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ON A CASE OF AN OVARIAN CYSTADENOMA  
ASSOCIATED WITH A TERATOMA  
(DERMOID) IN HORSE

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INTRODUCTION

Recently the authors encountered an interesting association of teratoma in ovarian cystadenoma of horse. The occurrence of cystadenoma shows a relatively high percentage among ovarian tumors, but the association of teratoma is very rare as compared with the former. Ovarian cystadenomae are classified into the following two well-accepted types: *cystadenoma ovarii glandulare pseudo-mucinosum* and *cystadenoma ovarii papilliferum serosum*. The case presented in this work is unilocular, but belongs to the former type. A dermoid projection was observed in the inside of this cystoma and the teratoma was a tumor-like mass of tissues which was derived from more than one germinal layer.

In general teratoma contains epidermis, hairs, sebaceous glands, sudoriferous glands, cartilages, bones, glandular tissues, adipose tissues, muscular tissues, connective tissues, nerve tissues, etc. In the case investigated by the present authors, hairs and nerve tissues were not recognized, nevertheless it was considered to be a dermoid.

HALBAN et al. stated that such associated cases were detected eight times, 6.4% of 131 cases of women's dermoid; only 5 cases were cystadenoma among them while there were 3 of other types. No ovarian tumor with this association has been found in the veterinary literature, therefore the authors have described the finding inasmuch as it is regarded as a rare case; further, some tumors were briefly discussed in this report for the purpose of comparison.

MATERIAL AND METHOD

The animal which presented this case was a black six year old Percheron mare which was slaughtered at the Sapporo Abattoir in December 1952.

After the fixation of genital organs with 10% formol solution, the materials were macroscopically investigated.

Histological preparations were obtained from various parts of the lesions and embedded in paraffin. Sections were stained with hematoxylin and eosin, v. GIESON's collageneous fiber, WEIGERT's fibrin and MEYER's mucin stains.

## DESCRIPTION

### 1. Clinical History

*Anamnesis* December 1, 1952: Both hind legs of the animal had been swollen for the preceding 10 days and the owner brought her to a veterinarian who diagnosed the case as edema caused by standing. Then all extremities were swollen. Three days ago, she was diagnosed by another veterinarian as heart weakness. Appetite was slightly decreased.

*Present Status* December 1, 1952: Slight malnutrition, depression and edema of extremities were observed. The conjunctivae were anemic and nasal mucous membrane was congested. No conspicuous changes were observed except the accelerated pulse of 74 and the raised temperature of 40.2°C. The blood picture and urinary findings showed no abnormalities.

### 2. Macroscopical Findings

*Right Ovary* The size of the right ovary is about that of a child's head, 28×27×28cm. Ovarian serosa is wet and glossy. Small hen's-egg-sized elevated nodules are scattered on the surface. The nodules feel hard. A large cyst is noticed on the cut surface after ovary is divided into two. The inside diameter is ca. 14×15 cm: the cyst occupies most of the ovary. The cyst cavity is filled with the mass of a large amount of muddy, colloid, chocolate-colored mucus. A proliferation of soft grayish brown tissues is observed at the interior part of the wall. Periphery of this proliferated cut surface is hard, but the central portion is very fragile. The other part of the wall is glossy and dark reddish violet petechiae are scattered on the wall of the cyst. In the inner surface of the cyst, necrotic masses are observed and also a prolonged hard pyramidal projection in the cyst. In its longitudinal section, a red-bean-sized yellowish gray spheroid is noted. Around the tissues of this spheroid is an accompanying cartilage formation. Outside surface of this projection is glossy. Ovarian parenchyma except the cystoma is characterized by an increased thickness due to a proliferation of connective tissue. One side of the wall is comparatively thin, the others thickened. Multiple yellowish gray nodules are scattered and conglomerated irregularly. The nodules are comparatively fragile, glossy and demarcated. The other parts of the ovary are in general wet and glossy, and gray in color.

*Left Ovary* The size of the left ovary is ca. 5.5×4.0×2.0 cm. On the cut surface, multiple small follicles are recognized without any remarkable changes.

*Oviduct* The right oviduct is slightly dilated, but there are no remarkable changes within the left oviduct.

*Uterus* This organ is symmetric. Serosa shows no apparent alterations. After having been opened, uterus presents an aqueous transparent fluid. The mucosa is edematous and

light red yellow or violet in color. Cervix uteri is relaxed and edematous. Vaginal mucosa is wet and glossy.

### 3. Microscopical Findings

*Right Ovary* a) The Wall of the Cystoma: In general, the wall is thickened by proliferation of connective tissue. A part of the wall is abundant in small vessels and congestive, and hemorrhages are often noted. The wall of the scattered large vessels are thickened. Ovarian stroma remnants are apparent. Glandular tissue lies in the ovarian connective tissue. Periglandular and interstitial tissues of gland are made up of loose connective tissue. Especially fibroblasts and fibrocytes are conspicuously proliferated. Cellular infiltration and cell accumulations are conspicuous; mainly composed of such elements as lymphoblasts, plasma cells and often eosinophiles. In these lesions, numerous capillaries and hemorrhages are observed. Siderophages are often noticed in these lesions. The interior gland acini are lined with more than one layer of cells. Glandular cells are polymorphous in shape and size, and show irregular arrangement. Sometimes the presence of syncytium giant cells can be demonstrated.

b) The Grossly Elevated Nodules: These lesions are demarcated. They consist of adenomatous gland tissues which were formed from the disseminatedly scattered glandular tissues. The stroma of the adenoma consists of irregular, branched and reticular connective tissues containing blood capillaries and small hemorrhages. Sometimes hyaline thrombi are recognized in the vessels. In some portions, neutrophils are markedly infiltrated. The adenomatous gland epithelium may be single or multiple layered. Epithelial cells are irregular and degenerative. Occasionally, syncytium giant cells are found in the epithelial cells. In the lumen of the adenomatous gland tissues, hyaline droplets, degenerated cells and calculi are noted.

c) The Thin Wall of the Cystoma: In a part of the inner surface of the cystoma, necrosis and hemorrhages are noticed. These tissues become homogeneous and contain siderocytes. Inner surface of these tissues is covered with thin adenomatous tissues and is situated adjacent to the ovarian stroma.

d) Inner Part of the Cystoma: The wall of the cystoma is distinctly demarcated with adenomatous tissues. Adenoma consists of epithelial tissue irregularly proliferated and of connective tissue stroma. The lumen of the adenomatous gland is occupied by a large amount of fibrinous mucous substance. The substance is positive in WEIGERT's fibrin stain and negative in MEYER's mucin stain. Contents of the cystadenoma consists of a large number of degenerated cell masses, marked infiltrated neutrophils and sometimes hemorrhages and calculi. The adenomatous gland epithelium shows polymorphy in respect to shape and size. The stroma of adenoma consists of loose connective tissue containing blood capillaries. Infiltration of small lymphoid cells is remarkable in the stroma. Hyaline thrombi are spottedly detected in small vessels. The central portion of cystadenoma is occupied by necrotic mass and filled with a large amount of fibrinous mucous substance. Also hemorrhages and calculi are noted. In the intermediate zone of cystadenoma, reticular structures are still discernible, but they show marked mucoid degeneration. The presence of syncytium giant cells, macrophages, siderophages, erythro-

phages, and sometimes so-called seal-ring cells is demonstrated in it.

e) The Projection: In the centrum of the projection, a red-bean-sized spherical cavity is found containing numerous desquamated keratinized epithelial cells. These epithelial cells are yellowish in V. GIESON'S stain. The edge of the cavity is covered with keratinized flattened epithelial cells. Sebaceous glands are noted in the subepithelial tissue. The tissue around such a sebaceous gland is similar to that of the corium. Collagenous fibers are loose and mixed with a large number of fine and rough fibers. These fibers are reddish in V. GIESON'S stain. Elastic fibers are not recognized. Small arteries, veins and capillaries are also noteworthy in the projected tissue and lumina of such vessels are empty. In another part, there are some muscular tissues and adipose tissues like an island. In the loose connective tissue, large siderocytes, fibroblasts and round cells are infiltrated. Around the spherical cavity, there is a cartilage formation. Cartilage cells have irregular arrangement and also multiple caverns like those in bone marrow are noticed in the cartilage. In the inner surface of such a cavern, osteoblasts are accumulated and the inside of the cavern edge is vacuolated like a honey comb. Bone trabeculae formation is noted in the part of the cavern edge. Also gland tissue with a lining of one epithelial layer is recognized in a part of this projected organ.

*The Other Genital Organs* The other genital organs show no outstanding changes.

#### DISCUSSION

It is apparent from the above description that the main lesion of the ovarian tumor reported in the present paper is a cystadenoma and is secondarily an association of teratoma. But an associated case of teratoma is a very interesting rare case. The centrum of this adenoma has been destroyed and also absorption is occurring. The tumor has formed a unilocular cystadenoma. The projection in the inside of the cystoma consists of many germinal layers, such as epidermis, sebaceous glands, cartilages, bones, muscular tissues, adipose tissues, connective tissues, blood vessels, etc. This tumor lacks hairs and nerve tissues, but the authors consider it as a dermoid projection, for it includes skin and accessory skin structures. It is a mixed tumor and is to be regarded as teratoma (dermoid). As for ovarian cystadenomae, two types are well known. The tumor now under consideration is categorized into the *cystadenoma ovarii glandulare pseudomucinosum* class. But the division is not important since the classification is evidently based on no essential differences. Observed from the viewpoint of histology, the present adenoma is lined with columnar or high cuboidal epithelium producing the fluid contents and this epithelium shows some resemblance to the cup cells in the intestine. These epithelial cells have a bright nucleus. In the adenoma the cyst is found to contain fluid rendered turbid by the presence of many desquamated cells or of hyaline, fibrinous, frequently blood-stained mucus. Epithelial structures have the arrangement of acini. In the centrum of the

adenoma, necrosis, hemorrhages and calculi are notable. Necrotic tissues are replaced by a degenerated cell mass and the above described secretion. The adenoma had become a large cavity due to the absorption of its central part. In the periphery of the tumor, remnants of papillomatous adenoma tissues are found. An adenoma of this type is like that of the papillomatous pseudomucin-cystoma class according to PFANNENSTIEL. On the other hand, it is easily distinguishable from the *cystadenoma ovarii papilliferum serosum* which in general have dark nucleus and occasionally display ciliated epithelia. But the present case is characterized by cells showing a great variation in shape and size, numerous bright or dark nuclei and some of them containing giant cells. This type of tumor is generally benign, but in the present case, the polymorphous appearance of the epithelial cells indicates a slightly malignant tendency. However, rupture and metastasis could not be recognized. In the ovary some epithelial growth is very commonly cystic. Ovarian adenoma also frequently occurs and it is noted that its weight becomes more than 20~30 kg or sometimes even 90 kg (KITT). In the present case the tumor was about the size of a child's head. According to TAMASCHKE's publication, the percentage of the occurrence of adenoma and cystadenoma shows following percentage against the occurrence of all sorts of tumors in each of various animals: horse 4.1, cattle 6.6, sheep 29.8, pig 12.9, dog 14.4 and cat 8.7%; the percentage is rather high. Ovarian cystadenoma have already been reported in horse, cattle, pig, dog and domestic fowl by many workers. SECHER stated that he had found in rat a very rare case of papillomatous ovarian cystadenoma which was carcinomatized, but had no metastasis. BOUCEK recognized two cases in pig; the one was multilocular hen-egg-sized, the other papillomatous. LÁSZLÓ found an ovarian pseudocystofibroma and adenoma in a 4 weeks old calf. In domestic fowl, BUCHHOLZ reported an ovarian adenoma which was considered to be derived from PFLÜGER's cords. JOEST and ERNESTI reported in hen a child's-fist-sized adenoma which weighed 135 g. This adenoma had multiple fibrous loculi and was lined with stratified cuboidal epithelium. The stroma was accompanied by hemorrhages and the centrum of this tumor showed necrosis. In the authors' present case, solid adenoma space was enlarged to form cyst due to the great amount of secretion and partly to the absorption of ovarian central necrosed mass caused by circulatory disturbances such as multiple hyaline thrombi. The authors consider that the development of solid adenoma and cystadenoma are both attributable to the same origin. The cystadenomae are derived from solid or tubular ingrowths of the superficial germinal epithelium, and not from the Graafian follicles nor from the so-called PFLÜGER's cord, which belongs to the group of ova and epithelial cells. But the mechanism of this development cannot now be completely explained.

On the other hand, a teratoma is, to speak in general, composed of tissue derived from more than one germinal layer, and not infrequently all three germinal layers are represented. Teratoma may contain tissues of great complexity, such as imperfectly formed skin, teeth, bone, cartilage, glandular epithelium, ganglia, etc. due to the development of some misplaced and isolated embryonic structure.

The teratoma of the present authors' case consisted of tissues from the three germinal layers such as epidermis, sebaceous glands (ectodermal tissues), connective tissues, adipose tissues, cartilages, bone, vessels, muscular tissues (mesenchymal tissues), corium and endothelium (mesodermal tissues), etc.

A simpler form of teratoma is known as a dermoid cyst and may occur in almost any place, but it is perhaps most common in the ovary; it is the most common form met with in animals. GURLT, BRUCKMÜLLER and SIEDAMGROTZKY, according to JOEST, had observed the dermoid cyst in horses. JOEST himself reported finding a fist-sized special cystic ovarian teratoma in horse which was, histologically, made up of hairs, sebaceous glands, stratified cuboidal epithelium with sudoriferous glands and connective tissues. In the other part of JOEST's tumor, some cysts were lined with cuboidal or flattened epithelium and the others with branched alveolar glands. In the other part of the cystic wall, pigmentation and similar alimentary gland tissues were detected. Furthermore a spindle-cell sarcoma in the ovarian parenchyma was noted. BOUCEK investigated histologically 35 tumor cases of various animals and found 5 ovarian tumors among these cases; as a very rare case, he described a unilocular egg-sized teratoma in pig as one of these 5 cases. Most of the content of his teratoma was easily liquified by ether, chloroform and benzol. Histologically his teratoma consisted of such elements as epidermis, digestive organ and respiratory canal.

As to the description of teratoma (including solid teratoma), KITT described a man's-head-sized carcinomatous and papillomatous teratoma. The content of that teratoma had a fist-sized hair ball, cartilages, bones, epithelium and connective elements. Epithelial elements showed metastasis in the abdominal cavity.

In his treatment of two cases of marked development of ovary, WYSSMANN described one case of mixed tumor in calf. Histologically that tumor consisted of calcified mucous tissue, cartilages, adipose tissue, similar follicular cyst, Graafian follicles without ova, one layered cuboidal epithelium and serous cyst which had round cell accumulations.

MARAJEW observed an egg-sized ovarian teratoid in a 5 months pig which had died from hog cholera (intestinal type). That teratoid consisted of connective tissue, adipose tissue, cartilage, gland tissue and mesodermal derived mass. The

cell elements also included immature cells. As an occurrence of teratoma apart from ovary, SCHMINCKE reported a goose-egg-sized teratoma which was situated in one part of the mesenterium in the body cavity of a young cock.

It is an interesting point that the situation of the tumor now under discussion is at the same place where it is frequently observed in human teratoma. As above noted, apparently there are many reports of teratoma, but the percentage of occurrence is very rare.

According to TAMASCHKE's publication, the occurrence of ovarian teratoma was 2 out of 1222 tumor cases in horse while no cases out of 1241 and 114 cases in cattle and sheep respectively were mentioned; no cases were recognized in dog and cat from among, respectively, 1925 and 156 tumor cases.

Teratoma are structures of every degree of complexity, composed of some organs and its appendages. The component of neoplastic tissues must have been obstructed in the very early stages of the embryonal development; it is considered that they may have been formed in either immature or mature stages.

As above noted, the authors' case presents two types of tumor, ovarian cystadenoma and teratoma (dermoid). It is a very interesting point whether these two tumors were developed separately then associated with one another or whether the adenoma was secondarily developed from the teratoma tissue. But in this case, the teratoma is limitedly existed as dermoid and it does not show any multiple occurrences. Moreover, the authors could not recognize any transitional pictures of the teratoma to adenomatous tissues or disseminated teratoma tissues.

The authors' case, as noted above, is composed of two completely different types of tumor mass, so the authors consider it preferably as an associated case. Though the association of teratoma (specially dermoid) with cystadenoma is of frequent occurrence in women, association with pseudomucincystoma is very rare. In the domestic animals they are even more rare. Generally, as these tumors grow to enormous size, obstructions occur in the adjacent organs.

DIDER reported, according to BOUCEK, the fatal blocking of the rectum caused by a child's-head-sized ovarian cystoma; BLUMENTRITT reported that the stalk of a tumor completely coiled itself round the colon in the ovarian tumor of an old military horse. The occurrence of bilateral ovarian tumor results in sterility. According to JOEST's publication, SCHLEGEL observed nymphomania caused by ovarian cystoma in mare.

Occurrences are well known of abdominal rupture of tumor or carcinomatous peritonitis caused by carcinomatized tumor.

## SUMMARY

1. The authors made a pathological investigation of the case of an ovarian tumor in a horse and decided that it should be considered as an associated case of teratoma (dermoid) and cystadenoma.

2. The principal composing element in the composition of the present ovarian tumor was a unilocular cystadenoma. This was classified to the *cystadenoma ovarii glandulare pseudomucinosum* in its character but it resembled the form of PFANNENSTIEL's papillomatous pseudomucincystoma.

3. The teratoma (dermoid) was comprised of three germinal layers, including tissues recognizable as belonging to such parts as epidermis, sebaceous glands (ectodermal tissues), connective tissues, adipose tissues, cartilages, bone, vessels, muscular tissues (mesenchymal tissues), corium and endothelium (mesodermal tissues), etc. In addition to the foregoing points it should be noted that the tumor lacked hairs and nerve tissues.

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## EXPLANATION OF PLATE

- Fig. 1. Naked eye appearance of the genital organs of the case.
- Fig. 2. The cut surface of right ovary showing the tumor mass.
- Fig. 3. Right ovary showing the pyramidal projection (teratoma) in the inside of a large cyst (cystoma).
- Fig. 4. The adenomatous tissue. H-E stain.  $\times 130$ .
- Fig. 5. A part of the teratoma (dermoid) showing epidermis, corium-like tissue and adipose tissue. H-E stain.  $\times 130$ .
- Fig. 6. A part of the teratoma showing cartilaginous tissue and bone-marrow-like tissue; trabeculae formation is observable at the edge of cavern. H-E stain.  $\times 100$ .

