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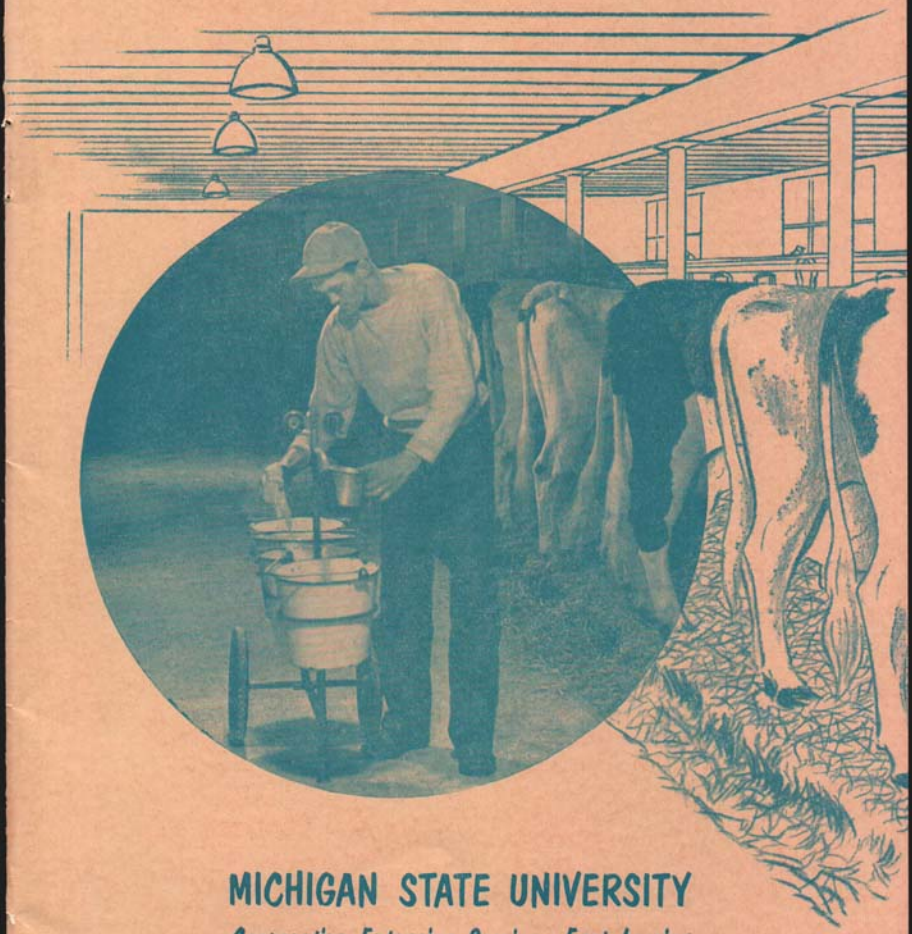
MASTITIS CONTROL

In Michigan Herds



MICHIGAN STATE UNIVERSITY

Cooperative Extension Service · East Lansing

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MASTITIS CONTROL IN MICHIGAN HERDS

By Albert R. Drury, Donald L. Murray, and Glen W. Reed

I. INTRODUCTION

By Donald L. Murray, Extension Specialist in Dairy

Mastitis causes more trouble than any other disease of dairy cattle in Michigan. Incidence of the disease has increased during the past 20 years. In an area survey in 1939 by Dean C. S. Bryan[1] including 322 herds with 2,715 cows, 86 percent of the herds and 26 percent of the cows were shown to be infected. In a smaller survey in this same area in 1960, 100 percent of the herds and 59 percent of the cows showed infection in one or more quarters.

Why has the number of cows infected more than doubled during the past twenty years? One theory proposed is that there has been too much reliance on treatment as a substitute for approved herd management practices that must be carried out if the infection rate is kept to a minimum.

Another item of interest drawn from these surveys is that 98 percent of the infections were *streptococci* in 1939 as compared to 58.8 percent in 1960. *Staphylococci* increased from practically zero in 1939 to 39.4 percent of the infections in 1960.

What does mastitis cost the dairyman? Individual high producing cows that flare up with mastitis several times during a lactation period and require treatment often incur a loss of more than one hundred dollars in discarded milk. Additional loss results from shorter productive life of the cow, decreased milk production, and value of the animal, lower milk quality and possible death.

An average yearly dollar loss for every producing cow and heifer that will freshen during the year has been estimated at ten dollars. This would indicate a dollar loss per cow ranging from a $10 average to well over $100 for individual cows, or total loss in case of death. Prevention costs much less. Since there is such a wide variation in the mastitis problem among herds, each herd owner must evaluate the economic loss for his own situation after he determines the extent of the problem.

Because mastitis infection is so complex, it may be unrealistic to think of eliminating it completely from a herd. But good, sound prevention and control practices certainly can minimize it. The material that follows provides dairymen with information on the nature of the disease, helpful herd management practices, and effective diagnosis and control.

[1]Bryan, C. S. (1940) Dairy Bacteriology Handbook for Veterinarians, Michigan State College, Division of Veterinary Science, East Lansing.

II. SYMPTOMS AND CAUSES

By Glen W. Reed, Extension Specialist in Veterinary Pathology

Symptoms

Mastitis may be defined broadly as any inflammation of the cow's udder. It often causes changes, or symptoms, which we can see. Other times, these symptoms are so mild that we do not notice them. Affected cows with unnoticed symptoms may be the most dangerous ones in the herd, as they may be carriers and spreaders of the disease. These mild or chronic cases are often the most dangerous because the dairyman is not aware of them. However, the mildness is deceiving, as udder tissue is gradually being destroyed and the quarters "go light." In addition, the conditions are ripe for acute flare-ups when various factors or combinations trigger trouble. Tests or laboratory work is needed to detect the condition early. Only by early detection and treatment before extensive damage occurs, can control be very effective.

The most common symptoms will eventually show in the milk. Some flakes may be so small as to require using a strip cup to detect them; (see page 9) or they may be large enough to interfere with milking. In more severe cases, the milk may become watery, bloody, or both.

The udder may swell and become painful, causing lameness as the cow moves. Changes in color of the udder may occur as the disease progresses, with redness turning to blue or bluish black. The udder tends to become cold and clammy to the touch as swelling and congestion interfere with blood circulation.

The cow may finally go off feed, develop a high fever, stand with ears drooped, head down, very depressed – a very sick animal. Death may follow in 24 to 36 hours; or the cow may recover and appear normal, only to remain a carrier of the disease if not properly treated.

Causes

Mastitis is a complex condition with many causes.

Noninfectious — Phase 1 Mastitis

The causes of noninfectious, or *phase 1,* mastitis are numerous. This phase of the disease results from injury, chilling, accidents, or physiological or body adjustments as outlined in detail below. Until recently, this phase had been largely neglected. Now with irritation tests (discussed in detail on page 15) and other checking devices, it is getting the attention it deserves. *Phase 1* "conditions" the quarters for infection or reinfection and may cause treatment failures.

Accidents in the barn, pasture or barnyard can bruise or otherwise injure the udder. Injury mastitis is important itself as a cause of poor quality milk, but more important, as a means of helping to start infectious

Fig. 1. Chapped teat ends (note lighter areas) open the door to mastitis.

or *phase 2* mastitis. In the case of a properly raised heifer that usually starts milking as part of a group of healthy cows, improper milking and handling eventually may produce irritation that results in injury to the quarters, causing *phase 1* mastitis. This group on any dairy farm varies in size depending upon many factors that are outlined below. It is this "conditioned" group that becomes more susceptible to infectious, or *phase* 2, mastitis.

It is also in this group that greatest control can be achieved with least effort. Simple injury can be corrected merely by finding and correcting the causes of irritation which lead to injury.

Some items which may contribute to mastitis are outlined below.

FROM MILKING

A. *Mistakes in Machine Use*

1. Overmilking
   a. Too many units
   b. Choring pattern – causing units to be left unattended
   c. Quarter difference – 6 to 10 lbs. from same cow
2. Milker on too soon
   a. Improper preparation of cow
   b. Cows vary in letdown time – apply machine when udder fills
3. Careless preparation, handling, and removal
4. Lack of cleanliness

B. *Machine Faults*

1. Vacuum instability
   Pump inadequate
   Lifting milk
   Flooding
   Plugged-in filters
   Line size, leaks, plugs
2. Liner faults
   Size and fit
   Design, quality, crawl
   Age, condition, fat filled
3. Pulsators – worn, dirty
   Pulsation rate
4. Vacuum level
   Too high – makes overmilking serious
   Gauges inaccurate
   Regulator not working properly
5. Other miscellaneous – low voltage, loose belt, etc.

FROM ACCIDENTS

A. *Stalls too small, poorly bedded, poorly designed* – Cow struggles to rise, bruises udder, steps on teats; pressure injury to udder.

B. *Obstructions* – Sills, steps, deep gutters, drifts, rocks, machinery; down fences, bogs, brush, stalks, saw grass; crowding about feed bunks, water tanks, through gates, doors.

C. *Slippery areas* – Wet or icy walks, approaches, stalls, alleys.

D. *Moving cattle too fast* – Dogs, horses, boss cows, tractors, kids; fighting, playfulness.

PHYSIOLOGICAL ADJUSTMENTS

A. Freshening, drying up, heats, feed changes

B. Weather extremes and changes, sunburn, cold

C. Chapping, chilling, from drafts and exposure

FROM ANTISEPTICS AND MEDICINES

FROM ALLERGIES AND SENSITIVITIES

Fig. 2. This stall is well bedded but too small to accommodate the cow comfortably and safely.

FROM STRESS AND DISCOMFORT

Boss cows, lack of feeding and lounging space, mistreatment, shock situations, inadequate stall size.

INFECTIOUS — PHASE 2 MASTITIS

A. *The usual udder germs* – strep families.

B. *Other germs in the environment* – Staph, coli, corynebacterium, pseudomonas, pasteurella, yeasts, molds, others.

C. *Disease complication* – Brucellosis, leptospirosis, tuberculosis, parasitism, hardware disease, metritis, milk fever, ketosis, etc.

In the past, mastitis was thought to be mostly infectious. Treatment control was mostly by infusion of medication into the udder. Now it appears there are more cases of *phase 1,* or simple injury, than there are of the second or infectious phase. It is also apparent that it is easier and cheaper to control mastitis in *phase 1* because finding and correcting the causes of injury, with a little time and the help of nature, corrects the damage before infection or phase two becomes established.

Proper milking, good bedding and stabling can reduce injury or *phase 1* which "conditions" quarters for infection. Proper emphasis on this phase can make control efforts far more effective, lessen the costs, reduce the treatment needed, thereby reducing dangers of residue of antibiotics in the milk supply.

III. PREVENTION

By Donald Murray

It is true we need more answers from research, but effective herd management can minimize the problem effectively besides giving a bonus of more and better milk.

Some suggestions for prevention of mastitis follow.

Good Herd Management

Prevention of mastitis should be the first concern of every dairyman in minimizing this health problem. Good dairy herd management is the key to prevention. Management includes milking procedures, operation and operating condition of milking equipment, feeding and care of the herd, sanitation, avoiding injury, and maintaining adequate health records of individual cows. It seems reasonable to assume that under good management, cow resistance will keep infection at a minimum. Herd observations bear this out.

Consider the following management items in mastitis control in relation to your herd.

Know the health status of your herd. – Use the California Mastitis (C.M.T.) or Milk Quality Test (M.Q.T.) to determine extent of udder irritation (see page 15). Results of the test run on a weekly to monthly basis properly recorded, will reflect the current udder irritation as well as any changing trends. An irritation index (method of calculation described on page 15) of 3 or less would be considered low, 3 to 5 fair, and 5 or above poor. A low irritation index should be the objective of every herd owner.

To reach this objective, you may have to take a close look at your herd management and adopt recommended practices if they are lacking in your present procedures.

Neither of the above tests would reflect actual infection. Use of a strip cup (See Figure 3) at every milking time will reveal the presence or absence of abnormal milk (see page 9.)

An arranged milking order will prevent spread of infection. All cows showing high udder irritation or abnormal milk should be regarded as a possible source of infection to other cows. In a stanchion barn, you can organize a milking procedure to reduce possible spread of infection: by milking heifers first, clean cows next, suspected mastitis cows third, and any cows known to be infected last. If several cows are troubled with mastitis, restrict one milker unit for these cows.

In most loose-housing operations, it is not practical to organize milking order of the herd. However, a separate milker unit should be used for cows that are known to be infected, show high udder irritation, or produce

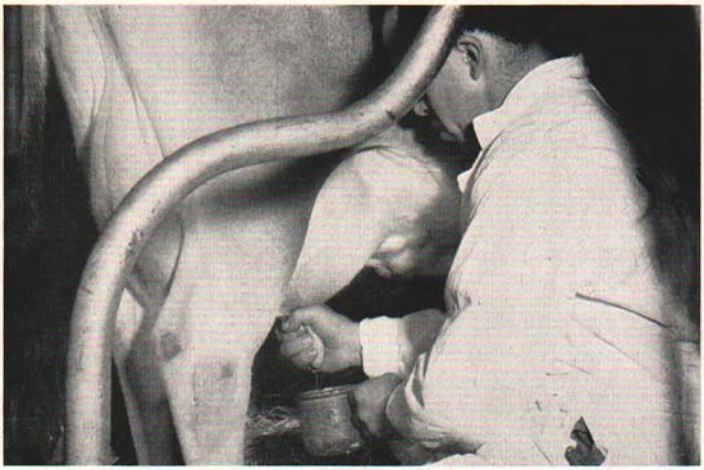

Fig. 3. Strip cup used in checking milk from each quarter before milking.

abnormal milk. Special facilities should be provided for separating the individual cows that need special observation and treatment from the rest of the herd.

Adopt a milking routine that will promote high milk production and udder health.

1. Wash the udder with warm, sanitizing solution (chlorine not over 200 parts per million, quaternary ammonium compounds or other acceptable sanitizing agents) 1 to 2 minutes before milking; then wipe off excess moisture. This prepares the cow for milking by stimulating milk letdown. It also provides a clean teat surface, which contributes to high quality milk. To wash the udder, spray with a solution, then wipe with a paper towel; or wash with an individual towel which has soaked in the sanitizing solution.

2. Use a strip cup to check 2 or 3 streams of milk from each quarter. This practice indicates the presence of abnormal milk *which must be discarded from the regular milk supply.* It also makes sure that the teat canal is open, and eliminates high-bacteria-count milk from the milk supply. Provision should be made for milker unit(s) for just those cows producing abnormal milk.

3. Put the milking machine on following milk letdown which usually occurs within 1 to 2 minutes after preparing the cow. Train your cows to

milk rapidly as possible. Experience has shown there is less trouble in herds where average milking time is 4 to 5 minutes per cow. It is important that an operator handle no more than two milker units in a stanchion barn or four units in a combine milking parlor so that he is on hand to check his cows, manipulate the udder for machine stripping, and get the machine off quarters in the shortest possible time. Where a pipeline conveys the milk in a stanchion barn, a good operator may handle three machines.

4. As soon as you remove the machine, disinfect the lower half inch of each teat with sanitizing solution. This can be of the same solution as used to wash the udder.

5. After milking each cow, rinse the teat cups in cold or lukewarm water to remove the milk. Then dip them in a chlorine solution or other approved sanitizing agent. For maximum benefits, the teat cups should be exposed to the sanitizing solution for 1 to 2 minutes, counting from when they go into the solution until they are put on the next cow. Avoid air lock to make sure the solution contacts the entire inner surface of each teat cup inflation.

Maintain milking machines in proper working condition. — If you want it to remove the maximum amount of milk in the shortest possible time, you must maintain high standards of machine operation and maintenance.

Maintain adequate and stable vacuum (recommended for your make of machine). — With pump in operation, put the maximum number of units on

Fig. 4. Gentle handling of udders and a close watch on machines are both musts in good herd management.

Fig. 5. Rinse the machine with cold or lukewarm water immediately after milking each cow. Then dip in a sanitizing solution.

the line that are being used. Note the vacuum level attained with an accurate gauge. Simulate the changing of units as at milking time and again note with an accurate gauge how much the vacuum drops and how fast it recovers. A general standard followed here is that the vacuum should not drop more than 2 inches and return to recommended level in 2 to 5 seconds.

Causes of low or unstable vacuum are:

(a) pump is worn or too small for number of units in operation; loose belt or low voltage

(b) Controller not working freely because of dirt or being worn

(c) vacuum line partially plugged; line too small or too long; or air leaks along the line

(d) pulsators worn; sticky or plugged parts

(e) cracked air hoses or inflations

(f) leaky gaskets on lid of milker pail, bulk tank, or pipelines.

A suggested maintenance program would be as follows:

Daily – Follow a cleaning procedure to keep equipment sanitary. Check air hoses and inflations for air leaks.

Weekly – (a) Check the belt and oil level on pump. (b) Check and clean the regulator. (c) Remove inflations and place in lye solution for weekly storage. (Lye solution – one 13-ounce can of lye to each 1-1/2 to 2 gallons water needed to cover the inflations). Inflations removed from the lye solution should be rinsed, brush-washed in an acid cleaning solution before placing on the milker units. (d) Clean pulsators and oil if recommended.

Monthly – Flush the vacuum line with a lye solution made up by adding a 13-ounce can of lye to a 12 or 14-quart pail of hot water. All the solution can be drawn into the last stall cock at the end of the line. If the line has not been cleaned for some time, start with the stall cock nearest the pump by drawing in about a quart of the solution and work toward end of line. Do not draw more solution into the line at one time than tank capacity on the milking machine pump. Drain the lye solution out of pump tank, rinse with hot water and let the pump run with stall cocks open to dry out line. A drop or two of oil on each stall cock will prevent corrosion. At least every six months, have the service man of your milking machine company come in and thoroughly check the operating efficiency of your milking

Fig. 6. Checking the vacuum pressure is necessary to maintain proper milking machine operation.

system. Most company service men have gauges and recorders that will accurately measure machine performance and indicate adjustments or replacement parts needed for good operation.

Keep milking equipment clean. – Follow manufacturer's directions as to temperature of solutions, cleaning agents and procedures for cleaning-in-place of milking system. Check periodically to determine if all surfaces in the system are clean. For bucket milkers, take equipment apart and wash thoroughly after every milking. The following procedure is suggested:

(a) Rinse with cold or lukewarm water immediately after milking.
(b) Brush-wall all equipment in hot water containing a good dairy cleaner.
(c) Rinse in hot water and place on storage racks.
(d) Rinse all equipment just before use with a bacteria-killing solution of proper strength.
(e) To prevent milkstone deposits, use an acid cleaner at least once a week on all equipment.

Fig. 7. Covered container for storing caustic lye solution.

Avoid udder and teat injury. – If your cows' teats are chapped, scratched, cut or crushed by being stepped on, or the udder shows bumps and bruises, look for the cause. Inspect your barn – are the stalls big enough for your

cows? Are the lots and fields free of wire, pieces of metal and other junk that may cause injury? Are the fences well stretched to discourage cows from trying to go through or over?

To avoid udder injury:

1. Provide stanchion barn stalls that are well bedded and large enough so cows will not stand in the gutter with udders hanging over the edge of platform as in Figure 2.
2. Get rid of high sills or other hazards in the area traveled by the cows.
3. Avoid chapping. Keep bacteria-killing solutions for washing teats and udders within recommended strength. If chapping or sore teats are a problem, use an udder ointment or lotion that has a mild odor. Such medicants should be absorbed before the next milking.
4. Keep yards and fields free from any debris that might cause injury.

Provide clean sanitary surroundings. – Clean barns and lots help reduce the number of infectious bacteria that may cause mastitis. Fewer numbers of infective bacteria reduce the herd's exposure to, and chances of contracting infectious mastitis. Clean barn floors, painted walls and ceiling and paved lots help reduce the mastitis problem.

Select healthy herd replacements. – The best policy is to raise your own replacements to avoid bringing disease into the herd. Manage your calves and heifers to guard against bacterial invasion of the udder tissue. Keep young calves in individual pens, or stanchions at feeding, to avoid their sucking one another. Sucking breaks the teat seal, thus opening the way for mastitis germs to enter and become established in the udder. If you buy cows, be sure they have been tested for mastitis infection by cultural techniques.

Make a regular routine of these various items of herd management and milking procedures. It may seem like an overwhelming task. But it will take less time and effort than giving individual attention to infected cows. A good preventive program should keep to a minimum the number of cows that will require special diagnosis and treatment.

IV. DIAGNOSIS AND TREATMENT

By Albert R. Drury, Assistant Professor of Veterinary Surgery and Medicine

At present we know how to eliminate mastitis that is caused by *Streptococcus agalactiae*. This type is still very prevalent on Michigan dairy farms. In a 1960 survey 17.4% of all cows were infected with this germ. A program to eliminate this type will be beneficial in preventing mastitis from other causes.

An examination of all existing factors pertaining to udder health is the

starting point of diagnosis. The physical plant (barn, barnyard, pasture, milking machine) should be inspected for shortcomings such as are listed under *causes* and *herd management* elsewhere in the bulletin. It has been shown that if such conditions are not corrected, permanent elimination of trouble from mastitis is less likely and reinfection more apt to occur.

The management factors listed elsewhere in the bulletin are no less important. These start with the raising of a heifer and end with good milking technique.

After all of the above items are assessed and steps taken to establish an adequate physical plant with a good milking routine, diagnosis is the next step in a mastitis control program. This can be best accomplished with a combination of tests such as the *California Mastitis Test* (CMT) or *Milk Quality Test* (MQT), whereby milk from each quarter is sampled with a specially designed paddle. A chemical is added to the milk, and then an irritation Index calculated.* An Irritation Index higher than 3 should be reduced by improved management practices.

At this time, ideally, one should also collect milk samples for laboratory diagnosis to locate "carrier cows" – the cows that are actively infected but

*The CMT is recorded as suggested in a report by Drury & Reed (1961), whereby numbers of 4, 3, 2, 1 and 0 are assigned for degrees of gelling. The sum of these numbers of all quarters in a herd is taken and divided by the number of milking cows in the herd. This figure is the Irritation Index and may range from 0 to 16.

Fig. 8. Visual strip cup examination of milk to check for abnormalities.

Fig. 9. California Mastitis Test (CMT) showing changes in milk due to irritation in the udder.

show no outward symptoms. Often these cows that you least suspect are the ones that quietly but surely spread chronic mastitis through your herd. These are the cows infected with *Streptococcus agalactiae*. They will generally respond to treatments infused into the udder selected by sensitivity testing. All treated cows should be checked 10 to 14 days post treatment to determine the success of the treatment.

Now let us consider further what the dairyman can do himself. It is essential to use a strip cup regularly to spot abnormal milk. An occasional flake or clot from the foremilk of a quarter does not necessarily mean infectious organisms, but it is a warning and such cows should be checked by laboratory tests.

Abnormal milk, such as flakes, may result from the action of enzymes on milk remaining in the teat cistern. (Enzymes are organic substances that speed up certain chemical changes.) They can cause the milk to clot either with or without aid of harmful bacteria. Harmless bacteria also may cause the flaking. Even though flaking occurs in the milk accumulated in the teat cistern, the milk up in the gland many times is a safe, wholesome product.

If you use a barn test, such as CMT or MQT, to measure the amount of irritation, run it weekly to monthly according to the severity of the problem and keep a record of results for each cow. If many reactions are apparent, further cultural or laboratory testing needs to be done. Neither the CMT nor MQT tests detects infection, nor do they tell the difference between noninfectious and infectious mastitis. *They should not be the only basis for an antibiotic treatment program.*

Fig. 10. Collection of milk sample for laboratory diagnosis.

CMT material can be purchased from your local veterinarian. MQT is available from dairy supply stores.

None of the other barn tests which the dairyman can carry out are accurate enough to be the only basis for a mastitis control program. They don't indicate all the infected quarters; they don't tell which cases are infectious and which aren't; and they give no clue as to the cause of infection. They may also indicate problems that do not exist because false positive readings are common.

Eventually dairymen should arrange for a careful collection of milk from all quarters and send it to a laboratory for cultural or microscopic examination. Better yet, use people who are trained, such as a local veterinarian, to collect and test milk to establish the status of each cow in your herd.

Fig. 11. Laboratory diagnosis of milk sample.

Do not develop a complacency because the local quality testing program carried out on your milk does not indicate infected animals or herds. Such tests only detect certain indicators such as excessive leucocytes (white blood corpuscles). The dilution factor is also able to mask a few shedders. Good cooling, which reduces bacterial growth, may prevent udder-infecting organisms from showing in the direct microscopic count of a sample collected for quality control. Mastitis organisms cannot be detected in the standard plate procedures used in quality testing. Low counts in quality tests should not be considered as indicating a lack of infectious mastitis.

Too many dairymen treat their own cows with antibiotics without first using laboratory tests to find whether treatment is needed and which antibiotic to use. Only in emergency cases should treatment be made without

first seeing lab results. In an emergency, call a veterinarian to take a milk sample from each quarter, then treat with the antibiotic that he feels is best according to past experience. Be sure to take a sample before treatment, otherwise you can't detect the type of infection.

If a herd is experiencing many flare-ups, collect samples, then go ahead and treat the cows. Send the samples to a laboratory for culture and sensitivity tests. The laboratory will grow the organism on several test plates, then put various antibiotics on the plates to find which ones control the organism. The one that works in the lab is most likely to work in the cow's udder. The only way to eliminate organisms from the udder is by infusion of antibiotic directly into the udder. Research up to this time has shown other routes are impractical.

Make another test 7 to 14 days after treating your cows to check the success of the treatment. Continue retesting and retreatment until all animals test negative or are disposed of. Ridding a herd of chronic infectious mastitis usually takes about three to five months of an intensive program. One must be very careful to prevent recurrence, and even then mastitis may return.

Fig. 12. Treatment of cow with infected quarters.

Disadvantages of Random Treatment

To be effective, antibiotic treatment for mastitis must fit the cause and conditions. To use antibiotics at random without proper diagnosis can be expensive and dangerous for several reasons.

First, if the mastitis is noninfectious, antibiotics would have limited value; instead, the cause of irritation must be eliminated.

Secondly, to treat all quarters is expensive, and causes loss of milk, *since milk from treated cows must be discarded for at least 72 hours after treatment.*

Treating only quarters that show visible symptoms often results in missing many quarters that are harboring infectious agents. On the other hand, many quarters are unnecessarily treated when based on abnormal milk showing in the foremilk. The most good is accomplished when early detection – possibly before blobs or flakes show up in the strip cup – leads to treatment of infected quarters. This will prevent further damage to the udder from infection.

Thirdly, careless use of antibiotics can result in the establishment of resistant organisms and organisms not usually found in the udder. These new organisms may not respond to present antibiotics. Careless handling of injection instruments can create a further abnormal condition that is most difficult to alleviate.

A program for mastitis control involves overall prevention in the herd as well as drug treatment for individual cows. Research has shown that drug treatment alone doesn't do the job – it takes a complete management program.

Results in two test herds brought this out. In one herd, 24 to 35 quarters were treated monthly with drugs selected by laboratory tests. In spite of these repeated treatments, mastitis continued to increase in the herd. The reinfection took place between treatments because poor management practices remained unchanged.

In another herd, negative results came after 4 months of testing, treating, and adoption of improved management practices. This herd was still free of infectious mastitis six months later. The Irritation Index declined to less than 0.3.

Right now, there are no antibiotics that can be injected into muscles that will effectively eliminate bacterial organisms from the udder. The best use for antibiotics is infusion into the udder. However, if an animal has a systemic involvement, parenteral treatment, injection into muscles, veins, or abdominal cavity is of value. The fact that the obvious signs, such as garget, no longer exist doesn't mean the animal is free of infectious bacteria.

Vaccination

Dairymen often ask about vaccination against mastitis. Such approaches go in cycles. Before development of sulfas and antibiotics, vaccines were used extensively – mostly for lack of anything better. However, many organisms used in vaccines are not able to build up protection in the udder against future invasion of the same, or similar, organisms. The reactions that would tend to create resistance are very specific; that is, they occur only with certain organisms and under certain conditions. Because of the changing tissue cells of the udder and because of the great variation in the organisms themselves, the udders do not build up resistance to future attacks.

Now that staphylococci are known to be a major cause of mastitis and because of the crack-down by the federal Food and Drug Administration on the sale of milk containing antibiotic residue, renewed interest in vaccination has come about. Knowledge of a few facts will aid in understanding the staphylococcus organism. It is the most prevalent or our potential disease-producing germs. One variety or another of it is active in acne, boils, "blood poisoning", food poisoning, pneumonias, wound infection, and mastitis. It does not mean that all "staph" bacteria can do all of the above. A variety that creates a violent food poisoning may not do any apparent harm to a cow's udder. The variety involved in serious hospital contamination did not become established when introduced experimentally into a cow's udder. This organism is carried in the nose and throat and on skin of many animals and man.

Two characteristics of great variability associated with this organism are (1) its ability to cause disease (known as virulence), (2) its ability to develop protection in a body against future invasion of a like organism (known as antigenicity). The real break in the chain of protection is the fact that even when protection does develop from exposure, it may be established only for that specific variety of staph; and there are over 100 known varieties to date, each with its own level of antigenicity. In practice, this leaves the cow vulnerable to the next exposure to this organism which may be another variety with a different capacity to develop protection or cause trouble. It follows that those varieties of low antigenicity are our most troublesome. Little is usually gained from vaccination with these varieties. Thus, chance of a stock vaccine being effective in a herd is quite improbable.

A most logical approach is to vaccinate healthy cows with a vaccine made from milk containing organisms from infected cows in the same herd. Such a vaccine is called an autogeneous vaccine. If highly antigenic organisms are known to be causing the infection, the vaccination may increase resistance in the herd. The cows have a milder attack and yield less abnormal milk. However, be aware that all staph varieties are not highly antigenic. As already pointed out, the reaction between the antigenicity and organism

and the vaccine is very specific and little cross-variety immunity is apparent for this organism. In summary, some vaccinations in some instances may be of some value in some herds.

Feeding

Good nutrition with a balanced ration providing adequate vitamins and minerals is a factor in providing resistance to infection. The feeding of sulfas and antibiotics has not shown any curative or even preventive value in controlled experiments involving udder infections.

There is an observation among dairymen that feeding high concentrations of soybean oil meal are a primary factor in causing mastitis. Research projects set up to examine this possibility have not yielded any evidence that such feeding programs have either caused or cured the disease. Generally it is agreed the mastitis symptoms may become apparent when feeding programs are altered. However, this is usually experienced in already infected animals and appears to be a matter of change which affects the delicate physiological balance necessary for milk production. Some evidence indicates that there is a changing pattern of resistance to infection as the natural feeding cycles change during the year.

Dry Cow Management

The dry cow is the key to a trouble-free lactation. A check should be made as she is dried off. This is an excellent time to treat if infectious organisms are present. A later check should be made to insure the success of the treatment. If staphylococci were in the udder an additional infusion about 10 days prior to freshening with a long-acting antibiotic will aid a cow to commence a trouble free lactation. Udders are highly susceptible to damage by staph during the freshening stage because of great changes taking place in the udder. The capillaries are easily damaged, causing bloody milk and permitting staph organisms to invade the milk producing cells.

Instruments

A successful program to control mastitis involves the entire operation, so a little should be said about availability of instruments to check milking machine performance. Many companies now have equipment to check pump capacity, pulsator performance and the entire operation of the milking system. Regular checks of this nature are very much in order. It also follows that a visual check of all parts is important, particularly rubber which is subject to accidents and deterioration.

The actual milking operation contributes much to the incidence of mastitis and no operation is any better than the person actually milking the cow.

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WHAT TO DO ABOUT MASTITIS

1. You most likely have mastitis in your herd. Recognize it as a problem. Take steps to minimize losses.

2. Survey – Physical plant, milking machine operation, cow comfort, barnyard and pasture hazards.

Mode of operation – proper milking procedures, handling and stabling of animals.

Type and extent of mastitis present

a. Noninfectious – use a test to check for irritation

b. Infectious – have laboratory tests run on milk samples from individual quarters to identify organisms.

3. Correct all possible items of environment, handling of equipment and animals to minimize spread and for successful aid to treatment.

4. Enlist aid from outside sources.
Check machine operations.
Check milking procedures.
Check udder irritations and infections.

5. Build a herd program for prevention and minimize need for treatment of individual cows.

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