

## **Descemet's membrane rupture associated with forceps delivery: A narrative review on diagnosis and management**

**Ruptura da membrana de descemet associada ao parto fórceps: Uma revisão narrativa sobre diagnóstico e manejo**

**Ruptura de la membrana de descemet asociada al parto con fórceps: Una revisión narrativa sobre diagnóstico y manejo**

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### **Abstract**

Neonatal corneal opacity (NCO) is an ophthalmologic emergency that severely threatens visual development. Among its causes, obstetric trauma, particularly from forceps delivery, remains a significant, though decreasing, etiology. This trauma can cause a rupture in Descemet's membrane (DM), leading to acute corneal edema, high astigmatism, and a profound risk of irreversible amblyopia. This narrative review aims to synthesize the most recent scientific evidence (2020-2024) on the approach to NCO, focusing on the clinical, imaging, and management findings that differentiate traumatic DM ruptures from their main clinical mimics. Methods: A narrative review was conducted, searching PubMed, SciELO, and LILACS for publications from 2020 to 2024 using relevant descriptors. Results: The synthesized literature indicates that any unilateral corneal clouding in a newborn with a history of instrumented delivery mandates urgent investigation. The classic differential diagnosis is primary congenital glaucoma (PCG). Clinical examination reveals that forceps-induced tears are typically vertical or oblique, whereas Haab's striae (from PCG) are horizontal or circumferential. Tools like Anterior Segment Optical Coherence Tomography (AS-OCT) are essential for confirming the presence, location, and extent of the DM tear or detachment. Management is time-sensitive and ranges from conservative (topical hypertonics) to surgical (descemetopexy with air/gas) or, in refractory cases, keratoplasty (PKP or DSAEK). Conclusion: The approach to neonatal corneal opacity requires rapid etiological clarification. The ophthalmologist plays a central role in using clinical history and advanced imaging (AS-OCT) to distinguish traumatic from congenital causes, a distinction that dictates immediate management and the critical, long-term strategy for amblyopia prevention.

**Keywords:** Forceps Delivery; Amblyopia; Ophthalmology.

## Resumo

A opacidade corneana neonatal (OCN) é uma emergência oftalmológica que ameaça severamente o desenvolvimento visual. Entre suas causas, o trauma obstétrico, particularmente por parto fórceps, permanece como uma etiologia significativa, embora em declínio. Esse trauma pode causar uma ruptura na membrana de Descemet (MD), levando a edema corneano agudo, alto astigmatismo e um risco profundo de ambliopia irreversível. Esta revisão narrativa tem como objetivo sintetizar as evidências científicas mais recentes (2020-2024) sobre a abordagem da OCN, focando nos achados clínicos, de imagem e de manejo que diferenciam as rupturas traumáticas da MD de seus principais diagnósticos diferenciais. Métodos: Foi realizada uma revisão narrativa, com busca no PubMed, SciELO e LILACS por publicações de 2020 a 2024 usando descritores relevantes. Resultados: A literatura sintetizada indica que qualquer turvação corneana unilateral em um recém-nascido com histórico de parto instrumentado exige investigação urgente. O diagnóstico diferencial clássico é o glaucoma congênito primário (GCP). O exame clínico revela que as rupturas induzidas por fórceps são tipicamente verticais ou oblíquas, enquanto as estrias de Haab (do GCP) são horizontais ou circunferenciais. Ferramentas como a Tomografia de Coerência Óptica do Segmento Anterior (AS-OCT) são essenciais para confirmar a presença, localização e extensão da ruptura ou descolamento da MD. O manejo é sensível ao tempo e varia de conservador (hipertônicos tópicos) a cirúrgico (descemetopexia com ar/gás) ou, em casos refratários, ceratoplastia (PKP ou DSAEK). Conclusão: A abordagem da opacidade corneana neonatal requer rápida elucidação etiológica. O oftalmologista desempenha um papel central no uso da história clínica e imagem avançada (AS-OCT) para distinguir causas traumáticas de congênicas, uma distinção que dita o manejo imediato e a estratégia crítica de longo prazo para prevenção da ambliopia.

**Palavras-chave:** Parto Fórceps; Ambliopia; Oftalmologia.

## Resumen

La opacidad corneal neonatal (OCN) es una emergencia oftalmológica que amenaza gravemente el desarrollo visual. Entre sus causas, el trauma obstétrico, particularmente por parto con fórceps, sigue siendo una etiología significativa, aunque en disminución. Este trauma puede causar una ruptura en la membrana de Descemet (MD), lo que lleva a un edema corneal agudo, alto astigmatismo y un profundo riesgo de ambliopía irreversible. Esta revisión narrativa tiene como objetivo sintetizar la evidencia científica más reciente (2020-2024) sobre el abordaje de la OCN, centrándose en los hallazgos clínicos, de imagen y de manejo que diferencian las rupturas traumáticas de la MD de sus principales diagnósticos diferenciales. Métodos: Se realizó una revisión narrativa, buscando en PubMed, SciELO y LILACS publicaciones de 2020 a 2024 utilizando descriptores relevantes. Resultados: La literatura sintetizada indica que cualquier opacidad corneal unilateral en un recién nacido con antecedentes de parto instrumentado exige una investigación urgente. El diagnóstico diferencial clásico es el glaucoma congénito primario (GCP). El examen clínico revela que los desgarros inducidos por fórceps son típicamente verticales u oblicuos, mientras que las estrias de Haab (del GCP) son horizontales o circunferenciales. Herramientas como la Tomografía de Coherencia Óptica del Segmento Anterior (AS-OCT) son esenciales para confirmar la presencia, ubicación y extensión del desgarro o desprendimiento de la MD. El manejo es sensible al tiempo y varía desde conservador (hipertónicos tópicos) hasta quirúrgico (descemetopexia con aire/gas) o, en casos refractarios, queratoplastia (PKP o DSAEK). Conclusión: El abordaje de la opacidad corneal neonatal requiere una rápida aclaración etiológica. El oftalmólogo juega un papel central en el uso de la historia clínica y las imágenes avanzadas (AS-OCT) para distinguir las causas traumáticas de las congénitas, una distinción que dicta el manejo inmediato y la estrategia crítica a largo plazo para la prevención de la ambliopía.

**Palabras clave:** Parto con Fórceps; Ambliopía; Oftalmología.

## 1. Introduction

Neonatal Corneal Opacity (NCO) represents an immediate diagnostic and therapeutic challenge. Corneal transparency is essential for the formation of a sharp image on the retina, and any obstruction of the visual axis in the first months of life can lead to profound and irreversible deprivation amblyopia (Mishra et al., 2024). Historically, birth trauma, specifically the application of obstetric forceps, was established as a classic cause of ocular injury, including the rupture of Descemet's membrane (DM) (Yadav & Tandon, 2023).

DM is the basement membrane of the corneal endothelium and, unlike the stroma, is relatively inelastic. Anteroposterior compression of the eyeball by the forceps blade can exceed the elastic limits of the DM, causing its rupture (Angmo et al., 2021). This rupture allows the acute influx of aqueous humor into the stroma, resulting in diffuse or localized corneal edema and clinical clouding (Gimenez-Aleixandre et al., 2020).

Although the incidence of instrumented vaginal deliveries has decreased in favor of cesarean sections, the use of forceps is still indicated in scenarios of maternal exhaustion or acute fetal distress (Harnet et al., 2022). Therefore, traumatic NCO remains a clinical reality.

The challenge imposed on the ophthalmologist is the need for a rapid and accurate differential diagnosis. Traumatic NCO is the great "mimic" of primary congenital glaucoma (PCG), another ophthalmologic emergency that also presents with corneal edema and ruptures in the DM (Haab's striae) (Kaur et al., 2024). The management and prognosis of these two conditions are radically different (Altay et al., 2022). Furthermore, other causes of NCO, summarized by the "STUMPED" mnemonic (Sclerocornea, Trauma, Ulcer, Metabolic disorders, Peters anomaly, Endothelial dystrophies), must be considered (Gupta et al., 2024). Misdiagnosis can lead to unnecessary glaucoma surgeries or, conversely, to the loss of valuable time in managing the trauma and amblyopia (Palioura et al., 2021).

This narrative review aims to synthesize the most recent scientific evidence (2020-2024) on the approach to NCO, focusing on the clinical, imaging, and management findings that differentiate traumatic DM ruptures from their main clinical mimics.

## 2. Methodology

A narrative review of the literature (Rother, 2007) of a qualitative nature (Pereira et al., 2018) was performed. The guiding research question was: "What is the current evidence for the differential diagnosis and management of Descemet's membrane rupture secondary to obstetric forceps trauma?"

The search was conducted in the PubMed/MEDLINE, SciELO, and LILACS electronic databases. Combined descriptors (DeCS/MeSH) were used: "Descemet Membrane" AND "Obstetric Labor Complications" OR "Birth Injuries"; "Corneal Injuries" AND "Forceps"; "Neonatal Corneal Opacity" OR "Congenital Corneal Opacity"; "Anterior Segment OCT" AND "Pediatric".

Inclusion criteria were: original articles (case reports, case series, cohorts), systematic reviews, and meta-analyses published between January 2020 and October 2024; languages of English, Portuguese, or Spanish; and a focus on the diagnosis, prognosis, or treatment of traumatic DM ruptures in neonates. Articles focused purely on iatrogenic (post-surgical) ruptures in adults, congenital endothelial dystrophies (CHED) without mention of trauma, or letters to the editor without original data were excluded.

The selected articles were critically analyzed, and relevant data were extracted and categorized for the synthesis presented in the results and discussion.

## 3. Results and Discussion

The analyzed literature allowed the findings to be grouped into three main axes: The clinical features that define obstetric trauma ("red flags"); the role of imaging tools in the differential diagnosis; and modern therapeutic approaches and amblyopia management.

A consensus is observed in the recent literature (2020-2024) regarding the importance of anamnesis. Unilateral NCO in a newborn, associated with a confirmed history of instrumented delivery (forceps), is highly suggestive of trauma (Yadav & Tandon, 2023).

The main change identified in recent years is the consolidation of imaging tools, notably Anterior Segment Optical Coherence Tomography (AS-OCT), as the gold standard for diagnosis (Nakamura et al., 2022). Examination under anesthesia (EUA) is often necessary, as slit-lamp evaluation is impractical (Lyu et al., 2024).

The most critical differential diagnosis for traumatic DM rupture is primary congenital glaucoma (PCG) (Kaur et al., 2024). Both conditions present with corneal edema, photophobia, and epiphora. The recent literature reinforces the classic distinction based on the orientation of the DM ruptures. Initially, Forceps ruptures are typically vertical or oblique, parallel to the direction of the compressive force from the forceps blade. They are often central or paracentral (Angmo et al., 2021; Romero-Rangel et al., 2022). On the other hand, Haab's striae (PCG): Are typically horizontal or circumferential, parallel to the limbus. This occurs because the increase in intraocular pressure (IOP) causes a general stretching of the globe (buphthalmos), and the DM ruptures at its point of greatest distension (Gupta et al., 2024). Besides the rupture morphology, IOP is a key differentiator: in trauma, the IOP is generally normal or low, whereas in PCG it is invariably elevated (Palioura et al., 2021).

Anterior Segment Optical Coherence Tomography (AS-OCT), especially in portable devices, has revolutionized the approach (Nakamura et al., 2022). AS-OCT allows for direct, non-invasive visualization of the DM. In cases of rupture, it confirms the break in continuity and, crucially, identifies if there is a DM detachment (DMD), where the membrane rolls on itself (Gimenez-Aleixandre et al., 2020). In eyes with total opacity, Ultrasound Biomicroscopy (UBM) can be used to evaluate the anterior chamber angle (to exclude PCG) and the presence of detachments, although AS-OCT has higher resolution for the DM (Mishra et al., 2024).

The management of DM rupture is determined by the extent of the detachment and the persistence of edema. The literature (2020-2024) shows a stepwise approach (Angmo et al., 2021; Lyu et al., 2024). Mild cases, with small ruptures and no significant detachment, can be managed conservatively with topical hypertonic agents (e.g., NaCl 5%) to reduce stromal edema and await endothelial healing (Gimenez-Aleixandre et al., 2020).

If there is a significant DM detachment (DMD) that does not re-attach spontaneously, surgical intervention is necessary (Romero-Rangel et al., 2022). The first-line procedure is descemetopexy: the injection of an air or gas bubble (such as SF<sub>6</sub>) into the anterior chamber. The bubble serves as a tamponade, pressing the DM back onto the stroma, allowing the endothelium to anchor it (Lyu et al., 2024). Multiple injections may be necessary (Angmo et al., 2021).

In cases where descemetopexy fails, the edema persists, or a dense stromal scar forms in the visual axis, keratoplasty (corneal transplant) is indicated (Han et al., 2021). Penetrating keratoplasty (PKP) in neonates has a historically guarded prognosis, with high rates of rejection and complications (Iqbal et al., 2024). More recent studies have explored the use of endothelial keratoplasty (such as DSAEK) for refractory detachments, which may offer faster visual rehabilitation, although it is technically very challenging in pediatric eyes (Lyu et al., 2024; Zhao et al., 2022).

The literature is unanimous that, even after the resolution of the corneal edema, the visual prognosis is guarded (Yadav & Tandon, 2023). The DM rupture itself, upon healing, induces high and irregular astigmatism. This astigmatism, combined with any residual opacity, creates strong anisometropia, which is highly amblyogenic (Harnet et al., 2022).

Therefore, the success of the treatment is not limited to clearing the cornea. The most critical aspect of long-term management is aggressive visual rehabilitation, with early refractive correction (contact lenses or glasses) and intensive occlusion therapy (patching) to combat amblyopia (Palioura et al., 2021).

#### **4. Conclusion**

The diagnosis of neonatal corneal opacity after a forceps delivery requires a methodical and urgent approach. The clinical and imaging differentiation between a traumatic Descemet's rupture and Haab's striae from congenital glaucoma is the most critical step.

The advent of portable AS-OCT has solidified its role as the diagnostic tool of choice. Therapeutic management has evolved from passive observation to active interventions, such as gas descemetopexy, reserving keratoplasty for refractory cases.

The final success is not measured only by corneal transparency, but by the implementation of an early and aggressive visual rehabilitation plan, as the prevention of anisometropic amblyopia is the true determinant of the patient's long-term vision.

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