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Original Research Article

Gallbladder motility in children with chronic functional abdominal pain

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ABSTRACT

Background: Chronic abdominal pain is a common gastrointestinal symptom in children that significantly lowers their quality of life. In adults, Gall bladder (GB) hypomotility / dyskinesia is associated with many functional abdominal disorders but there is scarcity of evidence on its role in childhood gastro-intestinal disorders. Aim of the study is to evaluate the GB motility in children with chronic functional abdominal pain (FAP).
Methods: Children aged 5-15 years with chronic abdominal pain fulfilling ROME-III criteria and healthy controls were included and all study participants were subjected to ultrasonographic evaluation of the gall bladder volume in fasting state and post - Fatty test meal (FTM) and its ejection fraction was calculated.
Results: Sixtysix children including 31 with chronic FAP underwent sonographic evaluation for GB motility. The mean ejection fraction (EF) of cases and controls were 51.72±17.76% and 57.3±23.26% (p value - 0.158). The mean EF of cases with upper abdominal pain and lower/peri-umbilical abdominal pain were 41.7±17.1% and 57.2±15.9% respectively (*p* value < 0.0001). Increasing BMI had no significant association with GB motility among the participants.
Conclusions: There is lack of significant association between children with chronic FAP and GB hypomotility. Children with upper abdominal pain have lesser GB EF, suggesting a possible abnormal GB motility.

Keywords: Childhood functional abdominal pain, Gallbladder, Ultrasonography

INTRODUCTION

Chronic abdominal pain is a common gastrointestinal symptom in children presenting to outpatient department. In United states and Europe, its prevalence rates ranges from 0.3 – 19% among school-going children and accounts for about 2% to 4% of all pediatric office visits.[1,2] Though it is not associated with any organic gastrointestinal pathology, children with FAP have a significantly lower quality of life and it contributes for school – absenteeism.[3] In 1999, the term abdominal pain related-functional gastrointestinal disorders in pediatric ROME II criteria, which included functional dyspepsia, functional abdominal pain (FAP), irritable bowel syndrome and abdominal migraine. These terminologies were further redefined based on duration of symptoms before diagnosis in ROME III criteria.[3]Many functional gastrointestinal disorders like functional dyspepsia, irritable bowel syndrome and disorders of Gall bladder (GB) has been studied for any possible association with abnormalities in GB motility, but the results are inconclusive.[4] In adults, GB hypomotility/dyskinesia is well established in idiopathic constipation and functional dyspepsia, but there is scarcity of evidence on its role in childhood functional abdominal disorders.[5,6] Our study

was designed to study the GB motility in children with functional abdominal pain.

METHODS

This crosssectional study was done in the outpatient department of pediatrics, PSG institute of medical sciences from January 2016 to August 2017. Children aged 5-15 years attending the OPD of the institution with chronic abdominal pain fulfilling ROME-III criteria, without any obvious cause for abdominal pain and with no previous abdominal surgeries were included in the study. Healthy children who visited the hospital for routine health visit or vaccination were included as controls. Institutional Human ethical committee approved the study and all study participants were included after obtaining informed consent. A detailed history including dietary and allergy history was obtained and clinical assessment was done. They were documented in a pre-designed data collection tool.

A total of 31 cases and 35 controls were recruited in the study and all study participants were subjected to ultrasonographic evaluation of the gall bladder in fasting state. A radiologist experienced in pediatric Sonography performed the evaluation using Philips iU22 xMATRIX ultrasound system. The Gall bladder was assessed for its area, thickness and volume, where area was derived by trace method and maximum GB width and length were measured using transverse and longitudinal images of the GB.

The volume of GB was calculated in fasting and 30-minutes following a fatty test meal using Dodd's formula, Volume (in cm^3) = 0.52 x [L x W x A], where L is the greatest length, W- greatest transverse width, and A-greatest anteroposterior diameter of the GB. The gallbladder ejection fraction (EF) for each examination was obtained from two-volume data using the following equation. Where V_0 = gallbladder volume in fasting state, Vn = gallbladder volume after the fatty test meal,

$$EF\ (\%) = [(Vo-Vn) / Vo] \times 100$$

For the purpose of this study, Children with ejection fraction of less than 40% were considered to have gallbladder hypomotility.

Statistical analysis was done using statistical package for the social science version-19 (SPSS) software. The fasting and post-prandial GB volume was expressed as mean ± SD and students t test was used to compare their means between groups. Chi-squared testing was applied to look for possible association between EF and BMI. A p-value less than 0.05 was considered significant.

RESULTS

There were a total of 66 children included in this study. The mean age of cases and controls were 10.14±2.71 years and 11.54±1.94 years respectively. The mean height of the cases group was 132.9±15.9 (range – 100 to 165cms) and that of controls was 145.14±11.6 (range – 110 to 159cms). The mean weight of cases and controls were 27.3 ± 10.5 Kg and 33.8 ± 6.6 Kg respectively. The mean body mass index (BMI) was 14.9±2.8 kg/m^2 (range of 11.3 to 26.3 kg/m^2) in case group and 15.9±1.8 kg/m^2 (range from 11.9 to 19.5 kg/m^2) in the control group. Out of 31 cases there were 11 boys (35.5%) and 20 (64.5%) girls respectively and in 35 controls there were 23 (65.7%) boys and 12 (34.3%) girls respectively (Table 1).

Table 1: Baseline characteristics in the study groups.

Clinical parameters	Cases (n=31)	Controls (n=35)	P value*
Age (in years)	10.14±2.71	11.54±1.94	0.08
Gender ratio	1:2	2:1	-
Height (in m)	1.34±0.15	1.43±0.11	0.06
Weight (in Kg)	27.3±10.8	34.31±6.3	0.03
BMI (Kg/m^2)	14.60±3.1	16.59±1.60	0.03
Abdominal pain			
Predominantly Upper (%)	11 (40%)	-	
Predominantly Lower (%)	19 (60%)		

*Student's T-Test

The mean fasting and post-prandial gallbladder volumes of cases and controls were 8.20±3.97 (cm^3), 7.52±3.13(cm^3) and 3.51±1.57 (cm^3) and 2.94±1.59 (cm^3) respectively. Though the fasting GB volumes were greater than post-test meal, in both groups, yet there was no statistical significance (P value – 0.390) (Table 2). The mean ejection fraction of cases and controls were 51.72±17.76% and 57.37±23.26% (p value – 0.158).

Table 2: Comparison of GB Volume and Ejection fraction in study groups before- and following a fatty test meal (FTM).

Groups	GB Volume (in mm^3)		Ejection Fraction (%)
	Fasting	Post-FTM	
Cases	8.20±3.97	7.52±3.13	51.95±18.02
Controls	3.51±1.57	2.94±1.59	57.04±23.03
P-value*	0.797	0.127	0.239

*Student's T-Test

The ejection fraction of GB were compared among children with functional abdominal pain who presented predominantly with upper or lower / peri-umbilical regions, to identify any possible association between the site of abdominal pain with GB motility. The mean ejection fractions of cases with upper abdominal pain and lower/peri-umbilical abdominal pain were 41.7±17.1% and 57.2±15.9% respectively (p value <0.0001), but the former did not qualify for the definition of GB hypomotility i.e. EF<40% (Table 3).

Table 3: Comparison of GB Volume and Ejection fraction based on the site of abdominal pain.

Site of Abdominal pain	GB Volume (in mm^3)		Ejection Fraction (%)
	Fasting	Post-FTM	
Predominantly Upper	7.41±3.13	4.17±2.15	41.73±17.13
Predominantly Lower	8.67±4.40	3.13±1.0	57.87±16.12
P-value*	0.497	0.25	0.019

*Student's T-Test

In order to identify any possible association between increasing BMI and GB contractility among cases, they were sub-grouped as, BMI<16 and BMI ≥ 16. There was equal number of children (n=4) in each subgroup with EF<40%, suggestive of GB dysmotility and their mean EF were 54.28 ± 17.99 % and 48.19 ± 17.53 % respectively (*p*-value < 0.001) (Figure 1).

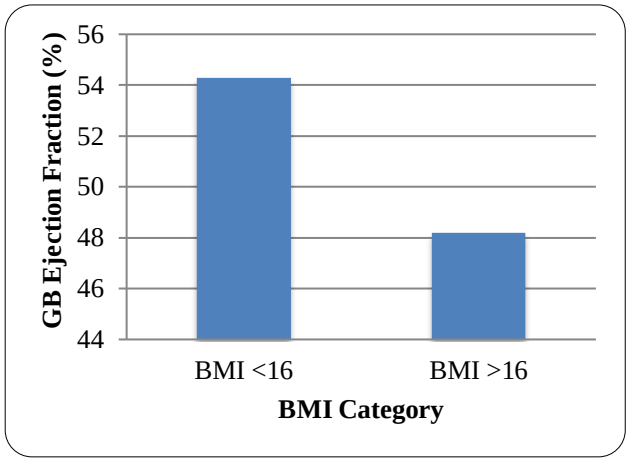

Figure 1: GB ejection fraction among bases grouped based on BMI.

DISCUSSION

In our study, we found no significant difference in the gall bladder volume (in fasting state and post Fatty test meal) among the cases and controls with equal number of children in both groups with GB ejection fraction <40%. Children who presented with upper abdominal pain had significantly lesser ejection fraction than those with lower abdominal pain. Many adult studies have recognized GB hypomotility in obese patients than non-obese patients. Sari et al found a positive correlation between fasting gallbladder volume and body mass index and body fat weight in obese women than non-obese women, but no such studies were available for comparison in children.[7] In the present study there existed no significant association in GB dysmotility and increasing BMI among cases.

The exact pathogenesis for FAP remains unclear, but visceral hypersensitivity, abnormal brain - gut interaction, immune dysregulation and altered gut motility has been postulated for the occurrence of the symptoms.[8,9] Gall bladder dyskinesia has been associated with various gastrointestinal symptoms like bloating, dyspepsia, post prandial epigastric pain and upper abdominal fullness.[10]

Mehra et alm observed gall bladder hypomotility in children with functional constipation, thus strengthening the claim of GB dyskinesia as a possible claim for functional abdominal symptoms in children.[11] Several imaging modalities like oral choledochocystography and syntigraphy are utilized to assess GB contraction but Sonography has been reliably used for assessing the GB area and volume, their changes following a fatty meal.[12] Ultrasonography could be preferred for its noninvasive nature and no radiation exposure that accompanies other modalities.

In our study we found 8 (26.7%) of the children with FAP healthy and 9 (25%) controls with mean GB Ejection fraction <40% suggesting that GB hypomotility could possibly be unrelated for the abdominal pain. Interestingly children who had predominant upper abdominal pain had low GB Ejection fraction compared to the children with lower abdominal pain (41.73±17.13% vs 57.87±16.12%) as noted by Hofeltd et al, in their study where a majority of children (96.67%) who underwent laproscopic cholecystectomy for biliary dyskinesia had upper quadrant pain.[13] A similar study with more subjects with FAP localized predominantly to upper abdominal could establish an association with GB motility.

Few limitations in our study are firstly the children were consecutively enrolled and sample size of the study is too small for drawing strong conclusions. Secondly the co-existing infection like H. pylori or parasitic infection of gut could possibly have an impact on the abdominal pain that was under evaluation. Nonetheless the present study is the first of its kind that has meticulously evaluated the GB volume and contractility in children with FAP and has found a possible association of GB dyskinesis with upper abdominal pain.

CONCLUSION

To conclude, abnormality in GB motility could be a cause for FAP presenting predominantly as upper abdominal pain in children thus necessitating its evaluation and a larger well-controlled study might help in better understanding of the entity.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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