How to Decrease the Use of Antibiotics in Udder Health Management

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Take Home Messages

- Antibiotic usage in production animals is a major concern for consumers.
- The most common cause of antibiotic usage in dairy herds is treatment and prevention of mastitis.
- Dairy producers, veterinarians and dairy advisors should work together to use antibiotics judiciously.
- Some guidelines are available to make judicious antibiotic treatment decisions.
- Treatment should be based on milk culture results.
- Chronic cases or expected low cure rate cases should not be treated.
- Selective dry-cow therapy is a valid option for herds with low bulk tank somatic cell count.

Introduction

Mastitis is still one of the most prevalent and costly disease of dairy cows. The annual incidence of clinical mastitis (CM) varies among herds from 5% to more than 100%.The mean annual incidence of CM in Canadian dairy herds is around 20%.

Antimicrobials have been used for decades as part of a control program for mastitis. They can be used for treatment of clinical or subclinical mastitis or for prevention of new intramammary infection (IMI) at dry-off. In fact, treatment and prevention of mastitis is the most important reason for antimicrobial use in dairy herds in Canada and in most countries. The quantity of antimicrobials used for treatment of mastitis is greater than the quantity used for prevention (dry-off) in Canada.

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Major concerns about antimicrobial usage and antibiotic resistance are raised by consumers worldwide. Everyone involved in the Canadian dairy industry has to take into consideration those concerns and adjust their practices accordingly. A national strategy for judicious use of antimicrobials was put in place recently and includes continuous education of veterinarians on that topic, knowledge transfer to dairy producers, establishment of guidelines for judicious use of antimicrobials, advertising campaign, etc..

Since mastitis is the major reason for antimicrobial use in dairy herds, it is logical to have a look at mastitis related practices in order to validate if antimicrobials are always used judiciously and possibly identify areas where their use could be decreased. Targeting the major reason for antimicrobial use will impact more substantially on the overall antimicrobial use in Canadian dairy herds.

The objective of this talk is to have a critical look over actual udder health practices and discuss ways to decrease antimicrobial usage for treatment or prevention of mastitis.

■ Prevention Is Still The Key!

The National Mastitis Council (NMC) control plan is a great tool to cover all aspects of mastitis control on a dairy farm. These recommendations should be well known and applied on all dairy farms. It can be found at: http://www.nmconline.org/docs/NMCchecklistNA.pdf

The 10-point program laid out in this document includes:

1. Establishment of udder health goals
2. Maintenance of a clean, dry and comfortable environment
3. Proper milking procedures
4. Proper maintenance and use of milking equipment
5. Good record keeping
6. Appropriate management of CM during lactation
7. Effective dry cow management
8. Maintenance of biosecurity for contagious pathogens and chronic infections
9. Regular monitoring of udder health status
10. Periodic review of mastitis control program

Points 2, 3 and 4 are particularly relevant for prevention of mastitis and often cause trouble in many herds.

A clean, dry and comfortable environment is critical in mastitis control. A scoring system for cow cleanliness has been developed and is available at:

http://www.medvet.umontreal.ca/rcrmb/dynamiques/PDF_AN/Toolbox/Factsheets/CleanlinessPro.pdf

It is easy to perform and gives a good idea if the environment, bedding, alleys, etc. are well managed or not. To illustrate the importance of cow cleanliness, it is important to realize that the best milker can only decrease the bacterial load on the teats by approximately 90% during teat preparation. For example, if you start with a dirty udder with a 1,000,000 bacterial load on the teats, you will put the milking machine on with a 100,000 bacterial load after an excellent preparation. On the other hand, with a clean cow, you might start with a bacterial load of 100,000 bacteria and achieve a 10,000 bacterial load after preparation. The take home message is that on a dirty udder, the best you can achieve doing a great preparation job is the same as doing nothing on a clean udder.

Milking procedures are also very important: wearing clean gloves, forestripping, cleaning the teats, adequate stimulation of the teats, attaching the milking unit between 60-120 seconds after the start of the preparation, good post-dip coverage, etc.. You need to make sure that all milkers receive training including a presentation of the milking procedures used on your farm. Unfortunately, this step is often skipped and leads to large variation between milkers and higher risks of mastitis and a decrease in the milk's quality. Frequent monitoring of application of the milking procedure by each milker should be performed in order to maintain consistency.

■ Antibiotic Use For Treating Clinical Mastitis

Some of the judicious usage of antibiotic principles are: select the appropriate antibiotic for the bug involved, use the appropriate dosage and duration of treatment, follow veterinarian recommendations, avoid usage of antibiotics for expected low cure rate cases (e.g. chronic non-responsive infections, non-treatable bugs), and use antibiotics of lesser importance for human medicine whenever possible. This classification is shown in Table 1. The application of these principles will help decrease the speed of emergence of antimicrobial resistance.

Table 1. Classification of antibiotics used in udder health based on their importance for human medicine.

Classification	Antibiotics
1. Very high importance	Ceftiofur (Spectramast® or Excenel®) Polymyxin (Special formula 17900 forte®)
2. High importance	Cephapirin (Cefa-lak®, Cefa-dri®) Pirlimycin (Pirsue®) Penicillin (Special formula 17900 forte®, Novodry®) Cloxacillin (Dry-clox®) Trimethoprim-sulfa (Borgal®, Trivetrim®, Trimidox®) Erythromycin (Erythro-36®)
3. Medium importance	Tetracyclin (Oxyvet®, Oxymycin®) Streptomycin (Special formula 17900 forte®)
4. Low importance	None available for use in udder health

The majority of CM cases are treated by dairy producers. Cases that are treated by veterinarians are usually severe cases, which usually represent less than 15% of all the cases occurring on a farm. A written CM treatment chart should be put in place in collaboration with the herd veterinarian for the remaining 85% of the CM cases that are treated by the dairy producer.

Milk bacteriology should be the cornerstone for the selection of appropriate CM treatment because several different bacteria, yeast and algae can cause CM. The distribution of these bugs may vary a lot between farms and antibiotic treatments are not always effective against them. For example, *Streptococcus agalactiae* is highly susceptible to penicillin but *Mycoplasma* is completely resistant. Finally, between 30 and 50% of CM cases are negative on milk bacteriology. This could be explained in 2 ways: the bacteria have already been eliminated by the cow's immune system or the bacterial count is under detectable concentration. Those cases should not receive antibiotics.

Milk samples should be taken aseptically prior to any treatment and should be kept cool or frozen if unable to be sent to the laboratory within 48 hours. Secretion appearance is not a good selection criterion for antimicrobial treatment.

Milk bacteriology results should be included in the CM treatment chart specific for each farm. This written chart should include: definition of CM and severity

scores (mild, moderate and severe), cow CM and DHI records, treatment (brand name, dosage, frequency, duration, withdrawal time) for each scenario and critical points where treatment should be stopped or the veterinarian should be consulted. This could be a great opportunity to discuss different treatment options, herd objectives concerning udder health and culling decisions, and to explore the feasibility of doing on-farm milk culture. An example of a chart is presented Figure 1. Treatment A, B, C and D should be well defined for each farm but could vary between farms.

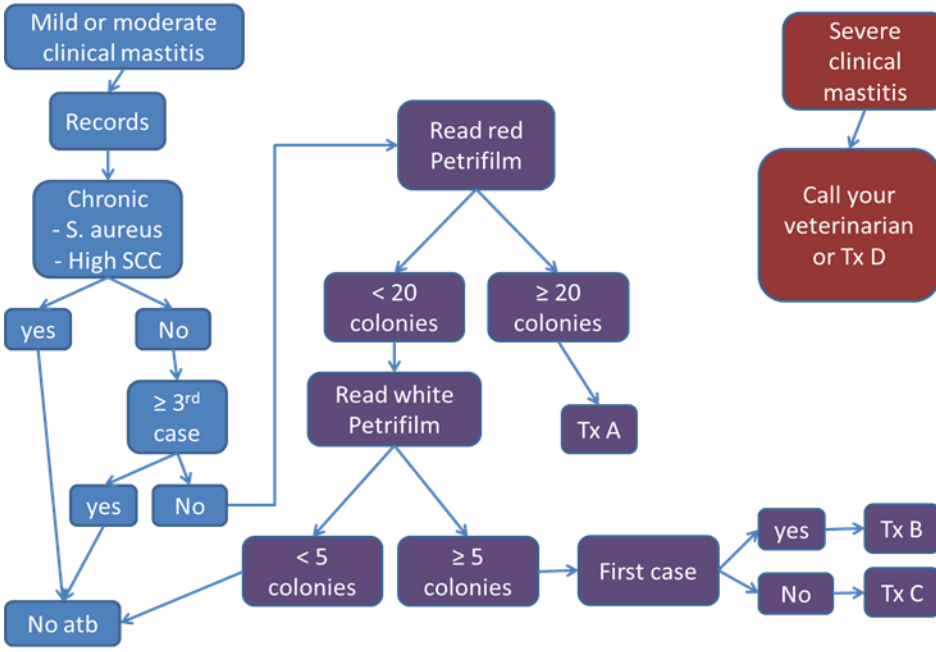

Figure 1. Example of a clinical mastitis treatment chart using on-farm milk culture (Petrifilm mastitis treatment decision system)

Few research projects have been conducted to assess CM treatment based on on-farm milk bacteriology (McDonald, 2011; Lago et al., 2011a, 2011b). The first study used the mastitis treatment decision kit with Petrifilm while the study conducted by Lago et al. used the Minnesota easy culture system (Bi-plates, Tri-plates). The results of this research have demonstrated that the amount of antibiotic used is significantly decreased (up to 50%) when treatment decision is based on an on-farm milk culture. Also, there was no negative impact on overall cure risk, on days to clinical cure, on new intramammary infection risk, on treatment failure risk or milk production. It is important to note that only mild to moderate CM cases were included in those studies. It is not recommended to delay treatment of severe CM cases.

■ Antibiotic Use For Treating Subclinical Mastitis

Treatment of cows with high somatic cell count (SCC) during lactation but without signs of CM is another possible usage of antibiotics on a herd. This usage should be based on milk culture since there is no emergency to treat and that treatment during lactation is not a cost-effective option depending on the bacteria and on days in milk at diagnosis. It is preferable to delay treatment up to dry-off for many cases.

Also, there are some bacteria or algae that should not be treated because of very poor expected cure rates. Intramammary infections (IMI) caused by *Prototheca, Mycoplasma, Serratia, Listeria, Pseudomonas, Salmonella, Trueperella pyogenes* and *Nocardia* should not be treated. Chronic IMI caused by *Staphylococcus aureus* should not be treated either. For all those IMI, culling the infected cow is probably the best option.

A decision should be made to treat or not new IMI caused by *S. aureus*. If treatment is an option, extended therapy (5 - 8 consecutive days) is the best treatment on selected cases (new IMI, 1 quarter infected, young cow, SCC lower than 1,000,000 c/mL) (Roy and Keefe, 2012). A cure rate of 50 to 60% is achievable using these criteria but the cost per cure is fairly high considering treatment costs and milk withdrawals (> $300).

■ Antibiotic Use At Dry-Off

Universal antibiotic treatment at dry-off is one of the cornerstones of the NMC control plan since the 70's. There are two important objectives with antibiotic treatment at dry-off: 1. treating existing IMI and 2. preventing new IMI during early dry-off.

Back in the 70's, herd SCC were much higher and *S. aureus* and *Streptococcus agalactiae* were highly prevalent. The situation has changed now. Many herds are able to maintain their bulk tank SCC under 200,000 c/mL, *S. aureus* is less prevalent and *S. agalactiae* is almost eliminated from dairy herds in Canada. There is less chronic contagious IMI.

Actually, up to 70% of the quarters do not have an IMI at dry-off. For those quarters, there is no need to treat IMI since they are free of it. However, dry-off is still a period of high risk for new IMI. A non-antibiotic option has been available for several years. Orbeseal® helps prevent new IMI during the entire dry-off period and reduces clinical mastitis incidence in early lactation. The fact that a high number of quarters are free of IMI at dry-off and that there is a non-antibiotic option to prevent new IMI during dry-off period has led to a research project on selective treatment at dry-off based on Petrifilm® (Cameron et al., 2012).

To be enrolled in that study, herds had to maintain a bulk tank SCC lower than 250,000 c/mL for the previous year. On the day prior to dry-off, cows were enrolled in the study based on some selection criteria: SCC lower than 200,000 c/mL for the previous 3 DHI tests, no clinical mastitis during the same period and no antibiotic treatment for the last 2 weeks. Cows that were included were then randomly allocated to the control group (antibiotic + Orbeseal® in all 4 quarters at dry-off) or the selective treatment group based on Petrifilm® (ST). For the ST group, a composite milk sample was collected and a total aerobic count plate was used on-farm to perform milk culture. After 24h of incubation, the number of colonies on the plate was enumerated. If there were less than 5 colonies present on the plate, the cow was considered non-infected and received only Orbeseal® in all 4 quarters. If 5 colonies or more were present on the plate, the cow was considered infected and received an antibiotic and Orbeseal® in all 4 quarters.

Approximately 50% of the cows were enrolled in the study based on selection criteria and approximately 50% of them were infected at dry-off even if their SCC were low in the previous 3 DHI tests. At the end, 25% of the cows did not receive any antibiotic at dry-off without causing any adverse effect on udder health or milk production during dry-off and at the beginning of lactation up to 120 DIM. There was no difference in milk production, CM incidence, new IMI risk at calving and cure risk during dry-off between control group and ST group.

Selective dry-cow therapy based on bacteriology is a new approach that could be very interesting for herds with a relatively low herd SCC and with a low prevalence of contagious IMI. A reduction of 25% in the overall usage of dry-cow antibiotic is expected.

A new project funded by the Canadian Bovine Mastitis and Milk Quality Research Network will repeat the project above but treatment selection will be done at the quarter level instead at the cow level. We expect that the proportion of quarters without antibiotic treatment will increase to approximately 50% using this approach.

■ Conclusion

Antibiotic use in production animals is a major concern for consumers. The most common cause of antibiotic use in dairy herds is treatment and prevention of mastitis. Dairy producers, veterinarians and dairy advisors should work together to use antibiotics judiciously. Some guidelines are available to make judicious antibiotic treatment decisions. Treatment should be based on milk culture results. Chronic cases or expected low cure rate cases should not be treated. Selective dry-cow therapy is a valid option for some herds with low bulk tank SCC.

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