[Mastitis in Dairy Cows](http://vetstudentresearch.blogspot.com/2015/06/mastitis-in-dairy-cows.html)

**Overview**

Mastitis is the **inflammation** of the **mammary gland** and **udder tissue**. It is a major **endemic disease of dairy cattle**.

It usually occurs as an **immune response** to bacterial invasion of the teat canal by variety of bacterial sources present on the farm, and can also occur as a result of chemical, mechanical, or thermal injury to the cow’s udder.

Milk secreting tissues are various ducts throughout the udder can be damaged by **bacterial toxins** and sometimes permanent damage to the udder occurs. Severe acute cases can be fatal, but even in cows that recover there may be consequences for the **rest of lactation** and **subsequent lactations**.

The illness is in most respects a **very complex disease**, affected by a variety of factors: it can be present in a herd **subclinically** (where few, if any, symptoms are present in most cows). Practices such as **close attention to milking hygiene, culling of chronically infected cows, good housing management and effective dairy cattle nutrition** to promote good cow health are essential in helping to control herd mastitis levels.



Mastitis is most often transmitted by contact with **milking machines** and through contaminated hands or other materials, in housing, bedding and other equipment. During the 1960s a **five-point plan** was devised by the National Institute for Research into Dairying, aimed at providing a strategy for reduction and control of mastitis at farm level, which in its adapted form is still followed today.

Losses from mastitis in the dairy industry are one of the most significant losses of all livestock, due to:

·         **Milk thrown away** due to contamination by medication or being unfit to drink.

·         **Reduction in yields** due to illness and any permanent damage to udder tissue.

·         **Extra labour** required to tend to mastitis-affected cows.

·         **Costs of veterinary care** and medicines.

·         **Cost of reduced longevity** due to premature culling.

In more recent years an **AHDB** **Dairy Mastitis Control Plan** has been used to implement ‘tailor made’ plans for individual farms in order to maximise the reach of mastitis control.

The plans take into account the **milk bacteriology, disease patterns, SCC and clinical mastitis information** in order to make each plan specific for each farm. These plans have been proven to show reductions in cases of mastitis seen.

**Pathogens that cause Mastitis?**

Disease-causing bacteria are called **pathogens**. The most common **mastitis pathogens** are found in the udder tissues, spreading from **cow-to-cow** (*contagious****pathogens***) or in the herd’s surroundings (*environmental****pathogens***), such as bedding materials, manure and soil.

This distinction may be important when assessing the challenges present in a herd and the measures which may be taken to reduce or treat mastitis.

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       **Contagious pathogens** that cause mastitis tend to **live on the cow’s udder** and **teat skin** and transfer from **affected cow (or quarter) to unaffected cow (or quarter) during milking**. They adhere easily to the **skin**, **colonising the teat end** and then**‘grow’**into the teat canal; this is where infection occurs. Because of this, post milking teat **disinfection** and **dry cow therapy play an important role** in controlling contagious mastitis. Farms with a high level of **contagious mastitis**often have a **high SCC** and relatively **normal Bactoscan** results.

·         **Environmental pathogens** are present in the **housing and bedding** and can transfer during milking or between milking time – when the cow is **loafing, eating or lying down**. The pathogen can enter the **teat canal** by force during milking, for example when liner slippage occurs. These environmental pathogens do not generally possess the same ability as contagious pathogens to **adhere to and colonise the teat**; dry cow therapy has little value in their control as these kinds of infections do not carry from on lactation to the next. High levels of environmental pathogens in a herd may cause **normal SCC** but **higher than average Bactoscan results**.



Mastitis pathogens can infect cows during the **dry period** and when cows are **lactating** and it is important to **identify and recognise** the source of the these infections, as approaches to control, prevention and treatment of the pathogen’s in effect can differ according to whether the infection occurs when the cow is dry or in lactation.

***Major and Minor Pathogens***

The main mastitis causing pathogens are ***Escherichia coli (E. coli), Streptococcus uberis (S. uberis) and Staphylococcus aureus (S. aureus)*** and a wide variety of other organisms have been identified as potential mastitis pathogens. These organisms are termed **major pathogens** and are generally regarded as those commonly associated with **clinical mastitis in dairy cattle**.

It is not always possible to identify the **causative pathogen** of the cause of clinical mastitis from the symptoms presented without laboratory testing of milk.

Other bacteria that may be present in the udder and often have an overall ***beneficial****effect*on the protection from infection caused by **major pathogens**, due to the production of natural anti-bacterial substances or competition with other bacteria, are termed **minor pathogens**. Due to their complex interaction with the udder they can be implicated in instances of increased SCCs and thus the incidence of *sub-clinical mastitis*but they do not usually cause clinical forms of the disease.



**Clinical Signs**

Clinical mastitis can present itself in a wide degree of severity of symptoms which can range from mild to moderate to severe. The **degree** of illness and the **symptoms** present will depend on many factors, such as **nutritional and immune status** of the cow, which **pathogen**is responsible for the **inflammation** and a range of **environmental factors** such as **cleanliness, humidity**and **ambient temperature**. Moderate to severe clinical cases can be very painful and unpleasant for the cow.

The most obvious symptoms of clinical mastitis are abnormalities in:

·         The **udder** such as **swelling, heat, hardness, redness**or **pain** and;

·         The **milk** such as **watery appearance, flakes, clots** or **pus**.

Other symptoms, depending upon the **severity** of the illness and how **systemic** (over the whole body) it has become, can also include:

·         **Reduction in milk yield**

·         **Increase in body temperature**

·         **The lack of appetite**

·         **Sunken eyes**

·         **Signs of diarrhoea and dehydration**

·         **Reduction in mobility, due to pain of a swollen udder or general unwell feeling**.

In severe cases of acute, clinical mastitis – in many instances caused by ***E.coli infections***– the cow may appear very ill indeed. In contrast, subclinical mastitis can result in few symptoms and may only be detectable in a **higher than normal SCC**.



The symptoms shown in most cases (swelling, heat, redness and milk abnormalities) are a **result of an immune response in the cow**, the changes in milk constituents in particular caused by **infection-fighting** **white blood cells** attempting to eliminate the infective organisms which may further be responsible for producing **toxins** which **damage milk-producing glands** within the udder, and can be responsible for **permanent udder damage in some cases**.

In some cases the **immune response** is sufficient enough to efficiently generate a **self-cure**for the illness, usually in mild cases of the disease where the cow is strong and has a good immune response. Other cases can result in more severe illness, perhaps even leading to loss of quarter or more of the udder, the loss of body tissue due to gangrene and in worse case situations, death.

Changes in **milk composition** even in cows with subclinical mastitis can result in significant changes in the **protein composition** in milk. While overall protein content may be unaffected, changes in the **types**of protein present may be affected by **leaching of (low-quality) blood serum proteins into milk**; also, casein, an important protein found in healthy milk can significantly be reduced in sub-mastitic cows and a further complication is that **casein**is closely linked with **calcium** levels in milk production.

**Preventing Mastitis in Practice**

Controlling mastitis through the prevention of infection is best appraised on a whole-farm basis. Many factors of the working farm environment as a whole influence how causative bacteria can spread and colonise, how cattle become exposed to infection and how working routines and farm staff have an important role in reducing mastitis incidence in the herd.

**Field conditions** while cows are out at grazing and the importance of good **cow tracks** - reducing soiling of the teats and keeping them clean and healthy – cannot be underestimated. Poor housing conditions are also instrumental in causing clinical mastitis and contributing to high SCC. The effective management of housing and good working routines help to ensure that the housed environment is less supportive of **pathogens**. Good handling techniques reduce **stress** and avoid cows being **rushed through doorways or gateways and down tracks** which can lead to an undesirable amount of teat and udder soiling, lengthening the milking time and leading to the increased potential of mastitis.

**The dry period is spectacularly poorly-managed on many dairy farms, with cows being put ‘out of sight and out of mind’, yet dry period management is *at least*****crucial as the lactation when aiming to reduce mastitis incidence in the herd. For more information on how to successfully and hygienically dry a cow off, visit my \*DRY COW\* blog post...**

In the parlour, well-considered and consistent routines and new technology or equipment can make a big impact on milk hygiene and how infections that lead to mastitis can be reduced. Similarly, good maintenance programmes ensure the milking equipment works correctly and that poorly-maintained equipment is not contributing to a herd mastitis problem.

Spraying the teats with disinfectant after milking is a simple and effective way of reducing bacterial colonisation of the teats when they are at their most susceptible (as the teat end is not sealed until roughly 30 minutes after milking).

**Detecting and Treating Mastitis**

*Foremilking*is the best way to detect early cases of mastitis. This involves using your hands to strip a small amount of milk from the teat and check the quality of the milk. This is done because changes in the milk are often seen as the **first signs** of mastitis. The changes in the milk are related to the causal organism with **clots and flakes** tending to be more common of *Staphs and Streps* while oddly coloured milk is associated with *E.coli*.

*Visual examination* of the udder and *palpation* prior to milking should be part of all milking routines. Any feel/appearance of swelling, reddening, heat and pain are usually indications of moderate cases of mastitis; therefore, if the disease has progressed to such stage, losses will have already occurred, which is why foremilking is a better more indicative checking method.

Once identified, the mastitis should be graded in terms of how severe the case is…

**Mild mastitis –**abnormality of the milk is the main sign, with little evidence of change in the udder and no systemic signs such as dullness of inappetance.

**Moderate mastitis –**changes in the udder are detectable as well as milk changes. These changes can occur rapidly or slowly; small systemic changes may occur.
Over time both of the above cases will progress and the udder inflammation and damage will lead to significant damage in the udder, this is known as ***chronic mastitis****.*

**Severe mastitis** – marked changes in the udder and milk are combined with major systemic effects in the cow such as fever, loss of appetite, depression, shock, dehydration and collapse. These cows are at risk to the most sever effects of the disease and need veterinary attention immediately. Often the onset of stress or trauma can trigger a sever case.

There are two aims for mastitis treatment:

·         **Returning milk to normal** with an acceptable level of SCC.

·         **Getting rid of bacteria** to reinstate udder health.

The first of these aims is much easier than the second…

Mild mastitis can often disappear in a few days with no treatment or with massage and hand stripping of the quarter. However the **bacteria** may still be there. The same process may also occur after **antibiotic treatment**; particularly short with courses with short milk withholds. Getting a visible cure without a complete **bacteriological** cure may result in an increase in subsequent clinical infections and a **permanently raised SCC.**

**There are two bases of most treatment regimens for mastitis:**Intramammary antibiotics (the classic mastitis tube) and systemic antibiotics (given by intramuscular or subcutaneous injection).

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        ***Intramammary antibiotics***should be the first-line treatment for cows with mild uncomplicated mastitis in a single quarter.

·         ***Systemic antibiotics***should be used when more than one quarter is affected and in severe cases of the disease.

·         Combination therapy are an increasingly popular way to treat mastitis, however the overuse of antibiotics is always a pressing matter in medicinal sciences.

In some cases, such as cows with a poor immune system, a high SCC with infection of *S. aureus*, both kinds of treatment would be ineffective and pointless.

**Traditional treatment:** typically when clinical mastitis is detected, the cow is milked out and then given an **intramammary infusion of antibiotic**, ie. Infused directly into the infected gland.

Due to the high blood flow of the udder, these antibiotics will be present in the milk of all the quarters. The milk from this cow must not be put into the milk tank because milk containing antibiotics is not fit for human consumption.

**Intramammary infusions** are sometimes used to administer antibiotics to the udder.
Firstly the teat is cleaned well and the tip of the teat swabbed with disinfectant or alcohol swab. Historically, a long tube (cannula) is inserted fully into the teat and the antibiotic is passed through the tube and into the quarter. This method is called full insertion; it has come under fire recently as it is thought that this long tube could act as a vessel for further bacterial colonisation of the teat cistern – in light of this, a shorter tube is used which only reaches half-way up the streak canal (partial insertion). The tube is then removed, the teat pinched off and gentle palpation is used to move the fluid further up into the gland.

***NSAIDs***

These are aspirin-like drugs which reduce the inflammation and pain associated with mastitis. They are very useful in severe cases of mastitis, but there is less evidence of their usefulness in mild to moderate cases. Using NSAIDs to reduce pain will reduce stress and may lead to a healthier and more able cow, offering a better chance of efficient immune response.

***Treatment Failure…***

There are four main reasons why treatment does not result in return to normal:

  1.      **Wrong antibiotic** – mastitis causing organisms not killed by the chosen treatment. All bacteria are susceptible to certain types of antibiotic and some have developed resistance to certain types of antibiotic.

   2.      **Not enough antibiotics for long enough**– at the site of infection; although bacteria are killed, not all are killed and they soon recolonize after the concentration of antibiotic has declined.

  3.      **Re-infection** – treatment works but a cow gets re-infected, possibly due to the stress caused by treatment or by incorrect administration/unhygienic conditions.

  4.      **Wrong cow –**persistent damage to the udder can prevent the antibiotic from coming into contact with the bacteria in sufficient concentration.

Most intramammary antibiotics are designed to be effective against most **common** mastitis pathogens, but some have a **narrow spectrum**.

Systemic antibiotics tend to have a narrower spectrum. So determining the antibiotics to use for first-line should be based on a thorough understanding of the main pathogens on your farm.

Antibiotic treatment of mastitis is aimed at getting the cow back into milk as soon as possible – short courses with low amounts of antibiotics with short withholds (time before milk can used again for human consumption as there is no antibiotic left in the milk). This reduces the chance of killing all the bacteria. Longer treatment is more **effective** but more **expensive, but it should be considered on farms where recurrent cases are a problem**, and when apparent cure rates after standard courses are lower than expected.