Diagnostic investigation of cases of deaths of newborn lambs

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A R T I C L E I N F O
Article history:
Available online 7 May 2010
Keywords:
Sheep
Lamb
Perinatal Mortality
Diagnosis
Newborn

A B S T R A C T
Neonatal lamb mortality, caused either by disorders of non-infectious aetiology or by pathological conditions of microbial or parasitic aetiology, is defined as the death of newborn lambs during the first 28 days of their life. Neonatal lamb mortality reduces significantly the productivity of sheep flocks. A realistic target for neonatal lamb mortality rate in a well-managed flock should be 3%; the upper acceptable limit under any circumstances should be 5%. Effective control of the various disorders requires timely and accurate diagnosis of the cause of mortality. Initially, management practices in the flock should be evaluated, as they can affect neonatal mortality rate. Then, appropriate clinical and pathological examinations should be performed; the age at which lambs had died should be determined. The paper summarises the steps to be taken when investigating deaths of newborn lambs, as well as providing some guidelines regarding identification of potential causes of the deaths.

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1. Introduction

1.1. Objective of the paper

The objective of this paper is to contribute to the diagnostic investigations of cases of deaths of neonatal mortality, in order to achieve a timely and correct diagnosis. The period immediately after birth of a young lamb, termed "neonatal period", is the most difficult period in the life of a sheep, and in fact most deaths of newborn lambs take place during this period.

In general, the financial significance of diseases of newborn lambs, which can often result to death of the affected lambs, is due to the following reasons (Dwyer, 2008; Morris, 2009; Thompson, 2009).

• Increased mortality of newborn lambs. Neonatal lamb mortality rate is defined as the percentage of lambs dying during the first 28 days of life out of the total number of lambs born alive. A realistic target for neonatal mortality rate in a well-managed flock should be 3%; the upper acceptable limit under any circumstances should be 5%. Occasionally however, and depending on the cause, neonatal lamb mortality rate can be as high as 50%, which – especially in meat producing flocks – significantly reduces the farmer's income.

• Growth retardation of lambs. As a consequence to various diseases which occur at a young age, the affected lambs frequently have a significant growth retardation.

• Increased feeding costs. As an effect of the suboptimal growth of lambs, the feed conversion ratio is increased. In an attempt to compensate for suboptimal weight gain, high-cost diets (e.g., increased energy and protein diets) may be given, but such diets are more expensive.

• Higher labour requirements. There are increased needs for the care of affected lambs (e.g., nursing, artificial feeding), which call for readily attendance by farm personnel.

• Increased veterinary expenses. Veterinary expenses include fees of veterinarians and cost of drugs.
1.2. Classification of causes of neonatal lamb mortality

Disorders of newborn lambs can be broadly classified in two types, based on their aetiology (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001).

- Disorders of non-infectious aetiology: congenital defects, injuries which occurred during birth, hypothermia.
- Pathological conditions of microbial or parasitic aetiology: systemic infections (e.g., Bibersteinia infection, tetanus), microbial or parasitic infections of the digestive tract (e.g., clostridial infections, enteritis caused by Escherichia coli, viral infections, watery mouth disease, Salmonella infection, Cryptosporidium infection), respiratory infections (e.g., Mannheimia infection, Bibersteinia infection, Pasteurella infection), other localised infections (e.g., liver abscess sydrome, streptococcal polyarthritis).

2. Perinatal period and perinatal-neonatal mortality

Perinatal period in sheep includes the period from the 60th day after conception until the 28th day after birth (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001).

In sheep flocks, the number of (a) foetus(es) which die later than the 60th day after conception, (b) foetus(es) which die during the birth process and (c) newborn lambs which die soon after birth, constitutes the flock's perinatal mortality. Thus, perinatal mortality includes (a) the foetal mortality and (b) the neonatal mortality.

Foetal mortality is death before birth and includes (a) ante-partum death (i.e., abortion) and (b) intra-partum death (i.e., death during the birth process). Neonatal mortality is death of newborn lambs during the first 28 days of life and includes (a) death during the first week of life (“hebdomadal”) and (b) death subsequently to the first week and until the 28th day of life (“post-hebdomadal”).

The first week of life is the most crucial for the survival of a newborn lamb. Knowledge of the precise age within this first week of life, at which death had occurred, is useful for the diagnosis of the cause of death. Within this first week of life, death of a lamb is defined as “immediate” (initial 24 h of life), “delayed” (24–72 h of life) or “late” (72 h to 7 days of life).

3. Procedure for investigation of deaths of neonatal lambs in a flock

3.1. Significance of neonatal deaths

Neonatal mortality rate is calculated as follows: [Number of lambs which died during the first 28 days of life]/[Number of lambs born alive] × 100. A realistic target for neonatal mortality rate in a well-managed flock should be 3%; the upper acceptable limit under any circumstances should be 5%. The rate should be constantly calculated and readjusted throughout a lambing season, in order to monitor any abrupt change (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001).

One may also calculate two further mortality rates. One is the stillbirth rate, which is defined as the percentage of lambs found stillborn out of total number of lambs born (this includes stillborn lambs and lambs born alive, but excludes aborted foetuses). The other is the mortality rate during the first 72 h of life of lambs; this includes only deaths which occurred in the first 3 days of the life of lambs and reflects the immediate and delayed neonatal mortality in the flock.

The above measures can provide some ideas regarding causes of neonatal deaths (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001). In general, stillbirth rate is influenced primarily by non-infectious pathological conditions. In contrast, mortality rate during the first 72 h of life, is equally dependent on non-infectious pathological conditions and on microbial diseases.

3.2. Evaluation of management practices

During investigation of neonatal deaths, the following information related to management practices should be obtained (Ganter, 2008; Farquharon, 2009).

- Reproductive management of the flock during the breeding season: application of hormonal control of reproduction, application of artificial insemination or ram mating, number of rams available for mating, management of replacement ewes. Subsequently to synchronisation of oestrus cycles of ewes during the breeding period and the consequent concentration of lambings in a short period, there may be increased neonatal mortality if inadequate personnel is available during the lambing period.
- Breed, age and body condition of ewes, whose lambs had died. Lambs of primiparous ewes are at higher risk to die than lambs of older ewes. Ewes with suboptimal body condition are predisposed to pregnancy toxaemia and to production of colostrum of inferior quality; thus, their lambs are more susceptible to infections and death.
- Health management of pregnant ewes: vaccination schedule, anthelminthic treatments, availability of supplementary feed. Vaccination of ewes during the last month of pregnancy contributes to protection of newborn lambs, provided they receive adequate colostrum intake.
- Lambing management: number and experience of farm personnel, monitoring of peri-parturient animals, hygiene conditions at lambing area, individual penning of ewes and their newborn lambs immediately after lambing, availability of heaters for lambs, etc. Inexperienced farm personnel may cause lamb injuries if they attempt to perform obstetrical interventions in cases of dystocia. Individual penning of ewes and their newborn lambs immediately after lambing and effective separation from other animals in the flock contribute to establishment of a strong ewe-lamb bond and to adequate intake of colostrum by the lamb; thus, risk of neonatal mortality is reduced. Good hygiene conditions in a farm reduce infection rates of animals and contribute to higher survival rates of newborns.
• Health management of newborn lambs: confirmation of adequate intake of colostrum, navel care, availability of “colostrum bank”, housing conditions, castration of males, docking, possible fostering of lambs in large litters. Disinfection of the navel of newborn lambs prevents entry of microorganisms, which might cause various diseases. Colostrum from a “colostrum bank” is advantageous over artificial colostrum, because it can protect newborns more effectively against diseases prevalent in the farm. Castration of male lambs and docking may interfere with colostrum intake and therefore, should be better performed on the 3rd or 4th day of life.

3.3. Clinical and pathological examination

Initially, a detailed clinical examination of sick lambs (if any) and their dams should be performed. The examination of lambs may direct diagnosis to an affected system (e.g., respiratory infection), whilst examination of ewes can provide information regarding conditions affecting survival of the newborn (e.g., dystocia, mastitis) (Mavrogianni and Brozos, 2008).

Subsequently, a post-mortem examination must take place in lambs that had died a short time before (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001). Although the pathological examination is a very useful diagnostic method, for management reasons, one can set a limit to the number of lambs that would be examined. The first 10 lambs which die in every lambing season should be examined. Thereafter, post-mortem examination must be carried out in 10% of lambs which die (i.e., in one lamb for every 10 which die). Post-mortem examination of young lambs is quick and easy to perform; its findings can support the diagnosis.

Samples for microbiological, parasitological and/or histological examination can be collected, if considered necessary (Willmington and Davies, 2009). Useful samples can be collected from the liver, the spleen, the lungs and heart blood; intestinal contents plus mesenteric lymph nodes (enteritis), joint aspirate (polyarthritis), brain (neurological disorders) may also be useful in the respective conditions.

3.4. Evaluation of the time of death

The farmer is probably able to give an indication of the age, at which a lamb died. However, this must be accurately determined, by taking into account the following findings (Hindson and Winter, 1990).

Cases of ante-partum death and long-standing intraterine retention of a dead foetus(es) are characterised by mumification, autolysis and collapse of eyeballs in the corpse. In cases of ante-partum death and immediate abortion, the dead foetus is fresh; no thrombus is evident at the squared-ended umbilical artery. In foetuses which had died intra-partum, there is no thrombus at the tapered-ended umbilical artery; if death occurred at an early stage of the lambing process, renal autolysis is also evident; if death occurred at a late stage of the lambing process, no renal autolysis is usually evident, but subcutaneous oedema can be seen. In lambs which had died in the first few minutes of their life, thrombus is obvious at the end of the umbilical artery; the navel is wet, but the lungs are not inflated. In lambs which had survived for some hours, the navel is wet and the lungs have been inflated; the hoof membrane may just start to separate. Finally, in lambs which had survived for a few days and had walked, the navel is shriveled and the hooves are hardened.

4. Significance of the findings

4.1. Intra-partum deaths

The most common causes of intra-partum death are the following (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001).

• Inexperienced farm personnel, which might have offered delayed obstetrical assistance or might have performed inappropriate obstetrical manipulations in cases of dystocia. Occasionally also, inexperience coupled to lack of patience by the farm personnel could lead to offering unnecessary obstetrical assistance in a ewe (e.g., at an early stage of lambing), which can be harmful.
• Management mistakes during the breeding period or during the last month of pregnancy. Mistakes during the breeding period include mating of ewes of small-size breeds to a ram of large-size breed or induction of reproductive activity in ewe-lambs prematurely and subsequent mating at an early age. This results to foeto-maternal disproportion and potential dystocia, leading to intra-partum death of the lamb. Mistakes during the last month of pregnancy include imbalanced nutrition of the ewes, leading to hypocalcaemia which puts ewes at risk of dystocia.

Finally, one should also take into account the possibility that death of a lamb can be caused by a microbial agent which had affected the pregnant ewe without causing abortion, but leading to death of a moribund lamb. Such cases (e.g., possibly caused by Chlamyphila abortus) usually follow or occur simultaneously with abortions in pregnant ewes within the flock (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001).

4.2. Post-partum deaths

Immediately after birth, the common causes of lamb death are mainly similar to those discussed above (intrapartum deaths). Moreover, injuries during the birth process can also lead to death of the newborn lambs, depending on their severity and early initiation of treatment (Dennis, 1974; Rook et al., 1990; Haughey, 1991; Bernal, 2001).

In the first few hours after birth (“immediate death”), the most common causes of neonatal losses are as follows:

• Congenital defects, causing difficulty to the newborn lamb to stand up and walk (e.g., defects of the spine, defects of legs, defects of the central nervous system).
• Injuries and traumas during the birth process.
• Early age (“primary”) hypothermia.
Subsequently to the first day of life ("delayed death"), the most common causes of neonatal losses are as follows:

- Congenital defects, making survival of the newborn lamb impossible (e.g., defects of the gastrointestinal tract).
- Secondary hypothermia, usually as a consequence of starvation.
- Pathological conditions of microbial or parasitic aetiology.

References