Practical Approach to Fluid Therapy

Frank A. Mongini, *D.V.M.*
Cotati, California

I'm sure all of you recognize the necessity of intravenous fluids as a therapeutic means in the treatment of many disease conditions. The major factors preventing us from utilizing fluids as frequently as we'd like, is usually either the cost of the fluids, or the time and effort spent in administration. With these problems in mind, we have attempted and I feel succeeded in arriving at a fluid that is balanced and a means of administration that is efficient.

In searching for the ideal type of fluid, the following objectives should be met: a) properly balanced, b) effective, c) efficiency in preparation, and d) economical.

There are numerous commerical preparations available. In Table 1, I have listed some of the common fluids and their relative values.

Table 1

Common Electrolytes–Values Expressed in mEq/L

	Na	K	CL	HCO_3	Tonicity
Lactated Ringer's	130	4	111	27*	1
Isotonic Saline	154	0	154	0	1
Lactated Ringer's *plus* 5.0 grams/L $NaHCO_3$	190	4	111	87**	1-1/3
Eltrad L.A.	140	10	103	55	

*In the form of lactate, 27 mEq/L of HCO_3 available after metabolism of lactate.

**Includes the 27 mEq of the Ringer's Solution plus 60 mEq from 5.0 grams $NaHCO_3$.

Of the above fluids, Eltrad L.A. is the most economical and therefore the one most used. We are now using a homemade Lactated Ringer's Solution that is very inexpensive (1).

I. Basic Ingredients
  A. Stock chloride solution
    a. Potassium chloride . . . . . 30 grams
    b. Calcium chloride . . . . . 22 grams
    c. Distilled water, q.s. . . . . .500 cc
  B. 60% Sodium Lactate Solution . . . . Merck No. 5082
  C. 1.0 gram Sodium Chloride tablets.

II. Homemade Lactated Ringer's Solution

Rx:		
Stock chloride solution	5.0 cc	60 cc
60% Sodium Lactate	5.0 cc	60 cc
NaCL tablets	6	72
Distilled water, q.s.	1000 cc	3 gallons

This solution can be made in any quantity and can be autoclaved. When analysed at a laboratory, its composition is as follows:

Table 2

Composition of Homemade Lactated Ringer's Solution

Na	144	mEq/L
K	4.0	mEq/L
Cl	111	mEq/L

A comparison price-wise points out the value economically of the homemade solution.

Table 3

	1 L	3.0 Gallons
Eltrad L.A.	$0.30	$4.35
Homemade Lactated Ringer's Solution	$0.13	$1.58

Our next concern is the administration of these fluids. We accomplish this in the following manner:

A. Intravenous catheterization of *all* patients. In the severely dehydrated scouring calf a venous cutdown is often necessary. After experimenting with many catheters, the catheter we've found most suitable is E-Z Cath. This is an 8 inch, 14 gauge teflon catheter easy to insert with a hub convenient for suturing in place. If not available from your local supplier, it is manufactured by Desert Pharamaceuticial Company, Sandy, Utah. The price is approximately $1.50.

B. As a fluid container, the Scholle bag has proven to be ideal. The Scholle bag is the milk container used in most milk dispensers in schools, restaurants, etc. They are a double walled plastic bag available in both 3.0 gallon or 6.0 gallon capacity. A cardboard box is also available to place the bag in. This isn't always necessary. What makes this so handy is you can carry a large number of these empty bags in your practice vehicle, affording you the opportunity to utilize intravenous fluids at any time.

Our cost of the bag is $.35; with the bag and box $.75. They are available at most creameries or milk processing plants.

C. To deliver the fluids, we prefer the Cutter intravenous set. The procedure is to: 1) Remove the cap from end of intravenous set adopted for bottle. 2) Cut end of cap off. 3) Replace cap on

intravenous set. 4) Cut end off rubber tube on Scholle bag plug. 5) Insert "cap end" of intravenous set into rubber tube of Scholle bag. 6) Let fluids run.

Cost for intravenous set is approximately $.75.

As you can see we have a very inexpensive system with a total cost of approximately $3.00.

Our next step is the selection of the proper type and quantity of fluid. Before we do that we should first make ourselves aware of the normal serum electrolyte levels and the changes encountered during some clinical conditions.

Table 4

Plasma Electrolyte Levels
Both Normal and Clinical in mEq/L

	Normal	Calf with Severe Diarrhea	Cow with Abomasal Ulcers
Na	138-145	130	145
K	3.5-4.5	8.1	2.0
Cl	98-105	102	74
HCO_3	25-32	13	48
ph	7.4	7.06	7.52

To determine the fluid requirement: 1) Slight to moderate dehydration represents a body fluid deficit of 6-8%. 2) Severe dehydration represents a deficit of 10-12%. Therefore, a severely dehydrated 50 Kgm calf needs: 10% x 50 Kgm = 5.0 Kgm (5 L)

Our HCO_3 requirement is determined as such: Formula:

HCO_3 deficit/L x ECF (L) - mEq HCO_3 needed.

The HCO_3 deficit can either be estimated or determined in a laboratory. As we see in Table 4, a scouring calf with metabolic acidosis has a deficit of approximately 15 mEq/L.

Normal HCO_3 (28) - actual (13) = 15 mEq.

An estimation of 10-15 mEq will always put you within range.

The normal animal has a compartment of ECF of approximately 30%, .:. ECF = body weight (Kgm) x .30.

In this case, 50 Kgm x .30 = 75 L of ECF.

Formula:

15 mEq x 75 L = 225 mEq of HCO_3 required (HCO_3 deficit) (ECF)

1.0 gram Na HCO_3 = 12 mEq HCO_3

1 teaspoon = approximately 13 grams Na HCO_3 (baking soda)

225 mEq + 12 mEq = 18 grams Na HCO^3 (HCO_3 needed) (mEq/gram)

By adding the 18 grams Na HCO_3 to the 5.0/L of lactated Ringer's, you will meet the requirements for rehydration and correction of the acid-base problem.

There is one more factor to consider, that being meeting the caloric requirment. This is usually satisfied by adding 5% glucose to all intravenous solutions. By using the figures of Table 5, this requirement can be calculated for either a calf or a cow.

Table 5

Caloric Requirement at Resting Metabolism

Body wt. (Kgm)	Kcal/24 hours
1	70
5	234
10	393
50	1316
100	2112
500	7000

1 L of 5% glucose = 200 Kcal. .:. 50 Kgm calf = 6.6 L of 5% glucose every 24 hours. 500 Kgm cow = 35 L of 5% glucose every 24 hours.

We routinely mix 3.0 gallons of electrolytes + 5% glucose for all scouring calves and administer it at a continuous drip over a 24 hour period. In adult cattle requiring fluids, they will automatically get 6.0 gallons of electrolytes + 5% glucose as fast at the catheter will take it. For the 14 gauge catheter, this is usually 3½ - 4 hours.

There is definitely a place for intravenous fluids in large animal medicine, specifically bovine practice. With an efficient and economical procedure it becomes routine.

I would like to include a note on the administration of oral fluids, whether these be colostrum, milk, oral electrolytes, or water. The human enema bag is ideally suited to the calf. It comes in a collapsible 2 L plastic bag and a 2 L cannister container. The flexible tubing provided is well adapted for passage down the calf's nostril.

This is an excellent way of getting 2 L of colostrum into calves soon after birth. We instruct any client that is willing to learn how to pass the stomach tube via the nostril. These clients then tube feed any calf that didn't receive colostrum within a few hours of birth.