Clinical Approach to Herd Mastitis

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I am here to discuss what we do in our practice relative to mastitis control and first I want to lay down some basic principles upon which we base what we do in our practice. Secondly, I want to examine what we do in our practice relative to the various factors which influence mastitis and mastitis control. And then, thirdly, I want to examine some actual cases we have had with the idea hopefully that it will help to put the pieces together.

Now, first, to the basics. When we think of mastitis and its related problems we think of clinical mastitis. We think of that much larger segment of subclinical mastitis; we think of elevated CMT scores or Wisconsin mastitis test scores; we think of the loss in production that is related to those high CMT scores; under certain conditions with mastitis and mastitis control-related problems we think of high raw counts. It is the intramammary infection that causes the clinical mastitis, the subclinical mastitis, the elevated CMT's, the loss in production and, in certain cases, the high raw counts. The higher the level of that infection, the more problems there will be or can be. The purpose of mastitis control becomes then, in herds with high levels of infection, to bring that level of infection down to a low level that is economically feasible, and the purpose of mastitis control in the herds that already have a low level of infection is to keep them there.

To lower the level of infection in a herd involves two courses of action that must be taken simultaneously. For you Davis graduates, that means at the same time. But these two courses of action that must be taken simultaneously are, first, to prevent new infections (also in the case of the cow that has been cleaned up to prevent re-infection), and, secondly, with as much coordination as you can get, to eliminate or reduce the number of infections already existing in that herd.

Now, the factors that relate on the one side to lower the new infection rate, those factors are the functionability of the machinery and sanitation. And when we are talking sanitation, we are talking in terms of sanitation of the machinery, sanitation of the cow herself, and we are talking in terms of the milker himself. Much of the same things Dr. Bushnell was discussing here. We are thinking of how functionability of the machinery, sanitation and hygiene-milking procedures-affect new infection rate.

General management factors affect new infection rate, such things as housing and the nutrition, etc. In our country, we have large herds and also we have herds of 100 or 50 cows. We have some herds in our area that we would like to get those strings split up. Some of them have 300 cows in a string so they are standing in holding corrals for a long time and these are all things that have an effect and influence on the rate of new infections. The type of cow also relates to general management.

The fifth factor that relates and influences new infection rate is dry cow treatment. Now, factors that reduce the existing level of infection in a herd or the things that you can do or that occur which will bring down the level of infection in the herd, of course, again are dry cow treatment, treating of the clinical cow, selected cow treatment and selected lactating cow treatment. The fifth area that reduces the level of infection in a herd is spontaneous chewers, and that's where I'm best.

So that, in summary, as far as principles are concerned, we are dealing with the intramammary infection. That is the key and that is the reason why the veterinarian should be the key man, the coordinator and the liaison man in mastitis problems and control. The purpose, then, of mastitis control is to wall off or build a fence around that clean uninfected cow to prevent new infections and at the same time lower the level of infection that already exists in the herd. What we do in our practice relative to these various areas may not be applicable to practices in other places. However, we are confident that the principles upon which we base what we do are the same whether it is a five thousand cow dairy in California or whether it is a 10-man hand-milked herd in the best part of upper New York state.

The first factor that relates to that group relative to new preventions is machinery function. We are fortunate in our area that we have four different sources of people we can call on to do our machine examinations. Those of you who live in areas that do not have that kind of service either need to develop it or else do it yourself, and that is the purpose of the schools that you have had the first three days before this convention started with Dr. Jarrett and Dr. Woods and their colleagues. If that kind of service is not available to you or you cannot develop it in your area, then you need to develop yourself because it is one of a five-part segment of what it takes to control mastitis and help prevent new infection. Not the only one, but it is one that is essential, and needs to be done. There are four sources that we utilize here, for your information, so that you may be able perhaps to develop them in your area.

One of the sources that we utilize is the farm ad-

visor. The University of California has an extension service and there are farm advisors in counties which are very much dairy-oriented who have received qualified education in machine analysis and function. Unfortunately, our farm advisors are not available on a full-time service. We can call them when we need to for some emergencies in problem herds that need some quick service and this is a service of the extension service in California. It does not cost the dairyman anything.

A second source that has developed in California is somebody that is related to the feed mills. For example, we have in our area two very qualified people, or two feed mills who have very qualified people. I have, for example, this one feed mill representative who is a Ph.D. nutritionist and has a complete three-page document of very careful instructions for a good half-day examination of the machinery, with a full page of typewritten recommendations. Again, this on the surface to the dairyman is of no cost to him. However, this service is to be available only to those dairymen who are feeding grain from that grain company.

A third source is the machine company employee. We like to stay away from those because they are in a difficult position. If they come in and find that a man's vacuum capacity or vacuum pump is inadequate, it is a little difficult if he says "you need a new pump" and he says, "where am I going to get it," "you're going to get it from me, I have one." So, we like to stay away and keep from having to put them in that position of conflict of interest, and where we have these other outside sources, these are the areas we turn to usually.

Now, the fourth source that we use for machine analysis is an outside, independent milking system analysis and this is a man that we helped develop and encouraged to go out into this business as we felt there was a tremendous need for it. He is available for the routine type of thing, whereas the others are not so much available for the routine examination of that machine. And this is a gentleman we had examined again by our Extension Service at Davis, so we feel that when he comes up with recommendations and findings, we feel that they are certainly competent. When it comes to machinery, we as a group are the liaison with it and highly recommend to our dairymen to go on to the routine analysis every six months or every three months in the big herd. In the problem herds he sends us a copy of his findings so we can correlate it as we sit down and try to put the whole scheme of mastitis control together. Those of you that do not have this kind of resource should try to develop them or else you will have to do it yourself.

The next set of factors which influence the new infection rate we will take as a group and those are sanitation and hygiene, the milking procedures and the general management factors. We are all familiar as veterinarians with a lot of the procedures that should be done to keep down the growth and spread of bacteria, and those things that Dr. Bushnell was talking about–dipping of the teatcups between each cow, dry and clean housing, the use of individual paper towels, proper prestripping, stimulation, machine takeoff, no overmilking and sanitizing the milker's hands. All these things relate to sanitation and hygienic milking procedures. I will tell you how we get it done in our practice–we don't! I want to tell you that there are few that will do some of these things but there are precious few, and usually they are the ones that are very much in trouble. They will do it for a short period of time. We concentrate our efforts in two main areas, then, rather than trying to get involved with milking procedures and trying to change these fellows.

The two things that we try to push the most, of course, is teat-dipping and the idea and the concept of milking a dry, clean udder. We feel that if we can accomplish these two things, we are a long way down the road. Of course, we keep hammering at all these other areas but we find it extremely difficult to get any of them done and we are certainly open to suggestions from the group as to how to get it done if somebody knows how.

We figure, for example, in teat-dipping in our practice, with as much jumping around and harping on it as we have done, maybe 25% of our dairies are teat dipping and the number is declining. You have to get some kind of housing that you can get them up to where they are clean and dry so that you can come up with a clean, dry udder to milk. We can talk and show them the various ways of doing it but, again, talking and getting it done are two different things because it takes tremendous investments. Motivation is very difficult in these areas. The more you get them to do, of course, the more effective your control program is going to be, but fortunately you can still get results and not have all those things which would be ideal.

The final factor influencing the new infection rate which we have previously mentioned is our dry cow therapy. Our recommendation to all our dairymen is to treat all cows when they go dry and our recommendation is based upon the work that came out of England which Dr. Bushnell referred to and which in their studies showed that 25% of all the new infections occurred within the first two to three weeks of the dry lot period. By dry treating all cows, you will have decreased that new infection rate at that particular time. So, now, we have discussed those factors relating to the new infection, which are the machinery, function of sanitation and hygiene, milking procedures, general management and dry cow treating. Those as a rule are areas in prevention and relate primarily to all types of organisms that could cause intramammary infection.

Now, let us move into that second area of reducing the number of infections already in the herd. To reduce that number of infections in the herd it is nice to know, and in some cases essential, for example, like the microplasma herds, to know what you are dealing with and which cows are infected if you are going to really control the level of microplasma or eradicate it. This brings us into the culture tech-

niques we use in our clinic.

We use sterile Q-tips to streak the beta toxin on to our plate. We use to take our milk samples as either tank samples or as individual cow samples or clinical samples in these sterile disposal plastic tubes. We use a 3% solution of potassium hydroxide, which is a quick, easy test for determining whether it is a gram negative or gram positive organism. You can take a sample off, put it on a slide with a drop of sterile water, mix it up and then add a drop of the 3% potassium hydroxide with it. If it becomes sticky, it indicates that it is a gram negative organism; if it does not become sticky it indicates it is a gram positive organism and then, finally, we have our sensitivity apparatus for running our sensitivity tests. The incubator does not have to be anything elaborate. What kind of bacteria are we looking for in our cultural work? This is something that I'm sure you are already familiar with, but I am going to reemphasize it and remind you that 95% of the organisms that we are dealing with are staphs and strepts. We want to develop a technique which is able to distinguish the staphs and the strepts. Gram negatives 2-3% is an old estimate, may be a little higher in some herds; the pseudomonas, corynebacteria, microplasma, yeast and fungi do not amount to very much. So, what we are looking for primarily are the strepts and staphs. We send any suspect microplasma samples or tank samples to the university to be analyzed for microplasma. The yeast can be grown very nicely and by gram stain you can pick them out if there is any difficulty.

NOTE: At this point the speaker showed several slides of various culture techniques used in his practice.

Our sensitivities are run only on the staphylococci; there is no need to do so on the streptococci since they are still sensitive to penicillin. We do run our sensitivities on all the staphylococci that we can isolate because of the different strains we can recognize based upon their physical appearance. There is some debate as to just how reliable that is in veterinary medicine. My university colleagues tell me that we can run sensitivity just on the straight blood agar plate. It may not be quantitative but it does give us an idea which is reliable relative to sensitivity. The width of the zone with the type of things that we relate to has no bearing upon the strength of the drug or the degree of sensitivity. So the plates that we use are the same plates that we use to culture with, we use for sensitivities, and we run our sensitivities again just on our alpha-beta staph which is the organism that we are primarily concerned with. We'll occasionally run one against coliforms.

The question always comes up as we relate to the intramammary infection with the need for knowing what we are dealing with: What kind of samples do we need to take? Our first procedure, of course, is to take a tank sample. This, however, is not always a reliable or a true indication of what is going on in the tank. You have good dairymen that will pull out a lot of the cows that may be causing him trouble and the milk is going into the tank. A herd that we are working with now has already pulled out 22 cows so that his tank sample shows us hardly anything. So, if a tank sample does not tell us what we are looking for, then we can take a percent of the CMT 2 and 3 cows.

As you recall, the CMT reaction of the white cell count is due primarily to the intramammary infection occurring in that udder so that those cows that have elevated CMT scores are going to be infected cows, the largest majority of them at one time, anyway. You can take a group with the highest producing cows and culture them and this will oftentimes give you a good indication of what the intramammary infection is in the herd, that is, what type of organism is in the herd. And the reason for this, of course, is that the higher producing cows have wider teat sphincters and the wider they are, the easier they are to become infected. Thus, you get a pretty good idea of what is going on in a herd by culturing a certain number of the high-producing cows. Of course, the old idea of culturing a percent of the herd, 10-15%, across the board will give you some idea. A complete herd culture is the ideal thing, but, often uneconomical, is not advisable and not justifiable.

Referring back to the factors that relate to the level of infection in a herd: the dry cow treatment, clinical cow treatment, selected lactating cow, the culling and spontaneous recovery, those areas which were utilized to reduce the level of infection. As related to dry cow, again we recommend that all cows be dry-treated on drying and we still feel that is the most economical, most effective and the easiest way, with the least management problems, of getting at the level of infection in a herd.

We formulate our own dry cow treatment preparation, but we think it is responsible dry cow formulation. We started it at a time when there were no dry cow formulations available that we thought were adequate in dosage. There are products available now which have gone through the test that the Food and Drug Administration has established, so that when you do use them, you know that they have met the standards of efficacy and safety, which takes a lot of the responsibility off your back. We are still using our dry cow syringes but, again I say, we think it is a responsible way of formulation. It is one that we put together based upon information given to us by a drug information retrieval service, which is a part of the services which are available to us through schools of pharmacy. We told them what we wanted to put together as drugs and they told us how to put them together as a responsible formulation with some sort of shelf life, how to adjust the pH to it to keep that shelf life, and what it was compatible with, and so on. We put them up as individual quarter syringes. We used to use the multiple-dose syringe but there are just too many chances for error, so we put this product up only in the squeeze jets as individual dry cow syringes and that is the way we dispense them, in boxes of a dozen with the alcohol swabs in them. Bas-

ed upon the cultural work that we have done relative to staphylococci and knowing that streptococci are sensitive to penicillin, our dry cow mix is a million units of procaine penicillin with a half gram, 500 milligrams, of neomycin, and as basic ingredients we use what is already prepared.

For our dry cow treatment, again we recommend that they dry-treat all quarters and this is what we are using–penicillin and neomycin. We have at the present time only one herd that has enough penicillin-resistant staphylococci that we are now using cloxacillin.

You have to realize in treating clinical cases that relative to the level of infection in a herd of a hundred cows that are infected through the course of a year, out of that hundred cows you would be lucky to have 5% of them show clinical signs. If you are relying strictly on the clinical mastitis cases, then you are only going to be hitting the tip of the iceberg. That tip is an important part because usually the cow is sick, and as a means of spread to other animals around her through the milking process, the clinical treatment needs to be done carefully and done well. We divide our clinical cases into two types. One is what we call a "hot" cow or a cow that has the high fever, oftentimes off feed. This is the cow that we will certainly go systemic with as a basic shotgun approach, which is valid. We use 5 grams of terramycin in glucose with 40 units of ocytocin. We think that milking these cows out is extremely important.

One criticism I have of people that I have seen treat cows is that oftentimes they do not cleanly evacuate the udder. I think probably that ocytocin is as much a part of the treatment, and the most effective part of it, as any other. We clean out all four quarters. We treat the quarters with again "a shotgun," which I can defend because by the time you culture the cow and take it back to the clinic and try to isolate the causative organisms and go through all the real nice academia in practicing the real nice medicine, the cow may be alive or may not! It is something that you have to do immediately and, again, based upon what has been done in the past and the type of cultures that we are getting and what we know about sensitivities, then our treatment of the clinical case, as a rule, is a million units of crystalline penicillin and a half a gram of neomycin in 250 cc of sterile water. We take water that has been distilled. We put it in 250 cc bottles then in 500 cc bottles and we inject into it neomycin and crystalline penicillin and will infuse it in the full 250 cc into each quarter. We use an I.V. set to do the infusion. We use sterile water rather than saline. There have been problems with saline. As I recall, a lot of the salines for veterinary use have not really been autoclaved. They have been sterilized, basically cold-sterilized by phenols, formalin and other type things that are very potentially irritating to the udder. That is a treatment that has stood the test of time and certainly will.

That is what we are doing with the "hot" cow. The "cold" cow, that is still eating, we will just use ocytocin to clean the udder out thoroughly and then use the sterile water treatment with crystalline penicillin and neomycin in the clinically affected quarter. If she has two quarters affected, we suggest to the dairyman or we will go ahead and treat all four quarters again based upon the information and knowledge that, if one quarter is infected, there is a 50% chance that there is another one infected. It is nice to use the CMT to examine other quarters and treat other quarters based on CMT. If we have one quarter infected, we take the CMT paddle and check the other three. If one of them shows a high CMT 2 or 3, that indicates a high degree of possibility of its being infected and we treat it.

With regard to culling, we have a basic recommendation–again which is only a recommendation, you have no way of carrying it out–hopefully, that they will get rid of those cows that have had four and five clinical cases. We certainly like for them to get rid of that "big-bagged" cow, the two-quartered cows and those cows with lots of scar tissue. One of the big controversies relative to the Food and Drug Administration and drug efficacies has to do with what is indeed an infected quarter. And if you sample the herd and culture a herd, you will find a lot of them that, if you teat-dip the week before you sampled them, you will have far less number of infected quarters by having done that than if you had cultured them immediately. Now, this is because there may be a streak canal infection as opposed to an infection clear on up in the udder. That is rather academic and you and I as practitioners are interested in beating down that level of bacteria. By teat-dipping you will see in some herds that are recently infected there has been a high degree of infectivity going through them real rapidly. You will see a rather good response relative to CMT scores and the like following teat-dipping. These are the spontaneous cures.

Now to get down to what constitutes a mastitis control work in actual cases and what we are really doing. We have five different groups of people that we get involved with in mastitis control and the first group, of course, takes by far the largest amount of our time, which is not really very much.

In that first group, of which we have probably about 40% of our dairies on dry cow treatment programs, every six months we like to take a tank sample and analyze it. Again with the idea, hopefully, of coming up with staphylococci in that tank so we can run sensitivities on it to again verify that what we are doing is proper as far as our therapeutic agents are concerned. The tank samples are not always reliable, as I mentioned before, in which case we will have to go down to some cow slide samples to get what we need as far as staphylococci in that herd. For example, we will write down our tank sample findings as we go out and take our samples every six months to re-verify that what we are doing is right. We will send them a copy of what our findings were with our recommendations, again which relates to them basic recommendations that you can give them: to continue to dry treat all cows, teat-dip all cows, milk the dry clean udder and make routine machine ex-

aminations. We keep hammering it at them through that particular type of thing.

Now, our second group that we get involved with is the group that expresses some concern over problems. They are not really being degraded yet, but they are either getting close or they are concerned about an elevation in the CMT's. This group takes a little more time, perhaps, and needs to do a little more diagnostic work. We can sit down and write out the recommendations as to what they should do but unfortunately most of them don't. In our practice we deal with all sorts and sizes of dairies. There's another 200-cow dairy that complained of a mastitis problem and the tank sample analysis showed alpha-beta staph and too-numberous-to-count *S. agalactiae.* On sensitivity they were sensitive to penicillin and neomycin, so our recommendations after an hour's discussion with him were to show him what could be done and what he really should do that was economically justifiable.

In another report pertaining to increased incidence of clinical mastitis, the following procedures were done in an attempt to diagnose the cause and determine the extent of the problem. Now, the extent of the problem is important because, depending on the extent, we will oftentimes dictate the course of action as to how drastic it has to be or how thorough you have to be. A tank sample of milk was cultured for types of organisms that could be involved and the following were found, as usual: the strepts and the staphs and some of the other organisms. The tank sample was further analyzed by U.C., Davis. There were no microplasma organisms in the tank milk.

Now, we also ran on this herd several clinical samples showing that they were *S. agalactiae* and several of the clinical cases and some coliform in the actual cases. His main concern about his clinical mastitis was he was starting to come up with some of these nonresponsive types of mastitis cases which probably are coliforms. The samples from the six cows that were clinical cases were sent to U.C., Davis, and they also were negative from microplasma organisms. This dairyman, who is one of the real good ones, was not running the California mastitis test on his herd so we suggested he run the CMT on his herd so it would give us some ideas as to what his level of infection was. The result showed 80% negatives in traces, 11% 1's, and 9% 3's. This is not a severe level of infection but it is still higher than desirable for maximum milk production. The machinery was examined for functional efficiency and I trusted the problem of the pulsator had been corrected. Antibiotics sensitivities were run and then, based on the sensitivities and drug compatibility, cost and residue and all these, drugs of choice for both dry cow therapy and the treatment of clinical cases would be penicillin and neomycin.

In conclusion, on the evidence to date there is no indication of any exotic or unordinary organisms building up or starting in the herd other than coliforms. Based on the assumed level of infection, which we assumed from the number of CMT cows that he had, I saw no further need for extensive culturing. I had enough information and could funnel the money that would be used for culturing into other areas of mastitis control such as dry cow treatment or teat-dipping costs. I told him I would like to continue culturing his clinical cases to provide further evidence that the information gathered so far was valid. I recommended that *S. agalactiae* mastitis control involves (1) preventing new infections, (2) reducing the level or number of infections already in the herd. Based on this strategy of control, the following recommendations were made: (1) thorough examination of the milking machinery at least every six months, (2) milk a dry clean udder (the lactating cow for let-down before application of the machine should be stripped out three or four strips of milk), (3) dip all teats of all cows following removal of the milking machine. And, finally, dry treat every cow on drying.

We have lots of clients that do a lot of their own therapy and it is our feeling that, if they are going to do it, they should do it correctly. So we will show them how and the directions for treating the clinical cases are given in the final part of the letter.

The third area that we get into, as far as our clients are concerned, is in special circumstance herds; for example, purebred herds that are wanting their true genetic value to come through. Those that want to really set as low a level of infection as they can in their herd. Others include high-production herds, herds being purchased, or, for example, we have one herd that is getting ready to add on another herd. We took a tank sample from the latter and it showed a large number of alpha-beta staphs. Our recommendation to him was not buy that herd and, if they did buy it, certainly buy it with lots of reservations in knowing what they were getting into. Staphylococci are really difficult to get out of an udder. If it is a strept herd, buy it. We can really do something with that one. There's another herd here with a high coliform problem.

The fourth area is the individual cow cultures which are usually that non-responsive type in which we are not really able to do very much. The fifth group is that problem herd. This represents about two or three herds a year. In practices that don't have someone who can do a little specialization in mastitis control, it is really a difficult group to do something for because you only have one or two or three of these a year and they are in trouble and you have got your neck stuck out. They are usually the real poorly managed herds and it is a difficult group to work with as a professional, and probably the most difficult part of it is staying up and staying fresh as a practitioner where you are not doing a lot of it. For example, a herd had a high raw count which turned out to be an *S. agalactiae* herd and there were many things going wrong as far as sanitation and machinery. We sat down and drew up a set of recommendations. Those dairymen are under tremendous pressure because they are being degraded.

This paper was prepared from a transcript of Dr. Morse's presentation.