



Radiodiagnosis

OUTCOME AND DETERMINANTS OF HYDROSTATIC REDUCTION OF INTUSSUSCEPTION UNDER USG GUIDANCE

Dr. Adya Kinkar Panda

Department of Radio diagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha.

Dr Pravakar Bahinipati*

Department of Radio diagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha.
*Corresponding Author

Dr. Abhijeet Joshi

Department of Radio diagnosis, IMS & SUM Hospital, Bhubaneswar, Odisha

ABSTRACT **Background:** Intussusception is a common cause of acute intestinal obstruction sometimes causing serious complications. The treatment of choice is an attempt at initial non-operative treatment.

Aim: The purpose of the study was to evaluate the efficacy of hydrostatic reduction of intussusception using saline enema and ultrasound being practiced in our institute; the secondary goal was to identify the subset of patient in which it is more successful.

Material and Methods : The case records of pediatric patients treated for intussusception in our institute from 1st October 2015 to 30 September 2017 were retrospectively analyzed to collect information. All patients showing ultrasound diagnosed intussusception that were not having signs of shock or peritonitis were treated with normal saline enema under ultrasound guidance. Failure of three such attempts was an indication for operative management.

Result and Conclusions: We found that this technique is easy, safe and extremely effective in treating intussusception in children. The success rate was 80.7% (42 out of 52 cases) and mortality rate was 1%. Ileoileocolic type of intussusception failed enema reduction more often (statistically significant; P value = 0.0032) while older patients (statistically significant, P value = 0.001) had higher success rates with the technique. Patients who had colocolic type of intussusception (P value = 0.29) and patients who present early (P value = 0.262) appear to have higher success rates

KEYWORDS : Intussusception, Therapy, Ultrasonography

INTRODUCTION:

Intussusception is a common cause of acute intestinal obstruction in infants; though it is also seen in older children and adults occasionally⁽¹⁾. Intussusception accounted for 16% of all intestinal obstruction in children in one study from India⁽²⁾

For reasons not known, intussusception is relatively uncommon in Asia and Africa despite the high incidence of infective diarrheal diseases in children found in these regions^(1, 2). Intussusception is managed by an initial attempt at non-operative reduction with saline water enema or air-insufflation through rectum; failure of three attempts or signs of peritonitis are indications for operation.

The best technique, the best imaging modality, patient selection criteria and the optimum protocol to be followed are still under debate; each method has its advantages and disadvantages. Although from western countries there are a number of studies which record the experience of treating intussusception with hydrostatic reduction, from India there are only a few series documented.

In our institution we have been using ultrasound guidance with saline enema to reduce intussusception for the last 5-6years. The aim of this study was to evaluate this technique; the other goal of this study was to identify the subset of patients in which it was more successful. Contraindications for non operative management are hemodynamic instability, peritonitis, and/or abdominal signs of perforation on abdominal X-ray.⁽⁷⁾

AIMS & OBJECTIVES:

- 1) To evaluate the success of hydrostatic reduction of intussusception under USG guidance
- 2) The secondary goal of this study was to identify the subset of patients and determinants which make the procedure successful

INCLUSION & EXCLUSION CRITERIA:

INCLUSION CRITERIA: All pediatrics patients presenting to the OPD or casualty diagnosed sonographically as intussusception.

EXCLUSION CRITERIA: Patients with features of peritonitis or shock

Material and methods:

All patients (N=52) with sonologically diagnosed intussusception from 1st October 2015 to 30 September 2017 were admitted to Pediatric Surgery ward, resuscitated and shifted to radiology department for

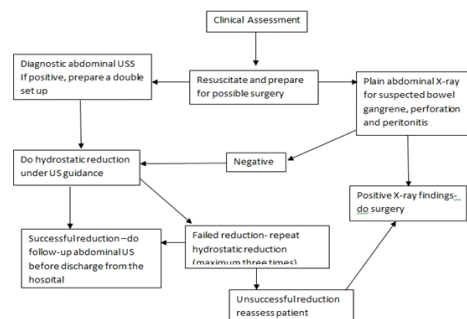
hydrostatic reduction by saline enema. Written informed consent was obtained from the parents for this procedure. With the patient lying in left lateral position a 16–18 Fr Foley's catheter was introduced into the rectum till its Y piece and the balloon was inflated with 20–30 ml of saline. Then the Foley's catheter was pulled back. The enema was performed by holding the container with normal saline about 100–150 cm above the patient and letting the fluid flow down by gravity into rectum through an intravenous infusion set. High resolution ultrasound LOGIQ S7 Expert was used to image the intussusception. A resident from Pediatric Surgery Unit remained in attendance in the department. Child was restrained. Sedation in the form of Injection Diazepam was given if needed. The vital parameters like pulse, B.P were monitored. A maximum of three attempts were made; each attempt was approximately 15–20 minutes in duration, between two attempts 1 hour gap was given.

The criteria of successful reduction are as follows:

- 1) Disappearance of the intussusceptum after passing the ileocecal valve
- 2) Demonstration of fluid-filled small bowel loops
- 3) Demonstration of the ileocecal valve
- 4) Fluid reflux from the cecum into the terminal ileum through the opened lips of the ileocecal valve

All patients who had successful hydrostatic reduction were kept under observation for 24 hours with NPO. Review ultrasound study was done prior to discharge after 48 hours.

All results were analyzed using appropriate statistical tools with the software SPSS version 10.0.



Results:

A total of 52 patients were treated for USG confirmed intussusception in the Pediatric Surgery Unit of our institution in the mentioned time period. Out of these, 32 patients (61.53%) were males and 20 patients (38.4%) were females; the male: female ratio was 1.6:1. The median age in our series was 7 months while mean age was 15.62 ± 26.07 months (mean ± standard deviation); The youngest child was a newborn male aged 17 days while the oldest were two male children 4 years of age. 42 patients had successful reduction with saline enema while in 10 patients it failed and these had to be operated upon; the success rate achieved with the procedure was 80.76 %.

Two patients developed shock and features of peritonitis soon after enema; he was resuscitated and rapidly taken up for surgery. Thus the chances of complications with this procedure in our institution was 3.4%.

Fig. 1 shows the distribution of different types of intussusception in our patients in both the groups. The commonest type noticed in our series was ileocolic (24) followed by colocolic (19) followed by ileoileocolic (05), in 04 cases the sonologist could not identify the specific type on ultrasound scanning.

Out of these types, patients having ileoileocolic type had a statistically significant risk of failing to reduce with hydrostatic reduction (Chi-square test; Odd's ratio = 0.20, RR = 0.29, 95% confidence limits, P value = 0.0032). Hydrostatic reduction appears to be more successful in colocolic type..

8 out of the 52 patients had sonologically detectable lead point in intussusceptum. Patients with a detectable lead point had lesser chances of successful hydrostatic reduction of intussusception (25%) compared to those who had no lead point (89%). Out of 6 cases with detectable lead points who had failure of hydrostatic reduction and were operated, 3 patients had hypertrophied Peyer's patches, 2 patients had polyps and 1 patient had a lipoma.

The diagnostic sensitivity of USG for intussusception in our study was 93.13 %. During follow-up five patients who were successfully treated with saline enema were readmitted later to our institution for recurrence of intussusception hence the recurrence rate was 7.1%. Two patients had recurrent intussusception at 1 month, 1 patient at 4 months and 1 at 6 months following the initial successful treatment. All of these were successfully re-treated with hydrostatic reduction.

TABLE 1:

	All patients	Group 1 Hydrostatic reduction successful	Group 2 Hydrostatic reduction unsuccessful
Number of patients	n=52	n=42	n=10
Age (in months)	15.62 ± 26.07	17.63 ± 28.52	6.87 ± 2.94
Duration of symptoms (in hours)	16.59 ± 20.02	14.99 ± 16.18	23.58 ± 31.51

FIGURE(1)

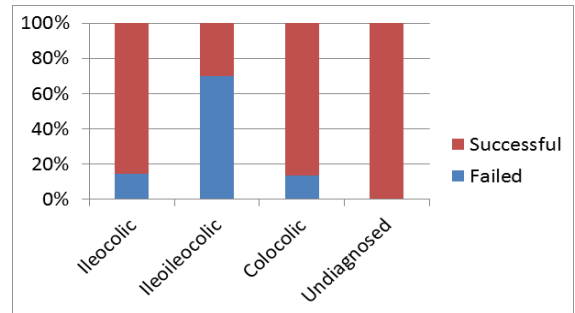


Table 2: Hydrostatic reduction of intussusception; comparison of results between some Asian and Indian studies

Setting of study	Kerala, South India [5]	Kerala, South India [6]	Punjab, North India [7]	Bhubaneswar This study	Saudi Arabia [8]	Iran [9]	China [10]	China [11]	Hongkong [12]	Korea [13]
Number of patients	25	50	5	52	60	76	5217	377	25	116
Success rate	96%	80%	60%	81.3%	83.3%	78.8%	95.5	95.5%	76%	85%
Complications observed	Nil	Nil	Nil	7.1% recurrence rate, Perforation in two cases (3.4%)	Nil	3.8% recurrence rate, Perforation in 1 case	Milk aspiration in 2 cases, 0.17% Colonic perforation.	Nil	Nil	Nil

Discussion:

Harald Hirschsprung of Denmark used saline enema to reduce intussusception in 1871 but it went largely unnoticed^[3]. In 1952, Ravitch and McCune published a famous landmark series from Johns Hopkins hospital in USA; they used barium enema to diagnose as well as reduce intussusception, calling this “hydrostatic reduction”. Ravitch and McCune reported a success rate of 73.6%, no deaths and 5.55% recurrence rate in their original study^[4].

There are relatively few studies on this technique from India and its neighboring countries compared to a large number of studies reported from USA, China, Argentina and Europe. Table 2 provides a comparison between our study and other studies from Asian countries.

Radiology has contributed a lot to the treatment of intussusception from X-ray in 1895, barium contrast enema in 1920s, ultra-sound was introduced into the treatment of intussusception in the 1980s. To diagnose and provide image guidance for hydrostatic reduction of intussusception today, most centers use only high resolution ultrasound. Its sensitivity ranges between 98–100% in various series^[14].

Various sonological signs like 'target' sign, 'pseudo kidney' sign, 'doughnut' sign and 'frond' sign are described in intussusception. The absence of blood-flow in mesenteric vessels on Doppler and presence of free fluid

Indicates intestinal gangrene and perforation respectively even if peritoneal signs are absent; hydrostatic reduction is avoided in these cases.

The practice of barium enema reduction under fluoroscopic guidance has the disadvantage of pathological lead-points being invisible, residual intussusception being missed and substantial dose of radiation being received by the baby. Sonography carries no risk of radiation and is cheaper, can be done at bedside and is repeatable^[14]. Air-insufflation has higher incidence of perforation and occasionally dangerous 'tension pneumoperitoneum' is seen^[16]. In another reported series air-insufflation had 2.8% intestinal perforation rate; in the same institution barium enema reduction had 2.5% intestinal perforation rate^[17]. There is no good randomized controlled trial comparing enema with air-insufflation.].

We have no experience with air-insufflation but to us it appears cumbersome as it requires complicated circuit, pump to blow air, manometers connected to the circuit to guard against over-insufflation. Hydrostatic reduction requires uncomplicated arrangements and no pressure monitoring; the intra-luminal pressure generated by the enema depends only on viscosity of fluid and height of the fluid column, both of these are known prior to the procedure and will not change during it^[16].

Most studies yield low successful reduction rates for ileocecal or ileoileocolic intussusception and higher rates for colocolic type of intussusception; this has never been adequately explained^[4, 14, 15, 16]. A study in which intracolonic pressure generated during air-insufflation to reduce intussusception was studied found “the area of greatest resistance (to hydrostatic reduction) is the region of ileocecal valve”^[21]. This might explain why ileocolic and ileoileocolic type of intussusceptions reduce so poorly.

Duration of symptoms and success of hydrostatic reduction has been studied in one study previously; the authors concluded that “duration of symptoms does not influence success rate with hydrostatic reduction”^[22]. In our patients, however, short duration of presentation was associated with significantly better results.

One study investigated the relative success rates in different age-groups and found that children above 5 years age had highest incidence of pathological lead-points and lowest reduction rates, children below 1 year age also had low success rates in this study but the incidence of lead points compared to other patients was the same; the authors failed to explain this^[23]. In our series the age of patients who had successful reduction had higher age and this was statistically significant. The number of patients in this study is too small to analyze age-group wise; a larger study will be needed.

Conclusion:

Ultrasound guided saline enema is safe and effective in treating intussusception in children with low rate of complications.

The success rate of 81.37 %, and minimal chances of complication of perforation (3.4%) or recurrence (7.1%) in our study compares favorably with other reported series.

Younger children, those who had ileoileocolic type of intussusception, delayed presentation and those with detectable lead point yielded lower success rates.

It appears that early presentation, colocolic type of intussusception and absence of detectable lead point may predict higher success rates with this technique.

References

- Huppertz HI, Gabarro MS, Grimprel E, Franco E, Mezner J, Desselberger U et al (2006) Intussusception among young children in Europe. *Pediatr Infect Dis J* 25:S22–S29
- Gangopadhyay AN, Wardhan H (1989) Intestinal obstruction in Children in India. *Pediatr Surg Int* 4(2):84–87
- Frush DP, Zheng JY, McDermott VG, Bisset GS (1995) Non-operative treatment of intussusception: Historical perspective. *Am J Roentgenol* 165:1066–1070
- Ravitch, Mark M.; Morgan, Russell H (1952) Reduction of Intussusception by Barium Enema. *Ann Surg* 135 (5): 596–604
- Krishnakumar, Hameed S, Umamaheshwari (2006) Ultra-sound guided hydrostatic reduction in the management of intussusception. *Indian J Pediatr* 73:217–220
- Henry PY, Hariharan S, Joseph J (2000) Childhood intus-susception-Saline hydrostatic reduction under ultrasound guidance: a prospective study. *J Indian Assoc Pediatr Surg*: vol-5, issue-2, p 51–57
- Sarin YK, Rao JS, Stephen E (1999) Ultrasound guided water enema for hydrostatic reduction of childhood intussusception-a preliminary experience. *Indian J Radiol Imaging* 9:59–63
- Abdulrahman A, Al-Bassam, Orfale N (1995) Intussusception in infants and children: a review of 60 cases. *Ann Saudi Med* 15(3):205–208
- Alamdaran SA, Zandi B, Sadeghipor S, Esfandiari H (2006) Ultrasound guided hydrostatic reduction of childhood intussusceptions using water enema. *Iran J Med Sci* 31(4):224–227
- Bai YZ, Qu RB, Wang GD, Zhang KR, Li Y, Huang Y et al (2006) Ultrasound guided hydrostatic reduction by saline enema; a review of 5228 cases in 17 years. *Am J Surg* 192(3): 273–275
- Wang GD, Liu SJ (1988) Enema reduction of intussusception by hydrostatic reduction under ultrasound guidance. *J Pediatr Surg* 23(9):814–818
- Peh WC, Khong PL, Chan KL, Lam C, Cheng W, Lam WW et al (1996) Sonographically guided hydrostatic reduction of childhood intussusception using Hartmann’s solution. *Am J Roentgenol* 167 (5):1237–1241
- Wood SK, Kim JS, Suh SJ, Paik TW, Choi SO (1992) Childhood intussusception: ultrasound guided hydrostatic reduction. *Radiology* 182 (1):77–80
- Pendergast L, Wilson M (2003) Intussusception: A Sonographer’s Perspective. *J Diagn Med Sonography* 19(4):231
- Fiorito ES, Cuestas LAR (1959) Diagnosis and treatment of acute intestinal intussusception with controlled insufflation of air. *Pediatrics*; vol-24, 2; Aug: 1959, pp 241–244
- del-Pozo G, Albillos JC, Tejedor D, Calero R, Rasero M, de-la-Calle U et al. (1999) Intussusception in Children: Current concepts in diagnosis and enema reduction. *Radiographics* 19:299–319
- Markowitz RI, Meyer JS (1992) Pneumatic versus hydro-static reduction of intussusception. *Radiology* 183:623–624 Joseph J, Palliyil MM. Non-surgical management for intus-susception in infants and young children. (Protocol) Cochrane Database of Systematic Reviews 2007, Issue 2. Art. No.: CD006476. DOI: 10.1002/14651858.CD006476
- Tellado MG, Liras J, Mendez R, Somoza I, Sanchez A, Mate A et al (2003) Ultrasound guided Hydrostatic reduction for the treatment of idiopathic intestinal invagination. *Cir Pediatr* 16(4): 166–168
- Mallol MJ, Cruz JMR, Hortiguera MEM, Perez JB, Corominas IC (1993) Acute intestinal invagination: Hydrostatic reduction Vs Pneumatic reduction. *An Esp Pediatr* 38 (1):17–19
- Shiels WE, Maves CK, Hedlund GL, Kirks DR (1991) Air enema for diagnosis and reduction of intussusception: clinical experience and pressure correlates. *Radiology* 181: 169–172
- van den Ende ED, Allema JH, Hazebroek FW, Breslau PJ (2005) Success with hydrostatic reduction of Intussusception in relation to duration of symptoms. *Arch Dis Child* 90(10):1071–1072
- Eklöf OA, Johanson L, Lohr G (1980) Childhood intus-susception: hydrostatic reducibility and incidence of leading points in different age groups. *Pediatr Radiol* 10 (2):83–86
- Lanocita M, Castiglioni (1980) Use of glucagons in the re-duction of intussusception; Presentation of one case. *Radiol Med (Torino)* 66 (7–8):513–516