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Elimination communication as colic therapy

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ABSTRACT

Colic is generally defined as excessive crying in early infancy and can have negative consequences on the infant as well as on the infant's family life. Excessive crying can result in escalating parental stress levels, abusive caregiver response, increased risk of shaken baby syndrome and parental postpartum depression. In addition to excessive crying, symptoms and descriptors of infant colic include inconsolable crying, screaming, legs drawn up against the abdomen, furrowing of eyebrows, distended abdomen, arched back, passing gas, post-feeding crying and difficulty defecating. There are few well-designed, reproducible, randomized, large-scale studies which demonstrate efficacy of any therapeutic method for colic. An unexplored etiology is that colic is functionally related to a decrease in stooling frequency. Gut distention may periodically result in intensifying discomfort for the infant and in concomitant inconsolable crying. Elimination communication (EC; also known as Natural Infant Hygiene and sometimes referred to as infant potty training, baby-led potty training or assisted infant toilet training) involves the use of cues by which the infant signals to the caregiver that the infant needs to micturate or defecate. Such cues can include types of crying, squirming, straining, wriggling, grimacing, fussing, vocalizing, intent look at caregiver, red face, passing gas and grunting, many of which are the same initial symptoms related to the onset of colicky infant states. A caregiver's attentive and nurturant response to an infant's cues involve uncovering the infant's intergluteal cleft and cradling the infant gently and non-coercively in a supported, secure squatting position. This position will increase the infant's anorectal angle thus facilitating complete defecation. It is hypothesized that effective and timely elimination will cause increased physical comfort for the infant; colic symptoms will concomitantly decrease.

Introduction and background

Infant colic is generally defined as excessive crying in early infancy and can have negative consequences on the infant as well as on the infant's family life. Excessive crying can result in escalating parental stress levels, abusive caregiver response, increased risk of shaken baby syndrome and parental postpartum depression [1–7]. Organic disease is associated with less than 5% of colic cases, while colic unassociated with an organic disease has an etiology that remains unknown [7]. Colic may be symptomatic of a multifactorial problem [5], the lack of parental tolerance for crying, or the upper range of crying in healthy infants [5,8]. Different research reports provide a range of colic occurrences in infant populations of up to 40% [2,3,5,9,10].

In addition to excessive crying, symptoms and descriptors of infant colic include inconsolable crying, screaming, legs drawn up against the abdomen, furrowing of eyebrows [1,4], distended abdomen, arched back [11], difficulty defecating, passing gas and post-feeding crying [9]. Colic symptoms manifest themselves such that the infant appears to be in pain [1,11]. The temporal dimension of crying patterns associated with colic includes an increase in crying from the second week of infancy to a peak at approximately 2 months of age, with crying bouts being paroxysmal (unpredictable) and with clusters of crying occurring in the late afternoon and evening [1].

There are few well-designed reproducible, randomized, large-scale studies which demonstrate efficacy of any therapeutic method for colic [2,8]. Supplemental carrying does not reduce crying in colicky infants [8], while a review of other complementary alternative therapies (probiotics, herbal tea, fennel seed, colimil, infant massage, targeted reflexology, chiropractic manipulation, cranial osteopathy) for colic indicates that these have substantial limitations [12] and reviews of studies examining changes in dietary habits of the mother or of the infant (e.g., formula) show limited results, are methodologically flawed, or require further investigation [2,4,13]. However, some benefit has been shown for some colicky formula-fed infants with formulas of hydrolysed whey/casein [3,13,14] and a hypoallergenic maternal diet for breastfed infants [14], and some promise for probiotics which are being investigated for their potential therapeutic properties [7].

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Hypothesis and evaluation

An unexplored etiology is that colic is functionally related to a decrease in stooling frequency (see [15]). Tunc et al. [15] demonstrated that stooling patterns of infants decreased at 2 months of age to half the number of stools from the previous month, corroborating evidence of postnatal decreasing stool frequency found by Weaver et al. [16]. Tunc et al. [15] also found that 40% of the 2 months old infants defecated less than once a day. While Landgren et al. [17] reported in their study of acupuncture as a therapeutic modality for colic, that stooling frequency was greater in colicky infants than in internationally reported infants, Tunc et al. [15] found that infants with colicky symptoms had a lower median number of stools per day, and state that:

> "To our knowledge, the relation of infantile colic to stool frequency has not been previously demonstrated. Less defecation due to slow transit time may result in distention of the gut and pain and crying in the infant, and this may be an associated reason of infantile colic" (1361).

Thus, gut distention may periodically result in intensifying discomfort for the infant and in concomitant inconsolable crying. For example, unexpected crying after feeding may indicate that the infant's gastrocolic reflex has been stimulated and is a sign that the infant needs to defecate.

While it might be hypothesized that an infant is sentient of the need to defecate, infants have shown clinically some awareness level of micturition. In fact, during quiet sleep, infants have been found generally to not void [18], while polysomnographic studies show that if voiding does occur when infants are initially asleep, significant changes in respiration rate, heart rate and EEG patterns occur [19]. In the study by Yeung et al. [19], half of the infants who voided while initially asleep woke up and cried, while the others showed changes in sleep patterns (e.g., REM sleep). Moreover, in an experiment which simulated a wet diaper for sleeping infants, the wet diaper itself did not arouse infants from sleep [20]. Zotter et al. [20] indicated that the voiding process stimulates corticol arousal for the sleeping infant.

Most Western infants are diapered and are expected to micturate and defecate in their diapers until they show toilet training readiness around 2 years of age. This current mainstay of caregiving practice in Western society was initiated in the medical community because of a revision of caregiving practices stimulated by Brazelton [21] with respect to toilet training. Rejecting some methods from earlier decades which purportedly espoused coercive early toilet training, Brazelton [21] championed a child-oriented approach [22–24]. Brazelton's [21] approach, which advises that caregivers wait until the child exhibits signs of toilet training readiness in all aspects, has been adopted by the present-day medical community, and has consequently resulted in caregiving methods which leave children in diapers until about 2 years of age. In a different paper published in the same year, Brazelton [25] postulated that infant crying is normal. In decoupling infant crying and the need for caregiver assisted infant elimination, Western society at large was enabled to regard infant crying as normal.

Crying reflects an infant's stress-response system to pragmatically address internal disregulation by targeting external regulatory assistance [6]. I postulate that, in contrast to Brazelton [21], and later Barr [1], inconsolable crying in the otherwise healthy infant is not normal nor part of normal developmental stages, but rather crying signals that a basic human need ought to be met by the caregiver to achieve mutual self-regulation (see [6]). Specifically, if disregulation is caused by lack of gut motility of the fecal bolus, which the infant cannot easily expel independently, or is caused by the infant's aversion of soiling its own environment (i.e., diaper) through voiding or defecation (see [27]), then assistance is required by the caregiver.

Elimination communication

Elimination communication (EC; also known as Natural Infant Hygiene and sometimes referred to as infant potty training, baby-led potty training or assisted infant toilet training[1]) involves the use of cues by which the infant signals to the caregiver that the infant needs to micturate or defecate [24,26–29]. Such cues can include types of crying, squirming, straining, wriggling, grimacing, fussing, vocalizing, intent look at caregiver, red face, passing gas and grunting (see [22,24,26,29–31]), many of which are the same initial symptoms related to the onset of colicky infant states. An international study by Rugolotto et al. [29] of 286 caregivers practicing EC with their infants, showed that over 90% of caregivers observed elimination cues (voiding: 90.6%, bowel movements: 95.4%). Caregiver response to elimination cues includes uncovering the infant's intergluteal cleft and then holding the infant in a gentle, non-coercive, secure and supported squatting position with the infant's back against the caregiver's chest, and with the caregiver holding the infant's legs flexed over an appropriate receptacle [22,24,26,27,29]. This position has been shown to assist the infant in micturition and defecation [26–28] by relaxing pelvic floor muscles [29] and creating a beneficial physiological posture for pushing [22,24]. This position is essentially a supported, secure squatting position, which mimics the position that a bipedal human would use over a traditional squat toilet.

The benefit of squatting for toileting has been shown in several important studies on defecation. Compared to a Western-style toilet, the use of squat toilets has been shown to increase the anorectal angle allowing for more complete voiding for adult users of such toilets [32]. With the help of six healthy volunteers and videomanometric measurements of subrectal pressures, Sakakibara et al. [33] studied the influence of body position on defecation in humans, finding that squatting provides greater hip flexion while straightening the anorectal canal and resulting in less strain during defecation compared to upright sitting positions on a toilet. This finding corroborates that of Sikirov [34] who studied the amount of time and straining required for defecation in 28 healthy volunteers in three positions: squatting, a low-sitting toilet (31–32 cm high) and a standard height toilet (41–42 cm high). The results of the research showed that the time spent emptying the bowel in a squatting position was half that for the standard height toilet and that the subjective assessment of effort for squatting was about one third that for sitting on a standard height toilet [33]. These studies indicate that squatting is a more physiologically beneficial approach to defecation. The puborectalis muscle, part of the levator ani group of pelvic floor muscles, acts as a sling between the rectum and the colon, creating an angle which reinforces continence in the sitting and standing position [26]. The squatting position relaxes the puborectalis muscle, reducing the anorectal angle [26,29]. Transperineal ultrasonographic imaging in neonates can identify the levator ani muscle, by imaging the neonate in a supine position, with legs drawn up to chest [35]. The methodology in Han et al. [35] indicates that an infant's puborectalis muscle is at rest in the supine, leg ventroflexion position. This body position is a horizontal analogue to squatting.

Infants less than approximately half a year cannot sit up on their own, let alone squat independently. As a result, defecation often will occur in a lying or reclining position for most Western

[1] EC is not considered to be potty or toilet training as is commonly understood in Western society. However, the terms are helpful to convey the idea of the infant being toileted, rather than micturating or defecating in diapers.

infants. A useful report which compares the ease of defecation in adults in a left lateral position compared to sitting is that by Rao et al. [36]. This study was undertaken because individuals experiencing bowel dysfunction often have their defecation examined by medical professionals in the left lateral position. The results of Rao et al.'s [36] study which assessed 25 healthy volunteers for rectal and anal pressures in the sitting and lying positions while defecating artificial stool, indicate that one-third of the volunteers experienced dyssynergia in the lying position while half the volunteers could not expel the stool [36]. Thus, a horizontal position is the most difficult one in which to defecate (see also [29]).

Hamadi and Hamadi [37] provide an evaluation and management of constipation in infants and children. Their recommendations for treatment include behavioural management for children involving proper position and deliberate timing for toileting. For example, the constipated child should sit on the toilet with foot support to provide hip flexion and the timing of toileting should be 5–10 min after a meal to benefit from the gastrocolic reflex [37]; however, no extension of the squatting position was made for infants in the recommendations.

Rectal discomfort triggers activation in the brain. In a functional MRI study of the brain on eight male subjects (age 21–39), artificial rectal stimulation revealed activation in the inferior primary somatosensory, secondary somatosensory, sensory association, peri-orbital, anterior cingulate and prefrontal cortices [38]. In contrast, anal stimulation showed activation in those same areas except for the anterior cingulate cortex (ACC). Hobday et al. [38] conclude that rectal stimulation activating the ACC indicates that visceral structures, compared to somatic structures, are more represented in the limbic cortex [38]. The ACC forms part of the limbic system and is responsible for processing not only visceral responses, but also emotional information [39]. In a study of visceral pain processing which included moderately painful electrical stimuli to the rectum (visceral) or midline lower abdomen (somatic) in eight healthy subjects, mean reported anxiety was significantly greater for visceral stimulation than for somatic stimulation [40].

Brazelton [21] espoused later toilet training for children, in part because myelination of the body's pyramidal tracts, which sends information from the spinal cord, is not complete (see Ford 1954 in [21]). According to Brazelton [21], before 18 months of age, local rectal control is due to reflex compliance and therefore not a cognitive task. Indeed, myelination of nerve fibres is a long term process, extending into late childhood and beyond. However, some human body nerve fibres are thinly myelinated A-delta fibres or unmyelinated C-fibres and both these types of fibres are part of the visceral organ of the rectum [38]. Thus, complete myelination is not required for afferent nociceptive messages from the colon to be received by the brain. It is also known that a newborn's central nervous system has the basic connections for the transmission of pain [41].

It may be possible that when an infant's brain receives signals about an increased rectal distension and visceral discomfort due to gastrocolic-induced gut motility, the infant experiences ACC activation and perhaps even anxiety. The infant's behaviour becomes disregulated because of rectal dyssynergy and the lack of gross motor skills to move the body into a suitable position; this in turn creates a disregulated, colicky state.

The evidence of the research into body position while defecating indicates a comparative ease of passing stool in a squatting position, with the most difficult position being in the left lateral lying down position. It is somewhat unsurprising that there are no known studies on the comparison of straining during defecation for healthy adults in the following body positions: dorsal decubitus, ventral decubitus, and semi-Fowler position. Thus, there are no extensions that can be made to infants, particularly for those infants who are 2 months of age or less, and who are often positioned in these postures (asleep in crib on the back, "tummy time" and in a carseat/bouncy seat, respectively) and expected to defecate in these positions. As a corollary, there are no known clinical studies of the benefit of an assisted, supported squatting position for infants to alleviate the strain of defecation.

Empirical data

EC is practiced widely in developing countries and traditional cultures (see [26,27,42,43]). DeVries and deVries [23] studied the mother-infant relationships of the East African Digo people and found that nurturant conditioning allowed infants to achieve daytime and nighttime dryness by 5 or 6 months of age. In traditional cultures, infants are known to cry less [8]. In fact, Boucke [27] states that "[i]t is tempting to ask if making babies wear their waste contributes to colic in the West, due to dirty-diaper discomfort or to withholding of elimination in order to avoid this discomfort. In both situations, cries for help go unheeded." In Western settings where EC is practiced on a limited basis, parents who started an EC practice with their infants noted less fussiness [27] and other recent anecdotal evidence and comments indicate the same (Huff, pers. comm. 2012, Campbell, pers. comm. 2013, Ireland, pers. comm. 2013). Small-scale studies have shown that EC is possible in a Western setting e.g., [31,44]. Additionally, Juris' [45] survey of 53 caregivers in Australia showed that there was a small group of highly educated parents amongst primary caregivers who practiced EC with their infants.

Consequences of the hypothesis

Reducing and potentially eliminating colic unassociated with organic disease will have a profound positive consequential benefit for caregivers and their infants. A reduction in excessive crying will ease parental stress levels and decrease the risks of abusive caregiver response, shaken baby syndrome and parental postpartum depression. There are no known negative clinical side-effects of EC. In fact, later (conventional) toilet training has been shown to delay bowel and bladder control, increase risk of constipation and stool retention (see review by [24]) while benefits of EC, in addition to ease of micturition and defecation, include promoting a closer, self-reinforcing mother-infant bond [26,43], a potential reduction in diaper use [28] and significant financial savings on diapers with long term EC practice [26]. EC also reduces the contact of feces with infants' skin, so diaper rash is minimized [26] and more hygienic circumstances surround handling of infant feces.

Conclusion

The hypothesis of EC as a therapy for colic does not center about toilet training at an early age, but rather implementing the aspect of child-orientedness in the infant stage, so micturition and defecation consequently become infant-led, caregiver-assisted events. An infant expresses signs of needing to micturate and/or defecate, which include types of cries and fussing. When these cues are recognized and the infant is positioned in the supported squatting position, the infant can micturate and defecate with ease. The infant will experience relief from gastroenterological discomfort and a reduction of colic symptoms. If cues are not appropriately responded to in a timely manner by an attentive caregiver, then fussing and crying will escalate. However, a caregiver's attentive and nurturant response to an infant's cues, which involve cradling the infant gently and non-coercively in a supported, secure squatting position, will increase the infant's anorectal angle thus facilitating complete defecation. Complete elimination will cause

increased physical comfort for the infant; colicky symptoms will concomitantly decrease.

Conflict of interest statement

No conflict of interest exists.

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