Diagnosis of Mastitis

(Garget, Caked Udder, Mammitis and Mastadenitis)

**Definition**

Inflammation of mammary gland accompanied by physical and pathological changes of udder and physical, chemical and bacteriological changes of milk with or without systemic reaction.

**Diagnosis**

1. Case history
2. Clinical examination
   a) Animal
   b) Udder
   c) Teat
3. Milk examination

**I) Case history**

1. Ask about milk current (amount) to detect hypogalactia (decrease of milk production) or agalactia (absence of milk production).
2. Ask about milking technique
   a) Hand milking --> Contaminated hand --> entrance of microorganism inside udder causing mastitis
   b) Milking machine --> Contaminated machine --> entrance of microorganism inside udder causing mastitis
   --> Faulty pressure of machine --> excessive suction --> teat injury and deformity --> causing mastitis.
3. Ask about milking hygiene including washing, disinfection of udder and teat dipping before milking so entrance of microorganism inside udder causing mastitis.
4. Ask about type of food --> high protein and estrogen --> damage of secretory cells --> decrease milk production
5. Number and course of previous lactation as milk production is normally small in first lactation but reach to peak in 4-8 lactation.

**II) Clinical Examination**

**Examination of animal:** determine animal temperature, pulsation, respiration, superficial mucous membranes and superficial lymph nodes. To:

1. Presence or absence of systemic reaction to avoid septicemia and bacteremia
2. Detect specific signs for specific diseases.

**Examination of udder**

1. **Inspection:** observe udder from rear, front and sides.
**Normally** ① udder appear symmetric, ② one mass, ③ without any abnormalities and ④ hind quarters larger than fore quarter

**Abnormally:**
- Swelling in one or more quarters or atrophy
- Presence of vesicle, ulcers, scar and wound as in cases of FMD, LSD, Pox

2. **Palpation:**
   - **Normally** ① udder appear as fine grains or spongy when free from milk, ② no cardinal signs of inflammation, ③ pliable skin under hand and ④ supramammary lymph node not felt.
   - **Abnormally** ① coarse grains and spongy when contain milk due to clotted milk in case of chronic inflammation, ② cardinal signs of inflammation, ③ not pliable udder with adherence to underlying tissue and ④ enlarged and inflamed supramammary lymph node

**Examination of teat**
1. Presence of fibrous cord at the base of teat or at teat opening
2. Presence of fibrous cord within teat canal
3. Dilated and obstructed teat opening

### III) Milk examination

1. **Physical examination**
   - **Color:** Normally is White in buffalo and whitish yellow in cow
     - **Physiological Discoloration**
       ① Yellow: ration contain high carotene, Colostrum, Some breeds as Jersey cow
       ② Blood stained: high producing animal
     - **Pathological Discoloration**
       ① Red: Dicumarol toxicity, Leptospirosis, Staphylococcosis
       ② Green: Corynebacterium
       ③ Yellow: Most of bacterial Mastitis
   - **Odor** Normally milky odor
     - **Abnormally**
       ① Fetid (Putrefied) odor: Gangrenous Mastitis, Dry cow Mastitis
       ② Fecal odor: Coliform Mastitis
       ③ Acetone odor: Ketosis
       ④ Rancid odor: Milking in bad ventilated place or leaving milk for 2 days in environment after milking
       ⑤ Antiseptic odor: excessive dipping of teat
   - **Consistency** Normally Milky consistency
     - **Abnormally**
       ① Watery milk (decrease consistency) → Streptococcal mastitis
       ② Increase consistency → corynebacterial mastitis
All physical changes can be detected by **Strip Cup Test**

**Strip Cup Test**: Field test used for detection of physical changes that occur in mastitic milk by pouring few amount of each quarter separately on shiny fine meshed plate over a cup then observe results.

**Result**:  
1. Presence of physical changes (abnormal color, consistency) → +ve Mastitis  
2. Absence of physical changes not indicate absence of mastitis so mastitis classified into Clinical and Subclinical mastitis.

2. **Chemical examination**

A. **pH**: Normally 6.4 – 6.8 (average 6.6) slightly acidic while during mastitis become alkaline due to high sodium, chloride and bicarbonate and low casein, lactose and fat  
   **Physiological alkaline** during dry period  
   **Detection by**: pH paper, pH meter, Bromothymol blue test and Bromocresol purple tests

B. **Chloride**: Normally 0.08 – 0.14 % while during mastitis become more than 0.14 %  
   **Detection by**: Chloride test

C. **Hotis test**: used to differentiate between Strept. agalactia and Staph. Aureus

D. **Monomast test (Immunodiffusion assay) (Radial immunodiffusion)** used to measure serum albumin level which increase in mastitic milk due to injury of udder

E. **Electrical Conductivity**: increase in case of mastitis due to high level of electrolytes

F. **Somatic cell count (SCC)**: WBCs + Sloughed epithelial cells  
   **Permissible limit**: less than 200,000 cells/ml milk  
   **Factors affecting SCC**:  
   1. Age: old > Young (Heifer)  
   2. Seasonal incidence: Summer > Winter, Afternoon > Morning  
   3. Frequency of lactation: ↑ frequency → ↑ SCC  
   4. Period of post-calving and Late stage of pregnancy: ↑ SCC (Physiologically)  
   5. Hygienic Measures: ↓Hygienic Measures → ↑ SCC  
   **N.B**: SCC can be used as control program

**Methods of SC Counting**

A. **Direct Method**: Direct Microscopic Counting – Direct Somatic Cell Counter  
B. **Indirect Method**: Using Chemical Reaction:

   1. **California Mastitis Test (Schalm’s Test – CMT)**
   **Def**: it is screening field test used for detection of subclinical mastitis which represent 30% of animals using plastic paddle.  
   **Principle**: it depend on reaction between anionic surface of Schalm’s reagent and DNA Liberated from somatic cell leading to precipitation and gel formation and according to amount of PPT number of Somatic Cells can be detected.  
   **Procedures**:  
   1. on the paddle put equal amount of milk from and Schalm’s reagent (each well represent one quarter of udder) –  
   2. gentle rotatory movement for 10 sec
Results and Interpretation:

<table>
<thead>
<tr>
<th>Result</th>
<th>SCC (Cells/ml)</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Normal Milk</td>
<td>↓200,000</td>
<td>- (N)</td>
</tr>
<tr>
<td>*Slight PPT Dissolve by rotation</td>
<td>200,000 – 400,000</td>
<td>Trace (T)</td>
</tr>
<tr>
<td>*Slight PPT not Dissolve by rotation</td>
<td>500,000 – $10^6$</td>
<td>+</td>
</tr>
<tr>
<td>*Gel formation</td>
<td>$10^6$ – $2 \times 10^6$</td>
<td>++</td>
</tr>
<tr>
<td>*Gel become viscous</td>
<td>$2 \times 10^6$ – $4 \times 10^6$</td>
<td>+++</td>
</tr>
</tbody>
</table>

NB: milk sample must be examined by CMT after milking by 2 hrs (loss viability) as so if examination will be delayed preserve sample using formalin 40% (1 ml can preserve upto 160-180 ml milk)

Advantages: ① Rabid field test (Cow Side Test) ② Cheap ③ Detect subclinical mastitis ④ Very sensitive
Disadvantages: ① not detect nature of mastitis (Microbial – Physical – Chemical) ② not done at 7-10 days post calving as SCC is physiologically high

**Modified white Side Test (MWST)**

Idea: depend on reaction between NaOH and DNA Liberated from destructed somatic cells → absorb solid and Fat from milk → leading to precipitation and gel formation

Procedures: on clean glass slide put 5 drops of tested milk + 2 drops of NaOH 4% then mix well until 10-20 min

Result: Precipitation and Gel Formation → + Mastitis

Adv. And Dis. Similar to CMT

③ Surf field mastitis test

N.B Screening field test used for diagnosis of mastitis (Cow Side Test):

① CMT ② MWST ③ Surf Field Mastitis Test

### 3. Bacteriological examination

**Aim:** ① Isolation and Identification of microorganism ② Culture and Sensitivity test to detect drug of choice

**Sampling**

**Sample Preparation:** incubation at 37°c overnight 18 hrs then centrifugation at 3000 rpm/ 20 min → 3 layers formed (Cream for TB – Whey for Mycoplasma – Deposit for others)

**Laboratory Procedures:**

A. Direct smear: staining by giemsa, gram, ziehl neelsen, newman's stains according to suspected microorganism

B. Culturing on specific media: sabouraud dextrose agar (Mycotic), baired parker media (Staph.), edward's media (Strept.), Macconkey (enterobacteriaceae)

C. Culture and Sensitivity test (C & S): colony → brain heart infusion broth → 37°c 18 hrs → mueller hinton agar → Dispense ABX on agar → measure inhibition zone for each Antibiotic and according to these inhibition zones select drug of choice
Headlines for Treatment of mastitis

1. **Detoxification of Toxins:**
   - Physical Detoxification: milking every 2 hrs – cold fomentation
   - Chemical Detoxification: Diuretics (increase excretion of toxins) – Fluid therapy (Dilute toxins) – anti-inflammatory (decrease toxin spread)

2. **Elimination of microorganism (ABX)**
   - Systemic at: Systemic reaction to avoid Septicemia and Bacteremia – badly swollen udder – help local treatment of udder
   - Local by intramammary infusions: disposable plastic syringe contain standard dose of AB dispensed on oil or aqueous phase with or without anti-inflammatory
     - **Procedure** tilt teat in acute angle then introduce syringe within teat canal in gentle rotatory movement – evacuate content of syringe – close the teat – make downward and upward massage of udder to distribute drug
   - **NB:** milk from treated quarter must not be used for human consumption at least for 3 days

3. **Supportive treatment and hygienic therapy** (Vitamins and Fluid therapy) to improve immunity

4. **Intraparenchymal injection** (inject udder mass by ordinary needle) used in case of:
   - 1- peracute mastitis
   - 2- badly swollen udder
   - 3- systemic treatment not give response

5. **Enzymes:** in all cases of mastitis characterized by chronic inflammation and fibrosis for removal of necrotic tissue and liquifaction