Characterization of Intussusception in Qena University Hospital

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Abstract

Background: Infants and toddlers have intussusception. Uncontrolled peristalsis or lymphoid hyperplasia after gastrointestinal disease produces ileo-colic, the most frequent kind. Pathologic lead points induce intussusception. Intussusception causes stomach discomfort, bloody feces, and vomiting. Early treatment reduces intestinal blockage, mesenteric vascular dysfunction, and bowel ischemia. Studying paediatric intussusception epidemiology and comorbidities.

Objectives: To analyses the epidemiologic features of pediatrics intussusception using the public health data base we also identified comorbidities associated with intussusception.

Patients and methods: This prospective observational study documented comprehensive records of 40 cases of intussusception admitted to General Surgery Department, Qena University, and associated hospitals over a period of ten months. Patient information including age, sex, address, presenting symptoms, severity of presentation, investigations performed, laboratory tests, and associated conditions were collected. Management was determined for every case.

Results: Fever, vomiting, and abdominal discomfort were the most prevalent symptoms in an intussusception research. 10% had COVID-19. All individuals had ultrasounds, with 42.5% having CT confirmation. 10% had exploration/surgery, 57.5% had conservative management, and 32.5% had hydrostatic reduction. Conservative and hydrostatic treatment had similar rates of recurrence (13 cases). Only 2 recurrences required surgery.

Conclusion: This work illuminates pediatric intussusception's epidemiology and comorbidities. Abdominal discomfort and vomiting are most prevalent. Our results emphasize the significance of rapid detection and therapy of intussusception in pediatric patients, particularly those with comorbidities. Explore the pathophysiological causes and risk factors of intussusception in children to guide preventive and early intervention techniques.

Keywords: Intussusception, Characterization, pediatrics, Diagnosis.
DOI: 10.21608/SVUIJM.2023.204043.1563

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Received: 1 March,2023.
Revised: 12 April,2023.
Accepted: 25 April,2023.
Published: 6 October,2024.
Cite this article as: Eman Saber Ahmed, Nezar Abdelraouf Abo Halawa, Mahmoud Abdelhamid, Mohammed Ahmed Negm.(2024). Characterization of Intussusception in Qena University Hospital. *SVU-International Journal of Medical Sciences*. Vol.7, Issue 2, pp: 654-667.

Introduction

Intussusception is a medical condition where a part of the intestine folds inside itself, leading to gastrointestinal obstruction in children. The most common age group affected by this condition is between 3 and 12 months, with ileo-colic variant being the most prevalent type **(Mandeville et al., 2012).**

Immediate detection and treatment of intussusception are crucial as it can lead to intestinal obstruction, mesenteric vascular dysfunction, and eventually bowel ischemia **(Kim, 2004).**

In nearly 90% of cases, uncontrolled peristalsis of the stomach or lymphoid hyperplasia triggered by a recent gastrointestinal illness leads to intussusception **(Hryhorczuk et al., 2012).**

Pathologic lead points (PLP) are localized masses or extensive gut wall abnormalities that cause approximately 5-6% of juvenile intussusceptions. Diffuse PLPs are mostly caused by cystic fibrosis, commonly known as Henoch-Schonlein purpura **(Mandeville et al., 2012; Applegate, 2009; Cogley et al., 2012; Chua et al., 2006).**

The clinical triad of intussusception is typically characterized by acute colicky stomach pain, bloody feces, and a palpable abdominal mass or vomiting. However, not all children may have all three symptoms, and intussusception can be temporary and self-resolving **(Kim, 2004; Jiang et al., 2013; Hryhorczuk & Lee, 2012).**

Many studies have established the association between intussusception and specific disorders with anatomical leading points. However, few studies have been conducted utilizing the national health database on the connection of other illnesses with intussusception, such as Meckel's diverticulitis and Peutz-Jeghers syndrome **(Okimoto et al., 2011; Csernia et al., 2007).**

The aim of our study to analyses the epidemiologic features of pediatrics intussusception (age, gender, residence) using the public health data base we also identified comorbidities associated with intussusception.

Patients and methods

This prospective observational study was carried out upon 40 cases of intussusception admitted to General Surgery Department, Qena University and affiliated hospitals during the study period that started from March 2022 to January 2023.

In this study, comprehensive records of all patients diagnosed with intussusception were meticulously documented. Data were collected including age and sex, as well as the patient's address, whether they were from an urban or rural area in Qena or nearby governorates. The referring hospital or physician, presenting symptoms, severity of patient presentation, general and local complications, investigations performed, and laboratory tests done before and after admission were also documented. Additionally, any associated conditions were recorded to provide a complete understanding of the patient's overall health status.

Intussusception confirmed diagnosis was done mainly by imaging methods for detection of different intussusception signs as pseudo-kidney and target sign **(Waseem and Rosenberg, 2008)**, (**Fig.1**).

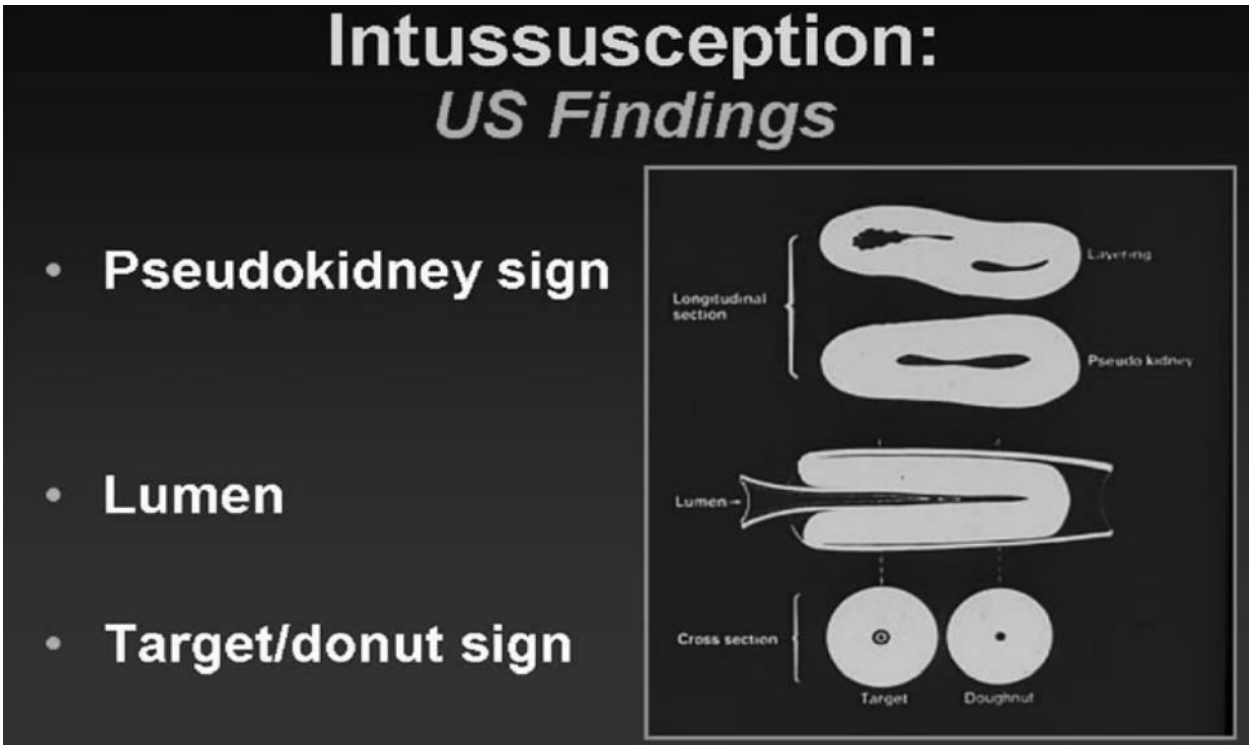

Fig.1. Various signs of intussusception on cross-sectional imaging. Depending upon the plane through which an intussusception is imaged, various configurations may be demonstrated. On cross section, the head of the walls of the intussusception may appear as a double donut or target sign. The image on the right demonstrates the pseudo-kidney sign obtained by imaging the intussusception in a longitudinal plane (**Waseem and Rosenberg, 2008**).

Intussusception Ultrasonography

Ultrasonographic imaging was obtained using a US machine **(Philips Healthcare, Amsterdam, Netherlands)** equipped with a 5 MHz curved array probe. US examination started at the level to Anterior Superior Iliac Spine in a transverse plane then the technician moved the probe superiorly looking for the caecum. The prop was swept superiorly and inferiorly in a progressive manner towards umbilicus.

On axial US, scans obtained at the apex shows a hypoechoic outer ring with a hypoechoic center. As the axial US study proceeded toward the base, the appearance changed gradually as increasing amounts of mesentery were included in the image. At the base, the amount of enclosed mesentery was maximal which caused a hypoechoic outer ring with a hyperechoic, crescentic center. On longitudinal US scans, three parallel hypoechoic bands separated by two nearly parallel hyperechoic bands were seen (**Fig.2**).

CT abdomen with contrast was performed when intussusception wasn't detected by abdominal x-ray and US: All CT examinations were performed with (**GE 1835CT01, General Electric (GE) Healthcare, Chicago, Illinois, USA)** system with a 16 –detector row CT scanner, which provided 90, 120, and 140 kV options. The maximal tube current–time product limit was 415, 350, and 300 mAs at 90, 120, and 140 kV, respectively, at a constant beam pitch of 0.659:1 and gantry rotation of 0.75 second. Zero calibration was performed to compensate for any deviance between the two tube voltage settings.

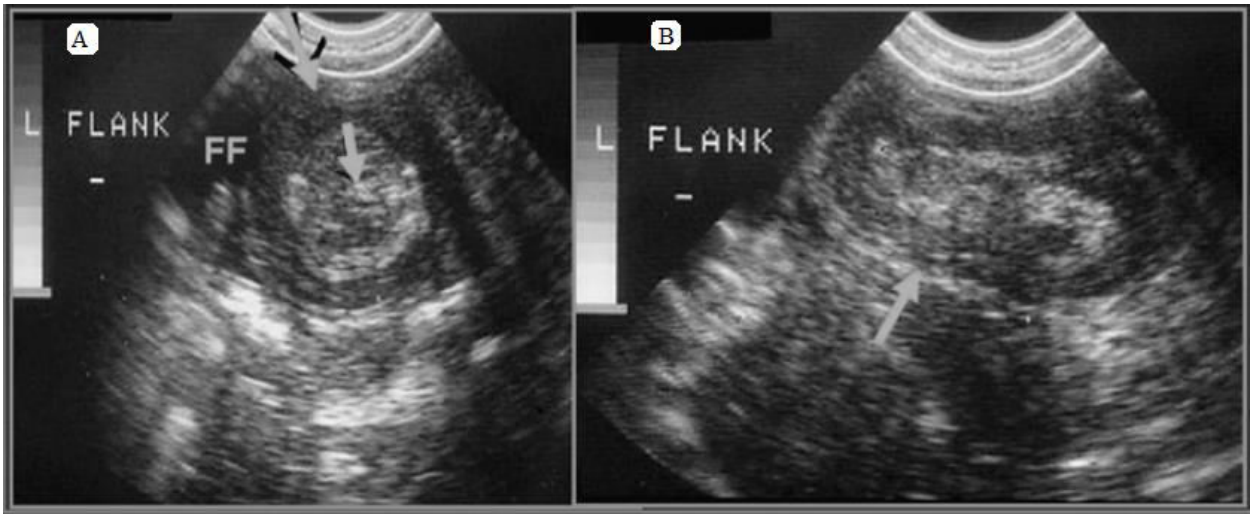

Fig.2. Ultrasound diagnosis of intussusception. The first part of the figure demonstrates the target or double donut sign with the inner ring representing the intussusceptum and the outer ring representing the intussuscipiens (larger arrow). The central dot represents mucus lining the lumen of the inner ring (smaller arrow). FF indicates free fluid.

The scanning parameters were tube current–time product of 300 mAs, rotation time of 0.75 second, beam collimation of 16 (detector rows) × 1.5 mm (section thickness), reconstruction section thickness of 5 mm, table feed per rotation of 21.1 mm, beam pitch of 0.659:1, field of view of 36 cm, and pixel matrix size of 512 × 512. The scans were obtained at 120 kV. The patient received approximately 800 ml of contrast material by mouth in divided doses of either dilute barium, such as barium sulfate 2.1% suspension or 2% meglumine diatrizoate. To maximize the benefits of contrast use, axial CT scanning was performed with minimum interscan delay, (**Fig.3**).

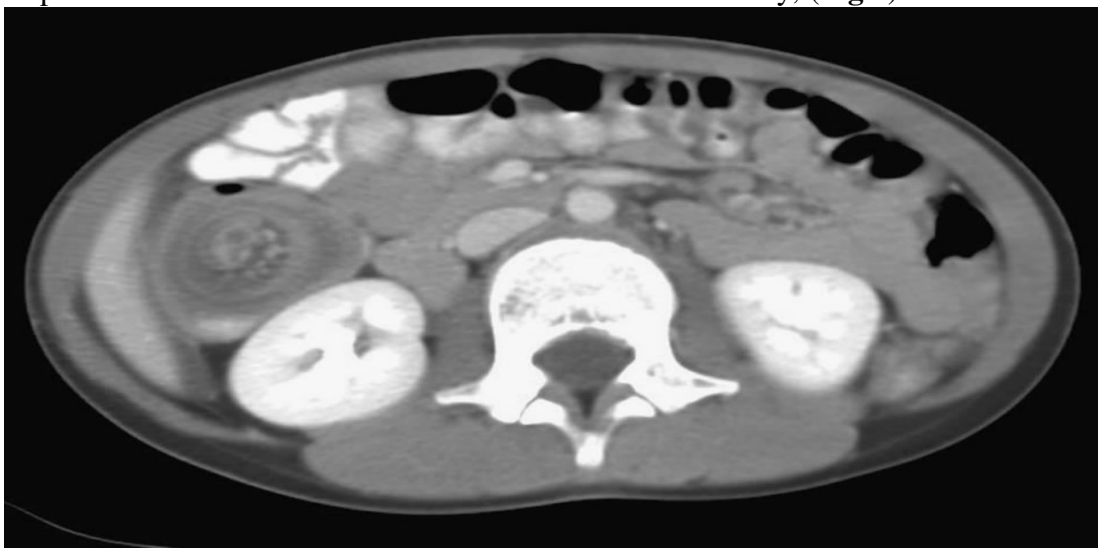

Fig.3. Computed tomographic diagnosis of intussusception. Axial intravenous and oral contrast-enhanced CT scan demonstrates target sign in the right side of the abdomen consistent with ileocolic intussusception. The adipose tissue seen between the intussusceptum and

intussuscipiens represents fat within the omentum that was caught between the walls of the telescoped bowel.

After detection of Intussusception initial conservative management was done. However if cases were acute abdomen, surgery was the first management. We followed **(Gluckman et al., 2017)** for management of detected cases.

Conservative management was conducted following (Huppertz et al., 2006), with observation and monitoring of the patient's vitals in the hope that Intussusception would reduce without any intervention. The patient was monitored for several hours to a maximum of 2 days to ensure that the intussusception did not recur. The patient was observed for signs of bowel obstruction or perforation, such as abdominal distension, vomiting, fever, and an increased heart rate.

Through observation, Fluid and Electrolyte Replacement therapy was administered if the intussusception had caused vomiting or diarrhea. The patient was given fluids and electrolytes to replace any lost fluids and to prevent dehydration. If no improvement occurred, Hydrostatic reduction was performed.

Hydrostatic reduction: A catheter or enema tube was then inserted into the rectum, and water or air was slowly injected into the intestine to create pressure. The pressure helped to push the telescoped bowel back into place. The procedure was monitored on imaging studies to ensure that the intussusception had been completely reduced (**Xie et al., 2018**), (**Fig.4**).

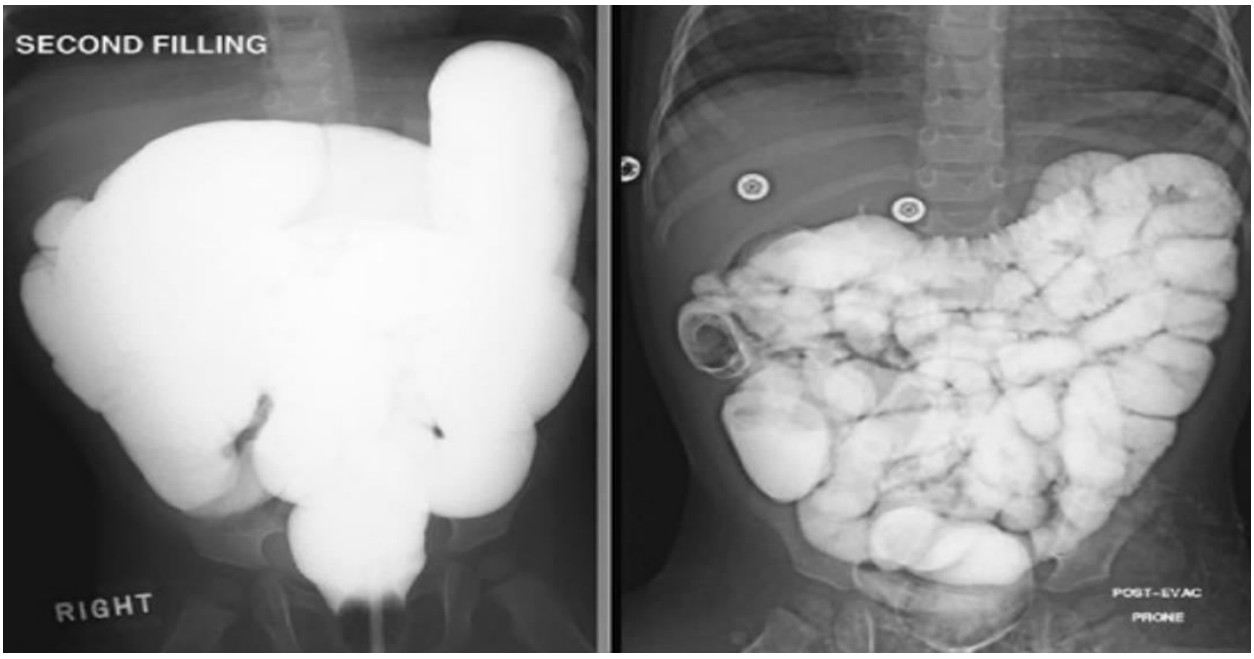

Fig.4.Hydrostatic reduction intussusception. Image with contrast filling multiple bowel loops shows complete reduction of intussusception, with the postevacuation film on the right showing decompression of the multiple bowel loops.

We followed cases for 2 days after initial management for detection of recurrence if occurred. Follow up was mainly clinical and through imaging. If recurrence occurred we initialized management with conservative treatment then hydrostatic reduction like performed in initial management. If no improvement after a maximum of two Hydrostatic reductions, surgery was performed.

In Exploration Surgery, under general anesthesia, An incision is made in the abdominal wall to gain access to the intestine then we examines the intestine for the intussusception and any underlying causes. When we detect Intussusception, we manually reduces the intussusception by gently pulling the telescoped bowel back into place. In cases where a gangrenous loop is identified, the patient is referred for resection anastomosis surgery **(Gluckman et al., 2017).** We noted final management of patients, (**Figs5-7**).

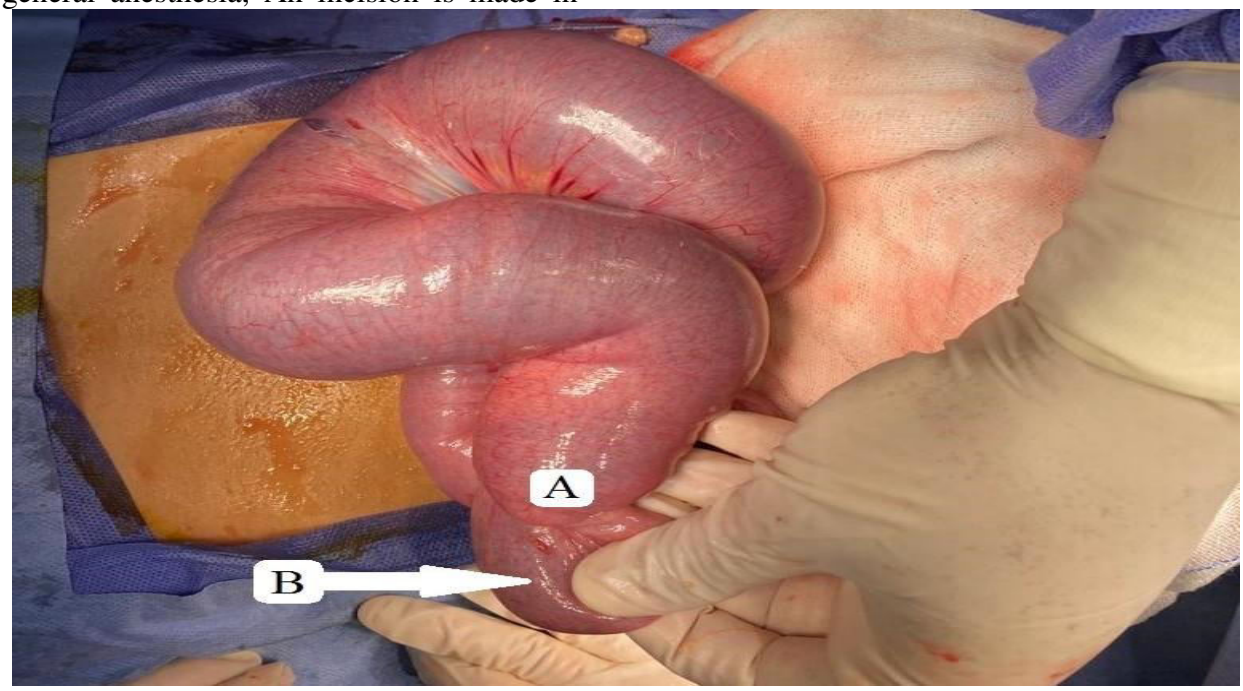

Fig.5. Intussusception in small intestine (Ileo-ileal intussusception). A: Intussuscipiens, B: Intussuseptum.

Fig.6. Gangrenous intestinal loop due to neglected intussusception.

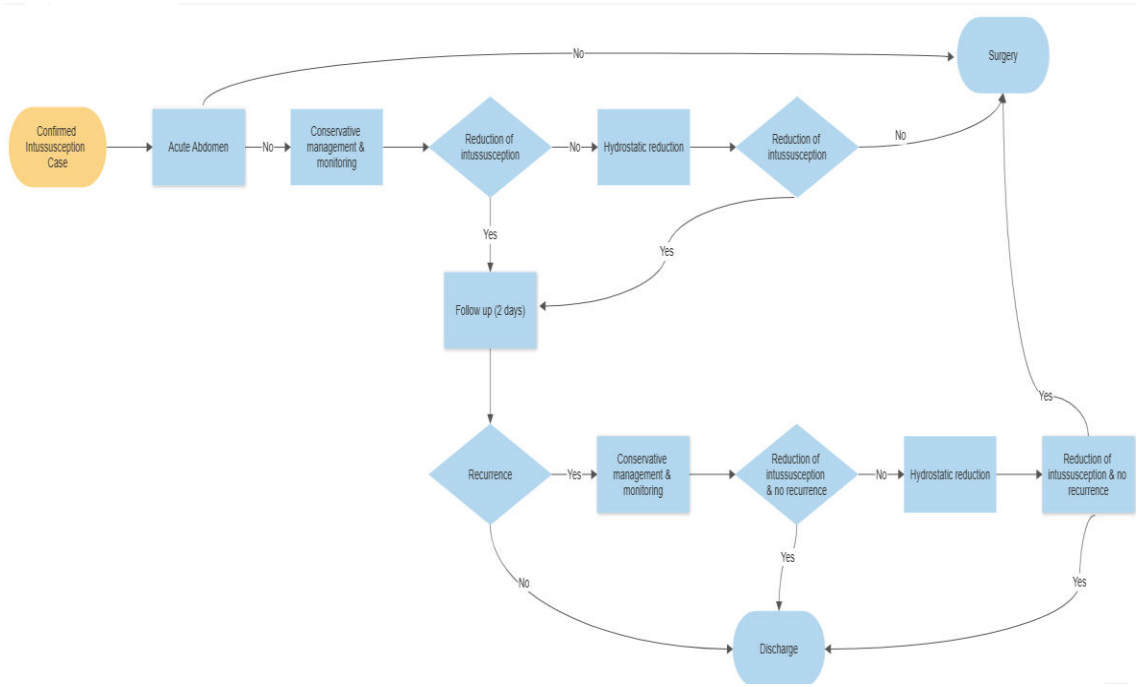

Fig.7. Management flow for different cases

Ethical Approval: The research was granted permission to proceed by the institution's Ethics Committee, and participants were required to sign consent forms stating that they were aware of and willing to undertake the risks associated with the study. The study has been granted permission to continue moving forward. The World Medical Association (WMA) is responsible for the creation of the Helsinki Declaration, which serves as the foundation for the ethical treatment of those who participate in research. This proclamation served as the basis for an ethical approach to the treatment of those who participated in research (WMA). Study was conducted under ethical approval code: **SVU-MED-SUR011-1-22-4-396**

Statistical Analysis

We utilized IBM's SPSS version 24 (May 2016) to conduct the analysis. The Kruskal-Wallis test, Wilcoxon test, Spearman correlation, and logistic regression were used to compare the groups. We examined the data for each variable to determine whether it was parametric or non-parametric. The results were considered statistically significant if the p-value was less than 0.05, corresponding to a five percent significance level.

Results

Males were 23 (57.5%) and females were 17 (42.5%), 12 (30%) patients were younger than 12 months and 28 (70%) patients were older than 24 months. From all patients, 21 (52.5%) were urbans and 19 (47.5%) were rurals. Ten patients were from outside Qena**.** Most of patients presented to our hospital referred from general and central hospitals in addition to pediatricians with the provisional diagnosis of intussusception based on the ultrasound findings (**Table.1**).

Table 1. Showing the demographic data of studied patients

Patients data	No of patients and percentage
Gender	
Male	23 (57.5%)
Female	17 (42.5%)
Age	
<12 months	12 (30%)
12-24 months	0
>24 months	28 (70%)
Address	
Urban areas	21 (52.5%)
Rural areas	19 (47.5%)
Outside Qena governorate	10 (25%)

The initial assessment was intussusception was 36 patient (90%) and other diseases was 10%. Acute abdomen was the initial diagnosis in 4 (10%) patients. The most common symptom reported was abdominal pain (70%), followed by distention (42.5%) and vomiting (55%). Fever was reported in 18 (45%) cases. Positive COVID-19 cases represented 10% of all cases and palpable mass was found in 7.5% of cases**.** Abdominal pain in half of the patients subside after mass reduction. Rectal bleeding stopped after hydrostatic reduction by one to two days. Acute abdomen required urgent surgery, (**Table.2 & Fig.8**).

Table 2. Showing the presenting symptom and type of presentation.

Variables	No of patients and percentage
Symptoms	
Abdominal pain	28 (70%)
Vomiting	22 (55%)
Rectal bleeding	14 (35%)
Diarrhea	9 (22.5%)
Fever	18 (45%)
Palpable abdominal mass	3 (7.5%)
Distention	17 (42.5%)
Red current jelly stool	14 (35%)
Shock	4 (10%)
Associated condition	
Acute Abdomen	4 (10%)
Palpable mass	3 (7.5%)
Positive Covid Cases	4 (10%)
Fever	18 (45%)

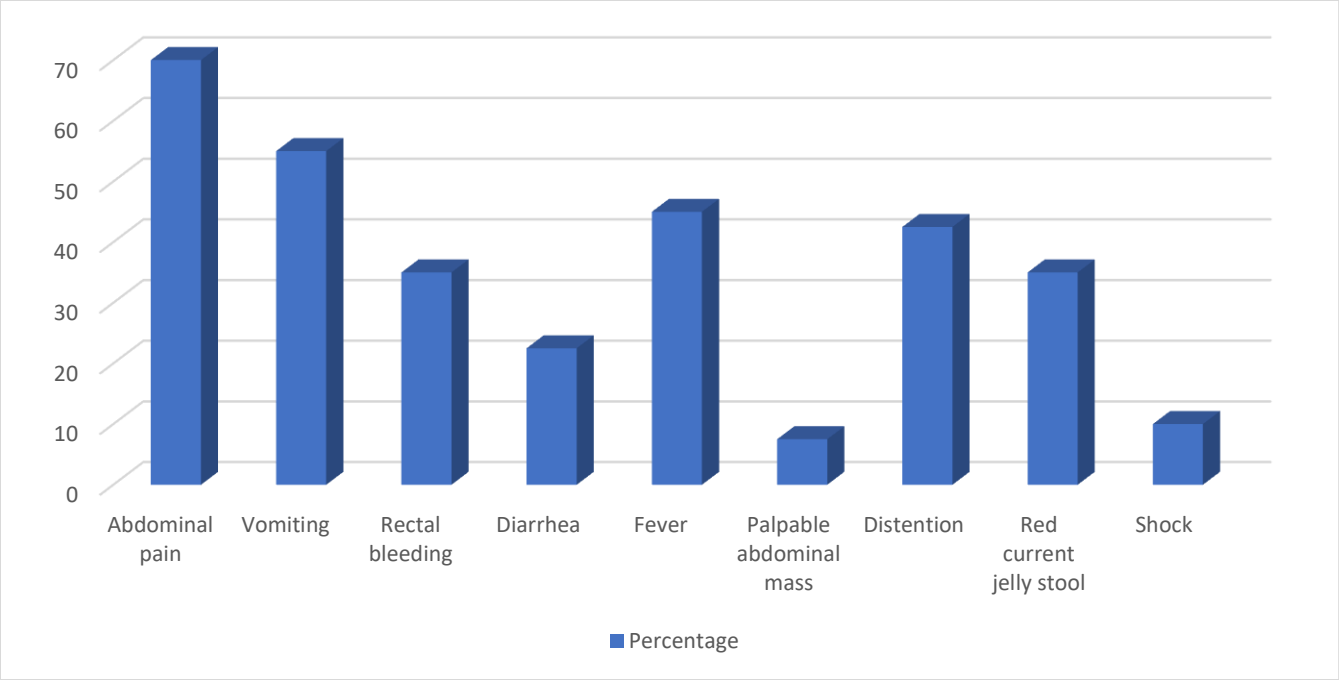

Fig.8. Symptoms prevalence among included subjects

Ultrasonography was performed for all participants but CT was used to confirm diagnosis in only 17 (42.5%) cases. For management, only a small proportion of the subjects (10%) underwent exploration and/or surgery, with half of those receiving exploration & mass reduction and half receiving resection anastomosis. The majority of the subjects (57.5%) received conservative management, while a slightly smaller proportion (32.5%) received hydrostatic reduction. Initial diagnosis for all 40 (100%) cases was done with U/S and CT was used for confirmation in 17 (42.5%) cases, (**Table.3 & Fig.9**).

Table 3. Imaging and Initial management of included subjects

Parameters	**Value (N = 40)**
Imaging	
• **Ultrasonography**	40 (100%)
• **CT**	17 (42.5%)
Initial management	
• **Exploration &/or surgery**	4 (10%)
• **Exploration & mass reduction**	2 (5%)
• **Resection Anastomosis**	2 (5%)
• **Conservative management**	23 (57.5%)
• **Hydrostatic reduction**	13 (32.5%)

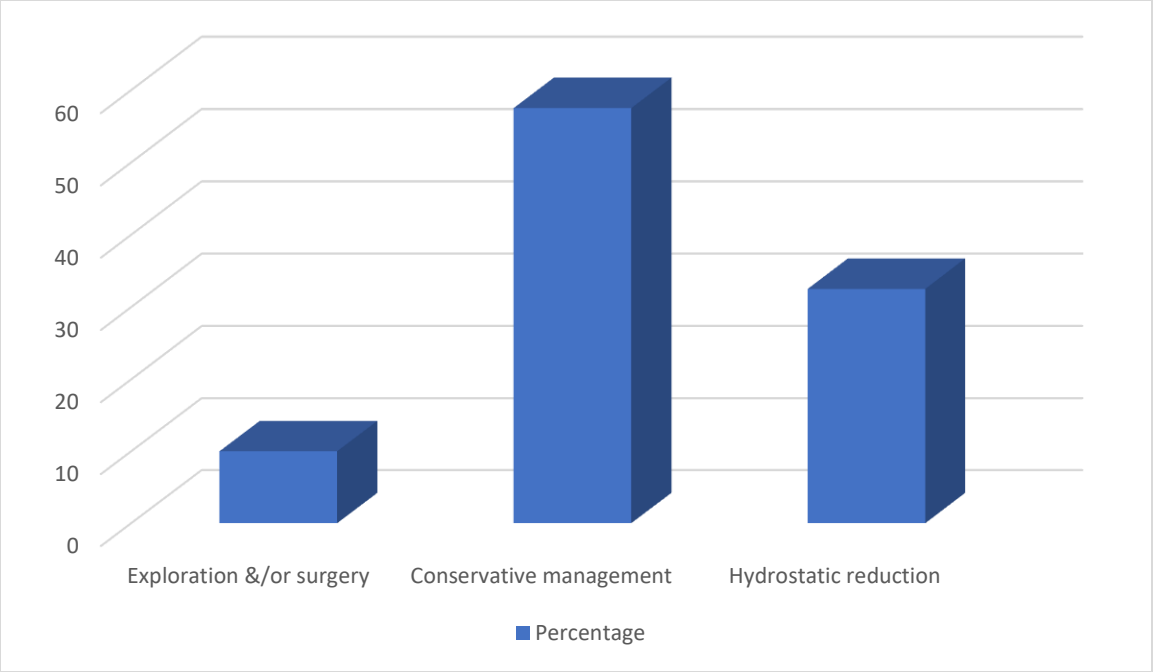

Fig.9. Initial management among included subjects.

After initial management recurrence was observed in 13 cases. Recurrence rate in cases managed with conservative management was 9 (39.13%) and in cases managed with Hydrostatic reduction was 4 (30.77%). There was no significant difference between cases managed with Hydrostatic reduction and Conservative management regarding recurrence rate, (**Table.4**).

Table 4. Recurrence rate of intussusception cases undergone Conservative management or Hydrostatic reduction.

Variable	Conservative management (N= 23)	Hydrostatic reduction (N = 13)	P. Value
Recurrence	9 (39.13%)	4 (30.77%)	0.616

We managed all cases complicated with recurrence by with conservative treatment if failed to reduce recurrence for two days we started management with hydrostatic reduction for one or two times if recurrence reduced patient discharged and if recurrence not reduced we performed surgery (**Table.5**).

Table 5. Management of cases complicated with recurrence of intussusception.

Management of recurrence	Value (N = 13)
Conservative	4 (30.77%)
Hydrostatic reduction	7 (53.85%)
Exploration and/or Surgery (Manual reduction or Resection anastomosis)	2 (15.38%)

Patients managed with conservative treatment only after recurrence were 4 (30.77%) cases, those who needed hydrostatic reduction only after failure of conservative treatment for management of reduction were 7 (53.85%) cases and patients needed surgery for management of recurrence were only 2 (15.38%) cases, (**Fig.10**).

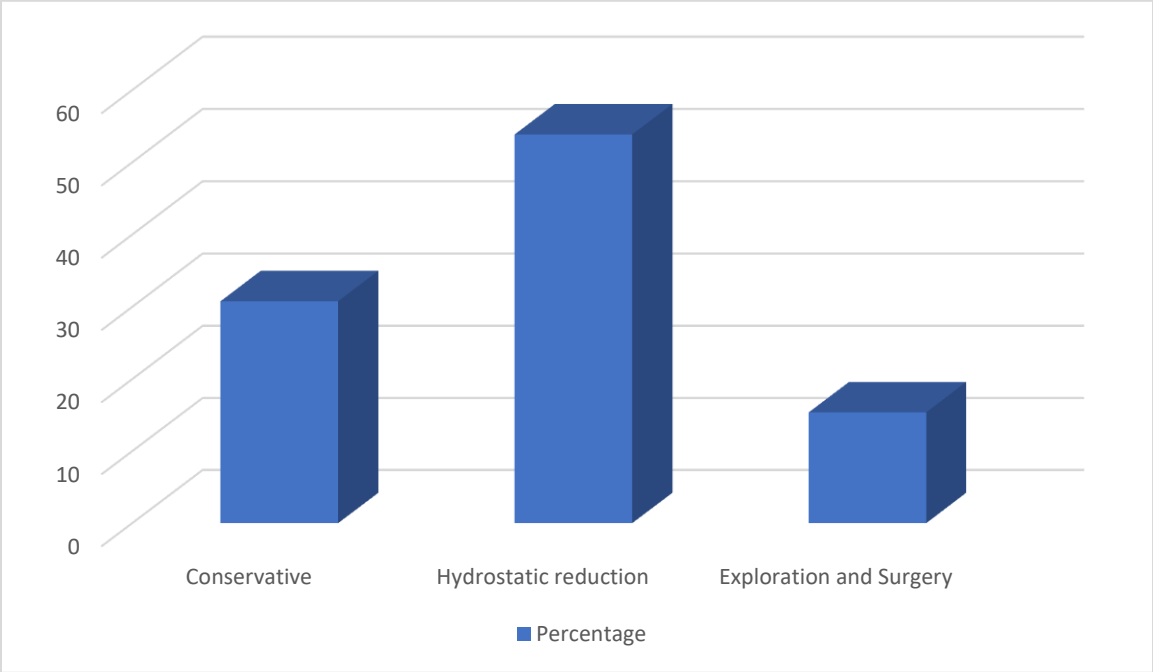

Fig.10. Management of cases complicated with recurrence of intussusception

Discussion

A severe medical disorder known as intussusception produces acute intestinal blockage by telescoping one segment of the colon into a more distal section of the bowel **(Mullis et al., 2019; Jain & Haydel, 2022).** It is a condition that is often seen in newborns and young children and has the potential to cause acute intestinal blockage **(Liu et al., 2018; Jo et al., 2019).** Intussusception may be initiated by respiratory or gastrointestinal infections, and it is associated to other disorders such as lymphoma, Meckel's diverticulitis, and polyps. Nevertheless, the causes of intussusception are not always identified, and the disease does not seem to follow a distinct seasonal pattern **(Ye et al., 2019; Neeser & Tharakan, 2022).** There have been instances of intussusception after rotavirus immunizations, however this has not yet been verified. Some studies have linked intussusception with infections caused by adenoviruses. Other reports have linked intussusception with infections caused by rotaviruses **(Ye et al., 2019; Neeser & Tharakan, 2022).** Intussusception is characterized by recurrent discomfort in the abdominal region, as well as vomiting and feces that are bloody **(Hom et al., 2022).** Ultrasonography should be used for early screening as soon as possible since diagnostic delays of more than 48 hours might lead to complications and increased death rates. When the blood supply to the intestine is cut off, serious complications such as intestinal infarction,

perforation, and even death may result **(Kobborg et al., 2021).**

In early intussusception, the abdominal pain may be mild and intermittent, and vomiting and nausea may be occasional. However, as the condition progresses to the late stage, the abdominal pain becomes more severe and constant, and vomiting and nausea become more frequent. In some cases, vomiting may contain blood, and diarrhea and rectal bleeding may also occur **(Tiwari et al. 2020).**

In the current study, the most common symptom reported was abdominal pain (70%), followed by distention (42.5%) and vomiting (55%). Fever was reported in 18 (45%) cases. However, Levinson et al., reported significant less prevalence of fever which was observed in only 24.2%. Most probably fever was prevalent among our cases due to infection with COVID-19.

Abdominal pain was most common symptom reported in our study this may be attributed to obstruction of the bowel caused by intussusceptum telescoping into the intussuscipiens. This causes a series of events that can lead to abdominal pain. The initial telescoping of the intestine causes compression of blood vessels, leading to a reduction in blood flow to the area. This leads to ischemia, or lack of oxygen and nutrients, to the involved section of bowel. Ischemia can cause inflammation, edema, and ultimately, necrosis, or tissue death. As the intussusception progresses, the bowel wall may become increasingly thickened, and the lumen becomes progressively smaller. This can lead to complete bowel obstruction, which can cause further stretching and distension of the bowel. The increased pressure within the bowel can cause severe abdominal pain **(Jain et al., Neeser et al., 2022).**

According to **Shiyi et al. (2017),** the most prevalent symptoms of intussusception in children at the time of presentation are abdominal pain, vomiting, and leg indrawing. It wasn't typical to have bloody stools. The majority of children reported with stomach pain as their main complaint; however, there was no particular pattern of symptoms that could be utilized to assist in the identification of children who had intussusception and other underlying disorders. These results serve as a helpful reminder to emergency doctors that intussusception may develop in children of any age, and that it may be brought on by infections or lead points. In addition to this, the research found that 40.92% of youngsters had fever within the same time period. This is significant because it indicates that doctors should reevaluate their diagnosis of intussusception in patients who also have other infections.

Wong et al. (2015) discovered that vomiting was the most prevalent symptom that children who had intussusception experienced. This was followed by stomach pain, copious rectal bleeding, or feces that looked like red currant jelly, and a palpable abdominal mass.

According to **Omore et al. (2016),** the most frequent clinical signs of intussusception in children are vomiting, blood in the stool or significant rectal bleeding, abdominal distension, diarrhea, and stomach pain.

Ten percent of patients were found to be positive for COVID-19 in the current research. Previous research revealed a correlation between intussusception and SARS-CoV-2 infection, which our findings corroborate. A case of intussusception caused by COVID-19 in an American kid was described by **Bazuaye-Ekwuasi et al. (2020).** In a novel manifestation of COVID-19, intussusception was described by **Rajalakshmi et al. (2020).** A case of intussusception caused by SARS-CoV-2 was described by Mercado-**Martnez et al. (2021).** A case of intussusception in a

newborn was described as a symptom of COVID-19 by **Moazzam et al. (2020).** In their report and analysis of the literature, **Athamnah et al. (2021)** described a case of COVID-19 manifesting as intussusception in a newborn. Children infected with SARS-CoV-2 have been reported to have intussusception twice by **Makrinioti et al. (2020).**

Conclusion

Our study provides significant insights into the characterization and epidemiological features of pediatric intussusception and the comorbidities associated with this condition. The most common symptoms reported are abdominal pain and vomiting. These findings underscore the importance of prompt recognition and management of intussusception in pediatric patients, especially in those with underlying comorbidities. Further research is warranted to explore the pathophysiological mechanisms and risk factors associated with intussusception in children, which could inform strategies for prevention and early intervention.

Funds: No fund

Author Consent and Conflict of interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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