Therapy In Practice

JOHN C. SIMONS, *D.V.M.*
Torrington, Wyoming

In the early days of World War II a general of marines named Smedley Butler said to the President, "Give me a dollar and I will produce a dollar and ten cents worth of soldier." Such is the kind of accountability that is the challenge of food animal practice and in no place do we cut it finer than in the prevention and treatment of the calf diarrhea complex.

By way of attempted prevention we can balance the ration of the cow. We can immunize against the clostridial entities that are part of the problem. We can insure that the calf gets a healthy dose of colostrum shortly after birth and we can provide some welfare precedures at times of difficult birth and inclement weather. But in spite of what we do, the results remain disappointing and frustrating. The best hope would seem to lie in long-time selection of breeding stock that have not even shown symptoms of the disease, as suggested by Mr. Lasater.

This presentation is directed towards therapy, particularly in advanced cases of calf diarrhea.

We will speak but lightly of the miracles of chemotherapy. Dr. Phillips and Dr. Lewis have emphasized a situation that calls for a lot of symptomatic "elbow grease." We are not only dealing with primary and secondary infections that are often resistant to our herbs, but we are dealing with advanced cases of shock, dehydration, starvation, acidosis, and, in some cases, gut paralysis and central nervous disturbance.

It does not take a very sharp pencil to show that if we are going to cope with these symptoms we are going to spend $20 to $30 per calf. If we spend $300 in treating ten calves, we must return to the owner six calves that are worth $60 each if we are to satisfy General Butler's criteria!

In general there are two kinds of calves that come into our clinic: those we can help and those we cannot. Part of our responsibility lies in not wasting money on the hopeless cases. I would admit that at this time we cannot always identify the hopeless ones but we can categorize the calves into two groups. In one group we will have a sixty percent or

better chance for success and in the other our chances will be twenty percent or less. Owners often insist on treatment and we spend their money and destroy our averages, but we cannot, in good conscience, recommend treatment for the second group.

We have said that we are dealing with shock, dehydration, acidosis, starvation, gut paralysis and CNS disturbance. The severity of these symptoms can be partially measured and such measurements determine the prognosis and treatment of each case. If the abdomen is distended and there is no active diarrhea, if the hematocrit shows a PCV of over 60%, if there is difficulty in making a jugular *vena puncture* with a sharp 18-guage needle, if there is no corneal reflex, if the body temperature is over three degrees subnormal, if there is evidence of CNS disturbance, if any or all of the above mentioned symptoms are showing this degree of severity, we are in the area of the second category and we do not recommend therapy.

For those calves whose symptoms are less severe, we design treatments on an individual basis. We have constructed an outline to explain these treatments.

I. *Some diarrheic calves are seen strong and nursing and can be left on their mothers.*
   A. Catching these calves is a significant part of the problem and blessed is he who can walk his horse among them quietly, catching selected individuals without scattering the herd all over the pasture and even into the neighbor's!
   B. For oral medication we use or recommend the use of two feet of clear plastic stomach tubing; on one end we fasten the bell and adapter from a bell type i.v. set by pushing the adapter into the tubing. A 500 cc or 900 cc plastic bottle can now be used as a container for whatever we want to feed and medicate the calf.
   C. Various combinations of fluids, electrolytes, nutrients and medicines can be used.
      1. Consomme soup, one-half can per feeding in 500 ccs of water two or three times a day.
      2. One teaspoon each of sodium bicarbonate and sodium chloride should be used at each feeding.
      3. Commercial electrolyte preparations may be used as diluents for nutrients and chemotherapeutic agents.
      4. Propylene glycol or sugar may be used as nutrients.
      5. "Gatorade" makes a good vehicle.
      6. One-half cup of coffee is added per feeding in inclement weather.
      7. Antibiotics, sulphas, furacins and gut protectants may be incorporated in the treatment.

II. *Calves requiring intensive care are brought into the clinic.*
   A. We intend to rest the gut for at least 24 hours, so we begin by

administering orally 60 ccs of mineral oil and 20 ccs of paragoric fortified by antibiotics.

B. We give broad spectrum antibiotics, vitamins and in some cases corticosteroids intramuscularly, twice a day.

C. Shock is treated by infusing 500 ml. of whole blood intravenously for each 75 pounds of calf.
   1. The blood is collected from donor animals into pooling flasks containing anticoagulants. These flasks have a capacity of two liters.
   2. We use a Y-type plastic infusion set connecting one side to blood and the other to an electrolyte nutrient solution.
   3. We begin the blood transfusion only after we are sure that our apparatus is working.
      a. We halter the calf and tie the legs.
      b. We clip the hair over the jugular furrow.
      c. We incise the skin over the jugular vein and make a venapuncture with a thin walled 14-gauge needle.
      d. We thread six inches of polyethylene tubing through the needle and remove the needle.
      e. We then insert a blunted 18-gauge needle into the tubing and connect it to our i.v. setup and turn it on.
      f. We fasten adhesive tape around the connection and suture it to the calf's neck. We also tape the i.v. tubing along the halter rope.
      g. When everything is working we start the blood transfusion and untie the calf except for the halter.
      h. We allow the blood to run as fast as it will through our setup. A 500 cc transfusion will require about one hour.

D. When the blood transfusion is complete we switch to fluids through the same setup, regulating the flow to about 200 to 300 ccs per hour.
   1. We use a hypertonic solution containing sodium chloride 0.9%; sodium bicarbonate 40 ccs of 7% solution per liter; 5% dextrose and enough potassium chloride to yield 5 milliequivalents K^+ per liter.
   2. Next year we will increase our potassium to 20 milliequivalents per liter according to Dr. Lewis' recommendation.

In general these calves make a dramatic response to the blood transfusion. Beyond this the results vary considerably. About half of the calves show a marked decrease in the fluid content of the feces in the first 24 hours and these are returned to their mothers. About one-half of the remaining calves will make a satisfactory response after 48-72 hours of oral feeding and medication. The remaining 25% remain

problems and we lose most of them. We expect to get about 80% recovery on the calves we treat.

The hope of tomorrow lies in the selection of breeding stock and immunization procedures yet to be developed. In the meantime we can work on meeting General Butler's standards.

Question and Answer Period

QUESTION: What is the procedure on these calves after you have them back on their feet and you have rested the gut for 24 hours?

DR. SIMON: We may keep them off the cow as long as 72 hours and feed them according to whatever we think is right. Or we may put them back on, if there is good consistency to the feces at that time. Repetitions on these are not too frequent, we mostly see them once, I am sure; however, the real reason we don't see it twice is that they will not be around that long! (laughter)

QUESTION: Isn't your treatment with bicarbonate designed to return the hydrogen balance to normal?

DR. LEWIS: That is correct. As you remember, the series of chemical reactions I had ending up the hydrogen ion in the bicarbonate ion. That is two-way reaction. The reason the hydrogen ion increases is because of the loss of bicarbonate pulling the reaction to the right. By adding bicarbonate, it combines with the hydrogen ion, goes back to carbonic acid and then through enzyme action back in the water on the outside. Of course lactates will also do this. Lactate is completely metabolized and breaks down into water, carbon dioxide and bicarbonate and therefore will do the same thing as bicarbonate, if it is metabolized. The only place it can be metabolized is in the liver. The liver does not have the ability in many cases to do this. Therefore lactate is contra-indicated.

QUESTION: Does an insecticide such as "coral" have some anthelmintic effect?

DR. POSCHEL: Yes, but it is not 100 percent. It is in the range of about 70 percent and it is not effective against all the important parasites. Most of these insecticides are organophosphates in nature and just about any organophosphate is an anthelmintic which is effective against one or a few parasites. But again, it is not completely effective.

QUESTION: Which parasites?

DR. POSCHEL: With "coral" you can get a good clearance of hemonchus, the large stomach worm. You can get a slight clearance against the medium and the small stomach worms but when you get into the intestinal tract it really doesn't do too much.

QUESTION: How much potassium is lost by the calf and how much is needed for replacement?

DR. LEWIS: The amount lost by the calf is 65 milligrams per kilogram. I know that does you a lot of good! What it breaks down to is you treat a 75 to 80-pound calf with three to four liters of fluid per

day, which contains 23 milliequivalents per liter of potassium. Again, I realize this doesn't help you a lot. That is about 1-3/4 grams of potassium chloride per liter of fluid. This is a potentially cardio-toxic fluid by itself. You must give something to get the potassium back inside the cell by adding glucose solution.

QUESTION: Is the solution hypertonic?

DR. LEWIS: The solution is hypertonic primarily because of the added glucose. Therefore it is only slightly above osmolarity. The amount to be given would be derived by a complete balanced study on a normal calf and continued as that calf became diarrheic until death. In other words, we measured everything that went into that calf and everything that came out of that calf. We also measured insensible loss and from this we determined this balanced study that Dr. Phillips presented and this is where we came up with our fluid. Five percent glucose is isotonic. We are giving 6-1/2 percent glucose, therefore it's more than doubling the osmolarity. The total osmolarity in the fluid that we are giving is about 2-1/2 times that in the blood, and this is the reason it is hypertonic. This fluid can only be given intravenously, it cannot be given subcutaneously. After you have treated adquately to overcome the peripheral vasoconstriction which you can tell just by feeling that calf's legs and how cold they are, I think you can go to an isotonic solution. In that case, just put 2-1/2 times more water than you put in the other fluid.

DR. PHILLIPS: I just want to add one more thing. The glucose that is given, although it does create a hypertonic solution, is metabolized very rapidly. These calves are very hypoglycemic, sometimes they get down from a normal circulating blood glucose of 80 to a 100 milliequivalents per liter to 20 or less per liter when they are in this severe diarrheic state.

QUESTION: What about a prevention program for viral involvement of neo-natal calves?

DR. PHILLIPS: I am really strongly convinced that the number of pathogenic agents that can cause insult to the intestinal tract of the neo-natal calf are almost infinite. There are isolated at least seven or eight different viruses that I am aware of as well as *E. coli* and *salmonella spp*, that are potentially pathogenic to this new, young immature digestive tract. You have to realize that the neo-nate under fetal conditions or in the uterus is under sterile conditions and as the calf is born it then becomes presented with the problem of developing a normal flora. It is under these conditions that calves seem to be particularly susceptible, much more so than some other species. Obviously, as the industry becomes more intensified, separation of individual animals will become more difficult. I think from an early therapeutic standpoint that before they get into hypervolemic shock with the loss of blood volume, you don't have to go to these hypertonic solutions that Dr. Lewis was talking about or perhaps the blood transfusions that Dr. Simons indicated. Give the intestines a

rest period as Dr. Simons mentioned, get the calf off the cow, stop feeding it milk to prevent bacterial proliferation in the upper small intestine. Then give it fluids subcutaneously if you can get the animal before the peripheral vasoconstriction and shock occurs.

DR. LEWIS: One other thing that we have found to be very effective for neo-natal calves which is easily handled by individual livestock owners is the use of beef consommé, purchased at any grocery store. We recommend it. One can of consommé plus three cans of water given as a drink twice a day provide amino acids and many of the electrolytes that the animal needs in a readily utilized source. It does not provide the carbohydrates that cause an additional increase in bacterial growth. It is something that is easily obtained and easily administered.

QUESTION: Do these calves that have a plasma potassium concentration up in the range of ten millieq̣uivalents per liter of plasma develop cardiac arrhythmia?

DR. LEWIS: We most definitely believe so! This cardiotoxic effect, incidentally, is probably one of the primary causes of death in these calves. Calves will show abnormal electrocardiograms due to potassium cardiotoxicity before they look very sick. The calf is still up, he is still drinking, he apparently still feels very good although he is scouring pretty fast. They progressively get worse and go into cardiac arrhythmia and eventually cardiac arrest and yet they can be treated! We have found that, although it contains high potassium concentration, by adding glucose we can lower the plasma potassium concentration and thus decrease the cardiotoxic signs and obtain clinical improvement in the calf. I've had calves that were down, as Dr. Simons said, that would not even wink at you when you tapped them on the eyeball, yet could still be saved!

QUESTION: What causes opisthotonus in these calves?

DR. PHILLIPS: In a diarrheic infant they often describe these signs with the head back. We also see this in the calf. I don't know about the calf, but I know in the infant they attribute this to potassium loss or potassium imbalance. So, if I can play a broken record again, give potassium anyway!