



# OUTCOME OF ULTRASOUND GUIDED REDUCTION OF INTUSSUSCEPTION USING NORMAL SALINE: EXPERIENCE OF A TERTIARY CARE HOSPITAL OF PESHAWAR, PAKISTAN

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## ABSTRACT

**OBJECTIVE:** To determine the success rate of ultrasound guided hydrostatic reduction of intussusception using normal saline as an alternative to laparotomy.

**METHODS:** This prospective cross-sectional study was conducted at Pediatric Surgery Department, Khyber Teaching Hospital, Peshawar from January-September 2018. Eighty patients aged between 3-24 months with clinical signs, symptoms and confirmatory sonographic evidence of intussusception were included in study. Procedure was carried out under ultrasound guidance using normal saline as medium for reduction. Maximum, three attempts were made each lasting 5-10 minutes.

**RESULTS:** Mean age of patients was  $11.9 \pm 4.8$  months. Majority (n=60/80; 75%) of patients were males. Thirty-five percent of patients (n=28/80) presented on second day followed by 32.5% (n=26/80) on first day. Mean time for presentation was  $2.1 \pm 0.9$  days. Most common type of intussusception was ileo-colic (n=72/80; 90%). Overall success rate was 82.5% (n=66/88). Success rate for patients presented within first day was 96.2% (n=25/26) as compared to 85.7% (n=24/28) in patients presented in 1-2 days and 65.3% (17/26) in patients presented after two days. Reduction time of intussusception ranged from 5-30 minutes with mean time of  $17.5 \pm 1.4$  minutes. In 76.3% (n=61/80) cases, intussusception was reduced within 20 minutes. In 14 (17.5%) patients, reduction could not be achieved (gangrenous gut=5, Meckel's diverticulum=3, illeo-ileal intussusception=1, perforation=5). Recurrence rate of intussusception was 7.5% (n=6/80), including 4 (5%) cases within 24 hours and 2 (2.5%) cases within 2 months after reduction.

**CONCLUSION:** Ultrasound guided hydrostatic reduction of intussusception is an effective way to reduce intussusception, especially in patients presenting within two days.

**KEY WORDS:** Intussusception (MeSH); Hydrostatic reduction (non-MeSH); Radiological guided reduction (non-MeSH).

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## INTRODUCTION

Intussusception is defined as invagination of one part of intestine into other and it is one of the common pediatric surgical emergency in age less than one years.<sup>1</sup> The incidence ranges from 2-4 per 1000 infants and children.<sup>2</sup> Episodic abdominal pain, vomiting and bleeding per rectum are the chief symptoms of intussusception. Examination sometimes reveals palpable mass in the abdomen however the initial radiological study for detection of

intussusception is ultrasound. Target sign also known as Donought sign or Bull's Eye sign is the diagnostic sign of intussusception on ultrasound.<sup>3,4</sup>

Treatment of choice of intussusceptions has remained controversial and vary from centre to centre.<sup>5</sup> Surgical exploration was the main treatment in the past and still practiced as first line treatment in some centers. Intussusception that has been primarily managed surgically results in significant load on theatres, increased cost and prolonged hospital stay.

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However, for past two decades there is a trend to reduce intussusception under radiological guidance using different materials like saline, barium and air.<sup>5</sup>

Ultrasound guided reduction has been successfully done in different centres according to literature review.<sup>6</sup> There is still controversy as to which technique is the best among barium, saline, air etc.<sup>7</sup> Saline being more physiological is preferred in most centres routinely. Ultrasound is easily available and cheap modality hence making it cost effective for patients and because of its availability radiologists are familiar with its use.<sup>7</sup> It also avoids radiation exposure that occurs with fluoroscopy. Being the initial investigation for diagnosis of intussusception, ultrasound guided reduction can be done in the same setting as soon as it is diagnosed. The advantage of ultrasound guided reduction over surgical treatment is that there is decreased hospital stay, less patient morbidity, early feeding and lesser complications.<sup>8</sup>

Different success rates have been reported by studies all over the world. Using saline as a medium for reduction, 75%-95% success rates have been reported.<sup>9,10</sup> Complication rates of 5%-30% have been reported which includes failed reduction, vomiting during procedure, perforation and recurrence.<sup>11</sup>

In our region most of the cases of intussusceptions are dealt by surgery. Due to higher success rates of reduction of intussusceptions, using such a

**TABLE I: SUCCESS OF REDUCTION OF INTUSSUSCEPTION WITH RESPECT TO DURATION OF SYMPTOMS (N=80)**

Duration of symptoms (days)	Reduction		Total
	Yes	No	
1	25 (96.2%)	1 (3.8%)	26
2	24 (85.7%)	4 (14.4%)	28
3	13 (72.2%)	5 (27.8%)	18
4	4 (50%)	4 (50%)	8
Total	66 (82.5%)	14 (17.5%)	80

minimally invasive procedure has shown its superiority over surgery and improves the management of this common condition. The aim was to identify the success rate of hydrostatic reduction of intussusceptions through using normal saline as a medium for reduction under ultrasound guidance and to find the rate of complications encountered during this study.

**METHODS**

This prospective cross sectional study was conducted in pediatric surgery unit in collaboration with Radiology and Anesthesia Departments of Khyber Teaching Hospital, Peshawar, Pakistan, from January 2018 to September 2018, after approval from ethical review board. Total sample size calculated using WHO calculator with confidence interval of 95% using non-probability consecutive sampling was 80. All patients fulfilling the following criteria were included in the study:

1. Age 3 months to 24 months.
2. Symptoms of abdominal pain, bilious vomiting, red currant jelly stools
3. Ultrasound proven intussusception.
4. Intussusception not prolapsing out of anus.
5. Symptoms less than 4 days old

All patients aging more than 2 years, those having signs of peritonitis (tense, tender and distended abdomen) and those in unstable condition (shock, sepsis) were excluded from the study. All the 80 patients included in the study were admitted to Pediatric Surgery Unit. Nasogastric tube was passed and intravenous fluids and antibiotics (ceftriaxone and metronidazole) were administered after the diagnosis. Baseline investigations including full blood count, blood gases, serum electrolytes, renal functions were performed and blood arranged according to the group. After informed consent from the parents, Radiology and Anesthesia Departments were informed about the procedure and a table was arranged in the theatre at the

same time in case of any complication including perforation or failed reduction. Prior to shifting to radiology suit, a 22G three-way Foley's catheter was inserted into rectum and balloon inflated with saline drip attached to the catheter. Pre-procedure steroids inj. Solu-Cortef (hydrocortisone 25mg) IV bolus were given. Patient was sedated with 0.5-1 mg/kg Midazolam given intravenously by the anesthetist with monitoring of vitals. Intussusception was then located sonographically. Saline drip was kept at a height of 100cm and the fluid allowed to flow under gravity until it reached the intussusceptum when compression of the fluid was done using blood pressure cuff until maximum of 120mm of mercury(Hg) and further changing the position of the patient. Attempt at reduction was continued for 5-10 minutes. If first attempt failed then second and third attempt of same durations about 5 minutes apart were attempted. The reduction of intussusception was observed sonographically and reduction was said to be done if it fulfilled the following criteria;

1. Disappearance of intussusception on ultrasound.
2. Free flow of fluid from caecum into ileum.
3. No evidence of intussusception on ultrasound after the evacuation of saline.

Post procedure all patients were shifted to ward with NG tube in place. Patients were kept NPO until bowel sounds were audible or stools or flatus passed. Repeat scans were performed 12 hours after the procedure for all patients. The patients were discharged after 24 hours and were followed up as outpatient for 6 months with 1<sup>st</sup> follow up visit done at 2 weeks. Subsequent visits after 2 months and 3 months respectively. The parents were advised to return to ER if the symptoms recur anytime. When all the three attempts failed to reduce the intussusception or perforation occurred the procedure was stopped and patient

shifted to theatre for exploration.

All data was analyzed by using SPSS Version 20. Success rate as well as complications which is qualitative data (categorical data) was expressed in frequencies and percentages. This categorical data was expressed pictorially as bar charts or pie diagram. All the results were presented as tables and graphs.

**RESULTS**

Out of 80 patients, 60 (75%) were males and 20 (25%) were females. The age ranged between 3 to 23 months with a mean age of 11.9±4.8 months. Thirty-five percent of patients (n=28/80) presented on second day followed by 32.5% (n=26/80) on first day. Mean time for presentation was 2.1±0.9 days. Most common type of intussusception was ileo-colic (n=72/80; 90%), followed by ileo-ileocolic (n=5/80; 6%), colocolic (n=2/80; 2.5%) and ileo-ileal (n=1/80; 1.25%). Overall, success rate was 82.5% (n=66/88). Mean time for reduction was 17.5±1.4 minutes and ranged from 5 minutes to 30 minutes. The time required for reduction, increased with increasing duration of symptoms. Success rate for patients presented within first day was 96.2% (n=25/26) as compared to 85.7% (n=24/28) in patients presented = 1-2 days (Table I).

Reduction time of intussusception ranged from 5-30 minutes with mean time of 17.5±1.4 minutes. In 76.3% (n=61/80) cases, intussusception was reduced within 20 minutes and in 6.3% (n=5/80) from 21-30 minutes (Table II).

In 14 (17.5%) patients, reduction could not be achieved. These patients were shifted to operation theatre where laparotomy was performed. Out of these fourteen patients, 5 (6.3%) patients had gangrenous gut for which resection anastomosis was done while the 3 (3.8%) had Meckel's diverticulum as lead point who also underwent resection and primary anastomosis and 1 (1.3%) had illeo-ileal intussusception while 5(6.3%) patients had perforation during the procedure. During reduction 6 patients had vomiting. There is no mortality reported in our study.

Recurrence rate of intussusception was 7.5% (n=6/80). Out of these 6 patients,

**TABLE II: TIME REQUIRED FOR REDUCTION OF INTUSSUSCEPTION WITH RESPECT TO DURATION OF SYMPTOMS**

Duration of symptoms (days)	Time of reduction (minutes)					Failed Reduction	Total number of patients
	Up to 5	6-10	11-15	16-20	21-30		
1	2 (7.7%)	8 (30.8%)	9 (34.6%)	4 (15.4%)	2 (7.7%)	1 (3.8%)	26 (32.5%)
2	1 (3.6%)	8 (28.6%)	7 (25%)	8 (28.6%)	0 (0%)	4 (14.3%)	28 (35%)
3	0 (0%)	5 (27.7%)	3 (16.7%)	4 (22.2%)	1 (5.6%)	5 (27.7%)	18 (22.5%)
4	0 (0%)	0 (0%)	0 (0%)	2 (25%)	2 (25%)	4 (50%)	8 (10%)
Total	3 (3.8%)	21 (26.3%)	19 (23.7%)	18 (22.5%)	5 (6.3%)	14 (17.5%)	80 (100%)

4 patients had recurrence within 24 hours of procedure and were successfully reduced under ultrasound guidance. Two patients reported with recurrence after 2 months. Ultrasound guided reduction was attempted but couldn't be reduced so open surgery was performed and per operative findings were ileo-ileocolic intussusception which were reduced manually.

**DISCUSSION**

In our study, success rate of ultrasound guided hydrostatic reduction of intussusception using normal saline was 82.5%. Intussusception is one of the frequently occurring emergencies in infants and toddlers.<sup>12</sup> The incidence in males is higher than females as is evidenced by our study.<sup>13</sup> Most common finding in this study was ileo-colic intussusception (90%), as is reported by the literature.<sup>14</sup>

Being the definitive way of management in the past, surgery is still used as primary mode of treatment in different centres.<sup>15</sup> However due to difficulties associated with surgery including long hospital stay, morbidity, pain, anesthesia complications, cost and post-op adhesions the radiological reduction has gained popularity.<sup>16</sup> Although the recurrence rate of non-operative management of intussusception is a bit higher than the operative management it is still comparable with it.<sup>17</sup> So being an easy, cost effective and having less morbidity and short hospital stay of the patient the ultrasound guided reduction of intussusception has become gold standard in most setups.<sup>9</sup>

In this study the success rate was 82.5% which is comparable with the study performed by Mensah Y, et al.<sup>10</sup> Similar success rate is also reported by Tander B, et al.<sup>18</sup> During reduction only 6 patients had vomiting.<sup>19</sup> Aspiration was prevented by keeping the child in lateral decubitus position.

Patients having failed reduction had either secondary lead point or

gangrenous bowel. While some patients had ileo-ileal intussusception which can not be approached via enema reduction of any kind and needs surgical exploration. One of the reason of failed reduction was perforation during the procedure. Similar complications have also been reported by Ocal S, et al. and Xiaolong X, et al.<sup>20,21</sup> The perforation rate is comparable with reported rate in different studies.<sup>22,23</sup> The gangrenous gut occurred in 5 patients all of whom have symptoms more than 3 days old. The percentage of failed reduction jumped to 50% in patients presenting after 4 or more days as compared to 5-10% when presented within first 2 days. Similar data has been reported by Talabi AO, et al.<sup>11</sup> Hence, we conclude that the duration of symptoms is an important parameter while considering radiological guided hydrostatic reduction. We do not recommend doing hydrostatic reductions in patients with symptoms more than 4 days.

The success rate is similar to different studies performed in other centres of South-Asia, however, lower than those of developed countries.<sup>24</sup> The better success rates in this study as compared to some of the regional and local studies is because of slight modification in our technique which is giving steroids before procedure which in our opinion reduces the edema and helps in hydrostatic reduction.

We recommend that ultrasound guided reduction of intussusception using normal saline should be a primary modality of treatment for treating intussusception. We also recommend that further studies should be carried out regarding the role of pre-procedure Steroids in hydrostatic reduction of intussusception.

**CONCLUSION**

Ultrasound guided reduction using normal saline is a safe, effective and a cheaper method for the treatment of intussusception, especially in patients who present early. There is high success rate, fewer complications and lower

rates of recurrence as well as avoidance of complications associated with surgery and anesthesia and there is no exposure to radiation.

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### AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

**FA:** Conception and study design, acquisition of data, drafting the manuscript, critical review, approval of final version to be published

**MU & DI:** Acquisition, analysis and interpretation of data, drafting the manuscript, approval of final version to be published

**UN:** Analysis and interpretation of data, critical review, approval of final version to be published

**IUR:** Conception and study design, critical review, approval of final version to be published

*Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.*

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Authors declared no conflict of interest

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#### DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.



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