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Central nervous system injury as a determinant of lamb mortality

X. J. DUFF*, S. N. MCCUTCHEON, and M. F. MCDONALD

Massey University, Palmerston North

ABSTRACT

The incidence and severity of central nervous system (CNS) injury in neonatal lamb deaths was examined in a commercial Romney flock. Cranial and/or spinal meningeal lesions were found in 87% of dystocia deaths and 32% of starvation-exposure deaths. Occurrence of injury was dependent on birth weight. Severe CNS injury was present in lambs dying of dystocia but rarely seen in lambs dying of starvation-exposure. CNS injury did not affect the proportion of lambs in the starvation-exposure group which had suckled prior to death. These results indicate that CNS injury may be an important factor in deaths due to dystocia but may have only a minor role as a cause of starvation-exposure mortality.

INTRODUCTION

Between 5 and 25% of lambs born annually in New Zealand sheep flocks die before weaning, the majority of these deaths occurring at or within 3 days of birth (Hight and Jury, 1970). The two most important causes of neonatal mortalities are dystocia and the starvation-exposure (S/E) syndrome, each accounting for approximately 30% of all lamb deaths (McFarlane, 1955; Hight and Jury, 1970; Dalton *et al.*, 1980).

Dystocia occurs when the passage of the lamb through the ewe's pelvic inlet is restricted during parturition. Death may occur during or immediately after parturition and is frequently the result of trauma and/or hypoxia affecting the lamb's central nervous system (CNS) or other vital tissues (Haughey, 1973b, 1975, 1978, 1980).

The major factors associated with S/E mortalities are less easy to identify because post-mortem examination frequently reveals evidence of both starvation and cold exposure. In their review of the S/E syndrome McCutcheon *et al.* (1981) described several pathways by which cold stress can have an important influence on lamb survival. However, CNS injury, sustained during the birth process, has also been implicated as a major cause of dystocia and S/E deaths (Haughey, 1973a, b, 1975, 1978). The incidence of CNS injury in flocks examined by Haughey (1973a, b), approached 100% in parturient deaths and exceeded 50% in post-parturient deaths. Severe injury may cause death during, or immediately after, birth (dystocia). Less severe injury may also prejudice lamb survival, primarily by impairing the lamb's suckling drive in cold environments (Haughey, 1975). Haughey's findings

have led to the proposition that cold stress may be only a secondary cause of S/E deaths and that lambs with a prior birth injury succumb to cold stress due to their inability to replenish declining energy reserves (Haughey, 1975, 1978).

This paper describes the results of a trial aimed at determining the incidence, severity and significance of CNS injury in lambs dying of dystocia and S/E in a commercial Romney flock.

EXPERIMENTAL

An internal culling mob of 1414 mixed-age Romney ewes at Massey University's 'Riverside' property near Masterton was randomly divided into 2 equal groups and mated separately to Southdown or Suffolk sires. Lambing commenced in early August 1980 and the lamb drop was estimated to be 1.37% lambs born per ewe lambing. All lambs dying at or within 3 days of birth were examined post mortem and sire breed, sex, birth weight, age, cause of death and incidence and grade of CNS injury recorded. The autopsy procedure was modified from that described by McFarlane (1965) by examining the CNS for presence and severity of cranial and spinal meningeal lesions (Haughey, 1973a). Examination of the spinal cord and cavity was confined to the cervical region. Grade of severity was assessed subjectively on the basis of the number of sites affected and the size of lesions involved. Grade 1 indicated very minor damage and grade 5 very severe damage. Classes of death included dystocia, starvation-exposure and unspecified 'other causes'. In the latter group time of death was classified as parturient or post-parturient. Analysis of discrete data was performed using the logit transformation (Nelder, 1975).

* Present Address: School of Agriculture and Forestry, University of Melbourne, Australia.

TABLE 1 Incidence of cranial and spinal meningeal lesions in lambs classified by cause of death.

Cause of death	Number examined	Incidence %		
		Cranial lesions	Spinal lesions	Cranial and/or spinal lesions
Dystocia	76	86	54	87
Starvation-exposure	97	18	23	32
Other causes				
parturient deaths	33	61	33	64
post-parturient deaths	19	32	16	32
Total	225	48	34	55

RESULTS

The neonatal mortality rate, defined as the proportion of lambs born which died at or within 3 days of birth, was 16%. Overall, 30% of lamb deaths were due to dystocia, 40% to S/E and 30% to 'other causes'. The proportion of dead lambs exhibiting CNS lesions in each cause of death is shown in Table 1.

The distribution of grades of cranial and spinal lesions in CNS-injured lambs is shown in Figure 1. In the S/E group, 86% of cranial lesions and 72% of spinal lesions were of grade 1, with only 5% of either lesion being grade 3. A greater frequency of severe lesions was seen in the dystocia group with 31% of cranial lesions and 42% of spinal lesions being grade 3 or greater.

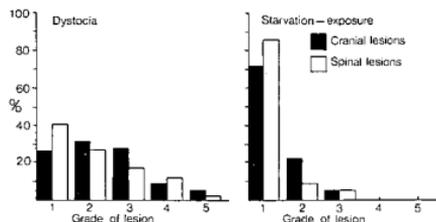


FIG. 1 The distribution of grades of cranial and spinal meningeal lesions in CNS-injured lambs dying of dystocia and S/E.

The presence of CNS injury in the form of either cranial or spinal lesions was found to have no significant effect on the proportion of lambs which had suckled in the S/E group. The proportions of CNS injured and non-injured lambs which suckled were 16% and 17%, respectively.

The relationship between incidence of CNS injury and birth weight in lambs dying of dystocia and S/E is shown in Figure 2. Frequency of both cranial and spinal lesions increased in an approximately linear fashion with increasing birth weight.

DISCUSSION

The relatively high incidence of CNS injury in lambs dying of dystocia is similar to that observed by Haughey (1973a, b). In that study the incidence of CNS injury in parturient deaths, the majority of which were due to dystocia, was 93%. Haughey (1980) subsequently reported that the incidence and severity of CNS lesions increases with the duration and vigour of birth. Lamb birth weight is an important factor which will determine both the difficulty of the birth process and the incidence of CNS injury (Figure 2), although interacting factors such as pelvic size of the ewe will also be important (Quinlivan, 1971; Haughey, 1973a, McSparran, 1975). The fact that in this study almost all lambs dying of dystocia exhibited CNS lesions and that a considerable proportion of these lesions were of major severity, supports the view that CNS injury is likely to have important pathological significance in this type of mortality.

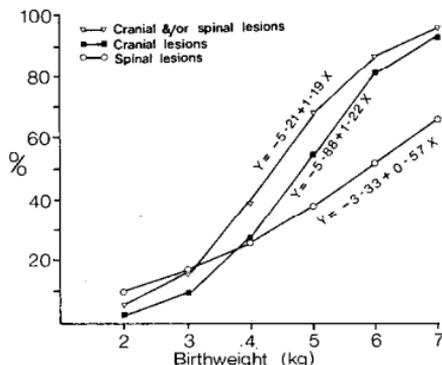


FIG. 2 The relationship between birth weight and incidence of CNS lesions of 3 categories—cranial and/or spinal lesions, cranial lesions overall and spinal lesions overall. (Regression equations are based on logit-transformed data.)

Conversely, CNS injury appears to have contributed little to S/E mortalities in this flock, since only one-third of the S/E lambs exhibited CNS lesions. This estimate is similar to that of Alexander *et al.* (1980) whereas Haughey (1973b) found that 55% of post-parturient deaths (all of which showed evidence of S/E) were CNS-injured. Moreover, the CNS injuries observed in the S/E lambs at 'Riverside' were rarely severe and it is questionable whether they would have been sufficient to impair the suckling drive.

Finally, the presence of CNS injury in this study apparently had no effect on the frequency of successful suckling, contrary to Haughey's (1975, 1978) findings. The proportion of lambs which had suckled prior to death was, however, low when compared with previous studies (McFarlane, 1961, 1966). Two-thirds of the S/E lambs were affected by lesions of cold injury (peripheral subcutaneous oedema) which have been shown to be useful criteria in determining the exposure of lambs to cold prior to death (Haughey, 1973c). Since the lamb's suckling drive may be impaired by hypothermia or by 'discomfort' associated with cold stress (Alexander and Williams, 1966) this factor, rather than CNS injury, appears likely to have been primarily responsible for the failure of most of these lambs to suckle. Inadequate maternal behaviour may also have been involved.

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