Ultrasound Guided Hydrostatic Versus Open Reduction in Intussusception

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**A R T I C L E  I N F O**

**Key Words:**
Ultrasound-guided Hydrostatic Reduction, Open Reduction, Intussusceptions, Successful Reduction, Recurrence, Hospital Stay

**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 also a popular treatment method to treat intussusceptions. This technique is much safer and effective.

**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 38/1 per 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, 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°C 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 doughnut or pseudo kidney sign, mass or it crosses the ileocecal junction and free flow of 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.

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>29.11 + 41.48</td>
<td>18.18 + 24.75</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>53 (67.1%)</td>
<td>57 (72.2%)</td>
</tr>
<tr>
<td>Female</td>
<td>26 (32.9%)</td>
<td>22 (27.8%)</td>
</tr>
</tbody>
</table>

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.

Table 2: Frequency distribution of patients according to clinical
findings

<table>
<thead>
<tr>
<th>Clinical Findings</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td>Yes 76(96.2%)</td>
<td>No 3(3.8%)</td>
</tr>
<tr>
<td></td>
<td>No 76(96.2%)</td>
<td>Yes 3(3.8%)</td>
</tr>
</tbody>
</table>
| Abdominal
distension | 14 (17.7%)    | 20 (25.3%)    |
|                   | 66 (82.3%)    | 59 (74.7%)    |
| Loose motion      | 6 (7.6%)      | 7 (8.9%)      |
|                   | 73 (92.4%)    | 72 (91.1%)    |
| Constipation      | 11 (13.9%)    | 14 (17.7%)    |
|                   | 68 (86.1%)    | 65 (82.3%)    |
| Bloody stool      | 5 (6.3%)      | 0 (0.0%)      |
|                   | 74 (93.7%)    | 79 (100.0%)   |
| Vomiting          | 24 (30.4%)    | 37 (46.8%)    |
|                   | 55 (69.6%)    | 42 (53.2%)    |
| Jelly color stool | 7 (8.9%)      | 15 (19.0%)    |
|                   | 72 (91.1%)    | 64 (81.0%)    |
| Intestinal
obstruction | 2 (2.5%)      | 0 (0.0%)      |
|                   | 77 (97.5%)    | 79 (100.0%)   |
| Bleeding PR       | 24 (30.4%)    | 18 (22.8%)    |
|                   | 55 (69.6%)    | 61 (77.2%)    |
| Palpable mass     | 0 (0.0%)      | 3 (3.8%)      |
|                   | 79 (100.0%)   | 76 (96.2%)    |
| Fever             | 0 (0.0%)      | 3 (3.8%)      |
|                   | 79 (100.0%)   | 76 (96.2%)    |

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.

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

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group A</th>
<th>Group B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Successful
Reduction | Yes 59  | 66      | 83.5%   |
|                  | No 20   | 13      | 16.5%   |

D I S C U S S I O N

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
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
included 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
attended 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 to 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 amongst 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 observeds 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

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