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Cooperative Project on the Weak Calf Syndrome

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Introduction

The "Weak Calf Syndrome" has been gaining wide recognition throughout the northwest and Rocky Mountain regions. The specific syndrome was first noted as possibly being caused by a new entity by Dr. Jack Ward in the Bitterroot Valley of Montana after Dr. Ward was unable to relate the observations of necropsied specimens with that of any known published reports. The actual orgin of the disease responsible for the specific syndrome noted in the area is not known and may have had its orgin elsewhere. However, interest in the problem is increasing in view of the apparent recognition of the disease and acknowledgment of its presence in many different areas.

The problem is particulary devastating when experienced within a herd for the first time, as losses range from 25% to as high as 75% of the calf crop. The initial recognition has been an increase in the abortion rate followed by the calves' inability to rise at birth. The degree of weakness has varied from animal to animal. Many of the calves will be polyarthritic and most die soon after. A few animals are able to survive when immune therapy, blood transfusion, electrolyte solutions, or other fluids are administered. A large number of the animals that survive progress poorly, attaining weight gains of one-half that of their normal counterparts.

Gross Pathology

1. Aborted fetuses: Edema of subcutaneous and interstitial tissues throughout the body; port-wine colored fluid in the pleural and peritonal cavities, and hemorrhagic lesions in the subcutaneous tissues.
2. Calves delivered at term and those dying after delivery: Subcutaneous edema, hemorrhages in the anterior neck and masseter muscles and in the muscles of the extremeties. Bloody synovial fluid with fibrin. Petechial hemorrhages in the third eyelid, sclera, conjunctiva, ventral surface of the tongue, esophagus, trachea, and frequently in the thymus. Enlarged and edematous suprascapular and prefemmoral lymph nodes. Mild to severe gastroenteritis associated often with enlarged mesenteric nodes. Striking reddish muzzle turning somewhat leathery within a few days, etc.

Neonatal calf losses observed at MARC similar to those occurring in the northwest were first observed near the end of calving 1975. Losses in the 1976 calving season reached levels of 10% of the calves born to heifers;1977 losses were similar to 1976. Dr. Arlan McClurkin, research veterinarian, National Animal Disease Center, has observed the losses here and has conducted extensive work attempting to isolate infectious agents.

Extensive research is being conducted by groups at Idaho State, Montana State, and Montana University. In general, the research being pursued is to search for viral agents that will reproduce the disease, to develop a diagnostic test to identify affected calves that do survive, vaccine development, and the relation of the diseases to cold-weather stress and/or nutrition.

US MARC Cooperative Research Project

Background. Neonatal calf disease with signs and lesions similar to those decribed for the Weak Calf Syndrome are now recognized as a serious problem in Nebraska as well as in most other states of the Old West Region. One of the herds in which it is a problem of considerable severity is the one at the U.S. Meat Animal Research Center (MARC). The problem at MARC has recurred annually for several years in first calf heifers. This herd will be a reliable source of materials with which to search for an infectious agent.

The facilities at the University of Nebraska are excellent for carrying out a search for a hard-to isolate infectious agent. Facilities for obtaining and holding gnotobiotic calves are unmatched in this country, and strict isolation facilities are abundant. There are also new, well-equipped research laboratories for virology, bacteriology, pathology, biochemistry, immunology, and electron microscopy; excellent diagnostic laboratories at Lincoln and North Platte; and a smaller diagnostic laboratory at Scottsbluff.

There are excellent facilities and personnel at MARC for handling and collecting materials from sick animals and for doing preliminary laboratory procedures. The record-keeping at MARC is a real asset in obtaining accurate histories for dams of weak calves.

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[1]William G. Kvasnicka is the herd health veterinarian at MARC.

Table 1.—MARC calving difficulty score

Score	Degree of difficulty
1	No assistance
2	Minor difficulty-hand assistance
3	Fairly difficlut-calf jack necessary
4	Major difficulty
5	Caesarean
6	Abnormal position on presentation

Table 2.—U.S. MARC 1980 weak calf syndrome incidence (within calving difficulty)

	909 Heifers calving						
Difficulty score	1	2	3	4	5	6	Total
Weak calf deaths	8	0	30	8	4	3	53
Total numbers	464	27	282	45	45	45	909
Percentage	1.72	0	10.63	17.77	8.88	6.66	5.83

	4,494 Cows calving						
Difficulty score	1	2	3	4	5	6	Total
Weak calf deaths	83	1	11	1	1	5	102
Total numbers	4045	40	180	40	20	135	4,494
Percentage	2.05	2.50	6.11	2.50	5.00	3.70	2.26

Objectives.

1. Attempt experimental transmission of the disease to Caesarean-derived, colostrum-deprived gnotobiotic calves.
2. Attempt isolation of infectious agent(s) from experimentally and naturally infected calves.
3. Study multiplication of isolated agent(s) in body tissues of experimental or natural cases using labelled globulins from convalescent or hyperimune sera.
4. Observe and evaluate gross and microscopic tissue changes in experimental and natural infections.

Methodology

Specific Tasks.

1. Extracts of tissue suspensions from infected calves, or cultures of infectious agents, will be inoculated into gnotobiotic calves by one or more of the following routes, as necessary:
   a. I.M. and/or I.V.
   b. Respiratory tract (via aerosol or intratracheal injection).
   c. Duodenum.
   d. Intrauterine, at 8 mo gestation.
2. If unsuccessful, the above inoculations will be repeated following cold and/or corticosteroid-induced stress.
3. Agents visualization and isolation attempts will be made using several techniques. Direct isolation by physical procedures will start with fluids (joint, intestine, CNS fluid, tissue suspensions), which will be subjected to differential- and density-gradient centrifugation and, alternately, molecular seiving.

   Density gradient bands and concentrated fluids will be negatively stained and viewed by transmission electron microscopy (TEM). The same fluids will be used for cell culture and chick embryo inoculations. Cell cultures and embryonating egg fluids will be examined for hemagglutinins and also will be negatively stained and viewed by TEM. Unconventional cell culture propagation techniques would be utilized that would allow for isolation of agents, which are strongly cell-associated, or which depend on the host cell being in an unusual metabolic state or at below-normal temperature.

   Body fluids and tissue suspensions will be inoculated into several mycoplasma media, collectively, which are capable of supporting growth of the species thus far reported from cattle.
4. Acute and convalescent sera from natural and experimental infections will be collected when possible, as well as serum and colostrum from dams that have given birth to an affected calf. These will be used for immunochemical tests, such as the indirect fluorescent antibody technique (IFAT). The IFAT will be done with cryostat cut sections from affected calves.
5. As infectious agents are isolated, they will be adjusted into laboratory animals to produce hyperimmune sera for immunochemical tests.
6. Blood sera and body fluids will be checked by conventional serology for antibodies against infectious bovine rhinotracheitis, bovine viral diarrhea virus, and adenovirus type 5, as well as for any infectious agents isolated in this study.
7. Detailed records of herd history will be obtained when possible. These data will include nutritional factors, vaccination regimen, prevailing climatic conditions, husbandry practices, and genetic background. This information will be used to help determine whether there is any correlation between these factors and the incidence of Weak Calf Syndrome.

Table 3.—Causes of neo-natal deaths 1980 by week of birth[1,2]

			Major cause of death				
Week of calving season	Calves born	Total calves lost	Dystocia	Weak calf syndrome	Scours	Starvation	Exposure
4th	480	40	14	7	5	0	0
5th	815	54	15	1	2	2	1
7th	716	154	28	48	33	0	18
8th	437	79	8	32	12	13	0
9th	311	37	5	12	6	2	3
Total	2,759	364	70	112	58	17	22
Percentage		13.2	2.5	4.1	2.1	0.6	0.8

[1]Calving season begins February 21 and lasts for 12 weeks with approximately 1,200 heifers and 3,800 cows calving. Heifers calve 3 to 4 weeks before the cows.
[2]Figures for 6th week were not available.