Gastroesophageal Reflux in Children

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GER in Children

- **GER**: Merely a descriptive term – Regurgitation of gastric contents in to the esophagus
- **GERD**: With Symptoms or Complications of regurgitation
- Commonly half heatedly treated but less frequently diagnosed even in high risk groups
- 40% of infants < 2 months regurgitate at least twice a day
Physiological Considerations - 
Lower Esophageal Sphincter (LES)

- Anatomically not a distinct muscle but a thickened extension of circular muscles of oesophagus
- Greater responsive to cholinergic stimulation
- Tonically contracted at rest and relaxes in coordination with peristaltic waves from body of oesophagus
- Spontaneous relaxations
Functioning of LES in Infants and Children

- Decreased basal tone
- Spontaneous Relaxations
- Inappropriate relaxations
- Neurotransmitters
- Age related thickness-to-radius ratio
Decreased Basal Tone

- Initial manometric studies suggested decreased basal tone in younger infants
- Animal models report LES muscles in newborns not weaker than in adults
- Bethenecol, which causes increase in LES pressure, not successful as a treatment modality
Spontaneous Relaxations (SRs) – Physiological

- LES undergoes SRs in normal children (Reasons not clearly known)
- Appear to result from a vago-sympathetic reflex initiated by stimulation of gastric wall mechanoreceptors
- Transient SRs usually partial, not associated with ‘acid reflux’
Spontaneous Relaxations (SRs) – Pathological

- More frequent
- Transient LES Relaxations (TLRs) are usually ‘complete’
- Greater proportion associated with ‘acid reflux’
- Impaired acid clearance

Acid Reflux
Inappropriate relaxation

- Abnormal functioning of CNS
- Developmentally exaggerated enteric reflexes:
  - Proximal (esophageal)
  - Distal (gastric)
- Animal models suggest neonatal gastric mucosa functionally different-retrograde peristalsis in the newborns
Neurotransmitters

- LES independent for its contracted state at rest
- Relaxes at the end of a esophageal peristaltic sequence – coordinated by a network of neurones
- Relaxation at the appropriate time depends on inhibitory transmitters
Age related thickness-to-radius ratio

- Thickness to radius ratio critical for generating basal pressure at LES.
- Thickness of circular smooth muscles and inner radius of LES increases with age.
- Adult LES has greater amount of smooth muscles than the adjacent esophageal and fundic muscles.
- Newborns have a mechanical disadvantage of reduced ratio.
GER – Predisposing Factors

- **Motility disorders**: Infants and children with neurological deficits or psychomotor retardation
- **Anatomic disorders**: pyloric stenosis, congenital webs, atresia, diaphragmatic hernia, hiatus hernia, malrotation etc.
- **Operated cases** of esophageal atresia
- **Metabolic disorders or CNS tumours** – secondary to retrograde peristalsis or incoordination in the relaxation of LES
GER & Cerebral Palsy

Study of 80 children with Severe CP (1-9 years):

- Symptoms s/o GER - 90%
- Recurrent respiratory infections - 15%
- Vomiting with or without recurrent resp. infection – 15%

Of the 25 cases positive by histology:
- Esophagitis by endoscopy (72%)
- Scintigraphy (80%)

GER and Respiratory Diseases

- Cause and effect relationship often difficult
- Close proximity of trachea to esophagus - aspiration
- Reflex bronchospasm or laryngospasm
- Reactive Airway Disease – reflex mechanism mediated by vagus, nocturnal asthma likely to be related to GER
GER and Reflex Apnea & Bradycardia

Apparent Life Threatening Events (ALTE)

- Reflex laryngospasm by local stimulation—apnea, near miss SIDS and stridor
- Reflex Central apnea – laryngeal and nasopharyngeal through receptors adjacent to oropharynx
- Reflex bradycardia during feeding due to reflux through the oropharyngeal receptors
- Unrelated to apnea- involve superior laryngeal nerve afferents
GER & Respiratory Symptoms

Study of 40 children (3 months- 3 years) with:

• Persistent /Nocturnal cough > 4 weeks
• Recurrent Bronchopneumonia, Reactive Airway Disease

86 % did not have typical symptoms
GER detected in 35% cases

Several changes produced by Respiratory functions can potentiate GER:

- Increase positive abdominal pressure
- Increase negative intrathoracic pressure
- Decrease LES pressure
- Increased gastric acid production
GER and Bronchodilators

• Isoproterenol, Theophylline and Aminophylline reported to cause a fall in LES pressure
Clinical Manifestations of GER in Children
GER in children – a wide spectrum
Clinical Manifestations

Wide spectrum

• Asymptomatic
• Severe esophagitis
• Stricture
• Profound nutritional failure
• Severe respiratory problems
• Barret’s esophagus
Clinical Presentations

Physiologic GER
• Reflux in young infants < 3 months

Uncomplicated GER
• Reflux without pathologic sequelae

Complicated GER
• With pulmonary aspiration, esophagitis, bleeding, failure to thrive

Secondary GER (un/complicated)
• CNS or Psychomotor impairment, large hiatal hernias, following repair of esophageal atresia
Symptomatology in Infants

- Reflux of gastric contents
- Acid Reflux
- Esophagitis
Reflux of Gastric Contents

- Regurgitation
- Vomiting
- Failure to thrive
- Aspiration (RTI, RAD, ‘Near miss’ SIDS)
- Rumination of refluxed contents
- Recurrent otalgia
- Dental erosion
Acid Reflux

- Infantile heartburn (unexplained incessant crying episodes)
- Erosive esophagitis
- Nocturnal asthma
- Choking attacks – Laryngeal spasm
Esophagitis

- General extreme irritability
- Infantile heartburn
- Hematemesis
- Chronic blood loss
- Esophageal strictures
- Dysphagia
Symptomatology in Older Children

• Symptoms like adults
• Commonest symptom heartburn
• Worsening of symptoms with exercise, stress, obesity
• Strictures, dysphagia
• Abnormal behavior and posturing
Sandifer’s Syndrome

GER with

- Abnormal posturing
- Opisthotonous
- Abnormal involuntary movements
Approach to a Child with GER

• Age of presentation
• Feeding pattern
• Associated Neurological deficit
• Psychomotor retardation
• Other definable causes
Who should be investigated for GER?

Happy Spitter

- Majority of young infants present with spitting/vomiting, healthy, thrive well
- No other symptoms/complications
- Symptoms resolve by 9-24 months in 60% by 18 months (greatest improvement 8-10 months)
- Reassurance, proper positioning, thickening of feeds
Who should be investigated for GER?

Infants with recurrent/persistent vomiting and poor weight gain and/or constipation & Infants with significant neurological deficits or psychomotor retardation

• Assess Feeding
• Assess symptoms by Infant GER Questionnaire scoring (Total score 25)
• Rule out other causes of failure to thrive
• Consider investigations

Red Flags in Infants!
Billious vomiting
Hemetemesis
Who should be investigated for GER?

- Persistent/recurrent vomiting beyond infancy
- Recurrent respiratory symptoms (> 3 episodes in last 6 months)
- Persistent respiratory symptoms like cough, wheeze, respiratory distress or crepitations beyond 4 weeks
- Chronic heart burn
- No improvement with change in feeding technique/thickness, posture, drugs given for 2-4 weeks
Diagnosis

- Early recognition of pathological GER can reduce severity of symptoms, risk of complications and improve nutrition
- A good history and thorough examination should lead to further investigations
- Various diagnostic modalities assess different aspects of gastroesophageal physiology
- Availability & Access, Sensitivity & Specificity of diagnostic modalities variable

Therefore there is a need to identify a diagnostic modality/ combination
Investigations

- Radiology
- Endoscopy
- Scintigraphy
- 24 hour pH monitoring
Radiology

- Barium meal identifies anatomical abnormalities
- Quantitates degree of GER
- Identifies strictures
- Identifies gastric outlet obstruction (required before surgery)
- Low specificity
Endoscopy

- Direct visualization (reflux esophagitis)
- Severity of reflux
- Esophageal biopsy
- Other gastric malformations (web, pyloric stenosis)
- Normal mucosa does not rule out GER
Histopathology

- Eosinophilic infiltrates
- Squamous epithelium changed to columnar with glandular elements
- Grading according to severity
- May be normal if symptoms are due to reflex broncho/laryngo spasm
Scintigraphy

- Scan with radiotracer Techneticum- 99 m Sulphur colloid, under Scintillation Gamma camera
- Frequent pictures after 30 sec. for 20 minutes
- Radioactivity above the LES represents GER – Reflux Index
- Detects how often reflux occurs
- Volume of refluxate
- Rate of gastric emptying
- Can detect pulmonary aspiration
- Limited sensitivity (short duration)
pH monitoring

- pH sensor of the probe sited 3 cms above the upper border of LES
- Simultaneous pharyngeal probe can be used
- GER studied in the best possible physiological circumstances
- Detects episodes that cause change in pH
- 24 hour study possible
- Unable to determine volume of refluxate
- Unable to detect post-prandial reflux (buffering effect)
24 pH monitoring

Reflux index:
Percentage of time that pH was <4
(GER: >10% in <1 year and >5% in >1 year)
pH monitoring
(Diagnostic Indices)

- Reflux Index
- No. of episodes lasting more than 5 min.
- No. of episodes with pH < 4
- Duration of longest episode
- Euler Byrne score
- Oscillatory index
- Area under curve
Other Investigations

- Manometric studies
- Bronchoscopy in some cases (Detection of lipid laden macrophages from the bronchial/tracheal washings)
## Diagnostic value of Investigations

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<th>Sensitivity</th>
<th>Specificity</th>
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<th>- PV</th>
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<td>Reflux index</td>
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<td>85</td>
<td>97</td>
</tr>
<tr>
<td>Duration of longest episode &gt;20 minutes</td>
<td>91</td>
<td>100</td>
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Management

• Reassurance, small frequent feeds, proper positioning
• Thickened feeds
• Pharmacological Therapy
• Surgical correction
Principles of Pharmacological Therapy

• Neutralizing gastric acid
• Antifoaming agents
• Reducing acid secretion by blocking H-2 receptors
• Pronounced and long-lasting reduction of gastric acid production, irreversibly blocking the H+/K+adenosine triphosphate enzyme system (Proton pump)
• Reducing regurgitation reverse peristalsis, enhancing gastric motility
Pharmacological Therapy

• Antacids
• $H_2$ Receptor antagonists
  - Ranitidine (5-10 mg/kg in 2 or 3 div. doses)
• Proton Pump inhibitors
  - Omeprazole (1-3.3 mg/kg/day, 15-30 minutes before first meal of the day)
• Prokinetic agents
  - Metoclopramide (0.2 mg/kg/dose)
  - Domperidone (0.3 mg/kg/dose)
  - Cisapride (0.15-0.3 mg (0.2 mg)/kg/dose - not to exceed 0.8 mg/kg/day)
Thank You