

Chemotherapy in Neonatal Calf Scours

George E. Staples

Virtually all tangible matter is chemical in nature. One definition for chemotherapy is: "the treatment of disease by the systemic administration of chemicals" (9). Broad interpretation of this definition relative to calf scours would include any substance administered to the calf to alleviate, counteract or reverse the detrimental effects of scours.

Scours, also called diarrhea, is evidenced by excretion of abnormally large volumes of thin or watery feces. Some cases are mild and resolve without treatment. Other cases may cause death from severe dehydration or death from septicemia without marked dehydration or prolonged illness.

CAUSES

Numerous causes of calf scours have been proposed or documented, including errors in management and feeding of the cow and calf, inadequate protection from the weather, viruses, various bacteria and viral-bacterial combinations. Regardless of the cause, once the problem develops therapeutic measures may be necessary to save the afflicted calves.

THERAPEUTIC MEASURES

Most therapeutic measures are designed with one or more of three goals in mind:

- (1) To counteract dehydration, restore lost fluids and slow fluid loss.
- (2) To destroy or reduce the effects of causative and complicating microorganisms.
- (3) To enhance or restore resistance and help the gut return to normal health.

DEHYDRATION AND FORTIFYING IMMUNE COMPONENTS

The usual method of correcting dehydration in young calves is to administer fluids either by mouth or by injection. Such fluids are aqueous solutions of elements designed to replace what was lost through the excessive volume of watery feces voided in calf scours. Early scours often responds well to withholding milk for two or three days and substituting oral electrolyte fluid formulas such as the following:

Dr. Staples is associate professor, Department of Veterinary Science.

^a1 Add to 1 gallon of water, $\frac{1}{4}$ teaspoon of potassium chloride (KCL), 1 level tablespoon of salt (NaCl), 1 level tablespoon of baking soda (NaHCO_3), $\frac{1}{2}$ lb. of dextrose (glucose) powder or 8 oz. of Karo syrup. Feed this amount daily for three days.

^b2 Fruit pectin, 1 packet ($1\frac{3}{4}$ oz) such as Sure-Jel, 1 teaspoon salt, 2 teaspoons of baking soda, 1 can ($10\frac{1}{2}$ oz) of beef consommé. Add water to make 2 quarts and feed this amount two or three times daily to calves 80 lbs. or heavier.

^c3 To 1 gallon of water, add: 2 oz. of Arm and Hammer baking soda, 500 cc of 50% glucose, 1 teaspoon of electrolyte powder, such as Polysol (Cutter Company). Calves have been maintained on this amount daily for up to five days.

[Note: Never substitute table sugar (sucrose) for glucose. As little as $2\frac{1}{2}$ oz. of this in milk replacer fed twice daily produced severe diarrhea in experimental calves.]

Other more sophisticated oral formulations containing electrolytes, glucose and amino acids are commercially available through veterinarians. Some of these are reported to be better absorbed by the scouring calf than the preceding three formulas.

Other orally-administered substances which have been used to help reduce dehydration include formulas containing such things as kaolin, pectin, activated attapulgite or carob flour. Stamford and Bennett (6) report very good success in treating scouring calves with 2 grams of freshly grated nutmeg in milk or water for 2 days. An experimental formulation containing mainly sodium propionate and alginate has shown promising

^aSource: Dr. J. B. Herrick, *Animal Nutrition and Health*, page 16, November, 1974.

^bSource: Drs. R. W. Phillips and L. D. Lewis as reported by Dr. Kurt Wohlgenuth from *Kansas Veterinary News*, November, 1974.

^cSource: Dr. John M. Woods, report at Western States Veterinary Conference, Las Vegas, Nevada, 1967.

results in experimental calves at North Dakota State University as an adjunct to other therapy. When used by a practicing veterinarian on approximately 200 field cases of calf scours, good results were reported.

In advanced dehydration, the most direct means of correcting this life-threatening condition is to administer fluids slowly by the intravenous (IV) route at a rate of 4 liters in approximately 24 hours. More rapid injection can be tolerated by the intraperitoneal (IP) route, but absorption and delivery to the dehydrated tissues will be slower than by the IV route and some inflammation to abdominal organs may result from hypertonic fluids on those deviating far from a neutral pH. Electrolyte fluids may also be given by the subcutaneous (SC) route if given over several surface areas on the calf. The subcutaneous pockets of fluid are largely absorbed within three hours and further administration can be repeated. High gamma globulin serum given by the SC route did not raise the calve's serum gamma globulin level until 48 hours had elapsed (7).

In addition to electrolyte fluids, other beneficial parenteral treatments have been suggested to combat dehydration and replace lost immune components. Wilgenbusch and Sexton (10) indicate that 1 liter of whole bovine blood is of considerable value. Fisher and Martinez (1) suggest that immune serum assists calf survival, but question the economic feasibility presumably due to the large volume required to be effective. Watt (8) reported death losses of 78 per cent in scouring calves treated with antibiotics only. Losses were reduced to 7.5 per cent by substituting a regime using parenteral administration of 2100 ml of Darrow's solution, 2100 ml of 5 per cent glucose plus 800 ml of bovine plasma over a 24 hour period. Only 30 per cent of the calves required a second 24 hour treatment to achieve the 7.5 per cent loss.

The economic barriers to the beneficial use of large volumes of bovine plasma or serum to combat dehydration could be overcome by developing more economic methods of obtaining these products than are presently used. Work at North Dakota State University has shown that high gamma globulin serum can be obtained from cull cows at slaughter. Pooled lots of such serum should contain a variety of specific antibodies. Serum so obtained has been chemically sterilized and safely administered in 1 to 2 liter amounts to more than 50 calves. Fisher, Martinez, Trainin and Meirum (2) established that IgG appeared in the feces of scouring calves in direct proportion to fecal volume, indicating an accelerated loss during diarrhea. This may partially explain the success of Watt (8) in reducing death losses by including large volumes of bovine plasma in his parenteral fluid regime. Logically replacing some of the lost immune substances should enhance resistance and liveability.

REDUCING THE EFFECTS OF MICROORGANISMS

"At the present there are no antiviral chemicals approved for use in animals. Three have been approved for use in human beings," according to Gustafson (3). Until effective antiviral compounds are developed, em-

phasis must be placed on reducing primary or secondary effects of bacteria on the scouring calf.

Use of sulfa type drugs preceded the use of antibiotics in managing calf scours. When sulfa-resistant bacteria emerged and antibiotics came into use, numerous scour products were developed and marketed. These consisted of different sulfas, different antibiotics and numerous combinations of sulfas and antibiotics. Apparently these numerous products give good results in selected cases. However, the battle goes on to find new drugs that will circumvent resistance developed by scour-producing bacteria. In recent years it has been increasingly difficult and costly to win approval for new drugs for use in meat or milk producing animals. It is doubtful a "one shot" prevention or cure for calf scours will be developed in the present century.

Many antibiotic and sulfa drugs have been approved for use in calves. Some of them, such as neomycin, are for oral use only; others provide both injectable formulations and oral preparations. The following drugs and possibly others are on the approved list.^a

- Tetracyclines (oxytetracycline, chlortetracycline, chlortetracycline hydrochloride, chlortetracycline bisulfate, tetracycline hydrochloride)
- Streptomycin and dihydrostreptomycin sulfate
- Erythromycin
- Neomycin
- Penicillin
- Tylosin
- Sulfas (sulfamethazine, sulfabromomethazine, sulfachloropyridazine, sulfamethoxine)
- Combinations such as (1) Sulfamethazine streptomycin phytalsulfathizole and kaolin, (2) Chlortetracycline and neomycin (3) Chlorhexidine hydrochloride and dihydrostreptomycin sulfate, (4) Penicillin G and dihydrostreptomycin sulfate)

Veterinarians may prescribe other drugs, some of which have been approved for humans but not for animals. Among those which have been found effective in treating selected cases of resistant calf scours are amoxicillin, dantifur, chloramphenacol and gentamicin. To avoid legal complications it is most essential that adequate withdrawal time be prescribed along with these or with approved drugs if a calf is to be marketed for veal. Gentamicin, for example, may cause tissue residues for more than 35 days. Biosol M, oral neomycin, is illegal to inject, and residues in some tissues may persist for 120 days if injected. Also the proper dosage should be strictly followed; animals may tolerate double the recommended dose of some drugs. Other drugs such as the amino-glycosides (neomycin, streptomycin, tobramycin, Amikacin and gentamicin)

^aSource: Circular V-610 (Revised) Drug Use Guide: Beef Cattle and Calves, North Dakota State University, I.A. Schipper and Kurt Wohlgemuth.

have a rather narrow margin between effectiveness and safety. Nolvasan (2% chlorhexidine) a disinfectant used by some for calf scours, will cause liver damage at the 100 ml per day level which is reportedly used.

In administering oral antibiotics, it may be of value to recognize that the effectiveness of many antibiotics is reduced when fed with milk or formulas containing calcium or magnesium, according to Price (5). This is especially true for the tetracyclines.

The use of corticosteroids in the neonatal diarrheic calf is not only useless, but may be detrimental, as reported by Lewis (4). It is well to remember that other diseases and complications may accompany diarrhea. Using skill and judgment in applying therapy measures to each individual sick calf will yield the best results.

In summary, presently recommended chemotherapy measures in dealing with neonatal calf scours includes:

- (1) Discontinuing milk and substituting balanced oral electrolytes for a day or two in mild cases. In advanced dehydration, injecting balanced sterile electrolyte fluids and replacing some of the lost immune fractions with a liter or more of whole bovine blood, plasma or serum.
- (2) Making use of oral compounds having protective, absorbant and/or astringent properties.
- (3) Using drugs which will inhibit or destroy pathogenic bacteria.

REFERENCES

1. Fisher, E. W., Martinez, A. A. **Immunity and Neonatal Calf Diarrhea** pp 83-86. From a Seminar entitled, Perinatal Ill Health in Calves. Edited by J. M. Rutter (September 22-24, 1975).
2. Fisher, E. W., Martinez, A. A., Trainin, A. and Meiom, R. **Studies of Neonatal Calf Diarrhea. II. Serum and Fecal Immune Globulins in Enteric Colibacillosis.** Br. Vet. J. 131:402-415 (1975).
3. Gustafson, D. P. **Projections on the Use of Antiviral Chemicals in Animals.** J. Am. Vet. Med. Assn. 176:1081-1084 (1980).
4. Lewis, L. D. **Calf Diarrhea: Part III - Management, Prevention and Treatment of Diarrhea.** Norden News, pp. 22-25 (Spring, 1978).
5. Price, K. E. **Antibiotic Potentiation - A Review.** Pp. 89-97, Eighth Annual Research Conference, Chas. Pfizer and Company (May 8, 1960).
6. Stamford, I. F., and Bennett, A. **Treatment of Diarrhoea in Calves with Nutmeg.** The Vet. Rec. 106:389 (1980).
7. Staples, G. E., and Graham, C. K. **Serum Component Changes in Calves Following Injections of Adult Bovine Serum.** In Press. Vet. Med./SAC.
8. Watt, J. G. **Fluid Therapy for Dehydration in Calves.** J. Am. Vet. Med. Assn. 150:742-750 (1967).
9. **Webster's New World Dictionary - College Edition.** The World Publishing Company, New York, NY (1964).
10. Wilgenbusch, L. C., and Sexton, J. W. **Some Ideas on the Pathogenesis of Neonatal Calf Scours.** Iowa State Veterinarian, No. 3, pp. 153-157 (1971).

Guest Column continued from page 2

This issue of North Dakota Farm Research reflects some of the results of the research efforts on calf scours during the first year of this 3-4 year project. Some of the data may impress you as being too technical, other findings may corroborate facts already known.

Nevertheless, as we assemble this bulletin, a better understanding of calf scours evolves and some of our questions are answered. We realize that infectious agents, such as *Escherichia coli*, coronavirus, rotavirus, and cryptosporidium, often play an important role in calf scours. We also appreciate the importance of favorable environment, early colostrum intake, maternal nutrition and maternal immunity in the prevention of calf scours.

Perhaps one of the most useful results evolved from the first year of this project is the assurance that personnel of your Veterinary Diagnostic Laboratory at NDSU have developed accurate and expedient technology to identify infectious agents associated with scours. Special efforts were devoted to accurately differentiate pathogenic strains of *Escherichia coli* from those which do not cause scours. The addition of the electron microscope has resulted in rapid identification of scour-causing viruses. A great deal of knowledge has been gained in detecting and isolating coronavirus and rotavirus. Particular emphasis was devoted to categoriz-

ing the various types of microscopic lesions observed in scours caused by various infectious agents.

No less important was the knowledge generated from clinical and field observations. It is anticipated that the significance of maternal nutrition, the chemical composition of colostrum, the effects of various vaccinations and the role of environment will receive special attention during the forthcoming years of this project.

It has been suggested in a rather unbenevolent way that every case of calf scours represents a failure of scientific efforts to deal with the problem and that the ultimate goal of related research must be the development of methods of prevention. Inasmuch as calf scours result from both infectious and non-infectious causes, we kid ourselves if we expect "a little bottle of vaccine" as the ultimate result of this research effort. We may obtain better vaccines to deal with certain infections; however, more important than vaccines is an informed cattleman who gears his overall management to preventing the non-infectious causes of scours.

A special recognition is due to those cattlemen who have volunteered their herds as field research laboratories. It is our sincere hope that their efforts, and the dedication of all the people associated with this project, will answer the most important question, "How can we successfully prevent calf scours?" Significant steps already have been taken to achieve this goal.