Original Article

Ultrasound Abdomen for Investigating Chronic Constipation and Associated Complication in Pediatric Patients

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ABSTRACT

Objective: To determine the significance of ultrasound abdomen as a tool in the diagnosis of idiopathic chronic constipation, and complication in pediatric patients.

Study Design: Comparative Cross-sectional study

Place and Duration of Study: This study was conducted at the Medicare cardiac and general hospital from 25th December 2021 to June 2022.

Materials and Methods: This was an observational study. Hundred pediatric patients (age range 4-7 years) with chronic constipation, Male(n=74) to female(n=46) ratio was 3:1, visiting the Pediatrics outpatient's department and were also referred from pediatric clinics, the Medicare Cardiac & General hospital, Karachi, Pakistan Pediatric patients with complaints of chronic constipation were included in this study. Ultrasound imaging was done, and anterior and posterior imaging of the abdomen and pelvis in the supine position to visualize intestinal walls, impacted fecal material, and complications.

Results: Ultrasound imaging of the abdomen and pelvis in hundred pediatric patients with chronic constipation, findings included fecal impaction (n =89), hypermobile small bowel (n=67), worm infestation (n =31), perforation and free fluid (n =3) in these patients.

Conclusion: Ultrasound investigation was the most valuable, non-invasive tool in the investigation and management of chronic constipation in pediatric patients. Associated complications such as bowel perforation and behavioral problems were evaluated in these children by appropriate and timely management (PEG, Laxatives, Fluid and fiber along with psychotherapy etc).

Key Words: Ultrasound abdomen, FC functional constipation, Disimpaction, Laxatives, Bowel perforation, behavioral problems.

Citation of article: Izhar S, Khan SP, Zaidi S, Kadri S, Sohail FA, Mir A. Ultrasound Abdomen for Investigating Chronic Constipation and Associated Complication in Pediatric Patients. Med Forum 2022;33(8):16-20.

INTRODUCTION

Constipation is a common problem in pediatric patients and may be associated with serious complications if remain untreated. The radiological investigation is the most important tool for proper diagnosis and management of serious complications associated with chronic constipation. Moreover, ultrasound imagining done early could prevent the risk of complications[1].

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Received: July, 2022
Accepted: July, 2022
Printed: August, 2022

Ultrasound is ideal non-invasive, safe investigation in diagnosing pediatric bowel pathology[2,3,4]. Functional constipation is reported in 95% of these cases where etiology, pathophysiology and prognosis are not well known[5-7]. Although pathophysiology of functional constipation is not certain According to Rome IV criteria it might be due to withholding habit in children[8]. Constipation is a common and prevalent condition that affects children worldwide. In Asia the prevalence of Functional constipation reported is from 0.5%-29.5%[9].

Since children are more prone to the negative consequences of constipation, it is therefore necessary to ascertain the proper medical care to improve quality of life and reduce morbidity that is associated with the condition. Idiopathic constipation can be excluded from other causes of constipation. Functional constipation is the most common presentation in children. It should also be noted that due to embarrassment associated with constipation, including but not limited to fecal incontinence only, also soiling of clothing etc., is a major factor in the reduced motivation of patients to seek assistance. Studies have shown that constipation is

associated with higher levels of stress in children[10-12] In another study, findings indicate that stressful events within a child's family circle also induce symptoms of constipation, such as divorce, death of parents etc. in about 88% of children with constipation[12]. Study done by[13] reports that children with functional constipation have behavioral problems and stress as compared to healthy controls. Another study also suggests that functional constipation is cause of emotional and social problems in children[14].

Investigation of constipation in pediatric patients with chronic constipation is abdominal radiograph or ultrasound imaging. Abdominal radiography may results in misdiagnosis, leading to frequent visits to the pediatric clinics, exposure to radiations and increased cost of diagnosis and management. Misdiagnosis can be harmful and prolong discomfort in millions of pediatric patients, thus result in recurrent multiple visits to clinic[1]. Children having abdominal pain, vomiting, constipation and diarrhea, the ultrasound is becoming a common assessment tool. In pediatric patients with acute abdominal pain ultrasound is an excellent tool to exclude any other causes of abdominal pain[2-7] .Thus ultrasound is a most convenient and accurate investigation in acute abdominal pain without any injury. B-mode and Doppler are most useful in diagnosis of underlying cause of abdominal pain. Ultrasound is a highly accurate in the diagnosis with sensitivity above 98% and specificity up to 100%-[2].This is non-invasive, with improved technology to rule out any anatomical variations, inflammatory bowel diseases or any other pathology of bowel. The imaging is performed in supine position, by using high resolution linear probe[3,5,7].

Pediatrics constipation was managed by dietary fiber and fiber supplement available over the counter along with increase in fluid intake. The addition of probiotics has been helpful in management of constipation in children [10]. Glycerin suppositories were used to soften stool in children. Laxatives or enema was used in acute cases under the under the medical advice. Deworm of the pediatric patients in case of warm infestation by albendazole or appropriate / appropriate anti-helminthic agents. Study by Cassettari et al., 2017 [11]recommended combination of green banana and laxatives to avoid complications and health issues by functional constipation. In cases of severe constipation, the patients were admitted in the hospital for short duration were prescribed enema to resolve the symptoms and severe abdominal pain. According to recommendation by NICE Guideline and ESPGHAN and NASPGHAN, increase fluid and fiber diet intake and PEG use of poly-ethylene glycol (PEG) with or without electrolytes (0.2–0.8 g/kg) (Tabber et al., 2014).[13]

MATERIALS AND METHODS

This observational study done from 25th December 2021 to 25th June 2022. Hundred pediatric patients between the age range 4-7 years with constipation and abdominal pain attending the outpatient's department and referred from pediatrics department of the Medicare Cardiac & General Hospital, Karachi, Pakistan were included in study after informed consent was taken from their parents or guardians. Abdomen ultrasound examination was performed by using Samsung HS40, examined liver, pancreas, spleen and gall bladder, urinary bladder, stomach wall for thickness and pyloric stenosis. Normal, thickness of bowel wall thickening was more than 4 mm confirmed diagnosis of bowel inflammation. Erect posture ultrasound imaging was performed to visualize free fluid and gas shadows as a finding due to perforation of bowel. By use of high resolution linear/ convex probe, normal muscularis mucosa (hyperechoic), mucosa (hypoechoic), submucosa (hyperechoic), muscularis (hypoechoic) and serosa(hyperechoic). Anterior and posterior imaging of abdomen and pelvis in supine position to visualize impacted fecal material. Erect posture imaging to diagnose free fluid and gas as are most important findings of perforation in bowel.

Inclusion Criteria: pediatric patients with chronic constipation and abdominal pain.

Exclusion Criteria: pediatric patients with any other cause of abdominal pain, inflammatory bowel diseases, spina bifida, pelvic surgery, anastomosis, hemorrhoids, diabetes mellitus.

Informed consent was taken from parents of participants. Study was approved by the ERC Sohil University (Protocol #: 000144/21)**.**

RESULTS

Hundred pediatric patients with severe or chronic constipation with or without abdominal pain were referred for ultrasound abdomen. Age range of participants was from 4-7 years. Male (n=74) and female (n= 26), ratio was 3: 1. Ultrasound images were of fecal impaction and gas shadows(dirty shadows) . Warm infestations were seen in thirty-one cases. Sluggish in case of perforation for chronic constipation. Three of these cases were referred for CT scan with ultrasound images showing perforation. All the children were recommended to increase intake of fluid and fiber in the diet. Twenty of these were prescribe lactulose and forty were given glycerin enema to relieve acute constipation. Thirty-one patients were given anti-helminthic therapy to deworm them. For children with psychosocial and stress were referred for psychotherapy. (Table 1). Ultrasound findings most frequent had fecal impaction, hypermobile small bowel. Due to fecal impaction in large bowel obstruction. Worm infestation in – cases four cases. Free fluid cases were seen were confirmed by CT scan. Sluggish movement in three cases due to perforation of the bowel. Obstruction was confirmed by the ultrasound imaging technique. Small and large bowel movements were examined for sluggish or hypermobile motility. Fecal impaction, fluid between (Graph 1) Abdominal

ultrasound images of pediatric patients (fig.1 a,b). Table -2 Management of constipation in the pediatric population.

Table No.1: General Characteristics of Pediatric patients with Chronic Constipation.

Characteristics Total no.=100	**No. Of pediatric patients With chronic constipation**
Age	4-7
Gender	M: 74 F:26 (3:1)
Clinical Findings	
Severe abdominal pain	80
Constipation	72
Loss of appetite	69
History of worm	35
Hypermobile small bowel	30

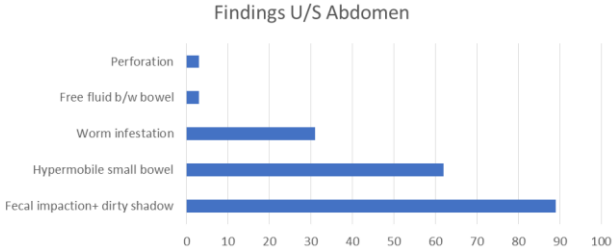

Figure No.1: Ultrasound Findings in pediatric patients

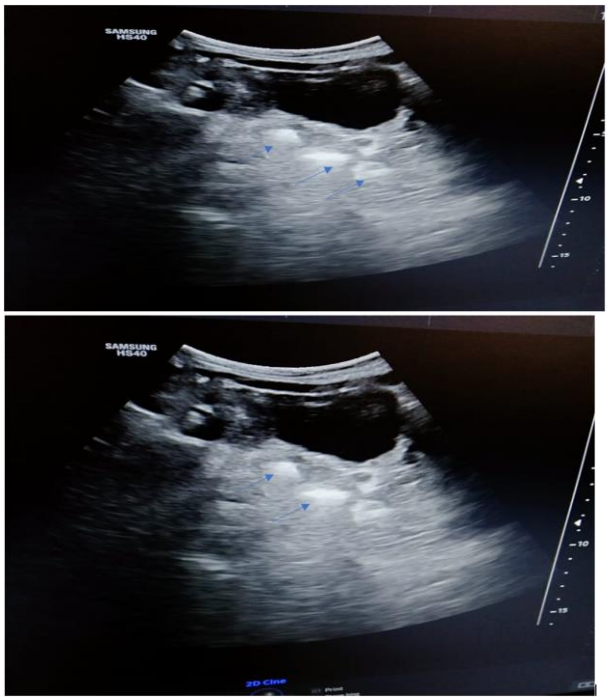

Figure No.2 (a,b): Abdominal ultrasound image, of pediatric patient with chronic constipation showing fecal impaction

Table No.2: Management of constipation in pediatric population

Fecal Disimpaction	**Doses in different age groups**
Peg 3350 + electrolytes (pediatric formula- 6.563g; NaHCO3 89.3mg; NaCl 175.4mg; KCl 25.1mg / sachet)	**<1 year -** ½ to 1 sachet
	1 – 5 years –
	Day 1 – 2 Sachet
	Day 2 and 3 – 4 Sachets daily
	Day 4 and 5 – 6 Sachets daily
	Day 6 onwards – 8 Sachets daily
	5 to 12 years –
	Day 1 – 4 Sachets
	Day 2 – 6 Sachets
	Day 3 – 8 Sachets
	Day 4 – 10 Sachets
	Day 5 – 12 Sachets (Max dose)
Osmotic laxative: Lactulose	1 month to 1 year – 2.5ml BD 1-5 year - 2.5ml to 10ml BD
	5 – 18years – 5-20ml BD
	The doses mentioned are adjusted as per the response by individual patient.
Stimulant laxative: Sodium Pico sulfate (5mg/5ml)	1 month-4 year: 2.5-10ml OD
	4-18 years: 2.5-20ml OD
Bisacodyl	2-4 years – 5-10mg OD suppository
	4-18years – 5-20mg orally, 5-10mg OD suppository
Senna (7.5MG/5ml)	2 – 4 years: 2.5-10ml OD, ½ to 2 tablets
	4 – 18 years: 2.5-20ml OD, ½ to 4 tablets
Docusate sodium (pediatric oral solution)	6months: 2 years: 12.5mg TDS
	2 – 12years : 12.5 to 25mg TDS
	12 – 18years: up to 500mg TDS
Maintenance therapy	
PEG + electrolytes	Half the disimpaction dose.

	<1 year: ½ to 1 sachet
	1-6 years: up to 4 sachet.
	6 to 12 years: up to 4 sachets.
	Dose is adjusted according to symptoms and stool consistency.
Stimulant laxative	Same as disimpaction dose
Osmotic laxative	Same as disimpaction dose
Management Given in Patients of FC	**Patients with FC (Total No=100)**
Intake of Fluids and Fiber	n = 100
Disimpaction	n= 60
Lactulose	n = 40
Enema	n = 30
Psychotherapy	n = 20

DISCUSSION

Constipation is one of the common causes of abdominal pain and frequent visits to pediatric clinics[9]. This study has shown that ultrasound abdomen investigation is most essential tool to be recommended. Ultrasound abdomen is quick, easy, cost-effective also useful in recording the bowel motility, perfusion and fluid in presence of perforation[5-6].

Patients were advise increase intake of fiber, fluid, disimpaction (n =60), lactulose (n =40), enema (n =30), anthelminthic (n = 30) and those with serious behavioral and psychological issues were referred for psychotherapy (n=20). Although functional constipation is a common problem in children worldwide with the associated issues. The research data is missing for several regions. This is a health problem resulting in frequent OPD visits, and overall physical and emotional well-being in these children. Functional complication is cause of disturbance in child's social behavior and well-being[14].

Studies [2-7] have shown that non-invasive technique of ultrasound to be highly recommended diagnostic tool for pediatric patients with chronic constipation and diagnose complications. Ultrasound imaging has found to be most useful investigation tool in investigating bowel pathology in children as it is safe, inexpensive, with no requirement of sedation or intravenous contrast. Also, with the recent advancements in ultrasound technology has improved the diagnosis[3]. It has been found rectal and radiological investigations have limitations, ultrasound abdominal examination was shown to have positive correlation [15].

Study by Nurko 2014[10], have recommended the management of functional constipation. The study suggests initiating the management by educating the patients and parents. As parents should have a positive and supportive attitude towards this issue. Change in dietary habits with increase in fluid, fiber and carbohydrates (e.g. prune, apple, and pear) improve in relief of constipation. As recommended by NICE, first step in the management is to clear the retention either via oral route of administration. Oral approach gives the child a sense of power and is the preferred method. An escalating dose of PEG 3350 (1-1.5g/kg/day for 3-6 days) is the first line with addition of stimulant if needed. In the light of available evidence, Polyethylene glycol is used as first line treatment for functional constipation in children [(NICE Guidelines 2010)[20]. Rectal approach can be used with sodium phosphate enema 2.5 mL/kg, maximum 133ml/dose for 3-6 days) if oral PEG is not available or failed to resolve. However, it is not preferred due to the fear and discomfort associated with it which can further aggravate the retentive behavior in children making constipation harder to treat. The findings in by Yoo 2017[22] study suggested combination of enema and PEG 3350 is more effective than monotherapy. Glycerin suppositories are indicated in infants for disimpaction. As maintenance therapy, once the fecal impaction has been cleared, start maintenance therapy so that the child has regular soft bowel movement. Start with half the disimpaction dose of PEG 3350 0.2–0.8 g/kg/day.

+Electrolytes or adjust as per the symptoms and response. Stimulant laxatives or lactulose can be added if PEG is not tolerated by the patient and failed to give response after 2 weeks. It is recommended to continue the maintenance dose for several weeks/months after resolution of symptoms. Many cases of re-impaction have been noted with abrupt discontinuation of laxatives. For this reason, laxatives should be gradually reduced. Appropriate and prolonged management is most essential to avoid serious complications [16-20]. Children with serious behavioral problems and stress due to functional constipation were managed by counseling the parents and involvement of child psychologist [20-22]. It has been mentioned that behavioral therapy along with laxative therapy has been suggested. The investigation for functional constipation and providing appropriate management is essential to reduce the risk of developing complication also to provide counseling to the parents and children.

CONCLUSION

All the pediatric patients with clinical findings of chronic constipation and severe abdominal pain must be recommended for abdominal ultrasound imagining in order diagnosing most serious complications such as

perforation of bowel and free fluid. Appropriate management options to avoid complications.

Acknowledgement: We acknowledge all the patients and their parents for participating in the study. Radiology department of Medicare cardiac & general hospital for patients.

Author's Contribution:

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Data Analysis:	Samreen Zaidi
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Final Approval of version:	Safia Izhar

Conflict of Interest: The study has no conflict of interest to declare by any author.

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