

# The Prevalence of Mesenteric Adenitis among Children with Intussusception: A Cross-sectional Study

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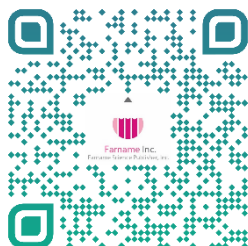
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## ABSTRACT

**Background & Objective:** Intussusception is the most common abdominal emergency in children. The present study was designed to investigate the prevalence of mesenteric adenitis among children with intussusception.

**Materials & Methods:** This cross-sectional study was conducted on 81 children aged 4 to 48 months with intussusception who were referred to Mousavi Zanjan Hospital during 2019-2021. Data were collected using a checklist including demographic and clinical variables extracted from the patients' records. The data were analyzed using SPSS software, version 26.

**Results:** The mean±SD age of the participants was 22.30±13.56 months. Most children were girls (70.4%). Ileocolic (45.8%) was the most common type of intussusception, and most children had mesenteric adenitis (79%). In terms of number, most (93.7%) cases of adenitis were multiple, and the right lower quadrant (RLQ) was the most common site of adenitis (85.9%). Moreover, 56.2% of adenitis had a diameter of less than 1 cm. No statistically significant associations were observed between mesenteric adenitis and variables such as age, sex, weight, time of onset of symptoms, duration of hospitalization, vomiting, type of intussusception, type of nutrition, type of treatment, and type of delivery ( $P>0.05$ ). However, there was a statistically significant relationship between jelly stool and mesenteric adenitis, so all children with jelly stool had mesenteric adenitis ( $P=0.009$ ).

**Conclusion:** The prevalence of mesenteric adenitis was high in children with intussusception, and a significant association was observed between these two diseases. However, further studies with larger samples are recommended.

**Keywords:** Intussusception, Mesenteric Adenitis, Prevalence



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## 1. Introduction

Intussusception is a critical pediatric emergency that occurs when a segment of the intestine telescopes into an adjacent segment, leading to obstruction and potential ischemia. It is the most common cause of intestinal obstruction in children between 2 and 36 months, and the most frequent abdominal emergency in children under 2 years of age (1, 2). About 65% of intussusception cases occur in children under 1 year old. The incidence rate is approximately 1-4 per 1,000 children. About 75% of intussusception cases are

idiopathic (3-5). An imbalance between longitudinal forces that disrupts the pattern of intestinal peristalsis has been proposed as the pathogenesis (6). In the idiopathic type, a connection with hypertrophy of Peyer's patches has been suggested, which may often be triggered following various gastrointestinal or respiratory tract infections (7, 8). Also, the risk of intussusception in children is slightly increased after receiving the rotavirus vaccine (9). Gastrointestinal infection or exposure to a new food protein, accompanied by swelling of intestinal

lymphoid follicles in the terminal ileum, has been suggested as a risk factor for intussusception (10, 11). The mass of lymphatic tissue leads to prolapse of the ileum mucosa into the colon and causes intussusception. Cystic fibrosis, celiac disease, Crohn's disease, and Henoch-Schönlein purpura are other risk factors (12, 13).

In typical patients, the onset of symptoms is sudden, with episodes of severe colicky pain accompanied by loud crying and drawing of the legs and knees into the abdomen. Infants may initially be calm and asymptomatic between attacks of pain. However, if the intussusception has not been resolved, the infant becomes progressively weaker and more lethargic (10, 14). Eventually, a shock-like condition with fever and peritonitis occurs. In the early stages, vomiting occurs following abdominal pain. In more advanced stages, vomiting becomes bilious. During the early hours of the disease, stool is normal. Then, the stool decreases or stops. Sometimes, blood is seen in the stool (15, 16). When clinical symptoms and physical findings suggest intussusception, an ultrasound should be performed to confirm the diagnosis (17). Successful management of intussusception includes early diagnosis, correction of fluid and electrolyte imbalances, and prompt reduction (e.g., enema). Intussusception is an emergency; preparation for possible surgery must also be made. Non-surgical treatment includes hydrostatic enema with air, saline, or contrast. If intussusception is treated properly within the first 21 hours, most infants recover; however, the mortality rate increases after this time (8, 18).

Mesenteric adenitis, characterized by inflammation of the mesenteric lymph nodes, is often associated with viral infections and presents with abdominal pain that can mimic appendicitis. The condition is common in children and is frequently linked to viral gastroenteritis, resulting in a clinical picture that can complicate diagnosis (19, 20). While intussusception and mesenteric adenitis can occur independently, a potential connection between these two conditions has been suggested. Evidence has indicated that inflammatory processes in mesenteric adenitis may predispose children to intussusception due to increased lymphoid tissue and resultant changes in intestinal motility (21, 22). However, the prevalence of intussusception occurring concurrently with mesenteric adenitis has not been extensively studied, leaving a gap in understanding that may impact clinical management. Understanding the co-prevalence and relationship between these two conditions is crucial for pediatric healthcare providers. Furthermore, distinguishing between these two conditions can guide appropriate management strategies, whether conservative or surgical. Therefore, this study was designed to investigate the prevalence of mesenteric adenitis in children with intussusception.

## 2. Materials and Methods

This cross-sectional study was conducted on 81 children aged 4 to 48 months with intussusception who were referred to Mousavi Zanzan Hospital from 2019 to

2021. The study was conducted as a census. The inclusion criteria were age between 4 and 48 months and having intussusception. Exclusion criteria included children suffering from immunological diseases and those with incomplete and illegible medical records. Data were collected using a checklist that included variables such as age, sex, weight, comorbidity, clinical symptoms, time of symptoms onset, length of hospital stay, types of intussusceptions, type of feeding, type of treatment (surgical or non-surgical), type of delivery, presence or absence of mesenteric adenitis, location of adenitis, number of adenitis, and diameter of adenitis. These data were extracted from the patients' records by referring to the medical records department.

Data were analyzed using SPSS software, version 26, and a P value of  $<0.05$  was considered statistically significant. For descriptive analysis, mean ( $\pm$ SD) and frequency (%) were used for quantitative variables. For analytical analysis, an independent sample t-test was used to assess the relationship between quantitative variables and the incidence of mesenteric adenitis if the data were normally distributed; otherwise, the Mann-Whitney U test was used. In the non-parametric Mann-Whitney U test, the median (interquartile range) was reported to describe the variables, and the mean ( $\pm$ SD) was reported in the independent sample t-test. The Chi-square and Fisher's exact tests were also used to determine the relationship between qualitative variables and the incidence of mesenteric adenitis.

The protocol of the study was conducted according to the principles expressed in the Declaration of Helsinki and was approved by the Deputy of the Research and Ethics Committee of Zanzan University of Medical Sciences (Code: IR.ZUMS.REC.1402.280).

## 3. Results

We investigated 81 children with intussusception, aged 4 months to 4 years. The mean $\pm$ SD age and weight were  $22.30\pm13.56$  months and  $11.20\pm4.02$  kg, respectively. Most of the children studied were girls (70.4%). Vomiting and jelly stools were reported in 53.1% and 23.5% of cases, respectively, and most (60.5%) had abdominal pain. Ileocolic was the most common type of intussusception (45.8%), and oral feeding (62.3%) was the most common type of feeding in children. Also, 58.6% of the children were born via vaginal delivery, and 38% underwent surgical treatment. None of the children had any underlying medical conditions. Only five children were tested for COVID-19, all of whom tested negative. The mean $\pm$ SD time of symptoms onset and length of hospital stay were  $2.46\pm2.12$  and  $4.76\pm5.24$  days, respectively. At the end of treatment, all children with intussusception were discharged from the hospital (Table 1).

Most children (79%) had mesenteric adenitis, most of which were multiple (93.7%), and the right lower quadrant (RLQ) was the most common site of adenitis

(85.9%). In addition, 56.2% of the adenitis cases had a diameter of less than 1 cm (Table 2).

There was no statistically significant relationship between age, weight, time of symptoms onset, and duration of hospitalization and the presence of mesenteric adenitis in children ( $P>0.05$ ) (Table 3).

There was no statistically significant relationship between sex, vomiting, type of intussusception, type of nutrition, type of treatment, and type of delivery and mesenteric adenitis in children ( $P>0.05$ ). However, a statistically significant association was observed between jelly stool and mesenteric adenitis in children; all children with jelly stool had mesenteric adenitis ( $P=0.009$ ) (Table 4).

**Table 1.** Demographic and clinical characteristics of children

Variable		N (%)		
Sex	Girl	57 (70.4)		
	Boy	24 (29.6)		
Vomiting	No	38 (46.9)		
	Yes	43 (53.1)		
Jelly stool	No	62 (76.5)		
	Yes	19 (23.5)		
Abdominal pain	No	32 (39.5)		
	Yes	49 (60.5)		
Type of intussusception	Ileo-ileal	9 (12.5)		
	Ileocolic	33 (45.8)		
	Jejunojejunal	5 (6.9)		
	Colonic	1 (1.4)		
	Ileocecal	24 (33.3)		
Type of feeding	Oral	38 (62.3)		
	Intravenous (I.V)	22 (36.1)		
	Nasogastric tube feeding	1 (1.6)		
	Gavage feeding	0 (0)		
Type of delivery	Vaginal delivery	41 (58.6)		
	Cesarean section	29 (41.4)		
Type of treatment	Surgical	30 (38)		
	Non-surgical	49 (62)		
Variable	Mean	S.D	Min	Max
Age (month)	22.30	13.56	4	48
Weight (kg)	11.20	4.02	6	20
Time of symptoms onset (days)	2.46	2.12	1	14
Duration of hospitalization (days)	4.76	5.24	1	27

**Table 2.** Frequency of mesenteric adenitis by number, location, and diameter in children

Variable		N (%)
Mesenteric adenitis	Negative	17 (21)
	Positive	64 (79)
Number of adenitis	Single	4 (6.3)
	Multiple	60 (93.7)
Location of adenitis	RLQ	55 (85.9)
	LLQ	3 (4.7)
	Paraumbilical	6 (9.4)
Diameter of adenitis (cm)	≤1	36 (56.2)
	>1	28 (43.8)

**Table 3.** Relationship between age, weight, time of symptoms onset, and length of hospitalization with mesenteric adenitis

Variable	Mesenteric adenitis	Mean (S.D) / Median (IQR)	P-Value
Age (month)	Negative	19.71 (15.42)	0.379*
	Positive	22.98 (13.06)	
Weight (kg)	Negative	13.75 (5.05)	0.140*
	Positive	10.31 (3.49)	
Time of symptoms onset (days)	Negative	1 (2)	0.506**
	Positive	2 (2)	
Duration of hospitalization (days)	Negative	4 (5)	0.368**
	Positive	3 (3)	

\*: Reported as mean (standard deviation) by independent t-test

\*\*: Reported as median (interquartile range) by Mann-Whitney U test

**Table 4.** Relationship between sex, clinical symptoms, type of invagination, COVID-19, type of nutrition, type of treatment, and type of delivery with mesenteric adenitis

Variable		Mesenteric adenitis		P-Value
		Negative	Positive	
Sex	Girl	11 (19.3)	46 (80.7)	0.565*
	Boy	6 (25)	18 (75)	
Vomiting	No	10 (26.3)	28 (73.7)	0.268*
	Yes	7 (16.3)	36 (83.7)	
Jelly stool	No	17 (27.4)	45 (72.6)	0.009**
	Yes	0 (0)	19 (100)	
Abdominal pain	No	9 (28.1)	23 (71.9)	0.202*
	Yes	8 (16.3)	41 (83.7)	
Type of intussusception	Ileo-ileal	1 (1.11)	8 (88.9)	0.074*
	Ileocolic	9 (27.3)	24 (72.7)	
	Jejunojejunal	3 (60)	2 (40)	
	Colonic	0 (0)	1 (100)	
	Ileocecal	2 (8.3)	22 (91.7)	
Type of feeding	Oral	9 (23.87)	29 (76.3)	0.150*

Type of delivery	Intravenous (I.V)	3 (13.6)	19 (86.4)	0.903*
	Nasogastric tube feeding	1 (100)	0 (0)	
	Vaginal delivery	8 (19.5)	33 (80.5)	
Type of treatment	Cesarean section	6 (20.7)	23 (79.3)	0.092*
	Surgical	9 (30)	21 (70)	
	Non-surgical	7 (14.3)	42 (85.7)	
COVID-19	Positive	1 (20)	4 (80)	-
	Negative	1 (20)	4 (80)	

\*: Chi-squared test

\*\*: Fishers exact test

#### 4. Discussion

Intussusception is a common surgical emergency in children. This condition occurs when a segment of the intestine slides into another segment, leading to intestinal obstruction, impaired blood supply, and serious complications such as intestinal necrosis (23). Mesenteric adenitis refers to the inflammation of the mesenteric lymph nodes, typically occurring in response to viral or bacterial infections (20). These two conditions can occur simultaneously in children; therefore, investigating the prevalence of mesenteric adenitis in children with intussusception is particularly important. The present study was designed to investigate the prevalence of mesenteric adenitis in children with intussusception. A total of 81 children aged 4 months to 4 years with intussusception were included. The results showed that the mean age was  $22.30 \pm 13.56$  months. Most of the children were girls (70.4%). Ileocolic was the most common type of intussusception (45.8%), and most children had mesenteric adenitis (79%). In terms of number, most cases of adenitis were multiple (93.7%), and the RLQ was the most common site of adenitis (85.9%). In addition, 56.2% of adenitis cases had a diameter of less than 1 cm. There was no statistically significant relationship between mesenteric adenitis and age, sex, weight, time of symptoms onset, duration of hospitalization, vomiting, type of intussusception, type of nutrition, type of treatment, and type of delivery. However, there was a statistically significant relationship between jelly stool and mesenteric adenitis in children, so all children with jelly stool had mesenteric adenitis.

In line with our study, in a study conducted by Rafiei and colleagues on 50 children under 10 years of age with intussusception, ileocolic was the most common type of intussusception. The most frequent chief complaint in patients was intermittent abdominal pain, and on clinical examination, bloody jelly stool was reported in 56% of cases. Unfortunately, in 60% of cases, there was a delay of more than 24 hours until the diagnosis of the disease. Intussusception was reported in 68% of cases through radiological imaging (24). In another study conducted by Jo, Lim (25) in South Korea, 64% of children with intussusception were

boys, and 82.7% were between 2 and 36 months of age. Among structural lesions of the gastrointestinal tract that could be the main cause of intussusception, lymphadenopathy was the most common (56.6%). The study also reported that intussusception in children in South Korea had an age-related seasonal trend, which may be due to exposure to infectious agents (25).

In another study, 73 children with intussusception were compared with 101 children who had normal physical examinations or conditions unrelated to intestinal lymphoid hyperplasia. The results indicated that most children with intussusception also had severe mesenteric lymphoid hyperplasia, and a relationship was observed between the occurrence of primary intussusception and intestinal lymphoid hyperplasia. The right lower part of the abdomen had better intussusception predictability than the periumbilical region. Healthy children under the age of 2 showed lower degrees of mesenteric lymphoid hyperplasia compared with those with intussusception (26). A hospital-based historical cohort study by Esteghamati and co-workers on 759 children with intussusception showed that the incidence of intussusception in children under 1 year old and under 5 years old was 66.54 and 31.61 per 100,000, respectively. The most common anatomical location was the ileocolic region (87.87%), and surgery was the most frequent treatment method (27). In our study, the case fatality rate (CFR) in children with intussusception was zero, which is consistent with the findings of Esteghamati and colleagues (27). Although intussusception can be potentially fatal, the CFR in Zambia was reported to be high at 33.7%. The zero CFR of intussusception in our study could be due to better diagnostic and therapeutic care (28). However, differences in the severity of intussusception and demographic characteristics of the samples in different studies could be reasons for the inconsistency of our study results with those of these studies.

Mesenteric adenitis appears to be a common finding in children with intussusception, with reported prevalence ranging from 10% to 20% among children with intussusception. This condition is usually considered a secondary complication that may affect



the severity and length of hospital stay (18, 28). Mesenteric adenitis is usually caused by viral infections, such as norovirus, or bacteria such as *Yersinia*. These infections can lead to lymph node enlargement and inflammation in the mesenteric area. In children with intussusception, mesenteric inflammation may exacerbate clinical symptoms and complicate treatment. On the other hand, the body's immune response to infections can lead to lymph node enlargement and ultimately to mesenteric adenitis (19).

## 5. Conclusion

The prevalence of mesenteric adenitis in children with intussusception was high, and a significant association was observed between these two diseases. The high prevalence of mesenteric adenitis in children with intussusception indicates the need for special attention in the diagnosis and treatment of these two conditions. Clinicians should remain vigilant regarding the symptoms of mesenteric adenitis in children with intussusception to provide the best care and prevent serious complications. Further research could help improve treatment protocols and reduce complications.

## 6. Declarations

### 6.1 Acknowledgments

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### 6.2 Ethical Consideration

The study was approved by the Deputy of Research and Ethics Committee of Zanzan University of Medical Sciences (ID-number: IR.ZUMS.REC.1402.280).

### 6.3 Authors' Contributions

Conceptualization, supervision, funding acquisition and resources: Mohammad Esagh Rozeh and Mohadeseh Mohamadkhani; Methodology: Amir Hossein Ladan and Reza Mahdian Jouybari; Data collection: Mahdieh Sharifi; Data analysis: Farzane Ahmadi; Investigation and writing: All authors.

### 6.4 Conflict of Interest

The authors declare that there are no conflicts of interest.

### 6.5 Fund or Financial Support

This study was funded by Zanzan University of Medical Sciences, Zanzan, Iran.

### 6.6 Using Artificial Intelligence Tools (AI Tools)

The authors were not utilized AI Tools.

### 6.7 Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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