Cleft Palate in Cattle

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Cleft palate can be a serious problem in large domestic animals because, when so afflicted, they inhale food or water and death may result from inhalation pneumonia (*11*). In addition, they may die of starvation. Consequently, animals with cleft palate are generally destroyed at birth because they are difficult to care for and because the owners fear the condition to be hereditary. Surgical correction of this condition is economically unfeasible and, indeed, undesirable in animals used for breeding purposes.

Runnells and associates (*11*) indicated that cleft palate is common in calves and lambs. Reports in the literature concerning cleft palate in large domestic animals are typically case reports, with practically no controlled research on cleft palate in cattle and sheep.

Evidence has been presented that cleft palate in humans and mice can be hereditary (*3, 5, 9, 16*). It can also be induced by exogenous methods (*1, 8*). There is also evidence for differences between strains in the susceptibility to cleft palate induced by teratogens (*6, 7, 14*). Variability in results would thus be expected among nongenetically homogeneous groups of animals, and it is difficult to obtain groups of domestic animals that are genetically homogeneous.

Cleft palate has been observed in association with a congenital skeletal deformity, commonly known as the "crooked calf disease", which occurs in certain beef cattle producing areas in western continental United States and in Alaska (*12*). This condition has occurred in most dairy breeds and in all major beef breeds of cattle grazing certain range areas. The deformity is characterized by arthrogryposis, torticollis, or scoliosis, or by all three. Cleft palate may occur in combination with these deformities, or it may occur as the only grossly discernible anomaly. The "crooked calf disease" has been produced by feeding some varieties of the Lupinus species of plants to pregnant cows (*13*).

This report describes the results of two field studies designed to provide information about some causes of cleft palate in the cow.

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FIGURE 1. A calf with a cleft palate from Field Study One. This calf also had skeletal deformities.

Field Study One

Calves having cleft palate were obtained from various areas of western United States where the "crooked calf disease" occurs and were brought to the laboratory for study. Various ranches in these same areas were surveyed to determine the incidence of cleft palate and to evaluate possible hereditary aspects and management programs. The cattle on one ranch were studied intensively for 15 years.

The findings indicate that cleft palate occurred alone or with any or all of the named anomalies associated with the "crooked calf disease". A deformed calf with a cleft palate is shown in Figure 1 and 2. Shown in Figures 3, 4, and 5 are a series of cleft palates of varying severity. Cephalic malformations were occasionally associated with the cleft palate. Calves with cleft palates frequently had subtle facial and neurocranial abnormalities.

A survey conducted over a 4-year period among 4,000 cattle from

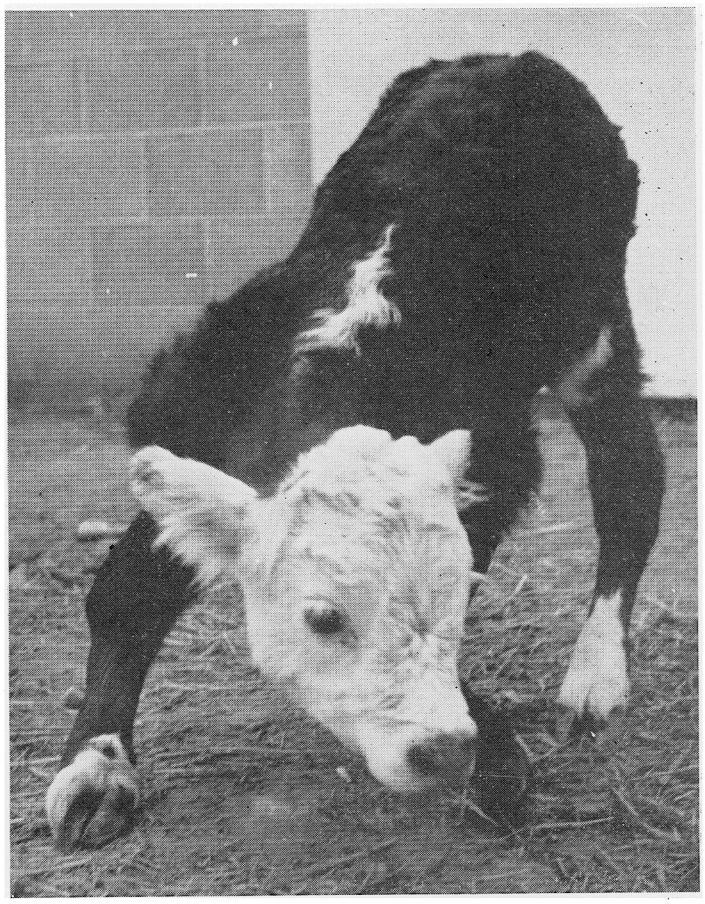

FIGURE 2. A calf with skeletal deformities often associated with the cleft palate seen in Field Study One.

ranches in 4 cattle associations indicated that 2.7% of the calves born were deformed. The deformities as described by the ranchers were crooked legs, twisted necks and backs, and lack of hard palates. In some years, one ranch had as many as 10% of the calves born with cleft palate.

The survey of the records of another ranch showed an average of 9.8% deformed calves over a 15-year period, with 2.5% of the total calves born having cleft palates. This ranch used 10 different bulls over the 15-year period, all of which were unrelated insofar as could be determined. There was no difference in the distribution of calves with skeletal deformities or cleft palates sired by the various bulls.

In an attempt to prevent this congenital deformity, many ranchers disposed of all their bulls or their cows, or both, while a few changed

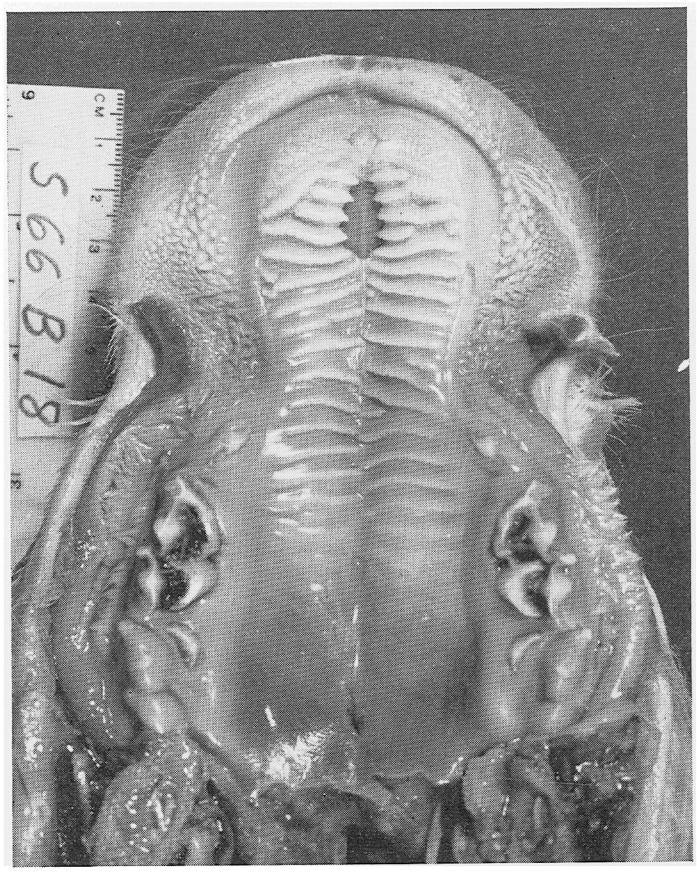

FIGURE 3. An example of a slight cleft palate seen in Field Study One.

breeds of cattle. None of these changes produced a decrease in the incidence of the deformity.

Eleven deformed cows with normal palates were mated to a bull with crooked legs and cleft palate, all gave birth to normal calves. The surveys and breeding experiment indicate that this deformity was probably nonhereditary.

Field Study Two

Seven hundred and fifteen hereford cows from a single ranch were artificially inseminated with semen from 6 normal appearing hereford bulls. Six of the 215 calves sired by one of these bulls had cleft palate and skeletal deformities. The following year the 6 cows that gave birth to the 6 deformed cleft palate calves were again mated to this bull. To further test the hypothesis that this condition was hereditary, 5 of

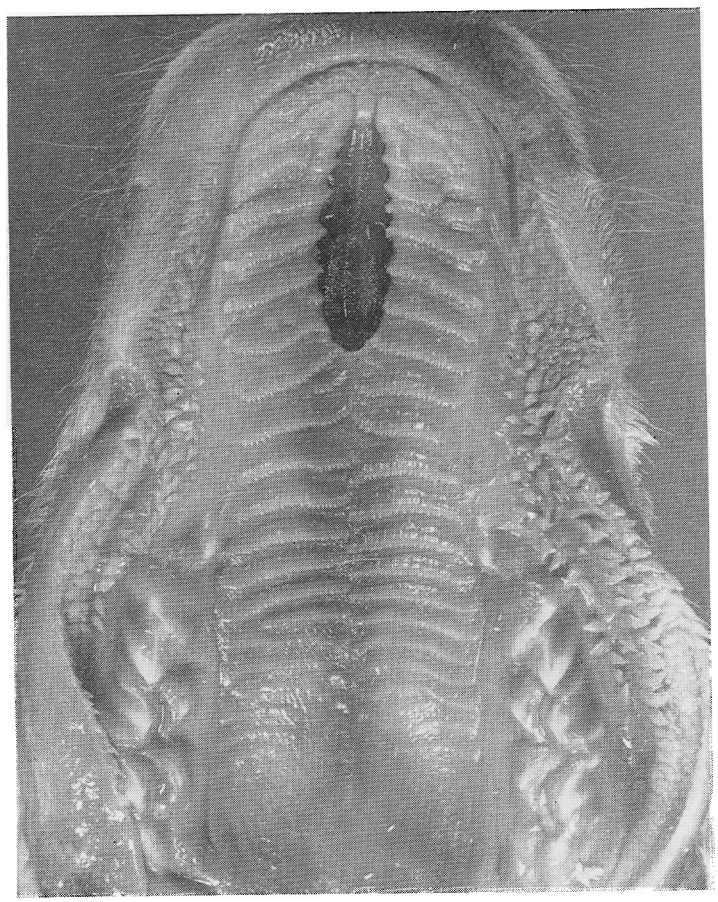

FIGURE 4. A more severe example of cleft palate seen in Field Study One.

these cows that gave birth to calves with the cleft palate and skeletal deformity were brought to the laboratory for further study.

All calves born to the 6 hereford cows mated to the normal appearing hereford bull had similar types of malformations. The skeletal malformations observed were arthrogryposis, torticollis, scoliosis, and kyphosis. All had cleft palates (Figures 6 and 7). Atretic anus was observed in some. The cows had prolonged gestation of about 2 weeks. There were no signs of preparation for parturition. The calves were all fully covered with hair and had normal appearing hoofs, but were only about half the size (29 to 32 lb) of normal hereford calves at birth. All calves were dead at birth or died immediately afterwards.

The following year, 1 of the 6 cows aborted or failed to conceive and was sold. Two of the remaining 5 cows had deformed calves with cleft palates typical of those born to these cows the previous year. The

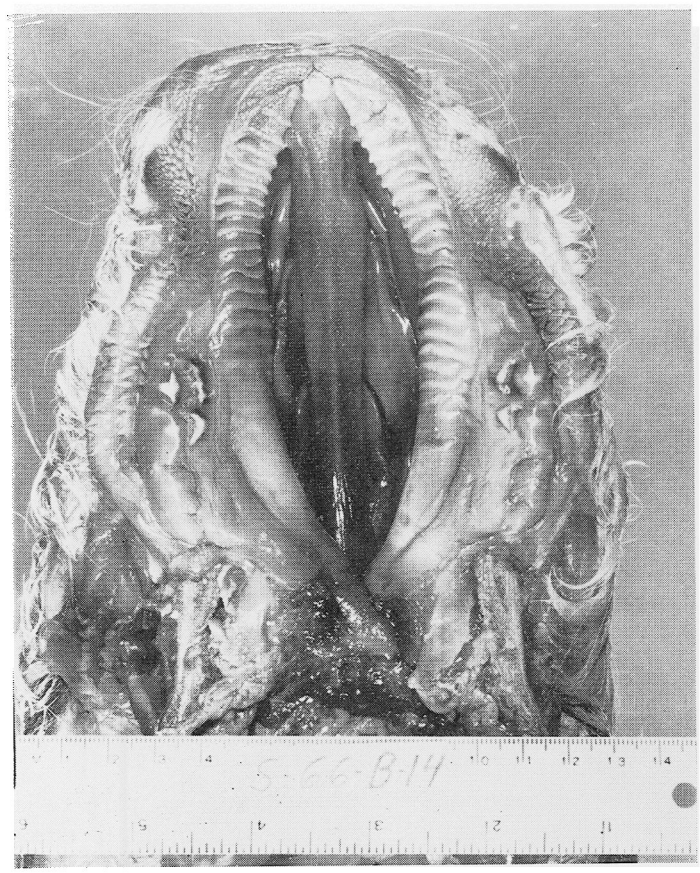

FIGURE 5. A severe cleft palate seen in Field Study One.

first year after the cows were at the laboratory, 1 of the 5 cows aborted, 1 failed to conceive or lost the conceptus, and the other 3 gave birth to normal calves. The next year, 1 of the 5 cows gave birth to a deformed calf with cleft palate and 3 had normal calves. One cow was not bred. Both sexes of the calves were equally affected.

Discussion

Cleft palate has been observed under field conditions in association with the "crooked calf disease", which has been induced by feeding lupine to cows from the 40–70th day of gestation. Cleft palate has not been experimentally induced with lupine as yet, although there is an etiological relationship between lupine and the skeletal deformities of the crooked calf disease.

There are a number of factors involved in the experimental production of such a deformity. Lupine plant toxicity varies with species,

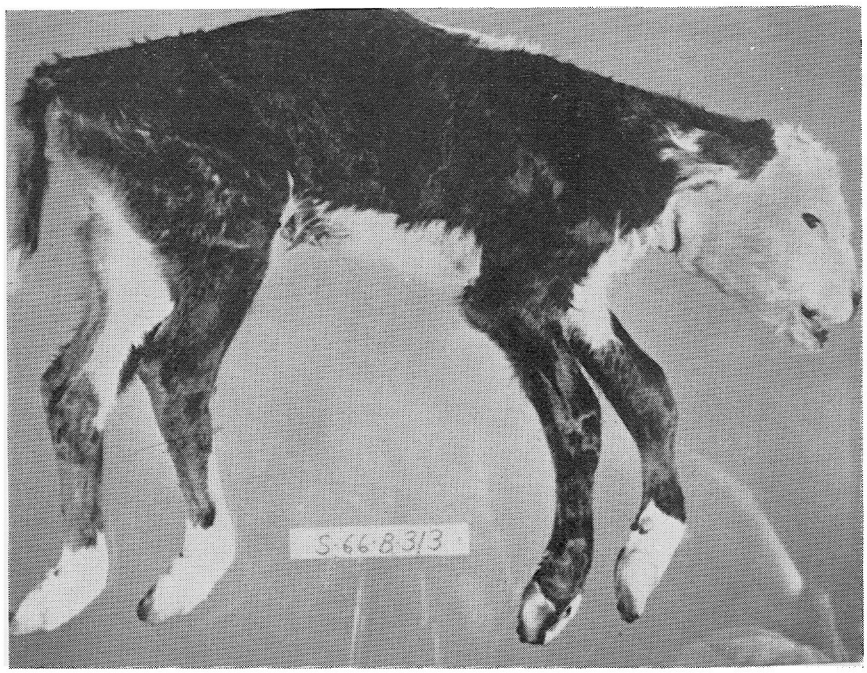

FIGURE 6. A calf with skeletal deformities from Field Study Two. The skeletal deformities included arthrogryposis, and kyphosis.

area, year, and stage of growth. These variables plus variation in individual animal response make it extremely difficult to establish the dosage, which is apparently rather specific for production of malformations (*15*). The exact time of insult to the palate is not known and it is difficult to project to cattle the information known about laboratory animals and man. In environmentally induced malformations, biological variables are seldom correlated sufficiently to produce a high incidence of the effect. Whatever the teratogenic agent, it may exert its effect in a dose range just below that which interrupts pregnancy altogether (*5, 10*).

Because of the size and economic problems of obtaining and caring for cattle, the number used in controlled experiments is, of necessity, small. This fact decreases the probability of obtaining statistically significant results in any year.

In addition, ruminant animals, such as cattle and sheep, differ somewhat from usual laboratory animals inasmuch as the microflora of the rumen are capable of synthesizing all of the water soluble B vitamins and also the amino acids. The rumen flora also may metabolically alter some of the toxic materials ingested.

The cleft palate syndrome observed in Field Study Two is somewhat similar to that reported in rabbits by Brown and Pearce (*2*).

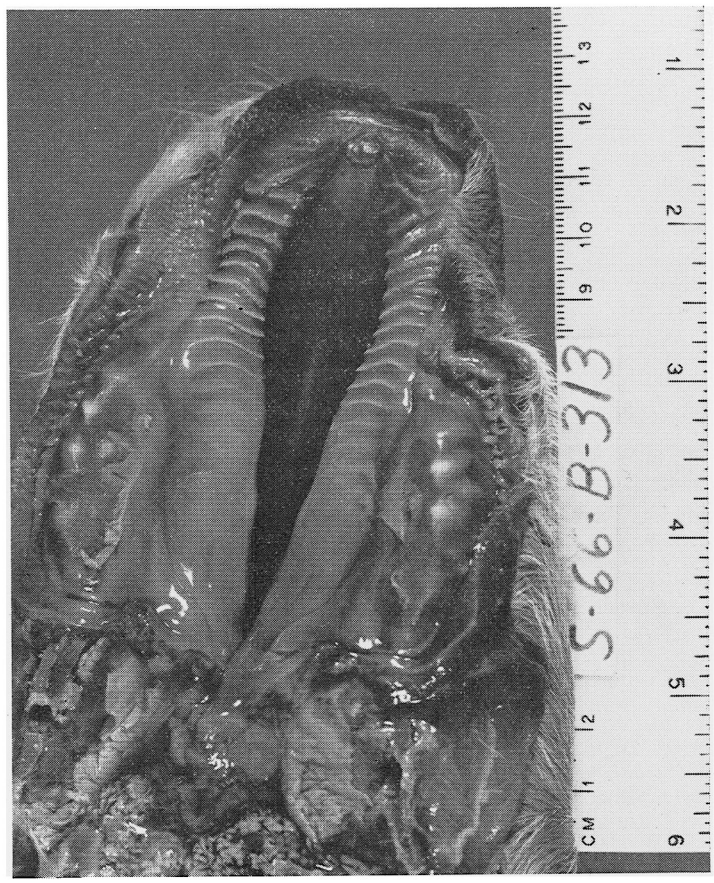

FIGURE 7. The cleft palate of the calf shown in Figure 6.

Approximately 1 of 4 calves born in Field Study Two had a deformed skeleton and cleft palate. This finding suggests that the deformity is a simple autosomal recessive character. The condition is lethal in nature.

Defective fetuses are more likely to die than be carried to term (*4*). This fact may explain the abortions observed among the 6 experimental cows. The bull siring the deformed calves has been used extensively by ranchers. One such rancher has reported cleft palate deformed calves sired by this same bull. One wonders what proportion of other cows bred to this bull have aborted or had resorbed fetuses.

Obviously, one can infer that the clefts observed in Field Study One were associated with the crooked calf disease and perhaps by a toxic agent such as lupine. Such a cleft could be considered to be induced. In contrast, clefts observed in Field Study Two may be considered related to a recessive genetic trait and can be labeled as hereditary. According to Fraser (*9*), almost every malformation induced by an

environmental teratogen can be matched by one induced by a mutant gene. Many of the anomalies observed in the two studies reported here are similar, and so may support Fraser's contention.

Summary

The causes of cleft palate in cattle were investigated in two field studies. In one study, cleft palate was found to be associated with the so-called crooked calf disease and, as such, may be considered to be related to a toxic agent, possibly lupine. In another study, cleft palate was apparently hereditary in nature. Calves in both studies showed skeletal deformities.

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