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Preliminary Observations on the Immune Status of Newborn Normal and Weak Calf Syndrome Calves

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PRELIMINARY OBSERVATIONS ON THE IMMUNE STATUS OF NEWBORN NORMAL AND WEAK CALF SYNDROME CALVES

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Summary

Thymus-derived lymphocytes from weather-stressed calves decline in response to Concanavalin A (Con A) and Pokeweed Mitogen (PWM) as the age of calf increases. Maximal response is from 24-hr old normal calves; very little response is from Weak Calf Syndrome (WCS) calves. This depressed response reflects the observed thymus degeneration in WCS calves and contributes to the animals' impaired immune system development.

Introduction

WCS is a collection of symptoms that includes severe weakness, difficulty in standing and subsequently nursing, swollen hock and carpal joints, bloody synovial fluid, susceptibility to secondary infection, and reddened muzzle. Upon postmortem examination, we observed enlarged and hemorrahagic lymph nodes and spleen, gastroenteritis, and degenerate thymus. Most weak calves are affected by 7 days of age and frequently die within 3 to 4 days. WCS appears to be associated with weather stress, and an increased frequency occurs during prolonged periods of cold, rainy weather. Seven percent of approximately 4,000 calves died with WCS symptoms during the cold, rainy 1980 calving season compared to less than 0.5% in the mild 1981 season. Because of the observed susceptibility to infection and abnormal lymphoid organs of affected calves, we assessed the immune status of WCS and normal calves.

Methods

Blood samples and thymus biopsy samples were obtained from age-paired normal and untreated WCS calves. Lymphocytes were enriched from the blood and from biopsy samples and assayed for their ability to respond to the immune stimulants Con A and PWM.

Results

Figure 1 shows that we observed no significant difference between peripheral blood lymphocytes of normal or weak calves nor an age dependent pattern of responsiveness. Similar patterns were observed with both Con A and PWM. However, Figure 2 shows that thymus-derived lymphocytes from normal calves respond maximally to Con A when obtained from 24 hr-old calves. This response declined by 10 days of age from one-third to one-sixth the observed response of peripheral lymphocytes. A similar pattern of decreasing responsiveness with age was observed with normal thymocytes when assayed with PWM. However, in contrast to thymocytes from normal calves, those from WCS calves showed very little response to either PWM or Con A (9% that of normal thymocyte Con A response and 11% normal thymocyte PWM response).

When cells from normal or WCS animals were assayed in the presence of WCS serum instead of normal serum, no differences were observed, indicating the absence of a serum-associated WCS factor.

The depressed response of the WCS thymus-derived lymphocytes would corroborate the increased susceptibility of these calves to such illnesses as pneumonia or scours. The immune system of cattle and of other mammalian species is incompletely developed at birth. Antibodies are present in very low levels in the calf and must be acquired from the dam through the colostrum within hours after birth. Development of the calf's own immune system continues from 6 months to a year after birth. In this process, the thymus plays an important developmental role, and its impairment would affect the animal's subsequent resistance to infection.

Thymus degeneration can be the result of malnutrition, either a general starvation or deficiency of a particular mineral, such as zinc. Prenatal virus infection causes a similar degenerate thymus in laboratory animals such as mice and could be causative in cattle WCS. The relative roles of these factors in WCS are not yet established, nor is the role of additional stress, such as weather stress, clearly understood.

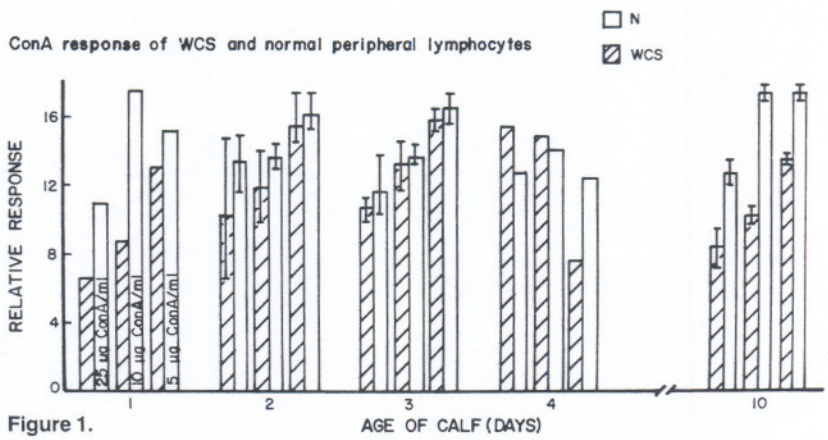

Figure 1.

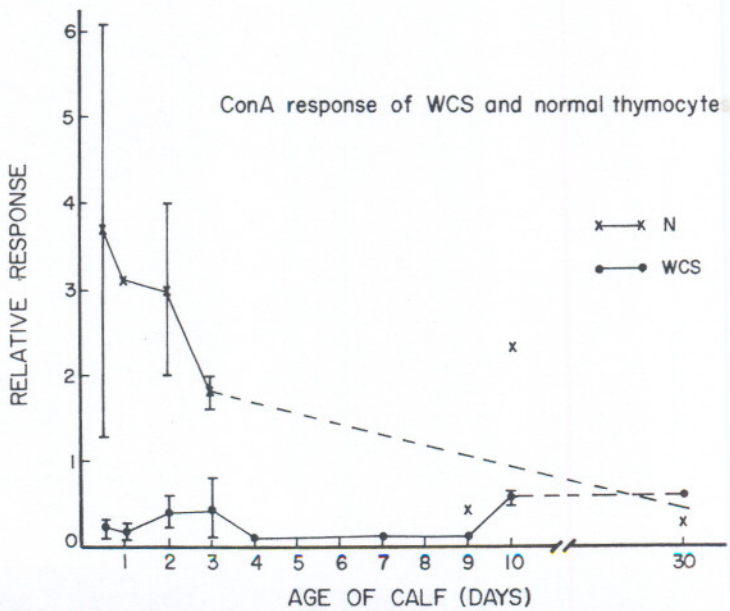

Figure 2.

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