

# Antibiotic Therapy: It's Not the Drugs, It's How We Use Them

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## ■ Take Home Messages

- Prudent antibiotic use improves animal welfare, food quality, public health and herd productivity.
- Mastitis is the single biggest cause of antimicrobial use in dairy cows.
- Picking the wrong fight is the biggest reason for antimicrobial failure when treating clinical mastitis.
- If you change the rules of labeled drug use, you will likely reduce the efficacy of treatment and increase residue risks.
- Prevention and monitoring of disease is profitable, reacting to a sick animal with antimicrobial therapy is not.

## ■ Mastitis Therapy—To Treat or Not to Treat

Mastitis is the most common reason for antimicrobial use for cows on U.S. dairy farms—about 80% of all antimicrobial use was for treatment or prevention of mastitis, which included dry cow therapy (Pol and Ruegg, 2007). Of the approximate 9 million cows in the U.S., 16.4% were treated for this disease (USDA-APHIS, 2008), or about 1.5 million mastitis cases treated annually. In a Canadian study, intramammary administration of antimicrobials (IMM) accounted for 35% of all antimicrobial use on dairy farms, which was lower than systemic administration (38%; Saini et al., 2012). However, the proportion of systemic administration that was for the treatment of mastitis was not recorded; systemic use also included that for calves. Although antimicrobial therapy improves animal health and well-being, economic losses from additional labour and discarded milk can be considerable. Culled dairy cows account for 67% of residue violations among all marketed livestock in the U.S., and 83% of the residues in culled dairy cows were antimicrobial drugs (USDA, 2018).

To date, the risk of emerging antimicrobial resistance among bovine mastitis pathogens has been low, particularly for drugs with high therapeutic value in human medicine (Lindeman et al., 2013). Nonetheless, prudent use of antimicrobials is good for the farm and good for the public. Thus, it is important to know the basics of mastitis therapy.

- Know the enemy—the bacteria causing the infection.
- Know which cows and quarters are at greater risk not to respond.
- Strictly follow a treatment protocol in consultation with your veterinarian.
- Follow the basic rules of pharmacology.

## Milk Culture to Identify the Enemy

Microbial culture of milk is a practical tool to identify mastitis-causing bacteria. On-farm culture of milk before treatment of mild clinical mastitis cases (Hess et al., 2003) reduces the percent of treated cows by 70 to 80%. This occurs because treatment is only given for cases that are caused by bacteria that are most likely to respond to antimicrobial therapy, especially Gram-positive bacteria (Lago et al., 2011a). Typically, treatment is not given for 24 hours until results of milk culture are known. Cows that do not yield a bacterium on culture or have a pathogen that is resistant to treatment (e.g., coliforms, Gram-negatives, yeasts) are not treated. Not only does the 24-hour delay reduce antimicrobial use, but this 'wait and see' approach doesn't cause any difference in long term milk production, somatic cell count (SCC) or likelihood of a repeat case of clinical mastitis compared with that in cows who are treated without waiting for culture (Lago et al., 2011b).

At the very least, milk samples should be regularly sampled from a portion of clinical mastitis cases in a dairy herd to help guide therapy and target management for prevention. Example flow charts for using culture to direct mastitis therapy are given below (Figures 1 and 2). While culture of severe clinical mastitis cases should also be done when possible, therapy should be administered immediately along with supportive care such as fluids.

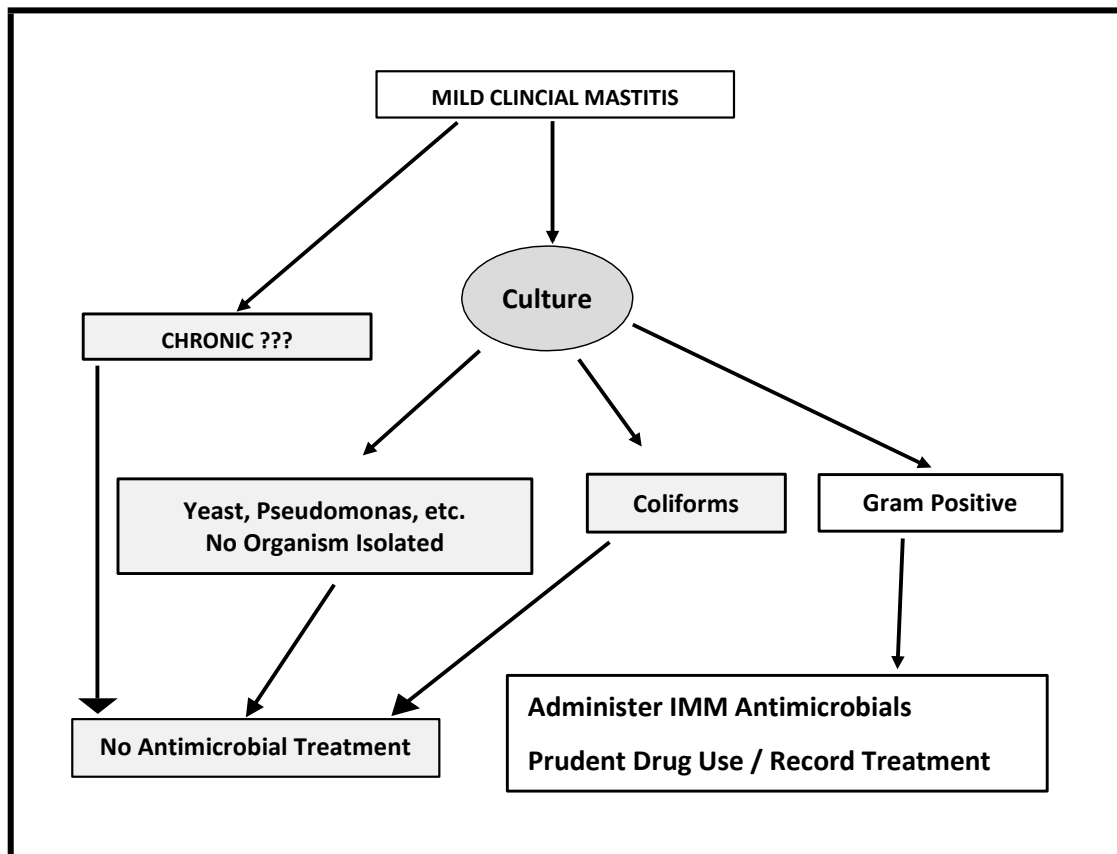


Figure 1. Flow chart for using culture to direct therapy for mild clinical mastitis

IMM = Intramammary (mastitis tubes)

Gram positive = Streptococci and Non-aureus staphylococci (coagulase-negative)

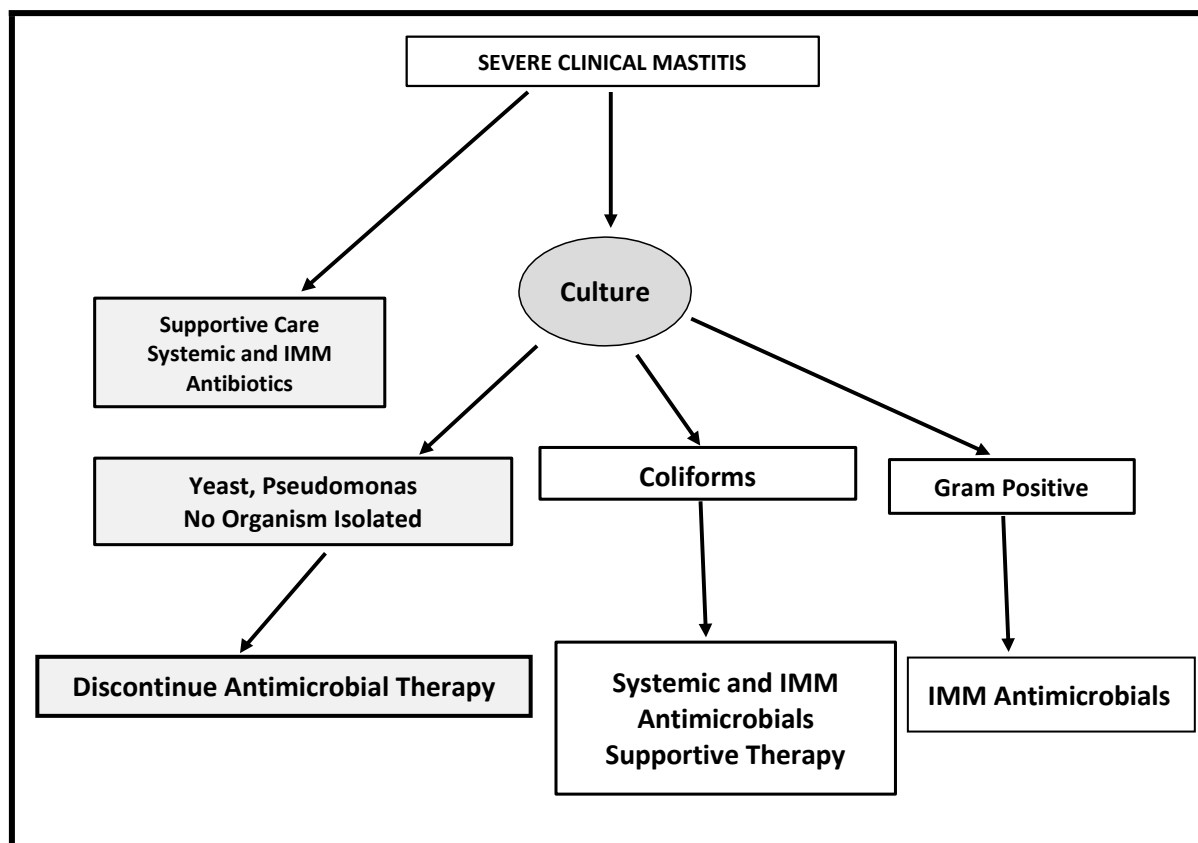


Figure 2. Flow chart for using culture to direct therapy for severe clinical mastitis

### Don't Treat Repeat Offenders (Chronic Mastitis Cows)

A mastitis treatment protocol prevents any “cow-side” biases in treatment decisions. That is, the protocol should limit the treatment of repeat offenders, or identify those cows that are not likely to respond to therapy. Producers should stay on the game plan and not get creative with either repeat treatments or different drugs for that favourite cow. Most dairy producers report not having a written protocol, and extra-label drug use for the treatment of mastitis is common (Raymond et al., 2006; Oliveira and Ruegg, 2014).

The efficacy of mastitis treatment decreases for older cows, cows with high SCC, and cows with chronic infections (Pinzon-Sanchez and Ruegg, 2011). Particularly, chronic infections are likely to have poor therapeutic outcomes and treatment should be avoided. The best way to reduce the treatment of chronic mastitis is to maintain records of all cases that occur, including treated and untreated cases.

In the U.S., the majority of dairy herds only rarely culture milk samples from clinical mastitis cases (Schewe et al., 2015). A Wisconsin study found that over half of clinical mastitis cases treated with IMM antimicrobials were caused by *Escherichia coli* or cases where no organism was isolated (Oliveira and Ruegg, 2014). Also, the majority of U.S. dairy herds do not maintain treatment records, or maintain only partially complete records (Schewe et al., 2015). In Canada, treatment records were found to under report antimicrobial use when compared to inventories of discarded vials and tubes. Thus, as in the U.S., records were incomplete on many Canadian herds (Nobrega et al., 2017).

The majority of farms in the U.S. and Canada may not consistently follow the practices critical for prudent antimicrobial use for mastitis therapy. Farms were as likely to use oxytocin or organic or natural formulations (15–20%) for clinical mastitis as they were to use bacteriology in treatment decisions (Schewe et al., 2017).

The questions that should be answered before treating a cow with clinical mastitis are:

- How severe is the mastitis case? A cow with systemic signs (septic or toxic), such as off feed, fever, dehydrated, decreased milk production, will require immediate treatment that includes systemic antibiotic therapy, IMM therapy, supportive fluids and close monitoring compared with a cow with mild clinical signs that are limited to the udder and milk.
- Is this a new case of mastitis or a relapse? Repeated treatment of a recurrent case of mastitis is frequently unrewarding. If the recurring case of mastitis is to be treated, the therapeutic regimen might need to be more extended than previous treatment. However, no repeat case should be treated without the results of a milk culture from the affected quarter.
- How many quarters are affected? The expense and the likelihood of treatment failure increase as the number of affected quarters increases. A cow with three or four clinical quarters may have immune system deficiencies, teat canal problems, or an infection with an especially virulent or persistent bacterial strain—this is common for *Mycoplasma*, for example.
- Has the cow had a history of high SCC? Cows with a history of high SCC for three months or more are more at risk to not respond to therapy, even if the clinical case is ‘new’.
- Does the cow have other health problems? Other health problems such as metabolic stress (transition cow diseases), heat stress and milk fever (hypocalcemia) impair immune responses. The likelihood of successful mastitis therapy may be reduced in cows with concurrent illnesses.

## ▪ **Barnyard Pharmacology—Top 7 Rules for More Effective Antimicrobial Therapy**

- 1) Clean teat ends COMPLETELY before infusing mastitis tubes, otherwise you increase the risk for new infections.
- 2) Limit the volume of (intramuscular injections to 10 mL; larger volumes alter drug distribution in the body and increase the risks for residues.
- 3) Don't change the labeled route of administration—same reason as 2) above.
- 4) More is not better. For most antimicrobials used in dairy cows, increasing the labeled dose will NOT increase efficacy.
- 5) If the label says shake well before use, do it.
- 6) Drugs do NOT distribute to all parts of the body equally. This is especially true for systemic drug use for mild mastitis. Most antimicrobials drugs labeled for dairy cows do not reach effective concentrations in the udder.
- 7) Follow a written protocol in consultation with your veterinarian.

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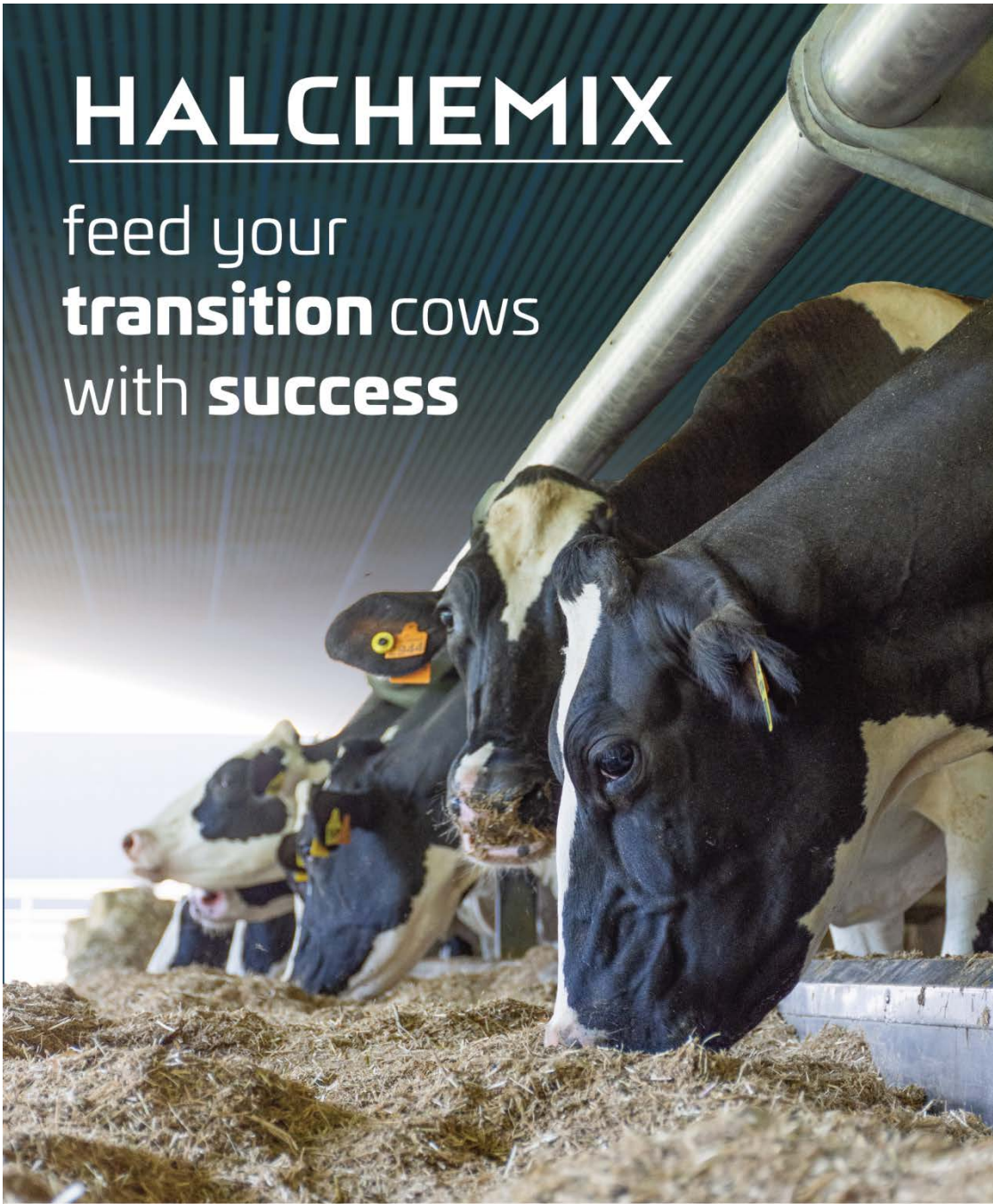
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