Pediatric Stridor

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KEYWORDS

• Pediatric stridor • Upper airway obstruction • Airway endoscopy • Laryngoscopy • Bronchoscopy

KEY POINTS

- Stridor is a symptom of upper airway obstruction, and can not only be heard but also visualized.
- Complete and efficient evaluation and diagnosis of the stridorous child is critical for safe and timely management and intervention.
- A wealth of ancillary diagnostic studies are available for airway evaluation, which can tailor further intervention, but operative endoscopy remains the mainstay of diagnosis and intervention.
- A thorough understanding of airway anatomy and associated obstructive lesions equips the surgeon for intervention with decreased risk of further injury.
- Creation of simulation scenarios and a multidisciplinary approach to the child with stridor may improve the physician and the team approach and subsequently the outcome.

INTRODUCTION

Stridor is a symptom and not a diagnosis (**Table 1**). It is defined by a partial obstruction of the airway caused by abnormal apposition of 2 tissue surfaces in close proximity, with resultant turbulent airflow. This condition produces a high-pitched sound known as stridor. The degree of obstruction can range from minimal to life threatening, and stridor may be inconsequential or a sign of impending airway collapse. Those untrained in the evaluation and management of a stridorous child are uncomfortable with the symptom and fearful of the potential implications. In some circumstances, without adequate airway protection or intervention, respiratory collapse may ensue, particularly in young children.

The evaluation and airway management of infants and children with stridor continues to evolve, with technological advancements and improved understanding of

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Abbreviations	
BVCP	Bilateral vocal cord paralysis
CT	Computed tomography
DISE	Drug-induced sleep endoscopy
ED	Emergency department
EoE	Eosinophilic esophagitis
GERD	Gastroesophageal reflux disease
HIB	*Haemophilus influenzae* B
HPV	Human papillomavirus
LPR	Laryngopharyngeal reflux
MRI	Magnetic resonance imaging
OSA	Obstructive sleep apnea
RRP	Recurrent respiratory papillomatosis
SGH	Subglottic hemangioma
SGS	Subglottic stenosis
UVCP	Unilateral vocal cord paralysis

the impact of inflammatory triggers and trauma in the causation of airway obstruction and stridor.[1,2] Preventive measures have been used to curtail pediatric stridor. The widespread use of *Haemophilus influenzae* B (HIB) vaccine has essentially eliminated HIB-induced epiglottitis. The incidence of stridor caused by acquired subglottic stenosis (SGS) in neonates has declined dramatically over several decades because of improved airway management of the intubated infant; however, those surviving may have multiple medical comorbidities that influence evaluation, management, and outcome. The advancements in technology for optical visualization of the airway and expanded surgical armamentarium have allowed surgeons to push the limits of endoscopic surgery for airway management in children with stridor.[3,4] Serendipitous discovery of the application of propranolol for management of airway hemangiomas has revolutionized treatment.[5,6] Adoption of slide tracheoplasty for complete tracheal rings has greatly reduced the morbidity and mortality traditionally associated with these lesions.[7,8] This article reviews the pathophysiology of stridor, and discusses key concepts and advances in diagnosis and management of common causes of stridor.

ANATOMY AND PATHOPHYSIOLOGY OF STRIDOR

Physics of Stridor

The phenomenon of stridor is mediated by 2 basic principles of physics: Poiseuille's law and the Bernoulli principle. Poiseuille's law of fluid dynamics describes the relationships among the variables involved in the rate of laminar flow of a fluid through a tube. This equation can be directly extrapolated to airflow through a tube:

$$Q = \Delta P \pi r^4 / 8 \eta L$$

The outstanding relationship in this equation is the proportion of flow rate (Q) to the radius of the tube to the fourth power, resulting in an exponential effect on flow rate related to any change in radius. When applied to the 4-mm diameter of a neonatal airway, 1 mm of edema reduces the cross-sectional area leading to a 75% reduction in airflow. Because of decreased cross-sectional area, airflow velocity increases and induces the effect of the Bernoulli principle. This principle states that as the velocity of airflow increases, the pressure exerted by airflow decreases. The application of the

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