

ABM Clinical Protocol #25: Recommendations for Preprocedural Fasting for the Breastfed Infant: “NPO” Guidelines

The Academy of Breastfeeding Medicine

A central goal of The Academy of Breastfeeding Medicine is the development of clinical protocols for managing common medical problems that may impact breastfeeding success. These protocols serve only as guidelines for the care of breastfeeding mothers and infants and do not delineate an exclusive course of treatment or serve as standards of medical care. Variations in treatment may be appropriate according to the needs of an individual patient. These guidelines are not intended to be all-inclusive, but to provide a basic framework for physician education regarding breastfeeding.

Purpose

THIS PROTOCOL WILL HELP define the minimum fasting requirements for breastfed infants and provide suggestions to avoid unnecessary fasts while improving the infant's safety and comfort during the required fasting periods. When providing guidance for breastfeeding mothers of *nil per os* (NPO) infants in the preprocedure period, the main goals are to:

- Prevent pulmonary aspiration of gastric contents during anesthesia or sedation
- Prevent hypoglycemia intraoperatively and during the NPO period
- Prevent volume depletion and maximize hemodynamics
- Minimize stress or anxiety in the NPO infant
- Support optimal breastfeeding of the dyad before and after the procedure

Both general anesthesia and moderate sedation require adherence to the same fasting guidelines that will be discussed in this protocol. For further information about sedation please refer to the guidelines created by the American Society of Anesthesiologists (ASA) Task Force on Sedation and Analgesia by Non-Anesthesiologists. As defined by these guidelines, “sedation and analgesia comprise a continuum of states ranging from minimal sedation (anxiolysis) through general anesthesia.”¹ For the purposes of discussing fasting guidelines in this protocol, the term anesthesia is used to encompass the continuum of moderate sedation to general anesthesia.

Background

Requiring a breastfed infant to fast for any period of time can be stressful for both the infant and the mother.² Hence, it is appropriate to minimize unnecessary fasting while maximizing the safety of diagnostic examinations, surgeries, and procedures with the patient under anesthesia.

Consequences of feeding prior to sedation or general anesthesia

The most serious sequela of noncompliance with fasting guidelines is pulmonary aspiration.³ Regurgitation and aspiration have been documented concerns of physicians providing sedation since the early 19th and 20th centuries⁴⁻⁶ and a leading cause of death under anesthesia in both adults and children. When this was established, all patients had to be NPO or nothing by mouth after midnight to avoid pulmonary aspiration syndrome.^{7,8} The fasting guidelines have developed through the years to be more reasonable for breastfeeding infants³ and are still evolving. Although potentially uncomfortable for the infant, the safest practice and most effective prevention of pulmonary aspiration is adherence to current fasting guidelines.

Mechanism

Upon initiation of sedation or induction of anesthesia, the gag and cough reflexes are inhibited; therefore, any remaining stomach contents can regurgitate and trickle into the open larynx that would have otherwise closed upon contact with acidic gastric fluid.⁹⁻¹¹ This can cause aspiration of solid food particulates and acidic gastric juices into the unprotected airway, which can then lead to pneumonitis or pneumonia. While the incidence of aspiration is low with proper fasting (anywhere from 3 to 10 out of every 10,000 anesthetics performed on children),^{3,12} the consequences of pulmonary aspiration of residual gastric contents can be serious.^{5-8,12} Aspiration pneumonitis may necessitate mechanical ventilation and/or a prolonged hospital course.³

Infants with multiple co-morbidities are placed in a higher risk stratification by the ASA, and they have a higher incidence of aspiration.¹²

Animal models

Animal models of pulmonary aspiration of gastric contents containing human breastmilk (HBM) are characterized by

airway irritability from inflammatory mediators, increased alveolar-to-arterial oxygen gradients, and decreased dynamic compliance. This leads to poor oxygenation and difficulty with ventilation¹³ and is especially evident when HBM is acidified. Death is more likely with gastric contents that have a pH of less than 2.5,¹⁴ with other studies showing increased death and severity with decreasing pH and increasing volume. Assuming that aspiration of HBM in an infant would have similar consequences as compared with animal studies, this could potentially affect adequate ventilation and oxygenation in the infant. Aspiration of larger volumes or concentrated particulate matter from HBM mixed with gastric juices further increases the severity of lung injury, including respiratory distress syndrome, alveolitis, atelectasis, and/or post-obstructive pneumonia.^{13,14}

Gastric emptying

Increased fat and protein content of a liquid correlates to increased gastric clearance times and heightened risk for aspiration. Acidified formula and casein formula empty from the stomach over a 3–4-hour period or more,^{15,16} but some formulas may take up to 6 hours to empty from the stomach. Gastric emptying time for cow's milk can also take up to 6 hours, similar to that of solids, although some studies show that it can empty almost as fast as HBM.¹⁷ Although some studies have demonstrated that HBM empties within 2–3 hours,^{15,17–20} gastric emptying times of HBM vary from infant to infant, and fat content of HBM is not consistent.²¹ The ASA perioperative task force on sedation recommends a four-hour fast from HBM due to individual variation in gastric emptying and human milk content, though this may differ from international recommendations.¹ Of note is that emptying time of liquids has not been proven to be altered by the presence of gastroesophageal reflux.¹⁸

Use of clear liquids

The only intake that is proven to empty from the stomach quickly is clear liquid, which can serve as a temporary substitute for HBM in the fasting period. Gastric volume and pH are not affected by unlimited ingestion of clear fluids up to 2 hours prior to anesthesia in healthy patients.^{17,19,21,22} Ad libitum ingestion of clear liquids 2–3 hours prior to anesthesia induction in high-risk populations, such as pediatric patients undergoing elective cardiac surgery, does not demonstrate additional risk when compared with healthy patients.^{22,23} Fast absorption of clear liquid minimizes the risk of residual gastric contents and pulmonary aspiration. Furthermore, the lack of particulate matter decreases the extent of lung injury if the clear liquid is aspirated.

Clear liquids, addressed below in our recommendations, may maintain electrolyte balance and can provide sugars to replenish glycogen stores in the fasting breastfed infant. Newborns have impaired gluconeogenesis, so it is important to offer frequent feeding.^{24,25} Up to 2 hours prior to anesthesia, a clear sucrose/electrolyte-based solution can be provided to the newborn. Aside from providing a safer form of volume and calories during a preprocedure fast from HBM, clear liquids ad libitum up to 2 hours prior to a procedure allow for greater infant comfort and less irritability.^{22,23}

Infant comfort

When an infant is not required to fast, breastfeeding can provide comfort during a painful procedure.²⁶ Otherwise, when the infant is fasting for a procedure and unable to access the breast for 4 hours, he or she may experience separation anxiety, frustration from hunger, and crying. In full-term healthy neonates, extensive crying causes oxygen desaturation, which can occasionally lead to cyanosis and bradycardia.²⁷ Non-nutritive sucking on a pacifier (dummy), when used as a temporary comfort measure, has been shown to reduce crying.^{28,29} Relief of anxiety is also potentially beneficial for improvement of gastric motility and increasing clearance of any residual gastric volume.³⁰

Prolonged fasting times

Although we cannot ask infants if they are anxious, hungry or thirsty, older children have stated that they are very hungry or "starving" in the perioperative period.³¹ The fasting period in pediatrics is sometimes prolonged beyond recommendations. Engelhardt et al.³¹ recently suggested that fasting times are commonly in excess of the recommended guidelines in a study of 1,350 healthy children 2–16 years old. Children are fasting 12 hours from solids instead of 6–8 hours and fasting from fluids for 7 hours instead of 2–4 hours.³¹ The fasting times for newborn breastfeeding infants may also exceed the recommended 4-hour period, causing unnecessary hypoglycemia, discomfort, and anxiety.

Recommendations

Quality of evidence for each recommendation, as defined in the U.S. Preventive Task Force guideline,³² is noted in parentheses (I, II-1, II-3, and III).

1. *Minor painless procedures or procedures requiring local anesthesia for pain control that do not require sedation or fasting.* Minor procedures such as circumcision with a local block, diagnostic examinations, placement of peripheral intravenous lines, and drawing blood can be performed without sedation or general anesthesia. A procedure that is considered minor should cause minimal physical trauma and psychological impact, therefore not requiring sedation. Without sedation, the infant can protect his or her airway with an intact cough/gag reflex, and thus fasting is not required (I).^{10,11} The need for sedation should be decided upon at the physician's discretion based on the intensity and duration of the procedure as well as the infant's medical history.¹ If sedation is not necessary, the need for oral analgesics or other means for comfort should be determined by the practitioner.
 - *If it is a minor procedure not requiring sedation or general anesthesia, then feed normally.* Infants are more likely to tolerate minor procedures when the usual feeding pattern is maintained. They will be more comfortable when they have eaten in a normal routine. Without anesthesia, even if the patient is sleeping during the procedure, the upper airway reflexes are intact, and infants will be able to naturally protect their airways (I).^{9,10}
 - *If possible, consider breastfeeding for comfort during the minor procedure without sedation.* Breastfeeding while

receiving a heel stick, intravenous placement, or drawing blood has been shown to be an effective means of pain relief and should be an option made available to mothers and infants (III).²⁶ Please refer to the Academy of Breastfeeding Medicine Clinical Protocol #23 for more information.²⁶

- *Exceptions for the active patient.* The child who is unable to follow instructions or cooperate because of age or level of development may require sedation for minor procedures after efforts to perform the procedure without it have failed. Under these circumstances, the procedure may need to be postponed so that the patient can follow strict fasting guidelines.
2. *Diagnostic examinations or invasive procedures requiring pharmacologic immobilization or sedation.* Procedures that are more painful or stressful, such as bone marrow biopsies or lumbar puncture with intrathecal chemotherapy administration, require sedation (III).² Other procedures may require a motionless patient, such as central line placement or magnetic resonance imaging/computed tomography exams. In these situations, a licensed anesthesia provider may need to perform a general anesthetic, but these procedures can possibly be performed under sedation if a strict sedation protocol is followed and the provider is well trained (III).^{1,33}
- *When should the infant fast?* When an infant undergoes a surgery or diagnostic examination under anesthesia, the mother must withhold breastfeeding for at least 4 hours prior to anesthesia (see Table 1) (III).^{1,3,21,34,35} Conditions such as gastroesophageal reflux disease have not been shown to change the gastric emptying times versus controls, so recommendations for these patients do not differ (I).¹⁸
 - *If the infant needs to fast, provide clear instructions to the caregiver.* The physician providing or supervising the sedation or anesthesia at the hospital, clinic, or surgery center must provide strict fasting instructions to minimize adverse outcomes such as pulmonary aspiration, hypoglycemia, and volume depletion (I). These in-

structions are often provided in a preprocedure office visit and/or by phone the day before the scheduled procedure. The mother can be reassured that adherence to fasting guidelines is for the safety of her child.

- *Consider the infant's daily medications.* Vital prescriptions such as antiepileptics, reflux, and cardiac medications should be taken as scheduled. If the prescription in the form of a clear sugar-based syrup, then the volume of the medication and its rapid absorption¹⁷ make the risk of aspiration of the medication lower than the risk of missing the needed prescription drug (I). This is also true of oral liquid acetaminophen/paracetamol, which may be given to the child prior to the procedure for analgesia. When possible, the dose can be timed a little earlier or a little later to separate the ingestion from the time of anesthesia. Whenever possible, nonprescription medications, multivitamins, or any medications that are opaque or alkaline should be avoided for 8 hours before a procedure because they are considered equivalent to solids (III).^{34,35}
- *It is best to finish breastfeeding at 4 hours prior to fasting and anesthesia.* Per ASA guidelines, the mother (or other caretaker) should be advised to finish breastfeeding or providing breastmilk to the infant approximately 4 hours prior to the scheduled surgery time, even if the infant needs to be awakened. Waking the child to feed 4 hours prior to the scheduled procedure decreases the risk for hypoglycemia and hemodynamic instability, especially in children less than 3 months old (II-1).^{24,25} This optimizes the infant's glycogen stores and volume status because the infant might otherwise sleep through the night and not receive optimal nutrition or hydration prior to the scheduled surgery or procedure.
- *Continue clear liquids until 2 hours prior to anesthesia.* Ad libitum clear liquids up to 2 hours prior to anesthesia or sedation are recommended (III).^{17,19-23,25,34-36} They are considered safe up to 2 hours prior because they empty from the stomach much more rapidly than HBM. They can prevent volume depletion, improve glycogen stores, and maximize hemodynamics by hydrating the infant. The most common clear liquids provided to breastfeeding patients are apple juice, water, sucrose-based solutions, clear broth (nonfat commercially prepared only—homemade will have fat in it), and electrolyte solutions. Water is least preferred because of the absence of a glucose source. If the mother prefers to avoid the bottle, the clear liquid can be offered via a small cup, syringe, or spoon (III).²⁶ Clear liquids can help to soothe an anxious infant while fasting and separated from the mother's breast. This can help to maximize satisfaction of the patient and parent and allow for a more pleasant perioperative experience.^{22,23}
- *Do not give formula and other HBM supplements for at least 6 hours prior to the anesthesia.* Enriched feedings include additives or supplements to expressed HBM,³⁷ like formula,¹⁵ protein powder, vitamins, or minerals. These empty more slowly from the stomach and worsen the lung injury if aspirated.¹³ Some fortifications to HBM may not change the gastric emptying (II-1),³⁸ but to avoid confusion, HBM given to an infant 4 hours prior to surgery must be "non-enriched."

TABLE 1. SUMMARY OF FASTING RECOMMENDATIONS TO REDUCE THE RISK OF PULMONARY ASPIRATION³⁵

Ingested material	Minimum fasting period (hours) ^a
Clear liquids ^b	2
Human breastmilk	4
Infant formula	6
Non-human milks ^c	6
Light meal ^d	6

These recommendations apply to healthy patients who are undergoing elective procedures. They are not intended for women in labor. Following the guidelines does not guarantee complete gastric emptying.

^aThe fasting periods noted above apply to all ages.

^bExamples of clear liquids include water, fruit juices without pulp, carbonated beverages, clear tea, and black coffee.

^cBecause non-human milk is similar to solids in gastric emptying time, the amount ingested must be considered when determining an appropriate fasting period.

^dA light meal typically consists of toast and clear liquids. Meals that include fried or fatty foods or meat may prolong gastric emptying time. Both the amount and type of foods ingested must be considered when determining an appropriate fasting period.

- *Do not give non-human milk for 6–8 hours prior to the anesthesia.* Gastric emptying times of soy, rice, or cow's milk vary, and volume ingested must be considered. Thus, it is safest to recommend that all non-human milk be held for 6–8 hours (III).^{17,34,35}
 - *Solid food must be avoided for at least 8 hours prior to the anesthesia.* An 8-hour fast is recommended for fatty or proteinaceous solids such as meat or any fried food (III).^{34,35} This is suggested for children who are at the stage of development when they are concurrently eating solid foods and breastfeeding. To avoid confusion, most physicians recommend a fast from all heavy solid meals, which would include most foods fed to babies, for an 8-hour period.^{3,34,35}
 - *Postpone sedation or anesthesia if fasting requirements are not met.* If an infant has breastfed within 4 hours prior to an elective sedation or anesthetic, the risk of aspiration of acidic contents or particulate matter is greatly increased (III).³ Attempts to allow "non-nutritive" suckling of the breast for infant comfort within the 4 hours prior to anesthesia may increase gastric contents and should not occur (III). Also, if clear liquids have been ingested in the 2 hours prior to sedation, the patient can have residual gastric contents. Thus, if the procedure is not an emergency, the case should be cancelled or postponed until the minimum fasting period is met.
3. *Comfort for the infant and mother during a fast.* Infant comfort during the fasting period can be addressed with a pacifier (dummy) or other measures such as swaddling, rocking, and holding by caregivers or nursing staff.²⁶ The mother holding the infant may send signals consistent with an impending meal; thus some mothers find that the infant may need to be held by another adult during the fasting period.
- *Use of a pacifier (dummy) in the NPO period.* Non-nutritive sucking on a pacifier (or a gloved clean finger)²⁶ has been shown to reduce crying spells and can be considered a temporary measure in the preoperative NPO period prior to the start of sedation or induction of anesthesia. Sucrose should be treated as a clear liquid if used with the pacifier for comfort. Therefore the use of sucrose should cease 2 hours prior to sedation per ASA guidelines (III).³⁵ Introducing a pacifier for the first time, with or without sucrose, may prove to be unrealistic in infants accustomed to breastfeeding. Also, mothers may try to avoid pacifiers (dummies) to prevent premature weaning. Studies on this have mixed results (I).^{39,40} If accepted by the infant and allowed by the mother, pacifiers (dummies) are an inexpensive and temporary way to relieve anxiety and improve the infant's comfort and physiologic status (I).^{25–29} Please refer to the Academy of Breastfeeding Medicine Clinical Protocol #23 for further information on comforting an infant with a pacifier and sucrose.²⁶
 - *If possible, express and store breastmilk during the NPO period.* Until the time the mother can breastfeed again, she should be encouraged to express and store HBM for her own comfort and to avoid feedback inhibition of milk synthesis. Mothers should be advised

of lactation rooms or other private spaces to express milk.

4. *Breastfeed immediately after the procedure.* After a minor procedure under anesthesia, if her child is stable, otherwise healthy, and the type of surgery does not prevent oral intake, a mother can immediately begin to breastfeed her infant as soon as he or she is awake (II-3).⁴¹ This increases comfort, reduces pain in the child, and is widely practiced and evidence-based, even following cleft lip and palate repairs.^{41–43}

Summary

The recommendations exist to protect the infant from pulmonary aspiration of gastric contents and to educate clinicians and parents of the risks associated with improper fasting. A summary of the current guidelines from the ASA Task Force for fasting periods for other foods or liquids a non-exclusively breastfed infant can ingest are provided in Table 1. Following the ASA guidelines helps prevent untoward events and decreases the risk of morbidity and mortality (III).^{3,35}

Current practice and evidence suggests that the safety of performing anesthesia is increased when a mother withholds breastfeeding for 4 hours, but no longer than this, prior to sedation or anesthesia. This is a general consensus in Western medicine (III).^{20,34,35} Hospitals and clinics are encouraged to review and revise their preprocedural instructions for caregivers, in order to integrate the current preprocedural fasting recommendations. Alternatives to comfort the infant during the fasting period improve patient, clinician, and parent satisfaction. By following the recommendations outlined in this protocol, the stress of the breastfeeding mother can be reduced, and the well-being of the NPO breastfeeding infant can be maintained.

Suggested Areas for Future Research

Consistency of HBM and gastric emptying time

There is insufficient evidence to determine if the variable consistency and components of HBM (i.e. fat content, protein, etc.) alter gastric emptying times. The contents of breastmilk in the first week are clearly different than the milk produced at 1 year. Some believe that breastmilk is similar in emptying times to clear liquids. Although studies have shown that it is safe to provide HBM up to 2 hours prior to a procedure, others report that the gastric emptying time can match that of 3% fat milk.¹⁷ This discrepancy could be due to the varying components of the HBM. Studies should be conducted with gastric ultrasound to determine the emptying time of an infant's meal of HBM that has been sampled throughout the meal for measurements of fat content and protein content. The gastric emptying time of a fat-rich HBM meal may be much longer than a mostly clear, lactose-rich meal of HBM that has a low fat content. In general it is safer to recommend that an infant not be fed HBM within 4 hours of sedation or anesthesia because it is undetermined if breastmilk will clear faster than this time period.

Co-morbidities in breastfeeding infants

There is insufficient published evidence to define whether gastric acidity or volume has a clear relationship to

gastroesophageal reflux disease, dysphasia symptoms, gastrointestinal motility disorders, cardiac disease, and metabolic disorders such as diabetes mellitus in breastfed infants. The risk of regurgitation and pulmonary aspiration may be increased in such disorders.²³ Although one study suggests that pediatric patients having elective cardiac surgeries share equal risk of aspiration with non-cardiac patients, there are not enough published scientific studies to support this hypothesis. More studies need to be performed on fasting infants with significant co-morbidities who are fed HBM.

Effect of non-nutritive sucking on gastric contents

It is difficult to find studies regarding measurement of gastric contents after an infant has been suckling on the mother's breast or a pacifier. It is well known that stimulation of the nipple causes milk let down in breastfeeding mothers, so "non-nutritive" sucking on the breast is likely impossible. This is even true if the mother has "prepumped" to make the breast more empty—even a small amount of breastmilk in the infant's stomach can have untoward consequences if aspirated. It almost certainly would increase the infant's gastric contents and delay the procedure. Sucking on a pacifier may have similar effects to chewing gum, which is known to increase gastric contents, but one study found the opposite to be true. Widström et al.³⁰ showed that sucking on a pacifier decreases gastric retention in tube-fed premature infants. Thus, aside from reducing anxiety and crying, pacifiers may also speed gastric emptying time and reduce the risk for aspiration. Effects of non-nutritive sucking on gastric contents need further investigation.

Pacifier use and weaning from breastfeeding

Pacifiers are an inexpensive means to reducing anxiety in an infant; however, pacifiers may contribute to early weaning from breastfeeding. Studies are inconclusive. If pacifiers are only used temporarily in the perioperative period, this risk of early weaning from the breast should be minimized.^{39,40}

Excessive fasting times

It is suggested that NPO guidelines are excessive and that the time from the last meal to the time of the procedures exceeds the amount of time required by fasting guidelines. The study of Engelhardt et al.³¹ demonstrated that fasting children 2–16 years old report significant hunger and thirst. No studies have addressed excessive fasting in breastfeeding infants. It is difficult to assess hunger and thirst in infants, but it is well known that their glycogen stores are used quickly and a fasting period of longer than 4 hours for a newborn infant can be detrimental.^{24,25} More evidence needs to be obtained pertaining to the actual fasting times of breastfeeding infants.

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ABM protocols expire 5 years from the date of publication. Evidence-based revisions are made within 5 years or sooner if there are significant changes in the evidence.

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