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Katherine M. Evans

University of Vermont, kmevans@uvm.edu

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Induced Lactation

Katherine Evans, MS-IV
University of Vermont College of Medicine
Women's Health Teaching Seminar
June 23, 2015

Definitions

- Induced Lactation: triggering breast milk production in a woman who has never been pregnant
- Relactation: triggering breast milk production in a woman who has given birth but who either did not breastfeed or stopped breastfeeding
- Galactorrhea: pathologic secretion of breast milk in non-puerperal women or post-partum breast milk production that persists despite lack of breast stimulation (“inappropriate lactation”)

So relactation applies to women “who previously breastfed a biologic child even years before and now is adopting a newborn.”

Utility of Induced Lactation

- Adoption
- Surrogacy
- Same-Sex Couples
- Maternal-Infant Separation
- Emergencies/Natural Disasters

Note: women in any of these categories can fall into either the induced lactation OR the relactation camp, depending on circumstances

Goals of Induced Lactation

- Exclusive Breastfeeding
 - Infant receives all of his/her nutritional needs from breastmilk
- Partial Breastfeeding
- Infant Bonding
 - Many women desire to induce lactation for the emotional benefits and relational closeness experienced by both mother and baby
 - Commonly the main reason behind inducing lactation

Positive attitude, motivation, and commitment are key.

This means being grateful and celebrating even when only tiny drops are produced.

Auerbach & Avery: had women rank in order the reason(s) behind wanting to induce lactation. Here is the ranked list.

1. Mother-infant relationship
2. Emotional benefits to baby
3. Body contact with baby
4. Nutritional benefits to baby
5. Nuturant fulfillment of mother
6. Ability to produce milk
7. Breastfeeding as a reflection of femininity
8. Amount of milk produced
9. Physical changes in mother

Success

- It is possible!
 - Even women who had not been preparing their breasts before the arrival of the infant were able to induce lactation
- “Success” can only be measured against the goal
 - For many women, exclusive breastfeeding is not primary
- “Success” is not negated by the need for infant supplementation
 - In cases of adoption or surrogacy, the birth mother may be willing and able to provide breast milk
 - Donor milk and cow’s milk formula as alternatives

Auerbach & Avery: 76% had positive experience

Note: inducing lactation is a PROCESS – it does not happen overnight. Peak production usually occurs 10-12 weeks after the first drops are made, which in itself may take weeks to occur.

→once baby arrives and is put to breast, onset of lactation is between 1-6 weeks; closer to 1-2 if the baby is receiving at-breast supplementation.

Induced lactation can be successful whether the infant’s arrival is anticipated or not. Often the adoption process is tricky and getting a timeline may be impossible; also, this same concept applies to inducing lactation in the case of maternal-infant separation (i.e. maternal death/illness which occurs suddenly).

Success

- Women in developing nations are more likely to achieve exclusive breastfeeding than women in developed nations
 - While inducing lactation is relatively new to Western countries, it has a longstanding history in many other parts of the world
 - Cultural influences and level of support for induced lactation and breastfeeding
- Women who have previously lactated are more likely to achieve exclusive or partial breastfeeding than women who have never lactated
 - Women with a history of lactation have more developed mammary tissue that is more responsive to breastfeeding stimuli
 - Nipple stimulation alone may suffice to induce lactation in these women
 - Lactation-naïve women often require a multi-faceted approach

WOMEN WHO THINK THEY WILL PRODUCE MILK ARE MUCH MORE LIKELY TO ACTUALLY PRODUCE MILK!!! CONFIDENCE AND POSITIVITY.

- Knowledge of breastfeeding → High exposure to breastfeeding starting from childhood, which increases confidence
- Beliefs surrounding breastfeeding and child care → Unrestricted vs. restricted breastfeeding; close contact with mother
- Encouragement to breastfeed → Expectation is to breastfeed; Uncommon to perceive lactational insufficiency (vs. in the West)
- Support for mothering (particularly, of adoption)
- Infertility and body confidence → Developing nations: adoption less likely due to issues of infertility
- Pregnancy and breastfeeding history → As above, adoptive mothers in developing nations are more likely to have lactated previously
- Use of pharmaceutical galactagogues and factors impacting hormone levels → Obesity increases estrogen → decreases prolactin

Having knowledge and support and breastfeeding more frequently. Do not begin counseling women by saying “it’s impossible for you to produce enough milk to exclusively breastfeed” as this becomes a self-fulfilling prophecy.

Building the Foundation for Induced Lactation

- Psychological factors have major influence
 - Breast stimulation during sexual intercourse does not trigger breast milk production
 - Positive mindset
 - Confidence in ability to produce milk
- Social support is key
 - Personal and healthcare realm
- Consultation with physician and lactation consultant
 - Education and encouragement

There is no example of behavioral changes taking place without these things (i.e. psychological mindset intact and primed, social support, education) being present! Induced lactation is no different.

Physiologic Basis for Inducing Lactation

- Human mammary tissue must be primed for lactation
 - Development and maturation (“mammogenesis”) is not complete until pregnancy
 - Estrogen → ductal development
 - Progesterone → lobular and alveolar development
 - Prolactin → lobular and alveolar development

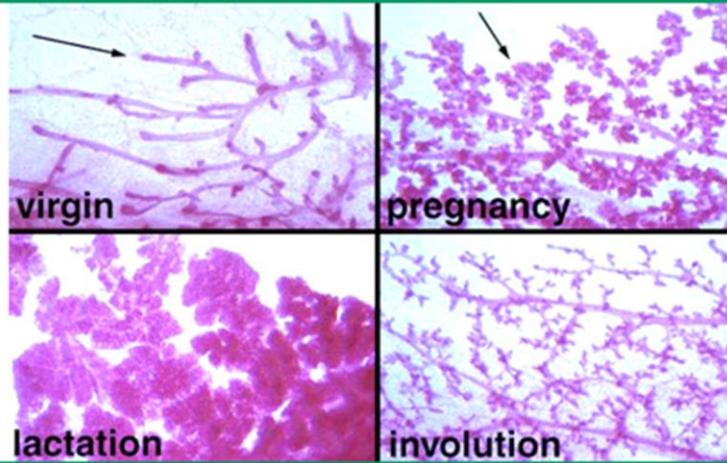
Hormonal influences triggering lactation.

The maturation that occurs in early pregnancy is known as “mammogenesis II” and involves the proliferation of both lobular and ductal systems within the breast glandular tissue (progressing into type 4 lobules, which are NOT present in the breasts of women who have never been pregnant).

Note that progesterone and estrogen are strong inhibitors of prolactin. So while prolactin is able to exert a minor effect in completing breast maturation and enabling the production of colostrum, full milk production is unable to occur in the presence of progesterone. Progesterone inhibits the mRNA synthesis of milk proteins triggered by prolactin; estrogen prevents prolactin from entering milk secretory cells effectively.

Nipple and breast stimulation are known to rise serum prolactin levels slightly. This is essentially the ONLY stimulus for prolactin secretion. However, oxytocin is released in response to not only breast/nipple stimulation, but also to sensory stimuli (sight, smell, hearing, touch, taste).

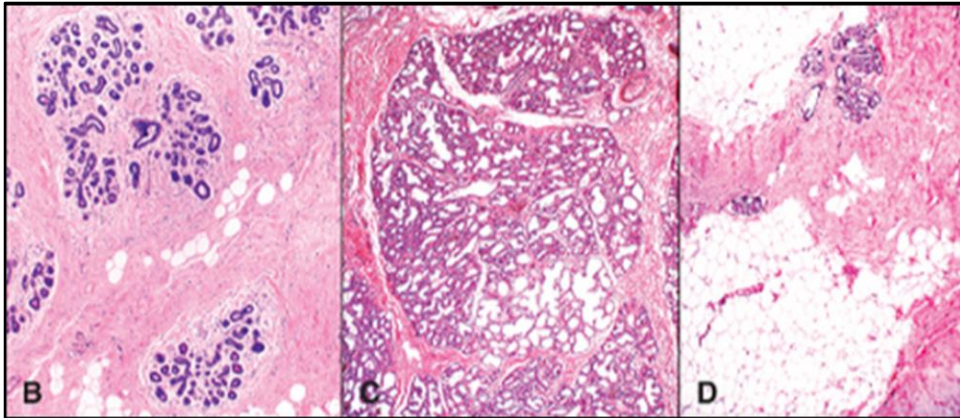
Development of mammary gland



Reproduced with permission from Lothar Hennighausen.

Graphic 76317 Version 2.0

Schanler RJ, Potak DC. Physiology of lactation.



- B: Nulligravid → few small lobules, abundant stroma
- C: Pregnancy → many large lobules
- D: Postmenopausal → involution of lobules, stroma replaced by adipose

Kumar V, Abbas AK, Fausto N, Aster JC. Robbins and Cotran pathologic basis of disease.

The density of a young woman's breast stems from the predominance of fibrous interlobular stroma and the paucity of adipose tissue. Before pregnancy the lobules are small and are invested by loose cellular intralobular stroma. Larger ducts connect lobules. C, During pregnancy, branching of terminal ducts produces more numerous, larger lobules. Luminal cells within lobules undergo lactational change, a precursor to milk formation. D, With increasing age the lobules decrease in size and number, and the interlobular stroma is replaced by adipose tissue.

Physiologic Basis for Inducing Lactation

- Production of milk (“lactogenesis”) occurs in stages
 - Lactogenesis I begins during pregnancy and yields colostrum
 - Lactogenesis II occurs postpartum and yields mature milk
 - Withdrawal of estrogen and progesterone → prolactin activates receptors on primed alveoli to begin making milk
 - Oxytocin → activates smooth muscle to squeeze milk out of lobules
 - Lactogenesis III (“Galactopoeisis”) maintains production
 - Adequate removal of milk is the stimulus for further milk production

Comparison of Colostrum (day 1) and Mature Human Milk*

<u>Constituent (per liter)</u>	<u>Colostrum</u>	<u>Mature Milk</u>
Energy (kcal/deciliter)	57.0	65.0
Lactose (g)	20.0	35.0
Protein (g)	32.0	9.0
Fat (g)	12.0	29.0



Naylor AJ, Wester RA. Wellstart international

Colostrum: for the first 2-4 days after birth

Transitional: 7-10 days after delivery

Mature: by 14 days after delivery

The Nitty Gritty

- There is a dearth of evidence-based guidelines on the most effective and safest method(s) to induce lactation
 - Most publications are case reports
- Research on galactorrhea and augmenting milk supply in postpartum breastfeeding mothers, combined with anecdotal evidence and folklore have all informed current practice
- Huge variation in published protocols
 - None have been officially endorsed by the AAP, AAFP, ACOG, or ABM

Variation: should breast pumping occur before hormones or after? Do galactagogues (including herbs) work? Timing of all of this?!?!?

AAP: American Academy of Pediatrics

AAF: American Academy of Family Physicians

ACOG: American College of Obstetricians and Gynecologists

ABM: The Academy of Breastfeeding Medicine

Physiologic Interventions

- Nipple Stimulation = Essential
 - Baby suckling
 - Manual massage
 - Breast pump
- Skin-to-Skin = Essential
- Supplemental Feeding Systems
 - Provide at-breast supplementation
 - Baby's suckling is most effective breast stimulation
 - Flow of milk provides continued stimulus to infant
 - May be effective alone or in conjunction with preparatory efforts



Lenore Goldfarb, PhD, IBCLC

Goldfarb L. The premature infant – a mother's perspective [Internet].

Photo: Lenore Goldfarb, PhD, IBCLC

Nipple stimulation: this is the ONLY intervention listed in some induced lactation protocols

Nipple stimulation: stimuli listed in decreasing order of efficacy.

Ideally, frequent nipple stimulation (5 minutes per breast several times daily) beginning 6 weeks before baby arrives.

Ideally, hospital-grade electric pump to double pump every 3 hours for 8 weeks before baby arrives.

Remember that breastfeeding is not robotic; it is the intimate interaction between two individuals who nurture one another. Thus, an environment of calm, peace, and skin-to-skin contact decrease the stress that may interfere with effective milk let-down/transfer and latch.

At-Breast Supplementation

Medela Supplemental Nutrition System (SNS)

- Relies on gravity
- Two tubes



Lact-Aid Nursing Trainer System

- Relies on baby's suckling
- One tube



SNS: <http://www.selfexpressions.com/supnursys.html>

Lact-Aid: http://www.medscape.com/viewarticle/540786_5

Pharmacologic Interventions

- Hormones
 - Given and then abruptly stopped to mimic pregnancy and withdrawal of hormones that occur with parturition
 - OCPs
 - Medroxyprogesterone (Depo-Provera) ± Estrogen
 - Promote breast maturation but inhibit lactation so must discontinue once breasts enlarge but prior to breastfeeding
- Galactagogues
 - Increase serum prolactin
 - Continued until milk supply is established
 - Studied primarily in postpartum women with poor milk supply
 - May be difficult to generalize to induced lactation population
 - May be less effective in induced lactation population, especially if breasts are naïve (i.e. unprimed by stimulation and hormones)
- Oxytocin (nasal spray)
 - Difficult to attain in US; requires compounding pharmacy

OCPs: best to stop their usage 24-48 hours [other sources say stop 4 weeks before] before baby arrives (if possible to plan so exactly).

Thearle & Weissenberger study: Depo 2.5-40mg + estrogen 0.05-0.4mg daily over 6-9 months

Nemba study: one dose of Depo 100 mg, 1 week before receiving chlorpromazine 25 mg qid or metoclopramide 10 mg qid.

Galactagogues

Agent	Mechanism of Action	Recommended Dosage	Availability in the United States	Side Effects	Hale's Lactation Risk Category*
Metoclopramide	Dopamine antagonist; crosses blood-brain barrier	Oral: 10-15 mg, 3 times per day	Yes	Diarrhea, sedation, depression, tremor, bradykinesia	L2
Domperidone**	Peripheral dopamine antagonist; crosses blood-brain barrier minimally	Oral: 10-20 mg, 3-4 times per day	NO	Dry mouth, skin rash or itching, headache, gastrointestinal disturbance	L1
Sulpiride	Selective dopamine antagonist	Oral: 50 mg, 2 times per day	No	Tremor, bradykinesia, acute dystonic reactions, sedation	L2
Chlorpromazine	Central nervous system tranquilizer; blocks dopamine receptors	Oral: 25 mg, 4 times per day reported; use not recommended because of associated adverse reactions	Yes	Sedation, lethargy, tremor, bradykinesia, weight gain	L3
Fenugreek	Herbal supplement; reputation as a galactagogue, but mechanism of action unknown	Oral: 2-3 capsules, 3 times per day; variable	Yes	Maple syrup odor in urine and sweat, diarrhea, hypoglycemia, dyspnea	L3
Blessed Thistle	Herbal supplement; reputation as a galactagogue, but no data support this use	Unknown	Yes	None	L3

Wittig SL, Spatz DL.

Witting

Galactagogues will NOT make the milk supply; only skin-to-skin and nipple stimulation can do this. However, they may be helpful in augmenting supply and initiating production.

Mixed/variable efficacy. Should be combined with nipple stimulation.

Metoclopramide

- Significant neurological (extrapyramidal) side effects
- Strong association with depression
- Use limited to 14 days for the purposes of induced lactation
- Not as effective as domperidone

Agent	Mechanism of Action	Recommended Dosage	Availability in the United States	Side Effects	Hale's Lactation Risk Category*
Metoclopramide	Dopamine antagonist; crosses blood-brain barrier	Oral: 10-15 mg, 3 times per day	Yes	Diarrhea, sedation, depression, tremor, bradykinesia	L2

Wittig SL, Spatz DL.

Domperidone

- Reports of adverse cardiac events with IV formulation has prompted the FDA to make it illegal in the US to prescribe any formulation for any reason (although no adverse cardiac effects have been described from the oral formulation)

Agent	Mechanism of Action	Recommended Dosage	Availability in the United States	Side Effects	Hale's Lactation Risk Category*
Domperidone**	Peripheral dopamine antagonist; crosses blood-brain barrier minimally	Oral: 10-20 mg, 3-4 times per day	NO	Dry mouth, skin rash or itching, headache, gastrointestinal disturbance	L1

Modified from Wittig SL, Spatz DL.

Domperidone made “orphan” status for hypoprolactinemia in breastfeeding and this opens the door for it to be studied exclusively in women looking to augment/induce lactation. Dr. Thomas Hale is largely behind these efforts to study the safety of the drug in both mother and baby, and to eventually reintroduce it to the market. <http://www.emeraldcoastbreastfeeding.com/2011/09/15/domperidone/>

Herbal Supplements

- Fenugreek
 - Caution in women with diabetes mellitus (risk of hypoglycemia)
 - Caution in women with asthma (may exacerbate symptoms)
- Blessed Thistle
 - Potential adverse: allergies (in the ragweed family)

Agent	Mechanism of Action	Recommended Dosage	Availability in the United States	Side Effects	Hale's Lactation Risk Category*
Fenugreek	Herbal supplement; reputation as a galactagogue, but mechanism of action unknown	Oral: 2-3 capsules, 3 times per day; variable	Yes	Maple syrup odor in urine and sweat, diarrhea, hypoglycemia, dyspnea	L3
Blessed Thistle	Herbal supplement; reputation as a galactagogue, but no data support this use	Unknown	Yes	None	L3

Wittig SL, Spatz DL.

Fenugreek: 1830 mg tid

-avoid in pregnancy → stimulates uterine contractions

Blessed Thistle: 1170 mg tid



Supplement Facts

Serving Size 1 Cup Brewed Tea Servings Per Container 16

	Amount Per Serving	%DV
Calories	0	
All Herbal Ingredients:		
Organic bitter fennel fruit [PhEur]**	560 mg	†
Organic anise fruit [PhEur]**	350 mg	†
Organic coriander fruit [PhEur]**	210 mg	†
Organic fenugreek seed [PhEur]**	35 mg	†
Organic blessed thistle herb [DAC]**	35 mg	†
Proprietary Blend:	560 mg	
Organic spearmint leaf		†
Organic West Indian lemongrass leaf		†
Organic lemon verbena leaf		†
Organic marshmallow root		†

† Daily Value (DV) not established.

Made By TRADITIONAL MEDICINALS
 4515 Ross Road, Sebastopol, CA 95472
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All Ingredients Certified Organic



This product is intended for use when nursing. Please discuss use of this product, and any other supplement products, with your lactation consultant, midwife or other healthcare practitioner.

Do not use this product if you are allergic to plants in the parsley (Apiaceae) family, such as fennel or coriander, or plants within the daisy (Asteraceae) family such as chamomile, echinacea or blessed thistle. **If pregnant and breastfeeding,** consult your lactation consultant, midwife or healthcare practitioner prior to use.

**This is the pharmacopoeial quality standard we use because quality matters.

Mother's Milk Tea [Internet].

<http://www.traditionalmedicinals.com/products/mothers-milk/>

- Fenugreek: 35 mg
- Blessed Thistle: 35 mg
- Marshmallow root

Antipsychotics

- Sulpiridie (unavailable in US)
- Clorpromazine

Agent	Mechanism of Action	Recommended Dosage	Availability in the United States	Side Effects	Hale's Lactation Risk Category*
Sulpiridie	Selective dopamine antagonist	Oral: 50 mg, 2 times per day	No	Tremor, bradykinesia, acute dystonic reactions, sedation	L2
Chlorpromazine	Central nervous system tranquilizer; blocks dopamine receptors	Oral: 25 mg, 4 times per day reported; use not recommended because of associated adverse reactions	Yes	Sedation, lethargy, tremor, bradykinesia, weight gain	L3

Wittig SL, Spatz DL.

Others

- Thyrotropin Releasing Hormone (TRH)
 - Promotes release of Prolactin and TSH
- Milk thistle
- Fennel
- Alfalfa
- Oats
- Marshmallow root
- Stinging Nettle
- Theophylline (coffee, tea)
- Goats rue
- Placenta
- Growth hormone (in animal models)



Encapsulated placenta

Photo: encapsulated placenta; <http://doula-services.com/placenta-encapsulation/>

On The Horizon

- SQ recombinant human prolactin (r-hPRL)
 - Studied in women with lactation insufficiency who were pumping for their preterm infants and in women with documented lactation deficiency
 - Prolactin was shown to increase milk volume and immunoglobulin secretion into breast milk, mimicking normal lactogenesis
 - Clinical trials for wider application ongoing
 - INDUCED LACTATION!

<http://pediatrics.aappublications.org/content/127/2/e359.full.pdf>
<https://clinicaltrials.gov/ct2/show/NCT00181610>

Case Report Strategies

- Szucs (long notice)
 - Domperidone 10 mg qid 20 weeks before
 - Domperidone 20 mg qid 19 weeks before
 - Norethindrone and ethinyl estradiol (OCPs) 20 weeks before (for 12 weeks, but stopped after 10)
 - Began pumping 6-7 times/day & taking fenugreek (1200 mg tid → 1830 mg) and blessed thistle (340 mg bid → 1020 mg) after OCPs stopped
- Wilson (long notice)
 - Ethynodiol diacetate/ethinyl estradiol 1mg/35mcg for 8 weeks 12 weeks before
 - On week 3 of OCPs, added domperidone
 - Herbal tea: fenugreek
 - Began pumping 4-5 times/day after OCPs stopped

Case Report Strategies

- Cheales-Siebenaler (short notice)
 - Pumped every 3-4 hours combined with at-breast supplementation
 - Oxytocin (syntocinon) nasal spray before each pumping
 - Metoclopramide 10 mg tid
- Nemba (short notice: all saw milk within 14 days)
 - All: infant suckling, psychosocial support and readiness
 - Lactation-naive:
 - Single 100 mg dose of medroxyprogesterone
 - 1 week later, begin chlorpromazine 25 mg qid and/or metoclopramide 10 mg qid until adequate lactation established
 - Lactation-experienced:
 - Chlorpromazine 25 mg qid and/or metoclopramide 10 mg qid until adequate lactation established

Lawrence & Lawrence Strategies

- Approach 1
 - Begin manual breast stimulation 8 weeks prior
- Approach 2
 - May utilize OCP continually, but need to be discontinued about 4 weeks prior
 - Double pump (gradually increase from 5 minutes 3x/d to 10 minutes every 4 hours)
 - Initiate domperidone
- Approach 3
 - 2 weeks of OCPs with breast stimulation



Ruth Lawrence, MD

Book (Breastfeeding: A Guide for the Medical Profession)

Ruth A. Lawrence, MD (University of Rochester)

<https://www.urmc.rochester.edu/people/20996369-ruth-a-lawrence/articles>

Newman-Goldfarb: Regular Protocol

- 6 months before: continual OCPs and 10 mg domperidone qid (to 20 mg after 1 week)
- 6 weeks before: stop OCP and begin pumping every 3 hours (5-7 mins, then massage, then 5-7 mins)
- 4 weeks before: may begin blessed thistle 1170 mg tid and fenugreek 1830 mg tid
- Upon arrival: continue domperidone until milk supply is established and pump for 10 minutes after each feeding until established (may then consider slowly weaning herbs and domperidone)

This is the “classic” protocol, but due to the FDA making prescribing domperidone illegal, and owing to the substantial negative (and sometimes irreversible) side effects of metoclopramide, the protocol is essentially impossible to follow in the USA.

Newman-Goldfarb: Accelerated Protocol

- Yasmin (drospirenone or Microgestin with domperidone 20 mg tid for 30-60 days until breast enlarges
- Then stop the hormone and begin pumping every 3 hours, also start blessed thistle and fenugreek

Yasmin = Drospirenone 3 mg & ethinyl estradiol 0.03 mg (30 mcg)

Microgestin = norethindrone 1.5 mg & ethinyl estradiol 0.03 mg (30 mcg)

Newman-Goldfarb: Menopause Protocol

- Either Provera 2.5 or Prometrium 100 mg (avoid Ortho 1/35 if over age 35)
- Domperidone 10 mg qid for 1 week then up to 20 mg qid
- Stay on both until breast enlargement (but at least 60 days) → then stop hormones and continue domperidone and start pumping and using herbs as previously described

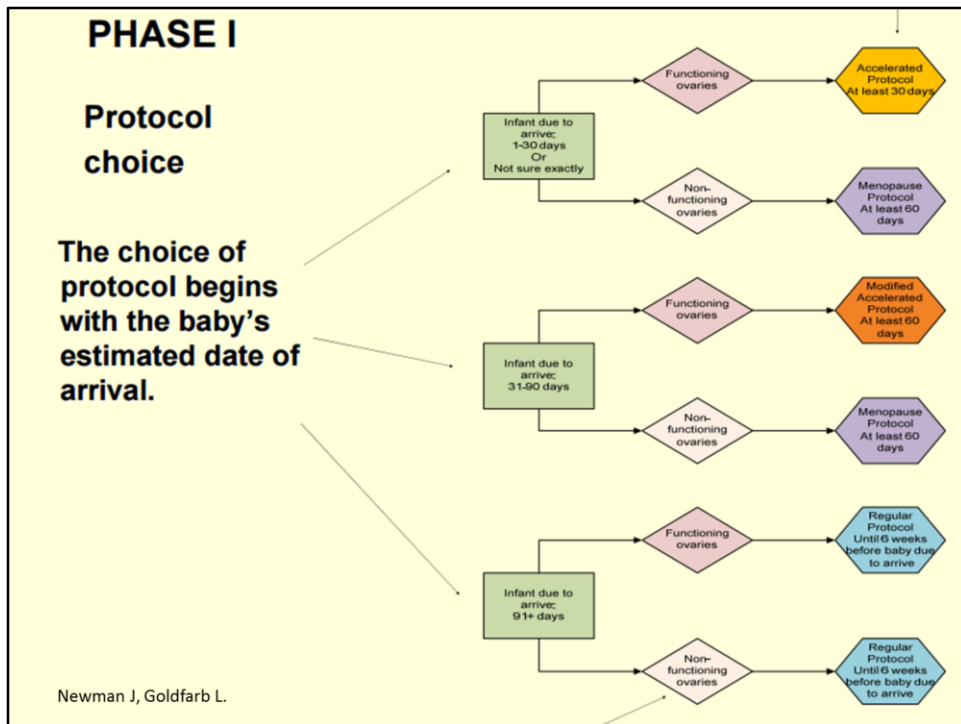
Ortho 1/35 = norethindrone 1 mg & ethinyl estradiol 0.035 mg (35 mcg)

Provera = medroxyprogesterone acetate

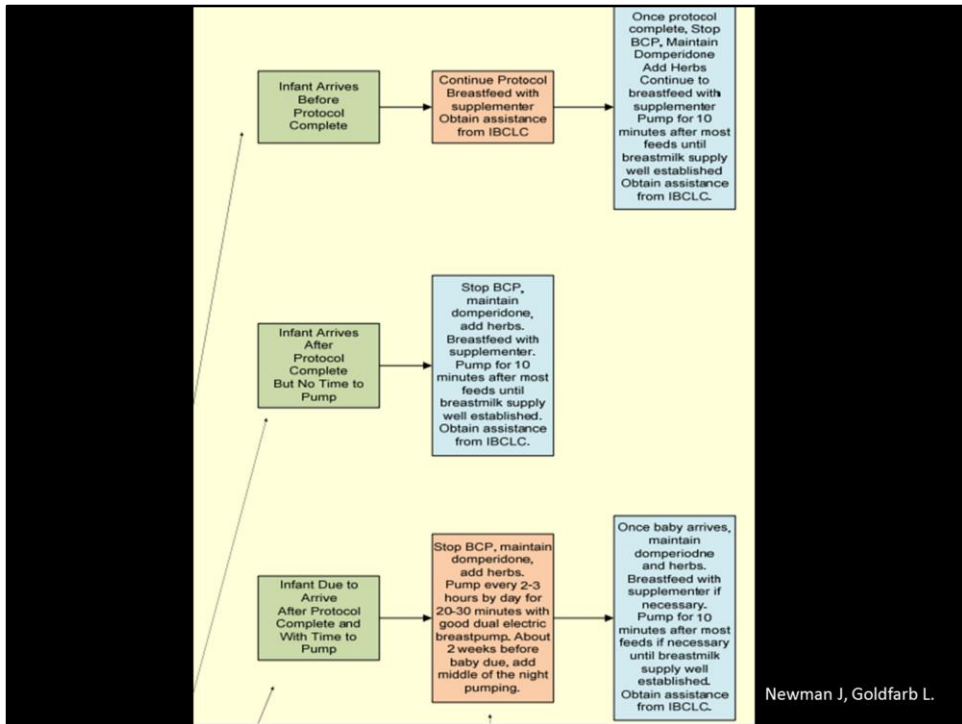
Prometrium = micronized progesterone

Newman-Goldfarb: Protocol Decision Tree

- Selecting the appropriate Newman-Goldfarb protocol for induced lactation
 - Estimated arrival of infant
 - Functional status of mother's ovaries
- Flowchart to guide protocol selection
 - Decision points for whether or not the mother has completed the protocol prior to the infant's arrival



http://www.asklenore.info/breastfeeding/induced_lactation/ilca2007decision_tool.pdf



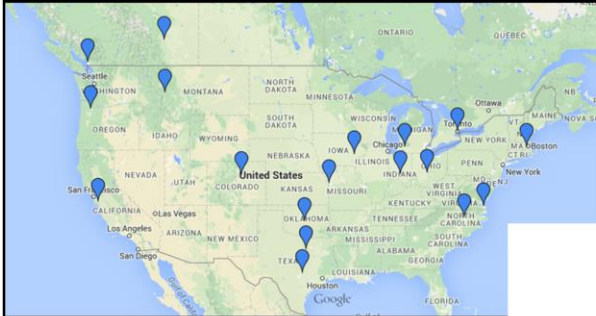
http://www.asklenore.info/breastfeeding/induced_lactation/ilca2007decision_tool.pdf

Induced Milk Composition

- Is it really the same?
 - The majority of women who induce lactation appear to lack colostrum
 - Milk produced is closer in composition to transitional or mature milk
 - Women who have previously given birth and breastfed the infant, and/or who have prepared their breasts with hormones may be more likely to produce colostrum-type milk
 - Likely very similar and with comparable amounts of protein
 - Note that the protein may be proportionally higher in albumin and lower in IgA
 - Studies have been unable to assess fat content, owing to small sample size or paucity of research

Donor Milk

- Difficult to receive insurance coverage
- Costs ~\$4.50 per ounce



HMBANA active milk banks [Internet].



Mothers' Milk Bank Northeast [Homepage on the Internet].

<http://www.nann.org/advocacy/agenda/reimbursement-for-donor-breast-milk-for-preterm-infants.html>

<http://milkbankne.org/>
<https://www.hmbana.org/locations>

Donor Milk: Recruiting Donors

I make milk.

What's **your** superpower?

Potential Donors [Internet].

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PMIDs

ABM: 21332371

Auerbach: 7193971

Bryant:16809652

Cheales-Siebenaler:10578774

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Emery:8715241

Gribble:17004343

Kleinman:7420228

Kulski:7193419

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Nemba:7932939

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Szucs:20571140

Nutritional:7024859

Thearle:6598379

Wilson:25311827

Wittig:18327104