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Studies in the Pelvic Region of the Ewe during Pregnancy and Parturition

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SUMMARY:

RESearch on infertility in sheep has been directed chiefly toward a better understanding of the elements underlying the conception and development of an optimum number of young. Less attention has been given to that point in the reproductive process on which the successful culmination of all these events depends, namely parturition. Problems such as difficult lambing and vaginal prolapse or bearing trouble may cause considerable reduction in effective fertility. Knowledge of the factors affecting the size of the birth canal is important in relation to both these problems; in bearing trouble the attachments of the reproductive tract must also be considered.

In view of the fact that for farm animals this aspect of reproductive physiology has been largely neglected, investigations have been initiated at Ruakura on the hormonal control of pelvic relaxation in the ewe. As a foundation to this work it was considered necessary to define first the physical changes which normally take place in the pelvic region during pregnancy and parturition.

A large number of ewes has been investigated at all stages of the reproductive year and several different techniques have been employed. Study of pelvic joint relaxation has been made on dissected animals, and by radiography of live ewes. Changes in the pelvic attachments of the reproductive tract and other appropriate soft tissue were first investigated on dissected material and some of the more informative techniques subsequently applied to live animals. To put such an anatomical study on an objective basis it was considered essential to develop physical methods, and instruments have been designed for this purpose. All characteristics involving the measurement of movement or displacement were made under conditions of constant tension.

To test the validity of this method of approach in the understanding of abnormalities of parturition it has not yet been convenient to collect information from ewes which have experienced difficulty in lambing. It has, however, been possible to study characteristic changes in pelvic anatomy of a number of ewes suffering from, or with previous histories of, bearing trouble. Fresh cases have been dissected and compared with normal ewes in the same stage of gestation. Animals with a previous history of the condition have been studied during their subsequent pregnancy.

Measurements on the dissected pelves of some fifty ewes killed at different stages of gestation and after parturition showed that changes in the attachments of the tract to the pelvic canal occurred first at approximately four months of gestation. Loosening of the sacro-iliac joint began at three months. The sacro-lumbar joint became more flexible with the advance of pregnancy, though the great variation between ewes caused difficulty in deciding the exact stage at which the changes first began. Maximum values for these different measurements occurred in ewes killed immediately after lambing. Regression of joint changes was incomplete in some cases three months after lambing. The soft tissues were regressed at one month. Ewes with bearing trouble killed at approximately full-term, tended to have more elongated tract attachments, looser sacro-iliac joints and less flexible sacro-lumbar joints than normal ewes at the same stage. The standard deviation for the means of these values was relatively high.

Radiographs on the pelves of a number of live ewes throughout gestation confirmed observations made on dissected animals showing that no change occurred in the pubic symphysis. The radiographs also showed that little, if any, lateral movement took place at the sacro-iliac joints. Loosening of the joints and elongation of the sacro-iliac ligaments resulted rather in a vertical pivoting movement at the sacrum with a consequent marked increase in size of the pelvic outlet at the time of parturition, the inlet remaining virtually unchanged.

Observations were made on fifty normal ewes and fifty ewes with previous histories of bearing trouble, at different stages of gestation and after parturition. The two main characteristics measured were the potential displacement of the reproductive tract in the pelvic canal and the vaginal circumference. It was considered that in the former case the pouches of the pelvic peritoneum were involved and that the latter measurement recorded the combined effect of relaxation in the circumference of the vagina and the muscles of the perineum.

In considering the results of this investigation, the "bearing" ewes were divided into two categories—previous and recurrent. The first 33 ewes consisted of those animals which did not develop bearing trouble in the season of the experiment. Ewes in the second category, (17) again developed the condition. Tract displacement measurements increased at between three and four months of gestation, while the vaginal circumference increased at about six weeks. The "previous" bearing ewes tended to have higher values than the controls for both characteristics, especially in late pregnancy. Most of the recurrent cases had very high values. There was considerable variation between ewes both in extent of relaxation and in the stage of pregnancy at which changes were first observed. Measurements taken 6 weeks after lambing approximated those taken before mating.

In addition to these quantitative methods, a deep-freeze technique has been developed to study in greater detail the anatomical relationships of the pelves of ewes in different conditions. A whole skinned carcase is frozen solid (at -15 degrees C.) and subsequently sectioned in different planes. Only a few animals have been studied so far. Gross displacement of vagina, bladder and uterus and of the two central peritoneal pouches has been observed in full-term ewes with bearing trouble. Even in a non-pregnant ewe frozen in a supine position the central peritoneal pouches and the uterus were considerably displaced against the perineum. It is thus easy to understand the development of prolapse in a supine or lying pregnant ewe with relatively relaxed tract attachments and a greatly increased volume of abdominal contents. Observations on these ewes and on dissected ewes strongly suggest that ewes which have developed bearing trouble do tend to have looser pelvic joints and more relaxed soft tissues than normal animals. A complicating factor is, of course, the difficulty in distinguishing between cause and effect. However, from a few observations made before development of the condition it appears that relaxation may be a predisposing factor. In considering the use of controls in all these experiments, it must be appreciated that as bearing trouble probably depends on several factors, it is likely that ewes with high figures for these measurements in the control groups were potential bearing ewes, the other necessary contributing factors, such as increase in abdominal volume, being absent.

Discussion

Professor McLEAN: At Lincoln we have also measured changes in the vulva and vagina through pregnancy. It is evident that these changes take place earlier than the bony changes and other characteristics studied by the Ruakura workers. Involution is also more rapid. We are also working with relaxin, which has a very rapid effect on connective tissue. It is likely that this hormone may cause changes in the pelvic organs, but further study is necessary. As regards the effect of hormones on hydration of tissues, I would like to ask if anything has been done to study the effect of hyaluronic acid.

Mrs. BASSETT: The vaginal circumference measurement we used has, I think, given comparable results to those obtained by Professor McLean. I am not familiar with any work concerning the effects of hyaluronic acid on connective tissue.

Mr. WILLIAMS: What is the incidence of bearing trouble in New Zealand sheep? And is the condition more prevalent in any particular breed?

Mrs. BASSETT: Dr. Edgar can probably give you a better answer to this question. He collected a considerable amount of information while in England.

Dr. EDGAR: In a New Zealand survey some years ago on 18 flocks, Laing reported that the average incidence may amount to 4%. In England, some 20,000 breeding ewes were studied and the all-over incidence was $\frac{1}{2}$ %. Twenty breeds and crosses were represented, thirteen of which had bearing trouble. The remaining seven breeds were represented by small samples only. No particular breed appeared to be more susceptible than any other.

Mr. GERRING: Have you done any work on the changes which may take place in abdominal pressure during pregnancy?

Mrs. BASSETT: We used a tympanometer to measure abdominal pressure through pregnancy in the same 100 live ewes and at the same times as we measured soft tissue changes. These ewes were studied in a standing position and it was found that no appreciable change took place even in full-term ewes carrying twins.

Mr. PHILLIPS: This lack of pressure change in the standing position is understandable if the relation between pressure and abdominal contents are considered theoretically. Measurement of volume changes in which "dry" and "full-term" ewes were compared, showed an increase of 70% and 90% in the case of single lambs and twin lambs respectively. A simple calculation shows that the increase in girth, and hence internal pressure for these two cases will be of the order of 20% and 24% respectively, a change overshadowed by posture changes in the sheep.

On the other hand the calculated abdominal pressure change for even a dry ewe for the standing position as against lying would be of the order of 300%. In a pregnant ewe the increase in pressure will be markedly affected by her increased weight.

Mr. McFARLANE: I have been very interested in this paper from the point of view of dystocia in ewes. Figures which we obtained at Gisborne during the last year showed that there was a neo-natal mortality in lambs of 16%, 25% of these were large lambs—2lb. heavier than the group average. They were not malpresentations but presented mostly head alone, the head being large and the feet consequently displaced. As a result of difficult birth the livers were torn loose from their attachments. The lambs had simply bled to death.