



# MASTITIS

## CASE 4: THE BODY SYSTEM

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Path 417

# Case

## **A New Baby**

Elizabeth's pregnancy and the birth of Amanda had gone well however, Elizabeth and Amanda were now struggling with breastfeeding. Elizabeth was aware from her prenatal classes of the various reasons why breastfeeding might be difficult. On the advice of a friend she made arrangements for a lactation consultant to visit her at home. She continued trying to 'latch' and feed Amanda in the days leading up to the visit but stopped when she began to experience breast pain and noticed that her right breast was red all around the nipple. She was feeling stressed and tired, along with a feeling of general malaise that she attributed to the stress associated with trying to breastfeed her newborn baby.

Based on Elizabeth's symptoms, the lactation consultant made a preliminary diagnosis of mastitis and suggested that Elizabeth see her doctor for a full diagnosis and possible antibiotic treatment. Do the symptoms that Elizabeth is experiencing concur with the preliminary diagnosis? What is the most likely bacterial cause and what are the antibiotics of choice to treat it?



# Signs and Symptoms

# SIGNS NOTED BY A PROFESSIONAL

- A common sign of mastitis is erythema : **redness around the nipple** which is usually in a wedge shaped pattern
- **Erythema** is usually accompanied by **swelling and is warmth** to the touch
- Mastitis is also usually **unilateral**
- Blockage or infrequent drainage can push substances from milk to tissue leading to oedematous breast

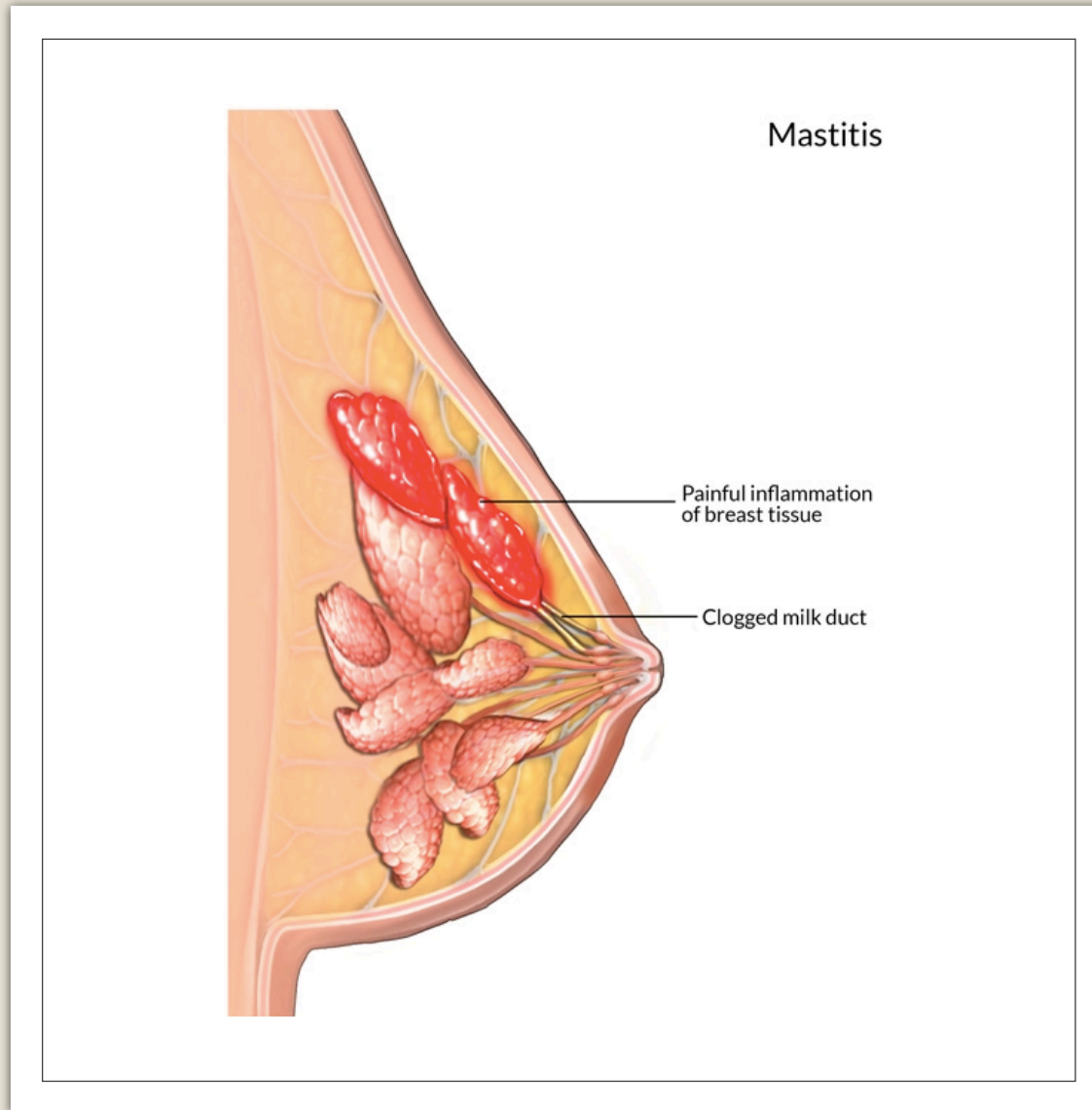


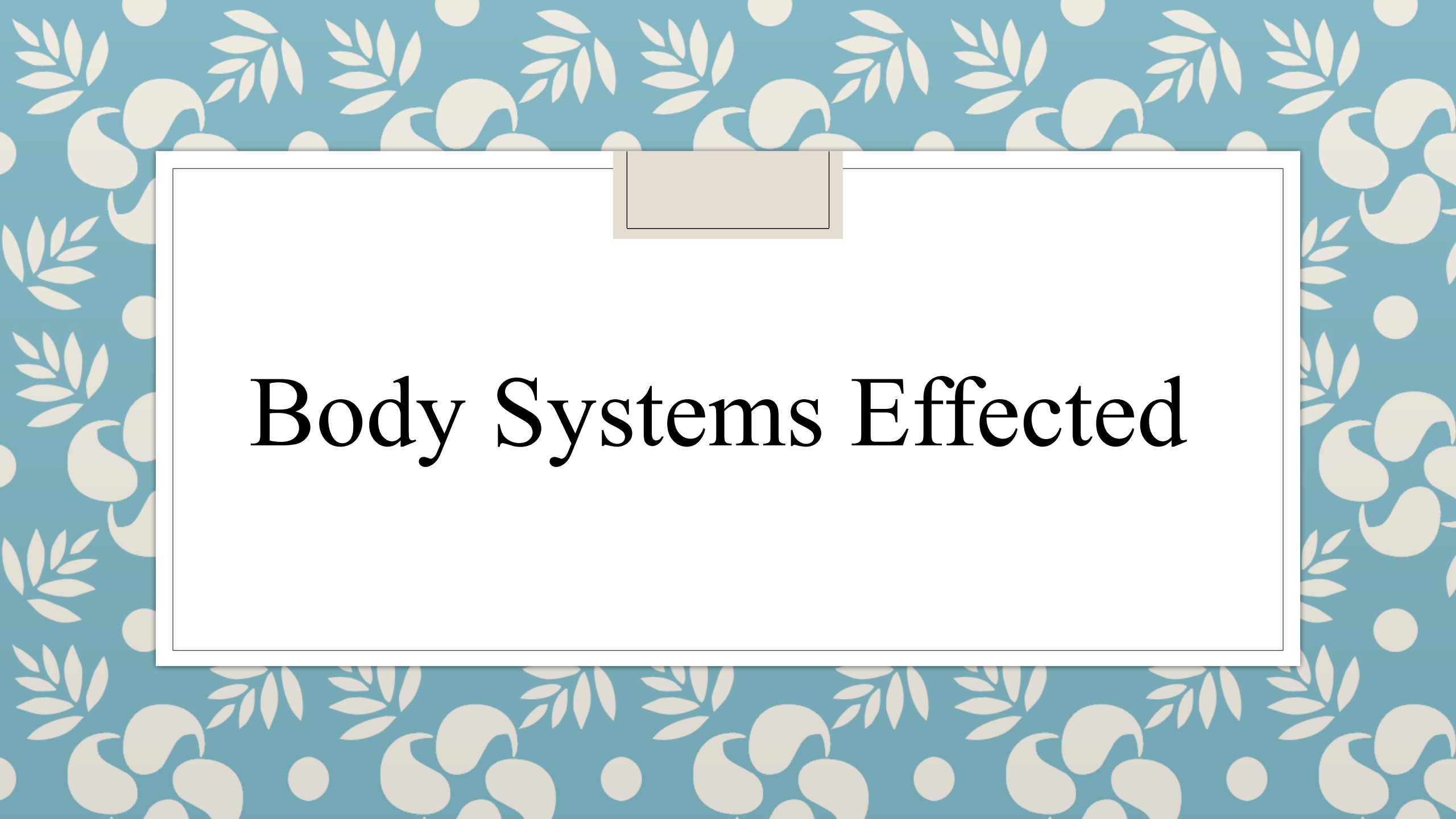
Figure 1 (Hicks 2017)

# SYMPTOMS EXPERIENCED BY PATIENT



- **1) BREAST PAIN WHILE BREAST FEEDING:**
  - Additional symptoms can be **burning sensation, breast tenderness**
  - **Blocked duct** can result in formation of a white spot at the end of the nipple, suggested to be **overgrowth of epithelium or accumulation of fatty material** (not specified in Elizabeth's case), this white spot is very painful and can be causing Elizabeth pain
- **2) MALAISE & TIREDNESS:**
  - Before appearance of redness, patients can **feel flu like symptoms** (high fever of 28.3 C or higher is possible)
  - **Stress** can be seen as a symptom and is also seen as a risk factor
  - Fever can accompany engorged breast (overfilling with milk and tissue fluid)

Figure 2 (Jones 2012)



# Body Systems Effected

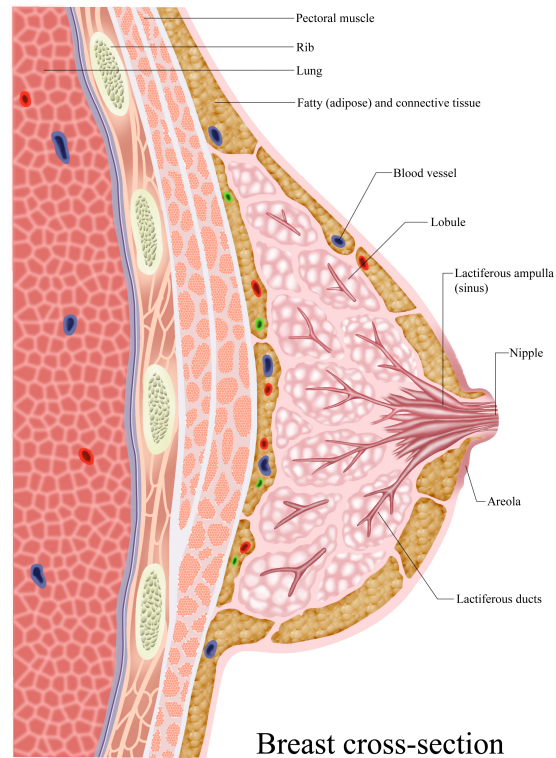


Figure 3 (Zimmermann 2016)

# THE INTEGUMENTARY SYTEM: BREASTS

- The main organ infected from the infection is the breast → **Integumentary system**
  - This system includes skin, hair, nails, glands which act as a physical barrier to protect the body from pathogens
- **Mammary glands** in the breast secrete milk to nourish infants, each mammary gland drains towards the nipple at the areola by the **lactiferous ducts**
- Mammary glands are lined with **myoepithelial cells** which contract the mammary glands to inject the milk into the lactiferous ducts
- Between mammary glands there are connective tissue made of collagen and elastin which anchor the breast to the chest wall via Cooper's ligaments
- **Oxytocin** is released when newborns start to suckle, this initiates contraction of myoepithelial cells and results in ejection of milk
- **Mammary function is essential for providing nutrients** for infants for the first 6 months after birth, and it also provides **antibodies**, specifically IgA to strengthen the infants immune system



# DISTURBANCE OF NORMAL PHYSIOLOGICAL FUNCTION

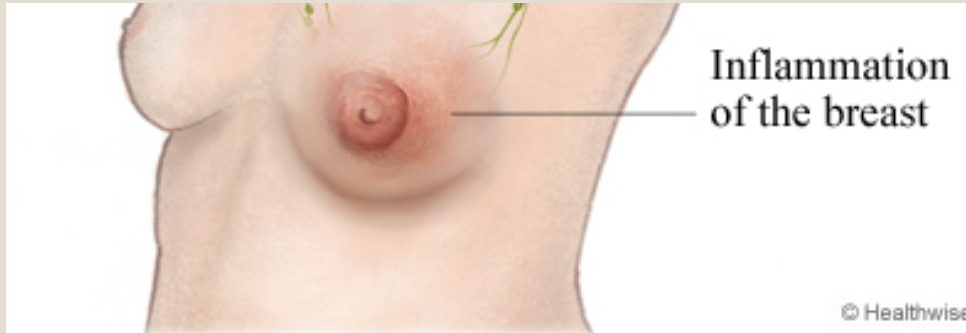


Figure 4 (Healthwise 2015)

- During **S. aureus mastitis**, the bacteria enters the breast and forms a biofilm to initiate replication
- → the **host immune response initiates the inflammatory response**  
→ activation of transcription factor NF-κB
- When **NF-κB** is activated → transcription of **inflammatory cytokines TNF-alpha , interleukins 1 and 6 is induced**
- The inflammatory cytokines cause the endothelial cells (lining the blood vessels in the breast) to become **"sticky and leaky"** in order for **immune cells** to attach (neutrophils, dendritic cells etc) and enter the site of infection via extravasation
  - These are the causes for the symptoms and signs of mastitis
- Because the tissue of the breast is inflamed, the drainage of milk towards the areola will be **clogged**
- Mastitis can lead to **changes in cellular composition of breast milk**, like lower fat, carbohydrate and energy levels
- Reduced milk flow rate and nutrient levels will lead to insufficient nutrients provided to the infant and this has to be taken under consideration when treating mastitis
- Sudden increase of milk volume and **milk duct obstruction** can lead to milk accumulation – which is a great environment for pathogens





# HOST DAMAGE FROM INFLAMMATION & SUSCEPTIBILITY

- Damage can be done by the host immune system
- During the inflammatory response → **neutrophils** are recruited and are important in killing the bacteria at the infection site , stimulated neutrophils increase their consumption of O<sub>2</sub> through **respiratory burst**
  - Their NADPH oxidase reduces O<sub>2</sub> to produce the **reactive oxygen species** to kill the bacteria → the superoxide anion can also rapidly oxidize and damage organic molecules of the host leading to **cell death and tissue damage**

Figure 5 (Ayurveda 2017)



# PREVENTION AND RISK FACTORS

# RISK FACTORS+ PREVENTION

- **Risk factors for mastitis:** Baby with cleft lip/palate, cracked nipples, infant attachment difficulties, milk stasis, missed feeding, nipple piercing, plastic backed breast pads, previous mastitis, restriction from a tight bra, short frenulum in infant, sore nipples, use of manual breast pump, yeast infection and maternal stress and fatigue
- Elizabeth was having issues breast feeding which would have allowed breastmilk to be created and stored in the breast for long periods – **created a suitable environment for bacteria to thrive in**
- Elizabeth also could have met with a **lactation specialist** to get help for proper breastfeeding techniques, or fully drain the milk from her breasts → allowing her baby to empty one breast before the other , **continually breastfeeding** and use **warm compresses** with a clean towel to reduce redness and worsening of mastitis
- Elizabeth is at risk for reinfection if there is a **breach in her nipple areola complex, cracked nipple, milk stasis**
- **Breast abscess** is a common complication of mastitis and can be prevented by early treatment and continued breastfeeding, but once it has occurred – surgical draining or needle aspiration is needed

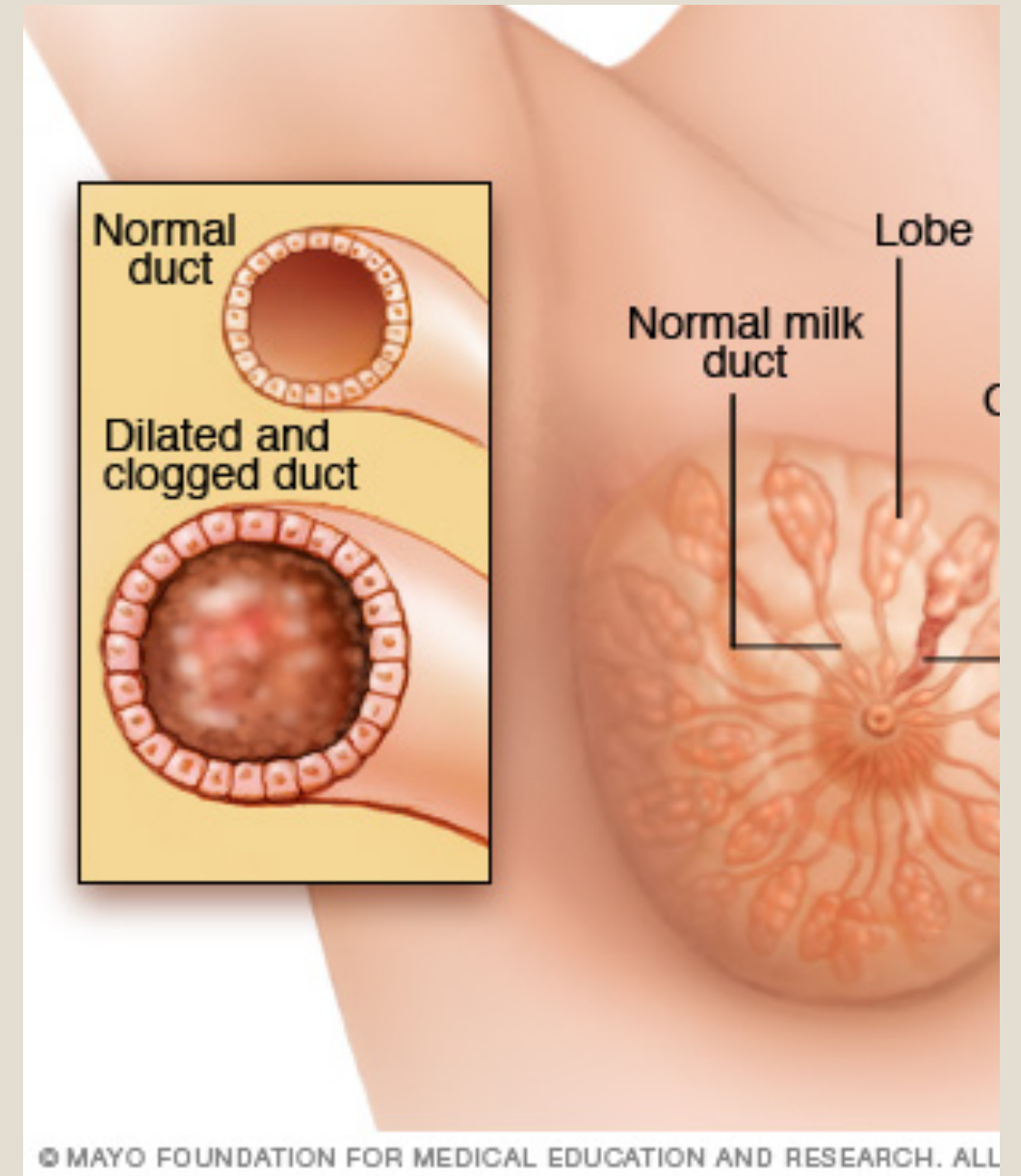


Figure 6 (Mayo 2015)



# ANTIBIOTICS

# ANTIBIOTIC MECHANISM

- **Oral antibiotics** are prescribed for 10-14 days
- **Erythromycin, Flucloxacillin, Dicloxacin** → penicillinase-resistant penicillin antibiotics to treat mastitis, they are effective against *S.aureus* (most common bacterial cause of mastitis)
- **Penicillin** is composed of thiazolidine ring, beta-lactam ring and side chain. They bind to penicillin binding proteins (located under bacterial cell wall)
- **The binding inhibits proper cell wall synthesis** → resulting in structural weakness and activation of autolytic enzymes, leading to cell lysis of bacteria
  - Cell lysis occurs due to differences in intracellular and extracellular osmotic pressure, water diffuses into the bacterial cell, autolytic enzymes also cause lysis
- **Cephalexin and Clindamycin** → alternatives if mother is allergic to penicillin
- These drugs prevent biosynthesis of bacterial cell wall by binding to **bacterial penicillin binding proteins**, causes **cell lysis or disrupts bacterial ribosomes to inhibit protein synthesis leading to cell death**

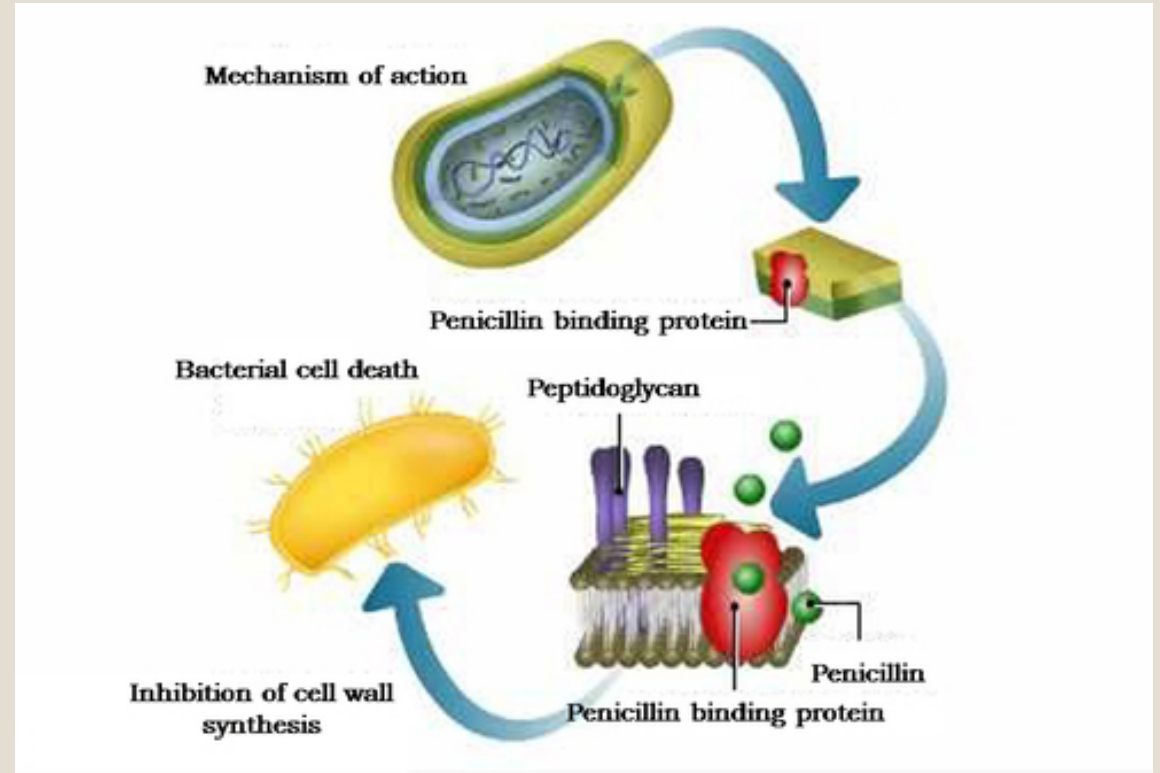


Figure 7 (UTAustinX 2015)

# POST ANTIBIOTIC

- Improvement is seen within **48-72 hrs** after antibiotic treatment is started
- In severe cases, they are administered **intravenously**
- Abscesses can be detected by **ultrasound**
- Some antibiotics are **safe** for breastfeeding mothers, but for some it is **unknown** or needs to be used with caution
- **Safe antibiotics** for breastfeeding mothers → amoxicillin, cephalosporin, aminoglycosides and trimethoprim-sulfamethoxazole
- **Unknown if safe antibiotics** for breastfeeding mothers → penicillin, clindamycin, tetracycline and chloramphenicol
- **Proper use and completion** of antibiotic treatment is crucial to prevent reinfection and bacterial resistance
- To reduce **pain symptoms** → non steroidal anti inflammatory analgesics can be taken such as ibuprofen
- **During recovery** → recommended to apply heat to affected area, express milk, lots of rest, avoid giving infant pacifiers or bottles



# EFFECTS OF ANTIBIOTICS ON PATIENT AND INFANT

- Antibiotics relieve the bacterial infection but not the underlying issue of milk stasis
- Mother should continue breastfeeding/pumping to remove milk from breast and reduce milk stasis and relapse of inflammation and bacterial infection
- Effects on the infant
  - Small quantities of antibiotic will enter the mothers breast milk but will NOT harm the baby →BUT infant can develop restlessness, stool may be loose or in severe cases can have diarrhea
  - Diarrhea can occur because the antibiotics can effect the microflora of the infants GI tract
  - Babies ability to handle and metabolise drugs varies and is somewhat dependant on gestational age at birth, underdeveloped kidneys, and livers are less likely able to deal with drug closer to the time of birth compared to late infancy
- Effects on the mother
  - pH of breast milk has influence on the quantity of antibiotic that can transfer from Elizabeths blood plasma into her breast milk
  - Concentration of antibiotic can result from late pregnancy and high fat and increased pH of the milk at this time

Figure 8 (Lamb 2018)



# REFERENCES

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