Utilization of the Reticular Groove Contraction in Adult Cattle—A Therapeutical Alternative for the Practitioner?

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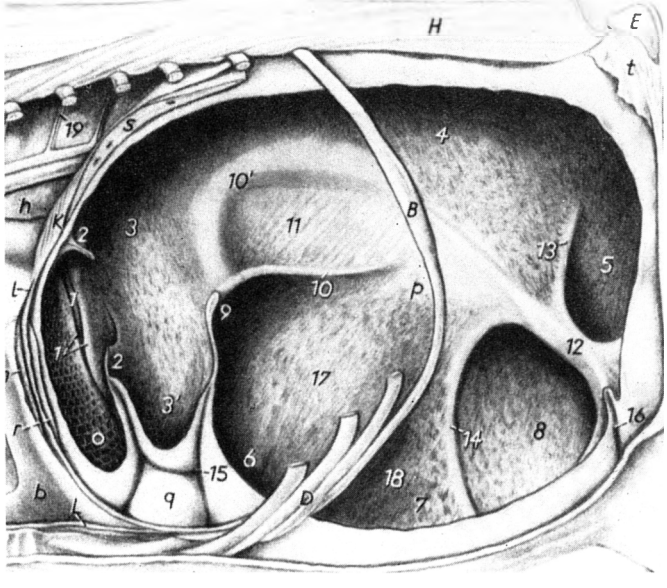
Summary

Investigations carried out on cattle suffering from diarrhea (n=36) and on dairy cows suffering from primary ketosis (n=23) showed that efficacy of oral treatment could be much improved by premedication with vasopressin (40 IU/per animal). Clinical parameters (e.g. feed intake, general appearance of feces, milk yield) as well as accessory clinical parameters (e.g. Na, K, pH, BE or β-HBS respectively, NEFA, total bilirubin, ASAT) were found to improve much faster and more steadily than after usual treatment.

Introduction

In the suckling calf, the reticular groove reflex provides a direct functional connection between cardia and abomasum (Fig. 1). The reflex which is essential for the young ruminant weakens as the animal becomes older but can be reactivated up to an age of two years when the animal is "trained" by continued milk-feeding (Ruckebusch and Kay, 1971; Guilhermet et al., 1973). Studies which attempted to elicit closure of the reticular groove by administering mineral salt solutions without previous conditioning resulted in no definite repeatability of the experiments (Devuyst, 1944, Rick, 1954; Orskow and Benzie, 1969).

Fig. 1. Anatomy of the reticular groove (1) (Nickel, Schummer, Seiferle 1976).



Mikhail reported in 1982, however, that the reticular groove contraction can be triggered by administration of the antidiuretic hormone vasopressin (ADH = VP) in the adult goat. Studies carried out together with Mikhail at Hannover Veterinary School (F.R.G.) showed that cattle are even more sensitive to parenteral administration of vasopressin than goats.

Hence, oral treatment of adult cattle or substitution of nutrients without loss of active substance during passage through the forestomachs or side effects of orally administered drugs on the ruminal milieu respectively was supposedly possible.

Following this hypothesis (many a veterinarian's fancy), studies were carried out to determine the efficacy of parenteral premedication with lysine-vasopressin (0.08 IU/kg body weight; 40 IU/animal on average) before oral treatment of the following two disease complexes:

1. unspecific diarrheas, and
2. primary ketosis.

The results of the studies are described in the following (for details please refer to Mikhail, 1986; Rehage, 1986; Mikhail and Scholz, 1987; Scholz and Mikhail, 1987; Scholz et al., 1987; Scholz and Rehage, 1987).

Treatment of unspecific diarrheas

The experimental setup is shown in Table 1. The affected cattle suffered from severe diarrhea and were patients of the Clinic for Cattle of Hannover Veterinary School. They had been treated unsuccessfully previous to hospitalisation and were assigned to either the control group or test animal group according to their arrival at the clinic in alternating fashion.

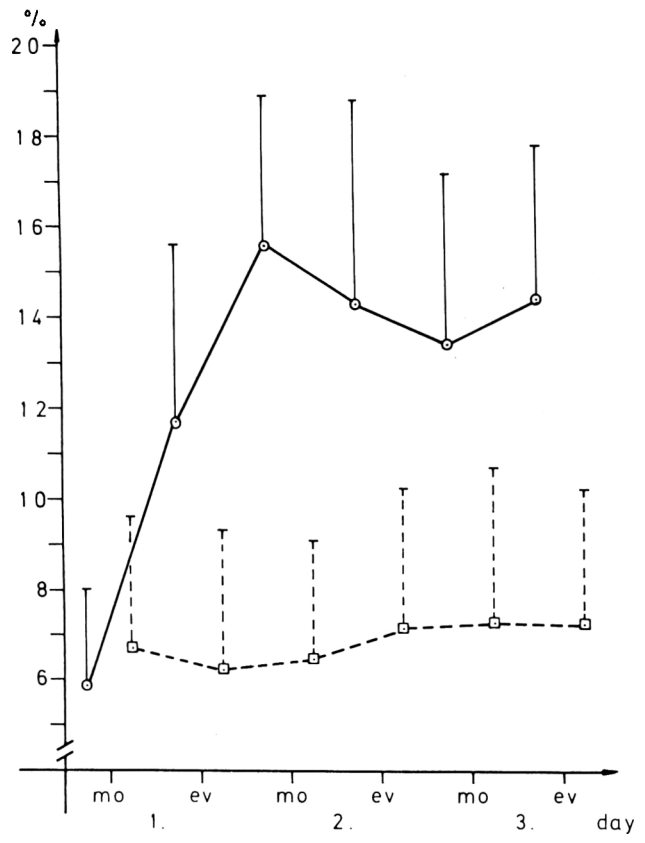
After eliminating the animals suffering from specific diarrheas (salmonellosis, BVD, paratuberculosis, coccidiosis, amyloid nephrosis) remaining group sizes were 16 animals for the control group and 20 animals for the test group.

Diarrhea treatment consisted of oral administration of 250 g cooked linseed, 150 g activated charcoal, and 100 g of a commercial antidiarrheal agent (Stullmisan*) in 2 litres of physiological saline per 100 kg body weight twice a day.

TABLE 1. Efficacy of VP-premedication in the treatment of adult cattle affected by unspecific diarrhea.
Experimental setup

	Controls	Test animals
Number (n)	16	20
Breed	German Friesian	German Friesian
Age(years)	2.7±2.0	3,9±2.5
Body weight (kg)	385±108	457±149
Treatment (3 days)		
premedication	2 ml physiol. saline i.v.	VP-solution 2 ml i.v.
medication (oral)		
twice daily: NaCl	2 1/00 kg	2 1/100 kg
0.9 p.c. with cooked	250 g	250 g
linseed Stullmisan*	100 g	100 g

Fig. 2 Changes in feces dry matter after oral treatment of diarrhea. (o-------o with VP-premedication, ■-------■ without premedication).



VAW-Flußspat Chemie GmbH, 8470 Stulln/Nabburg (F.R.G.)

Treatment of the two groups differed only in premedication: Whereas the controls were given an intravenous injection of 2 ml of physiological saline, the test animals received 40 IU lysine-vasopressin in 2 ml physiological saline, also intravenously. Treatment and monitoring of the animals were continued over a period of three days.

Results

Already within 9 to 10 hours after the initial treatment of the test group, the color of feces changed to black and feces dry matter increased from 5 to 10% (Fig. 2). On the day following treatment, feces dry matter reached a maximum of approximately 16% and remained on this level throughout the period of the trial. In contrast to this, hardly any changes occurred in feces dry matter of the controls, and the color of feces of the control group changed to black only towards the end of the trial.

The changes in feces dry matter within the test group were paralleled by an improvement of the general condition of the animals as indicated by feed intake (Fig. 3). Intake of hay and also concentrates increased by more than 100% over the trial period, whereas feed intake of the controls showed only little improvement.

Reduced enteral loss of water as well as increased feed intake influenced body weight (Table 2). Whereas the controls lost 8% of their body weight on average during the monitoring period of 3 days, the animals premedicated with vasopressin retained their body weight.

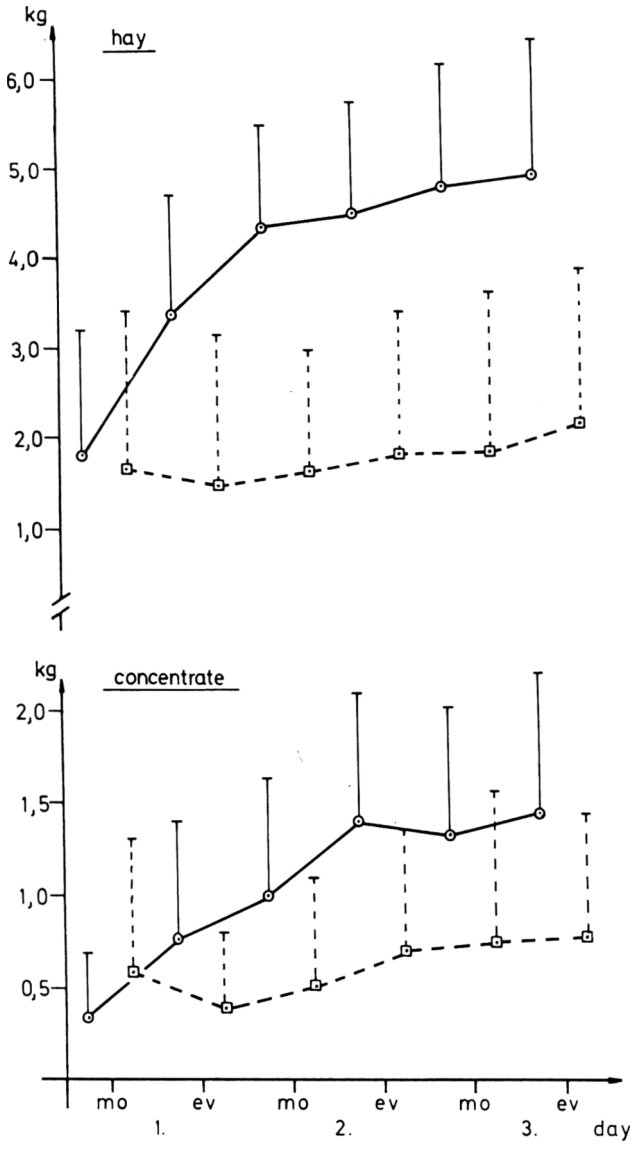
TABLE 2. Efficacy of VP-premedication in the treatment of adult cattle affected by unspecific diarrhea.

	Body weight (kg)	
	Controls	Test Animals
Before treatment	385±108	457±149
After treatment	355±101	462±148
Difference in kg	-30	+5
Difference in % body weight	- 8	+1

Besides these obvious clinical differences, related accessory clinical parameters such as hematocrit, sodium and potassium in serum, and bicarbonate in full blood improved much faster. Total therapeutical success was 91% for the test animals compared to 69% for the controls.

Even if the number of animals included in the study is fairly small, there is an indication that ruminating cattle affected by unspecific diarrheas can be treated more effectively by oral treatment following premedication with vasopressin than by oral treatment alone.

Fig. 3 Changes in feed intake after oral treatment of diarrhea. (o-------o with VP-premedication, ■-------■ without premedication).



Treatment of primary ketosis

The effect of oral treatment with glucose after premedication with vasopressin was compared to a standard therapy of the clinic. The experimental setup is shown in Table 3.

The animals were again patients of the Clinic for Cattle of Hannover Veterinary school. A total of 23 cows suffering from severe primary ketosis that had been treated without success previous to hospitalisation were included in the study. The animals were divided into controls and test animals at random. Group sizes were 10 for the control group and 13 for the test animal group.

The controls were administered 100 g glucose in 20 p.c. solution intravenously in the mornings and were given 150 g sodium propionate orally in the evenings. Premedication with vasopressin was replaced by an intravenous injection of 2 ml of physiological saline.

TABLE 3. Efficacy of VP-premedication in the oral treatment of primary ketosis with glucose.

	Controls	Test animals
Number (n)	10	13
Breed	German Friesian	German Friesian
Age (years)	5.5±1.8	4.6±1.8
Body weight (kg)	591±37	550±63
Days post partum	16.1±9.9	25.4±11.5
Treatment (3 days)		
premedication	2 ml physiol. saline i.v.	VP-solution 2 ml i.v.
Medication mornings	100 g glucose i.v.	500 g glucose p.o.
evenings	150 g Na-prop. p.o.	500 g glucose p.o.

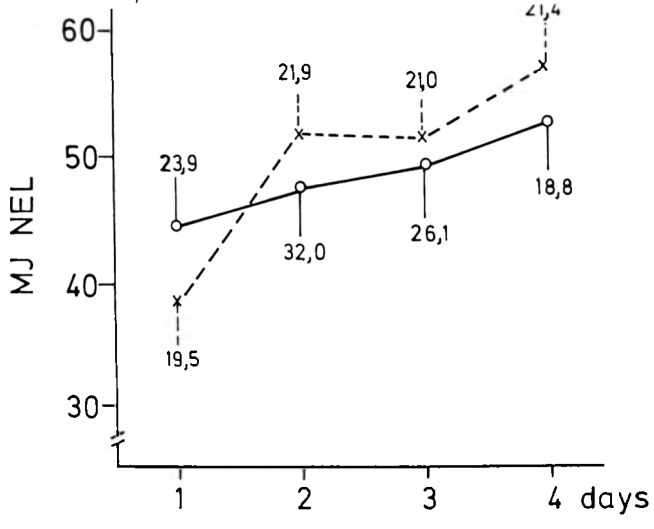
The test animals received oral treatment with 500 g glucose dissolved in 1 litre of water after intravenous premedication with 2 ml lysine-vasopressin solution (40 IU) morning and evening.

Treatment was continued over a period of 3 days. Clinical status and accessory clinical parameters were monitored over the period of the trial.

Results

Mean energy intake of the test animals was increased by nearly 50% during the trial period ($p<0.01$), whereas mean energy intake of the controls only increased by approximately 10% and total energy intake remained below the level reached by the test group (Fig. 4). Taking appetite

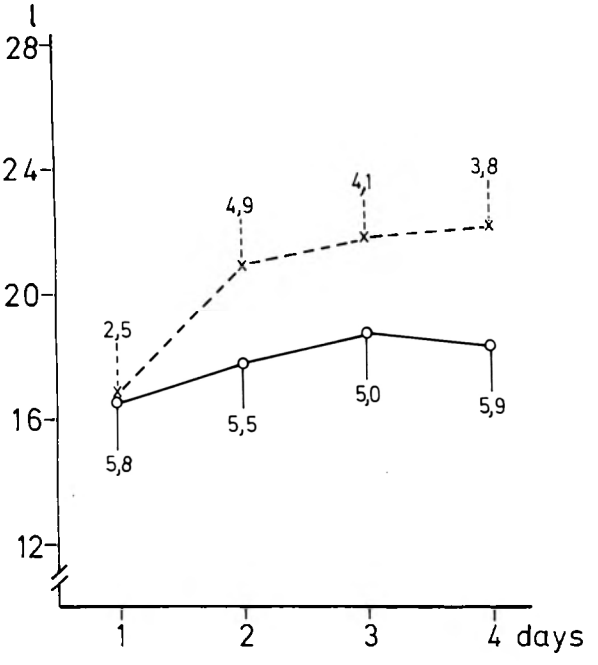
Fig. 4. Energy intake after conventional treatment of ketosis and VP-premedication respectively (o-------o = controls, x-------x = test animals).



as a parameter for the general condition of the animals, it was found that the general condition of the test animals improved much faster than that of the controls.

An improved general condition and higher feed intake were also reflected by the milk yield (Fig. 5). The mild yield of animals premedicated with vasopressin showed an increase from a mean 16 l/day before treatment to a mean 22 l/day after treatment. Performance was thus increased by 30%.

Fig. 5 Milk yield after conventional treatment of ketosis and VP-premedication respectively (o-------o = controls, x-------x = test animals).



This was contrasted by an increase in milk yield of only about 10% for the controls.

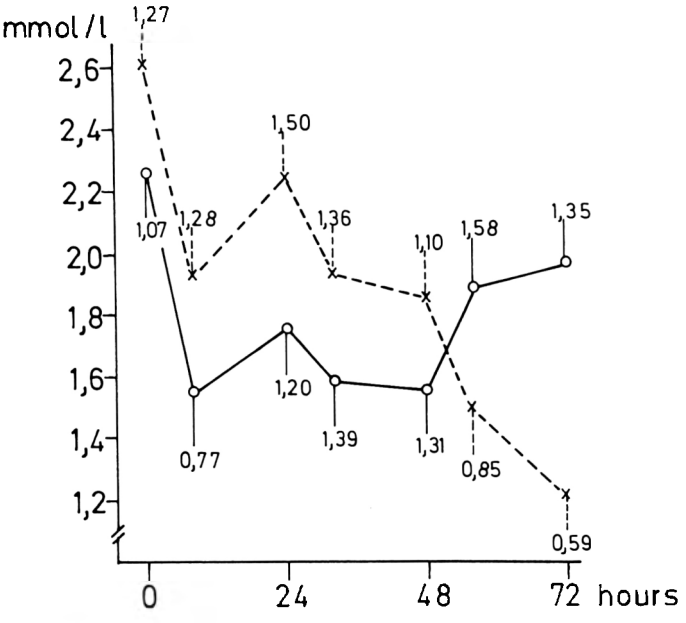
Concentrations of β-hydroxy-butyric acid in blood plasma served as parameter for the severity of the metabolic disorder. The observed changes are shown in Figure 6. In spite of higher initial values and a considerably higher milk yield, values for the test animals were back to normal within 3 days and concentrations of β-hydroxy-butyric acid decreased not immediately, but later in this period.

Similar values were determined at first for the controls, however was an increase of β-hydroxy-butyric acid in blood plasma recorded towards the end of the trial that reached pre-therapeutical levels and was obviously due to a higher performance.

The changes were almost paralelled by ketone body excretion with urine but for a delay of 12 hours.

Compensation of an energy deficit balance is attempted by mobilisation of the fatty depots of the body in order to provide energy. This mobilisation is associated with an

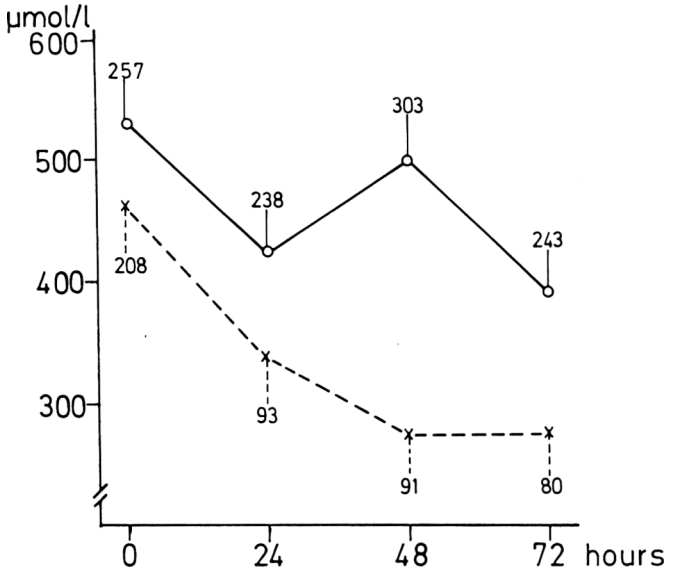
Fig. 6. Plasma β-HBS after conventional treatment of ketosis and VP-premedication respectively (o-------o = controls, x-------x = test animals).



increase of non-esterised free fatty acids (NEFA) in blood plasma, and NEFA levels in plasmas thus also served for assessment of the energy deficit. Values of less than 350 xmol/l (Kronfeld, 1965) are regarded as normal.

Both groups showed increased levels of NEFA at the beginning of treatment (Fig. 7). Both methods of treatment reduced fat mobilisation. However reduction of NEFA in plasma of the controls was not as great as for the animals premedicated with vasopressin and

Fig. 7 Plasma NEFA after conventional treatment of ketosis and VP-premedication respectively (o-------o = controls, x-------x = test animals).

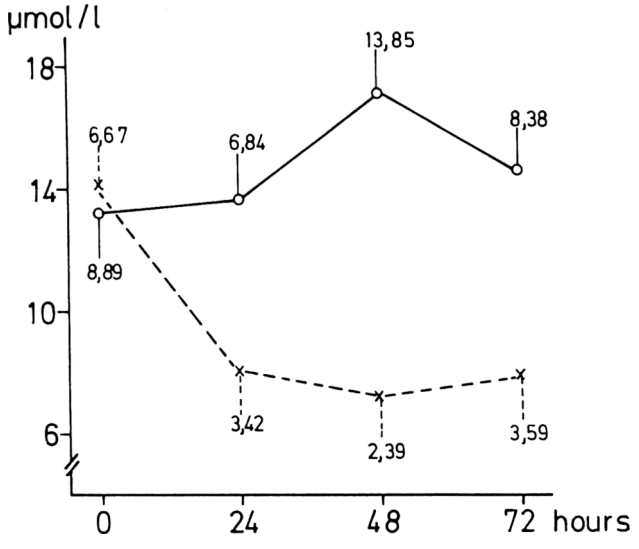


values did not return to normal levels within the trial period. NEFA levels in plasma of the test animals were observed to return to normal within the period of the trial.

Upon checking of the liver function of both the controls and the test animals it was found that total bilirubin (Fig. 8) and also ASAT activity in serum of the test animals returned to physiological levels whereas values determined for the controls showed some variation but were still pathological throughout the trial period.

GLDH and y-GT remained unchanged in both groups.

Fig. 8. Total bilirubin in plasma after conventional treatment of ketosis and VP-premedication respectively (o-------o = controls, x---------x = test animals).



Conclusions

The possibility to trigger the reticular groove contraction in the adult ruminant by premedication with lysine-vasopressin introduces some new aspects into cattle practice.

Possible applications range from influencing the enteral milieu to substitution of nutrients.

It could be shown that treatment of unspecific diarrhea and primary ketosis including premedication with lysine-vasopressin was superior to conservative methods of treatment.

Further studies are needed to investigate the efficacy of the described method for the treatment of other diseases.

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