


RESEARCH ARTICLE

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PORTABLE NASOLARYNGOFIBROSCOPY FOR UPPER AIRWAY BURN DIAGNOSIS

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Abstract

Airway burns are one of the most frequent causes of hospitalization worldwide, and they generate a series of clinical manifestations in the patient that compromise the general state of the respiratory system and therefore correspond to a high risk of mortality. In recent years orotracheal intubation has been implemented as the main management plan; however, portable nasolaryngofibroscopy has been proposed as a burn assessment tool, which is why its usefulness in various exposed cases is analyzed.

Keywords: Nasolaryngofibroscopy, burn, upper airway, smartphone.

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1 | INTRODUCTION

Inhalation burns are defined as those of the airway that are produced by the inhalation of hot gases and combustion products. Thermal airway injuries are generally limited to supraglottic structures, while lower airway injury is usually chemical in nature (1). Inhalation injuries, which can occur as a result of a fire or explosion in a confined

space, may be associated with coexisting facial skin burns and trauma. Specific complications include thermal injury and inflammation of the upper and lower airways, bronchospasm, bronchial obstruction with plugs of carbonaceous sputum, pneumonia, acute respiratory distress syndrome (ARDS), carbon monoxide toxicity, and cyanide toxicity, as well as complications of coexisting skin burns and trauma, if present (2). Patients with this type of burns corre-

spond to the most serious group, have a high mortality rate and require intensive airway management.

In the United States, between 10 and 20% of patients admitted to a specialized center have airway burns, which is directly associated with the size of the affected surface. The result of the burn can range from 2% if the burned body surface has a percentage lower than 20% to 55% if the body surface is compromised by 80% or even a higher percentage. (3) In Latin America, mainly in Chile, mortality due to burns that are too high stands out, with an oscillation between 40-50% in the youngest groups, up to close to 100% in adult patients. In those patients of extreme ages, the risk of complications and death is high, since they constitute the highest risk group. (4)

The diagnosis for an inhalation burn is indicated by direct vision of the fiberoptic bronchoscope, where it is possible to observe carbonaceous endobronchial debris, ulcerations, redness or paleness of the mucous membranes. Likewise, there are other signs that should be suspected such as airway burn such as burnt nasal vibrissae, cough with carbonaceous sputum, dysphonia, laryngeal stridor and soot on the face. (5)

The evolution of technology, as well as its accessibility and availability, has allowed the incorporation of mobile telephony in the field of medicine. Direct laryngoscopy has been the standard of care to secure the airway, both in routine and emergency cases. Video laryngoscopy, introduced about a decade earlier, aims to overcome the limitations of direct laryngoscopy. Therefore, the use of mobile phones today in the medical field has been increasing as a way in which physicians acquire, transport, store, process and share information to provide meaningful results (6).

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2 | METHODS

A detailed bibliographic search of information published in the databases PubMed, Scielo, Elsevier, national and international Libraries was carried out. The following keywords were used in the development of the search: nasolaryngofibroscopy, burn, upper airway, smartphone.

3 | RESULTS

Several studies highlight the use of a flexible Android-USB endoscope with Gerdex, with a 5.5 mm diameter lens and 6 LED lights on its edges, with adjustable brightness and 1280 x 960 resolution allowing the evaluation of the rhinopharynx, pharyngolarynx, Choanas and glottis that allows recording through the USB end of the endoscope connected to the smartphone through videos and photographs with different applications through phones with an Android operating system and a full HD screen of 1080p resolution. Likewise, a nasolaryngofibroscopy was performed through a flexible 8mm Karl-Storz fiberoptic connected to a Karl-Storz camera with more than 450 lines of horizontal resolution, 300w Karl-Storz xenon light source, Kar Optical Fiber. Storz, attached to a 1280 x 960 Resolution Olympus 2D ONU monitor (Figure 1). These studies allowed the comparison of different parameters such as brightness-illumination cataloged in both methods as good and excellent, with the contrast of the images the basic colors in 75% of the videos obtained with the smartphone were concentrated as good and 25 % of these with excellent quality; for video quality, 100% of the images obtained with a smartphone were considered excellent, and in the same way, the effectiveness of this method for the diagnosis of upper airway injury was classified. (7).

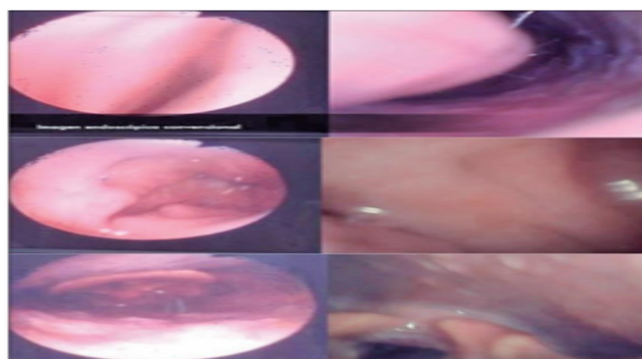


FIGURE 1: | Images obtained with conventional endoscopy (left side) compared to images obtained with portable nasolaryngofibroscopy (right side).

Similarly, other studies show the use of a smartphone with an iOS operating system, highlighting a video resolution of 1080p at 30 fps with an 8 megapixel camera that allowed the evaluators to take into account the focal point, color, and saturation, etc. The majority of these recordings were rated as satisfactory, which allowed the natural colors, the correct brightness and lighting to be visible. However, dif-

ferent factors such as the place of storage of said procedure made the results obtained difficult on certain occasions, therefore the recordings. They had to be carried out 2 and even 3 times to achieve the objectives that were set. The flexible fiberoptic nasolaryngoscope allows them to make 18 recordings, allowing them to observe anatomical areas such as the nasopharynx, oropharynx, hypopharynx and larynx (8,9).

4 | DISCUSSION

In the clinical setting, airway burns, independent of their causative agent, constitute one of the main reasons for hospital admission, being considered a problem that in turn induces a series of respiratory complications, in which the airway is both compromised high and low air, and that leads in the long term to the death of the patient, due to the severity of the injury produced by the burn, which has several phases: first the thermal injury and then the injury produced by chemicals. The lesion that develops in the first 24 hours is characterized by an inflammatory process in the mucosa that goes from edema to de-epithelialization, forming a pseudomembrane and causing obstruction after 48 or 72 hours. The lesion caused on the lung parenchyma is characterized by different degrees of interstitial and alveolar edema, infiltration of neutrophils, hyaline membranes and areas of atelectasis, in addition to a 50% decrease in lung compliance due to an increase in lung water

and an increased lymphatic flow (10) for which, in most cases, in the presence of an airway burn, the patient is intubated in order to avoid swelling and loss of permeability of the pathway (11). However, it is considered necessary to evaluate the extent of the burn in question. I feel that nasolaryngofibroscopy is an effective, innovative and avant-garde alternative.

In the otorhinolaryngology specialty, procedures such as nasolaryngoscopy, endotracheal intubation, tracheostomies, transnasal endoscopic surgery and ultrasonic instruments are procedures that increase the risk of contagion of various diseases (12), which makes the implementation of procedures even more necessary. faster and more efficient, hand in hand with biotechnology that provide the necessary ease for both patients and health personnel.

In recent years, the orotracheal intubation technique has been strongly questioned due to the complications that patients may present due to the pathophysiology of the burn; This should be done taking into account the 8Ps, which include prior planning and preparation, pre-oxygenation, premedication, simultaneous hypnosis and paralysis, patient position and cricoid pressure, laryngoscopy, passage and verification of ETT; and post-intubation proceedings. (13)

The intubation process is increasingly challenging in the presence of a patient with an airway burn, as those who are well initially can deteriorate rapidly. Furthermore, the development of edema is inevitable due to the pathophysiology of the burn, and as airway edema worsens, intubation becomes technically more difficult (14), as confirmed in the Management Guide in gastroenterology and hepatology emergencies in Colombia, where it is stated that the implication of intubating a burned larynx is not well documented (15), therefore it is not assured that this is the appropriate measure to follow.

However, this premise has been refuted by Toussaint, who in his study concludes that the most appropriate measure for the treatment of this medical emergency corresponds to early endotracheal intubation, emphasizing that this must be initially mediated by fiberoptic bronchoscopy in which can observe the conditions of the airway, because with the evolution

of the burn, the edema can obstruct it, so that the intubation process becomes more complicated. (16) as seen in figure 2.

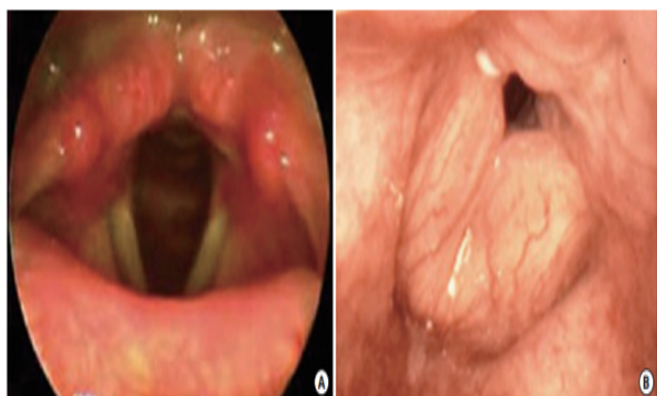


FIGURE 2: Image A (left) obtained by fibrobronchoscopy corresponds to a healthy airway, while image B (right) corresponds to an airway nuanced by burn. Obtained from: Toussaint, J. Singer, A. The evaluation and management of thermal injuries: 2014 update

In their analysis and subsequent letter to the editor, in which the use of a Smartphone-type cell phone is evaluated to transmit the image provided by a microcamera installed in the laryngoscope, Karip-pacheril and others concluded that this is a highly effective technique, since this manages to transmit a high quality image, maintaining the initial costs of the procedure. During this, the USB camera was fixed about 40mm from the tip of a Macintosh blade (size 3 or 4) using clean adhesive tape. The application supported high-quality image capture as well as real-time video capture, and the results produced completely clear images of the airway status, so this technique yields excellent results using components readily available with a small modification of a conventional laryngoscope. (17)

Encouraging the application of biotechnology in the field of medicine, the American company Das-sault Systemes SolidWorks Corp, who pioneered this innovative technique when they discovered that by aligning the smartphone camera with the endo-scope's 32 mm eyepiece,

a image on the smartphone screen. In addition, the autofocus and automatic aperture mechanisms built into these cameras allow the endoscopic image to be digitally reconstructed on the high-definition screen of smartphones, they made an adapter device designed to temporarily se- cure a smartphone or portable digital imaging device using handles. flexible (18) further facilitating the procedure and increasing the degree of comfort of the health personnel in charge of performing it.

In their observational, retrospective and descriptive study, in which 2 groups of patients were studied based on the existence or not of damage to the bronchial tree due to the burn, according to the findings of the bronchoscopy performed in the first 48 hours after admission, Corbacho et al., Concluded that fiberoptic bronchoscopy can be performed at the bedside and with minimal risks that do not increase the morbidity and mortality related to the procedure, in addition it allows in the same maneuver to review the damage of the airway, both at the beginning of the procedure. process as during its evolution, obtain secretions for sampling and clean the bronchial tree if necessary. It even makes it possible to determine early the need for airway surgery and confirm suspi- cions of inhalation syndrome. (19)

Therefore, Baixauli et al., Through their presentation of a clinical case of a 44-year-old patient admitted to the emergency room for airway burns induced by fire and smoke inhalation, propose a care algorithm based on the clinical history of exposure to smoke, evaluation of the clinical manifestations and also the observation of the airway by fibroscopy, and taking into account what was observed in it, the viability of orotracheal intubation and the management plan to be implemented is determined. (20)

5 | CONCLUSION

Airway burns constitute one of the most important causes of hospitalization in recent years, because the rates of risk factors for suffering an airway burn regardless of its cause have increased considerably, and are manifested with the presence of burnt nasal vibrissae, cough with carbonaceous sputum, dyspho- nia, laryngeal stridor, airway edema and

soot on the face, which in turn triggers a series of systemic complications, which in the long term cause mortality in the patient.

In this way, it is necessary to implement a fast and effective management plan, so that in recent years and according to various studies, portable nasopharyngoscopy has been positioned as one of the most economical, useful and effective alternatives, through the use of technology through cell phones, which allows observing the extent of the burn, the involvement of the structures, and therefore suggests the viability of orotracheal intubation of the patient, however, this continues to be the object of study.

6 | REFERENCES

- Larrea, B. MANEJO DE LA VÍA AÉREA EN LOS PACIENTES QUEMADOS CRÍTICO. *Rev Chil Anest.* 2010 ; 39 (1) : 137-140.
- Walker, P, Et al. Diagnosis and management of inhalation injury: an updated review. *Critical Care Medicine.* 2015;19 (1).
- Palmieri T. Introducción a la conferencia de consenso sobre lesiones por inhalación. *J Burn Care Res.* 2009; 30: 141-142
- Danilla S, Pastén J, Fasce G. Mortality trends from burn injuries in Chile 1954-1999. *Burns.* 2004; 30: 348-356.
- Mlcak RP. Respiratory management of inhalation injury. *Burns.* 2007; 33: 2-13
- Lee YG, Jeong WS, Yoon G. Monitoreo de salud móvil basado en teléfonos inteligentes. *Telemed JE Health* 2012; 18: 585-590.
- Bastardo, E, Monsalve, P, Pantoja, P, Barela, M, Ruiz, C. Nasolaringofibroscofia portátil con teléfono inteligente para diagnóstico de quemaduras de vía aérea superior. *Cir plast iberolatinoam.* 2018 ; 44 (4).
- Mazhar, M, Tolga, O. Endoscopia en otorrinolaringología utilizando un teléfono inteligente como dispositivo de captura. *Revista de Comunicación Visual en Medicina.* 2018.
- Liu, H., Akiki, S., Barrowman, N.J., & Bromwich, M. (2016). Mobile endoscopy vs video tower: a prospective comparison of video quality and diagnostic accuracy. *Otolaryngology–Head and Neck Surgery*, 155, 575–580.
- Gonzalez, C. Ordoñez, V. Reporte de caso: quemadura de la vía aérea. *Rev colomb anestesiología.* 2013;41(3):226–228
- Orozco, Y. Quemadura de vía aérea o injuria por inhalación: ¿Todos deben ser intubados?. *Rev Colomb Anestesiología* (2018) 46:Sup
- Ornelas, M. Parada, M. Leon, M. Lucero, F. Mondragón, C. Castañeda, L. Práctica quirúrgica durante la pandemia por COVID-19: revisión de literatura. *Rev Mex Cir Endoscop.* 2020; 21 (1): 41-53
- Riaño, L. Perez, C. Noriega, D. Conocimiento e identificación de quemaduras de vía aérea. Proyecto final de investigación. Bogotá. Universidad CES. 2017
- Wise, B. Levine, Z. Inhalation injury. *Emergency Files.* Janvier 2015. Vol 61
- Aponte D. Ardila, D. Cañadas, R. Et al. Guías de manejo en urgencias de Gastroenterología y Hepatología. *Revista Colombiana de Gastroenterología.* Suplemento 1. Volumen 33 - Número 2 2018
- Toussaint, J. Singer, A. The evaluation and management of thermal injuries: 2014 update. *Clin Exp Emerg Med* 2014;1(1):8-18
- Karippacheril, J. Le Cong, M. Videolaryngoscopy using an Android smartphone: A direct digital technique. *Indian J Anaesth* 2016;60:143-5.
- George A, Prince M, Coulson C. The 'endoscope-i': a mobile solution for endoscopy in otolaryngology. *Clinical Otolaryngology.* 2013.19;38(1):104-106.
- Corbacho, M. De la Santa, P. Iglesias, F. Polo, Utilidad de la broncoscopia en el paciente quemado con síndrome inhalatorio. *Pneuma* 2007; 8: 25 - 29
- Baixauli, P. Morales, J. Rovira, L. De Andres, J. Propuesta de algoritmo para el manejo de la vía aérea del paciente tras inhalación de humo. *Rev Esp Anestesiología Reanim.* 2018

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