DOI: 10.21088/per.2320.0022.14126.2

ORIGINAL ARTICLE

Moro Reflex in Newborns: Physiology, Clinical Relevance, and Diagnostic Value

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HOW TO CITE THIS ARTICLE:

Chakradhar Maddela. Moro Reflex in Newborns: Physiology, Clinical Relevance, and Diagnostic Value. Pediatr. Edu. Res. 2026;14(1): 11-14.

ABSTRACT

The Moro reflex is one of the most recognizable primitive reflexes in early neonatal life and provides important information about the functional status of the central and peripheral nervous systems. It is routinely assessed in newborns and reflects brainstem activity, motor pathway integrity, and developmental maturity. This review summarizes the physiological basis, method of elicitation, normal and abnormal patterns, and differences between preterm and term infants. Literature from standard neonatal references and indexed medical databases was reviewed. The reflex consists of a two-phase sequence initial abduction and extension of the upper limbs followed by adduction and flexion mediated mainly through brainstem circuits. Abnormalities such as absence, asymmetry, or sluggishness may indicate neurological dysfunction, peripheral nerve injury, or systemic illness. The reflex appears during late gestation, is well developed at term, and typically disappears by 4–6 months of age. Accurate assessment of the Moro reflex aids in early identification of neurological abnormalities and guides further evaluation.

KEYWORDS

• Included Moro Reflex • Primitive Reflexes • Neonatal Neurological Examination • And Brainstem Reflexes.

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➤ **Received:** 30-04-2026 ➤ **Accepted:** 03-05-2026

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INTRODUCTION

Primitive reflexes are involuntary motor responses originating from subcortical structures and serve as essential indicators of neurological integrity in newborns. Among these, the Moro reflex is one of the most clinically valuable because of its strong association with brainstem and vestibular function. The presence, symmetry, and quality of the reflex provide important clues about the infant's neurological status and may reveal early signs of injury or developmental delay.

The reflex develops during fetal life and is usually well formed in term infants. Its gradual suppression over the first few months of life parallels the maturation of cortical inhibitory pathways. Any deviation whether exaggerated, diminished, absent, or asymmetric may indicate underlying pathology and therefore requires careful interpretation during neonatal examination.[1,2]

METHODS

This narrative review draws on information from standard pediatric and neonatal textbooks, peer-reviewed articles, and authoritative clinical references. Searches were conducted in PubMed, Google Scholar, and the Cochrane Library for literature published between 1990 and 2025.

Inclusion Criteria

- Standard pediatric and neonatology textbooks
- Review articles and clinical studies on neonatal reflexes
- Publications describing physiology and clinical significance

Key references included Nelson Textbook of Pediatrics, Volpe JJ Neonatal Neurology and Prechtl HF R Neurological Examination of the Full-Term Newborn Infant.

RESULTS

1. Definition and Components

The Moro reflex is a stereotyped startle response consisting of two phases:

- **Phase 1: Abduction/Extension:** Sudden extension and abduction of the upper limbs with finger opening.
- **Phase 2: Adduction/Flexion:** Return of the arms toward the midline, often accompanied by crying.

2. Method of Elicitation

- Infant is placed supine.
- The examiner supports the head and allows it to drop slightly, creating a brief sensation of falling and sudden halt.
- A sudden loud sound or tactile stimulus may also trigger the reflex.
- Should be elicited when baby is in arousal state 3 or 4 or active with head in midline and arms besides the trunk.

3. Normal Response

A normal Moro reflex includes:

- Symmetrical abduction at shoulder, forearms extension at elbows and extension of fingers.
- Followed by adduction at shoulder and flexion at elbow.
- Often accompanied by opening of hands and crying.

Appearance of components of Moro reflex by gestational age[3]

- 28 weeks – hand opening
- 32 weeks – extension and abduction of arms, audible cry
- 37 weeks – anterior flexion of arms
- 6 months after birth – disappearance of Moro reflex in normal infants.

Table 1: showing grading of component movements response of Moro reflex[4]

Movement type	Grade	Response
Abduction (shoulder)	0	Absent
	1	Ante flexion (shoulder)
	2	45* abduction from trunk
	3	90* abduction from trunk
Extension (elbow)	0	Absent
	1	90* extension
	2	135* extension
	3	180* full extension
Adduction (shoulder)	0	Absent
	1	half range
	2	full range
	3	across midline
Flexion (elbow)	0	Absent
	1	week
	2	full movement

4. Abnormal Moro Reflex Patterns

Type	Description	Clinical Significance
Incomplete	Reduced amplitude	CNS depression, prematurity
Partial	Only one phase present	Neurological immaturity
Absent	No response	Severe CNS injury, asphyxia
Asymmetrical	One-sided response	Brachial plexus injury, clavicle fracture

5. Reflex Arc

- **Afferent limb:** Vestibular and proprioceptive inputs.
- **Central integration:** Brainstem (medulla).
- **Efferent limb:** Motor nerves to upper limb muscles.

6. Preterm vs Term Differences

Feature	Preterm	Term
Response	Weak or incomplete	Strong and complete
Coordination	Poor	Well coordinated
Symmetry	Variable	Symmetrical

7. Causes of a Sluggish Moro Reflex

- Prematurity
- CNS depression (e.g., HIE)
- Maternal medications or neonatal sedation
- Sepsis

8. Causes of an Absent Moro Reflex

- Severe birth asphyxia
- Intracranial haemorrhage
- Neuromuscular disorders
- Profound CNS depression

9. Developmental Timeline

- **Onset:** 28–32 weeks gestation
- **Fully developed:** Term
- **Disappearance:** 4–6 months

Persistence beyond this period suggests abnormal neurological development.

DISCUSSION

The Moro reflex is a valuable clinical marker of neurological integrity in newborns. Its two-phase pattern reflects coordinated activity between vestibular input, brainstem processing, and motor output. Because it involves both central and peripheral pathways, abnormalities may indicate a wide range of conditions from brachial plexus injury to severe CNS dysfunction.

Asymmetry is particularly important, often pointing toward peripheral nerve injury such as Erb palsy or clavicular fracture. Conversely, a weak or absent reflex may be seen in infants with hypoxic-ischemic encephalopathy, intracranial bleeding, or systemic illness. In preterm infants, immaturity of the nervous system results in a weaker and less coordinated response, emphasizing the need to interpret findings in relation to gestational age.[2,3]

The disappearance of the Moro reflex is a marker of cortical maturation. Persistence beyond the expected age is frequently associated with developmental disorders, including cerebral palsy. Serial assessments therefore provide valuable information for both immediate diagnosis and long-term neurodevelopmental monitoring.[1,4]

CONCLUSION

The Moro reflex remains a cornerstone of neonatal neurological assessment. Its presence, quality, and symmetry offer essential information about brainstem function, motor pathway integrity, and developmental maturity. Accurate elicitation and interpretation help clinicians identify neurological abnormalities early and guide further evaluation and management.

Learning Points

- The Moro reflex is a brainstem-mediated primitive reflex
- It has two phases: abduction/extension → adduction/flexion
- Asymmetry suggests peripheral injury
- Absence indicates severe CNS pathology
- Sluggish response is common in prematurity or CNS depression
- Disappears by 4–6 months
- Persistence suggests neurological abnormality
- Incomplete response is noticed in preterm infants due to weak antigravity muscles

Sponsors: No sponsors for this study.
Conflicts of Interest: Nil

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