



Clinical Applications of Real Time Ultrasonography in Childhood Intussusception

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ABSTRACT

Objective: *The aim of this study was to assess the diagnostic screening efficacy of sonography in suspected case of intussusception in childhood and its role in guiding hydrostatic reduction, as a non-operative treatment in intussusceptions.*

Methods: *The prospective study included 53 paediatric patients (up to 12 yrs) who were referred to the radiology department with clinically suspected intussusception. Cases with sonological evidence of intussusceptions (32 patients) had undergone hydrostatic reduction with ultrasound guidance. Cases with sonological or other features of peritonitis (fluid with particles) and those who are haemodynamically unstable are excluded.*

Results: *Out of 53 patients with suspected intussusception, 32 patients showed intussusception on ultrasound. With sonography all except one had correct diagnosis; 31 cases were found to have intussusception by means of hydrostatic reduction or surgical correlation. One case where ultrasonography failed was to be a worm mass on laparotomy. No cases found to be negative by ultrasound was later shown with follow up clinical observation to have been positive; so the accuracy of ultrasound was 98.1%*

Conclusion: *Ultrasonography are an accurate and safe modality for diagnosing childhood intussusceptions with thorough knowledge of the characteristic US features. Our study findings demonstrate that ultrasonography -guided hydrostatic saline reduction seems to be a feasible and effective method for the its treatment because of its radiation-sparing effect to either the patient or medical personnel, thus allowing a greater number of attempts at hydrostatic reduction and high success rate.*

Keywords: *Ultrasound, Hydrostatic reduction, intussusceptions.*

Introduction

Intussusception is a common abdominal emergency in infants and children. It occurs when a portion of the digestive tract becomes telescoped into adjacent bowel segment. This condition usually occurs in children between 6 months and 2 years of age where

majority are idiopathic and are ileocolic, but can be seen in older children. Rarely can it occur in neonates and in intrauterine life. Chronic intussusception is also not rare. Currently, prompt diagnosis and effective treatment lead to a favourable outcome in most cases.

The clinical triad of acute abdominal pain (colic), currant jelly stools or hematochezia and a palpable abdominal mass is present in <50% of children with intussusceptions. In some cases, palpable emptiness in right flank or lower right quadrant is present.

Only 30-68% of children with clinical findings suggestive of intussusceptions are shown to have this condition. Superior performance of ultrasound in diagnosing intussusceptions, high patient comfort and safety and its ability to arrive at an alternate diagnosis and its role in non-operative treatment of the condition made it superior among the diagnostic methods. Ultrasound is highly accurate in diagnosis of intussusceptions sensitivity of 98-100% and specificity of 88-100%.

Guidance with Ultrasound permits a more liberal approach to hydrostatic reduction (in contrast to enema therapy) owing to the lack of radiation exposure. Many studies showed high reduction rate (76-95%) with few complications. Rate of perforation is somewhere between 1-3% and recurrence rate between 9-10%.

The aim of this study was to assess the diagnostic screening efficacy of sonography in suspected case of intussusception in childhood and its role in guiding hydrostatic reduction, as a non-operative treatment in intussusceptions.

Materials and Methods

In our prospective study, group comprises paediatric patients (up to 12 yrs) referred with clinical suspicion of intussusceptions. Consent from the parent for ultrasonological examination, hydrostatic reduction and for using the data for the study.

The Institutional Ethics Committee board approved this prospective study, and signed informed consent was obtained from each patient's parent. During the 12 months, intussusceptions were diagnosed in 32 consecutive patients at ultrasonography. We did not analyse abdominal radiographs for the diagnosis of intussusceptions. They underwent 32 attempted hydrostatic reductions with US guidance. The study population included 20 boys and 12 girls. The age at onset ranged from 3 ½ months – 10 yrs.

The ultrasonography system used in this study was a commercially available real time unit (ATL Apogee 800 plus unit or Philips Envisor) with curvilinear and linear array 5-10 MHz transducer or L & T. Ultrasound symphony machines using sector transducers.

After recording history and performing a proper clinical examination, sonological examination is done. Abnormalities detected are noted. Hydrostatic reduction was performed without sedation. Usually, two radiologists were able to perform the procedure, with the main operator performing introduction of saline in addition to holding the patient. However, if the situation required it, one more assistant, nurse was added to our team. The methods we used were as follows. A Foley catheter (10-18 F) was inserted into the patient's rectum, and 20-25 ml of air was injected to inflate the balloon. The Foley catheter was gently pulled down as low as possible. Tape was applied to secure the catheter to each buttock. Finally, the buttocks were firmly taped together to ensure a tight anal seal with the patient in a supine position.

Reduction was attempted with saline enema on body temperature, introduced by Foley's catheter (10-18F). The bottle of normal saline was hung up 1 m over the examination desk. Extra few litres of saline to replace the lost liquids due to incomplete occlusion of rectum are needed. Monitoring of the moving intussusceptum back into proximal direction is done.

No complications have occurred and the pain was relieved immediately after procedure. Once reduction was complete, the water was evacuated from the colon, and the abdomen was re-examined sonologically to determine whether there was any residual lesion or recurrence of intussusception. Usually one or two attempts each lasting 5-10 minutes were needed. Second sonography was done in every case after 12 hours. Minimal edematous wall of ileocaecal valve and terminal ileum noted. On post reduction sonography after successful reduction, the patients were discharged only when they tolerated a regular usual diet and had normal bowel movement. In cases where hydrostatic

reduction cannot be performed or where it is unsuccessful, diagnosis will be confirmed by surgical correlation.

Results

Of the 53 children with suspected intussusception, 32 cases were found to have intussusception on sonography. With sonography all except one had correct diagnosis; 31 cases were found to have intussusception by means of hydrostatic reduction or surgical correlation. One case where ultrasonography failed was to be a worm mass on laparotomy. No cases found to be negative by ultrasound was later shown with follow up clinical observation to have been positive; therefore the accuracy of ultrasound was 98.1%

There were 20 boys and 12 girls ranging in the age from 3 ½ months- 10 yrs (majority of cases <1 yr; except for one 10 yrs old child with ileo ileocolic intussusception).

The common presenting features include abdominal pain 75% (24 out of 32 cases), vomiting 62.5% (28 out of 32 cases), blood in stools 65.6% (21 out of 32 cases-65.6%), palpable abdominal mass 21.8% (7 out of 32 cases), diarrhoea 25% (8 out of 32 cases) and atypical symptoms 12.5% (4 out of 32 cases). Diarrhoea, abdominal mass and atypical symptoms occurred less frequently. Classical triad of symptoms were found in 18.7% (6 out of 32 cases). Out of the 32 cases, sonograms revealed doughnut sign in 30 out of 32 cases (93.7%), pseudo kidney sign in 30 out of 32 cases (96.7%) combination of both signs in 28 out of 32 cases (87.5%). Other sonographic finding included dilated fluid filled small bowel loops in 14 of 32 cases (44%) and minimal free intra peritoneal fluid in 10 of 32 cases (31.2%).

Majority of the cases are located on the right side. 25 (78.1%) out of 32 cases are located in sub hepatic, epigastrium and right lumbar region.

We tried ultrasound guided hydrostatic reduction in 28 cases immediately after diagnosis with sonography; No reduction was attempted in 3 cases. Out of 4 unattempted cases, 2 were with trapped

fluid, the third one was with a lead point and the fourth one was the case with worm mass.

Regarding trapped fluid, 3 cases were found to have trapped fluid in which reduction was attempted in one case which was failure and was found to be lymphoid hyperplasia on surgico-pathologic correlation. In rest of the 2 cases, reduction was not attempted which were proved to be ileo-ileocolic intussusception whereas per literature complete reduction is difficult. So our data favours surgery for cases with trapped fluid.

Regarding lead point, 6 out of 32 cases were found to have lead point. Majority of the cases were found to be idiopathic.

3 out of the 5 cases (60%) with lead point were successfully reduced and in one case reduction was not attempted due to the fear of recurrence. The remaining one case with failed reduction was found to have lymph node as lead point on surgery ileo-caecal valve could be seen clearly in 23 cases (71.8%). Of these ileocaecal values, 21 were edematous and 2 were normal.

In our study, only one case showed recurrence but ultimately found to have no lead points on surgery. So our conclusion is that it is better to attempt reduction in cases with lead point avoiding the morbidity of surgery in most cases. The success rate of attempted hydrostatic reduction was 81.2% (26 out of 32 cases) Remaining 5 included unattempted and unsuccessful cases (5 of 32 cases – 15.6%). Among the unsuccessful cases, one was a case with lymph node as lead point and the other was a worm mass. The cases not attempted were 3, among which 2 were cases with trapped fluid and one with lead point.

Of 32 cases, 29 were of ileo-colic type (70.6%) and 2 were ileo – ileocolic (6.25%) and 1 was worm mass. 6 cases underwent surgery, 2 cases were ileo – ileocolic where segmental resection of ileum was performed due to ileal gangrene; one was found to be worm mass and in remaining 3 cases manual reduction was done among which 2 cases were found to have lead point which ultimately ended in segmental resection and anastomosis.

Our patients have had no complications during or after hydrostatic reduction with normal saline and average time required for hydrostatic reduction with normal saline and average time required for hydrostatic reduction was 20 minutes (few minutes to 50 minutes). In our study, maximum reduction attempts were only two. Only 2 cases of surgically proved ileo – ileocolic intussusceptions were encountered in my study. In both cases, reduction could not be attempted due to the presence of trapped fluid. On retrospective review, patient with ileo-ileocolic intussusceptions did not appear to have clinical features that differ from those of ileo colic group. Both cases of ileo – ileocolic intussusceptions in our study had a similar picture that closely mimicked “double target” appearance. One of the limitations of our study was that we were not able to appreciate the appearance of ileo – ileocolic intussusceptions at the time of reduction since reduction was not attempted. In short, our data suggests that sensitivity in diagnosing intussusception with ultrasound is 100% and specificity is only 95.5%.

Table 1 : Summary of Clinical Results

Clinical parameter	No. of cases (%)
Patient examined	53
Patient in whom intussusceptions was diagnosed with US	32
False positive case	1
Diagnostic accuracy of US	98.1%
Patient in whom reduction was tried	28
Overall success rate	26 (81.2%)
Lead point identified with US	6 (18.7%)
Complications during or after hydrostatic reduction	0



Figure 1: Saline and air bubbles refluxing through ileocaecal valve

Discussion

The sonographic findings of intussusceptions are highly suggestive of the diagnosis, although not totally pathognomonic.

On comparison with Wang and Liu¹ and Woo & Kim² who were having 100% diagnostic accuracy, our diagnostic accuracy was found to be a bit less (96.8%). There was one false positive case in our series which was later proved to be a worm mass.

Still ultrasound proved to be a better initial screening procedure for a patient with suspected intussusceptions.

Bisset and Kirks^{3,4} pointed out the limitations of US examination for routine screening. First, ultrasound findings are suggestive of diagnosis of intussusceptions but are not pathognomonic because other causes of bowel wall oedema may mimic these findings. Second, if there is moderate gaseous distension in the crying child or in a patient with small bowel obstruction, the examination is difficult to perform. Third, success of the study is operator dependent. In our experience also, few limitations were present but still ultrasound findings are highly suggestive of intussusception if clinical signs and symptoms of intussusception exist.

Pre-ultrasound radiograph was not taken in our study but in 3 cases abdomen radiographs were available with the patient which were ordered by the clinician that did not reveal any clue to the diagnosis.

Conclusion

Ultrasonography has permitted more comprehensive understanding of the anatomy and pathophysiology of intussusceptions. As an accurate and safe modality, ultrasonography may also allow one to detect lead points and identify alternative diagnoses. While literature advocated a maximum of 3 reduction attempts, here we tried only 2 attempts which was another limitation of our study.

Nonsurgical treatment of intussusceptions is possible in most cases, especially at institutions with paediatric surgery facilities and personnel for use as a backup. Our study findings demonstrate that ultrasonography-guided hydrostatic saline

reduction seems to be a feasible and effective method for the treatment of intussusceptions in children because of its radiation-sparing effect to either the patient or medical personnel, thus allowing a greater number of attempts at hydrostatic reduction and high success rate. .

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Conflict of Interest – All authors state that there are no conflicts of interest.

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