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THE BARRIER TO PEDIATRIC PATIENTS' COLONOSCOPY PREPARATION REGIMEN AT THE TERTIARY CARE CENTER

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ABSTRACT

Colonoscopy is essential for identifying gastrointestinal disorders in children and adolescents. In individuals with colonic polyps or lower gastrointestinal tract hemorrhage, colonoscopy is an important procedure. Traditional bowel preparation for children undergoing colonoscopy includes a clear liquid diet for 2–3 days, laxatives, and multiple enemas the night before and morning of the procedure. Bowel preparation with balanced lavage solutions is safe and effective in children but rare in adults. For best visualization, colonoscopy, radiography, and colorectal surgery need a clean luminal environment. Small intestine sodium absorption is considerably reduced by sodium sulfate preparations without chloride, the anion essential for active absorption against electrochemical gradient.Currently, a number of bowel preparations are commonly used for pediatric colonoscopies; nevertheless, none of them comply with all of the prerequisites.A cross sectional research conducted. It investigated impediments to colonoscopy preparation among patients of Children Medical Center in Tehran. The participants were studied as adequatebowel preparation andinadequate bowel preparation measured by Ottawa bowel preparation scale. Demographic and indicators analysis was drawn between these bowel preparations to infer any association between them.On analysis, 62(82%) patients had adequate bowel preparation than 14(18%) patients who had inadequate bowel preparation. There was insignificant relationship between age, gender, medication before colonoscopy(p-value<0.05). To conclude it was found that all probiotics and medications before colonoscopy for bowel preparation showed important role. Although there is not any relation between meal precautions, age, gender and bowel preparation before colonoscopy.

Keywords: Barriers, Colonoscopy, Preparation regimes, Pediatrics.

INTRODUCTION:

Colonoscopy is an important test for identifying a number of gastrointestinal tract problems in children and adolescents. Furthermore, it is a well-established method for studying large bowel and terminal ileal illnesses in babies and children. For example, it is the criteria standard for diagnosing one of the frequent chronic GIT disorders in children, such as inflammatory bowel disease (IBD). Furthermore, colonoscopy offers decisive therapy alternatives for individuals with colonic polyps or lower GIT haemorrhage. Several factors contribute to a colonoscopy's efficiency. One of the most important of these elements is good patient preparation, which allows for a safe, rapid, and complete examination [(1)].

Bowel preparation in children having colonoscopy has typically been accomplished by following a clear liquid diet for 2-3 days, followed by laxatives and repeated enemas the night before and morning of the operation. Although bowel preparation using balanced lavage solutions (BLS) has been shown to be safe and effective in children, it is less commonly used in adults. Young children and teenagers typically object to the flavour and volume of liquid required for a proper preparation.

Nausea, vomiting, and bloating caused by BLS ingestion, along with poor compliance, may impede adequate preparation for a clean colon, necessitating nasogastric delivery in certain younger patients [(1)]. The frequency of inadequate preparation varies among each research. However, in one study, around one-third of the patients needed yet repeat procedure owing to poor preparation [(2)].

In paediatric population, preparing might be especially difficult. An adequate preparation is one that is minimal in volume, quick to complete, pleasant, affordable, and effective in total colon clearance. Furthermore, an ideal preparation would be free of adverse events such as severe fluid or electrolyte difficulties, long-term dietary changes, disruptions in everyday life, or effects on histological results. In paediatrics, whole-gut lavage was used to prepare the colon, injecting up to 12 L of fluid. The aforementioned earlier formulations were abandoned and replaced by other laxatives and polyethylene glycol (PEG) solutions because to the significant danger of fluid and electrolyte imbalances, prolonged administration, hospitalisation, and hypothermia.**(1).**

Pediatric bowel preparation techniques performed prior to a colonoscopy vary greatly, with no acknowledged best practice. A new research report examines the evidence for several bowel preparations in children and reports on their use among members of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition.[(2)]. The paediatric literature regarding bowel preparation regimens is discussed, including mechanisms of action, effectiveness, and simplicity of use. Dietary restrictions, laxatives, and large-volume oral bowel lavage were among the bowel preparations developed for colonoscopy after cleaning enemas. These regimens were time-consuming, unpleasant, and resulted in fluid and electrolyte imbalances. The initial regimens were replaced with a variety of laxative and polyethylene glycol (PEG) solutions. The ideal colonoscopy preparation would remove faeces from the colon while leaving the colonic mucosa intact. Furthermore, the preparation would be cost-effective and would not cause patients' pain or fluid electrolyte changes. Nowadays, a number of bowel preparations are utilised for paediatric colonoscopies; nevertheless, none of them satisfy all of the prerequisites**(1).**

A clean luminal environment is required for adequate visualisation during colonoscopy, different radiological tests (such as the double contrast barium enema technique), and colorectal surgery**(3)**. Suitable preparation provides ease of handling, a reduced bacterial load, and the convenience of palpation, lowering the danger of wound and peritoneal contamination during operation**(4).**However, insufficient colon and rectum preparation can result in cancelled treatments, longer procedural delays, missed diagnoses, and an elevated risk of peritoneal infection.A short ingestion and evacuation period, consistent removal of all formed and liquid faeces from the colon and rectum, prevention of gross or histological changes in the colonic mucosa, less pain to the patient (e.g., bloating, cramps, nausea), and no significant electrolyte or fluid fluctuations are all desirable characteristics of an ideal colorectal cleansing agent. The efficacy and safety of the operation are

directly impacted by the calibre of the colorectal cleaning agent used to prepare the colon and rectum [5].

The combination of sodium pico sulphate, a stimulant laxative, and magnesium citrate, an osmotic laxative, is known as oral sodium pico sulphate/magnesium citrate. It is authorised for use as a colorectal cleansing agent before any diagnostic procedure (such as a colonoscopy or x-ray examination) that requires a clean bowel and/or surgery in adults, adolescents, and children (Picolax). The powder is supplied in sachets containing 0.01 g of sodium picosulfate, 3.5 g of magnesium oxide, and 12.0 g of citric acid. When the magnesium oxide and citric acid components are combined with water, the result is magnesium citrate.Oral sodium pico sulfate/magnesium citrate acts locally in the colon to remove faeces from the colon and rectum. It does this by acting as an osmotic laxative (which keeps fluids in the colon; sodium pico sulphate component) and a stimulant laxative (which increases the frequency and force of peristalsis; magnesium citrate component). It absorbs very little at all. The prodrug sodium picosulfate is hydrolyzed by bacteria in the colon to provide the active metabolite 4, 40-dihydroxydiphenyl-(2 pyridyl) methane. Magnesium citrate and sodium pico sulphate may have a dehydrating effect based on a decrease in body weight and an increase in haemoglobin levels. Older patients may require more electrolytes, and certain at-risk individuals may also develop postural hypotension [6].

PEG-containing isosmotic preparations are high-volume, nonabsorbable, nonfermentable electrolyte solutions with an osmotically balanced composition. With little water or electrolyte changes, these solutions evacuate the colon and clean it, mostly by the mechanical action of large-volume lavage. Because sodium sulphate preparations lack chloride, an accompanying anion required for active absorption against electrochemical gradient, salt absorption in the small intestine is significantly decreased. Ascorbic acid or stimulant laxatives are utilised in conjunction with low-volume PEG formulations. In one of these regimens, 240 mL of preparation is given every ten minutes until the waste is clear or 2 L is consumed, following which 10 mg of bisacodyl pills taken after the first bowel movement. In another regimen, the ascorbic acid is included in the 2-L PEG solution, which is also dosed at 240 mL every 10 minutes[7]. Another study also compared their effects but unable to determine their superiority in terms of effectiveness[8].

The role of patient counselling also plays significant role in preparing the patients for bowel who are about to undergoing colonoscopy[9]. The demographic factors, family history, patient education, compliance and co-morbidities also help in determining the adequate bowel preparation for patients undergoing colonoscopy. Therefore, these factors also must be considered before conducting colonoscopy to ensure adequate bowel preparation[10, 11].

Owing to the various bowel preparation regimes, there is not standardized guidelines available. However, there is a limited data available regarding the association of factors contributing in adequate bowel preparation for colonoscopy. These barriers involve in adequate and inadequate bowel preparations must be addressed comprehensively. Therefore, the purpose of this study was to identify and find barriers of bowel preparation among pediatric population while highlighting adequate and inadequate preparation practice before colonoscopy.

MATERIALS AND METHOD

Study Design and Participants

It was across-sectional analytical study on patients, 2 to 17 years of age, who are candidates of colonoscopy and admittedwith cystic fibrosis during 2020-2022 as their first visit in Children Medical Center Tehran. Ethical Review Board approval (Reg# IR.TUMS.CHMC.REC.1401.095) was taken. A consent of minors was also taken from their parents before procedure as per hospital policy and according to the records assessed. A non-probability consecutive sampling technique was used.The participants of this study were patients who referred to Children Medical Center Tehran.

Sample Size Calculation

The sample size was calculated by using the WHO calculator and taking findings of poor tolerance of patient two bowel preparation (Magnesium citrate with Xprep and clear liquid diet for two days

(group A):5%, and Golytely 20 ml/kg (up to 1 L) per hour for four hours with clear liquid diet for one day (group C):29%) by considering 5% type I error and power of 80%, and with the following formula, the final sample size is 76 patients[12].

Data Collection:

All data on cystic fibrosis treatment was collected from the hospital record. For attaining the required information, the data present in patient documents/medical records was used. Ottawa bowel preparation scale considered to find adequate bowel preparation for colonoscopy[13]. Ottawa bowel preparation score ranges from 0 to 4 i.e., "0" means excellent bowel preparation and "1" means good, "2" means fair, "3" means poor and "4" means inadequate. The information present in records of cystic fibrosis patients referring to the tertiary care center (present in the Archive) from 2020 to 2022 was extractedfrom files of all admitted and died patients in the emergency department of Children Medical Center. The chief complaint, the background disease, the age, and the gender of those who died after admission to the emergency department were recorded, extracted and evaluated by the SPSS software (v.26.0). All data were entered into the SPSS software (v.26.0) and the relationship between bowel preparation procedure and its relationship with related factors were also statistically analyzed. The related data had been collected in the pre-designed Performa according to the objectives mentioned by the researcher.

DATA ANALYSIS

The Ottawa intestinal Preparation Scale was used to measure the bowel preparation. The statistical analysis was performed with version 26 of the Statistical Package for the Social Sciences (SPSS). Demographic and baseline data were also examined for post-stratification analysis. A frequency (%) table was generated for categorical variables, and the data was presented as mean ± standard deviation (SD) for continuous variables. chi-square) $\chi 2$ tests was employed for statistical analysis. A statistical significance was determined by a P-value of less than 0.05.

Ethical Approval

This study was evaluated and approved by Research Ethics Committees of Children Medical Center-Tehran University of Medical Science with the Ethic ID of IR.TUMS.CHMC.REC.1401.095. It was not inevitably to inform the patient role about this study, as it based on publicly approachable data, without using their personal visibility. Therefore, anonymity and confidentiality of included patients were maintained. Moreover, all data was only used for medical research purpose to establish clinical evidence-based practice.

The information gathered from patients' files and records is confidential and safe. The permission of the University Ethics Committee and the code of ethics in this study was obtained for the proposal.The research follows the guidelines provided in the Declaration of Helsinki. The following will be considered.:

- Respect confidentiality and privacy
- Plagiarism
- Conflict of interest statement
- Scientific misconduct in research
- Honesty with the samples and the research team
- Keep in mind the values, beliefs of the samples
- Taking wrong advantage of the sample's availability
- Writing the direct results of the study in the research without any manipulation
- Giving credits to all participants equally as deserved
- Having complete transparency regarding costs used in research
- No action should we acted on that is against the rules and regulations of the country.

RESULTS

The adequate and inadequate bowel preparation were presented in graphical form with 62(82%) patients reported adequate bowel preparation than 14(18%) inadequately bowel prepared. The overall mean age of patients in study were 8.66±3.81 years (figure#1).

On demographic analysis, there was an equal gender distribution with slight increase in number of females as compared to males i.e. 39(51.32%) were females and 37(48.68%) were males. On further evaluation it showed distribution in a way that majority of 33(43.42%) females and 29(38.16%) males had reported adequate bowel preparation.

It was found that, 59(77.63%) patients who took drugs before colonoscopy had experienced adequate bowel preparation. However, despite taking drugs before colonoscopy 11(14.47%) patients also demonstrated inadequate bowel preparation.

The 32(42.10%) patients who followed the instructions before the colonoscopy had positive impact and majority of them 23(30.26%) patients were belong to adequate bowel preparation group. However, 39(51.32%) patients who had adequate bowel preparation did not follow instruction before colonoscopy.

Family history was reported positive in 15(19.73%) patients, out of which 13 (17.10%) belong to adequate bowel preparation group as compared to 02 (2.63%) patients of inadequate bowel preparation group (Table-1).

The majority of 62(81.52%) patients who experienced adequate bowel preparation had also suffered various side effects tabulated below due to medication before colonoscopy. The majority of side effects experienced by patients mainly consists of Rector Hagia,Hematochezia nausea, vomiting, abdominal pain, and bloating (Table-2).

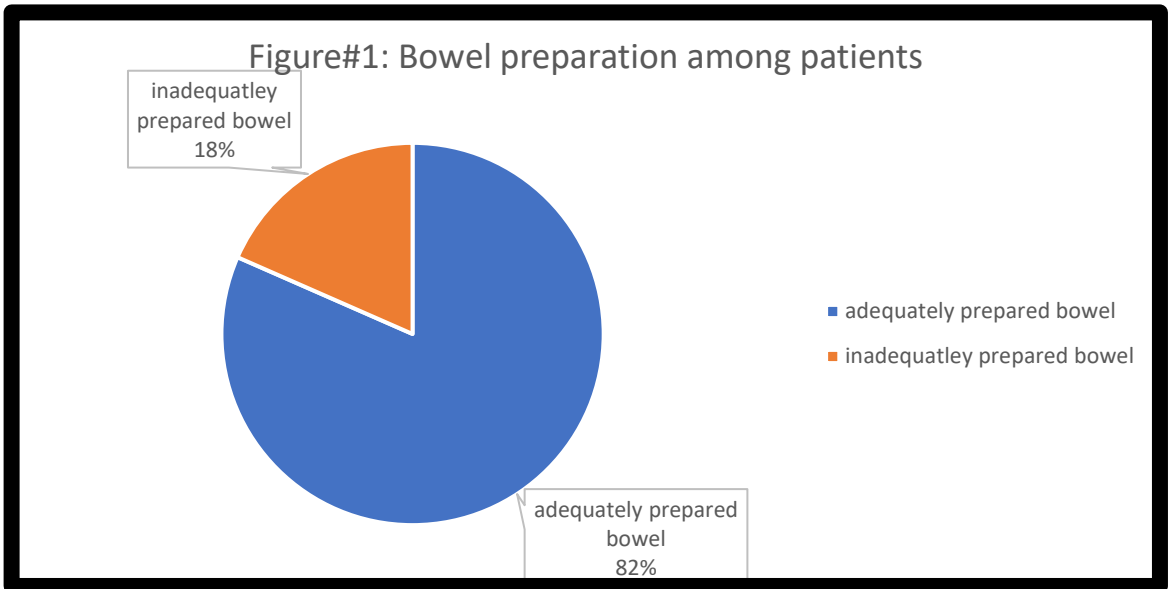

Table-1: Demographic characteristics & post stratification of potential confounders and barriers (n=76)

Variables		Adequately prepared Bowel f (%)	Inadequately prepared bowel f (%)	Total f (%)	p-value
Age (Mean±SD) (years)		8.76±3.79	8.21± 4.02	8.66±3.81	>0.05
Gender	Males	29(38.16%)	08(10.53%)	37(48.68%)	
	Females	33(43.42%)	06(7.89%)	39(51.32%)	

Total		62	14	76	
Drug before colonoscopy	Taken	59(77.63%)	11(14.47%)	70(92.10%)	
	Not taken	03(3.95%)	03(3.95%)	06(7.90%)	
		62	14	76	
Instruction before colonoscopy	Follow	23(30.26%)	09(11.84%)	32(42.10%)	
	Do not follow	39(51.32%)	05(6.58%)	44(57.9%)	
Total		62	14	76	
Family history	Positive	13 (17.10%)	02 (2.63%)	15(19.73%)	
	Negative	49 (64.47%)	12(15.79%)	61(80.27%)	
Total		62	14	76	
co-morbidities	Hypothyroidism	3(3.95%)	1(1.32%)	04(5.26%)	
	HTN	4(5.26%)	1(1.32%)	05(6.58%)	
	Diabetes	5(6.58%)	0(0.0%)	05(6.58%)	
	Cardiac Problem	1(1.32%)	0(0.0%)	01(1.32%)	

Table-2: Cross tabulation between symptoms experienced after prescribed medication experienced Vs bowel preparation groups (n=76).

Symptoms experienced Vs bowel preparation groups	**Adequate f (%)**	**Inadequate f (%)**	**Total f (%)**
Rectorrhagia	27(35.53%)	4(5.26%)	31(40.79%)
Hematochezia	6(7.89%)	3(3.95%)	09(11.84%)
Chronic Abdominal Pain	7(9.21%)	1(1.32%)	08(10.53%)
Abdominal Pain & Constipation	3(3.95%)	1(1.32%)	04(5.26%)
Chronic Diarrhea	2(2.63%)	2(2.63%)	04(5.26%)
FTT & Pain on Defecation	4(5.26%)	0(0%)	04(5.26%)
Persistent Vomiting and Diarrhea	4(5.26%)	0(0.0%)	04(5.26%)
Bloody Diarrhea	5(6.58%)	0(0.0%)	5(6.58%)
Abdominal Pain	1(1.32%)	2(2.63%)	3(3.95%)
Melana	1(1.32%)	1(1.32%)	2(2.63%)
Pain on Defecation	1(1.32%)	0(0.0%)	1(1.32%)
Bleeding & Constipation	1(1.32%)	0(0.0%)	1(1.32%)
Total f (%)	62(81.52%)	14(18.42%)	76
	100.0%	100.0%	100.0%

DISCUSSION

In this study, a bowel preparation adequacy was observed among patients undergoing colonoscopy with 62(82%) experienced adequate bowel preparation on Ottawa bowel preparation scale as compared to 14(18%) who experienced inadequate bowel preparation. The mean age of patients who were about to undergo colonoscopy was 8.66$\pm$3.81 years. Although gender distribution between bowel preparation is almost equal with slight increase in number of females. The majority of females were reported to be experienced adequate bowel preparation as opposed to inadequate. It was also observed that majority of patients who took medication before colonoscopy, they experienced adequate bowel preparation as compared to those without medications. Despite instructing patients regarding meal restrictions and diet before colonoscopy to get adequate bowel

preparation, it was observed that majority of 39(51.32%) patients did not follow instructions, but they still experienced adequate bowel preparation. Among 61(80.27%) patients, there is negative family history. Symptoms caused by medication prior to colonoscopy included rectal bleeding, stomach discomfort, nausea, vomiting, and bloating. These symptoms were more often observed among patients who had undergone adequate bowel preparation.

Adequate bowel preparation in this study is reported among 62(82%) patients, which is similar to the findings reported by Adamiak et al., (2010)[14]. Adequate bowel preparation was possible because of the pre-colonoscopy bowel medication. Thus, 59(77.63%) patients who took medication prior to colonoscopy experienced adequate bowel preparation. These findings are also similar with the findings of a retrospective trial. In this trial children patient of 1 to 17 years of age were included and found that regardless of age, constipation history, or procedure indication, 93% of patients experienced effective cleansing after taking PEG-3350 in 1.9 L of sports drink for two hours in the middle of the afternoon on the day before the colonoscopy. The day before the test, these subjects had a regular meal and lunch and only drank clear drinks until three hours before to the scheduled operation [10]. In this study, probiotics to patients were given, and as a result of their intake, we got adequate bowel preparation outcomes among 82% of patients.

However, significant number of patients such as 11(14.47%) were taken medication prior to colonoscopy, but still had in adequate bowel preparation. Which needs to be highlighted and reported. It maybe possible because majority of patients did not follow instructions prior to colonoscopy or because of tolerability and acceptability of medications. As we did not have any data regarding tolerability and acceptability of medications provided before colonoscopy. Researchers are unable to comment on this aspect, but this finding may highlight factors important for future researcher.

In our study on analysing demographic factors, a mean age of patients who were about to undergo colonoscopy was 8.66 ± 3.81 years. There was an insignificant relationship between age and inadequate bowel distribution ($p>0.05$). However, a randomized controlled trial reported that increased age especially among adults there is more chances of inadequate bowel preparation rather than in pediatrics[15].

While discussion about gender distribution, although there is almost equal gender distribution between adequate and inadequate bowel preparation with slight increase in number of females. There is not any statistical difference between these ($p>0.05$). However, a trial conducted by Mahmood et al., (2018)[16]that there is likely to having odds of inadequate bowel preparation among males due to their biological sex as male (OD=0.85). Which is opposite to the findings of this study, but this study reported adult male not children. To the best of our knowledge there is not any Asian study which came across while establishing the role of gender among pediatrics.In contrast, although insignificant relation was found, majority of females were reported to has had experience adequate bowel preparation. Owing to the limited data got files regarding socioeconomic status, educational status and cultural belief, researchers of this study were unable to make any sort of analysis which is one of the limitations of this study.

There is another indication of effective bowel preparation which was the occurrence of few side effects from the medication. About 80% of patients had adverse effects, but they were still able to has adequate bowel preparation. However, another prospective trial reported that only 30% of those who used medicines for bowel preparation experienced moderate side effects[14]. Meanwhile, in this study the most common adverse effects reported were abdominal pain, bloating, vomiting, and sleep disturbance. The majority of participants in our research reported adverse symptoms such as nausea, vomiting, bloating, and abdominal pain. However, there is also need to do proactively guides or medicate patients in order to reduce bad experience of side effects which may impact on the adherence of medication before colonoscopy. It may be one of the better strategies to improve patient adherence to colonoscopy procedure if they may have to repeat colonoscopy. As patient may try to avoid bad experience or ultimately effecting treatment regimens.

Data on children's bowel preparation drugs were examined by Hunter and Mamula [1]. Researchers concluded that, in addition to ineffectiveness, poor taste, high volume, and dietary

restrictions during clean-out all reduce compliance. Therefore, a low volume, efficient preparation with minimal side effects would be preferable. In this study, parents were asked to give more liquid foods and avoid most salty, sour, and chilled foods during patient education as mentioned in guidance chart because these kinds of salty drugs may reduce compliance.

A few parents found the experience to be extremely stressful as they were confused what to anticipate after completing bowel preparation procedure, prompting them to worry if they had followed the instructionsappropriately. Most curiously, parents sensedpressure to complete the cleaning of bowel in an adequate manner. Without encouraging parental fear, parental ambition to attain a total cleanout facilitated efficient bowel preparation. This is consistent with the findings of Vejzovic et al., (2015)[17] on parental impressions during in-hospital bowel preparation. Similar to our study, the parents were concerned that if the intestine was not clear enough, the colonoscopy would not be finished, and the family would have to repeat the procedure[18]. In this study, data also revealed that patients' parents were concerned about the results of bowel preparation before to the colonoscopy and about not having the colonoscopy done again. Furthermore, it may lead to noncompliance owing to the elements that patients encounter as a result of the operation.

We tried our best to do comprehensive discussion regarding the variables such as the effects of age, and gender upon bowel preparation before colonoscopy. To the best of our knowledge, there were not many studies regarding the effects of age, and gender on bowel preparation before colonoscopy among pediatrics. Therefore, the unique character of our study is that it analyzed the effects of age, and gender on bowel preparation before colonoscopy. It also found out that there is insignificant relationship between an effect of age on bowel preparation before colonoscopy. Moreover, there was not role of gender among children upon bowel preparation.

LIMITATIONS

- Patient's data will be unavailable or misinterpreted.
- Medication adherence information is not available.
- Medication tolerability and acceptability cannot be determined.
- Laboratory data may also be wrong due to errors and emissions.
- Time constraints
- Cost and sources limited.
- Uncontrolled factors and unavoidable variables affecting the study or the sample because incomplete data available in files which was not included.

CONCLUSION

This study found thatage, gender, medication before colonoscopy, co-morbidity factors such as hypertension, diabetes maybe the risk factors or barriers for colonoscopy among pediatrics. There is not statistically significant difference was observed throughout the study. It was alsoinferred that the use of probiotics and drugs before colonoscopy for bowel preparation played a significant role. However, there is not any association found between food precautions and medications before colonoscopy in bowel preparation. Furthermore, there is found that demographic factors such as age and gender role in bowel preparation before colonoscopy was not significant.

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FUNDING DECLERATION

None.

CONFLICT OF INTEREST

There is no conflict of interest among authors.

AUTHORS' CONTRIBUTION

All authors participated in design, acquisition and analysis of the data, as well as writing the manuscript. All authors reviewed and approved the submitted manuscript.

SAFETY CONSIDERATIONS

No living being been harmed in this research. No resources were wasted.

PATIENT CONSENT

This study was not required to have written informed consent from patients as it based on publicly approachable data, without using their personal visibility.

ETHICS

Informed consent was taken from each subject's guardian. Full Respect for anonymity and confidentiality was ensured. The design of the study was examined to ensure that integrity and quality were upheld and that transparency was ensured. Avoided fabrication by the creation of false data or other aspects of research. The study was conducted independently with no conflict of interest to disclose. This project officially received the ethical code IR.TUMS.CMHC.REC.1401.095 from the Ethical Committee.

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