

# The Value of Ultrasound in the Application of Water Enema in Intussusception

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**Abstract:** *Objective:* To introduce high-frequency ultrasound diagnostic technology to cooperate with diagnosis and treatment for patients with intussusception, and to observe its clinical application effect. *Methods:* The study took patients with intussusception as the object of observation, with a total of 52 cases participating, all of which were clinically admitted from December 2022 to December 2023. After enrollment, the patients underwent high-frequency ultrasound detection in sequence, recording the ultrasound imaging characteristics, and referring to the results of surgical or leaky saline enema reset to confirm the diagnosis (the gold standard) to assess the diagnostic efficacy of high-frequency ultrasound technology. *Results:* Comparing the confirmed diagnostic results of surgery or leaking saline enema restoration, the detection rate of high-frequency ultrasound technology was 98.07% ( $P > 0.05$ ). Among the 52 patients treated with hydropneumatic enema restoration with the cooperation of high-frequency ultrasound monitoring, 39 patients were successfully reset in the first treatment (75.00%), while 9 patients were successfully reset (17.30%) after multiple treatments ( $\geq 2$  times); the remaining 4 patients were unsuccessful and then converted to surgical treatment, and all of them were successfully treated and cured. *Conclusion:* For the diagnosis of intussusception, high-frequency color Doppler ultrasound has the advantages of high accuracy and simple operation, which provides a scientific and accurate reference basis for the clinical diagnosis and treatment of patients.

**Keywords:** Ultrasound; Intussusception; Enema; Diagnostic efficiency

**Online publication:** June 24, 2024

## 1. Introduction

Intussusception is a gastrointestinal disease, which is most common in infants and young children, mainly caused by the intestinal tube and its connecting mesentery entering into the neighboring intestinal lumen, which leads to the obstruction of the passage of intestinal contents, and ultimately causes intestinal lumen obstruction symptoms<sup>[1]</sup>. The onset of intussusception is characterized by acute condition and rapid progression, and the condition is generally due to the age of the patient is relatively small, the physiological function development is imperfect, and the degree of tolerance to the condition is low, if timely diagnosis and treatment interventions are not carried out, along with the progression of the condition, the late stage may induce acute and critical diseases such as intestinal necrosis or peritonitis, which may threaten the patient's life and safety<sup>[2]</sup>. At present,

clinical diagnosis of patients with intussusception mainly relies on imaging technology, in which color Doppler ultrasound technology can accurately and clearly observe the lesion situation under its simple operation and good safety performance, which has a better clinical role [3]. In this study, a retrospective analysis was designed to investigate the value of high-frequency ultrasound technology in the clinical diagnosis and treatment of patients with intussusception.

## 2. Materials and methods

### 2.1. General information

During the study period of December 2022–2023, in the form of a retrospective trial, a total of 52 cases of intussusception patients were screened as the object of observation, and after enrollment, high-frequency ultrasound testing was carried out on the patients in sequence, and the “gold standard” was to refer to the results of surgery or leaking saline enema reset to confirm the diagnosis and to determine the clinical practice of high-frequency ultrasound technology. Among the 52 patients, there were 30 males and 22 females, aged between 4 months and 6 years, with a mean age of  $3.32 \pm 1.02$  years; the disease duration ranged between 2–64 hours, with a mean duration of  $32.56 \pm 4.29$  h.

### 2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) All clinical data were complete and records were not missing; (2) Admitted to the hospital for typical symptoms of intussusception, such as vomiting, bloody stools, etc., and the diagnosis was confirmed by surgical or leaky saline enema reset; (3) Voluntary participation and good compliance.

Exclusion criteria: (1) Combination of other serious gastrointestinal system diseases, such as intestinal necrosis, active bleeding, etc.; (2) Combination of other serious organic diseases, such as congenital heart disease, hepatic and renal function diseases, etc.; (3) Cognitive or communication, audio-visual disorders.

### 2.3. Methods

- (1) Examination instrument: color Doppler ultrasound diagnostic instrument (PHILIPS IUElite) and its supporting system.
- (2) High-frequency ultrasound operation method: guide the patients to cooperate, inform them of the method, purpose, and meaning of the examination, and enhance their cooperation; choose the lying position, remove the interfering objects carried by the patients, and expose the abdomen; adjust the frequency of the probe to 5–12 MHz, slowly close to the patient’s abdomen, and move it continuously to complete the comprehensive sweep; focus on sweeping the patient’s right abdomen, and if there are interfering factors such as intestinal gas during the sweeping period, then the probe can be added appropriately according to the needs of the examination. If interference factors such as intestinal gas occur during the scanning, appropriate pressure can be applied according to the needs of the examination, and then scanning and probing can be carried out, and the results can be recorded.
- (3) Water enema operation for intussusception: after ultrasound exploration, if specific changes are found in the sonogram, combined with the history, the diagnosis of intussusception can be confirmed; if the patient’s disease duration is not more than 48h, the vital signs indicators are normal, the health degree is good, and there is no toxicity symptom (hyperthermia, dehydration, depression, etc.), then the patient can be guided by ultrasound to carry out the water-pressure enema to reset the treatment; a 15F triple-lumen catheter can be placed in the anus slowly, and 30 mL of air is injected into the balloon to fix the catheter and check whether there is any abnormality (slipping, loosening, etc.) to ensure that

saline enters into the body smoothly when injecting water and avoid overflowing; the middle of it is connected with the infusion set and 500 mL of warm saline, and the other lumen is connected with the drainage bag and clamped shut to prevent the saline from flowing out. Connect the high-frequency ultrasound diagnostic instrument with real-time ultrasound monitoring, uniformly inject the saline into the intestines, and stabilize the pressure within 90 mmHg.

## 2.4 Observation indexes

- (1) Diagnostic efficacy: Based on the results of surgery or leaky saline enema reset to confirm the diagnosis, statistically under the detection of high-frequency ultrasound, the detection of lesions detected; Diagnostic efficacy assessment: based on the detection of lesions, the accuracy rate of high-frequency ultrasound is calculated.
- (2) Prognostic statistics: For patients with confirmed intussusception, high-frequency ultrasound technology was combined with intussusception water enema treatment, and the follow-up treatment effect of the patients was recorded.
- (3) Analysis of ultrasonic imaging signs: Record the diagnostic results of high-frequency ultrasound, conduct imaging analysis on them, and clarify the characteristic signs of patients' sonograms under high-frequency ultrasound examination.

## 2.5. Statistical analysis

SPSS 20.0 software was used to organize, describe, and analyze the data, and the count data were statistically described using frequency counts ( $n$ ) and constitutive ratios (%), and the measurement data (which conformed to normal distribution) were expressed as mean  $\pm$  standard deviation (SD). Differences between high-frequency ultrasound technology and surgical or leaky saline enema repositioning to confirm the diagnosis were analyzed using the chi-squared test ( $\chi^2$ ), and all tests were two-sided, with a test level of  $\alpha = 0.05$ , with " $P < 0.05$ " indicating a statistical difference.

## 3. Results

### 3.1. Diagnostic efficacy

Comparing the results of surgical or leaky saline enema restoration to confirm the diagnosis, the detection rate of high-frequency ultrasound technology was 98.07% ( $P > 0.05$ ), see **Table 1**.

**Table 1.** Diagnostic efficacy evaluation

| Diagnostic method   | Cases | Detected (cases) | Not detected (cases) | Total detection rate (%) |
|---|-------|------------------|----------------------|--------------------------|
| High-frequency ultrasound technology  | 52    | 51               | 1                    | 98.07                    |
| Surgical or leaky saline enema repositioning to confirm the diagnosis results | 52    | 52               | 0                    | 100.00                   |
| $\chi^2$  | -     | -                | -                    | 1.0098                   |
| $P$   | -     | -                | -                    | 0.3149                   |

### 3.2. Prognostic statistics

All 52 patients with intussusception were treated with hydrodynamic enema reset under the cooperation of high-frequency ultrasound monitoring; among them, 39 patients were successfully reset with the first treatment

(75.00%), 9 patients were successfully reset with multiple treatments ( $\geq 2$  times) (17.30%); the remaining 4 patients were unsuccessful and then changed to surgical treatment, and all of them were successfully cured by the treatment.

### **3.3. Analysis of ultrasonic imaging signs**

#### **3.3.1. Concentric circles in short-axis view**

This kind of sign mainly appears in the diagnostic process of the lesion, through the analysis of the abnormal mass echoes, combined with the size and shape, internal echoes, as well as the blood circulation and location, it can be observed that it is characterized by the “concentric circles” sign in the short-axis section, and the “sleeve” sign in the long-axis section. The “sleeve” sign is observed in long-axis views.

#### **3.3.2. Peninsular sign of intestinal malleolar mass**

This kind of sign is mainly for color ultrasound monitoring of water pressure enema reset treatment; when saline is irrigated into the intestines, color ultrasound can monitor the dynamic changes of the water-filled intestinal tubes and the head of the socket, in which the enema liquid enters the ascending colon from the rectum, descending colon, transverse colon, and with the increase in the amount of injected water, the water pressure continues to rise, and the socket sheaths and sockets into the site of the dark liquid area between the sheaths and the socket area, and with the gradual increase in its area, socket masses gradually show the With the gradual increase of its area, the trocar mass gradually showed the “peninsula” sign, and the sign gradually became smaller with the progress of the enema restoration treatment.

#### **3.3.3. “Crabfoot” sign in the ileocecal region**

During the gradual withdrawal of the intestinal tube, the mass gradually disappears in the high-frequency ultrasound image, and the liquid enters the ileum through the ileocaecal valve; the small intestine gradually flushes with water and changes in the state of a “honeycomb,” and at this time, the blind part of the ileum appears to be like a “crab’s foot,” accompanied by edema of the ileocaecal valve and a decrease in the pressure of the water injection. At this time, the blind part of the ileum showed a “crabfoot” shape, accompanied by edema of the ileocecal valve, and the pressure of water injection decreased.

## **4. Discussion**

Intussusception is a common type of gastrointestinal disease in clinics, and the pathological mechanism of this disease is complicated, which is related to viral infection, poor diet, and some pathological factors (congenital intestinal malformation, etc.). As intussusception mostly occurs in infants and young children, and is mainly acute in onset, if not timely diagnosis and treatment, with the condition of tension, it will lead to a large amount of residual fluid and digestive fluid in the intestines of the patient, and eventually cause intestinal wall edema and other symptoms, and in severe cases, it can induce intestinal perforation and necrosis, resulting in the death of the patient. For patients with intussusception, timely diagnosis after the onset of the disease, and with effective diagnosis and treatment programs, is very important to enhance the survival rate of patients and prevent the occurrence of related complications <sup>[4]</sup>.

For patients with intussusception, color Doppler ultrasound technology can carry out the diagnosis by its ultrasonic physical characteristics, integrate the Doppler effect, effectively receive echo data, and carry out data processing and imaging, thereby realizing the tracking and observation of the lesion <sup>[5]</sup>. Compared with the traditional detection technology, the high-frequency color Doppler ultrasound technology not only has the

characteristics of clear imaging, but also is able to collect information on local hemodynamics. In addition, it can capture the signals of the lesion dynamically, obtain better imaging effect, display the lymph nodes at the site of intussusception, and observe the fine structure of the lesion mass, effectively observe the blood supply status of the intestinal wall, and assist the clinic in judging the hemodynamics and the degree of edema, thereby effectively assisting the clinic in making a diagnosis<sup>[6]</sup>. At the same time, high-frequency color Doppler ultrasound diagnosis can provide feedback in the form of three-dimensional customized images of various dimensional sections in the lumen of the patient's gastrointestinal tubes, clarify the focus of the image, and carry out image reconstruction of the suspected foci found, so that lesion screening can be better carried out under three-dimensional diagnosis. In the results of this study, there was still one patient who was not detected. The reason for this is that it may be related to the frequency of color Doppler ultrasound scanning and imaging or the influence of intestinal gas, and when the diagnostic frequency is low-frequency, its signal changes are slow, so it is easy to produce the omission of small lesions<sup>[7]</sup>.

In addition, high-frequency color Doppler ultrasound can also be used to monitor the treatment of patients with intussusception. During the entire period of hydrodynamic enema treatment, the attending physician is able to monitor according to the ultrasound image, and carry out the scanning of the abdominal intestinal space, liver, spleen and renal crypts at the appropriate time, to determine whether there is a liquid free dark area or whether there is an increase in free fluid, so as to make a judgment on whether there is the occurrence of intestinal perforation and other complications in the course of treatment, and if it is clear that it occurs, then the result can be used as a reference indication for the referral to out of the surgical treatment<sup>[8]</sup>; if the patients can not continue the water pressure reset treatment, then according to the actual clinical situation, the patients should be instructed to take appropriate rest, and then repeat the water pressure enema reset treatment under high-frequency color Doppler ultrasound monitoring again, and the attending physician should decide whether to continue the follow-up treatment by combining the patient's condition and the performance of the physical signs. In the follow-up efficacy review, the results can also be referred to with the help of color Doppler ultrasound technology<sup>[9]</sup>.

In the study of Lv and others<sup>[10]</sup>, 120 cases of children with suspected intussusception were taken as observation objects and grouped according to the different diagnostic and treatment programs, in which the observation group underwent ultrasound-guided water pressure enema, and the results of the data showed that the ultrasound diagnostic accuracy was 96.67% regarding the results of the enema reset and surgery. It shows the accuracy of ultrasound diagnostic technology for the diagnosis of intussusception. The conclusion is similar to the current study.

In conclusion, for patients with intussusception, this study considers high-frequency color Doppler ultrasound technology has certain advantages under no conflict of interest, and it can participate in the diagnosis and treatment process of patients, which not only improves the accuracy of clinical diagnosis but also objectively evaluates the results of the treatment and ensures the safety of the treatment.

## Disclosure statement

The author declares no conflict of interest.

## References

- [1] Chen Z, Li Y, Dai Z, et al., 2023, The Etiologic Diagnostic Value of Water Pressure Enema Under Ultrasound Surveillance in Children with Secondary Intussusception. *Chinese Journal of Ultrasound Medicine*, 39(6): 693–695.

- [2] Wu S, Gao Y, Yang B, 2023, Diagnostic Efficacy of Transabdominal Ultrasound Combined with High-Frequency Ultrasound in Pediatric Intussusception and Its Predictive Value in the Success or Failure of Warm Saline Enema Repositioning. *Clinical Medicine Research and Practice*, 8(20): 98–101.
- [3] Yu F, Mao W, Jiang S, et al., 2020, Clinical Value Analysis of Pediatric Intussusception Diagnosed by Color Doppler Ultrasound and Reset by Ultrasound-Guided Water Pressure Enema. *Modern Medical Imaging*, 29(6): 1111–1113.
- [4] Zhao Y, Zhang Y, 2019, Application Value of High-Frequency Ultrasound in the Diagnosis of Pediatric Acute Intussusception and Restoration Treatment with Water Pressure Enema. *Chinese Journal of Anorectal Diseases*, 39(8): 44–45.
- [5] Wang L, 2021, Study on the Value of High-Frequency Ultrasound Combined with Color Doppler Ultrasound in the Diagnosis of Pediatric Intussusception. *Imaging Research and Medical Application*, 5(2): 209–210.
- [6] Hu L, Ye X, Zhu Y, et al., 2020, Analysis of Risk Factors for the Occurrence of Recoiling After Successful Ultrasound-Guided Hydropressure Enema Treatment of Pediatric Primary Intussusception. *Journal of Clinical Ultrasound Medicine*, 22(8): 596–599.
- [7] Hu L, Ye X, Zhu Y, et al., 2020, Risk Factors for Recurrence After Ultrasound-Guided Hydraulic Enema for Pediatric Intussusception. *China Interventional Imaging and Therapeutics*, 17(8): 484–488.
- [8] Hu L, Xia P, Liu T, et al., 2021, Effectiveness and Safety of Ultrasonic Water-Enema Restoration of Intussusception in Children. *Chinese Journal of Ultrasonography*, 30(9): 800–805.
- [9] Liu F, Wu J, Sun Q, et al., 2018, Value Assessment of Ultrasound Combined with Related Factors in Predicting the Success or Failure of Hydropressure Enema Resuscitation in Pediatric Intussusception. *Chinese Journal of Ultrasound Medicine*, 34(5): 431–434.
- [10] Lv Y, Qiang Q, Wang W, 2022, Application of Ultrasound-Guided Water Pressure Enema in the Diagnosis and Treatment of Acute Intussusception. *Imaging Science and Photochemistry*, 40(1): 147–150.

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