperatively. Clinical examination (pulse and respiratory rates and transrectal temperature) remained within normal limits during the postoperative period. The horse was discharged from the clinic 7 days postoperatively without the abdominal bandage and the laparoscopic portals and the laparotomy wound healed primarily without incident. Postoperative management included hand walking for 3 months.

Pathology

The cut section of the 25×25×10 cm mass revealed well-demarcated, multiple solid beige-to-red nodules. Representative samples were fixed in 10% neutral-buffered formalin. Following fixation and routine paraffin embedding, 4 μm sections were made and stained with haematoxylin and eosin.

Histopathology revealed a somewhat multinodular growth pattern of the mass, with extensive necrosis and haemorrhage. In the non-necrotic regions, a moderately pleomorphic population of round to polygonal neoplastic cells with large, variably sized nuclei and large nucleoli was seen. Scattered, multiple multinuclear neoplastic cells were encountered. Neoplastic cells regularly contained mitotic figures and a moderate amount of basophilic to amphophilic cytoplasm (Figure 6). The histology was consistent with a seminoma.

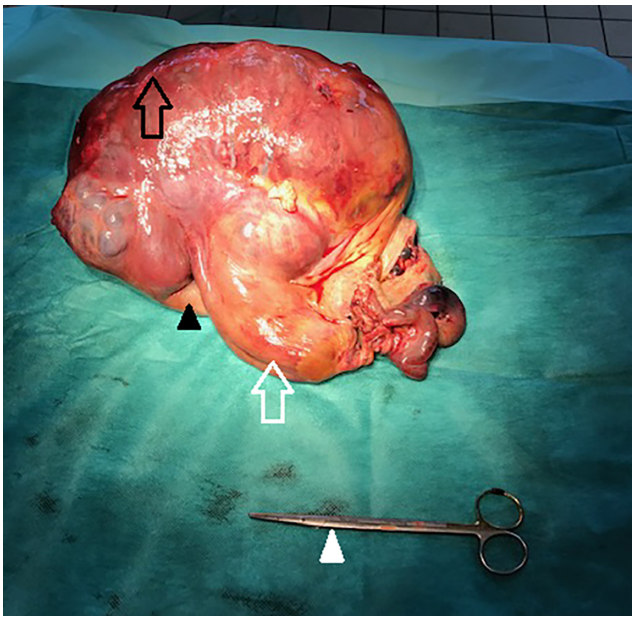

FIGURE 5 Macroscopic view of the retrieved mass (25×15×10 cm). The mass still resembles a testicle, showing an irregular surface with large vessels on the liberal border of the presumed testis (arrow) accompanied by the epididymis (arrowhead) and spermatic cord (white arrow). A curved pair of dissecting scissors (20 cm) is shown (white arrowhead) to compare to the size of the mass.

Follow-up

Clinical examinations at our clinic and information obtained from the owner indicated normal postoperative recovery. The mass caudal to the left kidney was monitored at 3 weeks, 3 months and 11 months postoperatively using transrectal ultrasonography. At the first two postoperative checks, the mass remained stable in size and shape (ca. 7×8 cm). However, 11 months postoperatively the mass was more prominent (8×25 cm). No signs of discomfort were encountered during the clinical examination and since the further surgical intervention was not an option, the decision was made to treat the horse with systemic corticosteroids (Rapidexon®, Eurovet Animal Health BV, 0.06 mg/kg bwt im, once daily for 10 days) to see if a reduction in the size, or rate of growth of the mass could be achieved. Four weeks following the introduction of this treatment the size of the mass appeared stable (8×25 cm). The horse remained asymptomatic and the owner was able to ride (at recreational level) for several months. Unfortunately, the horse developed signs of discomfort 17 months post-surgery. The horse also lost weight, developed oedema in all 4 legs and along the ventral abdomen, showed intermittent lameness and a stiff gait in the hindlegs. Within 3 weeks following these initial signs of decline, the owner noticed the loss of appetite and a change in behaviour (reportedly dull and subjectively unhappy). Further deterioration was noted within several days following this and the client decided she did not want the horse to suffer anymore. Based on the assumption of metastatic disease, the owner elected euthanasia. The stallion was euthanised (Euthasol® 50 mg/kg iv, AST Pharma BV) and the body was submitted for necropsy.

Necropsy and histopathology

Externally, no lesions were visible. Within the abdominal cavity, approximately 1 L of dark-red fluid (blood) was identified (haemoabdomen). Occupying approximately 40% of the abdomen, in its caudo-dorsal extent, was a large mass of about 60×45×25 cm, with an irregular multilobulated surface. A focal area of laceration (15×7×2 cm) covered by a large blood clot was seen on its lateral aspect (Figure 7a). On cut section, the mass was heterogenous, showing areas with a soft to firm consistency and a grey to yellow-brown colour. Multiple nodular masses (up to 8 cm in diameter) were also seen on the serosal surface of multiple abdominal organs (diaphragm, omentum, urinary bladder, hepatic Glisson's capsule, spleen) all showing a focal point of attachment to the serosal surface (peritoneal contact metastases) (Figure 7b,c). Additionally, pulmonary congestion and oedema and hydronephrosis of the right kidney were noticed. The latter showed expansile growth towards the right

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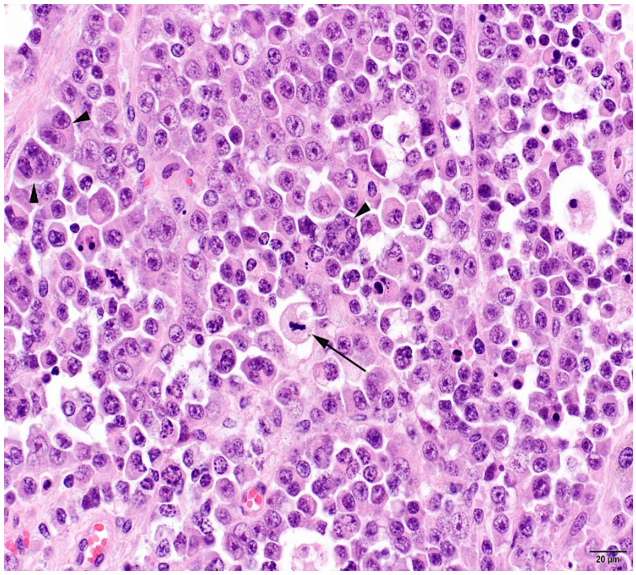

FIGURE 6 Histology of the testicle of the horse characterised by sheets of a monotonous, though pleomorphic population of neoplastic cells. Multiple multinucleated neoplastic cells (arrowheads) and a neoplastic cell with a mitotic figure (arrow) are visible. This histology is consistent with a seminoma. Haematoxylin and eosin stain, 40× objective.

side of the body with compression of the right renal hilus. No lesions were noticed in the left kidney.

Cytological examination of impression smears of the largest mass was performed showing a highly cellular population of round cells. Cytological findings were compatible with the diagnosis of a round cell neoplasm, possibly a metastatic seminoma. On histopathology, the abdominal mass and the metastases presented morphologic features similar to the removed testicle, indicating widespread abdominal metastasis of the seminoma.

DISCUSSION

Cryptorchidism is one of the risk factors for developing testicular cancer, with seminomas being the most commonly observed testicular tumour in adult domestic animals and humans (Alexander et al., 2010; Trigo et al., 1984; Weiermayer & Richter, 2009). The abnormal location of the testis is a prerequisite for the development of cancer (Hutson et al., 2010). The higher intra-abdominal temperature is considered to have an influence on the aetiology of testicular cancer, causing impaired transformation and maturation of germ cells as well as affecting apoptosis (Cortes et al., 2001; Strader et al., 1988; Thorup et al., 2010). In cryptorchid humans, a 40-fold higher risk of developing neoplasia is described compared to humans with descended testes (Wood & Elder, 2008). In cryptorchid dogs, a 26-fold increase in risk for Sertoli cell tumour development and a 15-fold increase in risk for seminomas exists (Hayes Jr. et al., 1985).

Diagnostic imaging

Diagnosing an abdominal neoplastic testicle starts with a clinical examination and a thorough transrectal examination, combined with diagnostic imaging. Ultrasonography is the imaging modality of choice to diagnose testicular neoplasia in horses, yet little information is available on the appearance of abdominal testicular tumours in the stallion. Ultrasonographic features of a mature teratoma arising from an undescended testicle have been described (Pasolini et al., 2016) and one case report of a seminoma in a descended testicle mentions a diffusely hypoechoic testicle with ill-defined regions of hyperechogenicity and a pseudocapsule (Beck et al., 2001). In our case, combined transrectal and transabdominal ultrasonography was necessary to diagnose the left-sided, twisted seminoma. Transrectal ultrasonography showed a strand with congested vessels (the twisted spermatic cord) close to the left kidney which ran in a cranioventral direction towards the middle, or, respectively, right side of the abdomen. The attached mass was seen ultrasonographically on the right side of the abdomen. This was most likely displaced due to its increased weight. The mass showed a diffusely hyperechoic pattern with a clear echogenic band, making the suspicion that it was a twisted testicle, or an abdominal testicular tumour plausible.

Using the Doppler technique, as has been documented in dogs and humans, might have had added clinical value by assessing intratesticular blood flow. Blood flow in a torsed testicle is decreased or absent and the testis is usually enlarged and diffusely oedematous (Hecht et al., 2004; Ringdahl & Teague, 2006; Zilberman et al., 2006). However, an incompletely twisted testicle may still have decreased blood flow and detorsion can lead to increased blood flow (Berman et al., 1996; Kapoor, 2008).

Haematology and biochemistry

Blood analysis could be helpful in detecting neoplastic testicles. In human patients with seminoma, leucocyte count is typically normal, but may be elevated (Hutcheson et al., 1996). In our case, the WBC was normal, whereas in other articles reporting on equine seminomas, varying results are mentioned; from no leukocytosis (Farjanikish et al., 2016), to mild (Weiermayer & Richter, 2009) or marked leukocytosis (de Lange et al., 2015). A possible explanation for the normal WBC in our patient is the encapsulation of the tumour, causing no elevation in the WBC initially. As time goes on and the size of the tumour increases, the risk of torsion of the spermatic cord increases. This can cause an inflammatory reaction of the involved structures followed by a rise in WBC. The slightly elevated aminotransferase (AST) in our case (395 IU/L ref 175–340 IU/L) could be an incidental finding. Elevated AST has however been described in two horses with seminoma (de Lange et al., 2015). Increased AST and CK are also seen in horses with colic signs and are frequently attributed to muscle trauma

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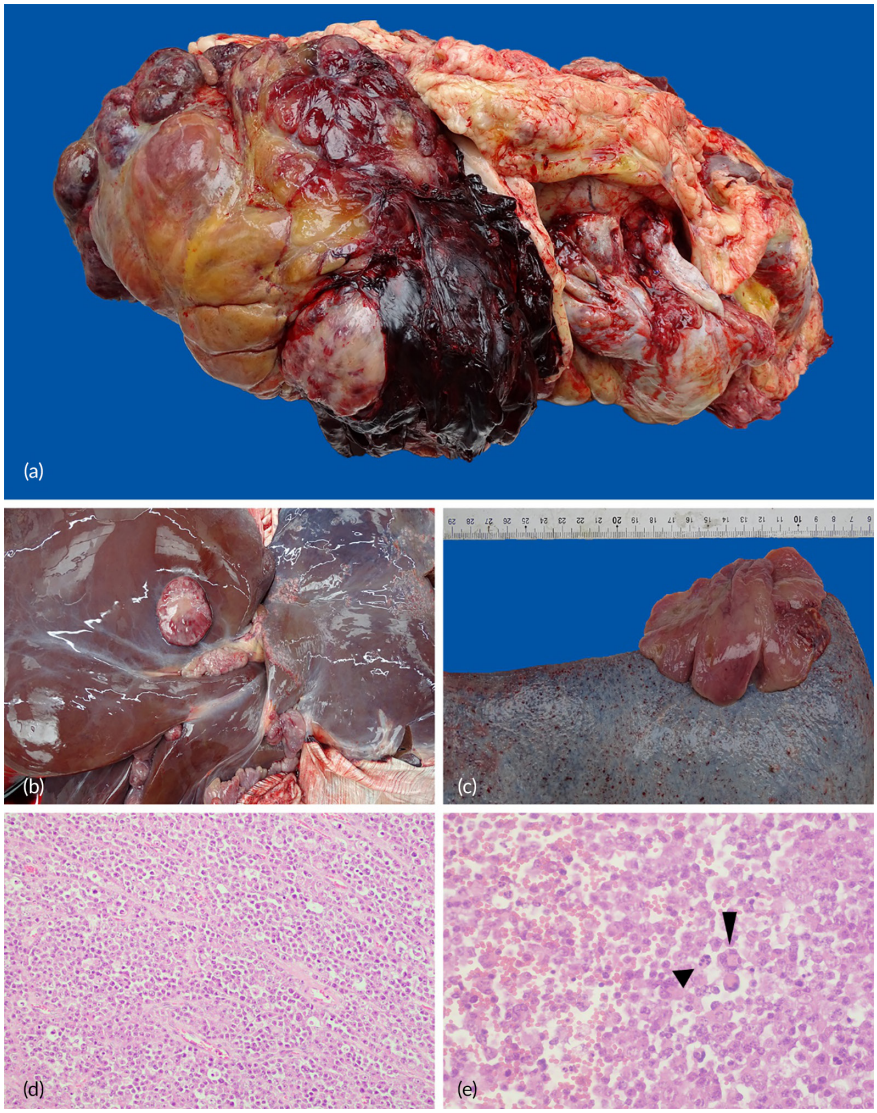

FIGURE 7 (a–e) Post-mortem examination, 18 months following removal of the original tumour. Macroscopic and histologic features of the neoplasm. (a) Macroscopic appearance of the abdominal mass showing a multilobulated appearance and lateral laceration covered by a large blood clot. (b) Liver, multifocal contact metastases are seen on the Glisson's capsule. (c) Spleen, a focal pedunculated metastatic nodule is seen on the visceral peritoneum covering the organ. (d) Neoplasm showing densely packed sheets of round cells (H&E, 20×). (e) Neoplastic cells showing marked anisocytosis and anisokaryosis, multifocally, multinucleated giant cells (long arrowhead) and single cell necrosis (short arrowhead) are also identified (H&E, 40×).

associated with thrashing, rolling, lying down, subsequent trailering to a referral centre and administration of intramuscular injections (Krueger et al., 2014). AST has a long half-life and can remain elevated for 7–10 days after resolution of the inciting cause (Reed et al., 2010). The slightly elevated AST could have been caused by the stallion's display of colic the day before arriving at the clinic.

Abdominocentesis

Abdominocentesis can be a useful diagnostic aid in cases of intra-abdominal neoplasia in the horse. Lymphoma and carcinoma are the most common neoplasms identified in peritoneal effusions (Walton & Southwood, 2013). As far as testicular tumours are concerned, there have been no reports of tumour cells in peritoneal fluid (Pratt et al., 2003; Shaw & Roth, 1986). However, it is noted that abdominocentesis is not routinely performed on horses presented with testicular neoplasia. In our case, peritoneal fluid analysis was not performed, but it should be considered in future cases to determine the possible added diagnostic and prognostic value of abdominocentesis in the case of neoplastic abdominal testicles.

Surgery

Standing laparoscopy was our first choice of surgical intervention, serving as a diagnostic and therapeutic technique. The twisted testicular pedicle showing a congestive vascular pattern confirmed the

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testicle as being the origin of the mass seen via ultrasonography. Due to its weight, the testicular mass could not be visualised and it was decided to ligate and transect the spermatic cord in the standing horse and subsequently remove the mass in dorsal recumbency through a ventral midline laparotomy. A hand-assisted approach, manoeuvring the abdominal testicle into the field of view by hand, could have been an option, however, the mass was considered too heavy. In order to reduce the size of the ventral midline laparotomy and prevent contact between the tumour and the muscle edges, a surgical drape was used to isolate the tumour (Rambags et al., 2003). Had the tumour been larger it would have been possible to reduce its size intra-abdominally within the surgical drape prior to removal to keep the abdominal incision as small as possible.

Seminoma

Our knowledge base on seminomas in equids is limited to case reports. Stallions with seminomas range from 8 to 22 years of age, with most affected stallions being >10 years old (Brinsko, 1998). Seminomas occur in scrotal and cryptorchid testes and appear uniformly pale, soft and lobulated (Caron et al., 1985). In humans, seminomas are highly malignant, whereas in dogs they rarely metastasise (Becht et al., 1979); only a few cases of metastases have been described (Dugat et al., 2015; Hogenesch et al., 1987; Tennant & Kelly, 1992). In horses, seminomas appear to show a greater propensity for metastases than in other domestic species. Metastases are most prevalent in abdominal organs, peritoneum, mesentery, lymph nodes, the aorta, vena cava and the ureters (Beck et al., 2001; Brinsko, 1998; Valentine, 2009). Metastatic lesions usually manifest themselves within 2 years following initial diagnosis (Brinsko, 1998; Trigo et al., 1984; Vaillancort et al., 1979). In our case, metastasis from the seminoma was suspected based on the firm swelling felt close to the left kidney. To confirm the suspected metastasis biopsy during laparoscopy would have been an option, and was considered, but the risk of haemorrhage was deemed to outweigh the diagnostic value of the procedure. Retrospectively, biopsy might have added value by serving as a prognostic indicator for the possible long-term survival of the stallion. However, the inability to remove the mass surgically and the risk of possible fatal haemorrhage was the deciding factor not to take a sample; it would not have altered our therapeutic plan. No further signs of metastasis were noted during laparoscopy. The expected survival time of a stallion with a seminoma with metastasis is between 10 and 24 months (Christensen et al., 2007).

Our patient survived for 18 months

The malignancy of the tumour became clear at necropsy, showing a metastatic mass occupying 40% of the abdominal cavity and further metastases in the abdominal organs such as the liver, spleen and on the diaphragm. These appeared to have developed within the 18 months following the initial surgery. Even though the first antemortem indication of metastasis was the firm swelling caudal to the left kidney, no lesions of the left kidney were seen. Hydronephrosis of the right kidney was encountered, most likely due to the expansile growth of the main metastatic mass towards the right side of the abdomen with resultant compression of the ureter on this side.

Colic signs

Colic signs, the main complaint in our case, have previously been described in equine patients with seminoma (Parks et al., 1986; Vaillancort et al., 1979). In our case, a spermatic cord torsion was also present. Twists of less than 180° may not be noted clinically and torsions of more than 270° are associated with colic. Torsions may be recurrent and occasionally have been associated with testicular neoplasia (de Bock et al., 2007; Edwards, 2008), as in our case. We assume that the torsion was more than 270° at some point—given the colic signs—but most likely rotated back partially, since signs of colic were not seen following admission to the clinic. In humans, testicular torsion of a cryptorchid testicle is extremely rare and mainly effects neoplastic testes (Hutcheson et al., 1996; Twiss & Grasso, 2000). Typical symptoms include abdominal or inguinal pain (Twiss & Grasso, 2000). In dogs, abdominal pain, apathy, anorexia and difficulty ambulating are described (Hecht et al., 2004; Mostachio et al., 2007). It is presumed that the ectopic position and neoplastic alteration, causing increased weight, increases the risk of rotation of the pendulous testicle (Hecht et al., 2004; Mostachio et al., 2007). The seminoma in our case weighed 4.3 kg, making this presumption plausible here as well. The torsion of the spermatic cord as well as the weight of the mass itself could have been responsible for the colic signs. Abdominal testicular neoplasms are known to occasionally be associated with testicular torsion, which often is characterised by abdominal pain (Brown et al., 1995; Edwards, 2008; Mostachio et al., 2007; Nelson & Calley, 1987; Rourke et al., 2018; Uguz et al., 2016).

Take home message

In conclusion, an intra-abdominal testicular tumour must be considered as a potential diagnosis in a unilaterally cryptorchid stallion who presents with signs of colic. Accompanying torsion of the testicle may be demonstrated by ultrasound; congested vessels are seen in a twisted spermatic cord. In this case report the diagnosis was made based on transrectal palpation, ultrasonographic findings and the macroscopic appearance of the surgically removed testis. Histopathology confirmed our diagnosis of a seminoma.

AUTHOR CONTRIBUTIONS

Chantal M. P. Peeters: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; supervision; validation; visualization; writing – original draft; writing – review and editing. **Teun Sterk:** Data curation; investigation; methodology. **Guy Grinwis:** Data curation; formal analysis; investigation; supervision; validation; writing – original draft. **Giuseppe Giglia:**

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Data curation; formal analysis; investigation; writing – original draft. **Astrid B. M. Rijkenhuizen:** Conceptualization; data curation; formal analysis; methodology; project administration; supervision; validation; visualization; writing – original draft.

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CONFLICT OF INTEREST STATEMENT

There is no conflict of interest.

ETHICS STATEMENT

This case report conformed to the ethical requirements in the Netherlands. The owner of the horse gave permission for using this information and approved the case report.

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REFERENCES

Alexander, E.J., White, I.M. & Horwich, A. (2010) Update on management of seminoma. *Indian Journal of Urology*, 26(1), 82–91. Available from: https://doi.org/10.4103/0970-1591.60451

Becht, J.L., Thacker, H.L. & Page, E.H. (1979) Malignant seminoma in a stallion. *Journal of the American Veterinary Medical Association*, 175(3), 292–293.

Beck, C., Charles, J.A. & Maclean, A.A. (2001) Ultrasound appearance of an equine testicular seminoma. *Veterinary Radiology & Ultrasound*, 42(4), 355–357. Available from: https://doi.org/10.1111/j.1740-8261.2001.tb00954.x

Berman, J.M., Beidle, T.R., Kunberger, L.E. & Letourneau, J.G. (1996) Sonographic evaluation of acute Intrascrotal pathology. *American Journal of Roentgenology*, 166, 857–861. Available from: https://doi.org/10.2214/ajr.166.4.8610563

Brinsko, S.P. (1998) Neoplasia of the male reproductive tract. *Veterinary Clinics of North America: Equine Practice*, 14, 517–533. Available from: https://doi.org/10.1016/s0749-0739(17)30184-0

Brown, I.R., Dunlap, H.J., Nizalik, E. & Schillinger, J.E. (1995) A child with an intra-abdominal testicular teratoma: a case report and review of prepubertal cryptorchid germ cell tumors. *Urology*, 46(6), 863–866. Available from: https://doi.org/10.1016/s0090-4295(99)80359-8

Caron, J.P., Barbeer, S.M. & Bailey, J.V. (1985) Equine testicular neoplasia. *Compendium on Continuing Education for the Practicing Veterinarian*, 7, 53–59.

Christensen, B.W., Ernst, N.S., Powe, J.R., Pozor, M.A., Morton, A.J. & Reinhard, M.K. (2007) Theriogenology question of the month. *Journal of the American Veterinary Medical Association*, 231(4), 531–534. Available from: https://doi.org/10.2460/javma.231.4.531

Cortes, D., Thorup, J. & Visfeldt, J. (2001) Cryptorchidism: aspects of fertility and neoplasms. *Hormone Research*, 55(1), 21–27. Available from: https://doi.org/10.1159/000049959

De Bock, M., Govaere, J., Martens, A., Hoogewijs, M., De Schauwer, C., Van Damme, K. et al. (2007) Torsion of the spermatic cord in a warmblood stallion. *Vlaams Diergeneeskundig Tijdschrift*, 76, 443–446.

De Lange, V., Chiers, K., Lefère, L., Cools, M., Ververs, C. & Govaere, J. (2015) Malignant seminoma in two unilaterally cryptorchid stallions. *Reproduction in Domestic Animals*, 50, 510–513. Available from: https://doi.org/10.1111/rda.12488

Dugat, D.R., Medici, E.L., Rochat, M.C., Arble, J.A. & Snider, T.A. (2015) An unusual case of metastatic seminoma in a dog. *Journal of the American Animal Hospital Association*, 51, 401–406. Available from: https://doi.org/10.5326/jaaha-ms-6263

Edwards, J.F. (2008) Pathologic conditions of the stallion reproductive tract. *Animal Reproduction Science*, 107(3–4), 197–207. Available from: https://doi.org/10.1016/j.anireprosci.2008.05.002

Farjanikish, G., Sayari, M., Raisi, A. & Shirian, S. (2016) Diffuse type testicular seminoma in a stallion. *Comparative Clinical Pathology*, 25(6), 1133–1136. Available from: https://doi.org/10.1007/s00580-016-2316-z

Gelberg, H.B. & McEntee, K. (1987) Equine testicular interstitial cell tumors. *Veterinary Pathology*, 24, 231–234. Available from: https://doi.org/10.1177/030098588702400306

Hayes, H.M., Jr., Wilson, G.P., Pendergrass, T.W. & Cox, V.S. (1985) Canine cryptorchism and subsequent testicular neoplasia: case-control study with epidemiologic update. *Teratology*, 32(1), 51–56. Available from: https://doi.org/10.1002/tera.1420320108

Hecht, S., King, R., Tidwell, A.S. & Gorman, S.C. (2004) Ultrasound diagnosis: intra-abdominal torsion of a non-neoplastic testicle in a cryptorchid dog. *Veterinary Radiology & Ultrasound*, 45(1), 58–61. Available from: https://doi.org/10.1111/j.1740-8261.2004.04009.x

Hogenesch, H., Whiteley, H.E., Vicini, D.S. & Helper, L.C. (1987) Seminoma with metastases in the eyes and the brain in a dog. *Veterinary Pathology*, 24(3), 278–280. Available from: https://doi.org/10.1177/030098588702400315

Hutcheson, J.C., Khorasani, R., Capelouto, C.C., Moore, F.D., Jr., Silverman, S.G. & Loughlin, K.R. (1996) Torsion of intraabdominal testicular tumors. A case report. *Cancer*, 77(2), 339–343. Available from: https://doi.org/10.1002/(SICI)1097-0142(19960115)77:2<339::AID-CNCR17>3.0.CO;2-2

Hutson, J.M., Balic, A., Nation, T. & Southwell, B. (2010) Cryptorchidism. *Seminars in Pediatric Surgery*, 19(3), 215–224. Available from: https://doi.org/10.1053/j.sempedsurg.2010.04.001

Kapoor, S. (2008) Testicular torsion: a race against time. *International Journal of Clinical Practice*, 62(5), 821–827. Available from: https://doi.org/10.1111/j.1742-1241.2008.01727.x

Krueger, C.R., Ruple-Czerniak, A. & Hackett, E.S. (2014) Evaluation of plasma muscle enzyme activity as an indicator of lesion characteristics and prognosis in horses undergoing celiotomy for acute gastrointestinal pain. *BMC Veterinary Research*, 10(Suppl 1), S7. Available from: https://doi.org/10.1186/1746-6148-10-S1-S7

Mostachio, G.Q., Apparício, M., Vicente, W.R.R., Cardilli, D.J., Motheo, T.F. & Toniollo, G.H. (2007) Intraabdominal torsion of a neoplastic testicle and prostatic cyst in a cryptorchid dog. *Schweizer Archiv für Tierheilkunde*, 149(9), 408–412. Available from: https://doi.org/10.1024/0036-7281.149.9.408

Nelson, D.W. & Calley, N. (1987) Torsion of a teratoma in an undescended intra-abdominal testis: ultrasonographic findings. *Journal of Clinical Ultrasound*, 15, 401–404. Available from: https://doi.org/10.1002/jcu.1870150609

Parks, A.H., Wyn-Jones, G., Cox, J.E. & Newsholme, B.J. (1986) Partial obstruction of the small colon associated with an abdominal testicular teratoma in a foal. *Equine Veterinary Journal*, 18(4), 342–343. Available from: https://doi.org/10.1111/j.2042-3306.1986.tb03648.x

20423292, 2024, 8, Downloaded from https://beva.onlinelibrary.wiley.com/doi/10.1111/eve.13956 by Utrecht University, Wiley Online Library on [09/07/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Pasolini, M.P., Della Valle, G., Pagano, T.B., Miele, F., Paciello, O., Fatone, G. et al. (2016) Mature teratoma arising from an undescended testis in a horse: comparison between ultrasonographic and morphological features. *Folia Morphologica*, 75(2), 211–215. Available from: https://doi.org/10.5603/FM.a2015.0088

Pratt, S.M., Stacy, B.A., Whitcomb, M.B., Vidal, J.D., de Cock, H.E.V. & Wilson, D.W. (2003) Malignant Sertoli cell tumor in the retained abdominal testis of a unilaterally cryptorchid horse. *Journal of the American Veterinary Medical Association*, 222(4), 486–490. Available from: https://doi.org/10.2460/javma.2003.222.486

Rambags, B.P.P., Stout, T.A.E. & Rijkenhuizen, A.B.M. (2003) Ovarian granulosa cell tumours adherent to other abdominal organs; surgical removal from 2 warmblood mares. *Equine Veterinary Journal*, 35(6), 627–632. Available from: https://doi.org/10.2746/042516403775467261

Reed, S.M., Bayly, W.M. & Sellon, D.C. (2010) Disorders of the musculoskeletal system. In: Duncan, L., Rudolph, P., Harms, L., Tannian, P., Taylor, J., Corell, S., & Pauls, K. (Eds.) *Equine Internal Medicine*, 3rd edition. St. Louis, Missouri: Saunders Elsevier, 495.

Rijkenhuizen, A.B.M., Lichtenberg, D. & Weitkamp, K. (2018) Cystic intra-abdominal testicles: standing laparoscopic removal in two colts. *Equine Veterinary Education*, 32(8), e130–e135. Available from: https://doi.org/10.1111/eve.13030

Ringdahl, E. & Teague, L. (2006) Testicular torsion. *American Family Physician*, 74, 1739–1743.

Rourke, E., Digman, G., Gourley, E. & Kaushik, D. (2018) Large intra-abdominal seminoma in a left undescended testicle complicated by torsion. *British Medical Journal Case Reports*, 2018, bcr2017222670. Available from: https://doi.org/10.1136/bcr-2017-222670

Schambourg, M.A., Farley, J.A., Marcoux, M. & Laverty, S. (2006) Use of transabdominal ultrasonography to determine the location of cryptorchid testes in the horse. *Equine Veterinary Journal*, 38(3), 242–245. Available from: https://doi.org/10.2746/042516406776866354

Schumacher, J. (1999) Testicular neoplasia of horses: an underreported condition. *Equine Veterinary Journal*, 31, 270–272. Available from: https://doi.org/10.1111/j.2042-3306.1999.tb03815.x

Shaw, D.P. & Roth, J.E. (1986) Testicular teratocarcinoma in a horse. *Veterinary Pathology*, 23, 327–328. Available from: https://doi.org/10.1177/030098588602300315

Strader, C.H., Weiss, N.S., Daling, J.R., Karagas, M.R. & McKnight, B. (1988) Cryptorchism, orchiopexy, and the risk of testicular cancer. *American Journal of Epidemiology*, 127(5), 1013–1018. Available from: https://doi.org/10.1093/oxfordjournals.aje.a114877

Tennant, B. & Kelly, D.F. (1992) Malignant seminoma with gross metastases in a dog. *Journal of Small Animal Practice*, 33, 242–246. Available from: https://doi.org/10.1111/j.1748-5827.1992.tb01128.x

Thorup, J., McLachlan, R., Cortes, D., Nation, T.R., Balic, A. & Southwell, B.R. (2010) What is new in cryptorchidism and hypospadias—a critical review on the testicular dysgenesis hypothesis. *Journal of Pediatric Surgery*, 45, 2074–2086. Available from: https://doi.org/10.1016/j.jpedsurg.2010.07.030

Trigo, F.J., Miller, R.A. & Torbeck, R.L. (1984) Metastatic equine seminoma: report of two cases. *Veterinary Pathology*, 21, 259–260. Available from: https://doi.org/10.1177/030098599402100223

Twiss, C. & Grasso, M. (2000) Abdominal pain associated with an intra-abdominal gonad in an adult. *Reviews in Urology*, 2(3), 178–181.

Uguz, S., Yilmaz, S., Guragac, A., Topuz, B. & Aydur, E. (2016) Association of Torsion with testicular cancer: a retrospective study. *Clinical Genitourinary Cancer*, 14, 55–57. Available from: https://doi.org/10.1016/j./clgc.2015.09.014

Vaillancort, D., Fretz, P. & Orr, J.P. (1979) Seminoma in the horse: report of two cases. *Journal of Equine Medicine and Surgery*, 3, 213–318.

Valentine, B.A. (2009) Equine testicular tumours. *Equine Veterinary Education*, 21(4), 177–178. Available from: https://doi.org/10.2746/095777309x419342

Walton, R.M. & Southwood, L.L. (2013) Abdominocentesis and peritoneal fluid analysis. In: Southwood, S.L. (Eds.) *Practical Guide to Equine Colic*, 1st edition. Pennsylvania: John Wiley & Sons, Inc., pp. 94–95.

Weiermayer, P. & Richter, B. (2009) Simultaneous presence of a seminoma and a leiomyoma in the testes of a horse. *Equine Veterinary Education*, 21(4), 172–176. Available from: https://doi.org/10.2746/095777309x400306

Wood, H.M. & Elder, J.S. (2008) Cryptorchidism and testicular cancer; separating fact from fiction. *Journal of Urology*, 181, 452–461. Available from: https://doi.org/10.1016/j.juro.2008.10.074

Zebeli, Q., Keßner, J., Kliseviciute, V. & Rijkenhuizen, A.B.M. (2015) Dietary approaches to optimize the fasting period before laparoscopic surgery in horses: an overview. *Journal of Equine Veterinary Science*, 35, 701–708. Available from: https://doi.org/10.1016/j.jevs.2015.07.018

Zilberman, D., Inbar, Y., Heyman, Z., Shinhar, D., Bilik, R., Avigad, I. et al. (2006) Torsion of the cryptorchid testis- can it be salvaged? *Journal of Urology*, 175(6), 2287–2289. Available from: https://doi.org/10.1016/20022-5347(06)00329-6

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