# Combined Use of C-MAC Video Laryngoscope and Bonfils Intubating Fiberscope in a Pediatric Patient with a Huge Laryngeal Mass: A Case Report

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## ABSTRACT

An anticipated difficult airway requires careful planning and teamwork among the anesthesiologists and the surgical team. This paper reports the airway management of a 7-year-old female scheduled for LASER excision of a huge, obstructing laryngeal neoplasm. Initial attempts to secure the airway with the patient minimally sedated using a C-MAC Video Laryngoscope (C-MAC) and a traditional intubating stylet failed. Successful tracheal intubation was achieved when C-MAC was combined with a pediatric Bonfils Intubating Fiberscope (BIF) with the patient under general anesthesia.

*Keywords: airway management, laryngeal neoplasm, laryngoscopy, intratracheal intubation*

## INTRODUCTION

Airway management in pediatric surgical patients has always been challenging due to this subgroup's respiratory, anatomical, and physiological differences compared to their adult counterparts. A difficult airway, which could be categorized as difficult face mask ventilation or difficult tracheal intubation, has been one of the feared scenarios of even the most experienced anesthesiologists.

The frequency of unanticipated difficult tracheal intubation in children above one year of age is 0.07%, while the incidence of expected difficult airway is 0.6%.[1,2] Anatomical pathologies and syndromic craniofacial abnormalities are among the common causes of an anticipated difficult airway in this population. Though rare, laryngeal masses in children like laryngeal papillomatosis and some forms of lymphoma could be insidious in growth that could manifest slowly as dysphonia or present urgently as airway obstruction.[3] Airway management and endolaryngotracheal surgery in this age group are challenging due to the tight airway spaces and high complexity of tumors.[4]

Several complex airway algorithms have been formulated for children with an emphasis on age, safety of anesthesia induction, and potential difficulty with mask ventilation and intubation. A major difference from adult algorithms is that awake intubation is rarely considered due to problems with cooperation.[5] Although algorithms exist, there are no clear recommendations on which specific technique and equipment to use for which scenario and age group. It has been emphasized that the operator's expertise with a particular method is more crucial than a specific application of a technique.

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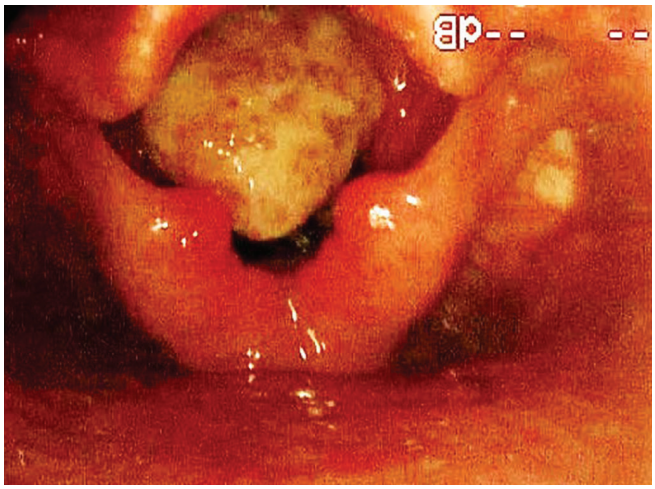

**Figure 1.** Airway mass on expiration.

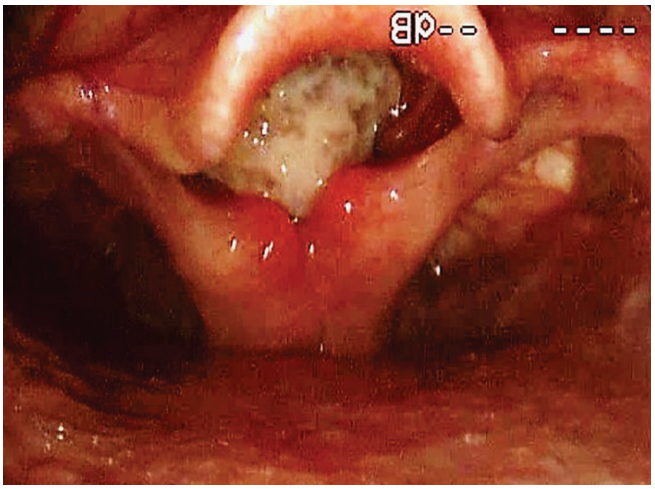

**Figure 2.** Airway mass on inspiration.

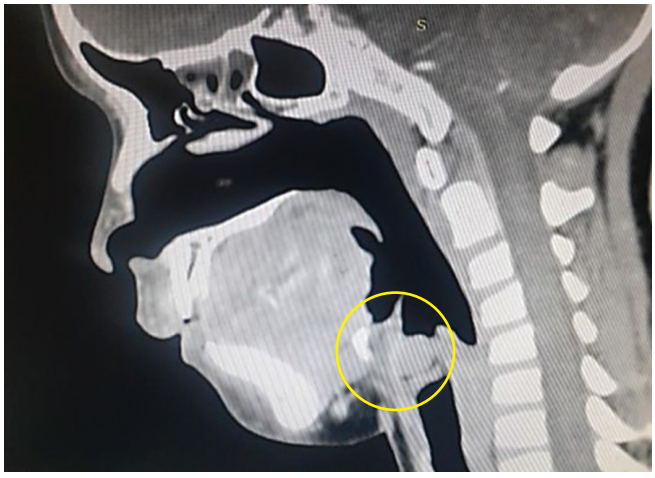

**Figure 3.** CT scan (sagittal view) showing the mass.

As failure to manage the airway is one of the leading causes of morbidity and mortality, this report highlights the dilemmas and the decision-making involved in managing an expected difficult airway in a pediatric patient.

## CASE PRESENTATION

A seven-year-old Filipino female, ASA I, weighing 18 kg, presented with a five-month history of worsening hoarseness and dyspnea. Consult revealed an obstructing supraglottic-glottic laryngeal mass. The patient was then scheduled for LASER excision and ablation of the mass due to an impending airway compromise.

A review of a video taken while the patient was asleep revealed a preference for a side-lying position, audible stridor, and labored breathing as evidenced by intercostal retractions during inspiration and use of abdominal muscles. While sleeping, oxygen saturation occasionally fell to as low as 80% but would recover spontaneously.

Pre-operative videostroboscopy showed a mass in the supraglottic-glottic area, obscuring 80% of the glottic opening. The mass was most likely anteriorly pedunculated with attachment either on the posterior surface of the epiglottis or on the vocal cords. It was partially mobile, causing a ball-valve obstruction (Figures 1 and 2).

CT scan findings showed a well-defined, lobulated, fungating, enhancing soft tissue mass from the supraglottic space, measuring approximately 1.1 cm x 1.0 cm x 1.2 cm. The mass was noted to be intimately related to the inferior edge of the epiglottis while the pre-epiglottic space was intact. There was also a narrowing of the supraglottic airway (Figure 3).

The patient's awake physical examination showed normal vital signs except for an increased respiratory rate. Airway examination revealed no limitation with mouth opening (>3 cm), Mallampati score of 1, adequate neck movement, a thyromental distance of 5 cm, and no visible mass or swelling in the oral cavity.

Standard monitors (NIBP, pulse oximeter, ECG, and capnograph) were attached to the patient upon arrival in the operating room. Vital signs were normal except for tachypnea. Since the patient was cooperative, the consensus among the anesthesiologists and surgeons was to do awake intubation as the initial plan to secure the airway.

The patient was positioned supine with the upper body elevated to forty-five degrees. Supplemental oxygen was provided using a nasal cannula at 4 liters per minute. Glycopyrrolate 72 mcg (4 mcg/kg) was given as an antisialogogue. Lidocaine 10% was sprayed on the posterior oropharyngeal wall, the base of the tongue, and bilateral palatopharyngeal arches. Ketamine 9 mg (0.5 mg/kg) was given intravenously. Videolaryngoscopy using a C-MAC with a size 2 Macintosh blade showed a full view of the glottic area and the mass (Figure 4).

Despite the excellent view provided by the C-MAC, an initial attempt at intubation was unsuccessful using the C-MAC and a traditional intubating stylet because of patient


**Figure 4.** Videolaryngoscopy using C-MAC.


**Figure 5.** Intubation using the Bonfils Intubating Fiberscope.

movement due to inadequate blunting of the gag reflex. After two more failed attempts despite additional lidocaine topical anesthesia, the team decided to proceed with the alternative plan.

Since there was excellent visualization of the glottic area and the mass, the team decided to put the patient under general anesthesia. The plan was to use a pediatric BIF instead of the traditional intubating stylet. Before the next attempt, the neck was aseptically prepared. The surgeons were on stand-by to create a surgical airway or tracheostomy in case the intubation failed and the patient couldn't be ventilated or oxygenated.

Preoxygenation with 100% oxygen was done, then general anesthesia was induced with titrated doses of ketamine (total of 30 mg (1.67 mg/kg) and sevoflurane 3% in 100% oxygen. Muscle relaxant was not administered to maintain the patient's spontaneous respiration. Videolaryngoscopy using the same C-MAC was done, showing the same excellent views. Successful tracheal intubation was achieved when a pediatric BIF, preloaded with a size 3.5 cuffed endotracheal tube (ETT), was insinuated beneath the mass. Intubation was confirmed by the BIF video showing ETT advancement into the trachea and the presence of capnography (Figure 5).

It took a total of 60 seconds from videolaryngoscopy to intubation. There were no desaturations, or other complications noted. The LASER surgery proceeded as planned, with complete removal of the mass. Dexamethasone, ketorolac, and paracetamol were given intravenously to address pain and airway edema. At the end of the surgery, the patient was extubated once she was fully awake. The postoperative course was generally unremarkable, and she was discharged three days after the surgery. Later, a mass biopsy revealed a benign lesion compatible with a mesenchymal spindle cell proliferation.

## DISCUSSION

Managing an expected difficult airway entails careful planning and discussion amongst the anesthesiologists and surgeons, recognizing dilemmas, and making judicious and strategic choices. This patient presented with a huge, obstructing laryngeal mass, causing hoarseness and progressive respiratory compromise. Thus, an urgent removal of the mass was deemed necessary. Missteps could have resulted in life-threatening consequences, especially in the situation of a ball-valve obstruction.

The method of securing the airway was based on several considerations. Given the location and extent of the mass as seen in the CT scan, outright tracheostomy could have bypassed the obstruction. Tracheostomy was considered too invasive and placing it was challenging in an awake or mildly sedated child. It also had its attendant risks and complications, including pneumothorax, tracheal granulomas, and tracheoesophageal fistula.[6] Videostroboscopy showed a point of entry for intubation as the mass moved in a ball-valve manner, with the glottic opening more exposed during expiration. Tracheal intubation under general anesthesia was not considered the initial approach, given the high risk of difficult ventilation because of the ball valve obstruction. With noted desaturations during the preoperative sleep observations, it was postulated that the obstruction could worsen during periods of unconsciousness.

Awake tracheal intubation was the initial plan to secure the airway as it conferred the benefit of maintaining airway patency, spontaneous respiration and gas exchange, and the ability to protect the airway from aspiration. Preparations for awake tracheal intubation included placing the patient in a semi-recumbent position to optimize patient comfort, continuous passive oxygenation through a nasal cannula, intravenous glycopyrrolate as an antisialagogue, and topical lidocaine spray as upper airway anesthesia. Ketamine at a low dose was given intravenously to provide sedation and analgesia while maintaining patient cooperation and spontaneous ventilation.

The initial attempts (3x) at awake intubation failed because of patient movement. The patient's minimal sedation did not allow full cooperation nor preclude movement. It was

also considered that the topical anesthesia was not effective enough in blunting the gag reflex. After carefully considering the risks and benefits, the plan shifted to general anesthesia and securing the airway using a combined C-MAC videolaryngoscopy and BIF intubation.

Ketamine and sevoflurane were the preferred agents for induction as they allowed easy titration, preserved spontaneous ventilation, and had fast onset and offset times.[7] The use of neuromuscular blockers has generally improved conditions for intubation. However, theoretically, spontaneous ventilation may not resume in time to prevent hypoxic brain injury in a cannot intubate, cannot oxygenate (CICO) scenario. Regarding paralysis during difficult mask ventilation, three prospective studies have suggested that face mask ventilation was either improved or unaffected by the neuromuscular blockade but not worsened by it.[8] There is no clear recommendation regarding using a neuromuscular blocking agent in a CICO scenario. With this in mind, the decision was not to paralyze to maintain the patient's spontaneous respiration.

The next issue was choosing which airway equipment to use. Flexible fiberoptic bronchoscopy (FOB) has been considered the gold standard in pediatric complex airway management. The use of FOB, however, traditionally required a steeper learning curve. It has been reported to be more expensive as its fragile optics were more prone to damage even with careful use. Also, at that time, a working pediatric FOB was not available.

In recent years, videolaryngoscopes in anticipated and unanticipated difficult airways have gained popularity as they significantly improved glottic views.[9] There have been instances, however, where the use of VL was not enough to expose the glottic opening. The combination of VL and a flexible tracheoscope has been shown in a study in adults to be a feasible alternative to VL alone or FOB alone.[10] In a study conducted among adults with predicted difficult airway (Cormack-Lehane III-IV), the combined use of VL and BIF significantly improved the glottic view. [11] The latter study has also cited the advantage of the VL and BIF combination technique, which was it enabled a single anesthesiologist to perform it. In contrast, the VL and FOB combination technique would require at least two operators, one to do the VL and another to do the FOB.

VL has become an option in pediatric complex airway management, improving first-pass tracheal intubation.[12] The BIF is useful in intubating adult and pediatric patients with difficult airways, specifically those with limited mouth opening and mandibular hypoplasia.[13,14] A study on the routine, elective use of BIF in pediatric patients showed that BIF increased intubation times and only had a fair success rate.[15] The poor results were attributed to the patients' secretions quickly obscuring the optical aperture. In most children, it was noted that there was a failure to enlarge the pharyngeal space upon insertion of the device. As a consequence, the optical aperture of the BIF almost always got in contact with secretions sticking to the pharyngeal mucosa, and subsequently, the clear view was lost.

A case report showcased the use of BIF in a pediatric patient with a known difficult airway because of Hurler's Syndrome.[16] Initially, Direct Laryngoscopy (DL) was done, revealing the same Cormack-Lehane scores as in previous DLs from previous surgeries. Without removing the DL, the BIF was successfully guided into the trachea. However, there is still a shortage of studies combining VL and other devices such as a flexible tracheoscope, FOB, or a BIF in the pediatric population.

In this case, the use of the C-MAC videolaryngoscope was favored because its Macintosh blade allowed the lifting of the epiglottis aiding in exposing the glottic opening. The C-MAC also increased the pharyngeal space, allowing the BIF to be inserted without touching much of the oropharyngeal mucosa. The challenge with using the C-MAC was the insertion of the tracheal tube because of its indirect course despite an optimal view. The use of the BIF addressed this as its 40˚ angulation at the tip followed the curvature of the C-MAC blade. Moreover, the BIF acted like a rigid stylet, able to displace the mass, which was very difficult using the traditional pediatric ETT stylet. The wide angle and the excellent view provided by the C-MAC allowed visualization of the BIF as it was maneuvered underneath the laryngeal mass. Tissue injury, edema, and bleeding, which could have led to catastrophic complete airway obstruction, were minimized using these two pieces of equipment since the upper airway structures and motion paths were always visualized during laryngoscopy and tracheal intubation.

## CONCLUSION

This report has shown that the combined use of C-MAC and BIF is a viable alternative in securing the airway of a pediatric patient with a huge, obstructing laryngeal mass.

### Declaration of Patient Consent

The authors certify that they have obtained appropriate patient consent forms granting the use of the patient's images and clinical information for publication. The patient's guardian understands that her name and initials will not be published, and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

### Statement of Authorship

DDVILLA, MTBA, and RMPC participated in writing both the original and final manuscript, while DDVILLA reviewed and approved the final submitted case report.

### Author Disclosure

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