

# **RESEARCH ARTICLE**

# A CLINICAL STUDY OF INTUSSUSCEPTION IN CHILDREN

# Dr. Syeda Siddiqui Banu<sup>1</sup>, Dr. Pramod M.<sup>2</sup>, Dr. Karthik I. Guttedar<sup>3</sup>, Dr. Balaji V.P<sup>4</sup> and Dr. Saravanan K.<sup>5</sup>

- 1. Assistant Professor, Department of Paediatric Surgery, ESIC Medical College and Post Graduate Institute of Medical Science and Research, Rajajinagar, Bengaluru.
- 2. Associate Professor, Department of General Surgery, Gulbarga Institute of Medical Sciences, Kalaburagi.
- 3. Senior Resident, Department of General Surgery, ESIC Medical College and Post Graduate Institute of Medical Science and Research, Rajajinagar, Bengaluru.
- 4. Senior Resident, Department of General Surgery, ESIC Medical College and Post Graduate Institute of Medical Science and Research, Rajajinagar, Bengaluru.
- 5. Senior Resident, Department of General Surgery, ESIC Medical College and Post Graduate Institute of Medical Science and Research, Rajajinagar, Bengaluru.

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## Abstract

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**Background:** Intussusception is one of the classic subjects of paediatric surgery. It is defined as the telescoping of one segment of bowel into another. It is one of the most common paediatric emergencies under the age of 2 years and is an important cause of small bowel obstruction in children; if left untreated leads to fatal complications. Early diagnosis helps to reduce mortality and morbidity. For many years open surgery has been its mode of treatment worldwide but since few years there is a paradigm shift in its management from immediate laparotomy after resuscitation to non-operative management. The current non-operative methods which are being used in the management of intussusception include hydrostatic and pneumatic method i.e., giving enema by using fluid or air. The pneumatic method of reduction of choice for the management of intussusception under ultrasound guidance is emerging as the method of choice for the management of intussusception in children.

#### Aims & Objectives

- 1. To study the clinical profile of paediatric patients with intussusception.
- 2. To assess the ultrasound guided pneumatic reduction of intussusception in children.
- 3. To study the complications and recurrence rate after the ultrasound guided pneumatic reduction of intussusception.

#### **Materials And Methods**

After obtaining Ethical committee clearance from the VIMS Bellary, a prospective case series study of 50 children who were admitted in Vijayanagar Institute of Medical Sciences, Bellary with diagnosis of acute intussusception was conducted. The study period was between November 2012 to April 2014. Informed written consent was obtained from all the cases. Thorough clinical history was taken and

physical examination including per rectal examination was done. All children clinically suspected of having acute intussusception were evaluated by real time ultrasonography and those with positive findings on sonography confirming intussusception were entered into the study. Thusthe clinical profile of intussusception and ultrasound guided pneumatic reduction was studied.

**Results:** Higher male preponderance was observed in our study, out of 50 patients who reported to us, 36 (72%) were males and 14 (28%) were females with highest proportion of cases 34 (68%) seen in the age group of 0 to 1 year. Most of the clinical symptoms were overlapping. The predominant symptoms in most of the cases in our study are excessive crying/abdominal pain seen in all 50 patients (100% followed by vomiting and mass per abdomen seen in 40 (80%) of the cases respectively. Most of the cases 78 (39) were idiopathic type and 22 % (11) cases were secondary to lead points most common lead points being Mesenteric lymph nodes seen in 6 (54.5%) cases followed by Meckel's diverticulum and gut associated lymphoma seen in 2 (18.1%) cases respectively. Appendix as a lead point was seen in 1 case (9.09%). The most common type of intussusception was found to be ileo-colic with 31 (62%) cases being reported.Out of the total 50 patients, 4 had spontaneous reduction of intussusception.Pneumatic reduction under ultrasound guidance was performed in 45 cases and directoperative intervention was carried out in 1 patient. Successful reduction was seen in 38 (84.4%) cases and failure of reduction was seen in 7 (15.55%) cases that were eventually taken up for surgery. No complications of pneumatic reduction, like intestinal perforation; rectal tear, were observed in our study.

Conclusion: Intussusception is one of the most common paediatric emergencies. In ourstudy a higher male preponderance is seen with highest proportion of cases seen in theage group of 0 to 1 year. Two peaks of seasonal variation were observed in our study onein winter and other in summer. Most of the clinical symptoms were overlapping, thepredominant symptoms being excessive crying/abdominal pain, vomiting, mass per abdomen and red currant jelly stools. Majority of cases are idiopathic and are of ileo-colic type. Secondary intussusception occurs due to the presence of lead points. Most common lead points in our study are mesenteric lymph nodes, Meckel's diverticulum,gut associated lymphomas and appendix.With the review of the available literature and observations made in our study, the standard mode of treatment in a child with acute intussusception is non operative. The present study on ultrasound guided pneumatic reduction in children with acute intussusception shows that ultrasound is a simple and reliable method for diagnosis of intussusception. The success rate achieved by Ultrasound guided pneumatic reduction of intussusception is high with no or very few complication rates. The entire reductionprocess can be followed on real time ultrasound and in cases of non-reduction or partial reduction, repeated attempts can be safely performed in the same setting. The occurrenceof surgical lead points increases with age and indicates that the probability of non-operative reduction is unlikely, however ultrasound guided pneumatic reduction can stillbe safely tried in such cases. The use of ultrasound for guiding reduction also has the added advantage of avoiding hazardous radiation exposure to the child as well as the attending surgeon. Ourdata in this studv suggeststhat Pneumatic reduction performed under ultrasoundguidance is a simple, safe, reliable, accurate and less-messier technique for paediatricintussusception with high success rates.

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#### **Introduction:**

Intussusception is one of the classic subjects of Paediatric Surgery. It is defined as the telescoping of one segment of bowel (intussusceptum) into another (intussuscipiens), usually proximal segment into the distal segment of bowel. It is one of the most common paediatric emergencies and an important cause of small bowel obstruction in childrens<sup>[1]</sup> if left untreated leads to fatal complications.

As the mesentery of the proximal bowel is drawn into the distal bowel, it iscompressed which results in venous obstruction and edema of bowel wall. If reduction the intussusception does not occur, arterial insufficiency and bowel wall necrosisfollows progressing to strangulation, transmural gangrene, perforation and peritonitis, which in turn will lead to morbidity and death of the patient<sup>[1]</sup>.

A small proportion of patients may have a spontaneous reduction of intussusception before the diagnosis is confirmed by radiological or surgical techniques. Diagnosis and treatment of intussusception is a combined effort among the paediatrician, the paediatric radiologist and the paediatric surgeon. In the past due to lack of diagnostic modalities, the morbidity and mortality of intussusception was very high.

For many years, open surgery has been its mode of treatment worldwide butsince few years, there is a paradigm shift in its management from immediate laparotomyafter resuscitation to non-operative management. There have been considerable debatesregarding the best method of diagnosis of intussusception and its treatment. The standardoption for treatment of intussusception in the British Isles, in the United States and inmost of Europe was formerly immediate operative reduction. Stress was laid on thenecessity for spectacular haste in moving such patients to operating room but theoperative treatment is associated with increased morbidity and mortality<sup>[1]</sup>.

The non-operative treatment of intussusception has a long, colourful and controversial history that is of interest to paediatric surgeons as well as radiologists, given the decisive influence on reduction techniques after the discovery of X-rays. The management protocol for intussusception shifted from operative to non-operative methods. The identification of the fact that intussusception can be reduced by enema techniques has triggered the methodologies of non-operative reduction.

The current non-operative methods which are being used in the management of intussusception include hydrostatic and pneumatic method, i.e., giving enema, by using fluid or air.Contemporary reduction practices (and controversies) have been evolving for more than three hundred years. Use of enema for non-surgical reduction of ileo-colic intussusception in infants and children was initiated more than 80 years ago.

For a longtime, the enema was given only under general clinical and local palpatory guidance.Reports on pressure and fluoroscopy-guided methods did not start appearing until forty years ago. In the western countries, the main contrast media used for this procedure were barium sulphate suspension and later water-soluble contrast medium mixtures. Rectalinsufflations of air are preferred in China and Argentina, where intussusception is particularly frequent. The use of air or oxygen to reduce intussusception was accepted inNorth America and Europe more than ten years ago.

In most published series, the imaging supervision of non-surgical reduction with various types of contrast agents such as barium, water-soluble contrast medium like gastrograffin and gases like air and oxygen has been performed by means of fluoroscopy with differing levels of radiation exposure regarded as inevitable<sup>[2]</sup>.

The use of air or saline solution helps to avoid this morbiditywhen perforation occurs. There was also a controversywhich existed in the use ofhydrostatic barium and pneumatic enema reduction technique, as to which technique wasbetter. The history is also one of the contentions, especially between advocates of pneumatic and hydrostatic reduction techniques.

Now with the advent of ultrasonography and of its role in diagnosing mostabdominal conditions, it has become the primary investigative modality due to its non-invasive nature. USG has been proven to be a reliable and accurate method in diagnosis of intussusception in infancy and childhood. The role of USG in diagnosis of intussusceptionis

standardized, by picking up either pseudo kidney appearance or doughnut sign of intussusceptions<sup>[4-9]</sup>. Due to its accuracy and with the advent of real-time USG, some have advocated new techniques of reduction of intussusception under ultrasoundguidance by using saline or air.

In both of these techniques the intussusception can bereduced by hydrostatic or pneumatic pressure with the help of saline or air introduced from the rectum respectively. The reduction process is continued until intussusception disappears clinically and ultrasonographically. In an event of perforation, moderateamount of fluid or air, whichever has been used will be detected in the abdominal cavityalong with its disappearance from the colon, which leads to an easy and early detection ofperforation during the process of reduction itself. Moreover, the use of saline or air in theultrasound guided reduction process also eliminates the hazards of barium peritonitis, in an event of perforation<sup>[10-14]</sup>.

However the main advantages of the ultrasound guided pneumatic reductiontechnique are absence of radiation exposure, high accuracy and reliability for monitoring the reduction process, easy and early detection of perforation with minimal soiling of peritoneum and possible improvement of reduction rates<sup>[15]</sup>, in addition to less morbidity and less colonic perforation<sup>[16]</sup>.

Thus use of air being faster, easier and cleaner in contrastwith Barium/ water/normal saline under ultrasound guidance, should be the preferred mode of management of intussusception<sup>[17-19]</sup>. In our institution, pneumatic reduction of intussusception under ultrasound guidance has been usedsince5 years.

There are some contraindications in the use of either hydrostatic or air enemareduction of intussusception in children. These include signs of bowel perforation, peritonitis, shock or a clinically unstable child<sup>[17,19]</sup>. Recurrence is not necessarily an indication for surgery. Each recurrence should be handled as if it were the first episode,provided that each is successfully reduced. Delayed repeat air reduction should bepreserved in case of intussusceptum with significant movement in each attempt and idealtiming for repeat reduction is two to four hours.

Accurate estimates of gender predominance, most common age of presentation, seasonal variation, lead points and modes of conservative or surgical management of intussusception and study of best possible management modality are not available for most of the developing and developed countries<sup>[21]</sup> (WHO/V & B/02.19)

Hence to determine these and to confirm the role of ultrasound guidedpneumatic reductions for acute intussusception, its success rates and complications, thisstudy was initiated.

# Aims & Objectives:

- 1. To study the clinical profile of paediatric patients with intussusception.
- 2. To assess the ultrasound guided pneumatic reduction of intussusception in children.
- 3. To study the complications and recurrence rate after the ultrasound guided pneumatic reduction of intussusception.

# Methodology:

Following is a detailed outline of materials and methods.

This is a prospective case series study where in 50 children who were admitted inVijayanagara Institute of Medical Sciences, Bellary with diagnosis of acuteintussusception from November 2012 to April 2014 were included in the study.

## Study Design:

Prospective Case series study.

#### **Study Setting:**

The study was done under the setting of Surgery Department in atertiary care teaching hospital, VIMS, Bellary.

## **Study Subjects:**

All children with diagnosis of acute intussusceptions admitted in Vims hospital, Bellary from 18 November 2012 to April 2014 were studied.

#### **Inclusion Criteria:**

1. Ultrasonographically diagnosed case of acute intussusception.

2. Age below 12 years.

#### **Exclusion Criteria:**

- 1. Child presenting with signs of peritonitis.
- 2. Child with X-ray findings of bowel perforation.
- 3. Child presenting with features of shock.

To measure the successrate, the following criteria was followed-

#### **Reduction Criteria:**

**Clinical Criteria:** 

1.Stoppage of crying by the child.

- 2 Disappearance of palpable abdominal mass.
- 3. Passage of flatus/faeces.

# Ultrasound Criteria: [22]

1. The single concentric ring representing the swollen terminal ileum instead of themultiple concentric rings (TARGET SIGN) of intussusception.

2. The abrupt transition of bowel wall thickness between the swollen terminal ileumand the proximal normal ileum when scanned along the long axis of the ileum.

#### Sample Size:

50 cases.

## Proforma:

Proforma used for the collection of data (Annexure II)

After thorough history taking and physical examination including per rectal examination, all children clinically suspected of having acute intussusception were evaluated by realtime ultrasonography and those with positive findings on sonography confirmingIntussusception were entered into the study.

The main diagnostic criteria in favour of Intussusception on sonography were:

- 1. Visualization of Intussusceptum, seen as a doughnut shaped or target shapedconfigurationon transverse images with hypo-echoic oedematous bowel surrounding central area of increased echogenicity.
- 2. Pseudo-kidney appearance on the longitudinal image.
- 3. Additional ultrasonographic criteria were a doublemultiple or concentricsign and an atypical target sign with a fluid filled centre.

Plain radiographs of the abdomen were obtained along with the ultrasonography, in few cases with suspected intestinal obstruction. After a diagnosis of intussusception was arrived at by ultrasonographic means and after confirmation that the childwas nothaving any signs of perforation or hypovolemic shock, or sepsis, the child was prepared for pneumatic reduction

Routine blood investigations were sent including serum electrolyte levels and adequate fluid resuscitation was carried out. A nasogastric tube was inserted in all thepatients and aspiration done. The contraindications for pneumatic reduction werepresence of peritonitis, sepsis and shock.

## Procedure Of Usg Guided Pneumatic Reduction Of Intussusception:

An appropriate sized threeway Foley's catheter (20-22 Fr.) is inserted into the rectum of the patient till the bulb is in the rectum proper and balloon is inflated with air to itscapacity. A portable sphygmomanometer dial is connected to one of the port and the airpump is connected to the other port of the foley's catheter.

Airis insufflated under ultrasound control, the intra colonic pressure beingmaintainedbetween 80-120 mm of Hg. The pressure chosen depends on patient age, low pressure ina younger child.

The pressure may fluctuate during insufflation or when the patient iscrying or straining and it can alsodrop between insufflations.

The reduction process is then tracked by means of an ultrasound scanning probethroughout the procedure. The intussusceptum reduces gradually through the ileocecalregion with increasing intra colonic pressure. Reduction of intussusception through ileocaecal junction is the most difficult part which is also evident during open reduction. The transducer of the ultrasound has to be moved quickly to follow the intussusceptum as it isgetting reduced. This is continued till the intussusceptum disappears completely.

Theprocedure is stopped once the clinical and ultrasonographic criteria for reduction of intussusception are met under ultrasound guidance. At least two out of these abovecriteria should be met with to confirm reduction of intussusception.

After achievementof complete reductionre-examination of the abdomen is done byultrasonography to see whether there was any residual or immediate recurrence of intussusception.

If the pneumatic reduction is unsuccessful even after maintaining pressure for half to oneminute, the procedure is repeated again usually after a rest period of 5-10 minutes.

The limit to number of attempts of reduction process was based on the sonographic evidence of reduction process and patient's clinical condition. The limit of maximum number of attempts at one sitting was kept as five in our study.

Failed reductions were surgically managed after initial resuscitation.

After successful reduction, patient is shifted to the wards, with abdominal girth charting;nasogastric aspiration and antibiotic cover is given. A review ultrasound is done after 48hours of successful reduction to see for any recurrence of intussusception.

If present, another attempt to reduce it again is done. Patients were started orally after 48 hours orwhen the peristaltic sounds appeared. Patients with successful reduction were kept in theward under observation for 24 hours to 48 hours.

Before discharge child had per rectalexamination to rule out any intra-procedural complications like rectal tear. All cases werefollowed up on monthly basis.

## **Observations And Results:**

A total number of 50 patients admitted with the diagnosis of acute intussusception at Vijayanagar Institute of Medical Sciences, Bellary were enrolled in this study from 1<sup>st</sup> November 2012 to April 2014 and analysis was done as follows:

Sex	No. of cases	Percentage (%)
Male	36	72
Female	14	28
Total	50	100

**Table 1:Sex** Wise Distribution Of Cases (N=50).

Sex Ratio M:F=2.6:1.0



Out of 50 patients, 36 (72%) were males and 14 (28%) were females. Thus a higher male preponderance was observed in our study.

# **Table 2:** Age Distribution of Intussusception.**Patients (N=50)**

Age in years	No. of cases	Percentage (%)
0-1	34	68
1-3	8	16
3-5	2	4
5-12	6	12

Highest proportion of intussusception cases 34 (68%) were seen in the age group of 0 to 1 year.



SEASONS	DISTRIBUTION	PERCENTAGE (%)
Winter	22	44
Summer	17	34
Monsoon	7	14
Post Monsoon	4	8

**Table 3:**Seasonal Distribution (N=50).

Two peaks of seasonal variation were observed in our study with 22 (44%) of cases occurring in winter and 17 (14%) cases were seen in summer.



#### Table 4:Symptom Profile(N=50).

SYMPTOMS	NO. OF CASES	PERCENTAGE (%)
Excessive crying/ abdominal pain	50	100
Vomiting	40	80
Mass per Abdomen	40	80
Red currant jelly stools	23	46
Fever	20	40
Diarrhoea	15	30
URTI	10	20
Abdominal distension	06	12
Constipation	03	06

The predominant symptoms in most of the cases in our study are excessive crying/abdominal pain seen in all 50 patients (100%) followed by vomiting and mass per abdomen seen in 40 (80%) of the cases respectively and red currant jelly stools were seen in 23 cases (46%) followed by fever in 20 cases (40%), diarrhoea in 15 cases (30%), URTI in 10 cases (20%), Abdominal Distension in 6 cases(12%) and constipation in 3 (6%) of the patients.



# Table 5: Etiologyofintussusception In This Series (N=50).

TYPE	NUMBER	PERCENTAGE (%)
	NONIBER	
Idiopathic	39	/8
Secondary	11	22

Majority of the cases 78% (39) were idiopathic type and 22 % (11) cases were secondary to lead points.



Table 6: Secondary Intussusception: Presence of Lead Points (N=11).

Pathological lead points	No. of cases	Percentage
Enlarged mesenteric lymph nodes	6	54.5
Meckel's Diverticulum	2	18.1
Gut associated lymphomas	2	18.1
Appendix	1	9.09

Among the causes of secondary intussusception mostcommon lead points were Mesenteric lymph nodes seen in 6 (54.5%) cases followed by Meckel's diverticulum and gut associated lymphoma seen in 2 (18.1%) of cases. Appendix as a lead point was seen in 1 case (9.09%).



# **Table 7:** Types of Intussusception(N=50).

TYPES OF INTUSSUSCEPTION	NO. OF CASES	PERCENTAGE(%)
Ileo-colic	31	62
Ileo-ileal	13	26
Caeco-colic	4	8
Ileo-colo-colic	1	2
Colo-colic	1	2

the most common type of intussusception was found to be ileo-colic with 31 (62%) cases being reported, followed by ileo-ileal type with 13 (26%) of cases. Caeco-colic type was seen in 4 cases, Ileo-colocolic and Colo-colic types were seen in 1 caseeach.



**Table 8:** Types of Intervention (N=50).

Types of Intervention	No. of cases	Percentage (%)
Pneumatic Reduction	45	90
Spontaneous reduction	4	8
Direct operative intervention	1	2

Out of the total 50 patients, Pneumatic reduction was performed in 45 (90%) of the cases.Out of which 38 children had successful reduction and 7 had failure of ultrasound guidedpneumatic reduction.Spontaneous reduction of intussusception was seen in 4 (8%) cases and one child was taken up for direct surgery after prompt resuscitation.



## Table 9: Outcome of Pneumatic Reduction (N=45).

Outcome of pneumatic reduction	No. of patients	Percentage (%)
Successful	38	84.4
Failed	7	15.55
Complicated	0	0

Out of total of the 45 cases that were subjected to Pneumatic reduction of intussusception under USG guidance in our study, successful reduction was seen in 38 (84.4%) of the cases and out of remaining 5 cases, 4 children had spontaneous reduction of intussusception and one child was directly subjected to surgery due to septicaemia. Successful reduction was seen in 38 (84.4%) of the cases and failure of reduction is seen in 7 (15.55%) of the cases. No complications due to usg guided pneumatic reduction are seen in our study.



**Table 10:**Attempts For Successful Pneumatic Reduction (N=38).

No. of attempts for reduction	No. of cases	Percentage (%)
1	30	78.9
2	4	10.52
3	3	7.89
4	1	2.63

Out of 50 children, 45 patients were subjected to pneumatic reduction. Successful reduction was in 38 cases. 30 (78.9%) of the cases underwent successful reduction at the first attempt itself, 4 cases (10.52%) at second attempt, 3 cases (7.89%) in third attempt and 1 case (2.6%) in fourth attempt.



Table 11: Results Of Operative Intervention (N	(=8).
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Operative treatment	Number of cases	Percentage (%)
Manual reduction	2	25
Manual reduction and appendicectomy	1	12.5
Intestinal resection (with Meckel's/mass/gangrenous	5	62.5
bowel)		

Out of the 8 cases subjected to surgery, in 7 cases reduction was tried before surgery. In one case as the child presented in shock and septicaemia. Direct surgical exploration was done after resuscitation, caeco-colo-colic intussusception with gangrenous changes was noted. Resection of gangrenous bowel till mid transverse level was done and bowel continuity was maintained with end-to-end ileo transverse anastomosis, child recovered well. Among the 7 cases with failed pneumatic reduction.

Manual reduction of intussusception was done in 2 cases (25%) as repeat pneumatic reduction failed probably due to delayed presentation of the child.

In one case, appendix was found to be the lead point for the development of intussusception so appendicectomy was done after manual reduction of intussusception.

In 2 cases, ileo-caecal complex mass involving the terminal ileum, caecum and appendix was found and hence the mass along with ileocaecal junction was resected and continuity restored by an ileo-ascending anastomosis, both these cases presented with abdominal distension, electrolyte disturbances and anaemia. Electrolytes and anaemia were corrected. HPE report came as gut associated lymphoma in both the cases, thus both patients were referred for chemotherapy.

In the remaining two cases, Meckel's diverticulum was found to be the lead point hence resection of the Meckel's and end to end anastomosis was done after manual reduction of intussusception.

## **Discussion:**

Childrenless than 12 years who presented with the diagnosis of acute intussusception were analysed in our study as follows:

## **Clinical Profile:**

## **1.Sex Distribution of Cases:**

Out of 50 patients who reported to us, 36 (72%) were males and 14 (28%) were females. Thus a higher male preponderance was observed in our study. This is consistent with all text books and with the study: Paediatric intussusception by Stringer MD, et al RJ: Br J Surg 79: 867-76, 1992<sup>[30]</sup>.

#### 2. Age Distribution of Cases:

Highest proportion of intussusception cases 34 (68%) were seen in the age group of 0 to 1 year. As quoted in all text books and mentioned in the studies on intussusception Stringer MD et  $al^{[30]}$  and Guo Jet  $al^{[23]}$ .

#### 3. Seasonal Variation:

The characteristic two peaks of seasonal variation were observed in our study with 22 (44%) of cases occurring in winter and 17 (14%) cases in summer, in accordance to a study by Ravitch M. M., where two peaks of incidence of intussusception one in the spring and summer, possibly the season of gastro enteritis, and another in the mid-winter, during the time of maximal incidence of respiratory illness <sup>[26]</sup> were seen.

## 4. Symptom Profile:

The predominant symptoms in most of the cases in our study are excessive crying/abdominal pain seen in all 50 patients (100%) followed by vomiting and mass per abdomen seen in 40 (80%) of the cases respectively, mass per abdomen could not be palpated in patients who presented with abdominal distension. Red currant jelly stools were seen in 23 cases (46%) followed by fever in 20 cases (40%), diarrhoea in 15 cases (30%), URTI in 10 cases (20%), Abdominal Distension in 6 cases(12%) and constipation in 3 (6%) of the patients. Most of these symptoms were overlapping.

SYMPTOMS	NO. OF CASES	TOTAL
Excessive crying/ abdominal pain	50	100
Vomiting	40	80
Mass per Abdomen	40	80
Red currant jelly stools	23	46
Fever	20	40
Diarrhoea	15	30
URTI	10	20
Abdominal distension	06	12
Constipation	03	06

#### 5. Etiology of Acute Intussusception and Causes of Secondaryintussusception:

Majority of the cases 78% (39) were idiopathic type and 22 % (11) cases were secondary to lead points. Among the causes of secondary intussusception mostcommon lead points were Mesenteric lymph nodes seen in 6 (54.5%) cases

followed by Meckel's diverticulum and gut associated lymphoma seen in 2 (18.1%) of cases. Appendix as a lead point was seen in 1 case (9.09%).

# 6. Type of Intussusception:

In our study the most common type of intussusception was found to be ileo-colic with 31 (62%) cases being reported, followed by ileo-ileal type with 13 (26%) of cases. Caeco-colic type was seen in 4 cases, Ileo-colocolic and Colo-colic types were seen in 1 caseeach. In all cases enrolled in our study after clinical examination and detailed history the diagnosis of acute intussusception was confirmed by ultrasonogram.

## 7. Types of Intervention:

Out of the total 50 patients, Pneumatic reduction was performed in 45 (90%) of the cases.Out of which 38 children had successful reduction and 7 had failure of USG guidedpneumatic reduction.Spontaneous reduction of intussusception was seen in 4 (8%) cases and one child was taken up for direct surgery after prompt resuscitation.

## 8. Outcome of Ultrasound Guided Pneumatic Reduction:

Out of total of the 45 cases that were subjected to Pneumatic reduction of intussusception under USG guidance in our study, successful reduction was seen in 38 (84.4%) of the cases. That is a little lower than the previous results obtained by Hadidi et al in  $1999^{[19]}$  and El Saket in  $2004^{[28]}$  giving a success rate of 90%. However our success rates of 84.4% in our study is higher than those of Supika Kritsaneepaiboon et al  $74\%^{[21]}$  and M A Zulfiqar et al,  $73\%^{[22]}$ , K M Kiran Kumar, et al  $76\%^{[23]}$ , Niramis R, et al. 7.1%.

No perforations were seen in our study in contrast to perforations seen in various studies including those by SupikaKritsaneepaiboonet al  $74\%^{[21]}$ , Yoon et al<sup>[14]</sup>, Niramis R et al<sup>[15]</sup>.

Failure of reduction was seen in 7 (15.55%) of the cases. The cases with failed reductions were explored surgically. In two cases manual reduction was done and definitive lead points were noted in 5 cases, out of which 2 children had Meckel's diverticulum, 2 had gut associated lymphoma and 1 child had appendicitis.

These results clearly state that pneumatic reduction of intussusception can fail only in the presence of lead points or in cases of loss of bowel vascularity. Out of the 38 cases of successful pneumatic reduction of intussusception, 30 (78.9%) of the cases underwent successful reduction at the first attempt itself, 4 cases (10.52%) at second attempt,3 cases (7.89%) in third attempt, and in 1 case (2.6%) four attempts were done. In the first three cases multiple attempts at reduction were performed in the first admission itself, whereas in the last case three recurrences were seen in the first admission and the child wasdischarged after successful pneumatic reduction after three attempts, however the child presented with recurrence again after one month which got reduced successfully after USG guided pneumatic reduction viz in fourth attempt, it didn't require open exploration as noobvious lead point was noted.

A detailed comparison of Success rates of pneumatic reduction of intussusceptions given in the table below:

Table 12.5howing the success fales of 050 guided pheumatic feddetion of intussusception in various studies.		
AUTHORS	SUCCESS RATE OF PNEUMATIC	
	REDUCTION UNDER USG GUIDANCE	
	(%)	
Guo6, 1986, China <sup>[33a]</sup>	94	
Jinzhe29, 1986, China <sup>[33b]</sup>	91	
Tamanaha30, 1987, Japan <sup>[33c]</sup>	81	
Stringer31, 1990, Canada <sup>[32]</sup>	80	
Glover32, 1991, Australia <sup>[33d]</sup>	75	
Shiels33, 1991, USA <sup>[68a]</sup>	87	
Palder34, 1991, Canada <sup>[68b]</sup>	76	
Renwick35, 1992, Australia <sup>[68c]</sup>	74	
Hadidi et al 1997, Cairo, Egypt <sup>[79]</sup>	90	
El Saket in 2004 <sup>[78]</sup>	90	
M A Zulfiqar et al, 2006 <sup>[82]</sup>	73	

Table 12:Showing the success rates of USG guided pneumatic reduction of intussusception in various studies:

Kaiser3, 2007, USA <sup>[86]</sup>	52
Ramachandran36, 2008, India <sup>[87]</sup>	89
Niramis R, et al <sup>[85]</sup> 2009, Thailand	67
Supika Kritsaneepaiboonet al, 2011, Thailand <sup>[81]</sup>	74
K M Kiran Kumar, et al 2014, India <sup>[83]</sup>	76
Present study	84.4

## 9. Outcome of Operative Intervention:

Totally 8 cases were subjected to surgery. 7 cases were posted to surgery after failure of USG guided pneumatic reduction:

Manual reduction of intussusception was done in 2 cases (25%) as repeat pneumaticreduction failed probably due to delayed presentation of the child.

In one case appendicitis was found to be the lead point for the development of intussusception so appendicectomy was done after manual reduction.

In two cases ileo-caecal complex mass involving the terminal ileum, caecum and appendix was found and hence the mass along with ileo-caecal junction was resected and continuity restored by an ileo-ascending anastomosis. Both these cases presented with abdominal distension, electrolyte disturbances and anaemia. Electrolytes and anaemia were corrected. H.P.E report came as gut associated lymphoma in both the cases, thus both patients were referred for chemotherapy.

In the remaining two cases, Meckel's diverticulum was found to be the lead point hence resection of the Meckel's and end to end anastomosis was done after manual reduction of intussusception.

The child who presented in shock and septicaemia, was subjected to direct surgical exploration after resuscitation. Caeco-colo-colic intussusception with gangrenous changes was noted, resection of the gangrenous bowel till mid transverse level was done and bowel continuity was maintained with end to end ileo-transverse anastomosis, child recovered well.

## Summary

A prospective case series study of 50 children admitted in Vijayanagara Institute of Medical Sciences, Bellary with diagnosis of acute intussusception was conducted from November 2012 to April 2014.

Complete clinical profile of intussusception was assessed and the following results were obtained:

1. Higher male preponderance was observed in our study, out of 50 patients who reported to us, 36 (72%) were males and 14 (28%) were females.

2. Highest proportion of intussusception cases, 34 (68%) were seen in the age group of 0 to1 year.

3. The predominant symptoms in most of the cases in our study are excessive crying/abdominal pain seen in all 50 patients (100%) followed by vomiting and mass perabdomen seen in 40 (80%) of the cases respectively; mass per abdomen was not seen inpatients who presented with abdominal distension and red currant jelly stools were seen in 23 cases (46%) followed by fever in 20 cases (40%), diarrhoea in 15 cases (30%), URTI in 10 cases(20%), Abdominal Distension in 6 cases(12%) and Constipation in 3 (6%) of the patients. Most of these symptoms were overlapping.

4. In most of the cases no obvious cause for intussusception was found. 78% (39) of the cases were idiopathic type and 22 % (11) cases were secondary to lead points. Most common lead points found were Mesenteric lymph nodes seen in 6 (54.5%) cases followed by Meckel's diverticulum and gut associated lymphoma seen in 2 (18.1%) of cases respectively. Appendix as lead point was seen in 1 case (9.09%).

5. In our study the most common type of intussusception was found to be ileo- colic with 31 (62%) cases being reported.

6. Out of the total 50 patients, Pneumatic reduction was performed in 45 (90%) of the cases and direct operative intervention was carried out in 1 (2%) case. Spontaneous reduction was seen in 4(8%) cases.

7. Successful reduction was seen in 38 (84.4%) of the cases, failure of reduction was seen in7 cases.

8. No other complications of pneumatic reductionlike intestinal perforation, rectal tearwas observed.

# **Conclusion:**

Intussusception is one of the most common paediatric emergencies. Our study showed a higher male preponderance with highest number of cases seen in the age group of 0-1 year. Two peaks of seasonal variation were observed in our study one in winter and other in summer. Most of the clinical symptoms were overlapping the predominant symptoms being excessive crying/abdominal pain, vomiting, mass per abdomen and red currant jelly stools. Majority of cases are idiopathic and are of ileo-colic type. Secondary intussusception occurs due to the presence of lead points. Most common lead points in our study are mesenteric lymph nodes, Meckel's diverticulum, gut associated lymphomasand appendix.

With the review of the available literature and observations made in our study, thestandard mode of treatment in a child with acute intussusception is non operative. Thepresent study on ultrasound guided pneumatic reduction in children with acuteintussusception, shows that ultrasound is a simple and reliable method for diagnosis ofintussusception. The success rates achieved by ultrasound guided pneumatic reduction ofintussusception are high with no or very few complication rates. The entire reductionprocess can be followed on real time USG and in cases of non-reduction or partialreduction repeated attempts can be safely performed in the same setting. The occurrence of surgical lead points increases with age and indicates that the probability of non-operative reduction is unlikely, however ultrasound guided pneumatic reduction can still be safely tried in such cases.

The use of ultrasound for guiding reduction also has the added advantage of avoiding hazardous radiation exposure to the child as well as the attending surgeon. Our data in this study suggests that Pneumatic reduction performed under ultrasound guidance a simple, safe, reliable, accurate and lessmessiertechnique for paediatric intussusception with high success rates.

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