ABSTRACT: Infant colic is a diagnosis of exclusion; its true cause is not known. To rule out alternative diagnoses, obtain a detailed history, look for clues to an underlying organic disease or genetic syndrome, and perform regular head-to-toe physical examinations. The interventions most commonly used to treat colic include modification of parental behavior (such as increased carrying of the infant or decreased infant stimulation), milk- and/or soy-free formulas, modifications in the diet of a breast-feeding mother, soothing measures (such as car rides, rocking, or use of a pacifier), anticholinergic agents, sedatives, and alternative medicine approaches (such as sucrose solution, herbal teas, or infant massage). The medications used to treat colic-such as antispasmodics and anticholinergics-can have serious adverse effects; discuss the pros and cons of drug therapy with parents before prescribing these agents. Remind parents that colic resolves by age 3 to 4 months, regardless of the intervention used.

An age-old problem still routinely encountered in family practice is that of the irritable infant—and the child's frustrated, desperate parents. When we cannot find anything physically wrong with the child, we tell the parents that their infant is colicky. However, there is little agreement as to what exactly colic is, what causes it, or how it should be treated. This can make it difficult to reassure parents. Our goal here is to provide a practical approach to the infant with colic. We describe what to include in the workup, and we discuss the effectiveness of various treatment options.

WHAT IS INFANT COLIC?

Several definitions of colic have been used in clinical trials. These range from the very specific ("paroxysms of irritability, fussing, or crying lasting for a total of more than 3 hours a day and occurring on more than 3 days in any 1 week") to the general (eg, any crying that a parent brings to the attention of a health care provider because it is problematic for the family). The definition used can greatly affect the outcome of the trial. One study found that the incidence of colic varied from 1.5% to 11.9%, depending on which definition was used.

Obviously, newborns have to cry some time each day to communicate with their caregivers. At age 6 weeks, healthy infants cry almost 3 hours a day, with crying and fussing more prevalent in the evening. By age 12 weeks, crying time decreases to 1 hour per day; self-soothing measures, such as finger sucking, increase by this age. "Three or more hours per day" is the duration at which crying is commonly said to qualify as "colicky," and 3 months is the age at which colic is typically said to resolve.

In clinical practice, we find it reasonable to define colic as any inconsolable crying in a healthy infant for which there is no physical explanation. Crying is the main symptom, which may or may not be worse at night.

The cause of the inconsolable crying and irritability of colic is unknown. Proposed causes include:

- Innate problems in an infant's neurologic system, GI tract, or temperament.
- Allergies.
- The parenting style of the mother and/or father.

DIAGNOSIS

Colic is a diagnosis of exclusion. If a physical abnormality is identified as the cause of an infant's irritability, colic is not the diagnosis.

Besides obvious symptoms, such as failure to thrive, clues to underlying organic disease include irritability that is almost continuous and not episodic, vomiting, diarrhea, heme-positive stool, constipation, rash, and respiratory symptoms (Table 1). It is also unusual for colic to persist beyond age 3 or 4 months without some improvement; when this occurs, suspect an alternative diagnosis.

To confidently exclude underlying disease, obtain a detailed history that includes specifics of when and how long the infant cries and what worsens or relieves irritability. It is also important to ask the family what they think the cause of the crying is and to listen carefully to their concerns. The
parents' ideas about the cause may be correct, in which case their insight can help guide treatment. Parents sometimes describe other symptoms they believe are associated with the crying. These include red face, distended belly, and perceived painful bowel movements or gas. Although the definitions of colic used in the literature typically do not include these associated symptoms, their presence may suggest that colic is the diagnosis.

A complete, head-to-toe physical examination is essential. Carefully examine every body part. Palpate each extremity for point tenderness, which can indicate an occult fracture or hair tourniquet around a digit. A thorough eye examination, including fluorescein staining of the cornea, may reveal a corneal abrasion, which can cause protracted crying. Check the anus for fissures, which can be quite painful. Although there is no published evidence that anal stenosis plays a role in colic, some pediatricians believe that this can be a source of irritability. Describe each step of the examination to the parents as you perform it, and inform them of each normal finding.

If you suspect the infant has esophagitis or gastroesophageal reflux, order a barium swallow and a pH probe and consider a trial of appropriate medications, such as H₂ blockers, proton pump inhibitors, or motility agents.

Look for clues, such as subtle dysmorphic facial features, that may reveal an underlying genetic syndrome that can be associated with severe and prolonged irritability in infancy. One such syndrome is Williams syndrome; the mean duration of colicky behavior in infants with Williams syndrome is 7.4 months. Some genetic syndromes are fairly easy to identify in the neonate; others require more time for the associated features to become apparent.

**WHY TREAT A "BENIGN" CONDITION?**

Colic affects not only the newborn but also the entire family-sometimes profoundly. Stress and exhaustion levels are high in the family of a newborn; these levels are elevated still further if the infant is colicky. Moreover, bonding with an irritable child can be difficult.

Are colicky infants more likely to be abused, cause parental depression, or contribute to family dysfunction? And are there long-term sequelae for the child and the family? As with much of the research on colic, studies of its long-term consequences have yielded conflicting results. For example, families of colicky infants display more distress than control families and report more sleep and behavior problems in their child as long as 3 years after the colic has resolved. However, another study found that even though families of colicky infants displayed distinct psychological features—such as impaired problem-solving or poor communication skills—1 year after the colic had subsided, these features were not observed 2 years later. Whether colic has any longer-term impact is unknown.

**TREATMENT OPTIONS**

The interventions most commonly used to treat colic are modification of parental behavior, dietary modifications, soothing measures, medications for possible GI disorders, and alternative medicine approaches.

**Modification of parental behavior.** Much of the literature on the treatment of colic focuses on modification of parental responses. Whether this consists of a stepwise approach to assess that all the infant's needs are being met, reduced infant stimulation, or increased infant carrying, the end result is that the parents gain some sense of control. Certainly no major risks are associated with interventions of this sort. However, it is important to reassure parents that it is not something they are doing or not doing that is causing the colic.

**Dietary changes.** Intolerances of cow's milk protein, sugar, and iron have been proposed as possible causes of colic. Based on these possibilities, various dietary modifications can be tried. Intolerance of milk or soy can manifest itself in many ways, including vomiting, diarrhea, hematochezia, rash, and chronic respiratory symptoms. Whether it can occur solely as colic-without any other symptoms—is a matter of debate. Consider a trial of a hypoallergenic formula. A reduction in crying has been demonstrated when the diet was changed to a hydrolyzed casein or whey formula. There is debate over how long a formula should be tried before it is deemed unhelpful; there are also conflicting opinions as to whether a stepwise approach to dietary modification is preferable (ie, switching first to a soy-based formula and then, if no improvement is seen, to a hydrolyzed formula). Because infants who cannot tolerate milk protein are also likely to be intolerant of soy, we recommend that parents switch directly to a hydrolyzed formula. Anecdotal evidence suggests that a 2- to 3-week trial of the new formula is prudent; however, many parents report improvement in their infant after just 24 hours on a hydrolyzed formula. Keep in mind that specialized formulas are more expensive; we do not take lightly the decision to switch to one.

Parents occasionally ask whether a "high-iron formula" is causing their infant's discomfort. Iron in
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fortified formulas is an unlikely cause of colic or GI abnormalities. A study showed no difference in the incidence of spitting, gas, and crying between infants fed iron-fortified formula, those fed a low-iron formula, and those fed breast milk.\textsuperscript{19} The American Academy of Pediatrics (AAP) Committee on Nutrition recommends that all non-breast-fed infants from birth to age 12 months be fed iron-fortified formulas; moreover, the committee specifically states that "low-iron formulas should not be used to treat colic, constipation, or gastro-esophageal reflux."\textsuperscript{20} If a parent insists on changing to a low-iron formula, monitor the infant's hemoglobin levels closely.

Colicky infants who are given apple juice have higher levels of breath hydrogen excretion than noncolicky infants.\textsuperscript{21} This increased hydrogen production is believed to result from carbohydrate malabsorption following consumption of fruit juices that contain sorbitol or have high fructose-to-glucose ratios. The recommendation of the AAP to avoid fruit juice in an infant's diet until age 6 months may be even more important to enforce in a colicky child.\textsuperscript{22} It is not known with certainty whether the mother's diet has any role in colic in a breast-feeding infant.\textsuperscript{23,24} If a breast-feeding mother wants to restrict her diet, she must ensure that her own nutritional needs will be met. We provide such mothers with lists of cow's milk-free and soy-free foods, information on calcium requirements, and guidance in the proper reading of food labels. If you are uncomfortable counseling a mother about nutrition, offer a consultation with a dietitian.

**Soothing measures.** Vibrations, rocking, car rides, white noise, and pacifiers are all commonly used to help soothe a crying child. Infant seats that vibrate are now available, and white noise can be generated by baby monitors or radios. Swaddling a crying child in a snugly wrapped blanket may also be calming. These comforting measures are generally safe (although one irritable infant who was strapped in a car seat and placed atop an operating washing machine suffered an epidural hematoma when the car seat fell off the washer\textsuperscript{25}). Many commercial products are available that simulate car rides or womb sounds; these may soothe a crying infant and pose little or no risk.

**Medications.** Antispasmodic agents, which are used extensively in adult irritable bowel syndrome, are prescribed by some physicians for colic. Dicyclomine has been studied in the treatment of colic, and there is some evidence that anticholinergic agents are helpful. However, because of rare but serious side effects, such as respiratory distress, dicyclomine is now contraindicated in infants younger than 6 months.\textsuperscript{26} Some pediatricians prescribe hyoscyamine, which is indicated for the treatment of infant colic. However, no studies of its efficacy have been published, and anticholinergic poisoning in colicky infants who were treated with hyoscyamine has been reported.\textsuperscript{27} Cimetropium bromide, an anticholinergic used in Italy, has also been shown to possibly help in a "colic crisis."\textsuperscript{28} However, this agent is not available in the United States. Sedatives, such as opium tincture, alcohol, phenobarbital, and chloral hydrate, raise obvious safety concerns. Desperate parents may demand one of the medications listed above. In such a situation, it is important to remember the injunction to "first, do no harm." Advise parents about the possible benefits and serious risks associated with drug therapy.

Many parents give their colicky infant simethicone because they believe the child is struggling to pass gas. Simethicone changes the surface tension of gas bubbles, which enables them to be eliminated more easily (through belching or flatulence). Simethicone is safe, but it has been found to be no more effective than placebo in the treatment of colic.\textsuperscript{29} If a parent insists on changing to a low-iron formula, monitor the infant's hemoglobin levels closely.

**Alternative medicine approaches.** Oral administration of 2 mL of 12% sucrose solution has been used as a harmless and effective colic treatment.\textsuperscript{30} Ingestion of a sweet liquid during a painful procedure, such as subcutaneous injection, has been shown to be effective in reducing pain responses even in preterm infants.\textsuperscript{31} If colic is a response to pain, then the ingestion of a sweet liquid may have an analgesic effect during an episode of irritability. In the United Kingdom, a combination of sugar and sodium bicarbonate is available over the counter for the treatment of irritability in infants. Herbal teas that contain chamomile, vervain, licorice, fennel, or balm mint may provide a measure of relief through antispasmodic action.\textsuperscript{32} However, the preparation of these substances is not controlled by the FDA and their safety cannot be guaranteed.

Infant massage has also been studied as a potential aid in soothing a colicky infant.\textsuperscript{33} Spinal manipulations, for unknown reasons, may have a positive effect as well.\textsuperscript{34} However, the safety of chiropractic procedures in the very young infant must be studied further before recommendations can be made.

**OUR APPROACH**

**Table 2** summarizes our approach to colicky infants and their parents. The cornerstone of this approach is to spend time with both infant and parents-with the infant, for examinations, and with the parents, for in-depth discussions of the problem. The bottom line is that colic does resolve in
time no matter what intervention is tried.

References:

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