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Original Research Article

An observational cohort study on the etiology and outcomes of neonates with thumb in flexion sign

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ABSTRACT

Background: One constant observation by Pediatricians during postnatal rounds is that many of the early neonates exhibit a sign with thumb adducted and flexed over the palm and the rest of the fingers flexed over the thumb. In an otherwise normal neonate with no obvious etiological factors, we do come across TIF sign in more than half of the early neonate. This study attempts to know weather this sign is physiological or pathological and what would be the neurological outcome of the neonates exhibiting this sign in the early neonatal period.
Methods: The study was conducted in the department of Pediatrics (post-natal ward in) of Sri Venkateshwara Medical College Hospital & Research centre, Ariyur, Puducherry, a tertiary care hospital loacted in a rural area.
Results: Among 227 study participants 152(67%) had TIF sign. The infants born after history of fetal distress had higher incidence of TIF sign (76.1%) with a p value 0.05. One significant finding was that all the 7 infants who had language delay had history TIF sign within 7 days of life. The p value was 0.01.
Conclusions: The pathological view of the TIF sign is, perhaps, a sign of minimal insult to the developing brain from which it recovers over a period of few months. From our study we conclude that the incidence of TIF sign was about 67 %. Thumb in Flexion sign has clinical significance with etiological factors like fetal distress in apparently healthy full-term infants. The secondary outcome of TIF sign was isolated language delay which was present in babies who had TIF sign within first week of life without neurological deficits up to 1 year of life with statistical significance. Hence it is recommended that the neonates with this sign need periodic neurological evaluation.

Keywords: Fetal distress, Hammersmith neonatal neurological examination, Language delay, Term neonates, Thumb in flexion sign

INTRODUCTION

One consistent observation by Pediatricians during postnatal rounds is that many of the early neonates exhibit a sign with thumb adducted and flexed over the palm and the rest of the fingers flexed over the thumb. It is bilateral or sometimes unilateral. The neonates are otherwise clinically normal. Few of them had h/o difficult labor but most of them had normal birth history.

The thumb in flexion sign

The early neonate often has a tendency to enclose his thumb within his palm with flexed fingers (Figure 1). This is called the thumb-in-fist (TIF) position and in literature as thumb in flexion sign.

Variants of TIF sign

1. Bilateral - Presence of TIF sign in both the hands (Right and Left)

2. Unilateral - Presence of TIF sign in only one of the hands (Either Right or Left)
3. Persistent - Presence of TIF sign continuously for more than a day
4. Intermittent- Presence of TIF sign on and off through the day and night
5. Complete- Presence of TIF sign which cover both proximal and distal creases of the palm
6. Incomplete- Presence of TIF sign which cover only the proximal creases of the palm
7. Early and delayed TIF sign: TIF appearance- < 7 days and >7 days (after birth).

Figure 1: Thumb in flexion sign in a newborn.

Michael Jaffe et al in their study in the year 2000, stated that "TIF posture occurs relatively frequently and that it disappears over a well-defined period. It was not noted in infants after 7 months old. Provided that other neurological findings are not elicited and that the infant is able to spontaneously open his hand, it is probably of minimal clinical importance. The possible association with language acquisition is an intriguing one and remains to be validated in other studies."[1]

Regarding the thumb in flexion attitude, three different conditions were (already) described for the newborn in the literature (with known causes.)

1. The "cortical thumb of Paine", is a strong flexion of the fingers and adduction of the thumbs across the palms, which are associated with generalized hypertonia and hypereflexia. This is an obvious sign of cerebral palsy. The "cortical thumb of Paine" was first described by Harvey B. Sarnat, which he interpreted as expression of the medial subcorticospinal pathway without antagonism of the corticospinal tract to balance its effects.[2]

2. Congenital trigger thumb is a condition in which the thumb joint locks and does not straighten out when trying to flex the thumb. The reason for trigger thumb and trigger finger is stenosing tenosynovitis. Stenosing refers to the fact that the sheath that surrounds the thumb's tendons becomes more narrow than normal.

3. Congenital clasped thumb is a condition in which there is a muscular imbalance: the flexors of the thumb are stronger than the extensors that straighten the thumb. The flexed position of the thumb is most often related to weakness of the key muscles that extend the thumb- extensor pollicis brevis and/ or the extensor pollicis longus. Other possibilities include shortening of the flexor tendons (flexor pollicis longus) or weakness of the abductor tendons.

All these conditions are pathological with definite etiology. In an otherwise normal neonate with no obvious etiological factors, we do come across TIF sign in more than half of the early neonate.)

Dubowitz and Dubowitz in their book on 'The Neurological Assessment of the Preterm and Full-term Newborn Infant' describe the abnormal hand and toe postures in neonates. They describe it as normal when the hands are open and toes are straight most of the time. They also call itnormal variant if hands have intermittent fisting or thumb adduction. But they label it abnormal when the hands have continuous fisting or thumb adduction, index finger flexion and thumb opposition. It is also abnormal if the foot has continuous big toe extension or flexion of all the toes.[3]

In 1941 Conel demonstrated a relationship between the cerebral cortical anatomic structure and the functional development of the hand and upper limb and suggested that the study of the precise hand positions of the infant might shed light on the maturational process of the cerebral cortex.[4]

In 1947 Gesell and Amatruda, in their pioneering work on the developmental assessment of infants and children, emphasized that during the first 2 months of life, the hands are tightly fisted, and by 12 weeks they become loosely closed. This facilitates the development of self-directed visually oriented voluntary grasp or prehension.[5]

In 1966 Cobb et al concluded that the elicited grasping responses in young infants, which are presumed to be controlled subcortically must diminish before voluntary prehension, which is cortically controlled, can occur.[6]

In 2000, Michael Jaffe et al studied the prevalence, resolution and clinical associations of TIF posture. In the whole study group was followed up until the disappearance of the TIF occurred, additional data on development and the neurological status were obtained at 12 months of life.[7-11]

METHODS

The newborns delivered in a medical college hospital, Sri Venkateswaraa Medical College Hospital and Research Center (SVMCH and RC), Puducherry, was included in the study. The babies included were all delivered by vaginal, instrumental and cesarean sections. The period

of study was (extended) from June 2017 to May 2018 (one year).

Study design

This was an observational cohort study (particular form of longitudinal study that sample a group of people who share a defining characteristic, typically those who experienced a common event in a selected period, such as birth, etc,. performing a cross-section at intervals through time which aids in evaluating associations between diseases and exposures). It was a universal sample.

Inclusion criteria

All infants fulfilling the following criteria were included in the study; Term babies (>37 completed weeks and <42 completed weeks). APGAR score of >7/10 in 5 minutes.

Exclusion criteria

Low birth weight babies (<2.5kgs), congenital malformations, dysmorphism and syndromic features, family history of developmental disabilities, sick neonates.

In this study, 227 babies born during the study period fulfilling inclusion criteria and compliance were selected for analysis. Maternal details such as age, socioeconomic status, education status, parity, maternal illness, pregnancy related illness, addictions and medications, induction of labor, mode of delivery, indication of LSCS were recorded. APGAR score at 1st minute, 5th minute and 10th minute of birth were recorded. The birth weight and gestational age were determined. Gestational age was determined using New Ballard scale.

A detailed examination of the neonates was done. The anthropometry of the baby was recorded.

A careful neurological status of the neonate was recorded using the Hammersmith neonatal neurological examination schedule. Babies were examined for the presence of thumb-in-flexion sign. If it is present, further details like whether it was bilateral or unilateral, weather the fisting was tight or loosely held and whether the fisted hand could be opened without resistance were recorded. If the TIF sign was present, the mothers of these babies were trained to observe the TIF sign and the subsequent change in its manifestation in the course of time. All the babies were followed up at 1, 2, 3, 6th month and 1st year of life, mostly coinciding with immunization schedule. At each visit detailed developmental assessment and neurological examination were done using the Hammersmith Infant Neurological Examination Schedule. In addition, the mothers of babies with TIF were enquired periodically about the presence or absence of TIF sign over the phone and if the sign had disappeared the age of the infant when it disappeared was recorded. Telephonic reminders ensured compliance of the mother for review in the hospital. The mother was advised to continue recording up to 2 weeks after the disappearance of the sign. During each follow up visits of the babies, developmental and neurological assessments were done.

The data was entered in MS Excel and analyzed using SPSS software 16 V. The descriptive statistics such as frequency, percentages, range, mean, SD were calculated. The association between variables were calculated by chi square test.

RESULTS

Among 942 infants of total deliveries during the study period, 235 babies were excluded since they didn't fulfill the inclusion criteria. Among 727 babies who were fit under inclusion criteria, 93 mothers did not give consent for joining the study. Another 132 mothers whose compliance of recording TIF sign regularly was not satisfactory. A total of 48 babies didn't not come for follow-up. Therefore rest of the 227 babies who successfully completed the study was included as study population.

Table 1: Distribution of TIF among the study population.

TIF	Frequency	Percentage
Present	75	33
Absence	152	67
Total	227	100
Complete	57	46.05
Incomplete	95	53.95
Total	152	100.00
Unilateral	62	40.79
Bilateral	90	59.21
Total	152	100.00
Persistent	57	37.50
Intermittent	95	62.50
Total	152	100.00
< 7 days of life	74	48.68
>7 days of life	78	51.32
Total	152	100.00
Male	74	66.6
Female	78	67.2
Total	152	100
Language Delay +	9	4
Language Delay -	218	96
Total	227	100

They were examined and followed up through out the study period. The demographic data in terms of age, gender, maternal factors, neurological examination and developmental assessment of all babies with and without TIF sign were as follows:

Among 227 study participants 152(67%) had TIF sign. About 74 male and 78 female babies had TIF. This amounts to 66.6% and 67.2% respectively which implies that the there is no difference in sex distribution. 59.21% had bilateral TIF and 40.79% unilateral TIF. 82(53.95%) had incomplete TIF and 70(46.05%) had complete TIF. 57(37.5%) had persistent TIF and 95(62.5%) had intermittent TIF. Seventy three infants had TIF sign within the first 7 days of life (48.68%) and 79 had the onset of TIF after 7 days of life (51.32%). The infants born after history of fetal distress had higher incidence of TIF sign (76.1%) with a p value 0.05. This is in contrast to infants without history of fetal distress who had 63.1% TIF sign among them.

Table 2: Comparison of TIF with language delay among various parameters.

Language delay	TIF bilateral/unilateral				
	Unilateral	**Bilateral**	**Total**	**Chi sq**	**p**
No	61 (42.1%)	84 (57.9%)	145		
Yes	1 (14.2 %)	6 (3.9%)	7	2.13	0.1
Total	62	90	152		
	TIF complete/incomplete				
	Complete	Incomplete	Total	Chi sq	p
No	69 (47.5%)	76 (52.4%)	145		
Yes	1 (14.2%)	6 (3.9 %)	7	1.79	0.1
Total	70	82	152		
	TIF persistent / intermittent				
	Persistent	Intermittent	Total	Chi sq	p
No	54 (37.2 %)	91 (62.7%)	145		
Yes	3 (42.8 %)	4 (57.1 %)	7	0.09	0.5
Total	57	95	152		
	TIF age of appearance				
	< 7 days	> 7 days	Total	Chi sq	p
No	67 (46.2 %)	78 (53.7 %)	145		
Yes	7 (100 %)	0	7	5.73	0.01
Total	74	78	152		

Table 3: Distribution of TIF among babies born to mothers with fetal distress.

	TIF -	TIF +	+ve%	Total
Fetal distress -	16	51	76.1	67
Fetal Distress +	59	101	63.1	160
Total	75	152		227

The language delay was present in 7 babies among TIF positive infants. But there were 2 babies who had language delay among infants without TIF sign. There is no statistical significance proving TIF sign is the cause of language delay as p value is 0.3. Language delay infants with TIF sign was compared with various parameters of TIF sign viz. TIF age of appearance- <7 days and >7 days, bilateral and unilateral, complete and incomplete, persistent and intermittent. There was no significant association between language delay and various forms of TIF. One significant finding was that all the 7 infants who had language delay had history TIF sign within 7 days of life. The p value was 0.01. There were no significant neurological and developmental problems in all these infants.

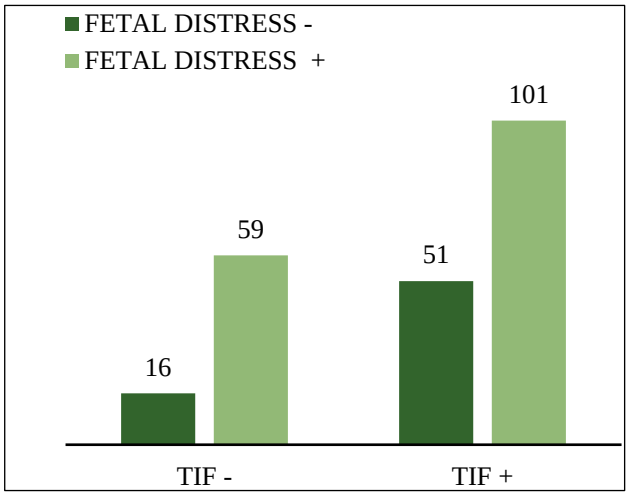

Figure 2: Distribution of TIF among babies born to mothers with fetal distress.

DISCUSSION

In this study, we have tried to analyze why 67% of normal term neonates had thumb in flexion sign. The sex

incidence was equal. 60% were having bilateral and 40% unilateral TIF. The sign was both complete (53.95%) and incomplete (46.05%) patterns. 62% was intermittent and the rest persistent in manifestation. We noted that the incidence of TIF sign was 48.6 % in early neonatal period and the rest occurred after 7 days of life. These statistics did not throw much light on the etio-pathogenesis of TIF sign. (The fact that it could appear even after 7 days of life in more than half of the infants that no perinatal factors could be attributed to this sign.) But there are some data, though statistically not much significant, indicating that some factors may play a role in the causation of TIF sign. For example, the incidence of TIF sign was more among infants whose birth weight was more, and who were born out of instrumental and emergency caesarian deliveries. Similarly, the incidence was also more among babies born after fetal distress.

It was observed that 34.8% infants became TIF negative within one month. Another 67 (44.0%) infants showed no TIF sign within 5 months. There was no TIF sign after 7 months of age. The language delay in the whole study population was present in 9 babies and 7 of them belonged to less than 7 days old TIF positive infants. There were no other significant neurological and developmental problems in all these infants.

Early identification of infants at risk for neurologic and developmental disorders (handicap) is the main aim of neonatal examination and follow-up. A syndrome of transiently abnormal neurologic signs in preterm infants was described by Drillen in 1972.[12] She identified neuromotor abnormalities in 40% of infants with birth weight less than 2000g and normalization of these findings in majority of infants by one year of age. Amiel-Tison defined transient tone abnormalities as abnormalities of tone, which are present in early infancy, which disappear by the end of the first year.[13]

CONCLUSION

Despite the fact that the fetus and the neonate face many challenges, there is a remarkable capability to develop normally overcoming the insults. The pathological view of the TIF sign is, perhaps, a sign of minimal insult to the developing brain from which it recovers over a period of few months. The physiological view is that the TIF sign is an expression of flexor tone persisting in one or both hands while in the rest of the body the flexor tone is waxing to facilitate movements. From our study we conclude that the incidence of TIF sign was about 67%. Thumb in Flexion sign has clinical significance with etiological factors like fetal distress in apparently healthy full-term infants. The secondary outcome of TIF sign was isolated language delay which was present in babies who had TIF sign within first week of life without neurological deficits up to 1 year of life with statistical significance.

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