

CLINICAL STUDY AND MANAGEMENT OF STRIDULOUS ADULT PATIENTS

CORRESPONDING AUTHOR -DR. POOJA N, SENIOR RESIDENT ,DEPARTMENT OF OTORHINOLARYNGOLOGY AND HEAD AND NECK SURGERY, VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES, BALLARI, KARNATAKA, INDIA

AUTHOR-DR.SUDHAKAR RAO M.S, ASSISTANT PROFESSOR, DEPARTMENT OF OTORHINOLARYNGOLOGY AND HEAD AND NECK SURGERY, VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES, BALLARI, KARNATAKA, INDIA.

AUTHOR-DR. G SHANKAR, PROFESSOR AND HEAD OF THE DEPARTMENT, DEPARTMENT OF OTORHINOLARYNGOLOGY AND HEAD AND NECK SURGERY, VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES, BALLARI, KARNATAKA, INDIA.

AUTHOR- DR.VINAY KUMAR S M, SENIOR RESIDENT ,DEPARTMENT OF OTORHINOLARYNGOLOGY AND HEAD AND NECK SURGERY, VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES, BALLARI, KARNATAKA, INDIA

AUTHOR-DR.SUSHMITHA V BADIGER, SENIOR RESIDENT , DEPARTMENT OF OTORHINOLARYNGOLOGY AND HEAD AND NECK SURGERY, VIJAYANAGAR INSTITUTE OF MEDICAL SCIENCES, BALLARI, KARNATAKA, INDIA.

ABSTRACT-

AIM-This study emphasizes on the clinical presentation of a stridulous adult patient and the management of it, in a tertiary care institution.

Methods and material – A prospective observational study conducted on statically calculated, sample adults of both genders, presenting with stridor of any type to the department of Otorhinolaryngology and Head and Neck surgery, emergency ward of tertiary care institution. between October 2019 to April 2021.

RESULT- A total of 24 cases were studied and among them 77.8% (n=18) were males and 22.2%(n=6) were females. In this study 37.5%(n=9) were supraglottic malignancy, 12.5%(n=3) were of deep neck space infection respectively. Our study noted out of patient presented with the inspiratory stridor (N=18), 33% (N=6) had voice change and among the patient with expiratory stridor, 5 out of 6 patients (94.4%) had the voice change (p= 0.03). saturation of oxygen among all the 24 stridulous patients the recorded SpO₂ at the room air had no statistical significance (P= 0.06) with respect to type of stridor. all patients underwent emergency tracheostomy were later referred to department of medical /surgical oncology.

CONCLUSION – The most dependable symptom appear to be “dysphonia” rather than recordable SpO₂ , among the stridulous adult secondary to supraglottic malignancies, further emergency/urgent tracheostomy is the time tested ,dependable morbidity reducing procedure among the stridulous adult patient and further studies needed in this regards with large number of population.

KEYWORDS - malignancy, stridor, Tracheostomy, tumor.

INTRODUCTION

Stridor is high-pitched sound produced by the abnormal flow of air in the airways in the upper /lower airways, heard at zelith in inspiration or expiration. Usually, an extra luminal obstruction leads to collapse of airway and cause inspiratory type of stridor, whereas intraluminal obstruction gives rise to expiratory type of stridor (1).

The variable character of the tone (breathy, harsh or musical) in terms of time, amount and the phase which provides added clues for the diagnosis.

Basically, expiratory stridor points at an obstruction in the lower airways or in a bronchus, Inspiratory stridor is due to obstruction at any level from palatal to larynx further obstruction in the tracheobronchial tree gives rise to biphasic type of stridor (2).

Differentiating /mimicking the stridor are the low pitched and inspiratory. Sometimes wet and grunting like stertor are to be eliminated clinically (3).

At the clinical presentation the stridor manifests when the 50% of the airway lumen is obstructed, due to variety of causes, which often needs multidisplinary approach as to find possible causes and its management (4,5).

The clinical assessment of type of stridor points towards the gravity of the anatomical level of obstruction. the supraglottic obstructions are often biphasic low pitched and fricative consonants (6).

The dimensions /inclinations of anatomy of children and adults vary (7,8). Frequently in adults' acute infections, post laryngeal instrumentation and non-nativesof human body aspiration trauma do cause stridor. Whereas in children foreign body aspiration /trauma are often the causes of stridor (2).

Ina stridulous patient the clinical management is often multidisciplinary (9).

A stridulous patient needs stable oxygenation with a regulated ventilation to avoid respiratory failure and mortality (4,5,10).

Materials and Methods

This study is conducted at a tertiary care centre in the Department of Otorhinolaryngology and Head & neck surgery, during the period October 2019 to April 2021.Total 24 cases were studied with relavent investigations, support management of these cases were undertaken.

Inclusion criteria

- All clinically presenting stridulous adult patients.

Exclusion criteria

- Stridulous pediatric patients.
- Munchausen's stridulous patients.

Design of study-

Observational Prospective study in single tertiary care centre by simple random selection of the sample size.

on presentation if the symptoms are of acute onset, the patients were assessed the following parameters.

- 1.nasal flaring
- 2.vitals data
- 3.levels of consciousness and responsiveness
- 4.ENT examination, focusing mainly on neck and throat
- 5.systemic examination mainly focusing on respiratory system. (11)

Differential Diagnosis of Stridor

Acute Infectious

- Viral croup
- Peritonsillar and retropharyngeal abscess
- Epiglottitis
- Bacterial tracheitis
- Severe lymphadenopathy

Acute Noninfectious

- Foreign body aspiration
- Foreign body ingestion causing airway obstruction
- Allergic airway edema
- Airway edema
- Neck trauma and caustic ingestions
- Laryngeal spasm
- Tumors

Chronic Infectious

- Laryngeal papillomatosis

Chronic Noninfectious

- Laryngomalacia
- Subglottic stenosis
- Laryngeal webs
- Vocal cord paralysis
- Subglottic hemangioma
- Laryngeal cysts
- Vascular rings
- Gastroesophageal reflux

RESULT:

In our study a total of 24 cases were studied and among them 77.8% (n=18) were males and 22.2% (n=6) were females. Majority of them were of the age group between 51-60 years.

A similar study conducted by Deepak Parmar et al comprised of the patient between age group of 36-70 years.

In this study 37.5% (n=9) were supraglottic malignancy, 12.5% (n=3) were of deep neck space infection respectively and 70.84% (n=17) had stridor symptoms ranging from 1-15 days.

The study conducted by Deepak Parmar et al does have majorly (40%) had growth in the larynx, 20% of the study population had Ludwig's angina (20%) that is infective cause and vocal cord paralysis comprises 2% of the study. In their study 70% of the patients had stridor for a duration of 6 months.

Similar to our study results the study conducted by Pallavi Nayak et al had supraglottic growth as majority cause of the stridor was supraglottic growth and among whom 72% were males and 27.7% were females and these majority patients' supraglottic malignancies were of squamous cell carcinoma type similar to found in our study too.

However, in our study the saturation of oxygen among all the 24 stridorous patients the recorded SpO₂ at room air had no statistical significance (P=0.06) with respect to inspiratory or expiratory stridorous patients.

In our study patients consuming alcohol and also smoking comprised only 8.3% where the patient who were consuming alcohol only and smoking only were 45.83% and 24.5% respectively, the tobacco chewing habituated patients in our study were slightly at a higher risk that is 29.16%, when compared to patients who had only the habit of smoking.

The study conducted by Krishnamurthy et al and Graham et al opined the smoking, tobacco is the main causative risk factor.

Majority of the patients in our study 70.84% (N=17) were having stridor for the duration between 1 and 15 days duration and only 1 patient presented with symptom of stridor for less than 1 day duration (4.16%).

Our study noted out of patient presented with the inspiratory stridor (N=18), 33% (N=6) had voice change and among the patient with expiratory stridor, 5 out of 6 patients (94.4%) had the voice change (p= 0.03).

In contrast to the symptoms observed in our study, Bobket et al their study found dysphagia, odynophagia, trismus and haemoptysis.

All the patients (n=24) of this study underwent emergency /urgent tracheostomy could survive only for less than 24 hours due to irreversible septicemic shock, even after sequential incision and drainage procedure, which followed the tracheostomy. Rest all patients were referred to department of medical /surgical oncology

DISCUSSION

The incomplete obstruction at the level of tracheobronchial tree or larynx characterized by high pitched harsh and abnormal sound often with dyspnea and turbulent airflow is stridor¹².

The nature of the stridor often points to the level of airway obstruction hence the lower airway obstruction, manifest as expiratory stridor whereas the on inspiratory stridor points towards supraglottic obstruction and a non-mobile lesion or weak / immature anatomical structure status like laryngomalacia / tracheomalacia give rise to biphasic type of stridor^{13,14}.

Among the stridulous adult patients, stridor of infective origin is not uncommon nor restricted to the paediatric age group, any error or delay to reach the diagnosis among these could lead to the morbidity/mismanagement.⁷ Agitation, altered sensorium, calm chest, apnoeic spells or bradycardia are the “red alerts” of a stridulous patient¹⁵.

Stridor is more morbid symptom which may seek immediate medical/ surgical attention to get rid of potentially mortal situations¹⁶.

The non-aggressive tumour of airway may not present with breathlessness instead they present with dysphagia or throat pain or effort of breathing⁹.

Pathophysiology

The airway obstruction that impairs the airflow through the airway may cause stridor. Because of the lesser diametered airway than that of adults among the young children and infants make them more susceptible. For this reason the resistance offered by the airways to the airflow is more, as this is governed by the poiseuille’s law. The poiseuille’s law states the fourth power of radius is inversely proportional to the resistance of the airway. Hence a minimal obstruction to the paediatric airway outsizes the effect of resistance. The vibrations of the airway walls due to the turbulent airflow is the cause of noisy character of the stridor. Thus the Bernoulli’s principle, explains the motion of the wall of the airway is ipsilateral to the areas of low pressure¹⁷.

A stridulous adult will present with dyspnoea in non-serve forms which often in later stage present as stridor¹⁸. The stridor is male gender preponderance symptom due to the airway obstruction by a growth or the oedema at the level of larynx making reduction in the air movement¹⁹. Among the frontline healthcare(particularly doctors) the Munchausen’s stridor takes the patient to the emergency department in the view of differential diagnosis²⁰.

In emergency situation priority is given to the assessment of breathing, circulation and airway. In cases of respiratory distress, priority for high flow oxygen therapy by the different modalities of delivery such as BAP or through nasal canal.

In cases of apnic / hypoventilated patient intubation may be difficult/ fail as the airway obstruction is the main cause, wiz in cases of foreign body, oedema. At times the manoeuvre of intubation may hazen the symptoms of stridor, in such cases. Hence endotracheal intubation has clinical constrains of necessity¹⁷.

In infectious conditions like epiglottitis the review of literature is opined differently to stabilize the adult's weather by tracheostomy or tracheal intubation. However the factor of skilled personnel attending the patient with facilities present becomes the main considerate factor.

At present inhalational induction is choice considered among the children for the nasotracheal intubation. In the view of increased incidence of high level complications and the mortality among infective conditions like epiglottitis management by the intubation and tracheostomy are almost equal the tracheostomy is acceptable mode of management in adults and also in children.

The oral intubation and the nasotracheal intubation in paediatric age and adult respectively are well tolerated. In necessary conditions the accidental extubation in both adults and children can be prevented with the modes of restraint and sedation.

Stridulous adult patients to be managed aggressively as they require long duration stay in the hospital as the frequently present with the symptoms that manifest due to subglottic narrowing¹⁸.

In the causality a stridulous patient examination gives differential diagnosis between a foreign body in the airway, organic lesions, airway obstruction or cord paralysis. The head and neck neoplasms often require urgent/emergency tracheostomy as about 45%^{10, 11} of the head and neck tumors arise from superior airway²⁰.

Among the acute or subacute and the chronic type of the stridor immediate assessment and management is taken over for the acute variety which will not necessitates time killing and unnecessary investigations. In such acute cases based on clinical examination grounds only the management should be focused²¹.

Stridor is a morbid sign often seen in children than in adults. Paediatric age group is vulnerable for the fast airway obstruction due to the respiratory system features in them verses that of adults²².

The significant reduction in the airway lumen size the stridor becomes more louder with the chest retraction²⁴. The rate of progress of the lesion detects the degree of respiratory distress²⁵.

The voice features is informative with regards to the vocal cord function, VIZ a muffled voice indicates the involvement of supraglottic structures similarly the vocal cord involvement often present with hoarseness²⁴.

During the evaluation of a stridulous patient, the pulse oximetry and arterial blood gas analysis often guide to determine the severity of morbid state.

Depending on the clinically suspected causes, the radiological examination of neck and chest, ph. studies, laryngoscopic (fibro optic/rigid bronchoscopic examination to diagnose the cause in a stridulous patient may be needed.

The choice of anesthesia induced or the awake intubation are determined by the medical experts involved in the clinical assessment of stridulous patient.

The acute stridulous states are better managed by an able personal who can perform fibro-optic endoscopic intubation²⁶.

Patients with critical stridulous state the role of radiography has limited role²⁶. The role of radiology remains controversial due to false negative/positive findings²⁷.

The diagnostic tool aids like USG larynx, laryngeal endoscopy and flow volume loop assess the vocal cord function^{28, 29, 30}.

The treatment of stridor must be tailored according to the particular underlying or predisposing condition present. Emergency management consists of ensuring that the airway is adequate. If it is not, appropriate measures must be initiated. For some conditions (eg, epiglottitis and bacterial tracheitis), antibiotic therapy are effective whereas in other scenarios, steroid therapy may be useful. Along with steroids, nebulization of bronchodilators and adrenaline is better.

Even after medical management the patients didn't improve and starts deteriorating tracheostomy is considered.

The definitive airway management in a adult stridulous patient includes mainly

- The tracheostomy under local anesthesia, although awake, inhalational, rapid sequence induction intubation techniques exists.
- The management of a stridulous patient is individualized based on cause/underlying condition hence it is not universal. The role of antibiotic, steroids and the bronchodilators do not stay in the medical management.
- In a clinically deteriorated patient emergency tracheostomy stands effective^{31,32}

Surgical Procedure

A midline vertical skin incision covering the area from 5 mm below the lower border of the cricoid to approximately 5 mm above the suprasternal notch was used to perform a traditional tracheostomy. The pretracheal fascia was reached by extending the midline blunt dissection through the fascia and in between the fibers of the strap muscles. Exposure to the side as with the help of Langenbeck retractors, the necessary retraction up to the carotid sheath was accomplished. The minimally invasive treatment involved making a short, horizontal skin incision that was roughly the same diameter as the trachea (about 25–30 mm) and situated halfway between the suprasternal notch and the lower edge of the cricoid.

Blunt dissection was then utilized in the middle after sharp dissection had been prolonged to the superficial cervical fascia. The length and diameter of a mosquito artery forceps'

expanded tips—about 2 cm—were the maximum vertical dissection allowed. The Langenbeck retractors were used to retract the strap muscles.

With both techniques, the thyroid isthmus was dissected from the trachea and retracted superiorly with a blunt cricoid hook and tracheotomy was completed with a horizontal inter cartilaginous incision placed approximately between 2nd and 4th tracheal rings.

In each case, an adequately sized portex blue line tracheostomy tube was used and then sutured to the skin. When necessary, monopolar diathermy was used in conjunction with pressure to produce hemostasis. In the traditional method, the incision around the tube had to be closed with two to three skin sutures. With the minimally invasive technique, there was no need for skin sutures because the tube fit tightly into the skin wound. A trial of capping was administered with a fenestrated or small-sized tube prior to intended decannulation, and if practicable, fiber-optic laryngoscopy was performed. Following decannulation in the OPD or ward, skin strapping with adhesive tape was applied³³.

Complications associated with surgical tracheostomies may be classified in minor (hemorrhage without hemodynamic instability, small cartilage, soft tissues or skin lesions, unilateral laryngeal recurrent nerve lesion, pneumothorax or pneumo-mediastinum without need of treatment, subcutaneous emphysema, surgical wound/stoma infection, tracheitis, and small pulmonary

atelectasis) or major (hemorrhage with hemodynamic instability, posterior tracheal wall perforation, bilateral laryngeal recurrent nerve lesion, pneumothorax or pneumo-mediastinum necessitating thorax drainage, mediastinitis, deep neck abscess, tracheomalacia, trachea-esophageal fistula, tracheal stenosis necessitating surgical therapy, and sepsis).

Complications may also be classified into immediate (anesthetic complications, hemorrhage, aeroembolism, laryngeal cartilage lesion or laryngeal recurrent nerve lesion), early (in the first post-operative week) (cannula dislodgement, subcutaneous emphysema, pneumothorax or pneumomediastinum, tracheal necrosis, tracheoesophageal fistula, and wound surgical infection) or late (tracheal stenosis, decannulation difficulties, and trachea-cutaneous fistula)³³.

Following tracheostomy procedure the complications of it will range between 5-40% which is influenced by the time of follow up and basic design of the study³¹.

In a casualty situation tracheostomy related complications range from 5 to 40%³¹. Which will increase about 5 times, further Urgent/Emergency tracheostomy under any required novel type of anesthesia is effective lifesaving procedure with minimal rate of complications^{34,35,36}.

The consonants like tissue bulk or traumatic states will lead to difficult intubations for the acute airway management are mainly taken over for the tracheostomy procedure^{37, 38, 39}.

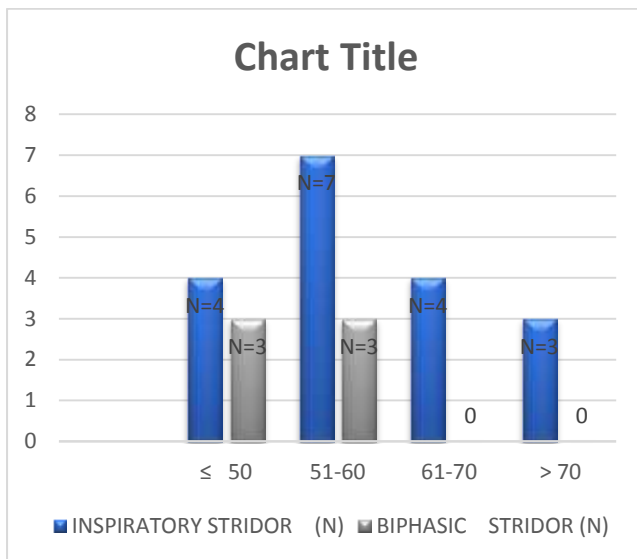
The surgical/medical or combined management is aimed at maintenance of airway with/without the support of mechanical ventilation⁴⁰.

CONCLUSION:

The most dependable symptom appear to be “dysphonia” rather than recordable SpO2, among the stridulous adult secondary supraglottic malignancies, further emergency/urgent tracheostomy is the time tested ,dependable morbidity reducing procedure among the stridulous adult patient and further studies needed in this regards with large number of population.

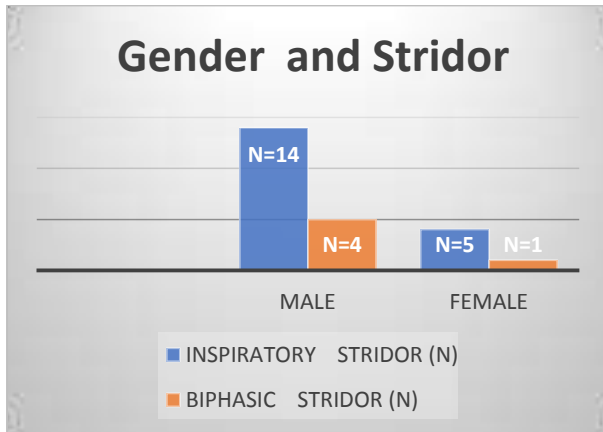
FIGURES AND TABLES

Bar graph 1- Age distribution



Graph-1 shows out of 24, 38.9% (n=7) patients and 50% (n=3) were between 51–60 years of age of both inspiratory and biphasic type of stridor . 22.2% (n=4) patients and 50% (n=3) were between <50 or =50 years of age of both inspiratory and biphasic type of stridor , 22.2% (n=4) patients and 0% (n=0) were between 61 – 70 years of age of both inspiratory and biphasic type of stridor, 16.7% (n=3) patients and 0% (n=0) were between >70 or =70 years of age of both inspiratory and biphasic type of stridor respectively.

Bar graph 2-Gender distribution



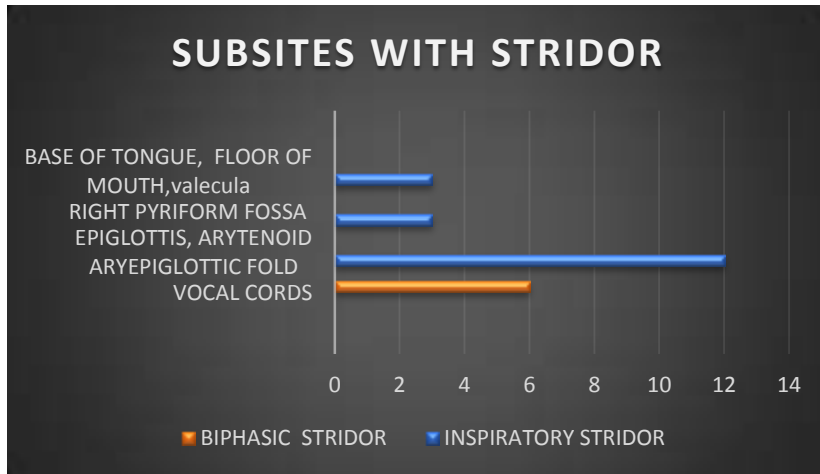
In our study (n=18) patients were male among them 77.8% (n=14) patients had inspiratory stridor and 22.2% (n=4) had expiratory stridor and (n= 6) were females among them 94.4% (n=5) patients had inspiratory stridor and 5.6% (n=1) had expiratory stridor

Table 1- Correlation change of voice and stridor

Change of Voice			Fisher's Exact test	
	INSPIRATORY STRIDOR	BIPHASIC STRIDOR	P Value	Significance
Yes	6 (33.3)	5 (94.4)	0.03	Sig
No	12 (66.7)	1 (5.6)		
Total	18	6		

In this study out of 24 , 33.3% (n=6) patients had change in voice with p value significant (0.03)

Graph 3-Subsites of our study population.



In this study out of 24 ,66.6%(n=12) patients had inspiratory stridor and subsites include epiglottis, arytenuid aryepiglottic fold,100%(n=6) patients had biphasic stridor and subsites include vocal cords,16.7(n= 3) patients had inspiratory stridor and subsites include pyriform fossa, 16.7(n= 3) patients had inspiratory stridor and subsites include base of tongue, floor of mouth, vallecula.

Table 2- oxygen Saturationin our study population

SpO2			Chi Square test	
	INSPIRATORY STRIDOR	BIPHASIC STRIDOR	P Value	Significance
95	5 (27.8)	1 (16.7)	0.06	Not Sig
96-97	3 (16.7)	4 (66.7)		
98-99	10 (55.6)	1 (16.7)		
Total	18	6		

Table-2 shows out of 24, 27.8% (n=5) patients and 16.7%(n=1) had 95% of oxygen saturation in room air, of both inspiratory and biphasic type of stridor . 16.7% (n=3) patients and 66.7%(n=4) had 96-97% of oxygen saturation in room air of both inspiratory and

biphasic type of stridor , 55.6% (n=10) patients and 16.7%(n=1) had 98-99% of oxygen saturation in room air of both inspiratory and biphasic type of stridor , 55.6% (n=10) patients and 16.7%(n=1) had 98-99% of oxygen saturation in room air of both inspiratory and biphasic type of stridor respectively.

Table 3- Site involved in our study population

SITE			Chi Square Test	
	INSPIRATORY STRIDOR	BIPHASIC STRIDOR	P Value	Significance
GLOTTIS	0	6 (100)	0.001	Highly Sig
SUPRAGLOTTIS	12 (66.6)	0		
HYPOPHARNX	3 (16.7)	0		
OROPHARYNX	3 (16.7)	0		

In our study out of 24 ,66.6%(n=12) patients had inspiratory stridor and site include supraglottis,100%(n=6) patients had biphasic stridor and site include glottis, 16.7%(n=3) patients had inspiratory stridor and site include hypopharynx, 16.7%(n=3) patients had inspiratory stridor and site include oropharynx.

Acknowledgements

The authors thank Dr.G Shankar (Head of the department of ENT) Dr.Sudhakar Rao M S ,Dr.Vinay kumar S M and Dr. Sushmitha V Badiger for assisting in the search strategy.

REFERENCES

- 1) Sicari V, Zabbo CP. Stridor. StatPearls [Internet]. 2021 Jul 10.
- 2) Soto FJ, Guntupalli KK. All that wheezes is not asthma: diagnosing the mimics. Cover article of Emergency Medicine: The Practice Journal for Emergency and Urgent Care 15 Nov 2001. Available via EMEDMAG. <http://www.emedmag.com/html/pre/cov/covers/111501.asp>.
- 3) Kate Stephenson and David Albert. Stridor. In: John C Watkinson, Raymond W Clarke, eds. Scott-Brown’s Otorhinolaryngology Head and Neck Surgery, 8th edition, volume 2. Boca Raton: CRC Press; 2018;p312.
- 4) Rees L, and Mason RA. Advanced upper airway obstruction in ENT surgery. BJA CEPD Rev 2002; 2: 134–138.
- 5) Bradley PJ. Treatment of the patient with upper airway obstruction caused by cancer of the larynx. Otolaryngol Head Neck Surg 1999; 120: 737–741.
- 6) Zwartenkot JW, Hoeve HLJ, Borgstein J. Inter-observer reliability of localization of recorded stridor sounds in children. Int J PediatrOtorhinolaryngol 2010;74:1184-1188.
- 7) Wilton N, Lee C, Doyle E. Developmental anatomy of the airway. Anaesth Intensive Care Med. 2015;16(12):611-5. <http://doi.org/b5r6>.
- 8) Tahir N, Ramsden WH, Stringer MD. Tracheobronchial anatomy and the distribution of inhaled foreign bodies in children. Eur J Pediatr. 2009;168(3):289-95. <http://doi.org/ddg4pq>.
- 9) Altman KW, Waltonen JD, Kern RC. Urgent surgical airway intervention: a 3 year county hospital experience. Laryngoscope 2005; 115: 2101–2104.
- 10) Mason RA, and Fielder CP. The obstructed airway in head and neck surgery. Anaesthesia 1999; 54: 625–628.
- 11) Bryant H, Batuwitage B. Management of the Obstructed Airway.
- 12) Textbook of Ear, Nose, Throat and Head and Neck Surgery, P. Hazarika, 3 rd edition, page 654.
- 13) Contreras EI, Rosa GG, Navarro MH, Bertrand NP, Cuevas PM, Sánchez DI, et al. Estridoren el pacientepediátrico: Estudiodescriptivo. Rev Chilpediatria. 2004;75(3):247-53. <http://doi.org/dzczkj>.

- 14) Spencer S, Yeoh B, Van Aperen PP, Fitzgerald DA. Biphasic stridor in infancy. *Med J Aust*. 2004 [cited 2017 Apr 14];180(7):347-9. Available from: <https://goo.gl/9yWy89>.
- 15) Majumdar S, Bateman NJ, Bull PD (2006) Pediatric stridor. *Arch Dis Child Educ Pract Ed* 91: 101-105.
- 16) Valman HB (1981) ABC of 1 to 7: Stridor. *Br Med J (Clin Res Ed)* 283: 294-295
- 17) Lovecchio E, Gruber N, Münnich M, Lachkar Z, Allegrini P, Geneston E, West BJ, Grigolini P, Gruber N, Münnich M, Byrne D. PEER REVIEWER. *trauma*. 2011 Mar;9(12):14.
- 18) Kuan WS, Quek LS. Stridor in an adult: not just a child's disease. *European Journal of Emergency Medicine*. 2009 Apr 1;16(2):109-10.
- 19) Parmar D, Gangwani V, Sharma J. Study of Stridor in Adults.
- 20) Ng TT. The forgotten cause of stridor in the emergency department. *Open access emergency medicine: OAEM*. 2017;9:19.
- 21) Kilham H, Gillis J, Benjamin B. Severe upper airway obstruction. *Pediatr Clin North Am* 1987;34:1-14.
- 22) Maloney E, Meakin GH (2007) Acute stridor in children. *Continuing Education in Anesthesia, Critical Care & Pain* 7: 183-186.
- 23) Sobol SE, Zapata S (2008) Epiglottitis and croup. *Otolaryngol Clin North Am* 41: 551-566.
- 24) Pflieger A, Eber E. Assessment and causes of stridor. *Paediatric respiratory reviews*. 2016 Mar 1;18:64-72.
- 25) Zochios V, Protopapas AD, Valchanov K. Stridor in adult patients presenting from the community: An alarming clinical sign. *Journal of the Intensive Care Society*. 2015 Aug;16(3):272-3.
- 26) Goodman TR, McHugh K. The role of radiology in the evaluation of stridor. *Archives of disease in childhood*. 1999 Nov 1;81(5):456-9.
- 27) Morton NS, Barr GW. Stridor in an adult: an unusual presentation of functional origin. *Anaesthesia*. 1989 Mar;44(3):232-4.
- 28) Eber E. Evaluation of the upper airway. *Paediatr Respir Rev* 2004;5:9-16.
- 29) Goodman TR, McHugh K. The role of radiology in the evaluation of stridor. *Arch Dis Child* 1999;81:456-459.
- 30) Vats A, Worley GA, de Bruyn R, Porter H, Albert DM, Bailey CM. Laryngeal ultrasound to assess vocal fold paralysis in children. *J Laryngol Otol* 2004;118:429-431.
- 31) Ye X, Jiang X, Lan H, Yang Y, Lian Q. Difficult Airway caused by a Subglottic Tumor: A Case Report.
- 32) Baxter FJ, Dunn GL. Acute epiglottitis in adults. *Canadian journal of anaesthesia*. 1988 Jul;35(4):428-35.
- 33) Costa L, Matos R, Júlio S, Vales F, Santos M. Urgent tracheostomy: four-year experience in a tertiary hospital. *World journal of emergency medicine*. 2016;7(3):227.
- 34) Goldenberg D, Ari EG, Golz A, Danino J, Netzer A, Joachims HZ. Tracheotomy complications: a retrospective study of 1130 patients. *Otolaryngol Head Neck Surg* 2000; 123: 495-500.
- 35) Gillespie MB, Eisele DW. Outcomes of emergency surgical airway procedures in a hospital-wide setting. *Laryngoscope* 1999; 109: 1766-1769.
- 36) Costa L, Matos R, Júlio S, Vales F, Santos M. Urgent tracheostomy: four-year experience in a tertiary hospital. *World journal of emergency medicine*. 2016;7(3):227.
- 37) Yuen HW, Loy AH, Johari S. Urgent awake tracheotomy for impending airway obstruction. *Otolaryngol Head Neck Surg* 2007; 136: 838-842.
- 38) Badaoui R, Thiel V, Perret C, Popov I, Dupont H. Bilateral pneumothorax, cervicofacial and mediastinal emphysema after surgical tracheostomy. *Ann Fr Anesth Reanim* 2013; 32: 718-720.
- 39) Bonanno FG. The critical airway in adults: The facts. *J Emerg Trauma Shock* 2012; 5: 153-159.
- 40) PallaviNayak , Subrat Kumar Behera, Aetiopathological Study with Evaluation and Management of Stridor, ISOR, Indian J Lepr 2019;91(2):195-8.