

Lingual frenulum and effect on breastfeeding in Thai newborn infants

Sopapan Ngerncham¹, Mongkol Laohapensang², Thidaratana Wongvisutdhi³, Yupin Ritjaroen³, Nipa Painpichan⁴, Pussara Hakularb⁴, Panidaporn Gunnaleka⁵, Penpaween Chaturapitphothong⁵

Departments of ¹Pediatrics, ²Surgery, ³Pediatric Nursing, ⁴Obstetrics and Gynecology Nursing and ⁵Surgical and Orthopedics Nursing, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Background: Breastfeeding has abundant biological and psychological benefits. Effective breastfeeding requires good latching on, which is possible when the infant is able to cup around the maternal areola with his tongue. One of the most common conditions resulting in poor latching on is tongue-tie.

Objective: To determine the prevalence of tongue-tie with subsequent breastfeeding difficulties and other factors affecting the success of breastfeeding in newborn infants.

Methods: This was a prospective, cross-sectional study of healthy Thai infants without contraindications for breastfeeding. Physical examination of the infants and mothers and their breastfeeding practices were assessed between 24 and 48 hours of life.

Results: 2679 mother–infant dyads were recruited. The study detected a prevalence of 16% for severe tongue-tie, 37.9% of which was associated with breastfeeding difficulties. Using multiple logistic regression analysis, moderate (adjusted OR 13.3, 95% CI 7.2–24.5) and severe (adjusted OR 62, 95% CI 34.1–112.8) tongue-tie, short nipples (adjusted OR 1.5, 95% CI 1.1–2.2), mothers feeling the infant's tongue on the nipple area (adjusted OR 3.4, 95% CI 2.2–5.2) and mothers' inability to feel the infant's tongue (adjusted OR 11.8, 95% CI 4.3–32.4) independently increased the risk of breastfeeding difficulties.

Conclusions: Tongue-tie is not uncommon and is associated with breastfeeding difficulty in newborn infants. Mothers of infants with severe tongue-tie should be closely and individually coached during breastfeeding and followed up, especially during the first critical weeks of the infant's life.

Keywords: Breastfeeding difficulties, Inverted nipple, Short nipple, Thai infants, Tongue-tie (ankyloglossia)

Introduction

Breast-milk is the best nutrition for infants, healthy or sick. Its abundant biological and psychological benefits to infants and mothers, as well as to families and society have been proven.¹ In 1979, the World Health Organization recommended exclusive breastfeeding for 4–6 months but in 2001 revised this to exclusive breastfeeding for 6 months.² Although this was adopted by the Ministry of Public Health in Thailand with the aim of achieving 30% of exclusive breastfeeding for 6 months by the end of 2006, a survey in 2005 revealed a rate of only 14.5%. One of the most commonly reported reasons for Thai mothers to supplement breastfeeding with infant formula is the perception of insufficient breast-milk.^{3,4} While a variety of conditions can contribute to decreased breast-milk production, one explanation is ineffective suckling which, in turn, leads to decreased prolactin

secretion and consequently less milk production, finally leading to failed breastfeeding.

Effective breastfeeding requires good latching on with the infant's tongue reaching beyond the nipple to cup around the maternal areola. Tongue-tie, a condition in which the lingual frenulum is too short, prevents the tongue from stretching to the areola.^{5–12} This study was undertaken to determine the prevalence of severe tongue-tie and subsequent breastfeeding difficulties as well as other factors affecting breastfeeding success in Thai newborn infants.

Subjects and Methods

This prospective, cross-sectional study was conducted at the Faculty of Medicine Siriraj Hospital, Bangkok, which is a collaborator in the Baby-Friendly Hospital Initiative. Between 11 November 2005 and 13 August 2006, 2679 infant–mother dyads were recruited. Inclusion criteria were (i) healthy infants and mothers, and (ii) having been born at Siriraj Hospital. Exclusion criteria were (i) breastfeeding could not be commenced

Correspondence to: M Laohapensang, Division of Pediatric Surgery, Department of Surgery, Faculty of Medicine, Siriraj Hospital, 2 Prannok Road, Bangkoknoi, Bangkok, 10700 Thailand. Fax: +662 412 9160; email: simlh@mahidol.ac.th

within the first 48 hours of life, or (ii) breastfeeding was contraindicated.

The study was approved by the Ethics Committee of the Faculty of Medicine Siriraj Hospital. During the study period, 2679 postpartum women were eligible and were recruited for the study. Physical examination of the infants and their mothers and the breastfeeding practices were assessed between 24 and 48 hours of life. The examination included the appearance of the infant's lingual frenulum and the nipple anatomy (after suckling) of the mothers (Table 1 and Figure 1). Mothers in whom one nipple appeared to be different from the other were categorized according to the more severe abnormality of the two. During evaluation, mothers were asked to commence breastfeeding and, after a short interval, to describe where she can feel her infant's tongue (Table 1). Mother–infant dyads with breastfeeding difficulty were referred to one of five lactation specialists who helped them intensively to correct the basic problem such as improper holding positions. To minimize bias, breastfeeding difficulty was diagnosed only if poor latching-on persisted after repeated coaching by the lactation specialists. The person who assessed the breastfeeding was not blinded to the presence of tongue-tie. Maternal and infant demographic data were also recorded.

Statistical analysis

A review of the literature found that the prevalence of tongue-tie is 1.7–4.8% and sample size was calculated on this basis.^{5,6,10,13} We used a prevalence of approximately 4% ($P=0.04$) and a 95% confidence interval of 3.2–4.8% (margin of error 20%). Data were analyzed by SPSS 10.0 (SPSS Inc., Chicago, IL, USA). Baseline data were reported as mean (SD), frequency (percentage), or median (interquartile range), as appropriate. For univariate analysis, the unpaired *t*-test or χ^2 test were used, as appropriate. Variables with a *P*-value <0.2 by univariate analysis were selected to fit the 'enter' model of multiple logistic regression. Possible co-linearity and interactions among variables were examined. Results were

Table 1 Definitions used in this study

Degrees of tongue-tie (Figure 1)	
Severe:	lingual frenulum is at or distal to the fimbrinated fold
Moderate:	lingual frenulum is proximal to the fimbrinated fold but in the distal half of the tongue
Normal:	lingual frenulum is in the proximal half of the tongue
Nipple abnormalities	
Flat or inverted:	nipple is flat or sinks down into the breast when the areola is pressed between the thumb and forefinger ¹⁹
Short:	length of the nipple is <0.7 cm
Maternal sensation of the infant's tongue	
Undetectable:	mother unable to feel the infant's tongue at her areola or nipple
At nipple:	mother feels the infant's tongue at her nipple
At areola:	mother feels the infant's tongue at her areola

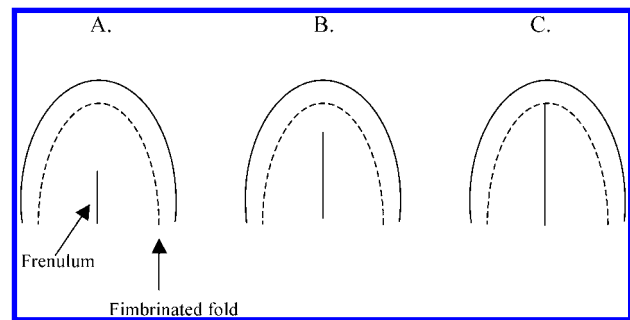


Figure 1 Degree of tongue-tie from ventral surface of tongue. A, normal; B, moderate; C, severe

presented as adjusted odds ratios (OR) and 95% confidence intervals (CI). Goodness of fit was tested by the Hosmer–Lemeshow test. The only missing data for variables in the model was being a first-time mother (4.7%).

Results

There were 2679 infant–mother dyads in the study. Demographic data are demonstrated in Table 2. Using anatomical criteria only, severe tongue-tie was found in 428 (16%) infants and moderate tongue-tie in 600 (22.4%). Male-to-female ratios for moderate and severe tongue-tie were, respectively, 1.1:1 and 1.8:1.

With all causes combined, 247 infants (9.2%) were diagnosed with breastfeeding difficulties. Rates of breastfeeding difficulty in infants with moderate and severe tongue-tie were 11.8% (71/600 infants) and 37.9% (162/428 infants), respectively. Prevalences of breastfeeding difficulty associated with moderate and severe tongue-tie were, respectively, 2.7% and 6%. The total prevalence of breastfeeding difficulty associated with moderate-to-severe tongue-tie was 8.7%.

By univariate analysis, factors significantly associated with increased risk of breastfeeding difficulties were moderate and severe tongue-tie, short nipples, mothers reporting undetectable sensation of the

Table 2 Demographic data

Data	No. (%)
Mode of delivery ($n=2546$)	
Vaginal delivery	1651 (64.8)
Caesarean section	809 (31.8)
Vacuum-assisted delivery	73 (2.9)
Forceps assisted delivery	7 (0.3)
Breech assisted delivery	6 (0.2)
Male	1391 (52)
Gestational age, w*	38.6 (1.5)
Birthweight, g*	3092.3 (378.5)
Apgar scores [†]	
1 minute	9 (8, 10)
5 minute	10 (10, 10)
Maternal age, y*	27.2 (6.4)
First-time mother ($n=2554$)	
No	1200 (47)
Yes	1354 (53)

* Mean (SD); [†] median (25th percentile, 75th percentile).

infant's tongue or feeling the infant's tongue at her nipple, and being a first-time mother (Table 3).

Possible co-linearity and interactions among tongue-tie, sensation and maternal nipple were examined. Correlation co-efficients of correlation between tongue-tie and sensation, maternal nipple and sensation, tongue-tie and maternal nipple were 0.29, 0.32 and 0.05, respectively. By multiple logistic regression analysis, the possible interactions between tongue-tie*sensation, and maternal nipple*sensation were fitted into the initial model, but no statistical significance was found. Factors independently associated with breastfeeding difficulties, in order of significance, were severe tongue-tie, moderate tongue-tie, mothers reporting not feeling the infant's tongue, and reporting feeling the infant's tongue at the

nipple, and short nipple (Table 4). Goodness-of-fit tested by the Hosmer–Lemeshow test showed $P=0.83$.

As is our standard practice, only those infants who still had breastfeeding difficulty associated with tongue-tie were counselled for conservative treatment or frenulotomy. However, this is beyond the scope of this study.

Discussion

The 16% prevalence of severe tongue-tie is higher than that reported in the literature in which the prevalence of tongue-tie varies from 1.7% to 10.7%.^{5,6,9,10,13} This is partly owing to the lack of a standard diagnostic definition.¹⁴ Most studies assess both appearance and function of the tongue. For

Table 3 Comparison by univariate analysis between infants with and without breastfeeding difficulties

Variables	Breastfeeding difficulty <i>n</i> =247 (%)	No breastfeeding difficulty <i>n</i> =2432 (%)	<i>P</i> -value	OR (crude)	95% CI
Gestational age, w*	38.6 [1.4]	38.6 [1.5]	0.55		
Birthweight, g*	3070.7 [380.6]	3094.6 [378.3]	0.35		
Male	143 (57.9)	1248 (51.3)	0.05	1	
Female	104 (42.1)	1184 (48.7)		0.8	0.6–1.0
Maternal age, y*	27.4 [6.5]	27.2 [6.4]	0.62		
Teenage mother					
Yes (<18 y)	17 (7.1)	118 (5.1)	0.20	1	
No	223 (92.9)	2186 (94.9)		0.7	0.4–1.2
Tongue-tie					
Normal	14 (5.7)	1637 (67.3)	<0.001	1	
Moderate	71 (28.7)	529 (21.8)		15.7	8.8–28.1
Severe	162 (65.6)	266 (10.9)		71.2	40.6–124.8
Nipple					
Normal	136 (55.1)	1686 (69.3)	<0.001	1	
Short	104 (42.1)	702 (28.9)		1.8	1.4–2.4
Flat/inverted	7 (2.8)	44 (1.8)		2.0	0.9–4.5
Sensation of tongue					
At areola	31 (12.6)	1271 (52.3)	<0.001	1	
At nipple	199 (80.6)	1129 (46.4)		7.2	4.9–10.6
Undetectable	17 (6.9)	32 (1.3)		21.8	11.0–43.3
First-time mother					
No	94 (39.2)	1106 (47.8)	0.01	1	
Yes	146 (60.8)	1208 (52.2)		1.4	1.1–1.9

* Mean [SD].

Table 4 Factors associated with breastfeeding difficulties: multiple logistic regression analysis (*n*=2554)

	OR (adjusted)	95% CI		<i>P</i> -value
		Lower	Upper	
Tongue-tie				
Normal	1			<0.001
Moderate	13.3	7.2	24.5	
Severe	62.0	34.1	112.8	
Nipple				
Normal	1			0.01
Short	1.5	1.1	2.2	
Inverted	1.3	0.4	4.8	
Mother's sensation of infant's tongue				
At areola	1			<0.001
At nipple	3.4	2.2	5.2	
Undetectable	11.8	4.3	32.4	
Male	1			0.21
Female	1.2	0.9	1.7	
First-time mother				
No	1			0.09
Yes	1.3	1.0	1.8	

example, the lowest prevalence of 1.7% includes only cases in which the lingual frenulum extends to the papillated surface of the tongue and prevents protrusion of the tongue or causes a sulcus in the tip of the tongue during normal movements.¹³ These infants probably have the most severe tongue-tie from both an anatomical and a functional point of view. On the other hand, Hogan *et al.* recruited infants with a frenulum extending along 25–100% of the tongue's total length and reported a higher prevalence of 10.7% based on appearance only.⁹ When both anatomical and functional criteria were assessed, the prevalence of tongue-tie with associated breastfeeding difficulty in our population was 6% and 2.7% for severe and moderate tongue-tie, respectively. This is comparable with studies using both anatomical and functional criteria.^{5,6,10,13}

Hazelbaker described a tool for assessing lingual frenulum function (ATLFF) which comprises five appearance and seven function criteria.¹⁵ Although Amir *et al.*¹⁶ demonstrated that some of the function criteria have low inter-rater reliability, Ballard *et al.*⁶ found a high degree of correlation between the ATLFF score and breastfeeding difficulty. At our hospital, with approximately 8500 deliveries per year, Hazelbaker's ATLFF seems to be very comprehensive but difficult to use; it is therefore not suitable as a screening tool in our situation. The appearance of the lingual frenulum was objectively assessed in our study by the more practical marker of the fimbriated fold. The benefit of this simpler anatomical assessment is that physicians and nurses can accurately detect tongue-tie by appearance. The detection of tongue-tie should alert the breastfeeding team to the possibility of breastfeeding difficulties and the need to ensure that mothers are given support and are closely followed up.

The presence of tongue-tie could influence the diagnosis of breastfeeding difficulty. Effective breastfeeding depends on mother–infant interaction. Correct positioning and good latching-on at the breast are fundamental to effective suckling.¹⁷ The human nipple is highly elastic and elongates during active breastfeeding to approximately twice its resting length.¹⁸ Other than the nipple's anatomy, the infant's tongue needs to reach the areola and stretch the breast tissue under the areola to form a teat in his mouth, thus achieving good latch-on.¹⁹ We consider that mothers reporting feeling the infant tongue at her areola indicates good latching-on. During breastfeeding, some infants with tongue-tie are unable to stretch the tongue beyond their lower gum, so it is difficult to achieve good latching on to the breast.^{6,19} The mother will feel the infant's tongue at her nipple (instead of areola) or feel the infant's gingiva causing a biting sensation on her nipple, associated with severe nipple pain and which can cause

cracked nipples. In this study, approximately 98% of the mothers who reported the infant's tongue at the areola did not have breastfeeding problems. Although in some cases the mother found it difficult to determine the position of the infant's tongue, these infants were eventually found to have poor latching-on.

While tongue-tie was the most significant risk factor for breastfeeding difficulty, short nipple and inability to feel the infant's tongue on the areola were also significant risk factors. A dose-response effect was demonstrated between severity of tongue-tie and breastfeeding problems. Similar to other studies,^{5,9} approximately one third of the infants with tongue-tie had problems with breastfeeding.

Mother–infant pairs were evaluated after the first 24 hours of life when the effect of maternal analgesics and sedation, which would affect breastfeeding success in mothers and infants, would have worn off. However, post-partum nurses commenced breastfeeding support as soon as possible.

Breastfeeding difficulty is an important issue, for individual patients and from a public health perspective. The potential for missed opportunities for breastfeeding is enormous. Ricke *et al.* reported that infants with tongue-tie were three times more likely to be exclusively bottle-fed at 1 week than infants with normal tongues.¹⁰ The problem needs to be identified early so that breastfeeding coaching and emotional support can be commenced as early as possible.

Tongue-tie is a significant problem and is associated with breastfeeding problems in Thai newborn infants. Breastfeeding evaluation which includes examination of the infant's lingual frenulum and the maternal breast should be done in every mother and her infant before they are sent home. The mother of an infant with severe tongue-tie should be closely and individually coached and followed up, especially during the first critical weeks of the infant's life.

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