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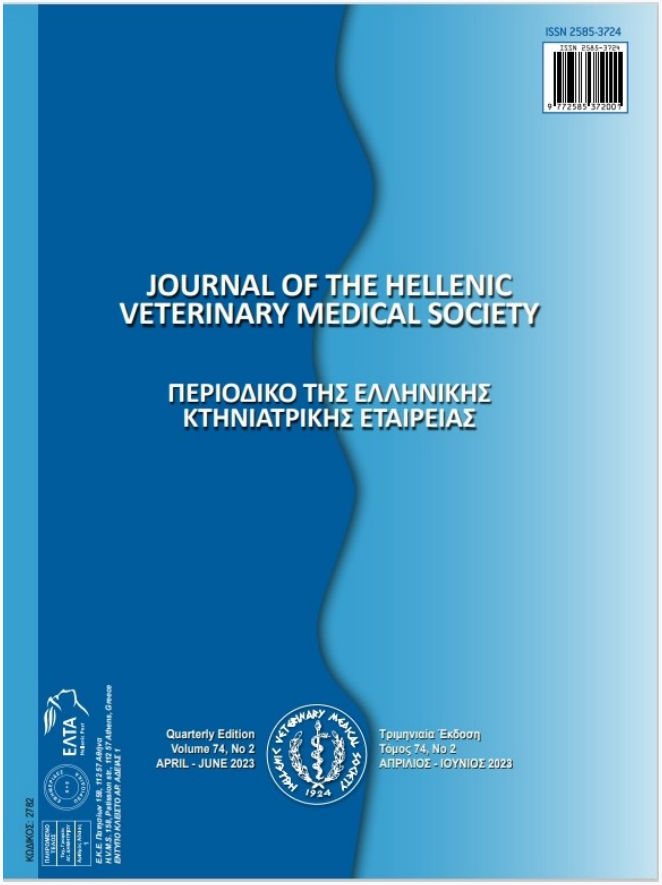

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Review article
Ανασκόπηση

Vaginal prolapse in ewes: A critical review of the literature and the disease status in Greece

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ABSTRACT: This article is a critical review on the vaginal prolapse in ewes. It describes the pathophysiology, risk factors, clinical signs, treatment, and prevention of the disease. It also describes the epidemiology of the disease in Greece based on data from the Clinical Veterinary Medicine Department (Faculty of Veterinary Science, University of Thessaly). The data show that the disorder is a rare condition in the Greek sheep industry. Finally, the highly elevated feeders and also the injectable chorionic gonadotrophin are emphasized as significant risk factors for the disease in the modern sheep industry.

Keywords: vaginal prolapse, ewes, small ruminants, Greece, feeders

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INTRODUCTION

Vaginal prolapse is a condition in which the vagina, sometimes also including the cervix, is pushed through the vulva and ends up outside the body (Figure 1). It typically occurs in heavily pregnant ewes, during the last 2-4 weeks of gestation. Goats, and rarely cows may also be affected. The disorder is a major vexation to farmers and is associated with important welfare considerations for the livestock industry.

Most commercial sheep flocks have cases of vaginal prolapse each year, worldwide. In general, the typical annual incidence of vaginal prolapse in sheep farms is 0.5-1.0% but individual farms occasionally experience severe outbreaks with an incidence up to 10% (Low and Sutherland 1987, Hosie et al. 1991, Litherland et al. 2007).

In affected ewes, the condition tends to recur in subsequent pregnancies, and in practice apart from culling affected sheep, there are no reliable preventive measures available to farmers (Edgar 1952, McLean 1959, Litherland et al. 2000). The main losses are associated with ewe and lamb deaths, shepherd time and costs linked to treatment, as well as with an increase in replacement rate.

In the literature, most data about the condition come from epidemiological studies carried out mainly in the UK and New Zealand (Bayly et al. 1936, Hosie et al. 1991, Jackson et al. 2014, Litherland et al. 2000, Low and Sutherland 1987), as well as from clinicians' descriptions (Scott et al. 1995, Hosie 2007, Scott 2015, Christodoulopoulos 2022). The topic of vaginal prolapse in sheep has recently re-emerged in the medical literature due to ewes having been used as animal models for pelvic organ prolapse in humans (Mori da Cunha et al. 2021).

In Greece, the disorder is widely known to the farming community and veterinarians (Fthenakis 2011), but related epidemiological and clinical data have never been published. This paper presents a brief critical review of the current knowledge on vaginal prolapse, and reports epidemiological data and clinical experience from central Greece.

PATHOPHYSIOLOGY

During the last month of gestation, the size of the pelvic outlet in ewes increases to facilitate the upcoming parturition (Bassett and Phillips 1955a). The anatomical changes include an increase in vaginal lumen volume due to growth and dilatability of the walls of the vagina (McLean 1956, McLean and Claxton 1958). These physiological and anatomical changes are believed to increase the risk of vaginal prolapse under conditions of increased positive intra-abdominal pressure (Jackson et al. 2014). Indeed, ewes with vaginal prolapse were found to have greater circumferences and stretchiness of the vaginal tract than unaffected ewes (Bassett and Phillips 1955b).

Furthermore, it has be proposed that changes in the hormonal status especially during late pregnancy may contribute to the outcome of vaginal prolapse (Kuijlaars 2011). More recent studies demonstrated that ewes with vaginal prolapse present alterations in their vaginal connective tissue antepartum metabolism (Ennen et al. 2011) and that the disease may be associated with chronic stress (Brown et al. 2021).

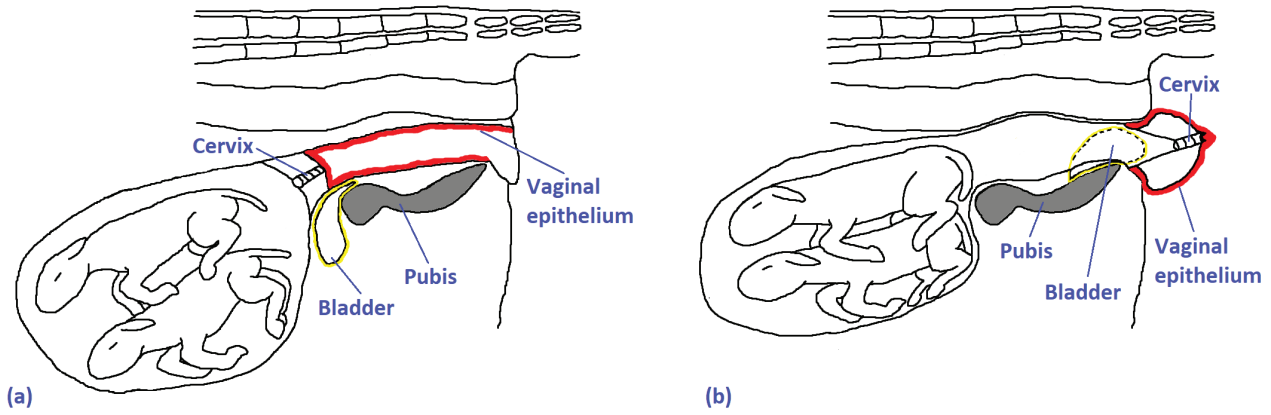

Figure 1. (a) Normal ewe. (b) Vaginal prolapse with involvement of the urinary bladder

RISK FACTORS

Multiple lambs, increased body condition scores, lack of exercise, full urinary bladders, previous dystocia complicated by uterus' prolapse, and sloping terrain, have all been identified as risk factors for the disease (Bayly et al. 1936, Hosie et al. 1991). The effect of these factors on the incidence was supported by observations that intra-abdominal pressure measured on a level with the pelvic inlet was slightly negative in pregnant grazing ewes, but increased appreciably and became positive when lying down. The effect was even more dramatic when lying on a slope with the hindquarters lower than the forequarters (McLean et al. 1957, McLean and Claxton 1960).

There appears to be an inherited susceptibility to the disease and there is now general consensus that affected ewes are more likely to have a recurrence in subsequent pregnancies (Edgar 1952, McLean 1959, Litherland et al. 2000). Some breeds have been reported to be resistant to vaginal prolapse. In New Zealand, Perendale or Perendale cross ewes have been found to have a lower risk for the disease compared to other breeds (Jackson et al. 2014). In Scotland, purebred hill flocks had an incidence of only 0.2%, while mixed-breed lowland flocks had an incidence of 1.8% (Hosie 2007).

There are only few data on the effect of age on the incidence of vaginal prolapse. Lastly, it has been recorded that hoggets are more likely to develop vaginal prolapse than mature ewes if they are forced to maintain an inclined position for long periods of time (Christodoulopoulos 2022). In addition, several practitioners report a high incidence in hoggets and two-tooth ewes despite previous assumptions that the risk increases with age (Edgar 1952, Hosie 2007). There are objective difficulties in testing these contradicting views in practice:

- The culling of affected cases removes sensitive individuals from older age classes.
- The modern sheep industry has adopted higher replacements rates and therefore rarely is a ewe older than 6 years kept in the flock.

In the older literature, there is a persistent interest in the role of various nutritional and dietetic factors in the aetiology of the disease. This includes low levels of calcium and magnesium, zeranol dosing, zinc oxide rumen boluses, unrestricted food intake of ewes in late pregnancy and at lambing time, bulky feed, and excess dietary fibre and dietary oestrogen or their precursors (Edgar 1952, Hosie et al. 1991). Recently, the effect of treating sheep with a vitamin A, D, E formulation during pregnancy on the incidence of vaginal prolapse was investigated (Allott et al. 2020). However, an association between nutritional/dietetic factors and incidence of the disease has never been demonstrated and their influence has remained speculative.

The length at which tails are docked has also been a subject for speculation in the past. It probably has its origins in unconfirmed observations that long-tailed sheep rarely develop prolapse, as well as concepts of possible damage to the caudal nerve's supply to the perineum during docking. In a recent study in New Zealand, no association was found between tail length and the occurrence of prolapses (Jackson et al. 2014).

CLINICAL SIGNS

Typically, the disease is characterized by a red spherical prolapse 8-20 cm in diameter, which protrudes beyond the vulva. The disorder develops over a few days during which the prolapse only appears when the ewe is lying down and disappears spontaneously when the animal stands up. Later, the vagina fails to return to its normal position, the prolapse becomes permanent and progressively the vagina is being completely reversed. Sometimes even the caudal end of the cervix can be seen externally [see Figures 1(b) and 3(b)].

The reversed vagina is initially pink, moist, and smooth, but after a period of usually 1-4 days it becomes swollen, oedematous, and congested and therefore very susceptible to injury. Subsequently, the dried vaginal mucosa becomes rough and haemorrhagic, and gangrene may develop (Hosie 2007). In addition, the prolapse's duration directly affects its degree of contamination with faeces, bedding material, and soil, and this applies to the integrity of the vaginal mucosa (Scott 2015).

Tenesmus becomes a feature of the condition when the mucosa is irritated, or when obstruction of the urethra leads to severe distension of the urinary bladder (Hosie 2007). If the disorder appears closer to the parturition, the affected ewes may show several behavioural signs consistent with first stage labour, including isolation from other members of the flock, failure to come forward for concentrate feeding and periods spent in lateral recumbency which may be accompanied by increased respiratory rate and frequent

attempts to urinate, with no urine voided, when the ewe raises herself (Scott 2015). More complications may also occur, including herniation of the caecum, ileum, and colon, and, occasionally, the uterus (Knottenbelt 1988). In any stage of the disease, the condition may lead to death by haemorrhage and shock.

TREATMENT

Treatment should be initiated by introducing caudal analgesia by sacrococcygeal extradural injection. This will contribute to relaxing the ewe, cease possible tenesmus, and facilitate the clinician's later manipulations. For the sacrococcygeal extradural injection, the area over the tailhead is clipped and swabbed with a 70% ethanol solution. The first intercoccygeal space can be identified by digital palpation during slight vertical movement of the tail, and a 21-gauge needle directed at 10–20° angle to the horizontal line is introduced into the vertebral canal. The needle's correct position can be determined by failure to strike bone during travel of the needlepoint, and later by lack of resistance to injection. Subsequently, in our practice, the needle is connected to a syringe that contains 2 ml of 2% lignocaine and 0.25 ml of 2% xylazine, and the mixed solution is injected into the ewe independently of the animal's weight.

Following extradural injection, analgesia is achieved after 5–10 minutes. During the waiting time, any exudates or contaminating materials on the vaginal mucosa are gently removed after soaking with of warm water. After cleaning, it is recommended to apply a light Lugol solution (2-4%) to the exposed mucosa.

Several times, the vaginal prolapse will return to normal once caudal analgesia has commenced and tenesmus has ceased. If this is not the case, the veterinarian should investigate to see if the prolapse contains the urinary bladder [see Figure 1(b)], which should first be decompressed before replacing the prolapse. For decompressing the urinary bladder, the prolapse is raised relative to the vulva, thereby reducing the fold in the neck of the bladder, at which point urine flows from the urethral orifice. Finally, the veterinarian should apply mild pressure to assist the return of the prolapse.

Several methods of retention after replacement of vaginal prolapse have been proposed including devices, pins, and suture techniques (Scott 2015). Among them, the Bühner suture is recognized as the most effective method by most practitioners. A Bühner suture of 5 mm nylon tape is placed in the perivulvar subcutaneous tissue 1–2 cm from the labia and is tightened to allow an opening of 1.5 cm diameter (Scott 2015). Most practitioners usually recommend that the suture should be tied up at the upper end of the vulva so the knot does not loosen due to soaking from the urine flow (Figure 2). After the operation, the ewe is monitored to reassure that can urinate freely. In case of extended lesions on the vaginal mucosa, parenteral penicillin should be injected once daily for 3–5 consecutive days, at the dose 44.000 IU/kg/day. The Bühner suture should be untied well before the expected lambing date.

PREVENTION

Culling of affected ewes is generally advised because almost half will prolapse in a subsequent pregnancy. In addition, possible traumas to the reproductive tract may render such animals liable to infertility, dystocia, or metritis (Hosie 2007). It is also recommended to cull the offspring from the infected ewes because the disorder is considered hereditary (Edgar 1952, McLean 1959, Litherland et al. 2000). Other preventive measures include keeping the heavily pregnant ewes in flat paddocks, daily exercise, and frequent stimulation of flocks to encourage urination (Bayly et al. 1936, Hosie et al. 1991).

CURRENT SITUATION IN GREECE

Vaginal prolapse is considered a rare condition in the Greek sheep industry. In the previous decades, when backyard small livestock farms were still common in Greek towns and villages, the condition was occasionally seen in those animals and mainly in dairy goats.

According to data from the Clinic of Medicine (Faculty of Veterinary Science, University of Thessaly), among 74 flocks regularly attended by the Department during the last 24 years (1999-2022), vaginal prolapse cases were recorded in 51±7 flocks each year (69±8% of the attended flocks, n=24). The mean overall incidence of the disease per year in the approximately 11,285 ewes in the attended flocks was 0.63% (n=24). This incidence confirms that vaginal prolapse is a rare disorder in the modern Greek sheep industry.

A high incidence of vaginal prolapse in hoggets has recently been reported in a dairy sheep farm in Greece. The farm showed an annual incidence of ap-

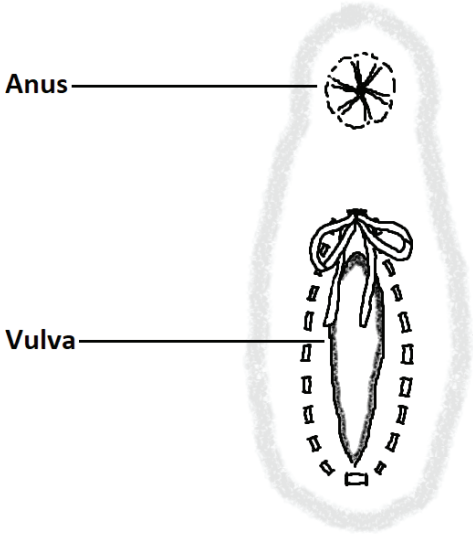

Figure 2. Bühner suture; the suture should be tied up at the upper end of the vulva so that the knot does not loosen as a result of urine flow

Figure 3. Feeders' infrastructure at the box of replacements stock (a) and in the box of hoggets (b). In front of each feeder, there was a wooden step on which the animals should step with their front legs to reach the feed, making a highly inclined position. In Figure 3(b), the hogget in the middle shows vaginal prolapse

proximately 13% in the hoggets in 2019 and 2020. The particularly elevated feeders were identified as the cause of the problem, due to the highly inclined position that the animals had to take to reach their feed (Figure 3) (Christodoulopoulos 2022). In the modern Greek sheep industry, feeders are often intentionally elevated in order to be functional even when the bedding is raised due to the accumulation of manure. Therefore, this practice should be avoided, and the manure' accumulation should be prevented with regular cleaning. On farms where there is already infrastructure with elevated feeders, these feeders should be replaced at least in the hoggets' barn.

Finally, our data, which is currently being published, shows a link between injectable chorionic gonadotropin and vaginal prolapse in hoggets. In Greece, it is commonly recommended to use zero levels of chorionic gonadotropin, when oestrus synchronization is applied with intravaginal sponges during

the breeding season. However, in practice, several farmers often use concurrent injection of 500 IU of the hormone. This dose causes multiparous pregnancies especially in hoggets, as they are of substantially lower body weight compared to mature ewes. This might be a possible explanation of hoggets have a high prevalence of more than 4% of vaginal prolapse in flocks that inject 500 IU chorionic gonadotropin for oestrus synchronization (as opposed to mature ewes).

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