Hydrometa in dairy goats: reproductive performance after treatment with prostaglandins

J. W. Hesselink

An intramuscular injection of 5 mg dinoprost caused a discharge of uterine fluid (cloudburst) in 49 cases of hydrometa in goats during the breeding seasons of 1988, 1989 and 1990. A spontaneous oestrus after the cloudburst was allowed to occur in 20 of the goats; in nine (45 per cent) of them a hydrometa recurred, three conceived at the first oestrus and eight returned to oestrus. Oestrus was induced in 29 other cases by means of a second intramuscular administration of 5 mg dinoprost, 12 days after the cloudburst. In this group a hydrometa recurred in only one goat, 14 goats (48 per cent) conceived at the first oestrus and 14 returned to oestrus. Of the animals in which a pseudopregnancy occurred once or more during the same breeding season, 85 per cent became pregnant, compared with 97 per cent of unaffected older goats. The mean number of kids of the goats that became pregnant and kidding after treatment for hydrometa was 2.0 compared with 2.3 for unaffected animals. The results indicate that a single administration of prostaglandin is not a satisfactory therapy for a hydrometa, but that reproductive performance improves when a second injection is given 12 days after the cloudburst.

HYDROMETRA is an accumulation of aseptic fluid in the uterine lumen in the presence of a persistent corpus luteum (Pieterse and Taverne 1986); hydrometra and pseudopregnancy are regarded as being synonymous (Eust 1983). Pseudopregnancy is an important cause of infertility in dairy goats (Hesselink 1993). The incidence can vary between farms from 0 to 20 per cent (Midlott and others 1991). An investigation in one herd during three consecutive years revealed that hydrometa occurred in 8.1, 20.8 and 5.2 per cent of the animals (Hesselink 1993).

The first aim in treating hydrometa is to induce the regression of the persistent corpus luteum. After which the animals will show oestrus and the fluid will be discharged from the uterus. The term cloudburst is used when the uterine fluid is discharged spontaneously around the expected time of parturition in animals which have been mated and developed a hydrometa (Pieterse and Taverne 1986). A hydrometa can also develop after a period of anoestrus (Hesselink 1993).

Oxytocin (Pieterse and Taverne 1986) and bromocriptine (Taverne and others 1988) have been used as therapy in experimental studies but they seem to be of no practical importance.

Prostaglandins PGE2 (PGF2α) or its synthetic analogues induce luteolysis in the goat (Hearnshaw and others 1974, Shutt and others 1976, Bosu and others 1978, Ogumbiyi and others 1980, Ott and others 1980b, Breitlaff and others 1983) and a single administration of either material will induce a cloudburst (Pieterse and Taverne 1986, Franck and others 1990) suggesting that they might provide an appropriate treatment under field conditions. The aim of the present study was to investigate the results of treating goats with hydrometa with prostaglandins under field conditions and the reproductive performance of the goats after treatment.

Materials and methods

The trial was conducted in a commercial herd of Dutch white dairy (Saanen) goats during three breeding seasons (September to March) from 1988 to 1991. During this period hydrometa was diagnosed in 39 goats. In eight of them hydrometa recurred during the same breeding season after treatment with prostaglandins, and in one a hydrometa recurred twice after treatment. In all, 49 cases of hydrometa were diagnosed in the 39 goats, and each recurrence of hydrometa is regarded as a separate case. The herd was officially declared free of brucellosis, tuberculosis, caseous lymphadenitis and caprine arthritis encephalitis. The goats were housed in cubicle stalls with slatted floors; the older goats were fed indoors all year but the yearlings were kept on pasture in the summer.

The does were examined ultrasonographically while standing, with a real-time portable scanner type 450 (Pie Medical) with a 5 MHz linear-array transducer. The transducer was placed on the goat's shaved right ventral abdominal wall, just cranial to the udder.

The animals were observed for oestrus five times a day, twice during the morning and evening milking, later in the morning, early in the afternoon and late in the evening. The goats were mated naturally, and if a goat was still on heat 12 hours later the mating was repeated. If two or more matings took place on one day or on two consecutive days, they were registered as one mating.

On diagnosis all cases of hydrometa were treated intramuscularly with 5 mg dinoprost (Dinolytic; Upjohn). If a goat showed oestrus within four days after treatment, and also appeared to have wet hnilquarters at that time, while no feta(es) or placental remnants were found, she was said to have a cloudburst. This implied that the diagnosis was correct and the treatment had been successful.

In 20 cases (group 1) no further treatment took place after the cloudburst and oestrus was allowed to occur spontaneously. However, 15 of these goats were mated accidentally during the cloudburst but returned to oestrus. The remaining 29 cases (group 2) were given a second intramuscular injection of 5 mg dinoprost, 12 days after the induced cloudburst.

The first oestrus pregnancy rate, the final percentage of pregnant animals and their litter size at birth were calculated. The pregnancy rate was based upon ultrasonographic pregnancy diagnosis between 40 and 70 days after mating. The first oestrus pregnancy rate was defined as the proportion of goats that became pregnant after one or more matings during the first spontaneous or induced oestrus. The fertility of the pseudopregnant goats was compared with that of the 210 unaffected older animals in the herd (group 3).

Results

A single intramuscular administration of 5 mg dinoprost caused a cloudburst in all 49 cases of hydrometa. The results of mating the goats during either a spontaneous or induced oestrus are presented in Table 1.

A spontaneous oestrus was allowed to occur in 20 goats (group 1). In nine of these animals (45 per cent) hydrometa recurred, three conceived at first oestrus and eight (40 per cent) returned to oestrus. Of the 29 cases in which an oestrus was induced 12 days after the cloudburst (group 2) hydrometa recurred in only one goat, 14 animals (48 per cent) conceived at the first oestrus and the other 14 returned to oestrus. The difference between rates of recurrence of hydrometa in groups 1 and 2 was significant (P < 0.0001, x² test). The pregnancy rate of the unaffected control goats at first oestrus was 75 per cent.

Of the goats in which a pseudopregnancy occurred once or more during one breeding season, 85 per cent became pregnant compared with 97 per cent of the control goats (Table 2).

During the three consecutive years, three of the 33 older goats...
TABLE 1: First oestrous pregnancy rates after treatment of hydrometas with prostaglandin

<table>
<thead>
<tr>
<th></th>
<th>Group 1* spontaneous oestrus</th>
<th>Group 2† induced oestrus</th>
<th>Group 3 control</th>
</tr>
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<tbody>
<tr>
<td>First oestrus</td>
<td></td>
<td></td>
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<tr>
<td>pregnancy rate</td>
<td>15-0% (5/32)</td>
<td>48-3% (14/29)</td>
<td>72-9% (15/21)</td>
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<tr>
<td>Recurrence of</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>hydrometas</td>
<td>45-0% (5/32)</td>
<td>3-4% (1/29)</td>
<td></td>
</tr>
<tr>
<td>Return to oestrus</td>
<td>40-0% (8/20)</td>
<td>48-3% (14/29)</td>
<td>27-1% (5/19)</td>
</tr>
</tbody>
</table>

* Single administration of 5 mg dinoprostr
† A second dose of dinoprostr was given 12 days after the cloudburst

which became pregnant after treatment of a pseudopregnancy aborted. The abortion rate in the control group was 8.3 per cent. The mean litter size of the goats which became pregnant and kid- ded at the normal time after treatment of a hydrometas was 2.0 compared with 2.3 for the control group.

Discussion

Treatment with 5 mg dinoprostr caused a cloudburst in all 49 cases of hydrometas, from which it can be concluded that the prostaglandin treatment effectively induced luteolysis.

When oestrus was allowed to occur spontaneously, a hydrometas recurred in 45 per cent of cases. In contrast, when an oestrus was induced 12 days after the cloudburst a hydrometas recurred in only one goat out of 29.

Some fluid can remain in the uterus of a pseudopregnant goat after luteolytic treatment (Petersen and Taverne 1986). This observation was confirmed in the present study by ultrasonographic scanning after the cloudburst. Zarco and others (1984) proposed that the accumulation of fluid in the uterus is the result rather than the cause of the persistence of the corpus luteum in sheep. The results of the present study suggest that the fluid remaining in the uterine lumen is responsible for the recurrence of the hydrometas by preventing luteolysis.

The finding that none of the 15 cases which were mated during the cloudburst became pregnant shows that the genital tract of the doe is not ready to conceive at that stage.

The first oestrus pregnancy rate increased threefold when oestrus was induced after the cloudburst compared with those cases in which oestrus was allowed to occur naturally. It is difficult to compare these data with published data, because information on fertility in dairy goats is scanty. Moreover, fertility is influenced by breed, climate, nutrition and housing (Riera 1982). For instance, Bosu and others (1978) observed a pregnancy rate at PGF2α induced oestrus of 77-0 per cent and Hearshaw and others (1974) observed a pregnancy rate of 56-0 per cent. In a group of does synchronised for oestrus by means of two intramuscular injections of PGF2α given 11 days apart, 94-0 per cent became pregnant in the breeding season, compared with 82-0 per cent of a control group in which the does were bred at natural oestrus (Ott and others 1980a). In the same report the first-service pregnancy rates were 70-6 per cent for does mated at an induced oestrus and 64-7 per cent for does mated at a natural oestrus.

Vaccination of newborn pigs against pseudorabies virus

AN attempt was made to stimulate protective immunity against pseudo- rabies virus in pigs which had received colostrum from immune sows by vaccinating them intranasally at birth with an attenuated strain of the virus. Two litter from immune sows and one from a non-immune sow were vaccinated and two litters were left unvaccinated (one passively immune and one non-immune). The pigs were all challenged at 15 weeks of age with virulent strain 4892 virus. The vaccinated pigs that suckled non-immune sows developed serum virus-neutralising antibody by 15 weeks and gained weight normally and did not have a febrile response, whereas the pigs that sucked immune sows were seronegative when challenged and lost some weight and developed fever, although less than the challenged unvaccinated pigs. The intranasal vaccination did not stimulate immunity sufficiently to reduce the shedding of virus after the pigs had been challenged.
Incidence of hydrometra in dairy goats

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Hydrometra or pseudopregnancy is characterised by the accumulation of aseptic fluid within the uterus and a persistent corpus luteum. In goats the diagnosis can be easily made by ultrasound. The incidence of hydrometra was investigated in three herds of dairy goats, in two of them during one oestrous season and in the other over three years. The incidence varied between 3.0 per cent and 20.8 per cent with a mean incidence of 9.0 per cent. The incidence in older goats was significantly higher than in yearlings, and the chance of a hydrometra increased with the age of the goats. The finding, during one year, that a pseudopregnancy occurred more often after an induced ovulation, was not repeated in another year.

HYDROMETRA in goats is a pathological condition of the uterus in which aseptic fluid accumulates in the uterine lumen in the presence of a persistent corpus luteum (Pletser and Taverne 1986). The volume of fluid can range from less than 1 to more than 8 litres (Mialot and others 1991). Pseudopregnancy is regarded as being synonymous with hydrometra (Guss 1977, East 1983), except by Smith (1980).

A similar uterine condition is found in cats at the time of ovariotomy (Stein 1975, Colby and Stein 1983) and it has been diagnosed in cats before a laparotomy, by radiography (Gertisch and Pantel 1977, Nash and others 1986) and by ultrasonography (van Haafelen and Taverne 1989). In dogs two cases of hydrometra have been reported (Johnson 1984); in one case it was an incidental finding in one uterine horn at ovariotomy (McAfee 1977). Five cases of hydrometra have been reported in rabbits (Johnson 1984, Morrell 1989). The term ‘cloudberry’ is used in pseudopregnant goats in which only a cloudy, uterine fluid is discharged at around the expected time of parturition in animals that have been mated (Pletser and Taverne 1986).

Hydrometra in goats can be diagnosed easily and reliably by ultrasound scanning (Lavoir and Taverne 1989).

A hydrometra can be diagnosed either in mated animals which fail to kid despite the presence of a distended abdomen and an enlarged udder at the end of a presumed pregnancy, or during the routine pregnancy diagnosis of mated or inseminated animals or in anoestrous animals either during or after the breeding season (Taverne 1991).

The occurrence of pseudopregnancy on a commercial farm of dairy goats causes economic losses because no kids are born and milk production is reduced.

This paper reports the incidence of hydrometra in three herds of dairy goats.

Materials and methods

Farms

During 1988, 1989 and 1990, respectively, there were 99, 120 and 135 goats on farm A. Apart from one Toggenburger, the herd consisted of white Dutch dairy (Saanen) goats. The animals were housed in a cubicle stall with slatted floors, and were fed indoors all year round. The yearlings were kept on pasture in the summer. The herd was officially declared free of diseases, according to Dutch veterinary regulations, which implies that the farm was free of brucellosis, tuberculosis, caseous lymphadenitis and caprine arthritis encephalitis.

On farm B 41 of 67 goats were examined in 1990 by means of ultrasonography. This herd consisted exclusively of white Dutch dairy goats and was officially declared free of diseases.

In the same year 134 multiparous goats were examined by ultrasound on farm C. This was a mixed herd of Toggenburgs and white Dutch dairy goats. The goats on farms B and C were housed in a deep-litter stall. In the summer the animals were kept on pasture. On all the farms the goats were mated naturally.

Scanning procedure

The ultrasonographic examinations were performed with a portable scanner type 450 (Pie Medical) with a 5-0 MHz linear-array transducer.

The goats were scanned in a standing position, either in the milking stable or on the milking table, while being restrained by an assistant. A section of the right ventral abdominal wall, just in front of the udder, was shaved and a coupling gel was applied to the transducer. The diagnosis of hydrometra was made if there was fluid present in the uterine lumen at least 40 days after mating, in the absence of a fetus and placentomes (Lavoir and Taverne 1989).

The fluid-filled uterus was visible on the monitor as non-echogenic components, separated by one or more sections through tissue walls formed by the two adjacent uterine walls (Kahn 1991).

The diagnosis of hydrometra was confirmed if the goat came into oestrus and had wet hindquarters after treatment with 5 mg dinoprost (Dinolytic; Upjohn) and no fetus or afterbirth was found.

Induction of oestrus in anoestrous goats

On farm A in 1988 and 1990 oestrus was induced in a number of goats which had remained anoestrous during the first part of the oestrous season, by the method described by Coutel and others (1982, 1984). It involves vaginal administration of medroxyprogesterone acetate for 11 days and of pregnant mare serum gonadotrophin and dinoprost 48 hours before the end of the progestagen treatment.

Results

Farm A

Oestrous season 1988 to 1989. In December 1988, 42 goats which had been mated after an induced oestrus or after they had come back into oestrus one or more times were examined. A hydrometra was diagnosed in eight cases, an incidence of 8.1 per cent (eight out of 99). It is remarkable that six pseudopregnancies occurred in a group of 10 goats which were mated after treatment with medroxyprogesterone acetate-sponges, pregnant mare serum gonadotrophin and dinoprost.

One of two remaining pseudopregnant goats had been mated at the beginning of September once and the other several times. The 57 goats which were not examined all kidded normally.

Oestrous season 1989 to 1990. In an attempt to diagnose hydrometra at an earlier stage of the oestrous season, all 120 goats were examined by ultrasound between 40 and 70 days after mating. Twenty-five cases of pseudopregnancy were diagnosed, an incidence of 20.8 per cent (25 out of 120). Ten cases of hydrometra were diagnosed in goats which had remained anoestrous during the oestrous season; 11 animals became pseudopregnant after they had been in oestrus once, and the remaining four animals were seen in oestrus twice before the hydrometra was diagnosed. Hydrometra recurred in six goats after they had been
treated with prostaglandins during the same oestrous season, and in one goat hydrometry developed twice after treatment.

**Oestrous season 1990 to 1991.** — Because it is not known when hydrometry starts to develop, all the goats were examined by ultrasound in the first week of September before the introduction of the bucks, at the transition from the anoestrous to the oestrous season. The examinations revealed four cases of pseudopregnancy. After they were treated with prostaglandins a hydrometry developed again in two of these four goats.

At pregnancy testing a pseudopregnancy was also diagnosed in three other goats; before the pseudopregnancy, one of them had been in anoestrous twice, and the other two had been in anoestrous once (Table 1). The incidence of hydrometry in this period was 5.2 per cent (seven out of 135).

During these three consecutive years 50 cases of hydrometry were diagnosed in 40 goats, an overall incidence of 11.3 per cent (40 out of 354). In the calculation of the incidence, a goat in which a pseudopregnancy occurred two or more times during one oestrous season, was regarded as one case, but if pseudopregnancies developed in one animal during two oestrous seasons, they were regarded as separate cases.

In Fig 1 the age distribution of the pseudopregnant goats is compared with that of the rest of the herd. The incidence of hydrometry in the older goats on farm A (18.3 per cent) was significantly higher than in the nulliparous animals (1.0 per cent). It is also evident that the incidence of pseudopregnancy increased with the age of the goats. The overall incidence in animals from one to five years old was 10.4 per cent (29 out of 280) and in goats from six to 11 years old the incidence was 32.4 per cent (11 out of 34).

The goats on farm A were bought from an experimental farm in Zeist in 1988. Lavoir and Taverne (1989) had tested a group of the animals at this experimental farm for pseudopregnancy by ultrasonography, and found an average incidence of 2.1 per cent; one out of 65 goats in 1985, three out of 89 in 1986, and one out of 86 in 1987.

**Table 1:** Numbers of goats in which oestrous or anoestrous were diagnosed before the diagnosis of hydrometry on farm A. Recurrent cases during the same season are not included.

<table>
<thead>
<tr>
<th>Year</th>
<th>Farm A</th>
<th>Farm B</th>
<th>Farm C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>8</td>
<td>41</td>
<td>134</td>
</tr>
<tr>
<td>1989</td>
<td>15</td>
<td>47</td>
<td>102</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>88</td>
<td>236</td>
</tr>
</tbody>
</table>

**Fig 1:** Age distribution of pseudopregnant goats compared with the remaining animals on farm A during three consecutive years.

**Discussion**

There is little information about the incidence of hydrometry in goats. Lyngset (1986) recorded three cases of hydrometry when examining 1020 reproductive tracts in a slaughterhouse (0.3 per cent); Holdsworth and Davis (1979) found four animals with hydrometry in a group of 98 goats (4 per cent). Malher and Ben Younes (1987) reported an incidence varying from 2 to 6 per cent. Recent observations on 71 farms in France revealed one or more pseudopregnancies on 40 farms. On one farm the incidence was more than 20 per cent. The incidences of pseudopregnancy in the whole population during two consecutive years were 2.4 and 2.8 per cent (Mialot and others 1991).

In the present investigation the mean incidence of pseudopregnancy was 7.9 per cent (50 out of 550) which is remarkably higher than reported by the above authors.

Mizenga and Verma (1984) observed that pseudopregnancies occurred more often after induced ovulations during the anoestrous season. A similar observation was made on farm A during 1988 to 1989 after induced ovulations during the oestrous season. However, no pseudopregnancies were diagnosed in 17 goats in which oestrous had been induced in the same way during 1990 to 1991.

Mialot and others (1991) found a significantly greater number of pseudopregnancies in goats which were mated after induced ovulations than in animals which came into oestrus spontaneously. Unfortunately these authors did not report at what time of the year and in which way the oestrus had been induced. It remains uncertain to what extent oestrous induction in itself or the season of year when the induction takes place, increases the chance of the development of a hydrometry.

The high incidence of the condition on farm A during 1989 to 1990 was remarkable. The only factor, compared with the two other periods, that might have had an influence, was a period of three weeks during the oestrous season when the cubicle stall where the goats were housed, was radially rebuilt; nearly all pseudopregnancies were diagnosed during the next two months.

The aetiology of hydrometry in goats is unknown. Webb (1985) reported a case involving a segmental aplasia of the uterus. Except for one case in a dog with an ectopic ureter opening into the uterus (Lapish 1985) there are no other reports of hydrometry being associated with anatomical abnormalities. However, it is considered that the accumulation of fluid in the uterus is the result of the persistence of the luteal phase rather than its cause (Zarco and others 1984). Taverne and others (1988) investigated the luteotrophic role of prolactin in pseudopregnant goats. Subcutaneous injections of 1 mg bromocriptine twice daily for six to 10 days effectively reduced the jugular plasma concentrations of prolactin and induced a gradual and continuous decline in the plasma progesterone levels, followed by the expulsion of uterine fluid after the progesterone levels had declined below 1 ng/ml. These data indicate that a change in prolactin secretion may possi-
bly play a role in the development of a persistent corpus luteum and hydrometra.

The present data show that the incidence of pseudopregnancy can vary considerably not only between different herds but also in the same herd between consecutive years.

The incidence of hydrometra in the older goats was significantly higher than in the yearlings, as has also been reported by Mialot and others (1991). Furthermore, the results of the investigation show that the chance of a hydrometra increases with the age of the goats. The question arises whether a difference in hormonal regulation between yearlings and older animals may be the underlying cause. The finding in one season that a pseudopregnancy occurred more often after induced ovulations was not repeated in a second season.

For a timely diagnosis it has proved useful to examine the goats by ultrasound not only between 40 and 70 days after mating but also at the beginning of the oestrous season, before the introduction of the bucks.

It is concluded that hydrometra is an important pathological condition of the uterus in dairy goats, whose aetiology is still unknown. More research seems desirable because of the clinical importance of the disorder.

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Short Communications

Cholangioma in a Svalbard reindeer (Rangifer tarandus platyrhynchus)

A. A. Cunningham, N. J. C. Tyler, A. Levene

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SVALBARD reindeer (Rangifer tarandus platyrhynchus) are among the most northerly of all terrestrial mammals. The subspecies occurs only in the high Arctic archipelago of Svalbard (74 to 80° northern latitude) where it has been isolated for up to 40,000 years (Hakala and others 1985). There are approximately 10,000 reindeer in Svalbard. The animals are wild, not semi-domesticated, and they are not hunted to a significant extent.

In December 1990, 46 reindeer were shot in Reindalen, Nordenskiöld Land, under special licence, as part of a three-year investigation into periodic reproductive failure of females in this area (Tyler 1991).

On routine gross post mortem examination of the carcasses, one adult (over two years old) female was found to have an abnormal liver which weighed 2940 g (normal seasonal range for adult females, 456 to 832 g, n = 51; N. J. C. Tyler, unpublished data). The animal was both lactating and pregnant (from the October rut). It weighed 74.5 kg, which is above the seasonal mean for adult females (68.2 kg ± 0.74, n = 53; N. J. C. Tyler, unpublished data), but fat reserves, measured as depth of subcutaneous fat over the rump (Duaphiné 1976), were smaller (34.6 mm) than the seasonal mean (43.3 mm ± 0.9, n = 52; N. J. C. Tyler, unpublished data).

Much of the liver had been replaced by pink to yellow tissue which had a spongy appearance (Fig 1), but a firm consistency. The margin of transition from normal to abnormal tissue was not clearly defined. The abnormal tissue projected caudally as an ovoid mass (20 x 27 x 10 cm), extending beyond the normal liver borders. On sectioning, this mass comprised numerous cystic structures, up to 4 mm diameter, which contained clear, colourless, mucinous fluid. The only normal tissue remaining was the diaphragmatic aspect of the liver, but this also contained islands of abnormal tissue (Fig 1). On gross examination, no other organs were affected.

On histological examination, the mass was found to consist of loosely arranged collagens tissue containing variably sized cys-