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Mature Cystic Ovarian Teratoma in an Arabian Mare

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ABSTRACT

A 9-year-old Arabian mare was admitted due to emaciation and infertility. Transrectal palpation revealed an enlarged left ovary. Ultrasonographic examination (US) showed a heterogeneous image. Blood samples were obtained for biochemical and hormonal analysis. The affected ovary was surgically removed. The mare's cycle was regular, evidenced by estradiol 17β and progesterone levels. After gross- and histopathology, the diagnosis of mature cystic teratoma (MCT) was confirmed. The elevated liver enzymes gradually decreased following the operation coinciding with the mare's improved body condition. The mare became pregnant two months later. Finally, MCT can cause problems with the mare's general health and fertility. The clinical and US characteristics suggested ovarian neoplasm; however, gross- and histopathology are critical for the final diagnosis.

Key words: Neoplasm, Animals, Ultrasonography, Blood, Body Weight Gain.

INTRODUCTION

Teratoma is a rare germ cell tumor found in domestic animals (Knottenbelt et al. 2015). Ovarian tumors are uncommon in mares, accounting for about 5% of all neoplasms (McCue 1985; Charles 2020). Ovarian teratomas are divided into mature cystic teratomas, immature teratomas, monodermal teratomas, and fetal teratomas (Outwater et al. 2001). Mature cystic teratoma is the most common lesion of these tumors. The majority of teratomas shows nonspecific features on ultrasound (US) (Outwater et al. 2001; Sahin et al. 2017). Grossly, MCT is commonly recognized as a unilocular cyst with septa dividing the cyst into many compartments (Caruso et al. 1971; Atwi et al. 2022). Histologically, it has at least two well-separated adult germ cell layers. Because the ectoderm and mesoderm are the most visible layers of germ cells on the tumor wall, mature skin and hair tissue (ectoderm) and fat and muscle (mesoderm) are frequently found in MCTs (Outwater et al. 2001; Catone et al. 2004). Surgical intervention is commonly recommended when an ovarian tumor is identified (Sinha and Ewies 2016). There have been few reports of equine ovarian teratoma in multiparous mares with clinical manifestations, with the majority occurring in nulliparous mares with no clinical signs (Vanhaesebrouck et al. 2010). The current study describes the clinical, morphological, biochemical, hormonal, and histopathological features of unilateral ovarian teratoma in a multiparous Arabian mare, as well as the outcome of unilateral ovariectomy.

MATERIALS AND METHODS

Circumstances relating to animal meet the International Guiding Principles for Biomedical Research Involving Animals as issued by the Council for the International Organizations of Medical Sciences.

A 9-year-old Arabian mare with emaciation and infertility was admitted. The mare had normally foaled four times. The mare failed to conceive (>3 times) after the last foaling (about 7 months ago), exhibiting general weakness and weight loss (body condition score 1, score 0-5, (Red Mills., 2022, Fig. 1). However, the estrous cycle was regular. The mare was subjected to a general health examination. The uterus was examined ultrasonographically (Sonoscape X3V, Hamburg, Germany). The authors recommended unilateral ovariectomy because an enlarged ovary was identified as the primary cause of poor health. The left ovary was surgically removed via conventional flank laparotomy

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performed under sedation and local anesthesia (Adams and Fessler 2000). Ovarian specimens were collected directly and immediately fixed in 10% neutral buffered formalin for 24hrs and embedded in paraffin. Consecutive 4-µm-thick sections were stained with hematoxylin and eosin for histological diagnosis (Bancroft and Gamble 2019). Six blood samples (10mL) were taken from the mare via jugular venipuncture into plain tubes, one at the time of surgery and one every week until the fifth week of surgery. The serum was separated and tested for sodium, potassium, total carbon dioxide, creatinine kinase, sugar, calcium, blood urea nitrogen, creatinine, aspartate aminotransferase, total bilirubin, gamma-glutamyl transferase, albumin, total protein, and globulin using an Automated Biochemical Analyzer VetScan VS2 (Abaxis, California, USA). Serum was also tested for estradiol 17β, progesterone, and testosterone using commercial ELISA kits (Human Gesellschaft für Biochemica und Diagnostica in Wiesbaden, Germany). As a precaution, the uterus was washed with one liter of 2% povidone-iodine when the mare was discharged from the hospital (about 6 weeks after operation).

RESULTS

Temperature, mucosae, and auscultation of the heart, chest, and lungs were all in line with equine standards. There was no enlargement of the lymph nodes or vulvar discharge noted. The uterus was normal in size and consistency upon transrectal palpation and there were no detectable abnormalities by US. The left ovary was large, round, and smooth, whereas the right ovary appeared normal in size and consistency. On US, the left ovary revealed a heterogeneous image with echogenic dispersed reflectors, calcifications, and echogenic spherical masses suggesting an ovarian tumor (Fig. 2). The existed ovary was oval measuring 12cm in length and 7cm in breadth that is encircled by a capsule and contains hair, bone, and semi-oval sebaceous materials and a clotted ball floating in a red liquid (Fig. 3). In sections, multiple benign tissue types emerging from all three germ layers were visible, confirming a case of MCT (Fig. 4). Aspartate aminotransferase and gamma-glutamyl transferase gradually decreased after the operation (Table 1). Testosterone level was undetectable, but estradiol 17β and progesterone levels fluctuated normally (Fig. 5). The mare became pregnant about two months after operation using natural mating.

A variety of hypotheses have been proposed to explain the origin of ovarian teratomas. The most widely accepted theory in human literature is the parthenogenetic activation of oocytes (Oliveira et al. 2004), which can also be applied to equine teratomas. Preoperative misdiagnosis is possible because of the lack of MCT-specific

Fig. 1: The condition of the mare's body when she arrived at veterinary clinics suffering from severe weakness.

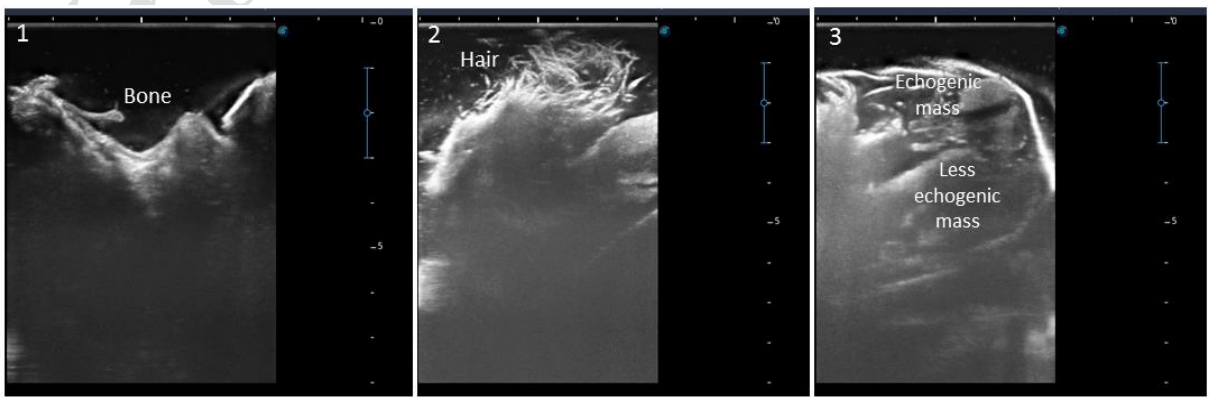

Fig. 2: Ultrasonography (US) of a mature cystic teratoma shows a heterogeneous image with echogenic dispersed reflectors suggesting hairs, calcifications assuming bone, and echogenic spherical masses supposing fat balls and clotted materials.

Table 1: Blood biochemistry of the Arabian mare before and after surgical removal of a mature cystic ovarian teratoma

Parameters	Units	Just before operation	Weeks after operation					Reference values
			1st	2nd	3rd	4th	5th	
Sodium	mmol/L	135	138	136	140	137	139	126–145
Potassium	mmol/L	4.7	5.1	4.5	5.3	3.9	4.6	2.5–5.2
Total carbon dioxide	mmol/L	25	25	24	23	24	26	20–33
Creatinine kinase	IU/L	107	160	136	158	139	129	120–470
Sugar	mg/dL	92	93	89	102	87	83	65–110
Calcium	mg/dL	13	13.4	13.8	12.7	14.6	12	11.5–14.5
Blood urea nitrogen	mg/dL	11	13	12	13	13	14	7–25
Creatinine	mg/dL	0.6	0.9	0.8	1.3	1.1	1.3	0.6–2.2
Aspartate aminotransferase	IU/L	285	214	216	224	223	218	175–340
Total bilirubin	mg/dL	0.7	0.8	0.7	1.2	1.3	1.1	0.5–2.3
Gamma-glutamyl transferase	IU/L	22	22	20	16	16	15	5–24
Total protein	g/dL	7.1	7.8	6.7	6.8	6.9	6.8	5.7–8
Albumin	g/dL	3.1	3.2	3.2	3.5	3.7	3.6	2.2–3.7
Globulin	g/dL	4	4.5	3.5	3.4	3.3	3	2.7–5

Fig. 3: Gross pathology of an ovarian mature cystic teratoma in a 9-year-old Arabian mare revealed several compartments packed with bone, hair, sebaceous balls, clotted blood, and reddish serous fluid in-between (arrow), findings that account for the signal intensity seen at US imaging.

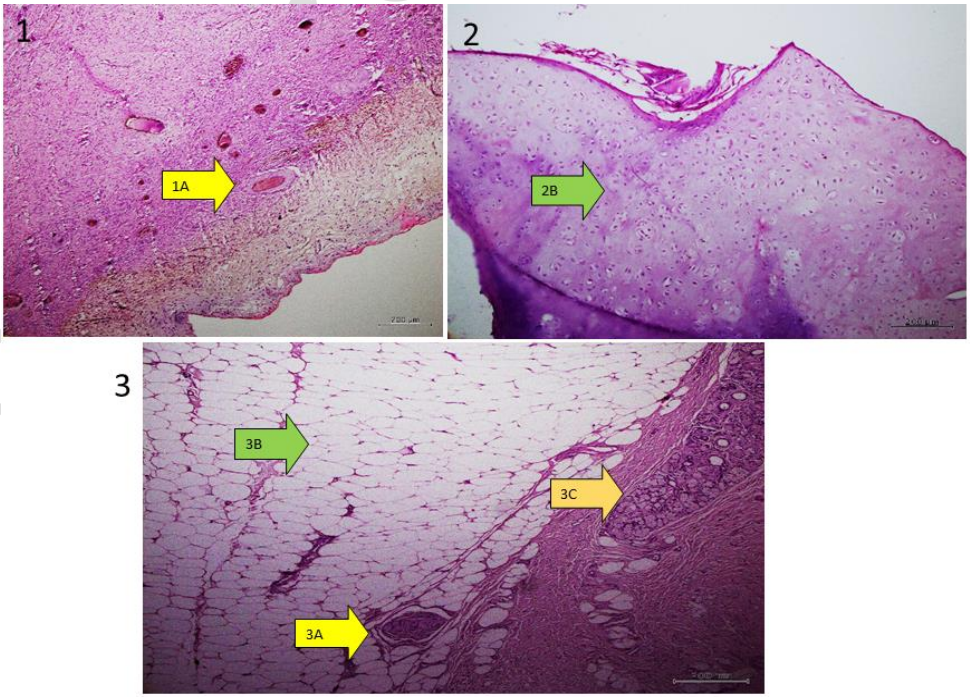

Fig. 4: Sections in tumor tissue formed of mature benign multiple tissue types derived from all three germ layers: ectoderm (1A: hair follicle; 3A: nerves), mesoderm (2B: cartilage, 3B: adipose tissue;) endoderm (3C: glandular tissue).

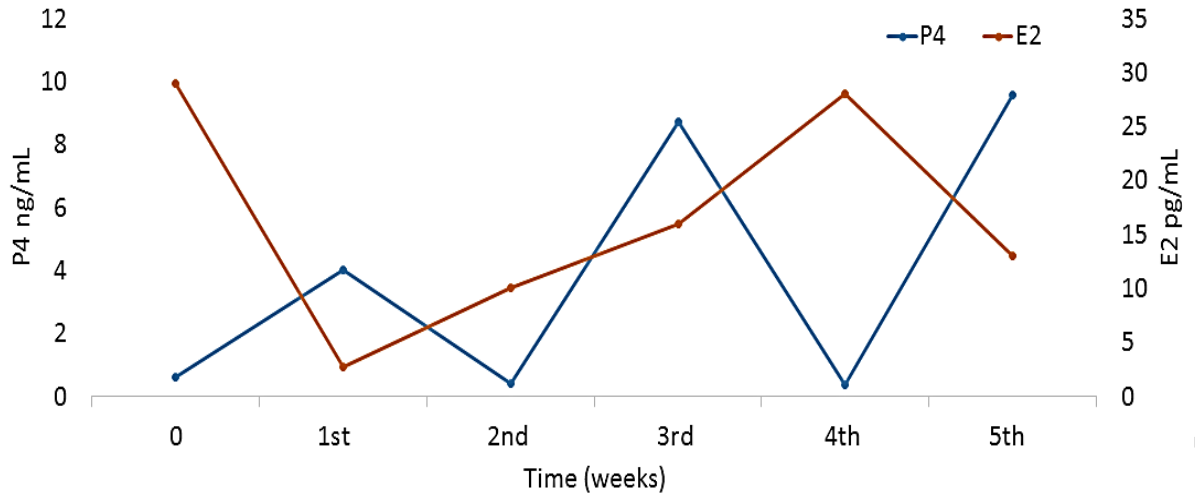

Fig. 5: Estradiol 17β (E2) and progesterone (P4) levels in an Arabian mare's serum after surgical removal of an ovarian teratoma. Week 0: time just before surgery.

symptoms. The fact that these tumors might appear in a variety of ways makes US diagnosis more difficult. CT and MR have an excellent sensitivity (93–98%) because of detecting fat in the diagnosis of MCT (Guerriero et al. 1997; AlGhamdi et al. 2020). Fat is reported in 93% of cases (Buy et al. 1989; AlGhamdi et al. 2020). Differential diagnoses for an enlarged ovary in mares should include both non-tumoral and tumoral conditions. The primary cause of enlarged ovaries is anovulatory follicles. It is most noticeable during the transitional period when the mare displays erratic estrus signs. Ovarian hematomas in mares are typically large. The blood-filled follicle appears hypoechoic at first, then mottled as the blood clot becomes more organized on US (Saleh et al. 2021). An ovarian abscess has a homogeneous hyperechoic appearance surrounded by a thick wall. Teratoma, in comparison with GCT, dysgerminoma, and lymphosarcoma is a tumor with a variety of mature tissues arranged at random throughout the tumor (Panciera et al. 1991; Lefebvre et al. 2005). Teratoma US features may resemble those of GCT, unless the ovarian teratoma contains highly echogenic components, such as bone or teeth. Furthermore, GCT causes hormonal and behavioral changes, as well as a variety of other reproductive issues (McCue et al. 2006; Ali et al. 2014; Singh et al. 2019; Renaudin et al. 2021).

In most cases, ovarian teratomas have no effect on the mare's general health (Panciera et al. 1991; Lefebvre et al. 2005). However, as in this case, symptoms can arise because of the expansive growth of an ovarian tumor, resulting in pressure symptoms, abdominal pain, and tumor adhesions to surrounding structures (Saleh et al. 2021). Additionally, the liver's effect in this sort of tumor is likely to occur, as evidenced by the progressive improvement in liver enzyme performance after the tumor was removed. In a three-year-old mare with ovarian teratocarcinoma that had spread to regional lymph nodes, progressive weight loss, anorexia, lethargy, and mortality were observed (Charles 2020).

The mare had regular estrous cycles prior to referral, which is not surprising given that a teratoma, like other nonfunctional ovarian tumors, does not produce hormones that interfere with reproductive physiology. Tumors originating in ovarian tissues are classified based on their cellular origin: 1) germinal epithelium, 2) stromal sex cord, and 3) germ cell (McCue 1985). Tumors such as adenomas and adenocarcinomas arise from the ovarian surface epithelium in the first category. Because they are non-secretory, they do not cause behavioral changes, and the mare continues to cycle normally and ovulate from the unaffected ovary. Tumors of the sex cord and the ovarian stroma, on the other hand, secrete a variety of hormones such as progesterone, estradiol, and testosterone. The most common ovarian tumor in this category is the GCT.

The question now is whether there is a link between this tumor and the mare's infertility. In fact, the link between ovarian tumors and infertility is a point of contention, owing to the difficulty in determining the true influence of the tumor and its treatment on eventual fertility (Legendre et al. 2014). MCTs and endometritis (Lefebvre et al. 2005), as well as endometriomas and MCTs (Kurt et al. 2019), can coexist. The fact that the MCT is a non-hormone secreting tumor and that the affected mare had a normal estrus cycle and ovulation may support the theory that the infertility was caused by a uterine problem that may or may not be related to the presence of the tumor in the ovary.

Conclusion

In conclusion, mature cystic ovarian teratoma can affect general health and fertility in equines. Restoring general health and fertility is proof that ovarian teratoma has a good prognosis; however, the affected ovary should be removed. Clinical findings, hormonal state, and US can all help with differential diagnosis, but gross- and histopathology is essential for the ultimate diagnosis.

Conflict of Interest

The authors declare that they have no conflict of interest.

Author's Contribution

FA Al-Sobayil: Conceptualization, investigation, biochemical analysis & surgical intervention. A Ali:

Conceptualization, data curation, validation, writing original draft & publishing. DR Derar: Revision, editing and validation. MM Khodeir: Histopathological examination, report writing and data interpretation.

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