Epidemiology and Confinement Operations (Feedlot Section)

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Basic Epidemiology in Confinement Operations*

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The program theme (What's the Present and Future of Bovine Practice?) provides a perfect opening for this paper because I believe the future is exciting for consultation practitioners who serve as advisors to owners of cattle kept in confinement. Because consultation practice is concerned with populations, the veterinary consultant should be versed in the fundamentals of population medicine. An intrinsic component of population medicine is epidemiology, that branch of medical science which records the distribution of disease in populations, attempts to explain the recorded distribution and then uses the knowledge thus obtained for control of diseases.

The epidemiologic method is that approach to medicine which determines the who, when and where of disease then uses this knowledge to explain "why." Epidemiologic methods are useful in investigation of specific outbreaks, in the design and evaluation of control programs and in determining the etiology of new or unknown diseases. Veterinary consultants to confinement operations deal with all these situations, but the most exciting is the determination of the cause, source and extent of specific outbreaks.

A request to investigate a specific outbreak may be the consultant's entree to an operation. Such an introduction leaves him totally unacquainted with the operation and provides a perfect setting for a thorough and hopefully unbiased investigation. The probability of the investigation succeeding can be increased by use of the strategies which will be discussed.

A complete investigation involves describing (and recording) the characteristics of the outbreak in terms of time, place, and the individual characteristics of both affected and healthy animals.

Unlike the clinicians who rush to examine affected cattle, the consultant-epidemiologist stays away from sick animals until he has surveyed the premises, the management, feeding and watering practices and until he has extensively interviewed manager and employees. Before examining sick cattle, he inspects areas where unaffected cattle are kept. By resisting the temptation to examine sick animals first, he avoids the natural tendency to make a diagnosis and then bias all subsequent observations to favor that diagnosis and he avoids the hazard of carrying disease to unaffected subpopulations subsequently examined.

The distribution of disease with respect to time should be determined early as it frequently provides insight into the type of disease process

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involved. Time distributions are best studied using simple epidemic curves plotting the times of onset (or death) on a simple graph.

In practice, such graphs assume numerous shapes which may (or may not) be indicative of the type of exposure and transmission involved. A contagious infectious disease spreading from animal to animal usually follows the pattern depicted in Figure 1. A point epidemic, consisting of all cases appearing at approximately the same point in time and space, assumes another characteristic shape (Figure 2). A point epidemic strongly suggests simultaneous exposure to a common source (of infection or toxicity) by means of a common vehicle and if gastroenteritis is apparent, it is virtually pathognomonic (epidemiologically) of foodborne or waterborne disease.

Conversely, food or waterborne disease does not always produce a point epidemic because of variations in incubation periods and because exposure of all affected animals does not always occur simultaneously.

The time relationship between onsets and exposure to possible sources of introduction of an agent must be considered early and is best depicted by adding possible exposures to the epidemic curve as illustrated in Figure 3.

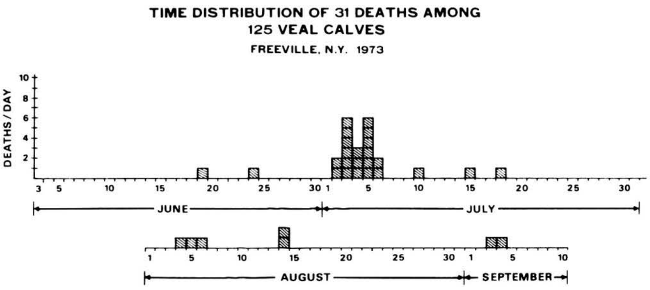

Figure 1. The epidemic curve of an outbreak of salmonellosis in confinement-raised veal calves suggests animal to animal spread, although this pattern could be produced by foodborne disease with varying exposure times or varying incubation periods or even by stress-induced activation of latent infections.

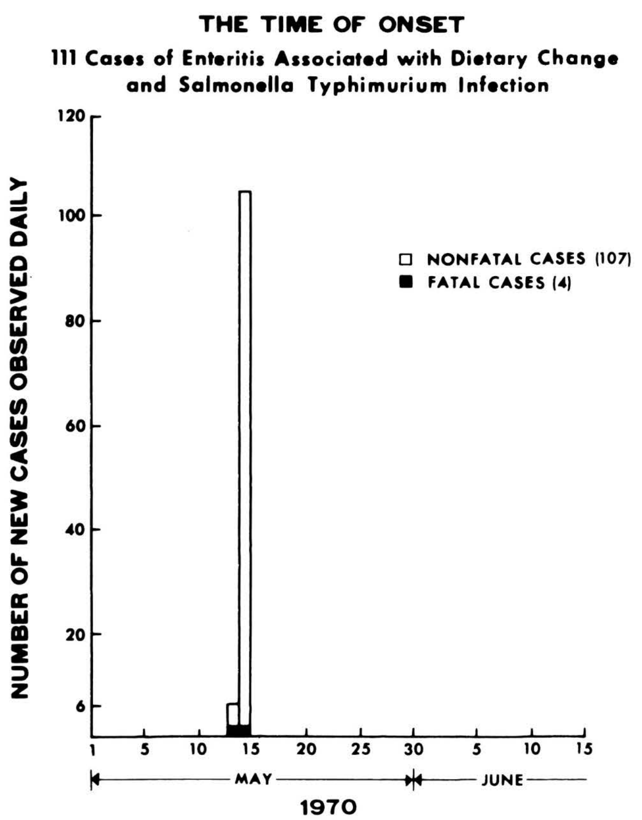

Figure 2. A point epidemic of salmonellosis in a confinement dairy operation strongly suggests simultaneous exposure to large numbers of organisms. If the entire herd were carriers of low grade salmonella infection, could this pattern be the result of sudden change to a diet ideal for intestinal overgrowth of salmonella?

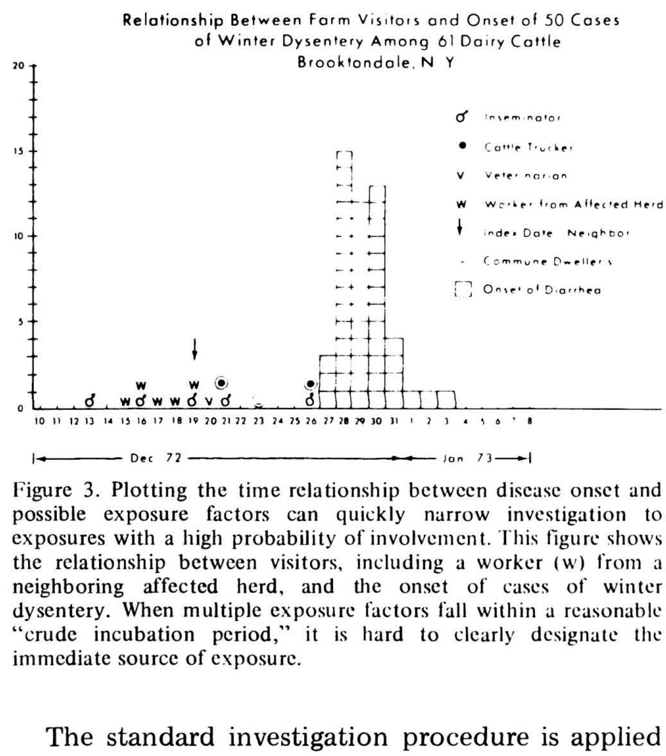

Figure 3. Plotting the time relationship between disease onset and possible exposure factors can quickly narrow investigation to exposures with a high probability of involvement. This figure shows the relationship between visitors, including a worker (w) from a neighboring affected herd, and the onset of cases of winter dysentery. When multiple exposure factors fall within a reasonable "crude incubation period," it is hard to clearly designate the immediate source of exposure.

The standard investigation procedure is applied by interviewing and observing the characteristics of healthy and affected cattle in terms of their personal characteristics (age, sex, breed) and their contact with various suspected exposure factors such as feedstuffs, water, medications, newly introduced cattle, visitors, location on premises, etc. A simple exposure checklist can be prepared for each problem by simply breaking the population into obvious subpopulations (pens, lots, barns, age groups, etc.), indicating clearly which subpopulations are affected and then checking off the factors to which each subpopulation has been exposed. A "hit" occurs when a given exposure factor is so distributed that all affected subpopu-

EXPOSURES

		WATER SOURCE		FEEDSTUFFS					
				Pellets		Chopped Hay		High Moisture Corn	Mineral Mix
POPULATIONS	Sick	Pond	Well	A	B	Dry	Green		
HIGH PRODUCERS	X	X	X	X		X	X	X	X
LOW PRODUCERS	X		X	X		X	X	X	X
DRY COWS (at home)	X		X			X	X	X	X
BABY CALVES (at home)			X		X				
DRY COWS #2					X				
HEIFERS #2					X				
YEARLINGS #3									

Figure 4. The population exposure chart for a salmonellosis outbreak in confined dairy cattle indicates four feedstuffs in correspondence with affected subpopulation.

lations have had access to it and all unaffected subpopulations have not. Since exposure and onset are not always in exact correspondence it is sometimes advisable to calculate attack rates in each subpopulation. Exposure factors of high suspicion are those with high attack rates among exposed groups and low attack rates among unexposed groups. Frequently, several exposure factors record hits and the suspicious factors must be further examined in respect to time (onset-exposure intervals) or subjected to toxologic or bacteriologic testing. Frequently, testing of water or feedstuffs is frustrating because these materials are no longer available when investigation occurs or because an obviously incriminated agent is not found. In such cases, experience shows that epidemiologic evidence, however circumstantial, is usually more convincing than negative laboratory tests.

The above procedure was used to narrow the search for sources of infection in an outbreak of acute salmonella typhimurium infection associated with a sudden change in feed (see Figure 4). Although four feedstuffs recorded "hits" (Figure 3) the green chopped hay was the only factor which had been freshly introduced within a reasonable "crude incubation period" and the temporal relationship was convincing although the organism was not found in the incriminated feed.

Careful epidemiologic investigation of outbreaks of both explosive and slowly spreading diseases can be rewarding to the consultant in confinement operations.

References

Kahrs, R. F., Bentinct-Smith, J., Borck, G. R., Brunner, D. W., King, J. M. and Lewis, N. F. Epidemiologic Investigation of an Outbreak of Fatal Enteritis and Abortion Associated with Dietary Change and Salmonella Typhiurium Infection in a Dairy Herd. Cor. Vet.

Results of Virological Examinations of "Feedlot" Specimens during 1973 at TVMDL

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Effective virological diagnostic services have long been hampered by the time-consuming assay procedures. However, in the last few years great advances have been made and the time lag between request and answer have been shortened. This h been mostly due to the use of the FA techniques i identifying a viral isolate. We no longer apply, at least on a regular basis, the FA test directly to tissue sections; even so, this would obviously be the fastest way in arriving at a diagnosis. The drawbacks with this method are nonspecific staining and low sensitivity. We inoculate all specimens for virological examination onto fetal bovine cell cultures. These cell cultures are then stained with conjugate two to three and three to five days after inoculation for IBR and BVD, respectively.

The chances of recovering virus are almost always better from an acutely sick animal than from chronically affected animals. Nasal and eye secretions (about 1-2 ml) in the case of respiratory problems and feces (10-50 ml) from animals with enteric symptoms are specimens of choice. These should be submitted well refrigerated or frozen. A blood sample from the same animal should accompany the shipment.