CASE REPORT

Neonatal diaphragmatic paralysis after a difficult delivery: a case report

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ABSTRACT

Background: Diaphragmatic paralysis in neonates, secondary to phrenic nerve injury, is a rare but important cause of respiratory distress, particularly in the context of shoulder dystocia, and may go unnoticed in mild cases. It occurs due to lateral hyperextension of the neck during delivery, affecting the C3–C5 nerve roots, and is often associated with brachial plexus palsy.
Case description: We report the case of a male neonate, born after a difficult delivery, who developed mild respiratory distress at 24 hours of life. Chest radiography and ultrasonography revealed elevation of the right hemidiaphragm and absence of excursion, confirming right diaphragmatic paralysis. Management was conservative, with supplemental oxygen administered via nasal cannula, resulting in favorable clinical progression and spontaneous resolution of the condition.
Conclusion: The findings underscore the importance of considering diaphragmatic paralysis as a differential diagnosis in neonatal respiratory distress after a difficult delivery, even when symptoms are mild, to raise awareness among neonatal care professionals about an uncommon but clinically relevant complication. In addition, early imaging evaluation and conservative management are recommended in mild cases to avoid unnecessary invasive interventions.

Keywords: Infant Newborn, Diaphragmatic Paralysis, Dystocia, Case Reports (Source: MeSH)

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Parálisis diafragmática neonatal tras parto distócico: a propósito de un caso clínico

RESUMEN

Antecedentes: La parálisis diafragmática en neonatos, secundaria a lesión del nervio frénico, es una causa infrecuente pero importante de dificultad respiratoria, especialmente en el contexto de la distocia de hombros y puede pasar inadvertida en casos leves. Se produce por hiperextensión lateral del cuello durante el parto, afectando las raíces nerviosas C3-C5 y a menudo asociada con parálisis del plexo braquial.
Descripción del caso: Se presenta el caso clínico de un recién nacido de sexo masculino, producto de parto distócico, que a las 24 horas de vida desarrolló dificultad respiratoria leve. La radiografía y ecografía de tórax mostraron elevación del hemidiafragma derecho y ausencia de excursión, confirmando una parálisis diafragmática derecha. El tratamiento fue conservador, con aporte de oxígeno suplementario mediante cánula nasal, logrando una buena evolución clínica y resolución espontánea del cuadro.
Conclusión: Los hallazgos resaltan la importancia de considerar la parálisis diafragmática como diagnóstico diferencial en la dificultad respiratoria neonatal posterior a un parto distócico, incluso en presencia de síntomas leves, con el fin de sensibilizar a los profesionales neonatales sobre una complicación poco frecuente pero clínicamente relevante. Asimismo, se recomienda realizar una evaluación precoz por imágenes y optar por un manejo conservador en los casos leves, a fin de evitar intervenciones invasivas innecesarias.

Palabras clave: Recién Nacido; Parálisis Diafragmática; Distocia; Informes de Casos (Fuente: DeCS)

INTRODUCTION

Diaphragmatic paralysis is defined as a complete loss of diaphragmatic mobility with secondary diaphragmatic elevation, resulting from aplasia or atrophy of the muscle fibers or, more commonly, from injury to the phrenic nerve without a disruption in its continuity (1,2). It represents a diagnostic challenge due to its low incidence; however, it should be considered in the differential diagnosis of respiratory distress during the perinatal period.

Etiologies are classified as congenital or acquired, with the latter being more frequent in the neonatal context. Among acquired causes, traumatic birth, particularly shoulder dystocia, and postoperative complications in the thoracic or cervical regions stand out (3,4). Other rare causes associated with diaphragmatic paralysis include procedures such as internal jugular vein sectioning, neck surgery, mediastinal tumors, congenital hypomyelinating neuropathy, and congenital myotonic dystrophy (3–5).

During a difficult delivery, lateral hyperextension of the neonate's neck has been reported to cause injury to the C3–C5 nerve roots, either by stretching, compression, or, in extreme cases, partial transection of the phrenic nerve (2). The motor fibers of the phrenic nerve pass through the brachial plexus region, which explains why, in approximately 78% of cases, diaphragmatic paralysis secondary to phrenic nerve injury is accompanied by ipsilateral upper limb paralysis, often of the Erb–Duchenne type, and sometimes associated with clavicle or humeral fractures (1,3).

The estimated incidence of perinatal diaphragmatic paralysis ranges from 1 in 15,000 to 1 in 30,000 live births, with a mortality rate of 10–15 % (3,4). It is more prevalent in term neonates, males, and in cases of fetal macrosomia (birth weight ≥ 4,000 g) or breech presentation (3,4). Clinically, the condition typically presents with respiratory distress of varying severity, which may progress to severe respiratory failure. It may also manifest as difficulty weaning from mechanical ventilation, recurrent respiratory infections, or, in some cases, be asymptomatic (1,3).

For diagnosis, the combination of chest radiography and ultrasonography is sufficient in most cases (1,5). Radiographs demonstrate elevation of the hemidiaphragm, decreased lung volume, and ipsilateral basal atelectasis. In contrast, ultrasonography enables real-time assessment of diaphragmatic mobility, detection of paradoxical movement, and functional evaluation without exposure to radiation. In more complex cases, computed tomography or electromyography may be used, especially in bilateral cases or when diagnostic uncertainty exists, to differentiate neuropathy from myopathy and guide prognosis and management (6,7).

Initial management is supportive: supplemental oxygen, noninvasive ventilation using continuous positive airway pressure via nasal cannula, or noninvasive mechanical ventilation ("gentle ventilation") when respiratory status requires it. Diaphragmatic plication is indicated only in cases of persistent failure to wean from ventilation, severe respiratory insufficiency, or when there is no evidence of spontaneous recovery after six weeks. Major series recommend waiting until the first month before deciding on plication, as most cases improve spontaneously; however, some authors advocate for early intervention in selected patients to reduce the morbidity associated with prolonged support (8–10).

We present the clinical case of a neonate diagnosed with right diaphragmatic paralysis, confirmed by imaging studies. The patient was managed in the neonatology service of a public tertiary referral hospital in Montevideo, Uruguay, which records an average of 5,000 births per year. Notably, there was no involvement of the brachial plexus. Conservative clinical management allowed favorable progression, both clinically and radiologically, with satisfactory spontaneous resolution.

Informed consent was obtained from the patient's mother for the publication of clinical data and images.

CASE DESCRIPTION

We present the case of a male neonate, born to a 29-year-old healthy mother with a history of two previous pregnancies and two vaginal deliveries. Maternal screening for transmissible infections was negative. Obstetric ultrasounds showed no abnormalities. At 40 weeks of gestation, labor commenced, complicated only by shoulder dystocia, which was successfully resolved using the Rubin maneuver.

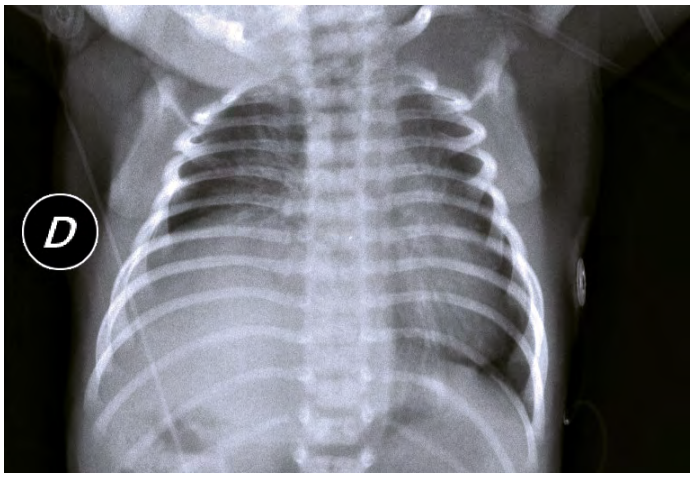
The neonate weighed 3,985 g at birth, with a head circumference of 36 cm and a length of 51 cm, appropriate for gestational age, and presented as vigorous. Physical examination at birth revealed no abnormalities, facial dysmorphisms, or respiratory distress. The cardiovascular examination was normal, and both upper limbs demonstrated adequate movement without any asymmetry. The neonate tolerated enteral feeding well from birth.

At 24 hours of life, respiratory distress was noted with mild respiratory insufficiency, characterized by tachypnea, intercostal retractions, and episodes of cyanosis during crying. The patient was admitted to the intermediate care unit, requiring low-flow supplemental oxygen via nasal cannula (1–2 L/min). A diagnostic workup was initiated to rule out congenital pneumonia, cardiac disease, and congenital pulmonary malformations.

Chest radiography (Figure 1) revealed marked thoracic asymmetry with elevation of the right hemidiaphragm. Thoracic ultrasonography (Figure 2) confirmed that the right hemidiaphragm was positioned high, with no detectable excursion, whereas the left hemidiaphragm exhibited preserved excursion. Additionally, areas of partially atelectatic parenchyma were observed in the right lower lung field.

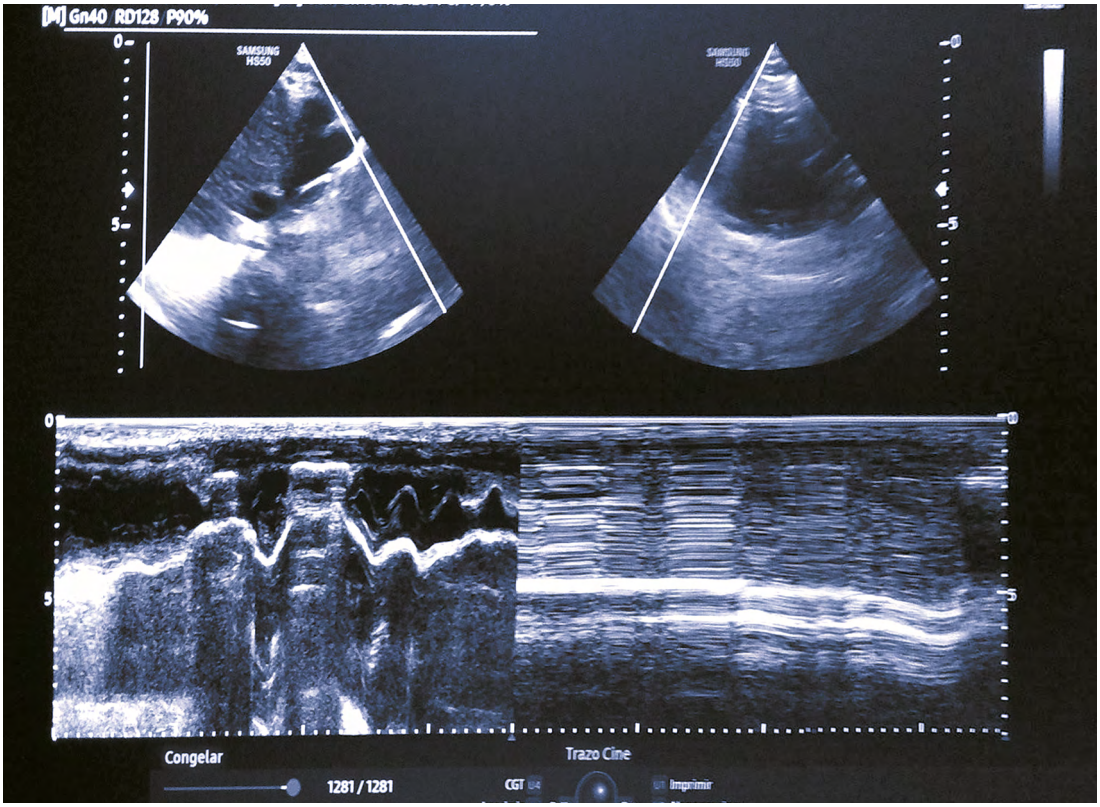
The patient showed progressive improvement in respiratory distress, without episodes of hypoxemia or signs of fatigue, and thus did not warrant invasive mechanical ventilation. Conservative management was chosen due to the overall good clinical status and adequate compensation with supplemental oxygen.

Figure 1. Chest radiograph.



Elevation of the right hemidiaphragm is observed.

Figure 2. Thoracoabdominal ultrasonography.



Reduced movement of the right hemidiaphragm is observed. Excursion of the left hemidiaphragm is preserved.

By day 6 of life, the neonate was breathing spontaneously on room air. He was transferred to the minimal care unit on day 9 of life. Follow-up ultrasonography demonstrated improved excursion of the right hemidiaphragm, confirming functional recovery and favorable evolution. During subsequent outpatient follow-ups, the patient remained asymptomatic, with appropriate growth and development.

Reduced movement of the right hemidiaphragm is observed. Excursion of the left hemidiaphragm is preserved.

DISCUSSION

Diaphragmatic paralysis due to phrenic nerve injury is an uncommon but crucial diagnosis in the evaluation of neonates presenting with early respiratory distress. Clinically, it usually manifests within the first hours of life, presenting with respiratory difficulty of variable severity, which is determined by both the degree of diaphragmatic involvement and potential association with other injuries, such as brachial plexus palsy.

Neonatal etiopathogenesis is commonly associated with traumatic events during delivery, particularly shoulder dystocia, macrosomia, and breech presentation (11,12). In such cases, lateral hyperextension of the neck can damage the C3–C5 nerve roots and, consequently, the phrenic nerve (3,13). When nerve involvement occurs, approximately 78% of patients present with concomitant brachial plexus injury, frequently in the form of Erb–Duchenne palsy, and occasionally with clavicle or humerus fractures (5).

In this case, the diaphragmatic paralysis was isolated, without upper limb involvement, which occurs in a minority of cases (approximately 22%) (5,6). The preservation of symmetrical excitation and movement of the upper limbs suggests a highly localized peripheral nerve injury, limited to the phrenic nerve without brachial plexus involvement.

Although respiratory compromise is the primary concern, other potential neonatal consequences must also be considered, including feeding difficulties due to increased respiratory effort, delayed weight gain, the need for prolonged mechanical ventilation, and an increased susceptibility to respiratory infections. In severe cases, persistent hypoxemia can lead to long-term neurological sequelae.

Epidemiologically, the incidence of this condition is low, estimated to be between 1:15,000 and 1:30,000 live births, with a mortality rate of around 10–15% (12). It is more prevalent in term male neonates and in cases of macrosomia (6,12). The current case matches this epidemiological profile: a male, full-term newborn delivered after a difficult birth, with a birth weight near the macrosomia cutoff. Regarding the distribution of mild versus severe forms, available evidence is limited and does not allow precise comparisons, as most reports consist of small case series or isolated descriptions.

Imaging is key to diagnosis. Radiography demonstrates elevation of the hemidiaphragm, reduced lung volume, and basal atelectasis (14). Thoracic ultrasonography enables the real-time evaluation of diaphragmatic motion and the detection of paradoxical movement, without radiation exposure (15). In this case, ultrasonography clearly showed absent excursion of the right hemidiaphragm. Other techniques, such as fluoroscopy, computed tomography, and electromyography, are reserved for cases with bilateral involvement, atypical clinical presentations, or suspected more extensive neuromuscular involvement (5).

Therapeutically, a conservative approach is recommended, recognizing that many cases improve spontaneously within the first six weeks (5,7). In this case, the neonate achieved respiratory stabilization by day 6 and was discharged on day 9 without complications.

Diaphragmatic plication is reserved for persistent or worsening respiratory insufficiency, inability to wean from ventilatory support, or progressive clinical deterioration. The literature suggests waiting at least four to six weeks to assess spontaneous recovery, except in cases with clear indications for early intervention (<30 days). Some studies report that most procedures were performed after the first month of life without subsequent spontaneous recovery. In contrast, others report favorable outcomes with early plication (<30 days) and earlier weaning from ventilatory support, thereby reducing the risks associated with prolonged mechanical ventilation (3,4).

In this context, the conservative strategy was entirely appropriate and consistent with the clinical course, validating the effectiveness of expectant management in mild to moderate cases (5,7).

Medium- and long-term prognosis is generally favorable (1,4). Nonetheless, patients should be monitored for signs of recurrent atelectasis, pneumonia, and other respiratory complications. Although most cases resolve within weeks to a few months, reports exist of recurrent episodes or mild long-term respiratory dysfunction (4,5).

Preventive strategies focus on obstetric management: prenatal ultrasonographic monitoring can identify risk factors such as macrosomia or adverse fetal positions, facilitating delivery planning and minimizing the risk of traumatic dystocia (2). Phrenic nerve injury may be reduced by avoiding maneuvers that induce lateral neck hyperextension and excessive traction during fetal extraction, especially in shoulder dystocia or difficult deliveries. Additionally, training in safe obstetric techniques (16) and timely cesarean delivery in selected cases are strategies that may help mitigate this risk.

In conclusion, this clinical case highlights the importance of considering diaphragmatic paralysis as a differential diagnosis in neonates with early respiratory distress after a difficult delivery, even when there is no brachial plexus involvement. Conservative management, with respiratory support and close monitoring, can be successful in mild cases, avoiding unnecessary invasive interventions.

Healthcare professionals managing neonates should maintain a high index of clinical suspicion when obstetric risk factors, such as shoulder dystocia, are present. Systematic documentation of relevant risk factors in the medical record is recommended to facilitate subsequent evaluation.

Early imaging assessment and individualized clinical follow-up are crucial for determining the most appropriate therapeutic strategy, prioritizing a conservative approach whenever the clinical condition permits.

Author contributions

Sobrero and Allio: Data curation and Writing – original draft. Sobrero, Berazategui, and Moraes: Writing – review & editing.

Conflicts of interest

The authors declare no relevant financial or non-financial conflicts of interest.

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Ethical aspects

Informed consent was obtained from the patient's mother for the publication of clinical data and images.

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