Mastitis Spectrum Disorder

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I have no financial relationships with ineligible companies

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Objectives

- Explain the various definitions of mastitis.
- Identify risk factors for mastitis.
- Explain the relationship between overproduction or milk stasis and lymphatic edema.
- Describe differences between infectious and noninfectious mastitis.
- Explain why a plugged duct is not likely caused by milk plugged in 1 duct.
- Outline a plan of moist wound treatment for sore cracked nipples.
- Describe the physiology of engorgement and evidence-based management
- Outline the role of hyperlactation in the spectrum of disorders related to mastitis
- Identify the role that contaminated pump parts can play in the development of mastitis
- Explain the concept of 'plugged ducts'
- Define phlegmon, galactocele and abscesses, and describe the relationship between these entities
- Outline practices that may prevent recurrent mastitis and its complications

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Which one of the following has been demonstrated to increase the risk of mastitis?

A. Nipple wounds
B. Low milk production
C. Alcohol use
D. Breastfeeding past 12 months postpartum.

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The most appropriate treatment of a 7cm breast abscess is serial aspirations until the abscess resolves.

A. True
B. False

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Which one of the following medications/herbs decreases milk production?

A. Estrogen
B. Fenugreek
C. Metoclopramide
D. Amoxicillin

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What is Mastitis?

'

Lactational mastitis is defined as inflammation of the breast tissue and is commonly experienced by breastfeeding women (Amir et al., 2007). It is a painful condition with high fever; flu-like symptoms, for example aches and chills; and red, tender, hot, and swollen areas of the breast (Lawrence, 1989; World Health Organization, 2000). It is diagnosed symptomatically and there is no broadly accepted clinical definition (Zarshenas et al., 2017). Mastitis can be experienced on a continuum from mild inflammation to more severe disease (Michie et al., 2003). There is also no consensus on the aetiology, which may be inflammatory, infectious, based on a bacterial imbalance, or multifactorial (Baeza, 2016)'

JHL 2020 (Systematic Review) Nov;36(4); 673-686

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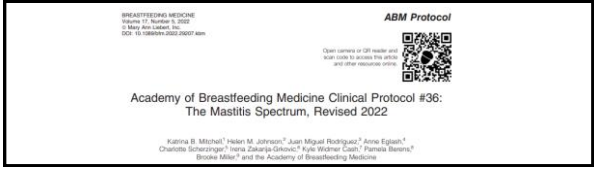
What is Mastitis?

"In the past, mastitis has been regarded as a single pathological entity in the lactating breast. However, scientific evidence now demonstrates that mastitis encompasses a spectrum of conditions resulting from ductal inflammation and stromal edema'

'Mastitis is inflammation of the mammary gland that most often presents in a segmental distribution of ducts, alveoli, and surrounding connective tissue (Fig. 3). Ductal lumens can be narrowed by edema and hyperemia associated with hyperlactation as well as mammary dysbiosis'


BREASTFEEDING MEDICINE
Volume 17, Number 5, 2022
Mary Ann Lieberth, Inc.
DOI: 10.1089/bfm.2022.29207.abm

ABM Protocol

Open camera or QR reader and scan code to access this article and other resources online.

Academy of Breastfeeding Medicine Clinical Protocol #36:
The Mastitis Spectrum, Revised 2022

Katrina B. Mitchell,[1] Helen M. Johnson,[2] Juan Miguel Rodriguez,[3] Anne Eglash,[4] Charlotte Scherzinger,[1] Irena Zakarija-Grkovic,[5] Kyle Widmer Cash,[1] Pamela Berens,[6] Brooke Miller,[6] and the Academy of Breastfeeding Medicine

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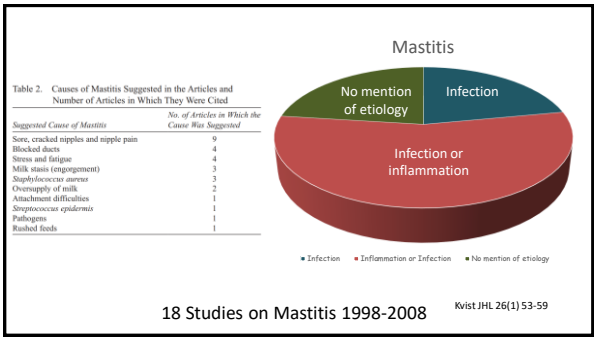
Table 2. Causes of Mastitis Suggested in the Articles and Number of Articles in Which They Were Cited

Suggested Cause of Mastitis	*No. of Articles in Which the Cause Was Suggested*
Sore, cracked nipples and nipple pain	9
Blocked ducts	4
Stress and fatigue	4
Milk stasis (engorgement)	3
Staphylococcus aureus	3
Oversupply of milk	2
Attachment difficulties	1
Streptococcus epidermis	1
Pathogens	1
Rushed feeds	1

18 Studies on Mastitis 1998-2008

Kvist JHL 26(1) 53-59

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Who Develops Mastitis?

- 25% of women affected up to 25 weeks pp
- Factors that increase risk:
  - Nipple wounds
    - Most common association among studies
  - Engorgement
  - Milk stasis
  - Stress
  - History of mastitis with previous children

No clear delineation between infectious and noninfectious mastitis

JHL 2020 (Systematic Review) Nov;36(4); 673-686

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Who Develops Mastitis?

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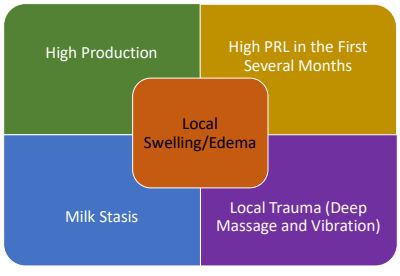

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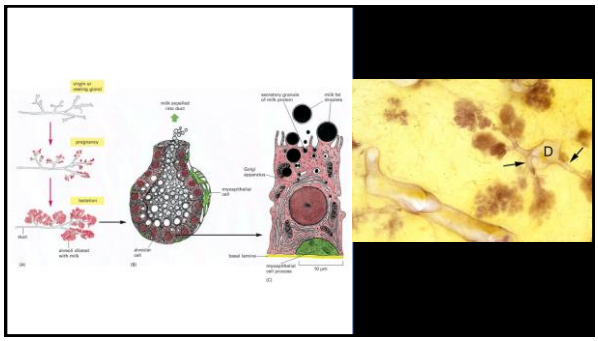

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Down Regulation in Response to Hyperlactation or Poor Milk Removal

- Tight junctions lose integrity
- Lactose moves out to the base of the cells
- Lactose exerts an inhibitory effect on milk production
- Blood vessels near the lactocytes narrow to reduced nutrients to the lactocytes
- Bioactive factors such as serotonin also feed back to lactocytes

J Mammary Gland Biol Neoplasia (2014) 19: 131-138
Kobayashi Cell and Tissue Res June 2022

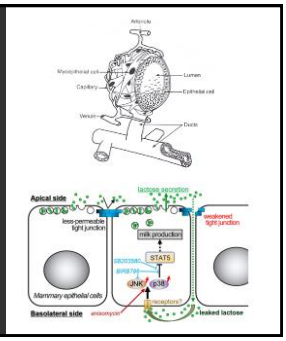

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Table III. Changes in the serum lactose and urinary lactose excretion during mastitis compared to the decrease in milk lactose (mmol/24-h^{1}). Day 30 asymptomatic results provided for reference (mean ± SD)

Mastitis day	Serum lactose (μM) median (25,75)	Urinary lactose excretion (mmol/24-h) median (25,75)	Percentage decrease in milk lactose (combined breasts) from the baseline (Day 30)	Percentage decrease from the baseline (Day 30) accounted for by lactose excretion in urine/24-h
Day 1	70.6 (49,94) (n = 11)	7.5 (6.3,12.4) (n = 11)	14.8%	5.6%
Day 2	62.5 (38,76) (n = 11)	7.1 (3.2,13) (n = 9)	10.3%	5.3%
Day 3	58 (39,110) (n = 12)	4.6 (3.9,6.7) (n = 6)	5.3%	3.4%
Day 4	42.5 (12,83) (n = 5)	2.8 (2.1,3.6) (n = 3)	5.3%	2.1%
Follow up	61.2 (48,66) (n = 11)	3.2 (2.6,4.1) (n = 11)	3.7%	2.4%
Baseline Day 30 results from asymptomatic cohort	39.5 ± 15.6 (n = 12)	2.9 + 1.15 (n = 16)	178 mmol/l (133 mmol/24 h)^{1}	2.2% lactose excreted/24-h at Day 30

^{1}Combined breast lactose (mmol/24-h) calculated using Day 30 reference results and adjusted for an average milk production of 750 ml/24 h.

Note the marked decrease by day 3

Fetherston_Hartman et al Acta Obstetricia et Gynecol 2006; 85: 20-25

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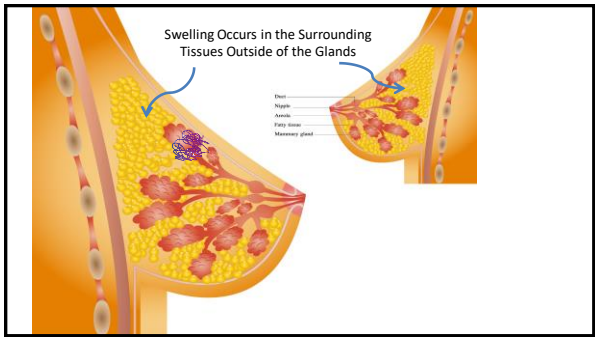

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Engorgement

Breast edema in the first week after secretory activation

Similar situation to later episodes of inflammatory mastitis

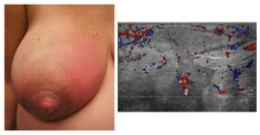

FIG. 3. Right breast upper inner quadrant mastitis with ultrasound showing hyperemia and edema without fluid collection.

- Prevent by limiting IV fluids during labor, rooming in, frequent direct feeding
- Avoid excessive pumping
- Hand express/reverse pressure softening/lymphatic massage to improve direct feeding
- Ice/cold compresses for edema

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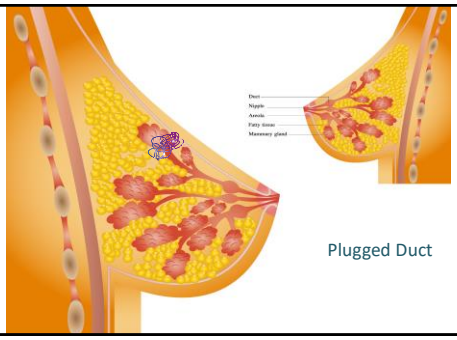

Plugged Duct

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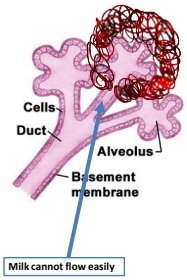
What is a Plugged Duct?

- A swollen area of the breast
- The milk in the swollen region cannot move through the ducts until the swelling resolves
- When the swelling resolves, clots of milk are sometimes expressed



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Symptoms of Plugged Ducts

- Tender localized area of fullness
- Pain radiates to/from the nipple during nursing
- No/minimal breast redness, no fever
- Drop in milk production because of substantial retention of milk

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Risk Factors for Plugged Ducts

All situations are associated with insufficient milk removal=> alveolar distension=> fluid moving from alveolar compartment to interstitium

- High milk production
- Return to work
- Irreg feeding/pumping
- Poor pump fit
- Change in feeding positions
- Restrictive clothing or other external compression

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The ducts are too tiny and innumerable for just 1 plugged duct to cause an area of swelling

Ductal narrowing (e.g., "plugging")

"Plugging" is a colloquial term for microscopic ductal inflammation and narrowing (Fig. 2) that is related to alveolar distension and/or mammary dysbiosis.

Ducts in the breast are innumerable and interlacing (Figs. 6–8) and it is not physiologically or anatomically possible for a single duct to become obstructed with a macroscopic milk "plug." It should be noted that ultrasound studies documenting a small number of orifices approaching the nipple[32] reflect limitations of radiographic images as compared with histological anatomy.

Ductal narrowing presents as a focal area of induration or more globally congested breast tissue that is tender. It may be mildly erythematous from lymphatic congestion and alveolar edema, and does not have associated systemic symptoms

FIG. 6. Cross section of nipple areolar complex with **arrows** demonstrating extremely small interlacing ducts in the retroareolar region.

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Plugged Duct- Treatment

- Rest
- Stay with same frequency of direct feeding or pumping
  - **Do not increase stimulation**
- **Avoid deep massage, vibrators**
  - Increases inflammation, increased risk of mastitis/abscess/galactocele
- Therapeutic ultrasound
- Vary nursing positions
- If the lump does not resolve in 48 hours, needs a visit
- Lecithin 1200mg-2400mg twice a day for prevention

Source: US Breastfeeding Committee

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Lymphatic Drainage

- Reduces swelling by assisting movement of lymph fluid, decreasing edema
- Technique
  - "Very gentle touch/traction of skin - "like petting a cat"
    - The purpose is to lift skin to allow flow of lymphatic drainage and vascular decongestion
  - Ten small circles at junction of internal jugular and subclavian veins
  - Ten small circles in axilla
  - Continue with light touch massage from nipple towards clavicle, axilla
- Start during pregnancy if experiencing painful rapid breast growth, and use as needed postpartum for engorgement

PhysicianGuideToBreastfeeding.org

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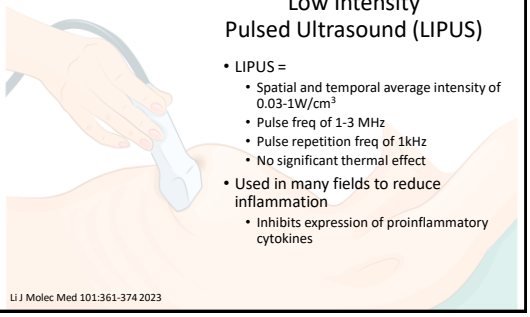
Low Intensity Pulsed Ultrasound (LIPUS)



- LIPUS =
  - Spatial and temporal average intensity of 0.03-1W/cm^3
  - Pulse freq of 1-3 MHz
  - Pulse repetition freq of 1kHz
  - No significant thermal effect
- Used in many fields to reduce inflammation
  - Inhibits expression of proinflammatory cytokines

Li J Molec Med 101:361-374 2023

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Therapeutic Ultrasound Treatment for Plugged Ducts

No standardized protocol

Protocol from cohort study Womens Health Physical Therapy, 39(3), 115–12

- Frequency- 1 MHz
- Intensity- 2.0 W/cm2
- Duration- 5-6.5 minutes
- Area- 2-3x size of head of radiating head

Clinical Lactation 2020 11(1)

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Acute Mastitis- Infectious or Non-Infectious (Inflammatory)?

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A Definitive Test to Distinguish Bacterial from Inflammatory Mastitis?

Bacterial Growth

All breastmilk will grow bacteria

- Coag negative staph, e.g. staph epidermidis will grow in all cultures
- Not uncommon to find gr B strep, staph aureus, strep mitis, staph lugdunesis, etc
- Lack of bacteria other than coag neg staph may be more c/w inflammatory mastitis (but not always)

Other Markers?

- Somatic cell counts as done in bovine is more closely related to milk production/involution than bacterial infection
- CRP in milk not reliable (Fetherson BF Med 1(3) 2006
- Na/K+ ratio increases with mastitis for 48 hours, but not associated with + culture results (Perrella BF Med Dec 2022)
- Increased IL-8, somatic cell ct in mastitis but does not distinguish infection vs inflammation BF Med Feb 2013

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Noninfectious vs Infectious Mastitis Clinical Considerations (given lack of standard definitions)

Non-Infectious

- No fever or possibly low grade
- Systemically feels OK
- Mild or no redness
- Breast pain/tenderness
- Typically improves in 48 hours

Infectious

- High fever
- Dizziness, nausea, weakness, headache and other systemic symptoms
- Breast redness and warmth
- Breast pain/tenderness
- May worsen over 48 hours

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	Non-Infectious Mastitis	Infectious Mastitis
Stay on same feeding/pumping routine (no extra milk removal), and address problems with milk removal	✓	✓
Ice or heat, whichever feels better	✓	✓
Avoid aggressive massage or vibration	✓	✓
Gentle lymphatic drainage	✓	✓
Add strategies to reduce milk production as needed	✓	✓
Antibiotics		✓
Milk culture	+/-	+/-

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Infectious Mastitis

Organisms:
Staph species- S aureus, S. epidermidis, S. lugdunesis, S. hominis
Strep species- S. mitis, S. pyogenes, S. agalactiae
E Coli
Serratia Marcescens
Pseudomonas

Antibiotics
Dicloxacillin, Clindamycin, cephalosporins, TMP sulfa

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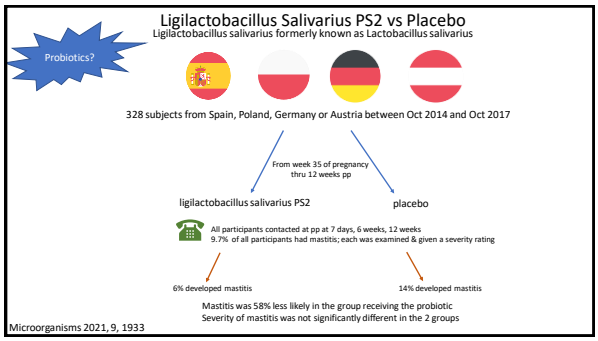

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How Does This Work?

- Unclear if the probiotic transfers into the mammary gland from the maternal gut
- One study (Benef. Microbes 2016, 7, 305–318) using L salivarius PS2 to treat mastitis identified:
  - Reduced bacterial and leukocyte counts in milk
  - Reduced interleukin-8, increased IgE, IgG3, epidermal growth factor, and interleukin-7

Photo by Elena Mozhvilo on Unsplash

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Breastmilk Culture

When?

- Recurrent mastitis
- Not resolving
- Abscess
- Chronic localized pain

How?

- Use sterile water/saline/alcohol on nipple/areolar complex
- Using sterile gloves, collect 1-2 tsp into a sterile container
- Send as a 'body fluid' culture

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Serratia Marcescens Breast Pump Contamination

- Gram neg Bacillus, in family of Enterbacteriaceae
  - Known to cause pink discoloration
- Found in water, soil, animals, plants, insects
  - Low virulence in general
  - Often found in bathrooms in grout, shower corners, basins
- Infection typically hospital-borne
  - Intensive care units, esp NICUs
  - Often from hands of hospital workers
  - Immunocompromised patients at highest risk
    - Premature and ill infants

Fig. 1. The patient's discolored breast pump equipment. Note the bright pink color around difficult-to-clean grooves.
Faro. Serratia in Breast Milk. Obstet Gynecol 2011.

Int J Environ Res Public Health. 2019 Feb; 16(4): 610.

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A G1P1 mother comes to your office at 8 weeks postpartum for a concern regarding persistent mastitis in the R breast.

- Healthy pregnancy
- NSVD at 39 weeks, no complications
- The infant nursed well immediately pp, and she had no early breastfeeding concerns, other than discomfort with engorgement.
- Since birth the R breast has been larger, makes more milk and is always red, painful and swollen. She has never had a fever.
- The redness and pain are worse when she is full.
- Pain is alleviated for a short time after breastfeeding
- She nurses 1 side per feeding if she starts on the R, not on the L
- She has been to the ER twice for this, when it has been worse.
- Antibiotics have not helped very much.
- She asks if you can do a culture and give her the correct antibiotic.

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You are seeing a G1P1 parent who is breastfeeding her 18 mo toddler. The parent stays home with the toddler, and never pumps. She reports that since 6 weeks postpartum, she has had recurrent plugged ducts and mastitis that used to occur about 1-2 times a month. In the last 3 months, they occur 2-4 times a month.

- She is healthy, on no meds or galactogogues.
- She has always had a generous milk production, often breastfeeding on 1 side.
- If her toddler stays on the same feeding schedule, she does not have any plugs or mastitis.
- If her toddler nurses more frequently for a day or 2, she ends up with a plugged area, that can take 48 hours to resolve. She tends to feel fluish with a headache, no fever, and sometimes has pink changes in the breast. Most of these occur on the R side, just 1-2 times in the L breast. She has never taken antibiotics.
- She has tried dangle feeding, vibration, heat, deep massage. She is not sure if any of these things help.
- She wonders what to do to prevent these issues.

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What Can We Advise to Decrease Milk Production?

- Avoid extra pumping, nurse 1 breast/feeding
- Herbal/medicinal treatments
  - Sage
  - Peppermint
  - No more milk tea
  - Pseudoephedrine
  - Estrogen (as in contraception)
  - Cabergoline

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Nipple Wounds and Mastitis

What is the association between nipple trauma and mastitis?
Is it associative or causative?

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Causes of Nipple/Areola Trauma

- Mechanical nipple damage
  - Poor latch or atypical suck
  - Tongue-tie
  - Pump trauma
  - Bite wound

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Cracked Nipple Treatment

- Moist wound healing
- Decrease trauma
- Treat underlying any skin pathology

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Moist Wound Healing

- Moist wound covering based on wound care principles
- No evidence for best topical materials
- Nonstick cover
  - Silver embedded materials
  - Foam materials
  - Parchment paper
  - Ointment/oil with nonstick pad or parchment paper
    - Nipple balm
    - Medicinal honey
    - Coconut/olive oil
    - Breastmilk
    - No evidence for benefit with APNO (popular combo cream of antifungal/antibacterial/steroid)

Cochrane Database of Systematic Reviews 2014, Issue 12.

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What is a Phlegmon?

Clinical features	Lactational phlegmon (N = 10)	Lactational abscess (N = 15)	Uncomplicated mastitis (N = 27)
Classic mastitis symptoms and signs	10 (100%)	15 (100%)	27 (100%)
Palpable mass	10 (100%), 0 (0%) fluctuant	15 (100%), 4 (26.7%) superficial and fluctuant	0 (0%)
Diagnostic ultrasound (US) findings	US obtained in 9 patients (90%) to establish diagnosis, with the following findings: ill-defined fluid collection with soft tissue stranding 1 patient (10%) was unable to complete an US as her infant was emergently admitted to the hospital	US obtained in 11 patients (73.3%) without fluctuant masses with the following findings: discrete fluid collection	US not generally required for diagnosis, but obtained in 10 patients (37.0%) for the following reasons: 7 (25.9%): question of deep, nonpalpable abscess—negative 2 (7.4%): recurrent mastitis in same location—negative for underlying mass/lead-point lesion 1 (3.7%): axillary lymphadenopathy—negative for concerning lymph nodes; benign appearance only

From Katrina Mitchell MD

Johnson, Mitchell KB. Breast J. 2020 Feb;26(2):149-154

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Fluid is dispersed throughout the region

Fluid is contained in a well-demarcated region

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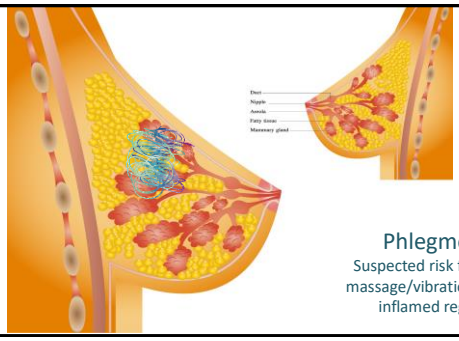

Phlegmon

Suspected risk factor is massage/vibration of the inflamed region

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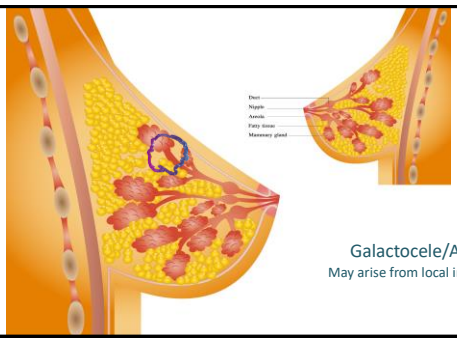

Galactocele/Abscess

May arise from local inflammation

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Phlegmon	Galactocele	Abscess
• Milk culture • Antibiotics	• Leave alone unless symptomatic • Aspiration or Drain • Culture fluid	• Aspiration if small, otherwise place a drain • Culture fluid

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Abscesses During Lactation

- Require drainage
  - I&D is generally preferred over serial drainages
    - >5cm absolutely needs drainage
  - If recurrence after 2 serial drainages, place a drain
- Continue antibiotics, relying on culture results
- Continue milk removal
  - Avoid driving up production
- Baby may nurse if milk is not purulent

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Abscess with Small Drain

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Nipple Blebs

- White/yellow spot on nipple
- Commonly associated with recent breast inflammation or nipple trauma
- Treatment
  - Often don't need to be treated
  - Steroid ointment to reduce inflammation
  - Avoid sterile unroofing- may create more inflammation

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Symptoms of Subacute Mastitis or Mammary Dysbiosis

- Typically present for more than 2 weeks
- Nipple pain
- Painful latch, improves during feeding
- Deep breast pain after feeding
- Breasts feel tender
- Recurrent plugged ducts
- +/- Nipple scabs
- Decrease in milk production

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Bacterial Dysbiosis-Exam

- Possible nipple lesions
  - Scabs
  - Cracks
  - Blebs
  - White biofilm
- Pain on manual expression and breast palpation

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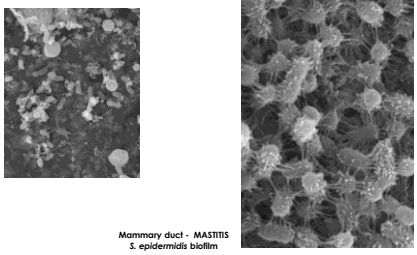

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Management of Subacute Mastitis

- This is a bacterial-overgrowth situation
  - Same pathogens as acute bacterial mastitis
  - Can occur from contaminated pump parts
- Breast exam and breastmilk culture
- Reduce overproduction
  - This will eliminate most cases
- Antibiotics based on culture results

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Conclusions

- Acute mastitis can be either infectious or inflammatory/noninfectious.
- The term 'plugged duct' is a misnomer. The 'plugged' region is an area of lymphatic edema, preventing movement of milk.
- Deep massage and vibration may lead to increased breast inflammation and phlegmon. Lymphatic drainage and down regulation, when appropriate, is ideal, along with optimizing milk removal strategy.
- Avoid overstimulation of inflamed breasts to prevent driving up milk production.
- Nipple wounds are best managed with moist wound healing
- Controlling over production is an important strategy to prevent recurrent 'plugged ducts' and mammary dysbiosis (subacute mastitis).

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Pseudoephedrine

- Decongestant
  - stimulates alpha- and beta- receptors, causing vasoconstriction
- Unclear mechanism in decreasing milk production
  - ? slight decrease in prolactin levels (13%)
- 24% drop in milk production after single 60mg dose

Dosing

Start with 30mg and assess effects, watch for infant fussiness
Repeat in 8-12 hrs as needed
If 30mg not effective, increase to 60mg
Do not prescribe regularly, ONLY as needed

Br J Clin Pharmacol 2003; 56/ Breastfeed Med. 2020;15

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Sage Use

- Use:
  - Extract in dose recommended by manufacturer after emptying before bed
  - Sage tea, 2-3 tsp, steep for 3-4 min
  - Use just as needed, not regularly
- Side effects:
  - Can lower blood sugar
  - Vomiting, dizziness, restlessness, anxiety
  - Seizures, kidney injury, fast heartbeat

Photo by Paulina H. on Unsplash

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Peppermint

- Peppermint tea
  - 1 cup 4 times a day
- Peppermint lozenges
  - Lozenges with real peppermint oil, 5 every few hours, 3-4 times a day

Natural Medicine Database 2021

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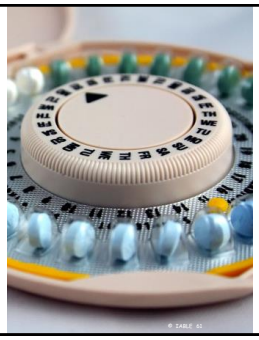
Estrogen Usually Slows Production

- Estrogen-containing OCPS
  - Not advised in the first 3-6 weeks pp
  - Must be OK'd by her physician/provider
  - Start with once daily dosing for a week
  - Typical drop in production by day 5-7
  - If milk production begins to rise again later, can re-dose for another week, or stay on it



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Cabergoline

- Strong dopamine agonist
  - Dopamine is the Prolactin Inhibitory Factor
- Dosing
  - Cabergoline 0.25mg po ONCE, and observe effect over 3-4 days
  - Dose every 3-5 days
  - Be careful what you ask for
- Use as VERY last resort!
  - Useful for fetal demise or other reasons to abruptly wean

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