



Original Article

Ultrasound Guided Hydrostatic Versus Open Reduction in Intussusception

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ARTICLE INFO

Key Words:

Ultrasound-guided Hydrostatic Reduction, Open Reduction, Intussusceptions, Successful Reduction, Recurrence, Hospital Stay

How to Cite:

Hameed, S. ., Haider, N., Rehman, W. U. ., Hashim, I. ., Ahmed, A. ., Shahbaz, F. ., & Saleem, M. . (2022). Ultrasound Guided Hydrostatic Versus Open Reduction in Intussusception: Ultrasound Guided Hydrostatic Reduction. *Pakistan Journal of Health Sciences*, 3(06).
<https://doi.org/10.54393/pjhs.v3i06.370>

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Received Date: 14th November, 2022

Acceptance Date: 27th November, 2022

Published Date: 30th November, 2022

ABSTRACT

The surgical and nonsurgical technique has been utilized to manage intussusception. Surgical management of intussusceptions involves open laparotomy along with manual reduction. The non-surgical technique, Ultrasound-guided hydrostatic reduction (USGHR) is a renowned alternative technique for intussusception reduction. **Objective:** To compare the ultrasound-guided hydrostatic reduction versus open reduction for the management of intussusception in terms of successful reduction, recurrence, and hospital stay. **Methods:** It was a randomized controlled trial in which 158 cases were admitted through the Emergency Department of Pediatric Surgery of The Children's Hospital Lahore, from August 2018 to August 2019. These patients were divided into 2 groups (79 in each group), Group A (ultrasound-guided hydrostatic reduction) and group B (open reduction). Data were collected through a questionnaire, which was entered into the computer using SPSS version 24.0. **Results:** Among 79 patients treated in-group A, 54.4% were up to 12 months old, and 67.1% males, in this group the hospital stay for 74.7% was 1-2 days and 74.7% had a successful reduction. In group B; patients treated in group B, 77.2% were up to 12 months old, and 72.2% were males. The hospital stay for 59.5% of patients was 5-7 days, and 83.5% had a successful reduction of intussusceptions. The recurrence was only in group B (3.8%) after the reduction of intussusceptions. **Conclusion:** The study concluded that ultrasound-guided hydrostatic is effective in terms of successful reduction, recurrence and hospital stay and should be preferred among children due to its safety and effectiveness.

INTRODUCTION

Intussusception was first described in 1692 [1]. It is acquired invagination of the intestine, one portion invaginates in the adjoining bowel. Its prevalence is about 31 to 38/1per 00,000 live births cases during 1st & 2nd year of the life respectively [2]. Males are three times commonly affected by intussusception than females. It has been classified, according to the area of involvement, for example, ileo-ileo-colic, ileo-colic, ileo-ileal, colo-colic, and jejuno-jejunal [3]. Most of intussusceptions (90%) are ileocolic and remaining 10% are of colo-colic or ileo-ileal type [4]. Intussusception clinical presentations could

differ and can comprise non-specific symptoms like crying episodes, vomiting, sluggishness and abdominal pain. Appearance of stool "currant jelly", delayed finding while indicator for the bowel ischemia, is seen among majority of cases. Ultrasonography is investigation of choice in current era for intussusception [5]. Nonsurgical and surgical technique has been utilized to manage the intussusception. Surgical management of intussusceptions involves open laparotomy along with manual reduction. The USGHR is also a popular treatment method to treat intussusceptions. This technique is much

simple, economical, efficient and quick for the management of intussusception [6]. The USGHR other advantages comprise patients less discomfort, less mortality and morbidity and less hospital stay when compared with surgical treatment [7]. Besides its benefits, open reduction is still preferred by majority of pediatric surgeons in our country. The main reasons are lack of surgical and radiological expertise and hesitancy to accept new modality. Furthermore, no authentic study has been performed till date in Pakistan. The objective of this study is to do the comparison of ultrasound guided hydrostatic reduction versus open reduction in intussusception in terms of successful reduction, recurrence and hospital stay [8].

METHODS

It was a Randomized controlled trial conducted in one year from August 2018 to August 2019 at department of Pediatric Surgery with the collaboration of Radiology Department of Children Hospital Lahore. A total of 158 cases were taken and divided into 2 groups (79 in each group). The sample size is calculated using the World Health Organization sample size determination in health sciences software version 2.0. for randomized control trial studies parameters for estimating an odd ratio with specific relative precision of 30 % (0.30), with confidence interval of 95%, anticipated probability of exposure given diseases (P1) 0.46, anticipated probability of exposure given no disease (P2) 0.30 and anticipated odd ratio of 2.0 was opted using the following formula. A total sample size of 158 was calculated which includes 100 cases and 58 age-matched controls. The patients of age ≤ 15 years of either gender with intussusception presenting within 48 hours after the development of the symptoms were included. While patients with recurrent intussusception, non-idiopathic intussusception with lead point on (USG) and children with radiological evidence of Pneumoperitonium or with features of peritonitis were excluded. Children fulfilling inclusion criteria were taken in this study from emergency department of Pediatric surgery of Children Hospital Lahore. After taking informed consent from parents or attendants of the children a detailed history was taken along with their age, gender and address. Following the physical examination, biochemical tests, blood grouping and cross matching, ultrasound abdomen and abdominal X-ray in erect position were done for all cases. Ultrasound linear array transducer of 7.5 to 10MHz using ALOKA SSD5500 was used. After resuscitation and making diagnosis with the help of ultrasound patients were assigned a group by lottery method. In group A (ultrasound guided hydrostatic reduction group) after giving sedation, abdominal ultrasound was performed in the transverse and

longitudinal planes to establish a diagnosis of intussusception and localize the region of the abdomen where the lesion is situated which is recognized by the 'dough nut' and 'pseudo kidney' signs. An appropriate sized Foley's catheter was passed per rectum lubricated with 2% lignocaine and the balloon inflated (with 7-10ml of N/S) and secured in situ. The buttocks were be taped together to provide a seal. The saline was heated to 37 oC injected in upright position and kept at a height of 100cm above the bed level. 100 cm height gave approximately 73 mmHg of pressure. The hydrostatic pressure was monitored by a sphygmomanometer attached to the Foley's catheter by way of a T-connection device. 500-1000ml of N/S was used depending on the size of patient. Reduction was deemed to achieve when a free flow of fluid was seen within the bowel and the disappearance of the dough-nut or pseudo kidney sign, mass or it crosses the ileocecal junction and free flow water in few inches in distal ileum. Once reduction achieved the catheter was removed after deflating the balloon while the excess fluid was drained by lowering the saline bag below the level of bed and some fluid was also spontaneously excreted by patient. If the intussusception was not reduced after three minutes of sustained pressure, the saline pressure was lowered and child rested for three minutes. Three such attempts were made before considering the intussusception irreducible and going for open procedure. After the procedure the patient was shifted to Surgical Follow up/ Recovery under monitoring. All the ultrasounds were performed by the radiology department. For patients who were planned in group B, they were operated with conventional open technique. All cases were followed up for 4 weeks to see underlying complications such as recurrence of intussusception with the help of ultrasound. Beside that patients were followed on outdoor basis, physically examined and were also informed in detail at the time of discharge about symptoms of recurrence. All follow-up scans were done by radiologist. The data collected were entered and analyzed using SPSS version 22.0. For quantitative variables like age and duration of hospital stay were calculated. For qualitative variables like gender and complications were presented as frequency and percentages. Independent sample t-test/Mann Whitney U-test was applied to compare hospital stay in both groups. Chi-square test was applied to compare complications in both groups. P-value ≤ 0.05 was considered significant.

RESULTS

A total of 260 cases presented in Emergency, after resuscitation and making diagnosis 102 cases patients were divided into two groups (Group A and B). The mean age of the patients was 29.11 + 41.48 months and 18.18 +

24.75 months in Group A and group B respectively. In both group male gender was dominant details are given in table 1.

Variables	Group A	Group B
Age	29.11 + 41.48	18.18 + 24.75
Gender		
Male	53 (67.1%)	57 (72.2%)
Female	26 (32.9%)	22 (27.8%)

Table 1: Frequency distribution of patients according to age and gender in both groups

The clinical findings; patients in group A, 76 (96.2%) had abdominal pain, in group B, 76 (96.2%) patients had abdominal pain, and other symptoms were includes; abdominal distension, loose motion, constipation, bloody stool, vomiting, jelly color stool, features of intestinal obstruction, bleeding PR and had palpable mass in both groups details are shown in table 2.

Clinical Findings	Group A		Group B	
	Yes	No	Yes	No
Abdominal pain	76 (96.2%)	3 (3.8%)	76 (96.2%)	3 (3.8%)
Abdominal distension	14 (17.7%)	65 (82.3%)	20 (25.3%)	59 (74.7%)
Loose motion	6 (7.6%)	73 (92.4%)	7 (8.9%)	72 (91.1%)
Constipation	11 (13.9%)	68 (86.1%)	14 (17.7%)	65 (82.3%)
Bloody stool	5 (6.3%)	74 (93.7%)	0 (0.0%)	79 (100.0%)
Vomiting	24 (30.4%)	55 (69.6%)	37 (46.8%)	42 (53.2%)
Jelly color stool	7 (8.9%)	72 (91.1%)	15 (19.0%)	64 (81.0%)
Intestinal obstruction	2 (2.5%)	77 (97.5%)	0 (0.0%)	79 (100.0%)
Bleeding PR	24 (30.4%)	55 (69.6%)	18 (22.8%)	61 (77.2%)
Palpable mass	0 (0.0%)	79 (100.0%)	3 (3.8%)	76 (96.2%)
Fever	0 (0.0%)	79 (100.0%)	3 (3.8%)	76 (96.2%)

Table 2: Frequency distribution of patients according to clinical findings

Among 79 patients treated in group A, 59 (74.7%) had successful reduction of intussusception, Likewise in group B, 66 (83.5%) had successful reduction of intussusception and p-value was (0.17) insignificant. In group A no recurrence after reduction of intussusception was observed, while among patients treated in group B, 3 (3.8%) had recurrence after reduction of intussusceptions. Out of 3 cases with recurrence, inflammatory fibroid polyp observed in 1 case and recurrence occur after 48 hours, no specific reason or any specific operative findings were observed in 3rd case that lead to recurrence. The result was found statistically insignificant. The mean hospital stay was 6.81 + 3.31 in group B, while its 2.52 + 1.76 days in group A. The results were found significant as the p-value was 0.00. Details are summarized in table 3.

Characteristics	Group A		Group B		p-value
	Frequency	Percentage	Frequency	Percentage	
Successful Reduction					
Yes	59	76.7%	66	83.5%	0.17
No	20	25.3%	13	16.5%	

Recurrence					
Yes	0	0.0	3	3.8	0.08
No	79	100.0	76	96.2	
Hospital Stay					
(Mean + SD)	2.52 + 1.76		6.81 + 3.31		0.00

Table 3: Frequency distribution of patients according to successful reduction and recurrence along with findings of mean hospital stay in both groups

DISCUSSION

Study revealed that according to clinical findings, majority (96.2%) of the patients in group A, had abdominal pain, followed by vomiting (30.4%), bleeding PR (30.4%), abdominal distension (17.7%), constipation (13.9%), jelly color stool (8.9%), loose motion (7.6%), bloody stool (6.3%) and intestinal obstruction (2.5%). Likewise among patients treated in group B, majority (96.2%) had abdominal pain, followed by vomiting (46.8%), abdominal distension (25.3%) bleeding PR (22.8%), jelly color stool (19.0%), constipation (17.7%), loose motion (8.9%), palpable mass (3.8%) and fever (3.8%). While the findings of study undertaken by Talabi and fellows (2018) highlighted that among patients treated with USGHR, 100.0% had abdominal pain and vomiting, followed by palpable abdominal mass (95.6%), red currant stool (80.0%), dehydration (40.0%), fever (31.1%) and abdominal distension (13.3%). The results of a study showed that in open reduction group, 100.0% patients had abdominal pain and vomiting, followed by red currant jelly stool (60.0%), abdominal distension (40.0%), palpable abdominal mass (40.0%) and fever (28.0%) [5]. The results of different studies revealed that among patients who were treated with ultrasound guided hydrostatic reduction the mean age of the patients was 29.11 + 41.48 months. Likewise among patients who were treated with open reduction the mean age of the patients was 18.18 + 24.75 months. In both groups, most of the patients were up to 12 months old. As far as gender of the patients is concerned, indicated that in both groups males were in majority. Age range was same as mentioned in literature [9]. When hospital stay was compared among patients of both groups, study showed significant results (P = 0.00) and found that hospital stay was less among patients of group A. This corresponds to the findings of a study carried out by Ogundoyin and collaborators (2015) that also reported statistically significant results (P 0.00) and confirmed that hospital stay was less among patients treated with ultrasound guided hydrostatic reduction [10]. Another study conducted by Courtney and coworkers., 1992 also demonstrated that majority of the patients (70.0%) treated with open reduction were up to 12 months old and 30.0% were aged above 12 months [11]. It was found during study that among patients treated with ultrasound guided hydrostatic reduction; rate of successful reduction was 74.5% while it

was 83.5% among patients treated with open reduction [12]. The findings of our study are better than a study undertaken by reported that USGHR success rate was 60.0% [13]. But a study conducted by Kolm P (1992) exhibited better situation that USGHR success rate was 90.0% [14]. A recent study conducted by Meyer., 1992 highlighted the better efficacy of USGHR technique and found that success rate was 80.7% [15]. It is significant to mention that no recurrence occurred among patients treated with ultrasound guided hydrostatic reduction while recurrence was seen among 3.8% patients treated with open reduction. The findings of our study are better than the study conducted previously who stated that among children treated with USGHR, 2.2% had recurrent intussusception [16, 17]. Bratton and fellows., 2001 showed 7.5% recurrent intussusception among children experienced USGHR [18]. Another study reported that in USGHR group, recurrence occurred in 2.6% of children [19]. As far as open reduction is concerned, the findings of our study are comparable with a study done by Calder and coworkers., 2001 who reported 3.6% recurrence rate of intussusception [20]. Nayak and fellows., 2008 also confirmed in their study that USGHR success rate was 84.4% [21].

CONCLUSIONS

Present study compared the ultrasound guided hydrostatic versus open reduction in intussusception. Study concluded that ultrasound guided hydrostatic is simple, effective, economical and quick method for managing intussusception. It was observed that USGHR is better in term or recurrence rate and hospital stay but regarding reduction, open method has higher success rate.

Conflicts of Interest

The authors declare no conflict of interest

Source of Funding

The author(s) received no financial support for the research, authorship and/or publication of this article

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