Laryngomalacia 2020

John Bent, MD
Professor, ORLHNS & Pediatrics
Children's Hospital at Montefiore
Bronx, NY

April 9, 2020

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

1

Annual Meeting of American Pediatric Society, New York City, 1905

- "appears shortly after birth. The infant otherwise may be in apparent health, lying quietly in its crib or the arms of a nurse, a peculiar crowing or grunting is heard with inspiration. The sound may be scarcely audible, or at some distance, as across the room and of a loud sawing timbre. As a rule, the sound is heard only with inspiration, but may in severe cases be heard in expiration also. At times the grunting may become inaudible, but reappears at intervals.
- Autopsy: "epiglottis so disposed that its sides are rolled up and almost in contact, and the AE folds draw the epiglottis downward and backward, covering the superior opening of the glottis."

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

2

All perinatal stridor is from laryngomalacia. That's why it's also know as congenital laryngeal stridor

- True
- False

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

3

Laryngomalacia: Historical

- Stridor used to be a diagnosis.
  - Thymectomy, radiation, radical epiglottectomy
  - Tracheotomy
- Laryngeal diagnosis was inferential.
  - Flexible laryngoscopy not available/avoided
- 1980s: LGM ≠ congenital laryngeal stridor
- Realization: LGM is the most common of many causes of stridor.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

4

Child born 6 hours ago with inspiratory stridor. Least likely diagnosis

- Subglottic stenosis
- Subglottic hemangioma
- Bilateral vocal cord paralysis
- Laryngomalacia
- Tracheomalacia

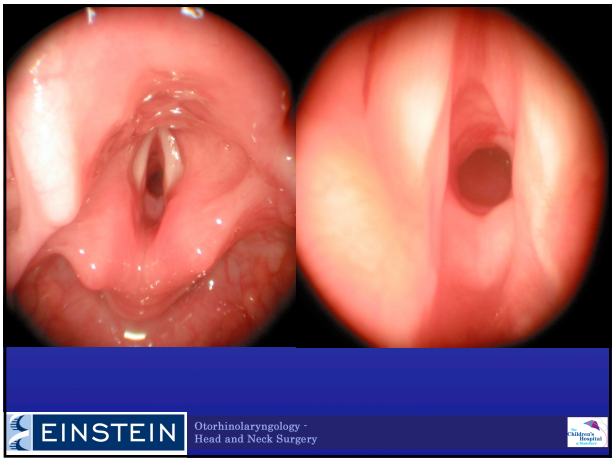
EINSTEIN Otorhinolaryngology - Head and Neck Surgery

5

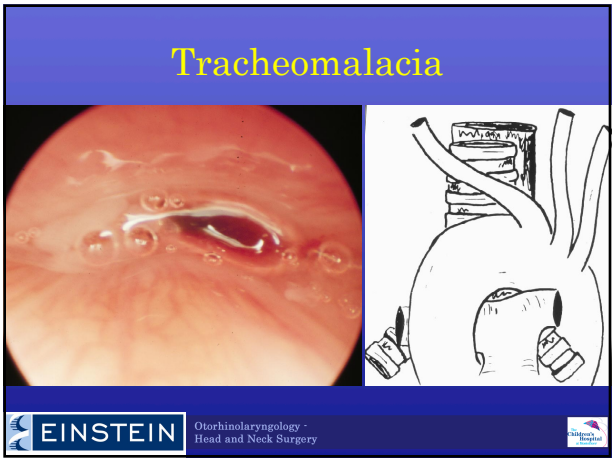
Subglottic Hemangioma

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

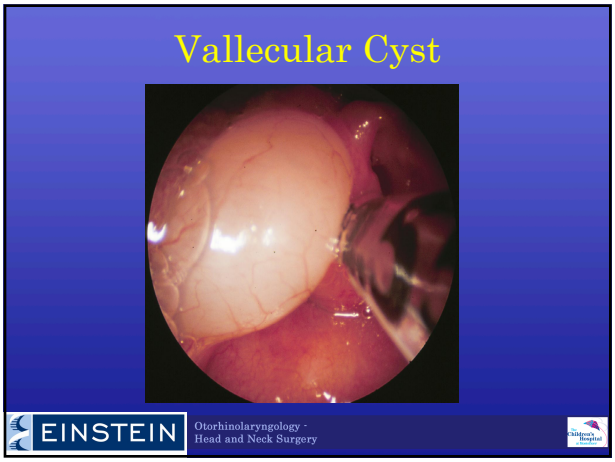
6


EINSTEIN
Otorhinolaryngology -
Head and Neck Surgery

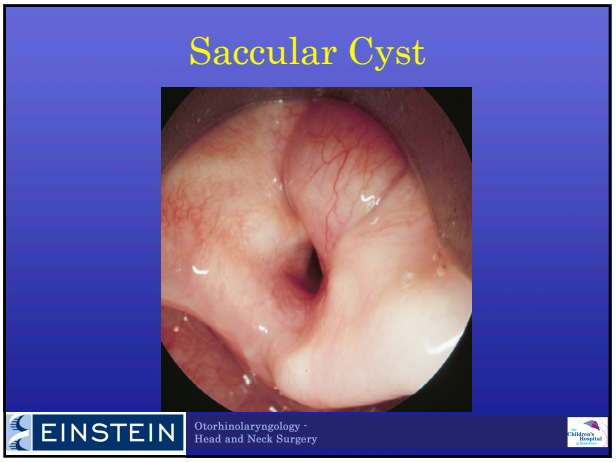
7


Tracheomalacia
EINSTEIN
Otorhinolaryngology -
Head and Neck Surgery

8


Vallecular Cyst
EINSTEIN
Otorhinolaryngology -
Head and Neck Surgery

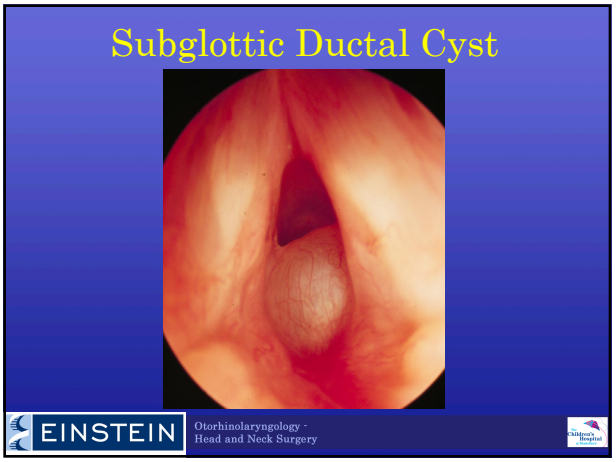
9


Saccular Cyst
EINSTEIN
Otorhinolaryngology -
Head and Neck Surgery

10


Congenital Anterior Glottic Web
EINSTEIN
Otorhinolaryngology -
Head and Neck Surgery

11


Subglottic Ductal Cyst
EINSTEIN
Otorhinolaryngology -
Head and Neck Surgery

12

If stridorous newborn weighs 10 pounds and was a difficult forceps delivery, your suspicion goes up for:

- Subglottic stenosis
- Subglottic hemangioma
- Vocal cord paralysis
- Laryngomalacia
- Tracheomalacia

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

13

Vocal Fold Paralysis

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

14

Widespread pediatric flexible fiberoptic laryngoscopy can be attributed in part to:

- Improved optics
- The HIB vaccine
- Peds ORL subspecialty development
- All of the above

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

15

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

16

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

17

Laryngomalacia …

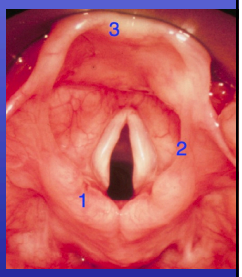
- Is most common cause of neonatal stridor
- Causes most stridor in children
- Should never be treated with tracheotomy
- Affects males and females equally
- All of the above

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

18

Laryngomalacia

- most common congenital laryngeal anomaly
- most common cause of stridor in infants
- high pitched inspiratory stridor
- presents hours to months after birth
- prolapse of supraglottic structures



EINSTEIN Otorhinolaryngology - Head and Neck Surgery

19

Most laryngomalacia is caused by

- Unfavorable anatomy
- Prematurity
- Second airway lesion
- Sensorimotor abnormalities
- All of the above

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

20

Etiology

- Anatomic vs neurologic
  - Anatomic theory supported by response to surgery; acquired laryngomalacia is recognized anatomic problem
  - Majority of evidence supports neuro etiology for neonatal LGM.
    - Alters with state of awareness.
    - Resolution correlates with neuro development
- Abnormal laryngeal sensorimotor testing
  - Correlates with disease severity
  - Improves as symptoms resolve
    - Thompson DM Laryngoscope 2007
- LPR strongly associated in prospective studies
  - 64% Giannoni et al
  - 100% Matthews et al

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

21

Natural history

- Typically presents days after birth
- 2:1 M:F ratio
  - More even ratio among non-Caucasians
  - Higher rates in low birth weight and premies
    - Edmundson et al, IJPO 2011
- Stridor becomes more prominent over several months.
- Largely resolved by 12 MO
- Completely resolved by 18 MO

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

22

Laryngomalacia poses some risk of:

- Aspiration
- Poor growth
- Sleep apnea
- B and C
- All of above

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

23

Laryngomalacia Evaluation

- Apnea, cyanosis, general comfort
- Feeding
- Growth
- Other anomalies?
- Flexible laryngoscopy
  - State dependent
- Sleep study?

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

24

Nonsurgical Treatment

- HOB elevation
- Thickened feedings
- Prone position (contradicts 'back to sleep')
- Anti-reflux medications
  - OTC topicals
  - H2 blocker
  - PPI
- Oxygen

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

25

IPOG LGM Consensus (2016)

- Treatment algorithm based on symptoms –
  - Mild: stridor only
    - observe
  - Moderate: stridor with coughing, choking, regurgitating, feeding difficulty
    - Acid suppression
    - Possible feeding therapy/swallow eval
  - Severe: apnea, cyanosis, FTT, pulm hypertension, cor pulmonale
    - Same as moderate with consideration of SGP

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

26

8-week child with laryngomalacia not responsive to 3-weeks of Ranitidine, HOB elevation. Weight has decreased below 5th%ile

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

27

You advise:

- Proton pump inhibitor
- Barium swallow
- Sleep study
- Drug induced sleep endoscopy (DISE)
- DLB and supraglottoplasty

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

28

Respiratory Statistics (Normal Values):

Apnea Hypopnea Index / Respiratory Disturbance Index (<5/hr):	34.8		
Central Apnea Index (<1/hr):	1.8	Obstructive Apnea Index (<1/hr):	21.0
Hypopnea Index:	12.0	Snore Intensity:	frequent, light
Baseline Oxygen Saturation (%):	100	Minimum Oxygen Saturations (>92%)(%):	65
Baseline ETCO2 (torr):	35	Max ETCO2 (<53 torr) (torr):	58

Respiratory Event Durations

EINSTEIN Head and Neck Surgery

29

Surgical indications

- Performed for approximately 15% of cases presenting to ORL
- Objective: cyanosis, sleep apnea, FTT, pectus deformity.
- Subjective: feeding difficulties, progressive stridor, general discomfort, sleep disordered breathing.
  - Mancuso et al Arch OHNS 122: 302-6, 1996

All indications are relative.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

30

Pectus Deformity Association

- elevated rates of pectus deformities
- deformity exists in 0.1-0.3% infants
- 137 LGM patients (2008-12)
  - 9 (6.6%) identified retrospectively (p=.001)
    - Virbalas et al, IJPO 2013
- seems to correlate with more severe disease.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

31

All children with laryngomalacia should have:

- DLB
- DLB before SGP
- pH probe
- Modified barium swallow

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

32

Second lesion

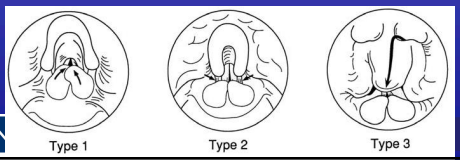
- Described by Bluestone et al 1996
- May occur in up to 50-60%
  - Frequency correlates with LGM severity
    - Schroeder et al. Arch OHNS 2009;135:647-51.
    - Dickson et al. Ann ORL 2009;118:37-43.
- Relationship may be
  - Anatomic (Bernouille's law),
  - Chemical (edema from LPR), or
  - Neurologic (central tone)
    - Probably not a genetic association.
- Merits comprehensive endoscopy prior to surgery.
- A second lesion increases need for SGP 4.5X
  - Landry, Thompson IJPO 2012

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

33

Which type of laryngomalacia is most common?

- Type 1
- Type 2
- Type 3
- Type 1 and 2 combined

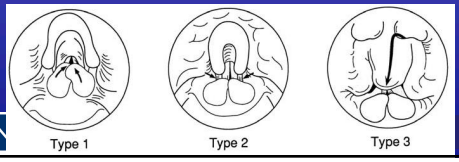


EIN

34

Type 1 most common (n=48)

- Type 1 (57%)
- Type 2 (15%
- Type 3 (12%)
- Types 1 and 2 (15%)
  - Olney et al, Laryngoscope 109: 1770-75, 1999.

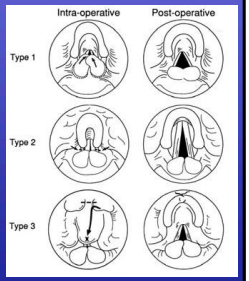


EIN

35

Supraglottoplasty (formerly called epiglottopplasty)

- Endoscopy first
- Laser
- Cold
- Microdebrider
- Avoid interarytenoid scar
- +/- divide folds
- Role for epiglottopexy/ectomy
- Tracheotomy



EINSTEIN Otorhinolaryngology - Head and Neck Surgery

36

Preferred Anesthesia Method

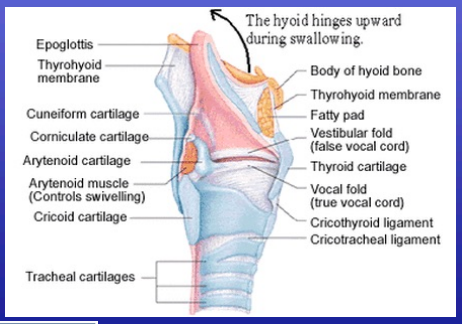
1. apneic technique
2. spontaneous ventilation
3. subglottic jet ventilation
4. supraglottic jet ventilation
5. endotracheal tube intubation

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

37

38

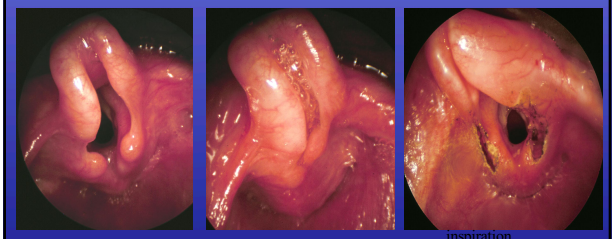
Laryngeal cartilages



EINSTEIN Otorhinolaryngology - Head and Neck Surgery

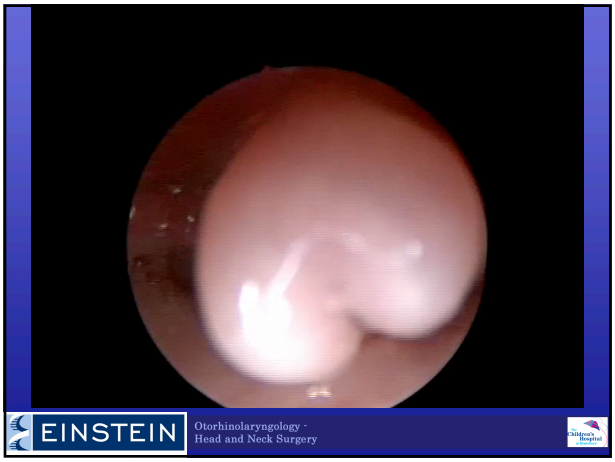
39

Laryngomalacia: Intraoperative



EINSTEIN Otorhinolaryngology - Head and Neck Surgery

40

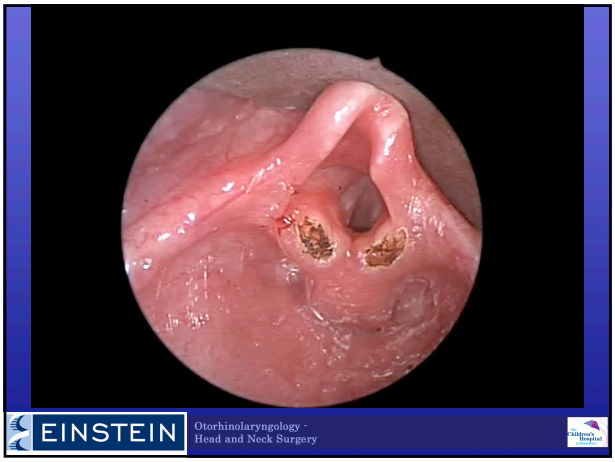


EINSTEIN Otorhinolaryngology - Head and Neck Surgery

41

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

42



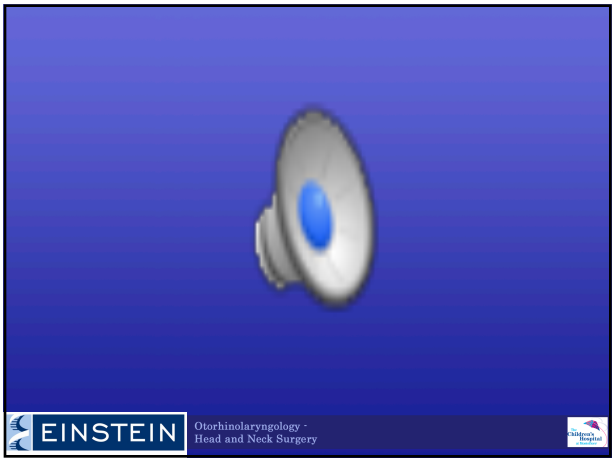
43

Microdebrider-assisted Supraglottoplasty

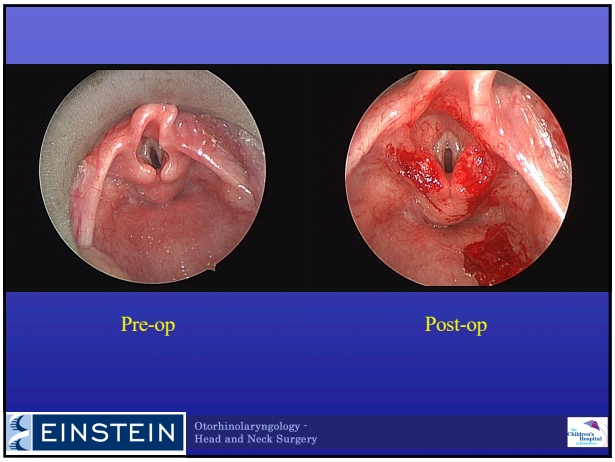
- Alternative to laser or microlaryngeal instrumentation.
- Controlled trimming of AE folds
- 5/5 pts had resolution of stridor without complications.
  - Zalzal and Collins. IJPO 69: 305-9, 2005.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

44



45



46

Appropriate post op care involves

- Intubation
- PICU care
- NPO
- Anti-reflux medication

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

47

Outcomes

- Higher rates of aspiration vs normal infants
  - Related to neuro impairment, not surgery
- 36 supraglottoplasties at CHAM 2008-14
  - 89% symptoms relieved after 1 procedure
    - 2 revisions, 2 tracheotomies
  - Mean postop stay 1.7 days for outpatients
    - 18.4 days for inpatients
- Poor outcomes and prolonged stay correlates with co-morbidity.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

48

Supraglottoplasty- Failures and Complications

- Isolated laryngomalacia- 102 pts
- Additional congenital anomalies (ACA)-34 pts
- All failures 8.8% ACA group
- Complication rate 7.4%
  - 3.6% supraglottic stenosis
    - Denoyelle F. Arch OHNS 129: 1077, 2003.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

49

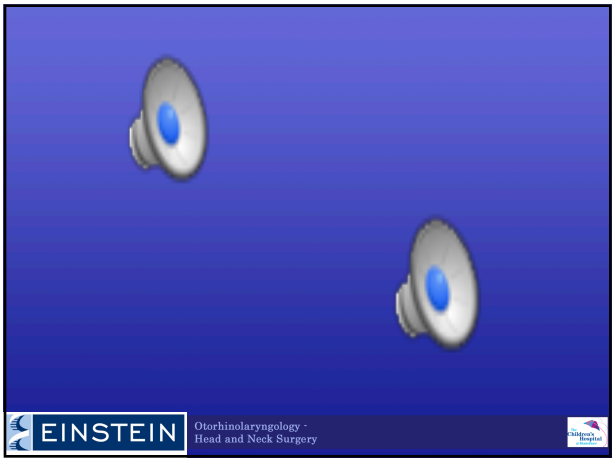
Supraglottoplasty failures occur …

- In < 10% of attempted cases.
- Occasionally from excessive surgery around posterior commissure.
- Most often among children with other congenital anomalies.
- At a higher rate when associated with pharyngolaryngomalacia.

•OHNS 129: 1077, 2003.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

50



EINSTEIN Otorhinolaryngology - Head and Neck Surgery

51

Do we do this surgery enough?

- Balancing risk of hypoxia and UAO vs potential anesthetic neurotoxicity
- In 1989 Hollinger predicted supraglottoplasty will be performed not just for "life-threatening obstruction" but also "to improve quality of life"
  - Laryngoscope 99: 136-42, 1989
- Comparison to T&A for OSA
  - Is supraglottoplasty underutilized?
    - White D, Laryngoscope 2012

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

52

Type 3 Laryngomalacia

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

53

If this patient has moderate sleep apnea and feeding difficulty, and you exclude a second lesion, you advise:

- Partial epiglottectomy
- Epiglottis-tongue adhesion
- Corniculate vaporization
- Oxygen and thickened feedings

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

54

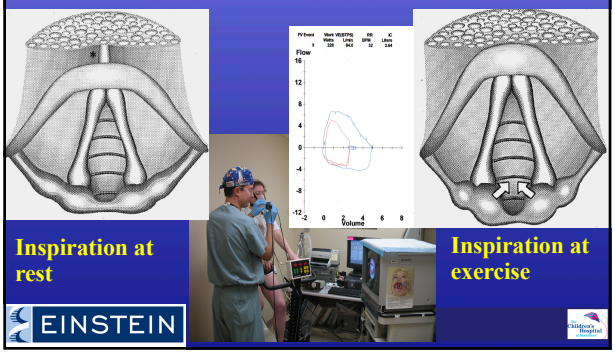
Late Onset Laryngomalacia

- Late onset LGM may cause dysphagia in toddlers, OSA in children, and exercise intolerance in teenagers.
  - Richter GT et al, Arch Otolaryngol Head Neck Surg. 2008 Jan;134:75-80.
- post-ictal, post head injury
- Increasingly recognized: "Occult" LGM as cause for persistent OSA after T&A

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

55

Exercise Induced Laryngomalacia



EINSTEIN

56

All of the following are true about LGM except

- Most cases are caused by abnormal sensorimotor integration.
- Type 3 LGM is the most common.
- Surgical success rates are approximately 90%.
- Roughly 50% of children have a second airway lesion.

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

57

Take home points Laryngomalacia

- The most common cause of pediatric and neonatal stridor
- Must consider other and second causes
- Most cases managed non surgically
- Most surgery very successful
- Keep in mind comorbidities and atypical presentations
- Surgery: balance how often and how much

EINSTEIN Otorhinolaryngology - Head and Neck Surgery

58