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# Use of cryobiopsy for diagnosis and treatment of a rare laryngeal tumor in pediatrics

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## ABSTRACT

This report highlights the importance of differential diagnosis of laryngeal obstructive airway pathologies, as well as the growing value of endoscopic techniques, such as cryobiopsy, in achieving a definitive, accurate diagnosis.

This is an 8-month-old infant who presented with signs of airway obstruction and a history consistent with foreign body aspiration. During endoscopy under general anesthesia, a supraglottic tumor was observed, which was resected using a cryobiopsy probe, a method that is not widely used in pediatrics and in our setting. Postoperative pathological anatomy confirmed the diagnosis of juvenile xanthogranuloma, a form of non-Langerhans cell histiocytosis with an uncommon location in the larynx.


***Keywords:*** *pediatrics; stridor; laryngeal diseases; juvenile xanthogranuloma; cryotherapy.*

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## INTRODUCTION

The diagnosis of acute upper airway obstruction in pediatrics is a frequent clinical challenge. The most characteristic clinical signs are stridor and ventilatory failure.

There are multiple congenital and acquired etiologies with clinical presentations that can compromise the patient's life and manifest as true endoscopic emergencies.

Among the most common causes of congenital stridor in infants, laryngomalacia is the most prevalent condition, with an estimated frequency of 60-70%. It is followed by vocal cord paralysis (15-20%), congenital subglottic stenosis (15-20%), subglottic hemangioma (1.5%), and congenital laryngeal cysts (1.5%). Among causes of acquired stridor, the presence of a laryngeal foreign body is estimated to occur in 2-14% of cases.[1]

Cystic and tumorous formations of the supraglottic structure are uncommon in children. The annual incidence of congenital laryngeal cysts is estimated to be 1.9 per 100 000 live births.[2] Laryngeal neoplasms are rare and, for the most part, correspond to benign tumors, representing approximately 98% of cases.[3] The main differential pathological diagnoses include hemangiomas, hamartomas, chondromas, teratomas, and granular cell tumors, among others.

The diagnosis of a supraglottic tumor is based on clinical manifestations and direct visualization (laryngoscopy) with sampling and biopsy. Complementary methods such as neck profile radiography and nuclear magnetic resonance imaging (MRI) provide data that help make a presumptive diagnosis and show its relationship with adjacent structures.

Multiple endoscopic techniques have been described for managing pathology in this location, including cold resection, carbon dioxide ($CO_2$) laser, and microdebrider. Surgical resection with adequate margins is the main strategy for preventing recurrence.

In recent years, cryobiopsy has gained importance as both a diagnostic and therapeutic tool.[4]

## CLINICAL CASE

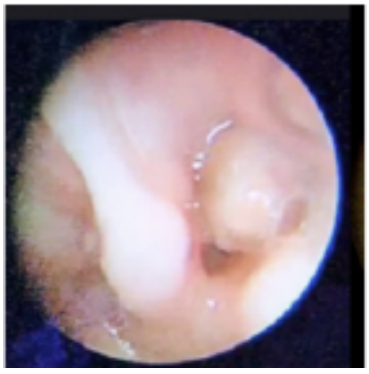
An 8-month-old infant with no relevant perinatal history, previously healthy, presented with a one-week history of cough and inspiratory stridor. A presumptive diagnosis of laryngitis was made, but the infant did not respond to treatment and subsequently worsened clinically.

In the targeted medical history, the mother reported suspected foreign body aspiration, which is why he was referred to our institution. The initial clinical evaluation revealed compromised general condition, inspiratory stridor, subcostal retractions, and moderate to severe ventilatory failure. Given the acute nature of the condition, it was decided to defer complementary imaging studies and perform an airway evaluation under general anesthesia (*Figure 1*).

During the procedure, a supraglottic tumor originating in the ventricle was observed.

Right laryngeal tumor measuring approximately 5 × 10 mm, occluding nearly 90% of the laryngeal lumen, had a solid consistency, with regular edges. Endoscopic removal using a cryobiopsy probe was performed, achieving complete endoscopic resolution without complications, immediate lumen recovery, and obtaining samples for anatomopathological study

**Figure 1. Direct laryngoscopy**



*Supraglottic tumor occluding 90% of the lumen.*

(*Figure 2*).

In the postoperative period, flexible fibrorhinolaryngoscopy was performed, showing a larynx with a proper lumen and minimal residual tissue alteration (*Figure 3*).

The histopathological study of the biopsy obtained showed juvenile xanthogranuloma (JXG), a form of non-Langerhans cell histiocytosis (*Figures 4A* and *4B*). Hematoxylin-eosin staining and immunohistochemistry techniques with CD68 were used to identify histiocytic cells.

During hospitalization, additional tests were performed, including chest and neck X-rays, with normal results, as well as ophthalmological, dermatological, and oncological consultations with no pathological findings. It was decided to postpone additional imaging tests, subject to clinical evolution. The patient had a favorable postoperative course without complications and was discharged from the hospital, with outpatient follow-up by the intervening specialties.

## DISCUSSION

A rare case of acute laryngeal obstruction secondary to juvenile xanthogranuloma (JXG) is reported. JXG is a form of non-Langerhans cell histiocytosis that is usually diagnosed during the first year of life or may be present at birth. The most common form of presentation is cutaneous, while extracutaneous involvement is rare. Among these locations, the eye is the most common (0.3-0.5%). Other locations described include the lung, intestine, liver, spleen, adrenal gland, central nervous system, bone marrow, and kidney.[5]

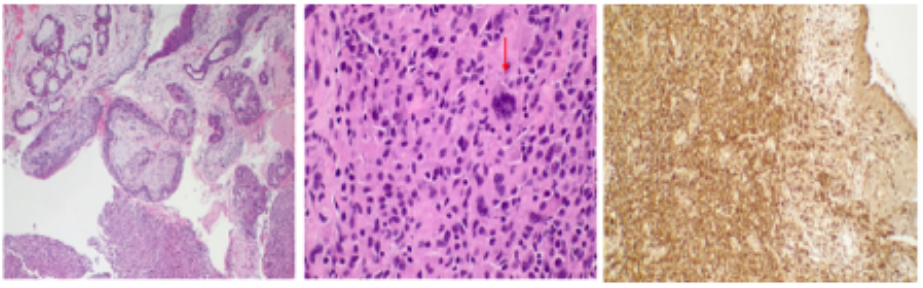
Histiocytosis is a group of rare entities that are generally biologically benign. From a classification standpoint, they can be grouped into xanthogranulomatous and non-xanthogranulomatous forms. The xanthogranuloma family is characterized by proliferation of histiocytes that differentiate into macrophages and dendritic cells, the absence of a *BRAF* mutation, and the occasional presence of Touton-type giant cells.

Skin lesions are usually self-limiting and resolve spontaneously, requiring no treatment. Extracutaneous manifestations may require specific therapeutic approaches, either surgical or medical, depending on the location and severity of the involvement. In cases with central nervous system involvement, systemic treatment with vinblastine, prednisone, and methotrexate

**Figure 2. Direct laryngoscopy with cryobiopsy probe**

**Figure 3. Post-surgical fibrorhinolaryngoscopy**

**Figure 4. Histopathology**



| **Figure 4A** | **Figure 4B** |
|---|---|
| Laryngeal biopsy. Hematoxylin-eosin staining and histiocytic proliferation with the presence of multinucleated cells. | Immunohistochemistry techniques with CD68: positivity in the histiocytic population. |

has been useful.[6] In this case, obtaining the laryngeal tumor sample using a cryobiopsy probe replaced traditional methods, making it possible to obtain a larger sample with adequate histological preservation, which facilitated anatomopathological analysis and the application of immunohistochemistry techniques. Likewise, acute airway obstruction was immediately resolved by combining therapeutic and diagnostic effects in a single procedure.

Cryobiopsy has been shown to have superior diagnostic performance to conventional transbronchial needle biopsy, although inferior to surgical biopsy, with lower associated morbidity. Its usefulness has been widely documented in the diagnosis of diffuse interstitial diseases and endobronchial and peripheral lung tumors. It is a valuable tool that combines high histological accuracy with immediate therapeutic benefit.[7]

From a technical standpoint, cryotherapy is an endoscopic procedure that has been described since 1977. The technique has been modified to increase freezing power and traction force, and its main indications include palliative treatment of bronchial obstructions caused by exophytic tumors and removal of granulation tissue, foreign bodies, and clots lodged in the airway. Its application has been reported to be very useful in the study of diffuse interstitial lung diseases, with recent publications in pediatrics.[8-10]

The mechanism of action is based on the Joule-Thompson effect, with rapid expansion of a compressed gas (carbon dioxide or nitrous oxide) at high pressure, which generates a temperature drop of -75 °C to -89 °C at the tip of the cryoprobe. The probe diameter ranges from 1.1 mm to 2.4 mm, which determines the size of the samples (*Figure 5*). The procedure is performed under general anesthesia, using an endotracheal tube, laryngeal mask, or rigid bronchoscope. The activation time ranges from 5 to 7 seconds; the extraction is performed *en-bloc* (cryobiopsy, flexible bronchoscope, and frozen, adhered fragment) using firm, rapid traction. The sample is then fixed in 10% formalin. The number of biopsies ranges from 4 to 6, with subsequent clinical and radiological monitoring for suspicion of pneumothorax.[11,12]

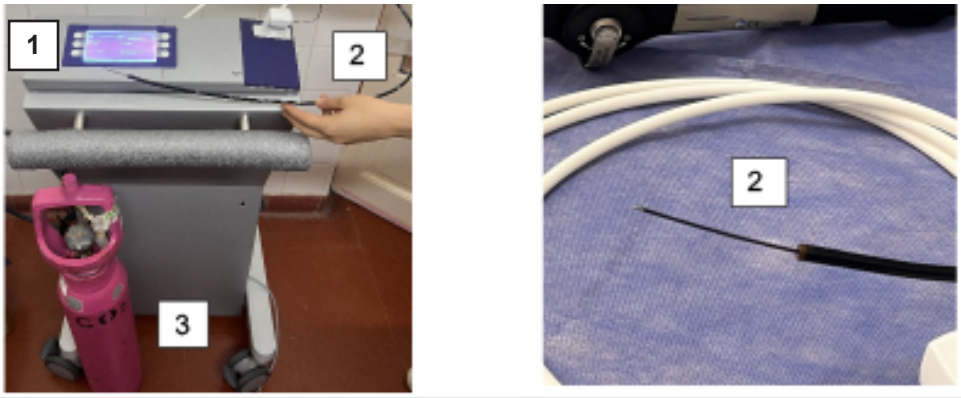
In pediatrics, the main indications for cryobiopsy include the study of idiopathic interstitial lung diseases, sampling of endobronchial tumors, removal of granulation tissue, mucous plugs, clots, and removal of foreign bodies with high moisture content or soft structure, such as tissues, seeds, and food, with a lower risk of fragmentation compared to the use of conventional forceps.

The most frequently reported complications are bleeding (4.9%), pneumothorax (9.5%), pneumomediastinum (1.4%), lung abscess, and death, with a lower incidence compared to video-assisted thoracoscopy.[13]

The main contraindications include thrombocytopenia, anticoagulant or antiplatelet therapy, elevated uremia affecting platelet function, hemodynamic instability, and severe hypoxemia. According to expert consensus, age is not a contraindication, provided that the general clinical condition and anesthetic safety permit it.[14,15]

The resolution of acute airway obstruction is a pediatric emergency that requires a detailed medical history, evaluation of signs and

**Figure 5. Cryobiopsy equipment**




1. Cryobiopsy/cryoconsol unit (cold generator).
2. Cryoprobe (inserted through the bronchoscope).
3. Gas source (nitrous oxide or carbon dioxide).

symptoms, and rapid action, without delaying airway clearance (endotracheal intubation) if necessary. In this context, endoscopic intervention allows, in most cases, effective resolution of the condition and a significant improvement in the clinical prognosis.

In our setting, transbronchial cryobiopsy remains a relatively new technique in public hospitals. Beyond its traditional therapeutic role in airway obstruction, its diagnostic and therapeutic potential could be expanded through adequate adaptation and standardization, optimizing its safety profile.

Despite the scarcity of reports and prospective studies in the pediatric population, especially in the upper airway, the favorable results of endoscopic treatment for bronchial tumors support the consideration of cryobiopsy as a promising tool. Its ability to facilitate early diagnosis, minimize invasive procedures, and offer effective clinical resolution positions it as a technique with encouraging potential for progressive incorporation into pediatric bronchoscopic practice.[16] ■

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