

What is the Significance of Leftward Cradling Bias?

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Abstract

Maternal cradling bias is the act of human females to tend to cradle new-borns to the left side in the first few weeks of life. Many factors contributing to the occurrence of leftward cradling bias have been explored including handedness and hemispheric dominance, neural development in neonates, breast feeding influences and early communicative. Accepted best practices for developmental support for premature infants incorporate positioning and holding neonates in their protocols. Questions as to what function leftward cradling serves and what impact it has on the developmental trajectory of the infant in the first few weeks of life is the subject of much research. This paper will review the literature focusing on maternal cradling bias and explore implications on best practices for paediatric professionals.

Keywords: Maternal cradling bias; Neonate; Early neural development

Introduction

Leftward maternal cradling bias has been the subject of research for several decades. Currently, it is widely accepted that this bias appears to be “innate” in a majority of the human female population [1]. Prevalence of leftward cradling has been reported to occur in 80% of women [2-4] although the reason behind this is unclear. In a study by Saling and Tyson [5] cradling behaviors of nulliparous females were observed. Data indicated a tendency to cradle to the left, even in women who had not given birth. These results appeared to underscore the “innateness” of the left ward cradling bias in the absence of communicative interactions. Cradling was observed in three different situations with the primary variable being which way the infant doll's head was turned. The researchers found that the leftward cradling bias is present in all conditions [5]. In a similar study by Saling and Bonert [6] cradling behaviors were examined in preschool children (cradling a doll). It was determined from the data that leftward cradling is also exhibited at roughly the same ratio in female children as in their adult counterparts. The authors suggested that this data supported the theory of an innate bias in females for leftward cradling, regardless of age [6].

It may be that this behaviour is part of a specific didactic interaction between mother and infant. New-borns initially display a rightward head turning bias for a short time following birth. It is reasonable to wonder whether the two “biases” are symbiotic, serving to meet differing needs of the mother and the new-born. It is possible that this particular interaction serves in fostering attachment and social engagement between the new-born and mother by automatically “setting the stage” for emotional connection (Table 1).

Cradling's role in attachment and social bonding

Reissland [7] suggested that the function of the direction of cradling was associated with communicative interaction initiated by the mother towards her new-born. In situations where leftward cradling bias was observed, maternal pitch and intonation were measured and compared to inflection and prosodic measures while the mothers were cradling to the right. The data indicated that maternal pitch and intonation patterns were unique to cradling preference with the differences corresponding to right hemisphere processing of prosody and inflection. The pitch and intonation patterns observed during cradling to the left were markedly different than the patterns observed during rightward cradling. This may indicate that the communicative intent of mothers is different depending upon which side they cradle their new-borns. The significance of varied inflection and prosodic patterns should not be

underestimated. The primary purpose of those patterns in speech is to communicate emotion or mental state. The responsibility for generation and comprehension of these patterns lies mainly in the right hemisphere of the brain [8-10]. Reissland [7] concluded that the leftward cradling actions correlated with the mother's attempts to soothe her baby. The act of soothing results in physiological changes in the brain. For infants, the act of soothing by the mother stimulates the release of endorphins and a reduction of cortisol levels [11-15] and promotes an optimal level of homeostasis. When a new-born is calm, bonding and attachment is supported for both the mother and the infant. For the mother, when early interactions with their infant are viewed as positive, specific changes also occur in the mother's brain [16]. Observed changes in the maternal brain occur in response to experience of parental warmth. It has been demonstrated that these changes ultimately regulate maternal affective regulation capacity and caregiving outcomes [16].

Soothing behaviors appeared to be cross-cultural as well. When assessing how mothers from Arab cultures choose to soothe their infants, Abdulrazzaq et al. [17] found that cradling was included in the activities a majority of mothers chose to use when attempting to soothe their babies. As with other studies that have been reviewed, the side to which mothers tended to hold their babies was not considered as a variable in this investigation [17].

Cradling and hemispheric laterality

Bourne and Todd [18] suggested that mothers cradle their infants to the left because of functional hemispheric differences in the brain. Their study suggested hemisphere dominance for emotional and face processing was the underlying impetus for the rightward head-turning bias in new-borns and subsequently for leftward cradling by their mothers. This idea is further supported by a study conducted by Parente and Tommasi [19]. Data from their study of implied hemispheric laterality during face processing supported the assumption that 1)

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Year	Authors	Conclusion
1981	Saling and Tyson [5]	Leftward cradling bias is exhibited in adult females prior to having children
1983	Saling and Bonert [6]	Leftward cradling bias is exhibited in normally developing preschool-age females
1988	Dagenbach et al. [2]	Parental side-holding preferences and infant head orientation biases may be components of a biobehavioral system for the purpose of organizational enhancement of the caregiver-infant relationship
2004	Sieratzki and Woll [40]	Posit that protection and facilitation of affective communication drives cradling postures
2001	Turnbull et al. [41]	Lateral hemispheric asymmetry of attention theory does not explain leftward cradling bias
2000	Reissland [7]	Mothers cradle to a specific side for a specific purpose: to soothe or to arouse their infant
2001	Turnbull et al. [41]	Cradling bias' relation to prosodic processing is not supported by the finding that deaf adults and deaf children display similar leftward cradling behaviors as their non-hearing impaired counterparts
2004	Sieratzki and Woll [40]	The universal left side cradling bias is related to a right hemisphere dominance for social attachment and communication behavior
2004	Bourne and Todd [18]	Women cradle on the side of the body that is contralateral to the hemisphere dominant for face and emotion processing (the left)
2004	Takahashi et al. [26]	Laterality and cradling positioning of non-human primates; cradling bias was species specific to the great apes but not to old and new world monkeys
2004	Sieratzki and Woll [40]	Deaf mothers have a tendency to cradle deaf infants to the right and to cradle non-hearing impaired infants to the left
1985	Harris and Fitzgerald [3]	Examined cradling bias in the early decades of the 12 th century and discussed possible theories that underly it.
1991	Johnson et al. [21]	Described factors that influence the implementation of Kangaroo Care
2006	van der Meer and Husby [39]	Functional cradling results as a result of use of dominant hand for other tasks while cradling an infant
2009	Bortfeld et al. [50]	Women's cradling side preference may have evolved to save cognitive resources during monitoring emotional baby face signals
2000	Reissland [7]	Cradling bias decreases with maternal stress and depression status
2013	Kinsey and Hupcey [24,45]	Left side holding preferences are demonstrated in roughly similar fashion when holding inanimate objects
2013	Esposito et al. [14]	The calming response in infants function to increase maternal carrying efficacy
2013	Pileggi et al. [43]	Children with ASD showed no preference for cradling side as compared with typically developing children who do demonstrate left side holding preference
2014	Wan et al. [47]	Unique neural responses were noted in women when shown a picture of their own child. Responses correlated with her perceptions of infant warmth.
2015	Fleva and Khan [42]	The tendency of individuals with ASD to cradle to left was correlated with lower ASD severity levels

Table 1: Selected research on maternal cradling bias.

the left side of the face is more important in determining gender and 2) the preference for the left side of the face was only present in faces in which the left side was female. The stimuli used included normal and chimeric faces. The authors concluded that data showed a right-hemispheric advantage for recognizing female faces. The hemispheric dominance theory was further supported by an investigation by Prete et al. [20]. This study concluded that normal individuals demonstrated a right hemisphere bias for identification of female gender, and left hemisphere bias for identification of male gender of faces. A functional Magnetic Resonance Imaging (fMRI) comparison was made between neurotypical adults and one individual with split brain syndrome during stimulus presentation. When subjects were viewing the left side of a face, they were able to consistently identify the gender of the photograph as that of female. Conversely, when the subjects were viewing the right side of the face they demonstrated consistently higher accuracy in determining if the face was that of a male. The authors concluded that the evidence supported results from previously studied face processing of gender data indicating a right hemispheric bias for female faces [20]. The configuration of the face versus other patterns of configuration is known to be preferred by neonates [21] and cradling an infant to the left side of the body establishes a view for the infant of the left side of the mother's face. This fact is also important when attempting to understand the purpose of a seemingly innate bias in females to cradle their infants to the left. This right-hemispheric face preference may provide a partial explanation for the utility of most mothers to cradle their infants to the left [19] so that their new-borns have an optimal view of the most expressive side of the maternal face.

Cradling and neonatal brain development

The act of cradling may foster the beginnings of regulation of experiential learning [22]. Development and solidification of neuronal tracts occur in response to repetitive external stimuli [23] and a mother

cradling her new-born could be considered a recurring situation in the first weeks of life. As with other reflexive motor patterns observed at birth, the act of cradling to the left may also be supportive of brain development. There are no studies examining developmental outcomes of children who were cradled mostly to the left as opposed to the right. As a result, this theory remains unsubstantiated. Many researchers posit that it may be possible that there is a direct relationship between maternal new-born interactions and the creation specific neuronal connections [24-26].

According to Kubis and Catala [27], the existence of new-born reflexive motor patterns may be partially due to the degree of myelination present in the pyramidal tract at birth [27]. These motor patterns appear in the absence of any specific stimuli and are referred to as general motor patterns. General motor movement patterns in neonates have been documented and are thought to be representative of neuronal organization [28-30]. They are thought to serve an adaptive function in utero as well as in full term neonates [28].

An infant being cradled is held in flexion. Ozdemir and Tüfekçi [31] studied the effects of flexion along with other factors on premature neonates. Results indicated that the flexion posture had a positive influence on premature infants' growth and development rate. Ozdemir and Tüfekçi [31] concluded that there was a direct relationship between amount of time spent in tactile contact and flexion and the resulting developmental gains. Current knowledge of the development of or solidification of specific neural substrates during cradling in neonates is incomplete. Additional study of neonate brain activation during the act of cradling is necessary.

Hane et al. [32] observed the impact of the Family Nurture Intervention (FNI) paradigm on the quality of maternal caregiving behaviour. This paradigm is used in the neonatal intensive care unit to facilitate positive outcomes in premature infants [32]. The authors

observed mother-infant “calming” sessions and measured maternal behaviours which included scent-cloth exchange, vocal soothing, skin-to-skin contact, holding, emotional expression, eye contact, and family-based support. Positive outcomes for premature infants were observed when FNI was actively utilized [32]. Maternal “holding” was an important component in this intervention; however, specific positioning of the infant including cradling was not recorded for the study.

Kangaroo care is a technique that has also garnered much interest by researchers.

Kangaroo care is the practice of holding an infant against the chest with “skin-to-skin” contact [33]. Kangaroo care has been associated with positive infant developmental outcomes; however studies did not stipulate to which side the neonate was held, only that “skin-to-skin” or “skin-to-cloth” contact was established [34-37]. Investigations into the effects of cradling while utilizing kangaroo care have yet to be conducted.

Cradling and breast-feeding

There has been investigation into a connection between cradling bias and maternal positioning of the new-born during breast and bottle feeding. The theory being explored proposed that breast feeding positioning preferences were the causal factor in leftward cradling. An investigation by Donnot et al. [38] explored the behaviours of cradling by depressed mothers during feeding using both bottle-feeding and breast-feeding as variables. The subjects in the study were divided into two groups consisting of mothers who had been diagnosed as depressed, and those who had not. Of interest to the researchers was the effect depression had on cradling during feeding, and if bottle or breast-feeding influenced side cradling in some way. During feeding, a finding of cradling bias towards one side was not observed during breast-feeding. Examination of cradling bias during bottle feeding in clinically depressed mothers demonstrated a tendency of the mother to cradle her baby to the right. The authors concluded that cradling behaviour in this circumstance was not due to a hemispheric

Specialization, but rather those higher levels of depression were associated in some other way with influencing cradling while bottle-feeding [38].

Cradling bias and hemispheric dominance

The relationship between cradling laterality and handedness has also been a topic of study. It is a reasonable assumption that hemispheric dominance would influence the act of cradling a new-born baby as a majority of the population exhibit right-handedness, a trait that is reflective of left-hemispheric dominance. This was investigated further in a study of functional cradling by van der Meer and Husby [39]. According to these researchers, “functional” cradling is the act of cradling an infant in the non-dominant arm while at the same time keeping the dominant hand free to complete functional tasks [39]. In their study, the relationship between hand dominance and directional functional cradling was observed with 765 participants. Van der Meer and Husby [39] actively recruited left and mixed-handed participants for their experiment however; right-handed individuals comprised 64.3% of the cohort, while 24.7% were “mixed” handed. The left-handed participants made up 11% of the sample. Outcomes indicated that a significant majority of the participants (regardless of handedness) tended to utilize the non-dominant arm during “functional” cradling. The authors concluded that the data supported a hemispheric dominance hypothesis as the main influencing factor

to account for left-ward cradling bias. The researchers surmised from their data that leftward cradling bias occurred with such frequency because this particular positioning of an infant would “intuitively” keep the dominant hand of the individual free to complete other tasks [39]. Weaknesses of the study lay in the selection of participants, a majority of which were right-handed or ambidextrous and the use of a life-like doll as opposed to a live infant. A hemispheric dominance theory for functional cradling to the non-dominant arm could be more clearly demonstrated in a situation where the stimuli (doll) is a live new-born and participants were all left-handed. The hemispheric dominance hypothesis for maternal cradling bias should stipulate that left-handed mothers “intuitively” cradle their infants to the right arm. The results of the study by van der Meer and Husby [39] leave the question of hemispheric influences that support maternal cradling bias unclear because the situations that were under investigation were those where the cradler was dividing attention between infant and other activity, rather than an interaction with the infant alone.

Cradling bias of atypical populations

In a study of the maternal cradling activities in mothers who are deaf, leftward cradling bias occurred in the interactions between deaf mothers and neonates with normal hearing. In contrast, it was observed that deaf mothers tend to cradle their deaf new-borns to the right [40]. An investigation into the relationship of leftward cradling bias and processing of prosody with individuals who are profoundly deaf also revealed interesting results. Turnbull et al. [41] observed similar rates of leftward cradling behaviours in profoundly deaf children, deaf adults and a control group of adults with normal hearing. The stimulus used in this study was a doll meant to simulate a new-born. Results indicated a strong leftward cradling bias in all groups and, the authors noted, the bias appeared even stronger in individuals who were deaf [41]. The leftward cradling tendency was the subject of an experiment by Fleva and Khan [42] who observed cradling behaviours in typically developing adults on the autism spectrum. Of interest was the observation that individuals who were found to be higher functioning (milder autistic symptomology) tended to cradle a life-size doll to the left. Individuals exhibiting significantly more characteristics of autism tended to cradle the doll to the right. The authors concluded that the data indirectly hinted at a relationship between leftward cradling bias and brain lateralization of emotional processing [42]. Pilleggi et al. [43] theorized that occurrence of leftward cradling bias was facilitated by social-affective attachment processes in neurotypical mothers. If this were true, the authors surmised that the leftward cradling bias would not be present in individuals diagnosed with ASD. To test this hypothesis, the authors studied the cradling activity of 96 children who ranged in age from 5 to 15. The characteristics of the participants included those with ASD, those with Non-ASD intellectual disability, and those with neurotypical development. The cradling behaviour of the children was observed on 4 separate occasions. Results indicated that leftward cradling bias was present in neurotypical children and intellectually disabled children. The leftward cradling bias was found to be absent in children diagnosed with ASD [43].

Conclusion

The reason for leftward cradling bias needs further investigation. The data gathered to date suggests several possible reasons as to why mothers cradle new-borns to the left. There are convincing arguments to support maternal/new-born bonding as the reason this occurs [44-47]. Several studies support positioning as an important component of the care of both premature and full term infants [31,33-35,48]. Researchers have investigated handedness [39] and other hemispheric

lateralization theories related to emotional processing both for the mother [8,9,49] and infant [14,50-52]. The relationship of cradling bias to the neural substrates of face processing have also been a subject of study [19,21,53-57].

Future research endeavours could utilize similar paradigms as the experiments mentioned previously, but rather than observing mothers holding a doll, the stimuli which would be most appropriate would be mothers holding their infant in a naturalistic setting. For example, an observation of mothers and infants in the NICU may prove that leftward cradling has a significant impact on developmental outcomes. The major drawback of this type of study may be the recruitment of mother-infant pairs to participate. It would also involve a significant time commitment to follow developmental trajectories of the participating new-borns. The result, however, would be of keen interest to many fields of study. In addition, studies that focus on positioning actual new-borns could add support to the theory of neonatal hemispheric dominance for the female face. The results of studies on specific populations, especially those known for social cognitive problems may also shed light on the question of why leftward maternal cradling bias exists and what purpose it serves.

At this time, the definitive answer to this question continues to be elusive. As with other “innate” biases, it is reasonable to investigate the “purpose” (if any) that this particular cradling pattern occurs, but data from many more studies from several disciplines is necessary. If it is found that this cradling position supports or even fosters more positive developmental outcomes, it would significantly impact the way that we view maternal/new-born interactions and the practices encouraged by medical and developmental specialist for mothers to actively provide this type of position for their new-born.

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