Short Topics

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Applied Fluid Therapy in Bovine Practice

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The physiologic value of fluid therapy has been well documented. However, the practical application of fluid treatment under field conditions leaves most bovine practitioners raising skeptical eyebrows. My purpose, in this presentation, is to peel the "ivory tower" label from fluid therapeutics, and re-tag it as a useful and cost effective addition to daily bovine practice.

Any disease process may upset endogenous fluid and electrolyte balance. This balance must be restored before health can be returned. Too often, therapeutic failure is not the fault of misdiagnosis or improper treatment; but rather, a failure to recognize fluid and electrolyte disturbances which undermine the therapeutic plan. Based on this premise, fluid therapy should be used as routine ancillary treatment, versus its all too frequent role as a "last resort" measure.

Routine fluid usage requires an objective assessment of water and electrolyte imbalance be made without the delay or expense of submitting laboratory samples. A thorough physical exam will reveal various clinical parameters upon which the formulation, volume, and rate of fluid administration can be used. These parameters are listed in the following table which illustrates fluid and electrolyte changes associated with four common bovine diseases.

	DEHYDRATION	ACIDOSIS	ALKALOSIS	HYPO KALEMIA	HYPO CHLOREMIA	HYPO NATREMIA	HYPO CALCEMIA
	dec. temp. sunken eye cold skin skin tent inc. PCV inc. T.P.	acid urine inc. resp. rate diahrrea	urine pH inc. or dec. dec. resp. rate dull eye	muscle weakness anorexia dull eye arrythmia	abdominal enlargement dec. manure	inc. urine specific gravity thirst hypovolemia	inc. neuromuscle excitability
ACUTE MASTITIS	endotoxic shock hypovolemia	inc. anion gap low O_2	iatrogenic HCO_3 R_x	iatrogenic HCO_3 R_x	dilutional (ADH)	dilutional (ADH)	iatrogenic HCO_3 R_x
GRAIN OVERLOAD	osmotic rumen fluid influx	inc. anion gap lactic acid	iatrogenic HCO_3 R_x	iatrogenic HCO_3 R_x	dilutional (ADH)	dilutional (ADH)	iatrogenic HCO_3 R_x
DISPLACED ABOMASSUM	fluid trap	shock (RTA)	inc. anion gap dec. H^+ paradoxical aciduria	K^+ trap dec. intake	Cl^- trap renal paradox alkalosis	dilutional (ADH)	dec. ionized Ca^{++} (alkalosis)
SALMONELLOSIS	GI water loss	normal anion gap HCO_3 loss	iatrogenic HCO_3 R_x	solute loss	inc. Cl^- (renal reabsorbtion)	solute loss	dec. protein bound Ca (inc. Ca^{++})

Once fluid replacement is deemed necessary, practical delivery methods must be engineered. The bovine patient lends itself well to oral fluid therapy. The rumen's large capacity permits fluid deficits to be replaced by a single oral dosing. This form of rehydration is very effective, not to mention safe and inexpensive. An efficient oral delivery system such as the Magrath Cattle Pump System[1], expedites treatment and minimizes complications. It is designed to rapidly deliver large volumes of fluid with minimal effort.

When oral fluid therapy is inadequate or contraindicated, an intravenous delivery system is used. A twenty-five liter jug[2] coupled with a twelve gauge indwelling catheter becomes an intravenous system applicable to most field situations. The catheter is comprised of infusion set tubing[3] threaded through a seven gauge bleeding trochar[4]. In contrast to smaller conventional systems, this design satisfies the high volume fluid needs of the acutely ill bovine patient.

To keep both oral and IV fluid schedules cost effective, electrolyte recipes are substituted for sterile, commercial preparations. Table salt, baking soda, and Morton *Lite* salt can be combined with hot tap water to produce isotonic solutions suitable for oral or intravenous use. Keeping these solutions osmotically compatible with plasma is very important. Discordant fluid tonicity further compounds existing interstitial/intravascular fluid imbalances.

The clinical application of these salt preparations is illustrated in the following case reports.

Case #1. Laura, a 5 year old Holstein female, fresh 10 days, anorexic, depressed milk prod.

Physical exam:	temp. 100.5°F.	pasty manure
	pulse 80/min	2+ rumen distension
	sunken eyes	
	cold ears	rt. side "ping"

Diagnosis: right displaced abomasum
Treatment: right flank omentopexy

The underlying problem has been corrected; however, without regard for the secondary symptoms. Dehydration, hypokalemia, hypochloremia, and metabolic alkalosis if unopposed, will impede post surgical recovery. To address these complications, ten gallons (approximately 40 liters) of oral fluid is administered.

5 gal. (19 L) of .9% NaCl =	8 tbsp. table salt (21 grams/tbsp.)
5 gal. (19 L) of 1% KCl/NaCl =	11 tbsp. *Lite* salt (17 grams/tbsp.)

10 gal. (38 L) providing:	153 meq Cl−/L
	35 meq K+/L
	118 meq Na+/L
	308 meq/L

The final isotonic solution is slightly acidic and enriched with potassium and chlorine to replenish existing deficits. This large fluid volume is well tolerated by adult cows, and promotes appetite and manure passage; thus, helping to prevent post operative complications: namely, acetonemia and abomasal impaction.

Case #2. Dolly, a 7 year old Holstein female, 60 days fresh, suddenly anorexic and lethargic.

Physical exam:	temp. 105°F.	dec. skin elasticity, generalized muscle weakness
	pulse 110/min.	
	resp. 30/min.	
	sunken eyes	
	cold skin and ears, diarrhea	hot, swollen quarter

Diagnosis: peracute, toxic mastitis
Treatment: broad spectrum antibiotics
anti-inflammatory agents

However well founded, antibacterial therapy alone can be a nearsighted treatment scheme which often proves inadequate. Therefore, additional supportive care in the form of intravenous fluids should be implemented. Based on her clinical symptoms, dehydration is estimated at 10%. Ten percent of her 500 kilogram body weight equals the fluid replacement volume needed; i.e., 50 liters. The first 25 liters will be given rapidly (within 6 hours) to counter endotoxic shock. The second 25 liters will be given slower (within 18 hours) to avoid inducing pulmonary edema.

The following recipe is an example of an inexpensive formula useful in combating the complications of acute mastitis; namely, dehydration and acidosis, while preventing iatrogenic hypokalemia, hypocalcemia, and hypoglycemia.

7 tbsp. table salt (17 L isotonic NaCl)	9gr/L
5 tbsp. baking soda (5 L isotonic $NaHCO_3$)	13 gr/L
1 tbsp. *Lite* salt (2 L isotonic KCl/NaCl)	10 gr/L
3 bottles Cal Dextro #2 (1 L isotonic Ca gluconate)	
1 bottle 50% dextrose	25 gr/L

q.s. to 25 L with hot tap water

providing:	135 meq Na+/L
	110 meq Cl−/L
	5 meq K+/L
	5 meq Ca+/L
	5 meq gluconate/L
	29 meq HCO_3-/L
	in a 2% dextrose base

[1] *Magrath Manufacturing Co., McCook, Nebraska*
[2] *Scientific Products, McGaw Park, Illinois*
[3] *Diamond Laboratories, Des Moines, Iowa*
[4] *Jorgensen Labortories, Loveland, Colorado*

Upon completion of this treatment regime, fluid balance may be maintained with oral solutions for the remainder of the convelescent period.

The mystic of fluid therapy is no longer veiled behind teaching hospital walls. Once we understand its application, fluid therapy becomes a palatable addition to bovine ambulatory practice that will foster therapeutic success as well as client satisfaction.

An Efficient and Safe Method of Castration for the Bovine By the Intra-Testicular Injection of Chem-Cast™

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The practice of castration, effecting elimination of the testes and reducing libido or virility, has for centuries been carried out in various ways. The method used has been largely dependent on the species, the opportunity to observe the animal following castration, and the nature of local disease problems. Such diseases as tetanus, black leg, malignant edema, and the presence of the screw worm fly may cause severe problems following castration by methods which result in an open wound or abrasion.

With these concerns in mind, there have been many attempts to find a method of castration as effective as surgical castration but free of the disadvantages of post-surgical inflammation and the risk of hemorrhage and infection. These latter two problems may result in 5 to 15% death loss depending on weather conditions, management practice and surgical technique. To avoid some of these problems, castration procedures have been performed using rubber bands above the testis to effect destruction of the testis, below the testes thereby pushing the testes against the body wall effecting hyperthermia of the testis and reduction of testical development and/or sperm maturation, knotting of the vascular supply and vas deferens by rotating (rotation) of the testis within the scrotum, and many other even lesser acceptable methods.

However the method that has previously met with the greatest acceptance, and until the advent of Chem-Cast, best meets the criteria of avoiding infection and hemorrhage, particularly in cattle, has been the method whereby the spermatic cord and its attendant vessels providing blood to the testis and drainage therefrom are mechanically crushed with a crushing instrument commonly known as a Burdizzo. This method of castration, generally called "clamping", usually renders the animal sterile by destroying the blood supply to the testis proper and effects varying degrees of testicular regression and resorption of the residual testis. This method also has its inherent drawbacks. The problems most commonly observed with the use of the Burdizzo are 1) complete scrotal and testis necrosis with and without secondary hemorrhage effected by completely transecting the crotal sack when "clamping" the testis/or testes; 2) edema that in some cases can be marked and persist for some time especially in older bulls; 3) "missed castration" whereby the spermatic cord slips out of the jaws of the Burdizzo or never was properly placed during "clamping"; 4) post-"clamping" distress which is exhibited by standing hunched up, lying down, reluctance to move and reduced appetites. Such stress may persist for several hours to several days depending on the age of the calf and the degree of post-"clamping" swelling that occurs; 5) difficulties with the use of the standard (18 inch or more) Burdizzo on small calves, 3 to 4 months of age or less; 6) secondary infections of the necrosed scrotum and testis or traumatized skin of the scrotum and/or hematomas of the genitalia following crushing and "breaking".

Therefore, it is evident that a method of castration that is easily accomplished, effective, and safe is needed. Chem-Cast, a chemical solution designed for intra-testicular injection, and restricted to use by the veterinarian, is such a product and offers distinct advantages over the other methods of castration. This Rx labeled Chem-Cast product is simple and fast to administer. It approaches the effectiveness of surgical castration and is superior, in this regard, to the Burdizzo method. The administration of Chem-Cast does not result in the pain, stress, edema, hemorrhage and unacceptable necrosis as inherent in the surgical and Burdizzo methods of castration; and further, it reduces the high risk if infection associated with the surgical procedure.

Chem-Cast field use data generated in twenty-one separate trials carried out in five different regions of the