

Clinical and Laboratory Patterns of Urinary Tract Infections Associated with Chronic Constipation Among Children: A Study from Saudi Arabia

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ABSTRACT

Constipation and urinary tract infections (UTIs) pose significant risks in pediatric populations. This study aimed to investigate the correlation between constipation and UTIs among children, focusing on clinical and laboratory patterns. A cross-sectional study was conducted from June 2022 to December 2024 at Paediatrics and Maternity Hospital, Arar, Saudi Arabia. The study included children under 10 years old with a history of constipation, meeting Rome IV criteria. Cases with organic constipation, recent antibiotic or antispasmodic use, history of anorectal surgery, or urinary tract disorders were excluded. The study enrolled 320 participants (54.6% females, 45.31% males), predominantly aged 1-5 years. Constipation duration analysis showed 59.3% experienced symptoms for less than a year, 28.1% for 1-3 years, and 12.5% for over three years. Concurrent UTI was identified in 54 cases (17%) of constipated children, with a significant relationship to constipation duration ($p = 0.01$). UTI prevalence was higher in girls (32 cases) compared to boys (22 cases). Lower UTI (55%) was more common than upper UTI (45%). Frequency (37%) and dysuria (31%) were the most common symptoms. Dribbling was reported in 25.9% of constipated children with diagnosed UTI. *Escherichia coli* was the predominant pathogen (64.8%), followed by *Klebsiella* (28.9%) and *Pseudomonas* (16.6%). This study demonstrates an association between constipation and lower UTI in children. The findings emphasize the importance of systematic evaluation of bowel and bladder function in pediatric UTI cases. Further research is needed to elucidate the underlying mechanisms and develop targeted interventions for this common pediatric health issue.

Keywords: Urinary tract infection (UTI), Constipation, Intestinal microbiome, Pediatrics, Arar

INTRODUCTION

In the pediatric population, constipation is frequently overlooked and often not managed properly. While medical professionals may be aware, parents are often insufficiently informed about the complications associated with constipation. It is crucial for both parents and doctors to be well-versed in the impact of constipation and its potential complications. Notably, children with recurrent urinary tract infections (UTIs) have exhibited fecal impaction or reservoirs, as revealed through rectal examination and manometry^{1,2}.

Constipation means less than two weekly bowel movements are referred to as constipation. The definition of chronic constipation states that the presence of two or more of the following symptoms for a minimum of three months is required: excessive straining during bowel movements, stiffness in the consistency of the stool, sensation as though there is incomplete excretion following a bowel movement, and fewer than two weekly defecations³⁻⁵. Numerous investigations have demonstrated the connection between the gut and the urinary system. The existence of intestinal symptoms in individuals with acute cystitis and urine symptoms in people with irritable bowel syndrome demonstrate the connection between the bladder and intestine. because symptoms of the lower urinary tract, such as hyperactive bladder, can be brought on by constipation⁶. Both the bladder and the rectum share the same embryonic origin, as well as comparable somatic and autonomic innervations. These two organs are so close to one another that problems with one can have an impact on the other. Therefore, urinary tract issues may be linked to abnormalities related to defecation.

Constipation has been linked to urinary system issues in children, such

as infection, vesicoureteral reflux, urine incontinence, and obstruction of the urinary tract. It is yet unknown what pathology underlies these findings⁷. A study revealed a strong correlation between a higher frequency of UTIs and an increase in rectal diameter⁸. Another article illustrated that constipation management produced a notable improvement in urine control⁹. Researchers discovered that 8% of children with UTIs experienced constipation, while 67.8% of those same children experienced recurring UTIs. Constipation and recurrent UTIs were found to be significantly correlated¹⁰. This study was conducted to evaluate the clinical and laboratory criteria of chronic constipation associated UTI in relation to the patients ages, genders and the duration of the chronic constipation

METHODS

This study was conducted as a cross-section study during the time frame from June 2022 to December 2024 in the division of Pediatric Nephrology at Paediatrics and Maternity hospital, Arar, Saudi Arabia, aimed to investigate the relationship between constipation and UTI in children. All related cases were enrolled visited the hospital during the study period were included except cases fulfilling one the study exclusion criteria. The study included 320 children below 10 years with a history of constipation, satisfying the inclusion criteria outlined in the Rome IV criteria¹¹. Exclusion criteria included the presence of organic constipation, prior utilization of antispasmodics or antibiotics, and a medical history involving anorectal surgery or congenital urological anatomical disorders. The study involved children under the age of 10 experiencing chronic constipation, as per the definition outlined in the Rome IV criteria⁶, which require the presence of at least

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two of the following symptoms for at least one month in children under four years and at least two months in older children: (1) fewer than two defecations per week, (2) a history of excessive stool retention, (3) painful or hard bowel movements, (4) large-diameter stools, and (5) the presence of a large fecal mass in the rectum.

Electronic files of 320 confirmed constipation cases below 10 years, were evaluated. Aseptic urine samples were collected, cultured, and analyzed for evidence of UTI. Colony count exceeding $>105/\text{ml}$ was considered significant evidence of UTI, and samples were collected prior to any antibiotic therapy.

Upper UTIs (pyelonephritis) were defined based on the presence of fever ($>38^{\circ}\text{C}$), flank pain or tenderness, elevated inflammatory markers (C-reactive protein and white blood cell count), and positive urine culture. Lower UTIs (cystitis) were diagnosed in cases with dysuria, frequency, urgency, suprapubic pain, and positive urine culture, without systemic signs of infection. When necessary, imaging studies such as renal ultrasound or DMSA scans were used to support the classification.

Exclusion criteria: It encompassed children with organic constipation and/or those with a history of prior use of antispasmodics or antibiotics. Furthermore, patients with a history of anorectal surgery or anatomical disorders of the urinary tract were not included in the study.

Statistical Analysis: The analysis of the data was conducted utilizing the Statistical Package for Social Science program (SPSS, version 11.0). The study hypotheses were evaluated through the application of chi-square (χ^2) test and independent t-tests. Statistical significance was determined by P values less than 0.05.

RESULTS

In this research, a total of 320 patients were enrolled in the study as they were diagnosed as chronic constipation with 54.6% ($n = 174$) being female and 45.31% ($n=146$) being male. Majority of children fell within the 1-5 years age group. Regarding the duration of constipation, the majority (59.3%) experienced it for less than a year, followed by 28.1% for one to three years, and approximately 12.5% for more than three years. Urine culture revealed UTI in 54 cases (16.8%) (95% CI: **13.2%, 21.4%**) according to Rome IV criteria. Relation between the ages of the participants and the duration of constipation to occurrence of UTI is shown in table (1). Chi-square data revealed significantly ($P=0.01$) higher levels of UTI with longer durations of constipation with Odd ratios for children **1-3 years = 1.38** (95% CI: **0.69, 2.79**) and for children aged above **3 years = 4.15** (95% CI: **1.92, 8.96**). Prevalence of UTI in the enrolled cases was in males 15% (95% CI: **10.2%, 21.8%**) and 18.4% (95% CI: **13.3%, 24.8%**) in females. There was no significant relation between the occurrence of UTI in the constipated patients and their genders and ages with odd ratio = **1.27** (95% CI: **0.70-2.30**) (includes 1, indicating no statistically significant difference).

Out of the constipated children with UTI, 45% ($n = 24$) had upper UTI, while 55% ($n = 30$) had lower UTI. No significant relationship was identified between gender, constipation duration and UTI type (P value = 0.94) (Table 2).

Regarding urinary tract symptoms and signs in constipated children, frequency and dysuria were the commonest manifestations of 37 and 31% of the cases respectively. While dribbling was reported in 25.9% in the constipated children with diagnosed UTI (Table 3). There was no significant difference between boys and girls regarding clinical manifestations.

Table 1. Relationship of Demographic Variables with Constipation and Urinary Tract Infection

Variable	Cconstipation, N (%)	UTI, N (%)	P Value
Gender			
Male	146 (45.4)	22 (40.8)	0.06
Female	174 (54.6)	32 (59.2)	
Age			
< 1 years	80 (25)	15 (27.7)	.57
1-5 years	200 (62.5)	30 (55.5)	
6-10 years	40 (12.5)	9 (16.6)	
Duration of constipation (years)			
<1	190 (59.3)	24 (44.4)	.01*
1-3y	90 (28.1)	15 (27.7)	
>3	40 (12.5)	15 (27.7)	
Total	320 (100)	54 (100)	

Table 2. Relationship of Demographic Variables with types of Urinary Tract Infection

variable	Upper UTI, N (%)	Lower UTI, N (%)	P Value
Gender			
Male	9 (37.5)	13 (14.4)	0.66
Female	15 (62.5)	17 (113.3)	
age			
< 1 years	9 (37.5)	6 (20)	.34
1-5 years	12 (50)	18 (60)	
6-10 years	3 (15.5)	6 (20)	
Duration of constipation (Year)			
<1	13 (54.1)	15 (50)	.94
1-3	7 (29.1)	10 (33.3)	
>3	4 (16.6)	5 (16.6)	
Total	24 (100)	30 (100)	

Table 3. Frequency of Urinary Tract Symptoms and Signs in Children with Constipation

Symptoms with chronic constipation	Girls, N (%)	Boys, N (%)	All Children, N (%)	P Value
Urgency	7 (36.4)	8 (36.4)	15 (27.8)	0.89
Dysuria	10 (31.8)	7 (31.8)	17 (31.5)	
Frequency	9 (28.1)	11 (50)	20 (37)	
Dribbling	7 (21.9)	7 (31.8)	14 (25.9)	
Total	32 (100)	22 (100)	54 (100)	

Bacteria was identified in the urine samples of UTI-diagnosed cases. *Escherichia coli* was the commonest as it was found in 64.8% of cases, followed by *klebsiella* and *pseudomonas* in 28.9 and 16.6% of cases, respectively (Table 4).

Table 4. Causative bacteria of cases of Urinary Tract infections in Children with Constipation

Organism Isolated	Total n	(%)
E.coli	35	64.8
Klebsiella	16	28.9
Enterococci spp.	3	5.0

Proteus sp	3	5.0
Staphylococcus	0	0
Enterobacter	1	1.3
Pseudomona	9	16.6
Citrobacter	3	5
Total	54	100

DISCUSSION

In discussing the results, the study involved a total of 320 participants, predominantly comprising 54.6% females and 45.31% males. Notably, a significant portion of the participants fell within the 1-5 years age group, underscoring the relevance of the findings to the paediatric population. Examining the duration of constipation, a substantial proportion (59.3%) reported suffering for less than a year, while 28.1% experienced constipation for 1-3 years, and approximately 12.5% for more than three years. This temporal distribution provides valuable insights into the chronicity of constipation within the studied population.

One other important aspect is the concurrent occurrence of urinary tract infections (UTIs), affecting 17% of the participants. Upon further examination, a subtle distribution emerged concerning the duration of constipation. Specifically, 15% experienced UTI alongside constipation for less than a year, 16% for 1-3 years, and 22% for more than three years. However, it's worth noting that no statistically significant relationship was established between the duration of constipation and the prevalence of UTI ($P = .069$). Gender disparities emerged prominently, with girls outnumbering boys 2:1 among children with UTIs ($P = .030$). The highest incidence of UTIs occurred in the 1-5 years age group, suggesting a vulnerability in this age bracket, although no significant relationship was observed between age and UTI prevalence ($P = .57$).

Examining UTI types, 45% were classified as upper UTIs, while 55% were lower UTIs. Intriguingly, no significant relationship was identified between constipation duration and UTI type ($P = .94$). Similarly, no significant relationships were found between UTI type and gender or age ($P = .66$, $P = .609$, respectively), emphasizing the complex interplay of factors influencing UTI characteristics. As for urinary symptoms are concerned, a small percentage reported dysuria (4.06%), while 5% experienced urinary frequency. Notably, gender differences were significant in urinary frequency ($P = 0.03$), more in girls than boys.

Dribbling was reported by 3.75% of participants, with no significant gender difference ($P = 0.3$). These findings collectively contribute to a comprehensive understanding of the associations between constipation, UTIs, and associated symptoms in the pediatric population. It is essential to interpret these results in the context of existing literature, as several studies have highlighted similar patterns in the relationship between constipation, UTIs, and urinary symptoms³⁻⁹. Constipation poses a significant challenge for both patients and their families⁷. Given the high prevalence of urinary tract infections (UTIs) and constipation in the pediatric population, coupled with the potential adverse effects of UTIs on the renal system, it is imperative to investigate these risk factors thoroughly.

Our findings revealed that the majority of patients experienced constipation for less than a year (59.3%), deviating from another study reporting a higher incidence in the 2-7 years age group (84.47%)⁸. In contrast, our study identified the prevalent age group for constipation patients as below one year, diverging from the findings reported in another research¹¹. Notably, about 17% of children with chronic

constipation in our study also presented with UTIs, a percentage that differed from the range of 27% to 67.8% observed in other studies^{10,12}. These investigations consistently highlight a substantial connection between UTIs and constipation. Interestingly, a separate study suggested that children with constipation were seven times more likely to experience lower UTIs than upper ones¹⁰. Another study reported a 13.3% prevalence of UTIs in children with constipation¹³. In our study, we observed no correlation between the frequency of UTIs, the types of infection (upper or lower), and the duration of constipation (P value = 0.94), representing a novel finding as no prior studies have explored this specific relationship.

Gender distribution in our study showed a predominance of girls, aligning with other studies indicating a higher prevalence of constipation in girls^{10,12,13}. The most common clinical manifestations of UTIs in our study were frequency, dysuria, urgency and dribbling. While consistent with some studies, our findings showed that frequency was more prevalent in girls than boys¹⁴.

The human gut microbiota is a vast microbiome that is home to millions of bacteria, fungi, and viruses that coexist peacefully with their host¹⁵. Dysbiosis is defined as any disruption in the gut microbiota's composition and is linked to a higher risk of disease development¹⁶. Numerous exogenous and endogenous factors, including an excessive or restrictive diet, medication, the integrity of the immune system, and the intestinal mucosa, can lead to dysbiosis¹⁷. Intestinal motility is significantly influenced by the gut microbial population, and dysbiosis has been linked to persistent constipation¹⁸. Research on the microbiota in constipation and constipation-predominant IBS has revealed an increase in potentially pathogenic bacteria like *Pseudomonas aeruginosa* and *Campylobacter jejuni* and a decrease in *Bacteroides*, *Bifidobacterium*, and *Lactobacillus* spp. when compared to control groups^{19,20}. Which were common pathogens of UTI and found in the enrolled cases.

Our study highlighted a higher prevalence of UTIs in girls, consistent with findings in many other studies^{21,22}. In our study, the age range predominantly impacted by UTIs was 1-5 years, aligning with the findings of Hakimzadeh et al., who observed the highest incidence within the 2-7 years age group²³. Given these insights, it is crucial to implement preventive measures to reduce the incidence of urinary tract infections, emphasizing the importance of targeted interventions for all constipated children.

To be acknowledged that the cross-sectional design limits causal inference between constipation and UTIs. However, this study aims to highlight the clinical and laboratory patterns of UTIs in children with chronic constipation rather than establish causality. To strengthen the evidence, future research should include longitudinal or case-control studies to better assess temporal relationships and risk factors. In addition, This study design did not consider a control group While a control group (children without constipation) would enhance the validity of comparisons, This study serves as an initial step in identifying clinical patterns within the target population. It is recommended that future studies incorporate comparative groups to further clarify the relationship between constipation and UTI risk. In addition, the study had excluded children with organic constipation which may bias the generatability of its outcomes. However, the decision to exclude these cases was to ensure a more homogeneous study population, focusing on functional constipation as defined by the Rome IV criteria. Including children with organic causes of constipation (e.g., Hirschsprung's disease, spinal abnormalities) could have introduced confounding factors that may obscure the relationship between functional constipation and urinary tract infections. So future studies are

recommended to explore a broader population, including children with organic constipation, to assess whether similar patterns are observed across different subgroups. Also, this study did not account for certain confounding variables, such as dietary habits, hydration status, and hygiene practices, which may contribute to both chronic constipation and UTI risk. Dietary fiber intake and fluid consumption are known to influence bowel movements, while inadequate perineal hygiene may increase susceptibility to UTIs. Future research should incorporate these factors to provide a more comprehensive understanding of the relationship between constipation and UTI occurrence in children. Finally, The classification of upper and lower UTIs was based on clinical and laboratory criteria, which may introduce some subjectivity. While imaging studies were used when available, not all cases underwent radiological evaluation, potentially affecting the accuracy of classification. Future studies incorporating standardized imaging for all patients could enhance diagnostic reliability

CONCLUSION

This study observed an association between chronic constipation and urinary tract infections, particularly lower UTIs, in children. The prevalence of constipation and (UTI) varies significantly across age groups, with a higher incidence observed among children aged one to five years. Females exhibiting a higher susceptibility to UTI compared to males. Patients with constipation lasting less than one year not only exhibit a longer duration of constipation but also a higher incidence of UTI compared to other groups. In children aged <1 year age group, lower UTI prevails over upper UTI, although not significant. Also, the duration of constipation <1 year is associated with a higher occurrence of both upper and lower UTI compared to other groups but not significant. Furthermore, female experience a higher frequency of UTI-related symptoms, particularly in the case of frequency, with statistically significant difference. Measures may be taken to prevent constipation and thereby UTI in children. However, given the cross-sectional design, a causal relationship cannot be established. Further longitudinal or case-control studies are needed to better understand the direction and strength of this association and account for potential confounding factor

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Competing Interest: None

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