Cyst Formation in Mesosalpinx, Mesovarium and Fimbria in Cows and Sows

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Abstract. Macro- and microscopic findings were obtained on cysts formed in the reproductive organs, particularly the mesosalpinx, mesovarium, and fimbria, of 709 cows and 791 sows. The number of cysts totaled 815 for the cows and 525 for the sows, with relative frequencies of 32.3% and 29.3%, respectively. The majority of the cysts measured below 5.9 mm in diameter, with 3 very few large cysts measuring over 10 mm in diameter. With regard to the location of the cysts, the highest incidence of cysts was found in the fimbria in cows (81.0%) and in the mesosalpinx in sows (62.9%). In both species, the incidence of the cyst formation in the mesovarium was lower than that in either mesosalpinx or fimbria. So-called parovarian cysts were quite rare. The cysts were classified into 3 types histologically and into 2 types on the basis of cyclic changes in their epithelia. In the latter classification, one type responded to sex hormones, along with the tubal epithelium which was classified as the cyclic change type. The other type did not respond to sex hormones and was classified as the non-cyclic change type. Because of its locality and response to sex hormones, the cyclic change type was regarded as of paramesonephric origin, whereas the non-cyclic change type was of mesonephric origin. Animals with cysts which gave pressure upon the oviducts exhibited histological changes, including partial atrophy or lack of folds in the tubal mucosa.

In general, cysts were reported to be frequently generated in the neighboring tissues of the ovary or oviduct [2, 4-6, 10, 11, 15, 17, 18]. Since any detailed investigation has hardly been conducted on them, their clinical importance or their origin is not so clear.

Since 1962, pathological studies have been performed on the reproductive organs of cows and sows. Many cysts were found around the ovaries and oviducts. Some of them caused constriction of the oviducts.

The present study was carried out to make clear the actual condition of cysts around the ovaries and oviducts in cows and sows, and to classify the cysts according to their origins.

Materials and Methods

Over a period from April, 1962 to September, 1978, reproductive organs were collected from 709 cows and 791 sows at a slaughterhouse in Tottori Prefecture (Table 1). Breeding or clinical history or age was unknown in any animal. As soon as possible after slaughtering, cysts formed in fimbriae, mesosalpinx and mesovarium were surveyed carefully. Sexual cycles were decided in all the animals by macroscopic findings of corpora lutea and follicles. The site of formation, number, size, and shape of each cyst were recorded. The cysts in the mesosalpinx were divided into types, A, B and C. Type A cysts were located apart from the oviduct, type B adjacent to the oviduct, and type C at such site as to give pressure upon the oviduct.

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Cysts with their neighboring tissues were fixed in 10% formalin to prepare paraffin sections 5 μ thick, which were stained with hematoxylin and eosin, Azan, and Weigert stain. Some of them were fixed in Carnoy’s fluid to examine for PAS reaction.

Results

1. Macroscopic findings

Of the 709 cows, 229 (32.3%) were found to have cysts which totaled 815. A total of 525 cysts were found in 232 (29.3%) of the 791 sows. The total number of cysts was larger in the cows than in the sows, although the incidence was approximately the same between the two species. With regard to the location of cysts, the highest incidence was found in the fimbria and its vicinity in the cows (81.0%), and in the mesosalpinx in the sows (62.9%). The incidence of cysts in the mesovarium was low, or less than 3%, in the two species.

Cysts giving pressure upon the oviduct were found a little less than 1% of the cows and nearly 3% of the sows (Table 1). There was no marked difference in the incidence of cysts between the right and the left side of the body (Table 2).

Cysts were mostly below 5.9 mm in maximum diameter. A few cysts were over 10 mm in diameter (Table 3). The largest one that existed in the fimbria of a sow was approximately 50 mm in diameter, as shown in Fig. 1. Most cysts were spherical or oval in shape, and existed in ligaments and the submucosa of the fimbria which they were buried in or attached to. Small pedunculated cysts were also seen (Fig. 2).

It was impossible to detect a high incidence in any sexual phase or such alteration in incidence as related with the sexual cycle.

2. Microscopic findings

Histologically, cysts in the mesosalpinx and mesovarium were composed basically of a central cavity surrounded by monolayer epithelium, lamina propria, muscular layer, subserosa, and serous membrane, which was the superficial layer of the cyst. Cysts in the fimbria had an outer superficial layer composed of the serous and mucous membranes of the fimbria.

The muscular layer was underdeveloped in cysts, especially those in the fimbria. It was frequently absent. The epithelial cells were simple, squamous, cuboidal, or columnar in shape. The columnar epithelial cells

<table>
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<tr>
<th>Table 1. Incidence of cysts by the region</th>
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<tr>
<td>Region</td>
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<tr>
<td>----------------</td>
</tr>
<tr>
<td>Mesosalpinx</td>
</tr>
<tr>
<td>Type A⁠(1)</td>
</tr>
<tr>
<td>Type B⁠(2)</td>
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<tr>
<td>Type C⁠(3)</td>
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<tr>
<td>Mesovarium</td>
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<td>Fimbria</td>
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1) Cyst is located apart from the oviduct.
2) Cyst is adjacent to the oviduct.
3) Cyst is putting pressure upon the oviduct.

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<th>Table 2. Bi- and unilateral incidence of cysts</th>
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<tr>
<td>Region</td>
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</tr>
<tr>
<td>Bilateral</td>
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<td>Unilateral</td>
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<td>Right side</td>
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<td>Left side</td>
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<td>Total</td>
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<th>Table 3. Size of cysts</th>
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<td>Diameter (mm)</td>
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</tr>
<tr>
<td>Below 1.9</td>
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<tr>
<td>2.0-5.9</td>
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<td>6.0-9.9</td>
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<td>10.0-13.9</td>
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<td>14.0-15.9</td>
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<tr>
<td>Over 16.0</td>
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<td>Total</td>
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were mostly ciliated or secretory.

Occasionally undifferentiated cells with lucent cytoplasm appeared at the base of the epithelium. The cuboidal epithelial cells contained a few or no ciliated cells. None of the squamous cells were ciliated.

The cysts were divided into three types, 1 to 3, according to the shape of epithelium and lamina propria. In Type 1 the epithelium had ciliated cells and the lamina propria formed folds (Fig. 3). In Type 2 ciliated cells existed, but no folds were formed (Fig. 4). In Type 3 neither ciliated cells nor folds were seen (Fig. 5).

Further histological examination was performed on 58 cysts of 29 sows. Cyclic changes in the epithelium were observed in most cysts of Types 1 and 2 (cyclic-change type; Fig. 6). No cyclic changes were found in any cyst of Type 3 (non-cyclic change type; Fig. 5). Fig. 7 shows the epithelium of the oviduct in the secretory phase. Cysts of non-cyclic change type coexisted with those of cyclic-change type in the mesosalpinx. The former could be distinguished from the latter only in the follicular and the luteal phase. In these sexual phases, the epithelium of the oviduct and cysts of cyclic-change type were characterized by the presence of low ciliated cells and secretory cells projected beyond these cells to show a bulbous herniation into the lumen of the oviduct and often carrying nuclei with the bulbous herniation. The epithelium presented no such characteristics in cysts of non-cyclic change type. In the cyst of cyclic-change type and the oviduct, the epithelium exhibited periodical changes and essentially the same histological cycles.

Fig. 8 shows the regions of generation of cysts of both types. In the fimbria, only cysts of cyclic change type were generated. In the mesovarium and mesosalpinx, cysts of the two types were generated together.

Type B cysts caused no histological disturbance of the oviduct when generated in the vicinity of this organ. Some Type C cysts gave pressure upon the oviduct, which presented partial atrophy and lack of folds. This pressure was so slight that no obstruction of the lumen was observed in the oviduct (Fig. 9).

Discussion

Number, size and location were examined on cysts located in mesosalpinx, mesovarium and fimbria of cows and sows. There was a small difference in the incidence of cysts at a given location between cows and sows. In terms of morphology, locality, and histological changes, however, all the cysts were regarded as products of the same origin in both species. Generally, the origin of cysts in the female reproductive organs is assumed to be the proliferation of remnants of mesonephric duct systems or of paramesonephric tubes, germinal epithelia, endometria, vaginal epithelia, lymphatic vessels, etc. For the cysts of mesonephric or paramesonephric origin, the terminology varied greatly from one author to another, causing a considerable confusion. Accordingly, an attempt was made in this investigation to classify the cysts as follows.

1) Embryological terms: Müllerian duct cyst [8], Mesonephric or Wolffian cyst [9].
2) Anatomical terms: a) Embryonal vestiges—Parovarian cyst [1, 6, 8, 11, 14, 18], Epooophoron cyst [8, 15], Paroophoron cyst [8], Cystic vestige [8], Cyst of or in Gartner's duct [3, 11], Gartner's duct cyst [20], Cystic Gartner's duct [11]. b) Others—Cyst in mesovarium [4], Cysts in mesosalpinx [6, 10], Cyst in oviduct wall [6, 10], Fossa cyst [15], Fimbrial cyst [15, 16], Hydatides terminales [12, 17].

3) Morphological terms: Pedunculated cyst [7, 17], Intraligamentous cyst [7].

4) Others: Hydatids of Morgagni [8, 12, 14, 17, 18], Non-follicular cyst [15].

As stated previously, the terminology of the cysts is so various and abundant, and no suitable nomenclature has been found that can imply the features of the cysts. Gardner et al. [7] classified the cysts of various origins to propose a new nomenclature. They divided the cysts into two groups of paramesonephric and mesonephric origin, respectively, the latter group consisting of mesonephric-duct cysts and mesonephric-tubule cysts. They further confirmed that some of the secondary invaginations which formed the anlage of the fimbria never reached the main duct but remained as patent lumina in the mesovarium or mesosalpinx.

Sternberg [19] reported that the accessory Müllerian duct vestiges occasionally persisted in the vicinity of the atrophic duct and tubules of the mesonephros. In the present investigation the coexistence of mesonephric and paramesonephric retention was also confirmed in the mesovarium of the sow (Fig. 10). Pointing out the difference in cysts between mesonephric and paramesonephric origin, Gardner et al. [7] reported that the epithelium of the cyst of this origin demonstrated the same response to sex hormones as the tubal epithelium, but that the epithelium of the cyst of that origin showed no such response.

In this study, the cysts located in the mesosalpinx, mesovarium, and fimbria were classified into two types. Cysts showed epithelial changes in response to sex hormones in the cyclic-change type, but failed to show such change in the non-cyclic change type.

On the basis of the histological features, especially epithelial changes in response to sex hormones, of cysts in cows and sows, the cysts of cyclic change type were regarded as of paramesonephric origin, and those of non-cyclic change type as of mesonephric origin. Veterinary reports published on these retention cysts are a few, and the majority of them were limited to the review of genetic facts [4, 10–12, 16–18], Parovarian cysts have frequently been found, particularly in cattle [18, 22]. Sisson and Grossman [17] reported that the paroophoron did not uncommonly give rise to cysts. Studying genital abnormalities in swine, Wiggins et al. [21] found rudimentary male ducts in the broad ligaments in 8.9% of 3,476 animals. Einarsson and Gustafsson [6] noticed parovarian cysts in 14% of 1,000 animals examined. Williams [22] reported that, in mares, vestigial mesonephric remnants occasionally resulted in cystic tumors (as in the case of cows) and that, in rare instances, these tumors induced fatal incarceration when pedunculated parovarian tumors looped about the rectum. Similar tumors to these have been observed in human beings [14].

In the present series of experiments, neither looping pedunculated cysts nor tumor was observed about any abdominal organ. There is a noted difference in the incidence of parovarian cysts between previous reports [6, 18, 22] and the present paper. For example, the incidence of cysts in the mesovarium was very low in the latter. So that what appeared to be a parovarian cyst was
rare in both sows and cows, because the parovarium was anatomically part of the mesovarium in both species. With regard to the clinical importance of the parovarian cysts, Nalbandov [13] mentioned that obstruction of the oviduct by embryonal rests of the Wolffian duct system resulted in hydro- and pycosalpings in female swine, and that at the site of occlusion of the oviduct on one-third of the tube, remnants of vas deferens tissue were demonstrated histologically in two cases. In the cases studied, cysts that impinged upon the tubal lumen induced such pathological changes as partial atrophy and lack of villi. These changes are consistent with those mentioned by Nalbandov [13] and may be associated with reduced fertility. As Einarsson and Gustafsson [6] asserted, it is highly probable that cysts localized to the infundibulum or its fimbria, particularly large cysts approximately 50 mm in diameter that occupy a large portion of fimbria, may impair the function of the infundibulum at the time of ovulation.

References

要約

牛および豚の卵管閉塞、卵巣閉塞および卵における囊胞形成；津村 崇・佐木博一・南 三郎・野並耕志・仲田茂樹（鳥取大学農学部畜外科教室）——1962年4月より16年間にわたり県内と畜場より蒐集した牛709頭、豚791頭の雌性生殖器について、とくに卵巣および卵管周囲に発生する囊胞を肉眼的・組織学的に検索したところ、牛に815個、豚に525個の囊胞の発生がみられ、発生率は牛の73.5％、29.3％であった。発生部位は牛では囊に多く（81.0％）、豚では卵管周囲に多くみられ（62.9％）、卵巣閉塞においては牛・豚とともに発生率は極めて低く、いわゆるparovarian cystの発生は稀であった。卵管閉塞に発生した囊胞で卵管を圧迫していたものは牛では6個、豚で14個みられた。組織学的には囊胞は3型に分類されたが、性周期との関連性を追求したところ、囊胞は性周期反応を示すもの（反応型）と、全く性周期反応を示さないもの（無反応型）に分類された。反応型囊胞上皮の性周期反応は、卵管上皮のそれと極めて類似していた。それらを発生部位的に観察したところ、前者は卵巣閉塞および卵管閉塞に発生し、囊の発生はみられなかった。また前者は卵巣内にも発生がみられたが、囊が集中する傾向がみられた。これらの囊胞はその発生部位および組織学的特徴から反応型は黄体由来、無反応型は中腸由来のものと考えられた。囊胞による卵管閉塞例においては、いずれも卵管閉塞に至ったものは認められなかった。しかし卵管ヒダの部分的萎縮および消失が認められた。

Explanation of Figures

Abbreviations for All Figures

ccc: central cavity of cyst.
cy: cyst.
me: mesovarium.

pc: pedicle of cyst.

ov: ovary.

ut: uterine tube.

Fig. 1 Three cysts in fimbría (sow). The cyst on the left side is the largest of the three (about 50 mm in diameter).

Fig. 2. Pedunculated cyst in mesovarium (sow).

Fig. 3. Type 1 (sow): epithelium has ciliated cells and lamina propria with folds formed.

Fig. 4. Type 2 (sow): ciliated cells exist, but no folds have been formed.

Fig. 5. Type 3 (sow): non-ciliated cells and folds. No cyclic changes are observed in epithelium (non-cyclic change type).

Fig. 6. Cyclic-change type (sow): epithelium shows characteristic changes, secretory cells are pro-

jected beyond ciliated cells, and a bulbous herniation is noticed in the lumen of the tube. A number of undifferentiated cells are present at the base of epithelium.

Fig. 7. Epithelium of the oviduct in the secretory phase (sow).

Fig. 9. Cyst putting pressure upon the oviduct (sow). Atrophic change and lack of folds (arrow) are observed on the pressed side.

Fig. 10. Coexistence of mesonephric (small arrows) and paramesonephric retentions (large arrow) in the mesovarium (sow).