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ORIGINAL ARTICLE

# Prevalence of chronic rhinosinusitis in children with dyspepsia—A cross sectional study



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**Abstract** *Background:* Chronic rhinosinusitis (CRS) is a complex condition that has been found to affect both adults and children. Risk factors associated with CRS are allergy, asthma, immunodeficiency, GERD/*Helicobacter pylori*, anatomic obstruction, genetics, congenital and environmental factors and irritants. Chronic rhinosinusitis is defined as a symptomatic inflammatory condition of mucosa of the nasal cavity and paranasal sinuses, the fluids within these sinuses, and/or the underlying bone for duration of greater than 12 weeks. Chronic rhinosinusitis affects 5–15% of populations worldwide. It has a significant impact on quality of life and has a negative economic impact due to rising treatment costs. This study attempted to determine the prevalence of CRS in children diagnosed with dyspepsia.

*Study methodology:* This was a hospital based cross sectional descriptive study that was carried out at one public tertiary facility and one private tertiary facility. Ninety-six children diagnosed with dyspepsia were proportionately selected from the two hospitals using simple random sampling. CRS and dyspepsia were clinically diagnosed and Rome III criteria used for dyspepsia. Baseline characteristics were compared and Spearman Rho' Chi Square test was used to test associations. Logistic regression assessed the association between multiple variables.

*Results:* Ninety-six children with dyspepsia were analyzed for *H. pylori* antigen by means of a stool test, Reflux symptom index and CRS. CRS was present in 41.7% of dyspeptic patients, *H. pylori* in 60.4% and GERD in 78.5%. CRS with GERD had OR 38.07 ( $p$  value 0.00001), CRS with *H. pylori* had OR 2.95 ( $p$  value = 0.0252) and CRS with GERD and *H. Pylori* had OR 20.05 ( $p$  value 0.001).

*Abbreviations:* CRS, chronic rhinosinusitis; ENT, ears, nose and throat; GCH, Gertrude's Children's Hospital; GERD, gastroesophageal reflux disease; *H. pylori*, *Helicobacter pylori*; KNH, Kenyatta National Hospital.

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**Conclusion:** Chronic rhinosinusitis was diagnosed in more than 40% of children with dyspepsia. The odds of CRS being present in children diagnosed to have GERD increases significantly as demonstrated in this study.

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## 1. Introduction

Dyspepsia is a medical condition characterized by chronic or recurrent upper abdominal pain, bloating, belching, nausea, heartburn, vomiting, retrosternal pain, and/or loss of appetite.<sup>1,2</sup> It is a common problem, frequently caused by gastroesophageal reflux and *Helicobacter pylori* affecting patients' quality of life.<sup>3</sup> The prevalence of dyspepsia is estimated at 10–45% in the general population with an annual incidence rate of 1–6%.<sup>4–6</sup> It is common in the paediatric population affecting 10–15% of children between the ages of 4 and 14 years.<sup>7</sup> The Rome III committee for functional gastrointestinal disorders, defined dyspepsia as “a symptom considered to originate from the gastroduodenal area”.<sup>8</sup> The Rome III committee proposed two diagnostic categories of dyspepsia (Appendix I). Symptoms were distinguished as meal-induced dyspepsia and meal-unrelated dyspepsia, forming its basis as: postprandial distress syndrome (PDS) and epigastric pain syndrome (EPS).

Rhinosinusitis is defined as a symptomatic inflammatory condition of mucosa of the nasal cavity and paranasal sinuses, the fluids within these sinuses, and/or the underlying bone.<sup>9</sup> It is termed chronic when the duration of symptoms exceeds 12 weeks.<sup>9</sup> Chronic rhinosinusitis (CRS) occurs frequently, with a significant impact on quality of life. CRS affects 5–15% worldwide populations.<sup>10</sup> Desrosiers did a study in Canada that described the similarity of CRS impact on quality of life with other chronic health conditions such as arthritis, cancer and asthma.<sup>11</sup> The economic impact is negative due to its rising treatment costs. An estimation of 6 billion dollars is spent in the United States annually on rhinosinusitis treatment.<sup>12</sup>

Risk factors associated with CRS are allergy, asthma, immunodeficiency, GERD/*H. pylori*, anatomic obstruction, genetics, congenital and environmental factors and irritants e.g. cigarette smoke, drugs including rhinitis medicaments, aspirin intolerance and diminishment of ciliary function.<sup>13</sup>

GERD is related to conditions like chronic coughing, dysphonia, dysphagia, globus sensation, laryngospasm, subglottic stenosis, benign and malignant lesions of the vocal cords.<sup>14</sup> GERD can be diagnosed using various methods: clinical features, pH monitoring and endoscopically with imaging. Clinically, it can be diagnosed using Reflux symptom index where within the past one Month; the condition is scored and rated. If score is more than 10, then the patient has GERD (Appendix II).

*H. pylori* infection is highly prevalent in developing countries. In Kenyan children diagnosed with dyspepsia, *H. pylori* was found in 73.3% of these cases.<sup>15</sup> Phipps et al.<sup>16</sup> conducted a descriptive study on the role of gastroesophageal reflux in children with chronic sinusitis and found out that 63% had esophageal reflux of which 32% had nasopharyngeal reflux. Seventy-nine percent of patients with GERD improved after

taking antacids and the authors concluded that GERD treatment actually managed sinus disease.

*H. pylori* is a risk factor of CRS and has been detected in the sinonasal mucosa in several studies.<sup>17,18</sup> This study was carried out to determine the relationship between CRS, *H. pylori* and GERD in children who have dyspepsia at a public and a private tertiary hospitals in Kenya.

## 2. Methods

This was a hospital based descriptive cross-sectional study carried out at Kenya's largest public tertiary level facility (Kenya National Hospital, KNH) and the largest private paediatric tertiary level facility (Gertrude's Children's Hospital, GCH). The pH monitoring method for diagnosing GERD is not possible due to equipment unavailability in Kenya. Rigid nasal endoscopy is an invasive procedure and expensive to the patient thus only clinical criteria was used to diagnose both CRS and GERD. Ninety-six children aged between 5 and 17 years diagnosed with dyspepsia using Rome III criteria<sup>8</sup> and whose parents/guardians consented to participate were recruited and subjected to a questionnaire as well as anterior rhinoscopy examination and stool for *H. pylori* antigen test (One Step Antigen *H. pylori* test, rapid chromatography immunoassay). The study was approved by both the KNH and GCH ethics committees. Written informed consent was obtained from parents/guardians. Specialist ENT referral provided for participants where necessary.

## 3. Results

The mean age of children from KNH was 9.0 ( $\pm 2.9$ ) years with a range of 5–17 years and the mean age at GCH was also 9.0 ( $\pm 3.2$ ) years with a similar range of 5–17 years. The mean weight of children from both hospitals was within normal range. The distributions of gender, age and weight were the same across KNH and GCH (Mann–Whitney *U* test *p*-values > 0.05).

The prevalence of gastroesophageal reflux disease (GERD) was 82% in KNH and 68% in GCH; prevalence of *H. pylori* was 59% in KNH and 62% in GCH and prevalence of chronic rhinosinusitis (CRS) was 39% in KNH and 46% in GCH (Table 1).

The difference in prevalence of GERD for KNH and GCH was not statistically significant (Mann–Whitney *U* test *p*-values = 0.765). The distributions of *H. pylori* prevalence was the same across KNH and GCH. Similarly the difference in CRS prevalence was not statistically significant between KNH and GCH (Mann–Whitney *U* test *p*-values = 0.461).

Regression analysis indicated that the age, weight and gender of children did not have a clinically significant (*p*-values > 0.05) effect on the prevalence of *H. pylori* and chronic rhinosinusitis.

**Table 1** Prevalence of gastroesophageal reflux disease (GERD), *H. pylori* and chronic rhinosinusitis (CRS) expressed as total number and percentage distribution.

	GERD		<i>H. Pylori</i>		CRS	
	Positive	Negative	Positive	Negative	Positive	Negative
Total	75 (78.1%)	21	58 (60.4%)	38	40 (41.7%)	56
*KNH	53 (82.8%)	11	38 (59.4%)	26	25 (39.1%)	39
#GCH	22 (68.8%)	10	20 (62.5%)	12	15 (46.9%)	17

\* Kenyatta National Hospital (public facility).

# Gertrude's Children's Hospital (private facility).

**Table 2** Association of chronic rhinosinusitis (CRS) with gastroesophageal reflux disease (GERD) and *H. pylori* (expressed as total number and percentage distribution).

Risk Factors	CRS		Total		<i>p</i> -value	*OR
	Positive	Negative	Positive	Negative		
<i>H. pylori</i>	28 (48.3%)	30 (51.7%)	58 (60.4%)	38 (39.6%)	0.0252	2.95
GERD	38 (50.7%)	37 (49.3%)	75 (78.1%)	21 (21.9%)	< 0.00001	38.07
<i>H. pylori</i> + GERD	26 (48.1%)	28 (51.9%)	54 (56.3%)	42 (43.7%)	< 0.001	20.05

\* OR = Odds ratio.

Regression analysis for GERD showed that age had a clinically significant impact (Wald Chi-square test  $p$ -value = 0.023) on the prevalence of GERD. This suggested that Children aged above 10 years were less likely to have tested positive for GERD as compared to those aged below 10 years.

The following results were obtained when association between *H. pylori* and GERD with CRS was sought (Table 2).

There was a statistically significant association between *H. pylori*, GERD and CRS with the odds being 38 times higher where GERD alone was detected ( $p$ -value < 0.00001).

There was only one patient who had CRS without *H. pylori* or GERD but it was statistically insignificant ( $p$  value = 0.856).

#### 4. Discussion

Chronic rhinosinusitis (CRS) has been associated with various risk factors and gastroesophageal reflux disease (GERD) and *Helicobacter pylori* (*H. pylori*). *H. pylori* has been found to colonize several otolaryngology regions such as the nasal cavity, paranasal sinuses, middle ear, oral cavity, oropharynx, and larynx. GERD is a known risk factor of CRS affecting patients' quality of life.<sup>3</sup> The patients included in this study had clinically proven dyspepsia and questionnaires were used to diagnose CRS symptoms and the CRS children treated by an otolaryngologist thereafter.

The prevalence of CRS was found to be 41.7% in this study. CRS prevalence determined by radiography in a European paediatric population was found to be 18–45%.<sup>19</sup> Similarly Phipps study in the USA on paediatric patients with CRS found that 63% of these children had GERD,<sup>16</sup> while Coehlo et al.'s study involving both children and adults concluded that 40% of the patients had GERD.<sup>20</sup>

The prevalence of *H. pylori* in the children included in this study was 60.4%. Regression analysis indicated that the age and gender did not have any significant effect on *H. pylori*

( $p$ -values = 0.560). The One Step Antigen *H. pylori* test has been shown to have sensitivity of >94.4% and specificity of >99.9% with relative accuracy of >97.9% and CI of 95% compared with endoscope based methods.<sup>21</sup>

In this study, the prevalence of GERD was 78.5% and age was found to be a significant factor for GERD, where majority of children were below 10 years and had a Reflux Symptom Index score of over 10 (Appendix II). This was higher than previously recorded GERD rates of 40% and 63% in patients with CRS.<sup>16,20</sup>

The odds of a child having chronic rhinosinusitis with GERD and *H. pylori* was 20.5 ( $p$ -value 0.001). Logistic regression indicated that GERD ( $p$ -value = 0.00001) had significant effect on CRS as well as *H. pylori* ( $p$  value = 0.0252). This implied that GERD increased the odds of contracting CRS by 38.07 times compared to *H. pylori* with OR = 2.95. Children with dyspepsia below age 8 years had odds ratio of 1.8039.

#### 5. Conclusion

Children with gastroesophageal reflux disease (GERD) are at a very high risk of developing chronic rhinosinusitis. Children below the age of 10 years are more likely to develop GERD. *H. pylori* alone does not increase the risk for chronic sinusitis. This was a hospital based study and is therefore not representative of the Kenyan population. Larger community based studies may provide more insight into this association between CRS and GERD.

#### Competing interests

The authors declare that they have no competing interests. AJ and MP are ENT specialists but were not involved with data collection or treatment of diagnosed children. LA is a Paediatric Gastroenterologist but was not involved with treatment of children with GERD.

### Author's contributions

MB conceptualized the study, funded the study, collected the data and was involved with data analysis and manuscript writing. AJ, LA and MP were involved with study design, interpretation of data and manuscript writing.

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### Appendix I

#### ROME III, diagnostic criteria of dyspepsia<sup>15</sup>

Diagnostic criteria must include:

1. One or more of the following:
  - a. Bothersome postprandial fullness
  - b. Early satiation
  - c. Epigastric pain
  - d. Epigastric burning and
2. No evidence of structural disease that is likely to explain the symptoms.

(Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis.)

### Appendix II

#### The Reflux Symptom Index<sup>22</sup>

Ordinal Scale: 0-no problem 5-severe problem score: > 10-patient has GERD.

Symptoms	Score
Hoarseness or other voice problems	0 1 2 3 4 5
Clearing throat	0 1 2 3 4 5
Excess throat mucus or postnasal drip	0 1 2 3 4 5
Difficulty swallowing food, liquid, or pills	0 1 2 3 4 5
Coughing after eating or after lying down	0 1 2 3 4 5
Breathing difficulties or choking episodes	0 1 2 3 4 5
Troublesome or annoying cough	0 1 2 3 4 5
Sensations of something sticking in throat or lump in throat	0 1 2 3 4 5
Heartburn, chest pain, indigestion, or stomach acid coming up	0 1 2 3 4 5

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