Pumping: Beyond the Basics Clinical Challenges

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1

Objectives

- Recognize the relationship between method of milk expression and prolactin response.
- Explain why exclusive pumping can lead to over production of milk.
- Identify how pumping can increase the risk of trauma and breast inflammation.
- Identify risk factors for low milk production among individuals who pump.
- Discuss strategies to *prevent* breast and nipple pain among individuals who exclusively pump.

2

Method of Expression and Prolactin Response

3

Recurrent Plugged Ducts

- Ginger, a 24 yo G1P1, gave birth to her daughter Bea at 39 weeks gestation. Bea nursed well pp and always gained weight well with no breastfeeding concerns.
- She described her production as 'fine'.
- Bea nursed 1 breast/feed most of the day except in the evening when she nursed bilaterally.
- Ginger needed to return to work at 6 weeks pp so began pumping after the morning feedings at 4 weeks pp. Using a double electric pump, she removed 60-90ml over 7 minutes and stored this milk each day. She limited the amt removed to avoid driving up her production.
- In addition, she was required to attend a work event for 36 hours without her baby at 8 weeks pp.
- After starting pumping, she began feeling 'fuller' throughout the day & developed clogged ducts lasting 24-48 hours every 1-3 days in either breast. She used ice and stayed on her same nursing schedule. She is seeing you 1 day before returning to work to find out what is going on.

Why is this happening?

4

Let's Briefly Review Anatomy and Physiology of Lactation

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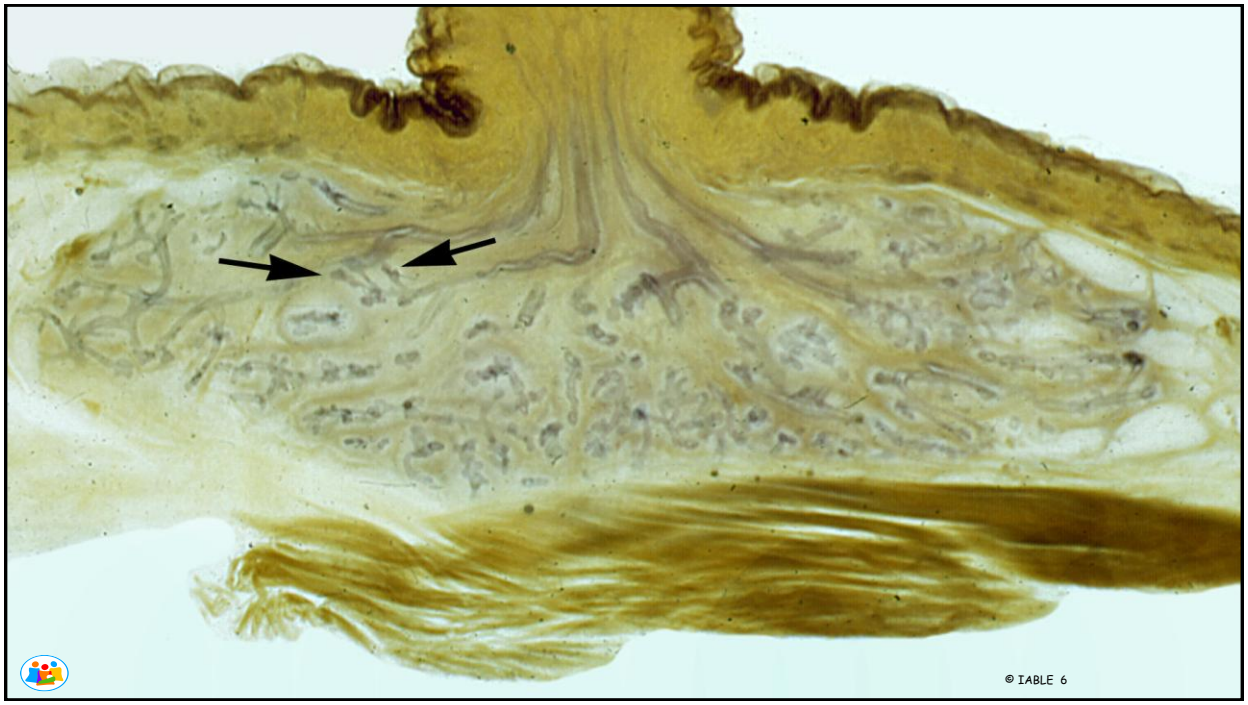

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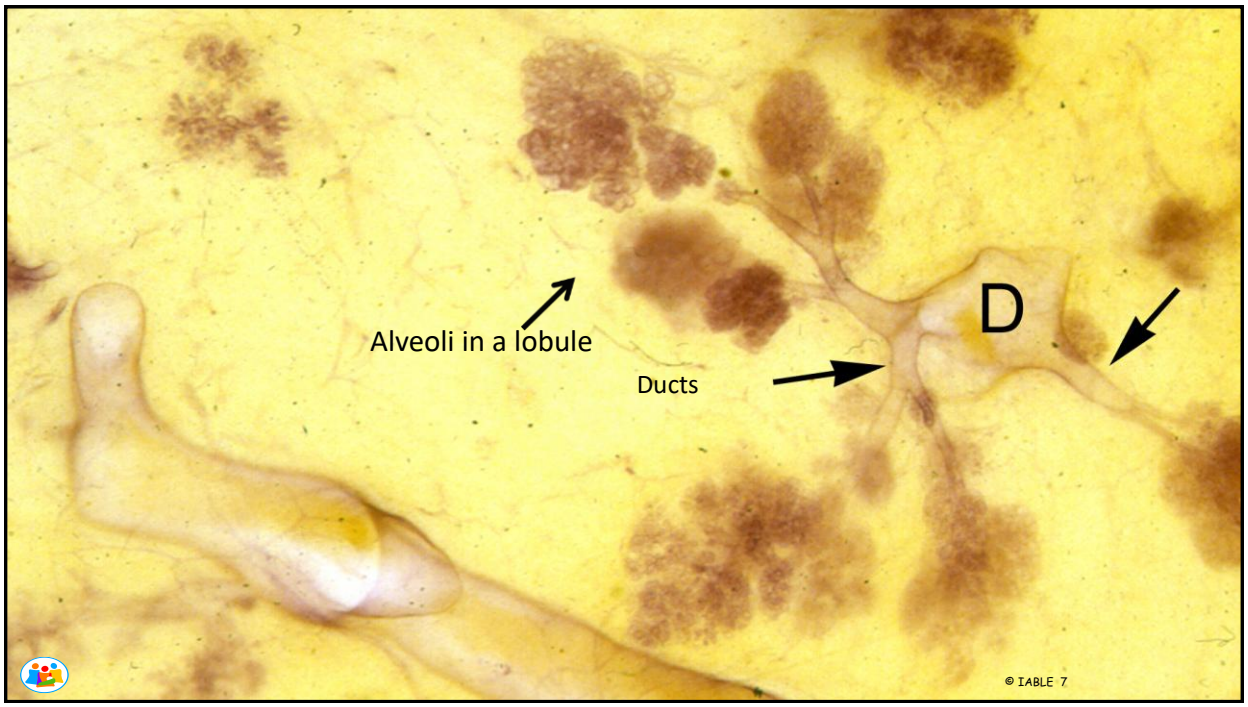
Alveoli in a lobule
Ducts
D
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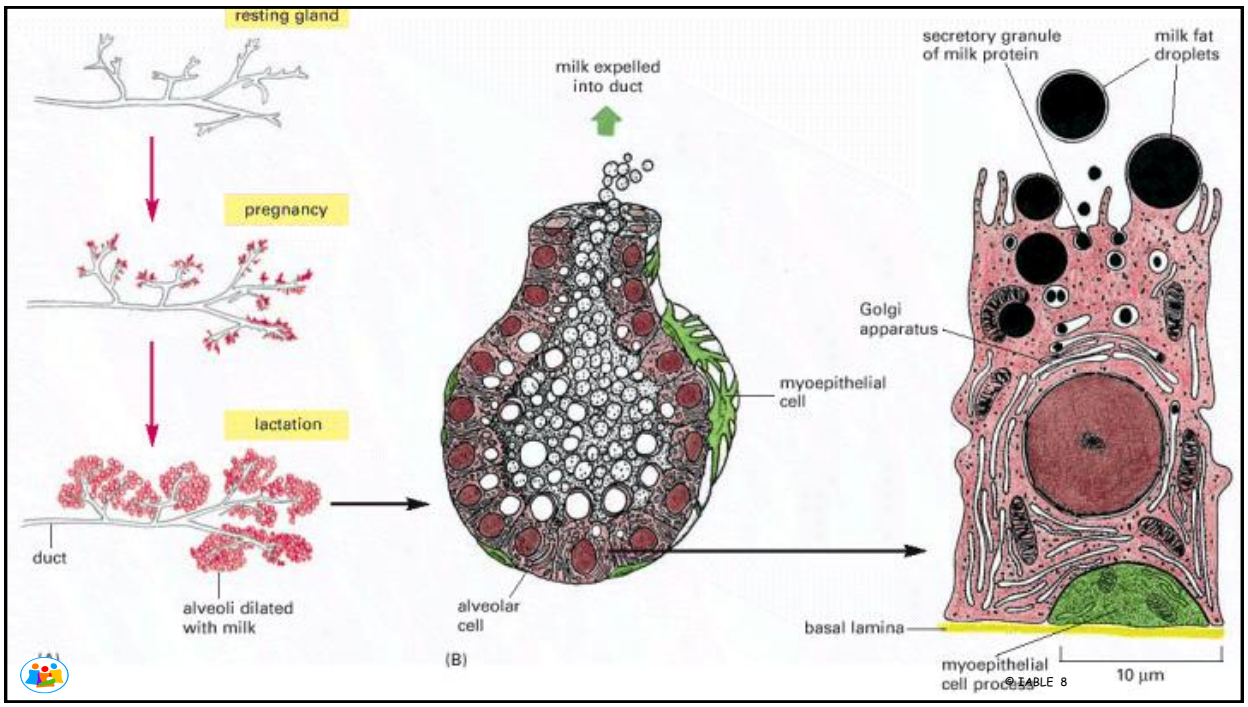
resting gland
pregnancy
lactation
duct
alveoli dilated with milk
milk expelled into duct
alveolar cell
(B)
myoepithelial cell
secretory granule of milk protein
milk fat droplets
Golgi apparatus
basal lamina
myoepithelial cell process
10 µm
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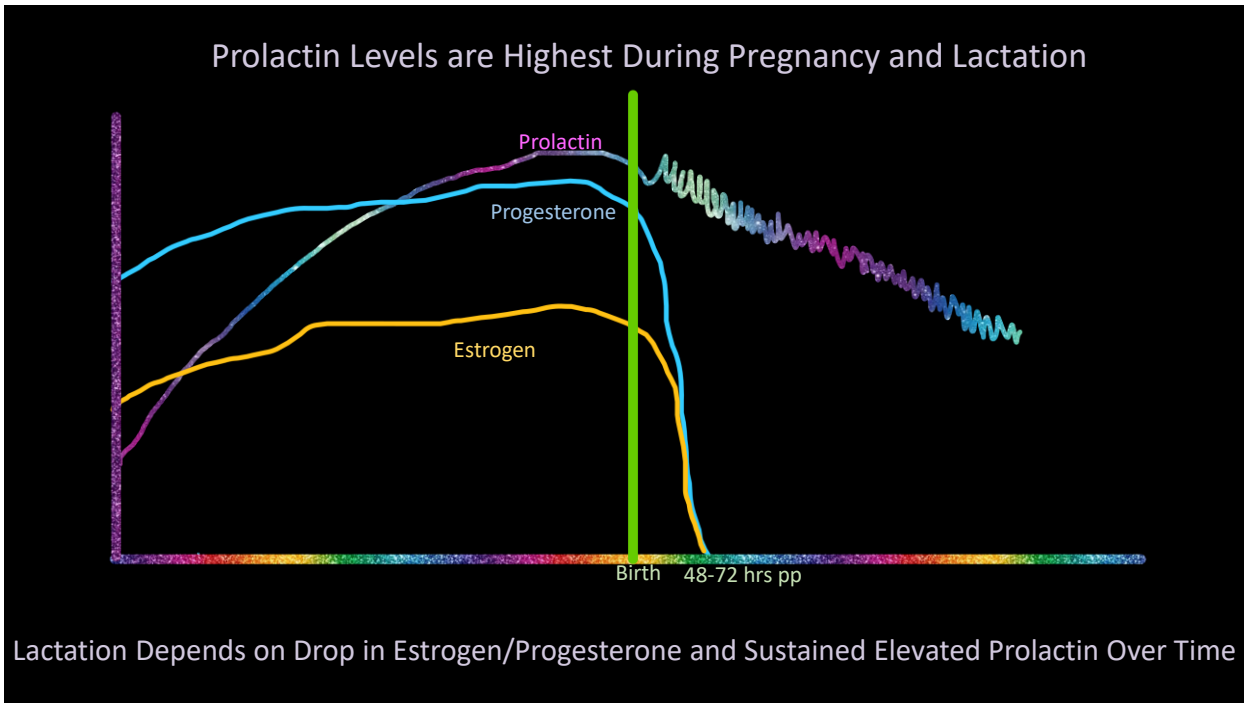

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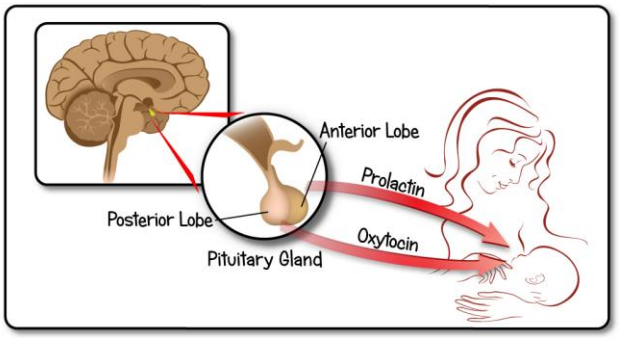
Prolactin

- Highest level at birth
  - Ensures production meets demand
  - Ensures any lactation, even if stillbirth
- After birth, elevation requires **nipple stimulation**



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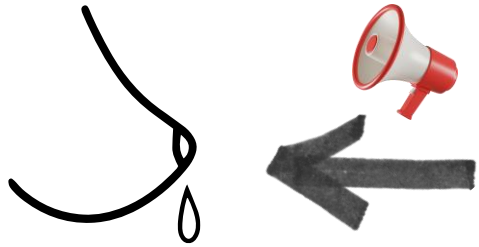
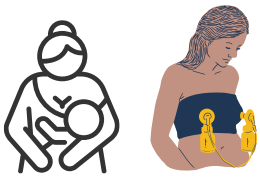


Prolactin sends a strong message to the breasts to make more milk

Pituitary secretes more prolactin



Nipple stimulation from nursing or pumping sends an 'order' to the pituitary gland

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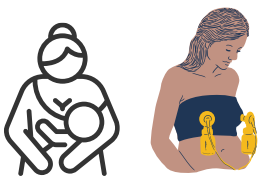
Please choose an answer:

A. Pumping raises the prolactin level higher than breastfeeding
B. Breastfeeding raises the prolactin level higher than pumping
C. I am not sure



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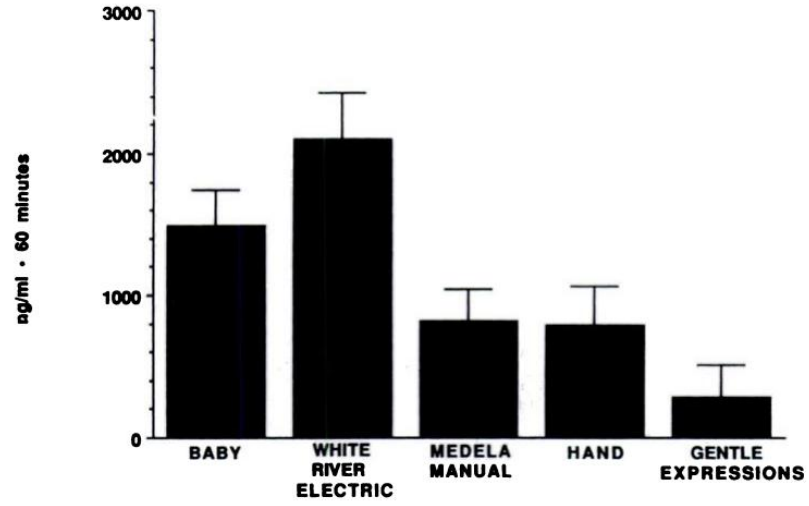

Fig 2. Serum prolactin results, with breast stimulation calculated as mean net area under the curves for each of the five methods. Data given as mean ± SEM.

Zinaman Pediatrics 1992; 89:437-440

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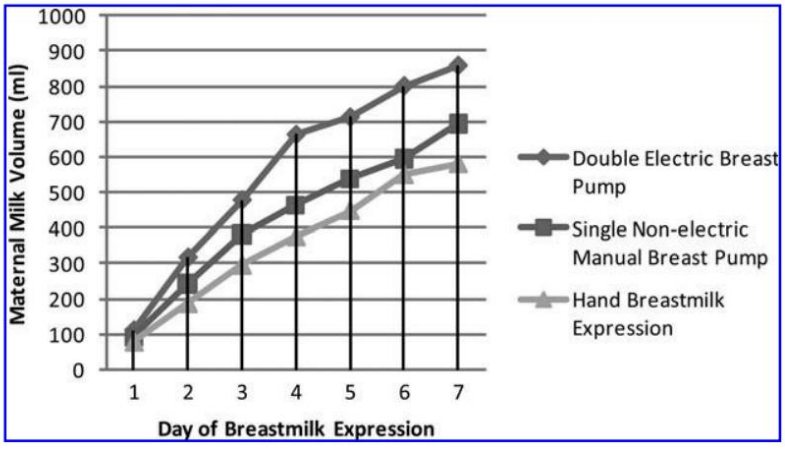

FIG. 1. Maternal milk volume by day of breastmilk expression in the three maternal milk expression groups.

161 Ugandan mothers with babies in the NICU, volumes from day 1-7 pp
Breastfeeding Medicine 7(2) 2012

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14

Over production (relative to milk removal)

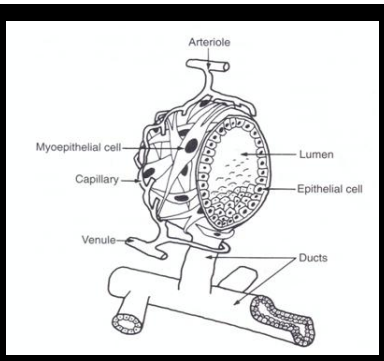
Regional areas of swelling (edema), AKA clogged ducts

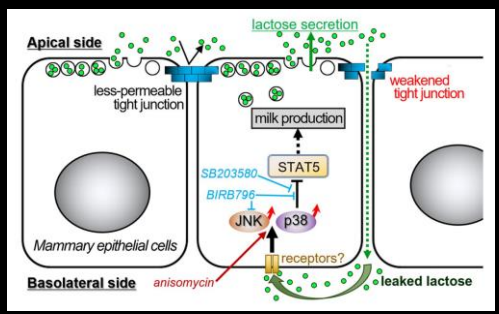
Acute mastitis

15

Consequences of Overly-Full Alveoli

- Tight junctions lose integrity
- Lactose moves out to the base of the cells
- Lactose exerts an inhibitory effect on milk production

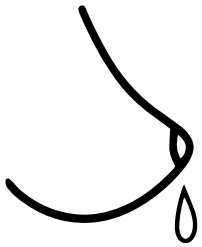




J Mammary Gland Biol Neoplasia (2014) 19: 131-138
Kobayashi Cell and Tissue Res June 2022

16

Ginger's Case



Pituitary secretes a hefty dose of prolactin

Prolactin sends a strong message to the breasts to make more milk than what the baby orders

Nipple stimulation from nursing AND pumping sends a large 'order' to the pituitary gland

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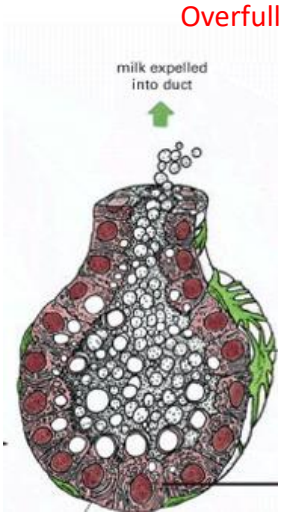
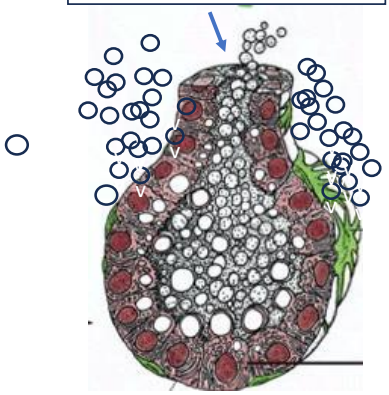
17

Overfullness => areas of swelling (clogs) => mastitis



Normally milk stays inside the alveolus and is expelled thru the ducts

Duct is narrowed due to external pressure from swelling and milk cannot leave

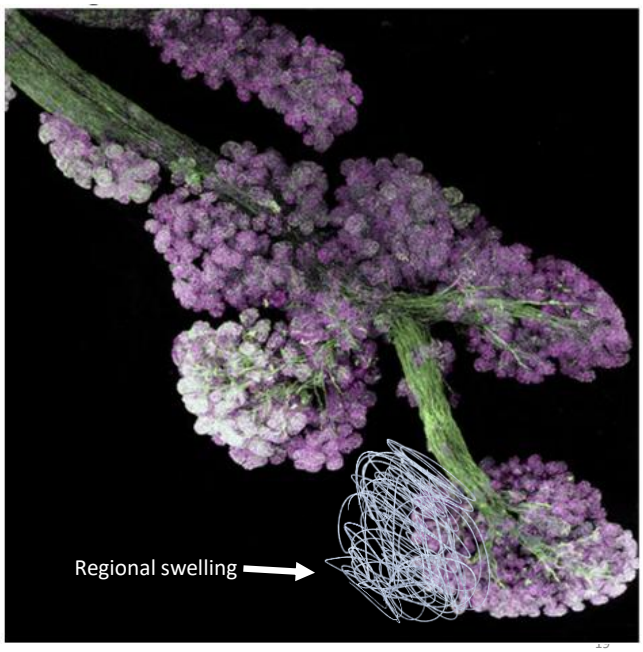


When overly full, milk will leak out between the cells, causing areas of swelling around the alveoli

18

What are Clogged Ducts?

- 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
- There is no such thing as a 'plug in a duct'



19

Recurrent Plugged Ducts

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How can we help Ginger?

20

Ginger's Case– Preventing Recurrent Plugged Ducts

- Ginger's milk production was driven up by adding pumping to breastfeeding
- Her baby could not remove enough milk, when production was higher, leading to swollen areas (clogs)
- Prevention of clogs include:
  - Pump for less time
  - Hand express or use a hand pump rather than a double electric pump to store milk
  - Minimize the amount of milk removed each day for milk storage

21

Low Milk Production Among People Who Exclusively Pump

22

For a postpartum client who is exclusively pumping for their newborn, how much milk should we expect them to produce by 2 weeks postpartum?

A. 100ml/day (about 3 oz total)
B. 450ml/day (about 15 oz)
C. 600-750 ml/day (about 20-25 oz/day)

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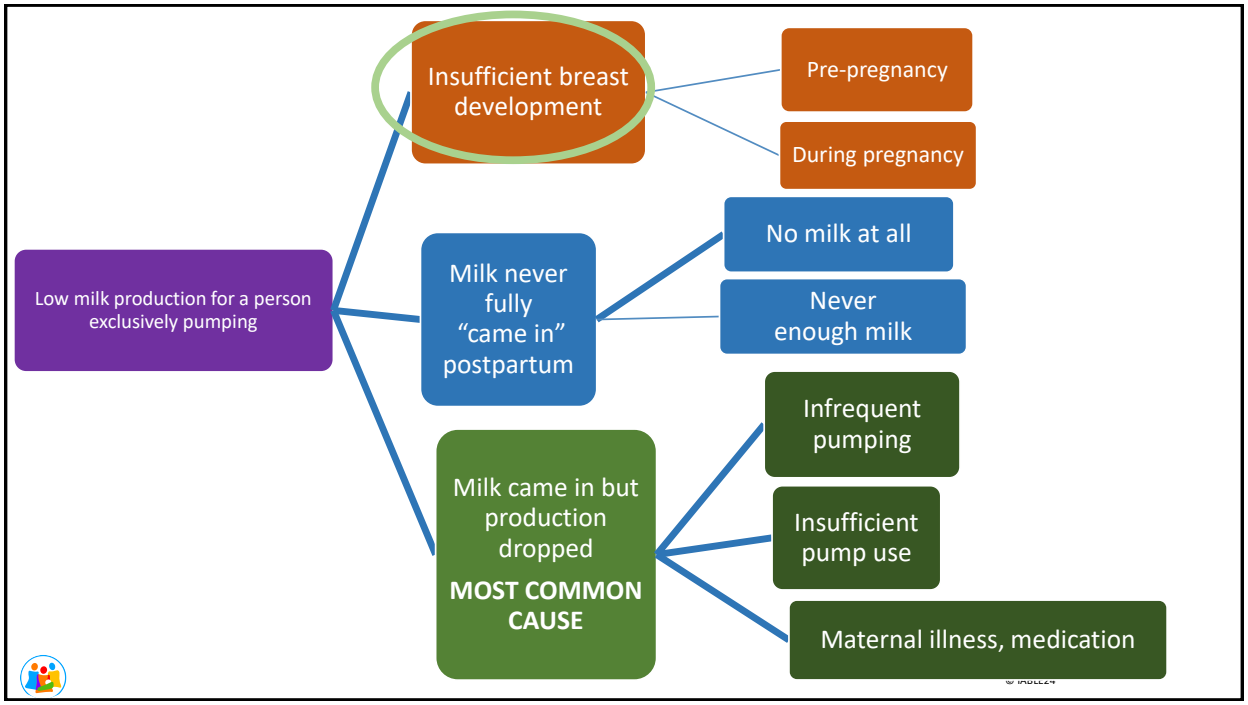

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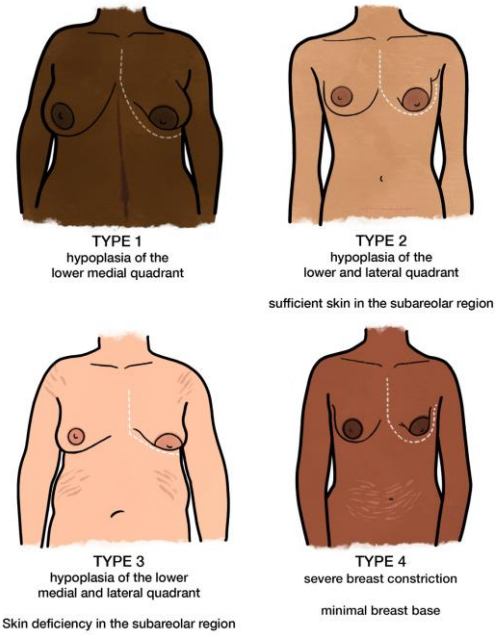

Congenital Insufficient Glandular Tissue

- May or may not report breast growth in pregnancy
- Not related to size of breast
- Shape of breasts can be a clue
  - Widely spaced
  - Nipples point down or outward
  - Large areola on small breasts

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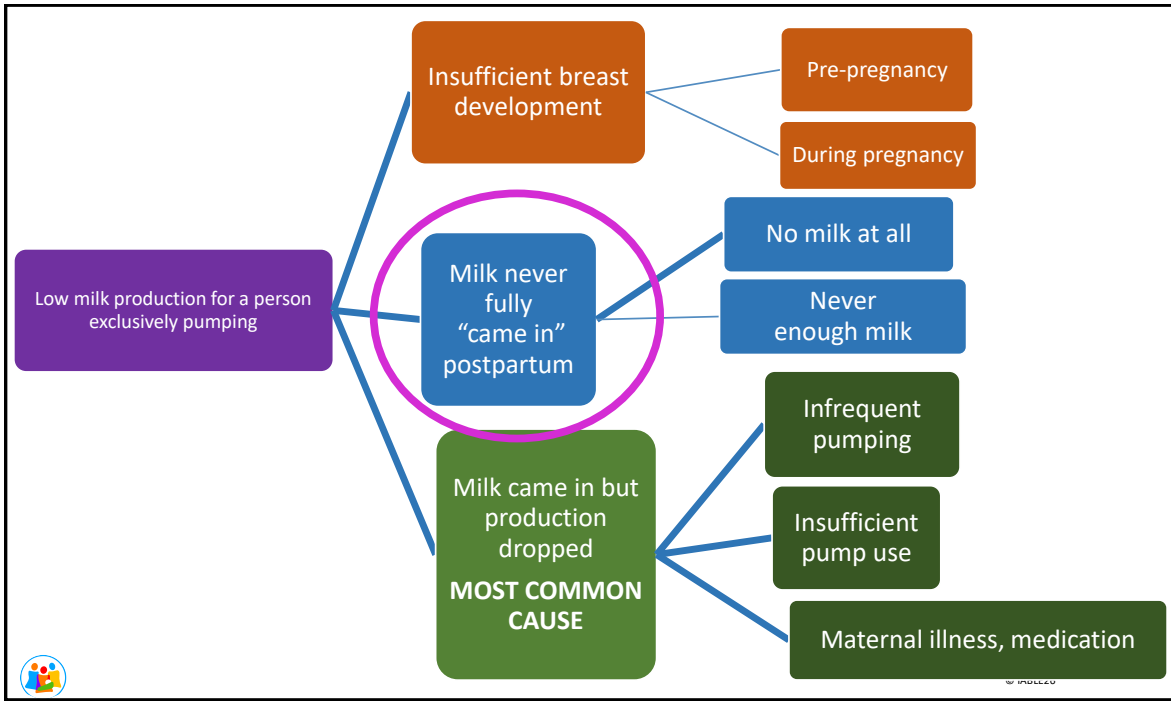

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You are seeing Jane, a G1P1 mother who is 9 days postpartum. She gave birth at 30 weeks gestation to her baby Alex, who is otherwise healthy and still in the NICU.

Jane began pumping 2 hours after birth and has been using a Symphony breast pump every 3 hours for 15 minutes, with no more than a 5-hour break overnight. She has not noticed any fullness in her breasts yet. She is expressing 2-5 ml each pump session.

27

What are possible reasons for Jane's very low milk production?

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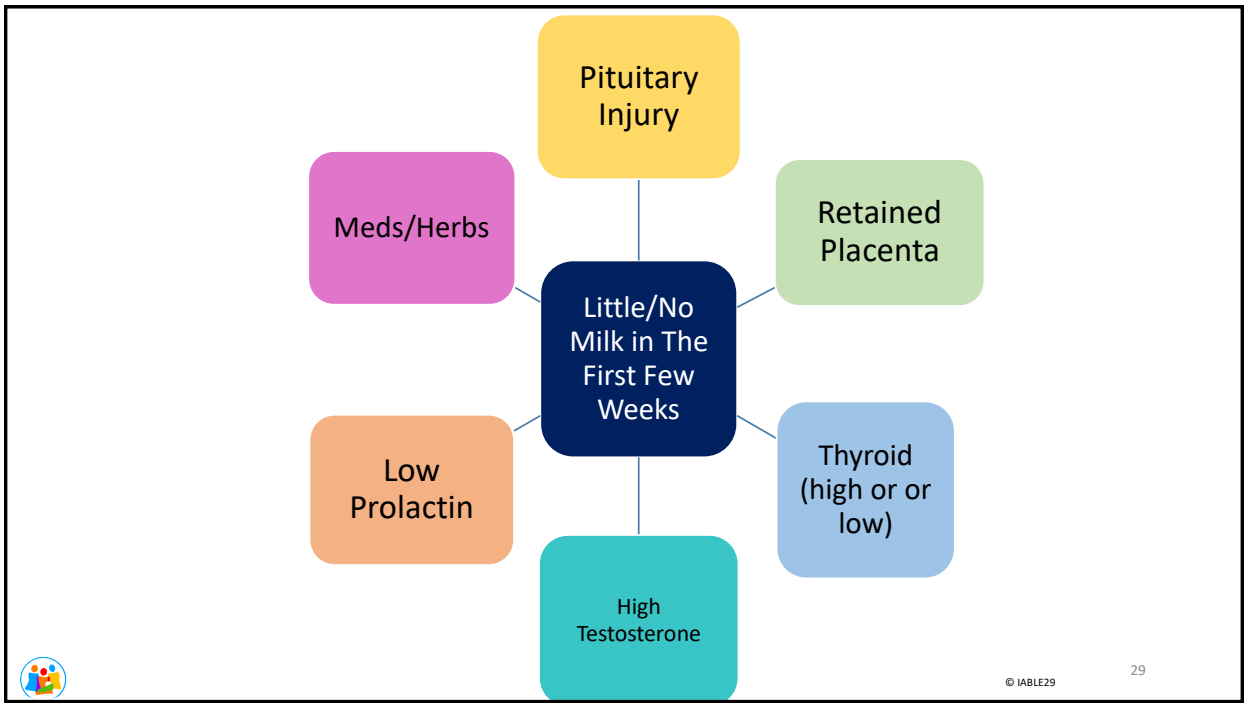


29

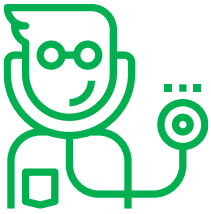
Could Jane's very low milk production on day 9 postpartum be due to the way she is pumping?

Not due to pumping:

- Nipple stimulation from pumping should raise prolactin
- If not removing milk well with the pump, she would have clogged ducts

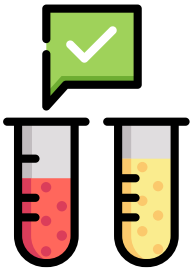
30

Take Home Message:
If Minimal/No Milk by 7-8 Days, Refer to a Knowledgeable Physician/Provider



Labs and eval needed for:

- Pituitary function
- Uterus for retained placenta
- Other hormone problems
- Medication side effects



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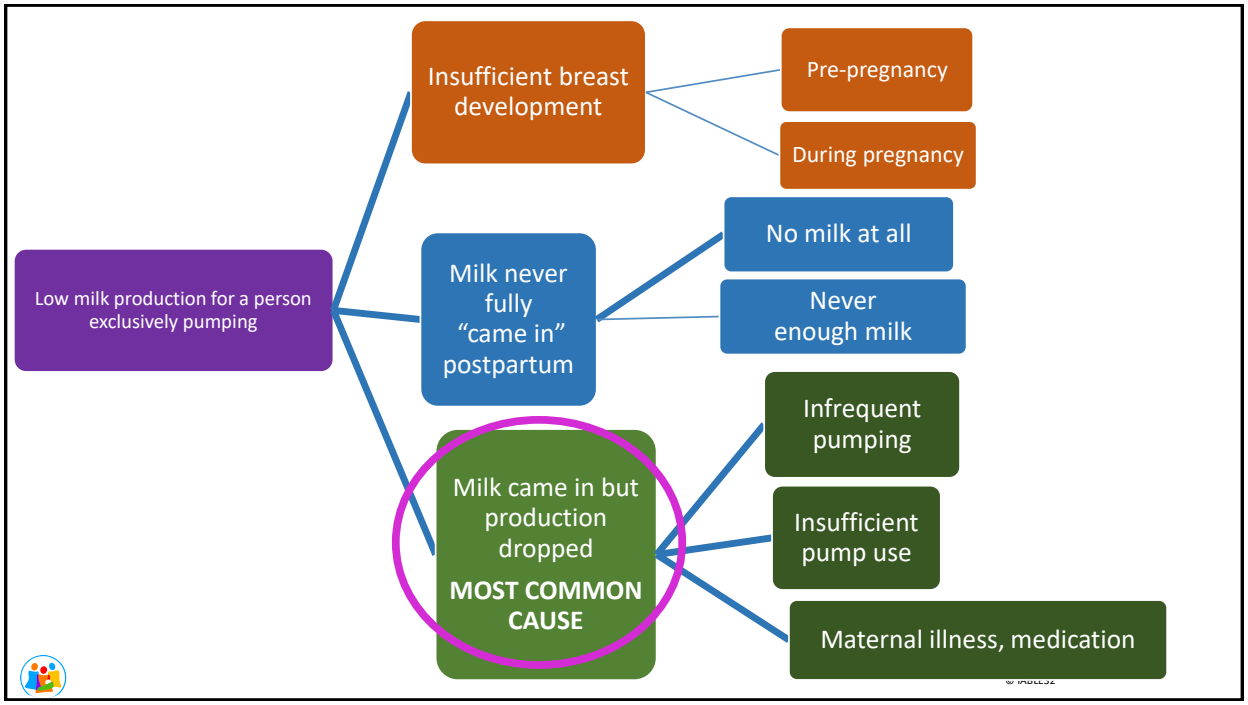

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You are seeing a lactating parent on day 35 postpartum. The individual gave birth to their second child at 29 weeks gestation. They had no lactation issues with their first child who is now 4 years old. No changes in health from the last pregnancy, such as gestational diabetes. This parent was expressing approximately 800ml since day 12, but in the last week noticed a drop in production and is now expressing 450 ml a day.

33

What would be possible reasons for the drop in milk production?

- Decrease in frequency/duration of milk removal
- Medications/contraception
- Illness
- Stress
- Change in pump/settings
- Ovulation

34

What is an optimal frequency of pumping to maximize milk production in the first 1–2 months postpartum?

35

Frequency of Pump Expression and Milk Production After Preterm Birth

Levene I, Fewtrell M, Quigley MA, O'Brien F (2024) The relationship of milk expression pattern and lactation outcomes after very premature birth: A cohort study. PLoS ONE 19(7): e0307522.

36

Background Recommendations

- World Health Organization guidance for mothers whose infants cannot breastfeed recommends pumping at least 7 times in 24 hours, including at least once in the night.
- UNICEF UK Baby Friendly Initiative recommends pumping 8-10 times in 24 hours with no more than a 6 hour break over night.
- UNICEF UK Baby Friendly Initiative- Target expressed milk production of 750ml/day by day 10-14 pp.

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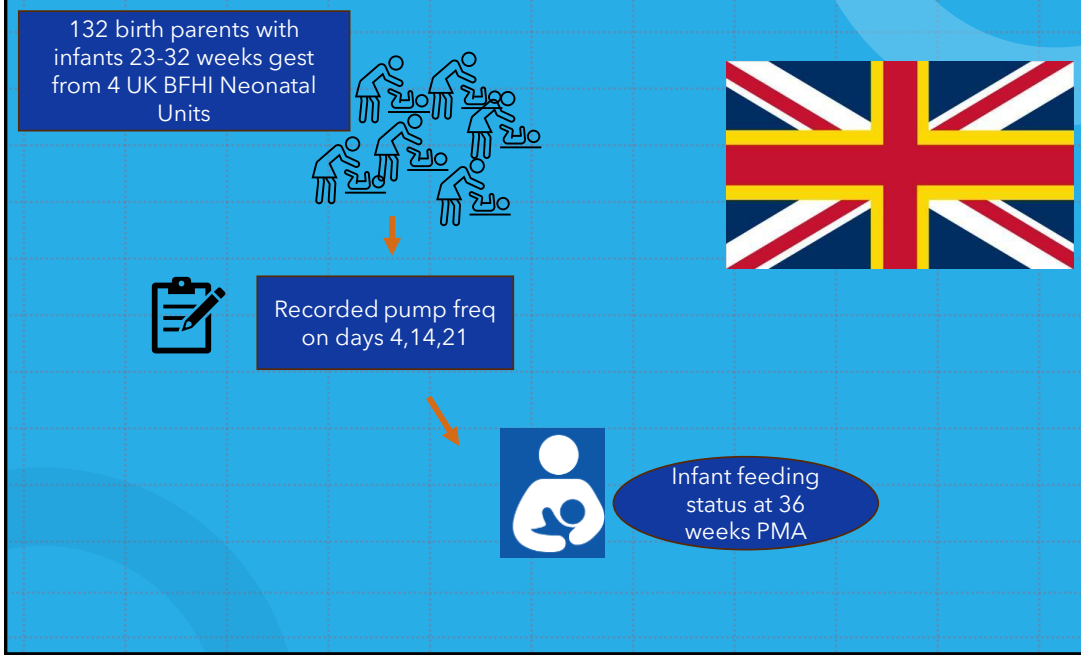

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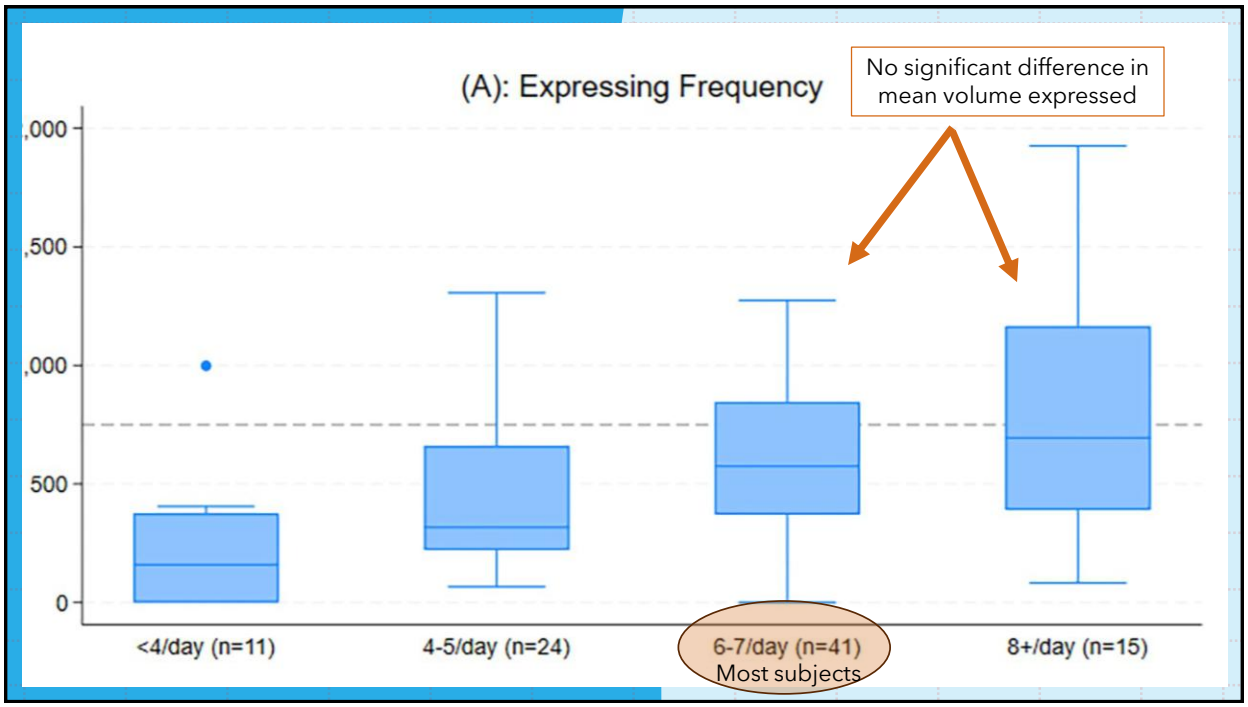

39

Table 5. Adjusted association of expressing pattern in categories related to clinical recommendations, with yield.

	Day 4			Day 14			Day 21		
	24-hour milk yield in grams (95% CI)	p value	n	24-hour milk yield in grams (95% CI)	p value	n	24-hour milk yield in grams (95% CI)	p value	n
Expressing frequency									
Expressing ≥8/day	*[baseline]*		14	*[baseline]*		19	*[baseline]*		15
Expressing 6-7/day	-82.1 (-190.1 to 25.9)	0.14	30	-28.5 (-186.1 to 129.1)	0.72	43	-163.8 (-369.6 to 42.0)	0.12	41
Expressing <6/day	**-146.8 (-246.1 to -47.4)**	**0.004**	59	-150.2 (-327.7 to 27.2)	0.10	29	**-402.1 (-615.4 to -188.8)**	**<0.001**	35
Longest gap between expressions									
Longest gap <6 hours	*[baseline]*		27	*[baseline]*		41	*[baseline]*		36
Longest gap 6–7 hours	-41.1 (-137.5 to 55.3)	0.40	23	-100.5 (-254.6 to 53.5)	0.20	20	**-221.0 (-396.8 to -45.2)**	**0.01**	23
Longest gap ≥8 hours	**-114.1 (-195.0 to -33.3)**	**0.006**	52	**-152.7 (-292.7 to -12.6)**	**0.03**	28	**-294.6 (-462.3 to -126.9)**	**0.001**	28

https://doi.org/10.1371/journal.pone.0307522.t005

- No signif difference in volumes expressed at 4,14,21 days at 6-7x/day as compared to more than 8x/day
- No signif difference between longest gap being 6-7 hours vs less than 6 hours

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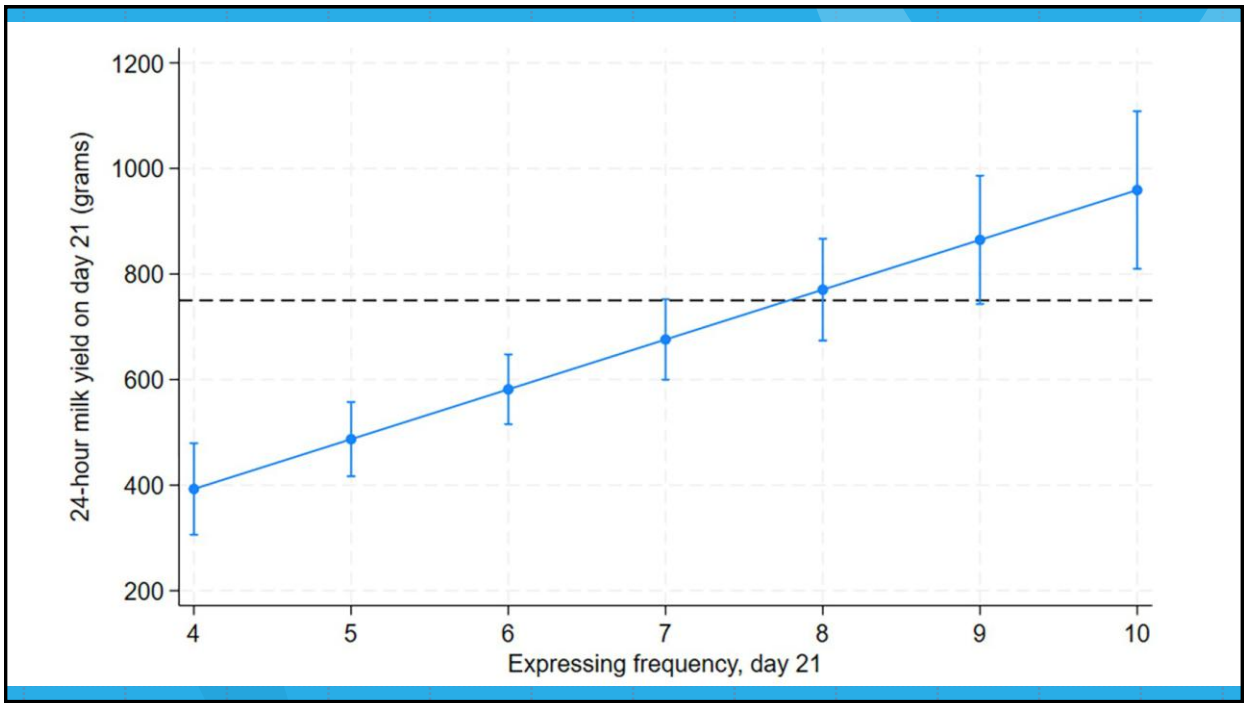

41

Conclusions

- Expressing frequency is related to milk yield.
- Expressing frequency only accounted for 8-22% of the variability of milk yield
- Even though the UK recommends pumping ≥ 8 times a day, few people achieved this, and the difference in volume was not statistically signif (small study).
- Most participants pumped 6-7 times a day
- Milk yield decreased by 30g for every hour increase of the longest gap between pump sessions on day 21.
- Authors states that the biggest limitation of this study is sample size. Others are patient reported data, and loss of participants at days 14 and 21 (day 4 n=103, day 14 and 21 n= 91). We also don't know bfeeding education provided for subjects.

42

What Medications and Substances Can Slow or Decrease Milk Production?

43

Substances That Can Slow or Inhibit Milk Production

- Cabergoline
- Estrogen-containing birth control pills
- Progesterone birth control, esp in the first 6 weeks
- Decongestants- pseudoephedrine
- Aripiprazole (Abilify) and brexpiprazole (Rexulti)
- Nicotine, tobacco
- Alcohol
- High dose steroids
- Epinephrine
- Antihistamines, especially frequent use
- Herbal teas/supplements
- Placenta encapsulation

44

What Pump-Specific Issues can Slow the Rate of Low Production?

- Low pump vacuum
- Ill fitting shields
- Using a cycle that is too fast
- Not pumping often enough
- Not pumping long enough
- Difficulty with let-down

45

Let's Discuss High Milk Production

46

You are meeting with Frankie, a G2P1 mother who is 29 weeks pregnant. Frankie had high milk production and frequent clogged ducts with her first infant Polly, who was born 2 years ago.
Polly didn't nurse well early postpartum, so she pumped after each breastfeeding session for 3 weeks. She recalls storing an extra 500ml in the freezer each day by 3 weeks. This was associated with clogs and mastitis, and she does not want this to happen again. She would like advice on getting off to a great start, and to avoid over production with her second infant.
How would you advise Frankie?

47

Getting Off to a Great Start and Preventing Overproduction of milk

- Nurse her baby regularly, ad lib, at least every 3 hours day and night.
- Avoid using the pump early postpartum.
- If breasts feel too full during secretory activation, hand express or use a hand pump, just to comfort. A double electric pump will stimulate prolactin too much.
- Mint tea, 1 cup once or twice a day for 1-2 days at most, can provide a gentle slowing of milk production.

48

You are seeing Mimi, a 23 yo G1P1 mother who is exclusively pumping for her 4-week old baby Bruce, who is in the neonatal intensive care unit.
She expresses concern about pain with pumping.
What are questions that you would ask her?

49

Evaluating Pain with Pumping

- Type of pump
- Flange size, how she had her flanges fit
- Pump settings- freq, vacuum
- Frequency of pumping
- Does she use a hands-free bra?
- Does she have nipple trauma or nipple changes with pumping?
- Does she have a rash?
- Did she have nipple pain during pregnancy?
- Describe the pain- in the breast and nipples? Quality of pain? Pain between times of pumping?

50

Evaluating Mimi's Pain with Pumping

- Type of pump- Spectra
- Flange size, how she had her flanges fit- She fit the shields herself using 28mm shields
- Pump settings- freq, vacuum- She uses 46 for cycle #, and 10-11 vacuum
- Frequency of pumping- every 3 hours with a power pumping session once a day
- Does she use a hands-free bra? – not really, she does the bra hack
- Does she have nipple trauma or nipple changes with pumping?- she notices that her nipples look swollen after nursing
- Does she have a rash? Not that she is aware of
- Did she have nipple pain during pregnancy? no
- Describe the pain- in the breast and nipples? Quality of pain? Pain between times of pumping? The nipples hurt during pumping but not in the breasts or in between pumping sessions

Thoughts?

51

Evaluating Mimi's Pain with Pumping

Image from Physicians Guide to Breastfeeding

Thoughts?

52

Conclusions

- Double pumping can raise prolactin more than breastfeeding, leading to over production of milk and breast inflammation with clogs and mastitis.
- There are several risk factors for low production that are not related to pumping technique or frequency.
- Nipple pain with pumping can be sorted out by evaluating flange size, pump settings, and breast exam for trauma.

53