CLINICAL REPORT:
Hemorrhagic Syndrome in Feedlot Cattle

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One of the authors (D.E.W.) was called to investigate a bleeding problem in 500-pound beef calves. These calves had been in a commercial feedlot for 45 days on a ration containing primarily corn silage. Of the 2,000 calves in this feedlot, approximately 70% were bulls and 50% had horns. Following dehorning and castration, approximately 2% of those involved in one or both surgical procedures died due to uncontrolled hemorrhage. Death loss was highest in the castrated animals. The use of normal hemostatic methods following castration did not seem to affect the death loss. The only effective therapy was the transfusion of 500 to 1000 ccs of whole blood to those animals still bleeding six to eight hours postoperative. The transfusion seemed to promote immediate clotting.

Treatment and Experimental Studies

Those steers which required transfusions were moved into a separate pen for study. These animals were placed on a ration containing approximately 1/3 alfalfa, 2/3 corn silage, and a 33% protein supplement for two weeks and clotting times were determined on seven animals (Table 1, Trial No. 1).

Table 1

Blood Clotting Times (Capillary Tube Method)

Animal No.	Trial No. 1	Trial No. 2
1	14 minutes	22 minutes
2	6 minutes	9 minutes
3	7 minutes	9 minutes
4	7 minutes	7 minutes
5	5 minutes	9 minutes
6	8 minutes	12 minutes
7	6 minutes	14 minutes
	Normal 5 to 6 minutes	

These animals were then returned to the original silage ration and after two weeks clotting times were again determined (Table 1, Trial No. 2).

Plasma samples were submitted to the laboratory* for assay of various clotting factors (Table 2). A marked deficiency of Factor VII was evident, even though the other Vitamin K dependent factors (II and X) were essentially normal.

All three Vitamin K dependent factors were then assayed on ten animals selected at random from the original pens, i.e., animals which had shown no particular bleeding problem. These

Table 2

Cow	PT	PTT	TT	FSF	Plt. Ct.	I	II	VII	V	VIII	X	FDP
1	20.0	52.2	13.8	+	330,000	1855mg%	44%	15%	360%	332%	136%	0
2	17.1	58.6	12.4	+	295,000	1145mg%	43%	14%	360%	40%	132%	0
3	17.8	40.4	11.6	+	83,000	1105mg%	34%	15%	480%	400%	106%	0
4	19.5	42.9	16.9	+	460,000	1100mg%	43%	14%	360%	400%	128%	0
5	19.5	40.4	12.9	+	680,000	533mg%	35%	14%	360%	260%	90%	0
6	17.8	39.4	13.1	+	990,000	505mg%	50%	12%	408%	120%	164%	0
7	20.7	49.2	12.7	+	366,000	458mg%	38%	9%	>600%	>400%	110%	0
Control	14.4	45.4	14.3	+	150,000	200-	75-	40-	75-	50-	75-	<68/ml.
(Human Plasma)	sec.	sec.	sec.		400,000 per cubic mm.	400%	125%	140%	140%	200%	125%	

PT = Prothrombin time in seconds.
PTT = Partial thromboplastin time in seconds
TT = Thrombin time in seconds
FSF = Factor XIII fibrin-stabilizing factor + = present
I = Fibrinogen
II = Prothrombin
VII = Serum prothrombin conversion accelerator
V = Accelerator globulin
VIII = Antihemophilic globulin
X = Stuart-Prower factor
FDP = Fibrin degradation products
0 = none present

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animals had only 12% to 28% of the normal level of Factor VII (Table 3).

Table 3
Clotting Factor Assays on Ten Normal Cattle*

	Factor II	Factor VII	Factor X
Cow 1	36%	18%	50%
Cow 2	32	12	40
Cow 3	35	24	60
Cow 4	44	20	70
Cow 5	41	20	76
Cow 6	35	16	44
Cow 7	35	22	68
Cow 8	32	14	60
Cow 9	58	28	60
Cow 10	42	21	59

*Percentage values were based on percent of normal human values found in plasma.

Because the bleeding syndrome appeared to be Vitamin K related, the original group of free-bleeders were fed 50 mgm. Menadione per day for three weeks. Factor VII assays were then determined and were found to have risen to a range of 37-48% of normal (Table 4).

Table 4
Factor VII Levels–Percent of Normal

Animal No.	Pretreatment	Post-Treatment
1	15	37
2	14	48
3	15	45
4	14	39
5	14	40
6	12	41
7	9	39

Treatment - 50 mgm. head/day/30 days

Silage samples were submitted to the laboratory of one of the authors (R.R.D.) for mycological and mycotoxin examination. *Fusarium tricinctum* was isolated with relative ease. Acetone extracts of the *Fusarium* species were assayed for antibiotic activity using the method of Burmeister and Hesseltine (1). A T_2-like mycotoxin was identified using this biological assay.

Discussion

The tendency for corn silage-fed animals to bleed freely has been a clinical observation by many veterinarians for many years. The exact nature of the syndrome and the pathogenesis have not been determined. Recently Osweiler and his group (2) have studied a porcine hemorrhagic disease. Their findings indicate the experimental disease is characterized by prolonged prothrombin time with Factor X deficiency and an associated Factor VII deficiency. These data suggest a Vitamin K deficiency. From the data presented here it would appear that this bovine hemorrhagic syndrome is at least related to a vitamin K deficiency, whether it be a simple deficiency, an antagonist, or interference with the liver's synthesis of Factor VII is unknown. With the unidentified mycotoxin, we were able to show growth inhibition to *E. coli* and numerous Sarcina species. Gustafsson (3) has shown that substitution of *E. coli* or Sarcina-like microorganisms completely reverses the vitamin K deficiency symptoms produced in germ-free rats. It is possible that these silage-fed animals become depleted in the vitamin K dependent plasma clotting factors due to the presence of this unidentified mycotoxin. If this is the case, it is not clear why Factor VII appears to be the most severely affected of the three vitamin K dependent factors.

Summary

A surgically induced hemorrhagic syndrome of feedlot cattle is described. The syndrome appears to be related to a deficiency of one of the vitamin K dependent factors, especially Factor VII. Oral medication with Menadione appeared to be effective as a means of prevention.

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