

## Treatment of ovarian cysts in sows – a field trial

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**ABSTRACT:** Different procedures of treatment of large follicular ovarian cysts in 177 sows using GnRH, hCG and  $\text{PGF}_{2\alpha}$  are evaluated in this study. Ovarian cysts were diagnosed by transcutaneous ultrasonography, which was a part of routine pregnancy diagnosis. No treatment was performed in the control group (Group 1,  $n = 29$ ); the method of treatment used in the other groups immediately after the diagnosis was intramuscular administration of leirelin in doses 50  $\mu\text{g}$  (Group 2,  $n = 28$ ), 100  $\mu\text{g}$  (Group 3,  $n = 27$ ) and 200  $\mu\text{g}$  divided into 2 equal doses administered at a 12-hour interval (Group 4,  $n = 25$ ) and of hCG in doses 1 500 IU (Group 5,  $n = 23$ ), 3 000 IU (Group 6,  $n = 21$ ), and 250  $\mu\text{g}$  of cloprostenol (Group 7,  $n = 24$ ). Insemination rate (IR), conception rate (CR) in inseminated sows, pregnancy rate (PR = recovery rate), treatment-insemination interval (TII) and treatment-pregnancy interval (TPI) within 42 days after the initial examination were evaluated. In addition PR in groups of sows divided according to parity (1–3, 4–6 and  $\geq 7$ ) were also evaluated. IR and PR were higher in Group 4 (84.0% and 44.0%) and lower in Group 1 (17.2% and 6.9%) in comparison with the other groups ( $P < 0.001$  and  $P < 0.05$ ). CR, TII and TPI did not differ between the experimental groups. PR were similar in sows with different parity. The study proved a positive response in sows with large follicular ovarian cysts to the treatment consisting of 2 administrations of 100  $\mu\text{g}$  GnRH at a 12-hour interval.

**Keywords:** cystic ovaries; swine; GnRH; hCG;  $\text{PGF}_{2\alpha}$

Ovarian cysts are a serious fertility disorder in sows which affects 2.4–40% animals (Vandeplassche et al., 1971; Kudlac, 1980; Schmidt et al., 1995; Castagna et al., 2004). Follicular cysts originate from follicles which do not ovulate but continually grow (Ryan and Raeside, 1991) until they exceed a diameter of 11 mm (Vandeplassche et al., 1971; Keenan, 1975; McEntee, 1990). A diameter range of 15–60 mm was described (Martinat-Botte et al., 1996). Luteal cysts arise from ovulated follicles, presumably due to the premature closure of the ovulation site (McEntee, 1990) and are assumed to develop from overgrown corpora haemorrhagica (Kauffold and Althouse, 2007). Follicular cysts can be single, multiple, unilateral or bilateral. They vary in size (Ryan and Raeside, 1991) and in the degree of luteinization (Ebbert and Bostedt, 1993). Single cysts can coexist with normal follicles and corpora lutea and appear to cause little interference with the

cycle length (Nalbandov, 1952; Ryan and Raeside, 1991). Multiple large or small cysts without corpora lutea in ovaries are common and are always associated with temporary or permanent infertility (Nalbandov, 1952; Vandeplassche et al., 1971; Kudlac, 1980; Heinonen et al., 1998).

There are no pathognomic clinical signs for cystic ovaries in pigs. Symptoms of this disorder include anoestrus and irregular and/or prolonged oestrous cycles (Bollwahn, 1975; Kudlac, 1980; Bostedt, 1988; Ryan and Raeside, 1991; Schmidt et al., 1995; Martinat-Botte et al., 1996; Castagna et al., 2004). Nevertheless, sows with a low number of cysts on ovaries can show typical oestrous cycles with ovulations and they can be fertilized (Vandeplassche et al., 1971; Dorka and Plonait, 1995; Martinat-Botte et al., 1996; Castagna et al., 2004). However, it leads to decreased farrowing rates as well as smaller litter sizes and it is a source of subfertility in sow herds

(Waberski et al., 1999). In addition, the spontaneous regression of larger ovarian cysts after their luteinization was described (Liptrap and McNally, 1977; Dorka and Plonait, 1995).

Various symptoms of the disorder and limited possibilities of clinical examination of sows make it difficult to diagnose ovarian cysts *in vivo*. Rectal palpation (Bollwahn, 1975; Toriumi et al., 1996), transrectal ultrasonography (Dorka and Plonait, 1995; Moriyoshi et al., 1996; Waberski et al., 1999) and laparoscopy or laparotomy (Schmidt et al., 1995) can be used to diagnose ovarian cysts in sows, but these methods are not common in practice. However, some authors favour transrectal scanning for assessing the ovaries (Soede et al., 1992; Knox and Rodriguez-Zas, 2001). Since transcutaneous ultrasonography was established as a diagnostic tool for ovaries in sows (Weitze et al., 1989), it has been used successfully for the diagnosis of ovarian cysts (Schmidt et al., 1995; Waberski et al., 1999; Castagna et al., 2004; Kauffold et al., 2004; Kauffold and Althouse, 2007). Follicular ovarian cysts are defined as anechoic structures with smooth, thin walls (Castagna et al., 2004; Kauffold et al., 2004) while luteal cysts have a rather thick wall and a distinct lumen (Kauffold and Althouse, 2007). However, differentiation between follicular and luteal cysts using real-time ultrasound is not easy because both types of cysts first appear as thin walled, fluid-filled structures in the sonographic image (Waberski et al., 1999). Transcutaneous ultrasonography is appropriate for the diagnoses of uterine disorders (Kauffold et al., 2005) and is widely used for pregnancy diagnosis (Botero et al., 1986; Szenci et al., 1997; Waberski et al., 1999). Ovarian cysts can occasionally be observed during the pregnancy testing of a large number of animals. Therefore the treatment of ovarian cysts in sows is on the increase.

The combination of aspiration with intracystic administration of hCG after laparotomy (Vandeplasche et al., 1971) or parenteral administration of GnRH (Bollwahn, 1974; Ogasa et al., 1983; Itoh, 1999), hCG, anterior pituitary gonadotropin (Kawata and Tomizawa, 1980) or PGF<sub>2α</sub> (Liptrap and Doble, 1981) are considered as useful methods of treatment. However, the majority of these treatments was performed in low numbers of animals or they were done in experimental conditions after the hormonal induction of ovarian cysts.

The objective of our study was to evaluate different treatment procedures in sows with ovarian

cysts diagnosed during routine ultrasonographic pregnancy diagnoses on several pig farms.

## MATERIAL AND METHODS

### Experimental animals and examination

Ultrasonographic pregnancy diagnoses (USG) were performed at 14-day intervals on six commercial pig farms. Sows were examined transcutaneously 21–35 days after insemination using an Aloka 500 SSD scanner equipped with 5 MHz linear transducer. Examinations were performed in individual pens for insemination or in group pens immediately after feeding. Restless animals were fixed using a portable barrier. The transducer covered by a plastic obstetrical glove with scanning gel was placed on the skin in the area of the right abdominal flank of the standing animal and directed towards the urogenital tract. Non-pregnant animals were examined carefully from both sides. Ovarian cysts were considered to be multiple follicular structures (more than four) visualised as anechoic and thin-walled with diameter larger than 14 mm (Figure 1).

Out of the total number of 36 947 examined sows pregnancy was not diagnosed in 7 119 cases. Ovarian cysts were diagnosed in 195 examined sows (0.53 %), 177 sows with ovarian cysts were used in the study. Out of other 18 animals three sows were diagnosed as having luteal cysts due to the presence of thick wall and echoic formations inside the cysts. These sows were not included in our study because of their low number. Fifteen sows were culled immediately after diagnosis because



Figure 1. Ovarian cysts in a sow (USG)

Table 1. Groups of animals ( $n = 177$ ) according to the treatment protocols

Group 1 ( $n = 29$ )	Group 2 ( $n = 28$ )	Group 3 ( $n = 27$ )	Group 4 ( $n = 25$ )*	Group 5 ( $n = 23$ )	Group 6 ( $n = 21$ )	Group 7 ( $n = 24$ )
no treatment	GnRH 50 $\mu$ g	GnRH 100 $\mu$ g	GnRH 200 $\mu$ g	hCG 1 500 IU	hCG 3 000 IU	PGF <sub>2<math>\alpha</math></sub> 250 $\mu$ g

\*200  $\mu$ g divided into two equal doses administered at a 12-hour interval

of cysts larger than 6 cm or according to farmers' decision. These sows were slaughtered and the volumes of ovaries as well as numbers and diameters of cysts were evaluated.

### Treatment protocols

One hundred and seventy seven experimental sows were randomly divided into seven groups. No treatment was performed in the control group (Group 1,  $n = 29$ ) and intramuscular administration of GnRH, hCG or PGF<sub>2 $\alpha$</sub>  was performed in other sows immediately after the initial examination. GnRH (Icirelin, Supergestran inj., Leciva, Prague, Czech Republic) was administered in doses 50  $\mu$ g *pro toto* (Group 2,  $n = 28$ ), 100  $\mu$ g *pro toto* (Group 3,  $n = 27$ ) and 200  $\mu$ g *pro toto* divided into two equal doses given at a 12-hour interval (Group 4,  $n = 25$ ). HCG (Werfador inj. sicc., Werfft, Vienna, Austria) was administered in doses 1 500 IU *pro toto* (Group 5,  $n = 23$ ) and 3 000 IU *pro toto* (Group 6,  $n = 21$ ) and PGF<sub>2 $\alpha$</sub>  (cloprostenol, Oestrophan inj., Leciva, Prague, Czech Republic) was injected in a dose of 250  $\mu$ g *pro toto* (Group 7,  $n = 24$ ) (Table 1).

### Evaluation

Insemination and pregnancy confirmed ultrasonographically within 42 days after treatment were

considered as a positive response to the treatment and recovery. Namely the percentage of inseminated sows (insemination rates, IR), percentage of pregnant sows (pregnancy rates, PR), percentage of pregnant sows only out of the inseminated animals (conception rates, CR), interval from treatment to insemination (treatment-insemination interval, TII) and interval from treatment to insemination after which pregnancy was confirmed (treatment-pregnancy interval, TPI) within 42 days after the initial examination were evaluated in the experimental groups. In addition, treated sows were divided according to parity (1–3, 4–6 and  $\geq 7$ ) and the relation of PR to the age (parity) of sows was evaluated.

Kruskal-Wallis test and  $\chi^2$  test were used for statistical evaluation.

### RESULTS

Ovarian cysts were diagnosed in 195 out of 36 947 ultrasonographically examined sows (0.53%). Mostly multiple ovarian cysts with diameters ranging from 20 to 50 mm were found. Figure 2 (ovaries of culled, untreated sows) shows the usual size of observed cysts compared to normal ovary and extraordinary large ovaries.

Insemination rates (IR), conception rates (CR), pregnancy rates (PR), treatment-insemination interval (TII) and treatment-pregnancy interval (TPI) within 42 days after the initial examination in ex-

Table 2. Insemination rates (IR), conception rates (CR), pregnancy rates (PR), treatment-insemination interval (TII) and treatment-pregnancy interval (TPI) within 42 days after the initial examination in experimental groups of sows with ovarian cysts

	Group 1 ( $n = 29$ )	Group 2 ( $n = 28$ )	Group 3 ( $n = 27$ )	Group 4 ( $n = 25$ )	Group 5 ( $n = 23$ )	Group 6 ( $n = 21$ )	Group 7 ( $n = 24$ )
IR (%)	17.2 <sup>a</sup>	35.7	51.9	84.0 <sup>b</sup>	39.1	38.1	37.5
CR (%)	40.0	50.0	64.3	47.6	66.7	62.5	33.3
PR (%)	6.9 <sup>a</sup>	17.9	33.3	44.0 <sup>b</sup>	26.1	23.8	12.5
Mean TII (days)	9.7	18.2	24.0	15.1	18.7	25.0	11.2
Mean TPI (days)	27	21.4	26.9	20.8	22.8	27.8	27.0

<sup>ab</sup>values with different superscripts are different ( $P < 0.05$ )



Figure 2. Cystic ovaries in comparison with normal ovaries in sows. The normal ovary with corpora lutea is in the centre of the figure. The largest cyst (100 mm in diameter) was observed in a sow where a pair of cystic ovaries had the volume of 1 219 ml (above). Two pairs of ovaries with follicular cysts of a maximum diameter of 3 cm without corpora lutea (below). Such cysts were the most frequent finding

perimental groups of sows with ovarian cysts are shown in Table 2.

Insemination rates (IR) were higher in Group 4 (84.0%) and lower in Group 1 (17.2%) in comparison with the other groups ( $P < 0.001$ ).

Pregnancy rates (PR) were higher in Group 4 (44.0%) and lower in Group 1 (6.9%) compared to the other groups ( $P < 0.05$ ).

Differences in the other parameters were not significant.

Pregnancy rate in younger sows (1–3 parity) was slightly higher (48.5%) than in older sows (4–6 parity = 35.3%;  $\geq 7$  parity = 35.5%), but the differences were not significant.

## DISCUSSION

Various incidences of ovarian cysts (2.4 – 40.0%) were described (Vandeplassche et al., 1971; Schmidt et al., 1995; Heinonen et al., 1998). Different characteristics of groups of evaluated sows caused this variability. Nevertheless, the values higher than in our study (0.53%) were more frequent because most of the data described in the literature were obtained from morphological examinations of ovaries in sows which were slaughtered following a poor reproductive performance. A similar method

of examination was used by Castagna et al. (2004) in 1 990 sows and they found the 4-times higher occurrence of ovarian cysts (2.4%) in comparison with our study. However, they examined the sows immediately after weaning when the occurrence of reproductive disorders is the highest. We examined anoestrous sows within 21–35 days after insemination, so that early rebreeding sows were not examined. Some sows suffering previously from ovarian cysts could have spontaneously recovered until that time because the spontaneous regression of ovarian cysts in sows was described (Liptrap and McNally, 1977; Dorka and Plonait, 1995). When evaluating only sows diagnosed as non-pregnant (7 119 sows), we found 2.51% sows with ovarian cysts. This is in agreement with the data presented by Kauffold et al. (2004), who observed ovarian cysts in 6 sows out of 178 sows (3.4%) diagnosed as non-pregnant between days 20 and 37 after insemination.

In addition, some ovarian cysts might not be recognized by transcutaneous ultrasonography. Botero et al. (1986) diagnosed cysts only in three out of six sows with ovarian cysts using 3.5 MHz probe. Although non-pregnant sows were carefully examined in our study, it is possible that some cases of ovarian cysts could not be diagnosed, particularly in overweight sows. Furthermore, no data comparing previous ultrasonographic results (number,

size, quality of cyst) with findings on ovaries after slaughter were available in contrast to numerous studies performed in cows. Therefore we suppose that in some cases of ovarian cysts neither number nor type of cysts can be diagnosed properly. Nevertheless, we evaluated ovarian findings in a similar manner like in other studies dealing with ovarian cysts in sows (Waberski et al., 1999; Castagna et al., 2004; Kauffold et al., 2004; Kauffold and Althouse, 2007).

It is difficult to discuss the effectiveness of treatment because there is an entire lack of data on the treatment of ovarian cysts in sows. Bollwahn (1974) treated six sows with experimentally induced ovarian cysts by GnRH. Cysts disappeared in all sows within 16 days after treatment and three out of five inseminated sows became pregnant. GnRH in doses 200, 400 and 500 µg was administered to 53 sows with ovarian cysts in another study (Ogasa et al., 1983). The concentration of progesterone in the peripheral blood increased immediately after treatment. Cysts disappeared in 71.6% and oestrus occurred in 60.4% of sows, the average interval between treatment and oestrus was 26.9 days, 70.2% of inseminated sows and 49.0% of treated sows became pregnant and the average litter size was nine piglets. Pregnancy rates in that study were similar to pregnancy rates after the treatment with two doses of 100 µg GnRH in our study. Luteinization of ovarian cysts was demonstrated by Vandeplasseche et al. (1971) after laparotomy and aspiration of cysts using intracystic administration of 500 IU hCG, but this method of treatment is not useful in practice. On the other hand, no response to the parenteral administration of 2 000–10 000 IU of hCG was described by Kawata and Tomizawa (1980). Although pregnancy rates were higher in sows treated with hCG (26.1% and 23.8%) compared to untreated sows (6.9%) in our study, the differences were not significant. Therefore, the usefulness of hCG in the treatment of ovarian cysts in sows needs further research concerning the dose and route of administration.

The relation of PGF<sub>2α</sub> to ovarian cysts was proved after hysterectomy or intrauterine administration of indometacine (Liptrap and McNally, 1977). A positive response to PGF<sub>2α</sub> administration was described in the case of large luteal cysts but no response was found in small follicular cysts (Liptrap and Doble, 1981). It is in accordance with the finding that large cysts from 15 to 60 mm in diameter are often luteinized (Nalbandov, 1952; Vandeplasseche

et al., 1971; Kudlac, 1980). Although we did not determine the level of cyst luteinization, we assumed the presence of a certain amount of luteal tissue because we treated only sows with cysts exceeding 15 mm. However, recovery rate in sows treated with PGF<sub>2α</sub> was lower compared to GnRH or hCG treatment and it was comparable with untreated sows in our study. Ovarian cysts did not probably achieve a sufficient stage of luteinization for response to PGF<sub>2α</sub>. Therefore the application of PGF<sub>2α</sub> treatment of ovarian cysts in sows is limited by possibilities to determine the level of their luteinization.

On the basis of our results we can conclude that two intramuscular administrations of 100 µg of GnRH at a 12-hour interval are an effective treatment of large follicular ovarian cysts in sows.

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