

## Ambulatory Rehydration: Endotoxins in Farm Water

Rehydration is a commonly neglected form of therapy in ambulatory veterinary practice. There are several reasons for this: lack of laboratory support in diagnosis of dehydration, time consumed by the procedure and veterinarians' ignorance about the life-saving importance of rehydration and electrolyte supplementation in many diseases.

One of the most restricting reasons is probably the fact that the amount of sterile and apyrogenic liquids required for large animal rehydration is large, costly and difficult to transport. Therefore, practitioners have traditionally discarded the use of commercial infusion solutions in favor of instantly prepared electrolyte-water mixtures. This is acceptable in emergency situations, but raises questions about the detrimental effects of poor water quality.

In Finland infusions are commonly given with unsterilized and often heavily conta-

minated rubber tubes. Yet their use is seldom known to cause problems when restricted to the intravenous route. Apparently the RE-system of the animal is able to cope with a considerable number of live microorganisms.

Endotoxins may be of more concern. They are heat stable lipopolysaccharide constituents of gram negative bacteria and cause fever, dyspnea, edema, pruritus, hypotension, abdominal cramps, agitation, shock and activation of a number of immunological systems, when applied to organism. In practice situations the symptoms of endotoxaemia may be masked by the primary disease of the patient and may escape being attributed to their true cause.

We examined 12 samples of farm water from farms around Southern Finland for the presence of endotoxins. The samples were taken to apyrogenic vacuum vials and kept

Table 1. Farm water characteristics.

Farm	Water	Source	Endotoxin conc.	Maximum dose for	
				500 kg	30 kg animal
1	A cold tap water visibly rusty	farm well	> 2.5 EU/ml	< 1.0 l	< 60 ml
	B hot tap water visibly rusty		> 2.5 EU/ml	< 1.0 l	< 60 ml
2	A cold tap water	farm well	> 2.5 EU/ml	< 1.0 l	< 60 ml
	B boiled water		> 2.5 EU/ml	< 1.0 l	< 60 ml
3	A cold tap water	farm well	> 2.5 EU/ml	< 1.0 l	< 60 ml
	B boiled water		> 2.5 EU/ml	< 1.0 l	< 60 ml
4	A cold tap water	farm well	> 2.5 EU/ml	< 1.0 l	< 60 ml
	B boiled water		> 2.5 EU/ml	< 1.0 l	< 60 ml
5	A cold tap water	farm well	0.65-2.5 EU/ml	1.0-3.8 l	60-234 ml
	B boiled water		< 0.64 EU/ml	> 3.8 l	> 234 ml
6	A cold tap water	farm well	0.64-2.5 EU/ml	1.0-3.8 l	60-234 ml
	B boiled water		< 0.64 EU/ml	> 3.8 l	> 234 ml

frozen until assay. The endotoxin concentration was tested with 2 batches of *Limulus* amoebocyte lysate. The determined sensitivities of the batches were 2.5 and 0.16 endotoxin units (EU)/ml. For the assay with the more sensitive lysate, the samples were diluted 1:4 with pyrogen-free water.

The characteristics of the water samples are listed in Table 1.

For rabbits and humans the approximate threshold pyrogen dose is 5.0 EU/kg b. w. (*FDA Guideline* 1983). We adopted it as a rough estimate of an acceptable high endotoxin dose for calculation of the maximum doses.

The findings indicate that there may be great differences in the endotoxin concentrations of farm waters. Most of the samples contained enough bacterial lipopolysaccharides to cause symptoms of endotoxaemia in small doses. The addition of salts and the use of non-sterilized vessel may further increase the total dose of endotoxins.

The fact that self-made infusion solutions rarely cause endotoxaemia may be the result of difference between environmental endotoxins and extracted endotoxin preparations, with which the *Limulus* test is calibrated. According to *Pearson* (1985), naturally occurring endotoxins are significantly less py-

rogenic on a weight-for-weight basis than extracted endotoxins and "natural" endotoxin may not cause pyrogenic reactions at least 95 % of the time at doses well over the threshold.

It is up to the practitioner to weight the pros and cons of using rehydration solutions of questionable quality in emergency situations. The use of commercial preparations is certainly preferable, but if they are not available, intravenous administration of fresh or boiled tap water may be a life-saving procedure.

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#### References

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- Pearson FCIII*: Endotoxin. In: Pyrogens - endotoxins, LAL testing and depyrogenation. Marcel Dekker, Inc. New York 1985, pp. 23-56.

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