

# The Role of Direct Laryngoscopy & Bronchoscopy in Hospitalized Croup

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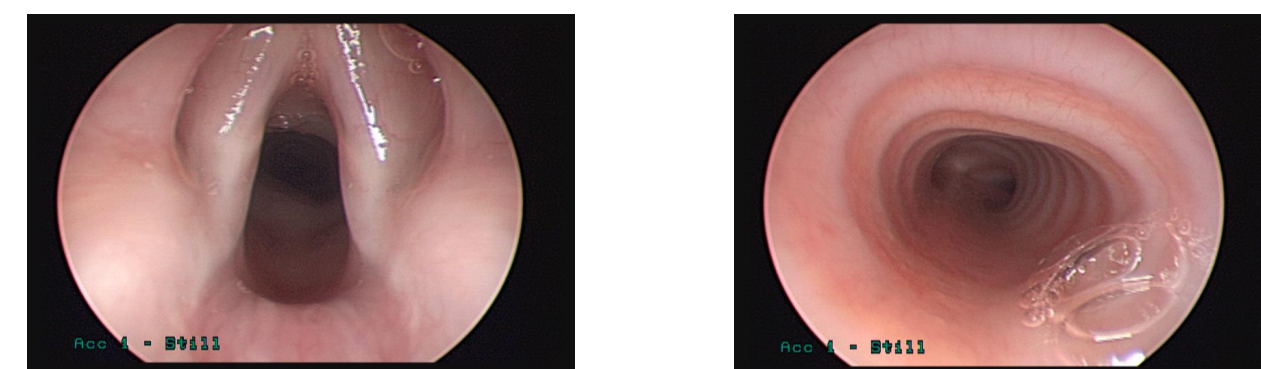
## INTRODUCTION

Croup is one of the most common causes of stridor in children during the fall and winter seasons. The causative organisms are typically viral, such as *parainfluenzae* and *influenza*<sup>1</sup>. While most children can be managed on an outpatient basis, a small proportion has significant airway symptoms, which require admission to the hospital or airway intervention. Treatment typically consists of steroids, nebulized racemic epinephrine, and heliox<sup>2</sup>. If the patient's symptoms do not improve over 48 hours, the possibility of bacterial tracheitis must be entertained.

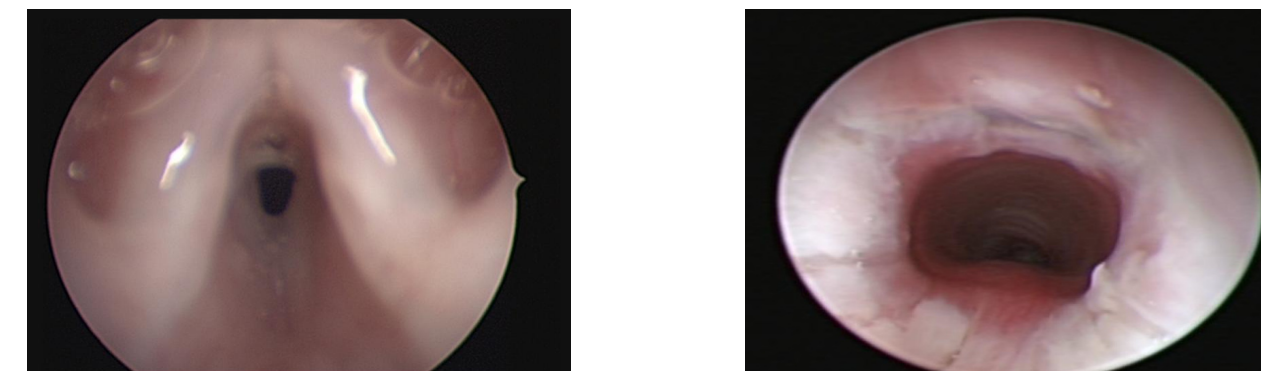
Although croup is typically a self-limited disease, it can be complicated by upper airway obstruction and respiratory distress<sup>3</sup>. The role of diagnostic laryngoscopy and bronchoscopy (DL&B) in the management of acute hospitalized croup remains unclear. Few studies have correlated risk factors noted at the time of consultation with DL&B findings and applicability of these studies has been limited.

## BACKGROUND

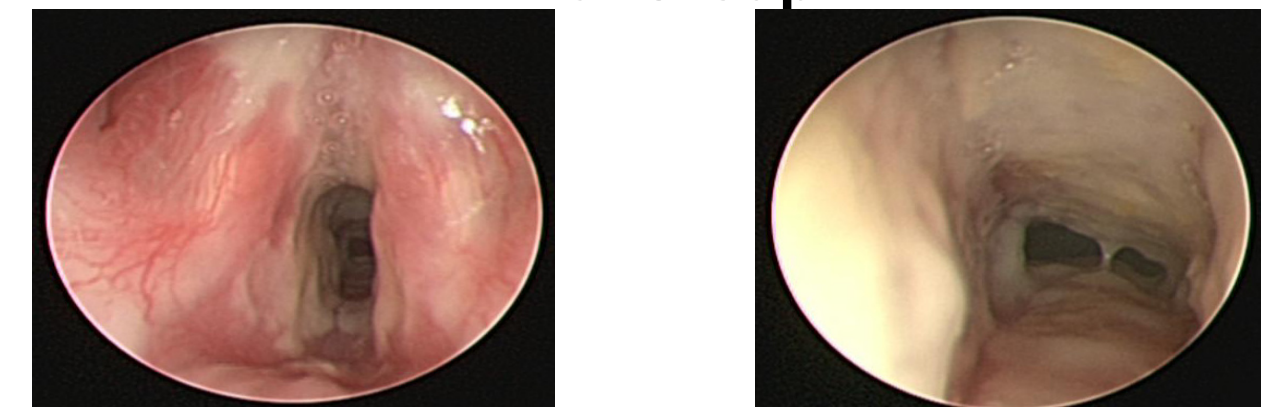
One of the risks of DL & B is the potential of worsening the respiratory status. Not only is there the exposure to general anesthesia, but also instrumentation of an already swollen subglottis can cause further edema<sup>4</sup>. Patients can then require intubation or transfer to a higher level of care post-operatively resulting in a prolonged hospital course. The benefits of diagnosing bacterial tracheitis (and thus changing medical management) are generally thought outweigh the risks of worsening the respiratory status if the patient has viral croup<sup>5</sup>.



Normal larynx and trachea



Viral Croup



Bacterial Tracheitis

## OBJECTIVES

The purpose of this study was to review our experience at Texas Children's Hospital with direct laryngoscopy and bronchoscopy in patients with hospitalized croup. We investigated (1) the frequency of viral vs. bacterial hospitalized croup at TCH (2) the epidemiological characteristics of hospitalized croup and (3) the efficacy of applying operative direct laryngoscopy and bronchoscopy in the detection of other significant respiratory pathology in certain groups of hospitalized patients.

## MATERIALS & METHODS

A retrospective chart analysis of 340 cases (338 patients) of admitted with a diagnosis of croup at Texas Children's Hospital over a nine-year period between September 2003 and December 2011 was carried out. Patients with tracheostomy, epiglottitis and non-respiratory complications (UTI etc.) were excluded from the study. Patient information was recorded and tabulated into a data key that numerated diagnostic and therapeutic criteria. Pre and post procedure physiologic parameters were recorded. Normal oxygen saturation (SO<sub>2</sub>) was > 96% on room air. Fever was defined as > 100.4°F, and respiratory (RR) and heart Rate (HR) were based on normative values for age<sup>6</sup>.

## RESULTS

Table 1: Epidemiological Characteristics

	Viral Croup	Bacterial Croup	P Value
<b>Gender</b>			0.92
Male	222 (69.2%)	11 (64.7%)	
Female	99 (30.8%)	6 (35.3%)	
<b>Age (average, range)</b>	16.8 mo (1.5 mo – 9 yr)	31.5 mo (7 mo – 10 yr)	0.0001
<b>Days of Symptoms before Admission (average, range)</b>	2.21 days (0-14 days)	4.65 days (1-14 days)	< 0.0001

Table 2: Hospital Course Characteristics

	Viral Croup	Bacterial Croup	P Value
<b>Length of Stay (average, range)</b>	2.35 days (0-21 days)	5.41 days (1-14 days)	< 0.001
<b>Associated Diagnoses</b>			
URI	42 (12%)	2 (10.5%)	0.92
Pneumonia	14 (4%)	2 (10.5%)	0.54
Otitis Media	22 (6.3%)	0 (0%)	0.53
Down's Syndrome	8 (2.3%)	0 (0%)	0.92
GERD	22 (6.3%)	1 (5.3%)	0.81
<b>Level of Care on admission</b>			0.16
Floor	214 (66.7%)	8 (47.1%)	
PICU/PCU/ICU	107 (33.3%)	9 (52.9%)	

Graph 1: Comparison of Admission Vitals

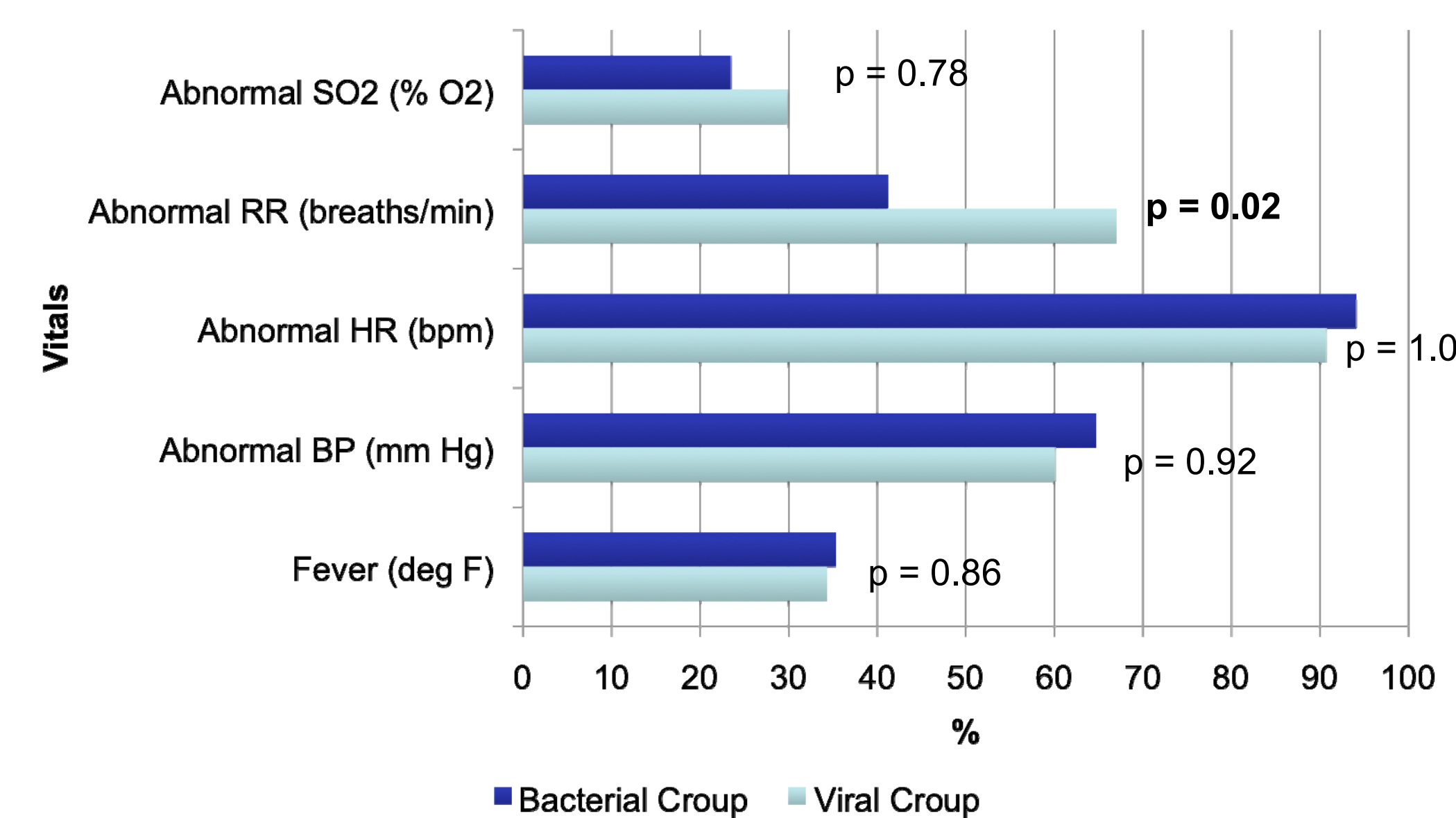


Table 3: Laboratory Findings

	Medical Management alone	Direct Laryngoscopy & Bronchoscopy	P Value
<b>Bacterial Culture</b>			< 0.001
Yes	10 (3.2%, + in 90%)	10 (40%, + in 80%)	
No	303 (96.8%)	15 (60%)	
<b>Viral Culture</b>			0.28
Yes			
Parainfluenza 1, 2	31 (9.9%)	2 (8%)	
Flu A/B	12 (3.8%)	2 (8%)	
RSV	6 (1.9%)	2 (8%)	
Negative	16 (5.1%)	6 (24%)	
Pending	11 (3.5%)	0 (0%)	
EBV/CMV/Other	5 (1.6%)	1 (4%)	
No	232 (74.2%)	12 (48%)	
<b>Blood Culture</b>			0.70
Yes	27 (8.6%, + in 11.1%)	3 (12%, + in 33%)	
No	283 (90.4%)	22 (88%)	

## CONCLUSIONS

Mild airway anomalies are common in children who are hospitalized for croup and are undergoing DL&B. Nevertheless, significant findings on DL & B do occur and when detected, often prevent life-threatening complications. Of the 25 patients who underwent DL & B, 8 patients had bacterial findings and 5 patients had other significant airway findings. Seventeen patients in total were diagnosed with bacterial croup. Tachypnea, older age and onset of symptoms on admission were found to be a statistically significant signs in distinguishing bacterial croup from viral croup. Thus, together with a thorough clinical history, DL & B can be used effectively to detect and manage severe manifestations and complications of these patients.

Table 4: Findings on DL & B

Age	Gender	Indication for DL & B	DL & B Findings
16 mo	F	Rule out soft tissue mass posterior to trachea	Subglottic edema & erythema consistent with viral croup
4 mo	M	Rule out soft tissue density over trachea	Moderate subglottic edema & erythema & increased milky secretions consistent with viral croup
17 mo	F	Rule out secondary bacterial tracheitis	Narrow subglottic with mild inflammation consistent with viral croup
3 mo	M	Rule out secondary bacterial tracheitis	Very narrow subglottis consistent with viral croup
5 mo	F	Airway edema from prior intubation	Could not complete
5 mo	M	Rule out anatomic abnormality	Severe subglottic edema consistent with viral croup
2 yo	M	Airway evaluation	Mild laryngomalacia & posterior type I laryngeal cleft
5 wk	M	Rule out underlying subglottic pathology	Mild subglottic erythema & edema consistent with viral croup
6 mo	M	Rule out foreign body or bacterial tracheitis	Very narrow subglottis consistent with viral croup
17 mo	M	Rule out foreign body or bacterial tracheitis	Subglottic swelling & sloughing consistent with H1N1 and superimposed bacterial croup
2 yo	M	Rule out foreign body or bacterial tracheitis	Tonsil & adenoid hypertrophy & subglottic edema consistent with viral croup
2 yo	M	Recent intubation – concern for airway	Subglottic stenosis & edema consistent with viral croup
3 yo	F	Recurrent croup & rule out bacterial tracheitis	Mild irregularity of distal trachea near L main stem bronchus consistent with bacterial croup
8 mo	M	Rule out foreign body or bacterial tracheitis	Severe subglottic and glottic edema consistent with viral croup
2 yo	M	Rule out foreign body or bacterial tracheitis	Severe subglottic stenosis & edema consistent with bacterial croup
5 mo	F	Recent intubation	Mild subglottic exudate consistent with bacterial croup & GERD
7 mo	M	Mass on CT	Upper cervical tracheal mass consistent with xanogranuloma and bacterial croup
12 mo	F	Current intubation – concern for airway	Some glottic swelling with exudate and edema consistent with bacterial croup
8 mo	F	Current intubation – concern for airway	Severe subglottic narrowing with exudate & erythema consistent with bacterial croup
14 mo	F	Rule out foreign body or tracheitis	Very edematous subglottis & with mild laryngeal thrush consistent with viral croup
12 mo	F	Rule out mass or tracheitis	Bilateral hemangiomas
6 mo	F	Recurrent croup	Large, bilateral subglottic cysts
2 yo	M	Recurrent croup	Small lesion in posterior arytenoid web to intra-arytenoid
18 mo	M	Recurrent croup	Large, bilateral subglottic cysts
3 yo	M	Rule out foreign body or bacterial tracheitis	Significant subglottic mucosal exudate & true vocal chord edema consistent with bacterial croup

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