



Abomasal disorders in cattle: Insights into prevalence, clinico-pathology and ultrasonographic examination

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Supplementary Table 1. Clinical anamnesis recorded in the abomasal disorders of cattle (n=36)

S. No.	Clinical history	Parameters	Abomasal ulcer (n=15)	RDA (n=12)	LDA (n=6)	Abomasal bloat (n=2)	Abomasal impaction (n=1)	Over all	
								No. of cases	Per cent (%)
1.	Duration of illness	< 2 days	2(13.3%)	3(25.0%)	1(16.7%)	-	-	6	16.7%
		3-5 days	9(60.0%)	4(33.3%)	1(16.7%)	2	-	16	44.4%
		> 5 days	4(26.7%)	5(41.7%)	4(66.7%)	2	1	16	44.4%
2.	Feed intake	Reduced	8(53.3%)	1(8.3%)	3(50.0%)	-	-	12	33.3%
		Absent	7(46.7%)	11(91.7%)	3(50.0%)	2	1	24	66.7%
3.	Rumination	Reduced	9(60.0%)	2(16.7%)	2(33.3%)	-	-	13	36.1%
		Absent	6(40.0%)	10(83.3%)	4(66.7%)	-	1	21	58.3%
4.	Feeding	Rice	4(26.7%)	8(66.7%)	3(50.0%)	-	1	16	44.4%
		Others (milk)	5(33.3%)	-	-	2	-	5	19.4%
5.	Melena	Present	5(33.3%)	1(8.3%)	1(16.7%)	2	-	9	25.0%
6.	Colic pain	Present	2(13.3%)	3(25.0%)	3(50.0%)	2	-	10	27.8%
7.	Bruxism	Present	8(53.3%)	2(16.7%)	4(66.7%)	2	1	17	47.2%
8.	Transport	Recently transported	3(20.0%)	6(50.0%)	1(16.7%)	-	-	10	27.8%
9.	Previous treatment	Treated	10(66.7%)	3(25.0%)	2(33.3%)	2	-	17	47.2%
		Reduced	3(20.0%)	3(25.0%)	2(33.3%)	-	1	9	25.0%
10.	Dung voiding habitat	Diarrhea	4(26.7%)	1(8.3%)	-	-	-	5	13.9%
		Absent	2(13.3%)	6(50.0%)	3(50.0%)	2	-	13	36.1%
11.	Milk yield	Normal	6(40.0%)	2(16.7%)	1(16.7%)	-	-	9	25.0%
		Decreased	12(80.0%)	8(66.7%)	4(66.7%)	-	-	24	66.7%
		Normal	3(20.0%)	4(33.3%)	2(33.3%)	-	-	9	25.0%

Where, RDA: Right displacement of abomasum; LDA: Left displacement of abomasum

Supplementary Table 2. Clinical signs recorded in the various abomasal disorders of cattle (n=36)

Clinical sign	Parameters	Abomasal ulcer (n=15)	RDA (n=12)	LDA (n=6)	Abomasal bloat (n=2)	Abomasal impaction (n=1)	Over all (n=36)	
							No. of cases	Per cent (%)
Demeanor	Depressed	10(66.7%)	11(91.7%)	4(66.7%)	2	1	28	77.8%
	Alert	5(33.3%)	1(8.3%)	2(33.3%)	-	-	8	22.2%
Mucous membrane	Congested	3(20.0%)	4(33.3%)	3(50.0%)	1	-	11	30.6%
	Pale	8(53.3%)	6(50.0%)	2(33.3%)	1	-	17	47.2%
Pyrexia	Pink	4(26.7%)	2(16.7%)	1(16.7%)	-	1	8	22.2%
		5(33.3%)	1(8.3%)	2(33.3%)	1	1	10	27.8%
Tachycardia		2(13.3%)	5(41.7%)	4(66.7%)	2	1	14	38.9%
Tachypnea		1(6.7%)	3(25.0%)	4(66.7%)	2	-	10	27.8%
Abdominal distension	Right	-	7(58.3%)	-	-	1	8	22.2%
	Left	-	-	3(50.0%)	-	-	3	8.3%
Dehydration	Bilateral	2(13.3%)	-	-	2	-	4	11.1%
	Mild	1(6.7%)	7(58.3%)	3(50.0%)	-	1	12	33.3%
Bruxism	Sunken eye ball	3(20.0%)	2(16.7%)	2(33.3%)	2	-	9	25.0%
Ping sound	Present	8(53.3%)	6(50.0%)	3(50.0%)	2	1	20	55.6%
Rumen protozoa		-	3(25.0%)	2(33.3%)	-	-	5	13.9%
	Normal	4(26.7%)	3(25.0%)	2(33.3%)	-	-	9	25.0%
Melena	Reduced	8(53.3%)	4(33.3%)	3(50.0%)	-	1	16	44.4%
	Absent	3(20.0%)	5(41.7%)	1(16.7%)	-	-	9	25.0%
FBOT		10(66.7%)	2(16.7%)	-	2	-	14	38.9%
Positive		5(33.3%)	3(25.0%)	1(16.7%)	-	-	9	40.9%
	Negative	-	7(58.3%)	5(83.3%)	-	1	13	59.1%

Where, FOBT- Fecal Occult Blood Test

Supplementary Table 3. Serum biochemistry of abomasal ulcer and displacements (RDA and LDA) of cattle (Mean±SE)

Parameter	Unit	Control (n=6)	Abomasal Ulcer (n=15)	RDA (n=12)	LDA (n=6)	p value
BUN	mg/dl	21.58±1.03 ^a	32.93±3.89 ^{ab}	49.25±4.61 ^b	40.67±6.48 ^{ab}	0.003*
Creatinine	mg/dl	1.16±0.13	1.21±0.07	1.28±0.19	0.80±0.12	0.187 ^{ns}
Glucose	mg/dl	52.00±6.63	62.53±2.49	57.50±3.04	73.33±4.08	0.121 ^{ns}
Total protein	g/dl	6.39±0.18 ^b	5.58±0.14 ^a	5.39±0.12 ^a	5.91±0.18 ^{ab}	0.001**
Albumin	g/dl	3.00±0.12	2.77±0.09	2.69±0.14	3.09±0.04	0.092 ^{ns}
Globulin	g/dl	3.39±0.11 ^b	2.82±0.12 ^a	2.70±0.09 ^a	2.82±0.16 ^a	0.013*
A:G ratio		0.89±0.04	1.01±0.06	1.02±0.08	1.12±0.06	0.413 ^{ns}
AST	U/L	87.98±5.08	108.58±9.61	80.93±13.21	117.90±14.88	0.145 ^{ns}

Means bearing same superscript do not differ significantly otherwise significant between groups; ^{ns}- Not significant (p≥0.05), * - Significant at 5 % level (p≤0.05), ** - Significant at 1 % level (p≤0.01); Where, RDA- Right displacement of abomasum; LDA-Left displacement of abomasum; BUN - Blood Urea Nitrogen; AST - Aspartate aminotransferase.

Supplementary Table 4. Blood gas analysis of abomasal ulcer and displacements (RDA and LDA) of cattle (Mean±SE)

Parameter	Unit	Control (n=6)	Abomasal Ulcer (n=15)	RDA (n=12)	LDA (n=6)	p value
pH		7.47±0.03	7.44±0.03	7.46±0.05	7.56±0.04	0.277 ^{ns}
HCO ₃	mEq/L	22.30±0.52 ^a	26.96±1.39 ^{ab}	32.04±3.58 ^{ab}	35.02±4.7 ^b	0.055*
Lac	mmol/L	1.48±0.12	3.00±0.49	2.94±0.41	3.55±0.63	0.129 ^{ns}
PO ₂	mmHg	56.12±13.3	97.03±10.33	64.67±8.39	70.33±11.16	0.060 ^{ns}
PCO ₂	mmHg	28.28±1.43	35.40±1.57	41.98±2.06	37.20±3.24	0.354 ^{ns}
SO ₂	%	86.17±4.53	93.07±2.62	87.33±3.36	93.67±2.85	0.324 ^{ns}
TCO ₂	mEq/L	22.50±0.56	28.00±1.35	26.08±3.81	36.83±5.21	0.065 ^{ns}

Where, RDA: Right displacement of abomasum; LDA: Left displacement of abomasum; HCO₃: Bicarbonate; Lac: Lactate; PO₂: Partial pressure of oxygen; PCO₂: Partial pressure of carbon dioxide; SO₂: Oxygen saturation; TCO₂: Total carbon dioxide.

Supplementary Table 5. Ultrasonographic findings of abomasal disorders in cattle (n=36)

Disorders	Location of abomasum	Echogenicity of abomasal contents	Appearance of abomasal folds	Motility / Contraction				
Abomasal ulcer (n=15)	Ventral midline-Right	12(80%)	Homogenous - hypo echoic	9(60.0%)	Hyper echoic	12(80%)	Present	14(93.3%)
	Ventral midline - dilated on right side	3(20.0%)	Heterogeneous	6(40.0%)	Not visible	3(20%)	Absent	1(6.6%)
RDA (n=12)	6-8 th ICS	5(41.6%)	Homogenous - hypo echoic	7(58.3%)	Hyper echoic	9(75%)	Present	10(83.3%)
	8-10 th ICS	3(25.0%)	Homogenous - hypo echoic with gas cap	2(16.6%)				
	8-11 th ICS	1(8.3%)	Heterogeneous with gas cap	2(16.6%)	Not visible	3(25.0%)	Absent	2(16.6%)
	8-13 th ICS	1(8.3%)	Heterogeneous-hyper echoic	1(8.3%)				
LDA (n=6)	10-13 th ICS	1(8.3%)						
	6-8 th ICS	1(16.6%)	Homogenous - hypo echoic	3(50.0%)	Hyper echoic	5(83.3%)	Present	5(83.3%)
	7-9 th ICS	1(16.6%)	Homogenous - hypo echoic with gas cap	2(33.3%)				
Abomasal bloat (n=2)	8-10 th ICS	2(33.3%)	Heterogeneous	1(16.6%)	Not visible	1(16.6%)	Absent	1(16.6%)
	9-12 th ICS	2(33.3%)						
Abomasal impaction (n=1)	Ventral abdomen	2	Homogenous - hypo echoic	2	Not visible	2	Absent	2
	Extended up to 7-9 th ICS of left side	1	Homogenous - hyperechoic	1	Not visible	1	Absent	1

Supplementary Table 6. Physical and occult blood test of abomasal fluids in cattle

Abomasal disorders	pH	Color	Nos.	Consistency	Nos.	Occult blood	Nos.
Abomasal ulcer (n=15)	2-3	Straw green	13	Watery	10	Positive	4
		Milky	2	Mild viscous	5	Negative	11
		Straw Green	6				
Right displacement of abomasum (RDA) (n=12)	1-3	Muddy	3	Watery	11	Positive	3
		Slightly yellowish	1				
		Dark green	2	Mild viscous	1	Negative	9
Left displacement of abomasum (LDA) (n=6)	1-2			Watery	3	Positive	2
		Straw Green	2	Mild viscous	3	Negative	4
Abomasal bloat (n=2)	3	Straw Green	2	Watery	2	Negative	2
Abomasal impaction (n=1)	2	Straw Green	1	Watery	2	Negative	1



Fig. 1. Black tarry feces (Melena)



Fig. 2. Positive FOBT