

PREFERED HEAD TURN AND LATERAL ARM MOVEMENTS IN NEWBORNS

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Resumo

A direção da rotação espontânea da cabeça (RC) é uma das assimetrias laterais mais investigada nos recém-nascidos. A RC também tem sido associada à posterior preferência manual. No entanto, são poucos os estudos que observaram se essas assimetrias da RC no nascimento se relacionam com as assimetrias ao nível dos movimentos dos braços. O presente estudo pretende (i) investigar a direção e a manutenção da RC, e (ii) se a RC está associada ao número de movimentos entre braços. Vinte e três bebês saudáveis foram filmados durante 2 minutos consecutivos logo após o nascimento em decúbito dorsal. A direção da RC e o número dos movimentos dos braços foram codificados. Tal como em estudos anteriores, a maioria dos recém-nascidos preferem rodar a cabeça para a direita. No entanto, essa preferência da RC não parece estar associada aos diferentes movimentos dos braços ou a qualquer atividade ao nível dos braços.

Palavras-chave

preferência da rotação da cabeça; recém-nascidos; movimentos dos braços; nascimento.

Abstract

One of the most common lateral asymmetries investigated in newborns is the direction of their spontaneous head turn (HT). HT has also been linked to later hand preference. However few studies have examined whether such spontaneous HT asymmetries at birth were already associated with similar asymmetries in newborns' arm movements. This study aimed (i) to investigate the direction and maintenance consistency of newborns' HT preference at birth, and (ii) to assess whether the observed preferred HT was associated with distinct amounts of movements between arms. Twenty-three healthy infants were videotaped for 2 consecutive minutes shortly after birth while resting in supine position. The direction of their HT and number of arm movements were coded. As in prior studies, we found that most newborns preferred turning their head to the right. However, such HT preference did not appear to be linked to differential numbers of movements or activity levels between arms.

Key-words

head turn preference; newborns; arm movements; birth.

INTRODUCTION

Spontaneous head turn (HT) preference is one of the most investigated asymmetry at birth. It has been linked with intrauterine factors (1–4), with ulterior manual preference (5,6) and with lower limbs asymmetries (7). The majority of these studies focused on the head posture and direction of HT shortly after birth (5,7–

10), and a few others followed the development of HT movements beyond birth (11–13). The HT movements are typically investigated while the newborns are lying in the supine position. The head is released from the midline position and the direction of head rotation is being observed. Most studies have documented a predominant right HT preference for both the direction of head turning from midline and the subsequent maintenance of head turn. Rönqvist and Hopkins (9) suggested that both responses (head rotation and maintenance) are the reflection of active neural processes that are mediated by the baby's state of consciousness, and are translated into different levels of quality and quantity of motor activity, a factor considered in several studies with neonates (7,14).

Although HT preference has been the most investigated lateral asymmetry in newborns, other responses such as some lateral reflexes and particularly the tonic neck reflex have also been addressed (15,16), but with no conclusive results with regard to a preferred direction or movement asymmetry. The palmar grasp reflex has also been investigated and some authors reported a stronger and longer right hand grip in newborns (17,18). However, other researchers did not observe significant asymmetries in these behaviors (15,18,19). Further, data about the development of manual lateral preference during the pre-reaching period (from birth to 3-4 months old) are quite scarce. Most longitudinal studies tracking the development of hand preference mainly focus on the period following 6-months of age. The few studies that examined lateral differences in newborns arm movements are also reporting inconsistent findings. Some mentioned a preference for the right upper limb movements, particularly in movements toward the midline (20), others reported a left upper limb preference (21), and some other studies did not find any asymmetries during this early period (22–24). These studies differ greatly in their methods. For instance, procedures, the criteria for selection of variables, the size and homogeneity of the samples, the methods for capturing and processing behavior, the placement of the infants, parents and researchers, the categorization and classification of the data, and the type of scoring attributed to the behaviors observed are all dimensions that can explain the differences in results between studies. In addition, not controlling or not defining infants' behavioural states at the time of observation may significantly influence results (10).

To summarize, the literature shows that active behaviour is present from the very beginning of life and is characterized by a predominantly right-sided HT preference after release from the midline position, while newborns' spontaneous arm movements appear to be mostly non-lateralized. Researchers have also argued that HT preference predicted the predominant right direction of the later developing hand preference, however few studies, to this day, have examined whether the spontaneous HT asymmetries at birth are already associated with some matching asymmetries in newborns' spontaneous arm movements. This study aimed (i) to investigate the direction and maintenance consistency of newborns' HT preference at birth, and (ii) to assess whether the observed preferred HT was associated with some differences in number of movements between arms.

METHOD

Participants

Twenty three newborns whose parents agreed to have their infant participate in this study were recruited from two hospitals in the Lisbon area. Infants were healthy without pre-, peri- and post-natal complications,

and were all born from a single pregnancy. Infants with functional disabilities, potential cognitive and /or behavioral impairments, or problems of a genetic origin were excluded, as well as cases of orthopedic and neuromotor diseases. Parents signed an informed consent form for their infant participation in the study. This study was approved by the Scientific Council of the Faculty of Human Kinetics, Technical University of Lisbon, and by the Ethics Committee of the two hospitals.

Procedures

Video recordings of the arm movements of the newborns were collected with a digital camera while in a nursing room at the hospital. Two other recording sessions (at 1 and 3 months of age) took place in the home of the child but results for those follow-up sessions are not reported here. The procedures were the same for all participants and the video recordings were performed while the infants were in behavioural state 4, between awake and alert according to Prechtl's and O'Brien's (25) scale. Self-generated upper limb movements were videotaped while infants were in a supine position for a 2 min duration. The noise and light intensity surrounding the infant during filming was controlled both at the hospital and in the homes, preserving a warm and welcoming environment for the infant. The direction of their HT immediately following release from midline was identified. Also, the subsequent HT maintenance and number of arm movements performed during the 2 minutes of recording were coded. The 2 min video recording time was longer than in prior longitudinal studies which reported an average of 60 seconds (22,26) and 30 seconds (23) per session.

Data analyses

The observation and classification of all behaviors from the video recordings were performed in their entirety by two independent observers. Inter-observer reliability scores (Cohen's kappa) for the behaviors coded at birth were $K = 0.670$. The coders tracked the:

- Direction of the initial head turn following release from midline (right or left side)
- Duration of each head rotation from midline to the right or left side
- Duration of each head rotation from the right or left side to the midline
- Duration of each head maintenance at the right side, left side, or midline
- Duration of each head rotation from the left to right side, or from the right to left side
- Duration of body rolling over to the left side
- Duration of body rolling over to the right side
- Number of spontaneous, self-generated movements performed with the right, left, or both arms

Spontaneous arm movements were defined as any free upper limb movement generated by the infant from their proximal joints (shoulder and elbow joints). Each joint movement, i.e. flexion, extension, abduction, or adduction was considered as one movement. Distal movements of the finger(s) or the hand alone were not included in the count. Hand-to-mouth movements were included.

RESULTS

When the newborns head was released from midline, 78% of the infants (18/23) turned their head to the right side (binomial test, p (exact, 2-tailed) = .011) (figure 1). The other 22% rolled their head to the left side.

Seventy five percent (12/16) of those infants with a spontaneous right HT, also maintained their head rotated to the right for most of the 2 minutes observation. Likewise, 75% (3/4) of the newborns who spontaneously turned their head to the left also maintained their head rotated to the left for most of the 2 minutes observation, but neither maintenance trend was significant (binomial tests, p (exact, 2-tailed) = .077, and .625 respectively). Three infants completely rolled over with their body and therefore were not included in the analyses. Regardless of the preferred head turn, whether it was to the right or to the left, the number of arm movements performed while the head was turned were not different (figure 2). However, infants with a preferred right HT seemed to perform more arm movements, overall, than infants with a left head turn preference (Mann-Whitney, $U=21.50$, p (2-tailed) < .056).

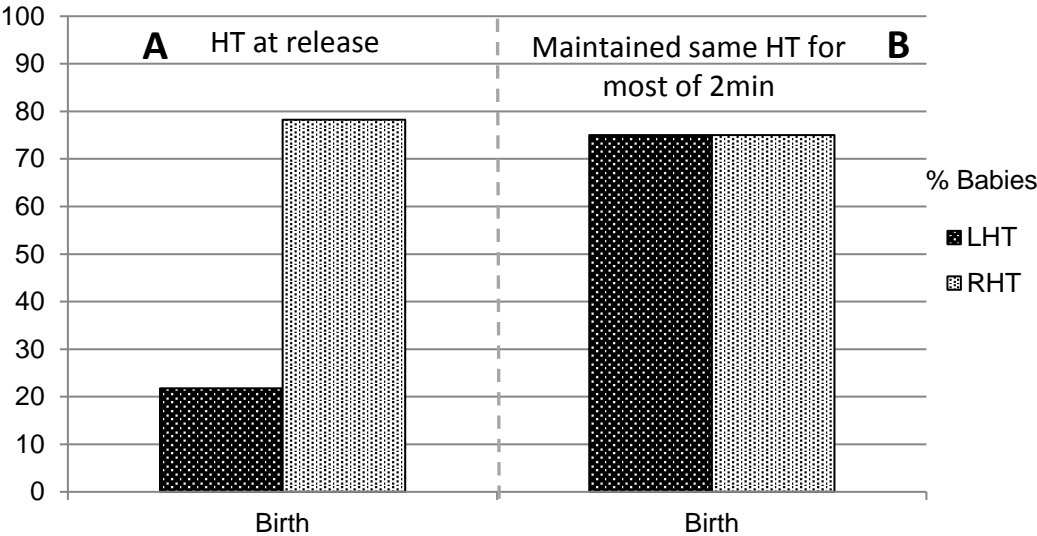


Figure 1: Initial head release (A) and maintenance (B) at Birth

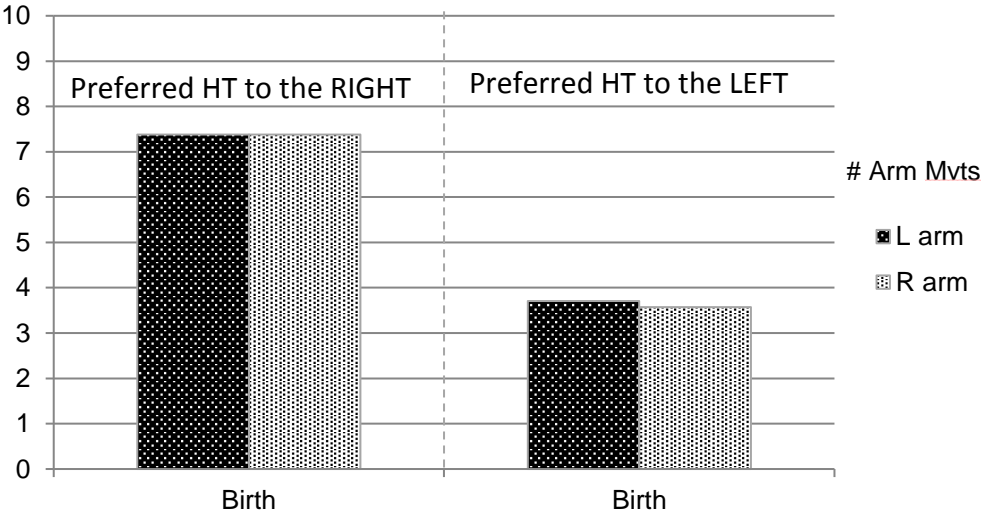


Figure 2: Arm movements by HT during 2 minutes recording

DISCUSSION

Our results on newborns HT preference are consistent with prior findings (1–10). They revealed that most infants preferred turning their head to the right. However, such HT preference did not appear to be linked to

differential numbers of movements or activity levels between the arms. Indeed, newborns moved their arm on the contralateral side of their HT as much as the arm on the ipsilateral side of the head turn.

One direct implication of these results is that lateral arm and head biases may not be linked from birth. Referring to the studies that relied on newborns' HT preference to predict the development of ulterior manual preference (5,6), we can speculate that a predominant right hand preference that is matching the preferred right HT of infants at birth may be the product of a progressive visuo-manual process that builds over time, rather than an already existing behavioral characteristic at birth. Indeed, as infants spend more time with their head turned to one side, they may possibly see and feel the hand and arm on that same side a lot more than the arm on the other side. Such visuo-manual link was already proposed in 1947 by Gesell and Ames (27) and evidence that newborn infants actively attempt to bring the hand on the ipsilateral side of the HT within their sight has been reported (28). However, this initial newborn HT preference does not suffice, in our opinion, to fully explain the development of hand preference. Hand preference is a protracted process (22,24,29) and according to many researchers, hand preference biases are not consistently observable prior to the age of 6 months (30) or even later (31). Newborns maintain, at most, a preferred HT up to about 2 months of age and then, they adopt a midline head position. If preferred HT was driving the direction of hand preference, we should be able to detect some differences in hand activity already in the few months following birth. Yet, according to the literature, by 2 months of age, infants are far from having developed a hand preference.

We are planning to examine this developmental progression more closely in future work. We have data on the same 23 infants that we followed at 1 and 3 months of age, thus we can document the progression in HT preference as well as tracking the change in number of movements between arms beyond birth. We should be able to assess if a burgeoning arm asymmetry begins to form following infants' preferred spontaneous HT with the 3 first months of life or not. One possibility could be that the neonates' preferred HT instills an initial side bias, and even if weak, it may contribute to the developmental cascade that will lead to a progressively stronger preferred hand use later in development. We would like to caution, however, that our 2 minute observations, even if longer than what other researchers have done, are still far from representing the moment-to-moment sensori-motor experiences that infants encounter in their daily lives. To fully understand developmental processes, observations over more extensive time windows might be warranted.

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