ORIGINAL ARTICLE

CURRENT METHODS OF REDUCING INTUSSUSCEPTION AMONGST PAKISTANI RADIOLOGISTS: A SURVEY BASED CROSS-SECTIONAL STUDY

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ABSTRACT

BACKGROUND: Intussusception is a common cause of acute abdomen in children, and timely diagnosis and management can significantly reduce morbidity and mortality. **OBJECTIVES:** The purpose was to identify the differences in radiological practices for pediatric intussusception reduction among radiologists in Pakistan and to establish trends by comparing the findings with reports of previous surveys. **METHODS:** A cross-sectional study was conducted using a validated survey assessing demographic information and techniques of intussusception reduction amongst attendees of the Radiological Society of Pakistan conference. Differences in radiological practices for pediatric intussusception reduction were identified. **RESULTS:** Out of 142 respondents, 82.4% had formal training in pediatric radiology. Amongst 121 respondents who had performed reduction, 60.6% used fluoroscopy, 24.6% used ultrasound guidance, 28.2% used air, and 57% used liquid enema. 90% required intravenous access. Additionally, 55.4% respondents had successfully attempted reductions three times in a one-year period. In unsuccessful reductions, 31.7% of the respondents waited and reattempted later, using maneuvers like manual pressure and left decubitus position change. **CONCLUSION:** The study highlights the wide variation in strategies for reducing intussusception in Pakistan, indicating the need for additional research to assess the efficacy of different methods and establish unified guidelines.

Keywords: intussusception, fluoroscopy, reduction technique, pediatric

Introduction

Intussusception, characterized by the folding of a proximal portion of the intestine (intussusceptum) into an adjacent distal portion (intussuscipiens), is commonly observed in children under the age of 5, with ileocolic intussusception being the most prevalent form 1-3. It is one of the most common causes of acute abdomen in infants and children. A delayed diagnosis of intussusception may result in peritonitis, which can cause severe abdominal pain, fever, shock, and even death.[1] In high-income countries, the diagnosis is usually made quickly with an ultrasound or radiograph, followed by enema or surgery as needed. However, in resource-limited areas, many children die before reaching healthcare, and surgery

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is often the primary treatment option, resulting in a mortality rate of approximately 10%.[1,2] Although once a serious illness with significant morbidity and death rates, recent breakthroughs in diagnostic and effective treatment approaches have resulted in positive outcomes in the majority of patients.[4] Edwards (2017) notes various non-surgical methods for reduction of intussusception, including air or barium enema under ultrasound or fluoroscopic guidance.[3] However, practices vary across global regions, and there is limited information on the preferences and practices for intussusception reduction among radiologists in Pakistan. Therefore, the aim of this study is to identify the methods used by radiologists practicing in Pakistan for pediatric intussusception reduction.

Material and Methods

Study design, setting, and participants:

A cross-sectional descriptive study was carried out at the annual conference of the Radiological Society of Pakistan (RSP), Karachi, Pakistan. The study was carried out over three days (27th - 29th/10/2017)of the annual conference. Radiologists from across the country attending the annual conference were included using convenience sampling.Participation was voluntary and informed consent was acquired from all willing to participants in this study.

Data collection tool and process:

After comprehensive literature search,a validated questionnaire was used.[5] The questionnaire included data on the basic demographic information, years of practice as a radiologist and frequency of intussusception reduction by respondents in last 12 months. Following that the respondents were asked about the approach they used to reduce intussusception. The questionnaire also had the variable on patient preparation, performance of intussusception reduction (successful attempts and unsuccessful attempts and solutions to unsuccessful attempts). A successful attempt resulted in intus-susception resolution, whereas a failed one resulted in persistence of intussusception.

Research assistants who had received prior training approached the radiologist attending the annual conference and invited them to participate after explaining the nature and purpose of the study. Each participant signed a written consent form and was given a printed copy of the questionnaire. In case of refusal to sign the consent form, the respondent was excluded from the study without making a second attempt to obtain the consent.

Ethical consideration:

The Ethics Review Committee (ERC) at Aga Khan University Hospital in Karachi, Pakistan, granted ethical approval for this study (Ref No: 5027-Rad-ERC-17). All participants in the research were guaranteed complete confidentiality and anonymity. All participants were given the right to withdraw from the study at any point, and participants received no monetary compensation for their contribution.

Data analysis:

Data coding, entry, and analysis were done using SPSS version 25.0 (SPSS Inc., Chicago, IL). Research assistants performed data entry and were cross-checked by other members for potential errors. Descriptive statistics were presented as means, standard deviations, and percentages where appropriate.

Results

A total of 171 RSP members were surveyed, out of which 156 filled out the questionnaire. After removing incomplete forms, 142 (83%) responses were included for statistical analysis. The mean age of the respondents was 37.5 – 10.5 years, and the majority of them (59.2%) were male. Among the respondents, 85.2% had prior experience in performing the procedure. In the past 12 months, 58.9% of the respondents attempted 1-3 reductions, and 55.4% of those attempts were successful. Only 14% of the respondents had performed more than six reductions during the same period. Moreover, the majority of the respondents (82.4%) had not received any formal training in pediatric radiology. Less than half of the respondents (44.4%) were radiology residents. It is noteworthy that a vast majority of the respondents (90.1%) belonged to academic institutions, as shown in (Tab.1).

Basic demographic characteristics	N (%)
Age	37.5 ± 10.5
Gender	
Male	84 (59.2)
Female	58 (40.8)
Current status	
Consultant	79 (55.6)
Resident	63 (44.4)
Type of Practice	
Teaching hospital	128 (90.1)
Non-teaching hospital	14 (9.9)
Experience	8.8 ± 8.3
Formal training in Pediatric's Radiology	25 (17.6)

Table 1: Basic demographic characteristics of study participants (n=142)

The most frequent reason for avoiding intussusception reduction was severe dehydration (29.9%), followed by the presence of free fluid on ultrasound (26.3%), hematochezia (20%), and decreased color Doppler blood flow (11.9%). Almost all respondents (90%) required intravenous access. Over three-quarters of them (78.5%) were in favor of continuous monitoring of vital signs and required the presence of a surgeon in the hospital (76%). Among these, less than a third (32%) preferred to perform the procedure under the supervision of a surgeon or surgical residents. Additionally, over a third (34.7%) of respondents used sedation, as shown in (Tab.2).

The most preferred method for intussusception reduction was the use of fluoroscopy (60.6%), followed by ultrasound (24.6%). A majority of the respondents (66.9%) preferred the use of liquid enema, while approximately one-third (33.1%) preferred air. Other options included gastrografin (28.9%), barium (19.8%), and cystografin (0.8%). Over half of the respondents (52.9%) used a Foley catheter, with preferred sizes listed in (Tab.2). In addition, more than half of the total respondents (58.7%) inflated the balloon of the Foley catheter. Other methods included taping the buttocks together (12%), using a tape-wrapped catheter (8.3%), or using a gauze plug (4.1%), as shown in (Tab.2).

The majority of respondents (72.7%) preferred using conventional methods of attempting reduction up tothree times, while 21.5% attempted fewer than three

Variables	N (%)
Symptoms longer than two days	34(17.5)
Severe hematochezia	23(11.9)
Severe dehydration	58(29.9)
Free fluid demonstrated at ultrasound	51(26.3)
Decreased blood flow demonstrated by Doppler Ultrasound	28(14.4)
Preparation and sedation	
Allow parents in room	68(56.2)
Require surgeon in hospital	92(76.0)
Require surgeon in room during procedure	39(32.2)
Do you require patient to have IV access?	109(90.1)
Require continuous monitoring of vital signs?	95(8.5)
Use any form of sedation during procedure?	42(34.7)
Preferred reduction medium	
Air	40(33.1)
Liquid	81(66.9)
Cystografin	1(0.8)
Gastrografin	35(28.9)
Barium	24(19.8)
Other	21(17.4)
Catheter choice and mechanism of seal	
Flexitip pediatric enema tip (in 12-month-old)	
14 Fr	24(19.8)
18 Fr	23(19)
24 Fr	10(8.3)
Foley's catheter (in 12-month-old)	
10-12 F	44(36.4)
14-16 F	10(8.3)
18-20 F	8(6.6)
Method to create seal	
Inflate foley's balloon	71(58.7)
Tape	15(12.4)
Gauze plug at anal verge	5(4.1)
Tape plug wrapped around catheter	10(8.3)
Others	20(16.5)
Number of attempts reduction with intussusception in same position	
<3	26(21.5)
3	88(72.7)
4-6	4(3.3)
>6	3(2.5)
Maneuver (if unsuccessful)	
Place patient left side down	14(11.6)
Wait and re-attempt later	45(37.2)

Manual pressure on abdomen	7(5.8)
None	6(5)
Refer to surgery	49(40.5)
Waiting period (minutes)	
0-15	32(54.2)
15-30	9(15.3)
30-60	14(23.7)
60-120	3(5.1)
>120	1(1.7)

Table 2: Contraindications, sedation, preparation, number attempts and maneuvers to reduce intussusception and intussusception reduction technique.

times and 5.75% made more than three attempts. In cases of unsuccessful initial attempts, most respondents (54.2%) usually waited for 0-15 minutes before reattempting reduction, while others (37.2%) reattempted reduction immediately. Very few used other maneuvers such as applying manual pressure on the abdomen (5.8%) or turning the patient to the left decubitus position (11.6%). However, the greatest consensus was to refer the patient to surgery (40.5%), asshown in (Tab.2).

Of the respondents who used air for intussusception reduction, nearly half (48%) used a maximum pressure of 120 mmHg and utilized a pop-off valve (47.5%). The next most common maximum pressure used was 100mm Hg (22.3%), followed by 80 mm Hg (21.5%), as shown in (Tab.3).

Contrast media using	Barium		Water soluble contrast	
height of bag hang	n	%	n	%
3ft	77	63.6	74	61.2
4ft	15	12.4	13	10.7
5ft	19	15.7	19	15.7
Other	10	8.3	15	12.4
Maximum Air pressure				
80 mm Hg	26	21.5		
100 mm Hg	27	22.3		
120 mm Hg	58	47.9		
140 mm Hg	2	1.7		
Greater than 140 mm Hg	2	1.7		
Other	6	5.0		

Table 3: Difference in height of bag and maximum air pressure with contrast media using barium and water-soluble contrast.

(Tab.3) displays the results for respondents who preferred using barium and water-soluble contrast media. Among them, over half (63.6% and 61.2%, respectively) hung the bag at 3 ft. In terms of complications, 27 respondents reported bowel perforation, and 24 reported tension pneumoperitoneum.

Discussion

The objective of this study was to determine the preferences and practices of radiologists in Pakistan regarding the methods used for pediatric intus susception reduction and to compare them with previous research. Although the primary goal of enema therapy is intussusception reduction, the most effective type of enema for this purpose remains a topic of debate, and a wide range of reduction methods are available. Sadigh's (2015) meta-analysis of 32,451 patients on enema reduction from 1966 to 2013 found that air enemareduction had a higher success rate than barium enema reduction, with success rates of 82.7% and 69.6%, respectively.[6] Air reduction was also shown to be the most common procedure, which is consistent withthe findings of Stein-Wexler's (2015) survey of radiologists.[5] In contrast, our study found an increased use of liquid enema for intussusception reduction compared to air enema reduction. This may be due to a lack of confidence among respondents in using air enema for reduction, indicating a need for more awareness and training on the technique in Pakistan.

Our findings also revealed that practitioners in our setting continue to prefer a short delay, with 54% of respondents waiting for 0-15 minutes before reattempting reduction. However, recent studies have shown that radiologists prefer waiting for a longer period before reattempting reduction, as reported by Naiditch (2012) and Stein-Wexler (2015).[5,7] This indicates a need for further research and education on the optimal waiting time for successful intussusception reduction.

Previous studies by Fike (2012) and Khorana (2016) have reported the possibility of successful reduction for longstanding intussusception.[8,9] However, our study found that 17.5% of the respondents did not attempt reduction if the patient had symptoms for longer than two days. It is noteworthy that previous

articles by Bartocci (2015) and Gondek (2018) have shown that while the chances of success with free or trapped fluid are slim, they are nevertheless possible.[10,11] In our study, 26% of the respondents reported not attempting reduction in the presence of free fluid. Additionally, according to Bartocci (2015) and Gondek (2018), reduction is possible if decreased blood flow is demonstrated by Doppler US.[10,11] However, our study found that 14.4% of the respondents considered this a contraindication to performing reduction.

As per Stein-Wexler's (2015) study, there was an increasing trend in the demand for IV access.[5] Our survey also showed a similar trend, with 90.1% of respondents requiring the presence of an IV cannula. However, unlike Stein-Wexler's study, where there was a significant reduction in surgeon involvement during the reduction procedure, our findings show that 76% of respondents preferred to have a surgeon in the hospital during the procedure, with only 32% wanting the surgeon in the room.[5] While Feldman (2017) reported a decreased use of sedation during the procedure, our study found that 34% of respondents still use sedation.[12]

In conclusion, our study has highlighted some important disparities between current practices in Pakistan and available literature. These findings suggest a need for better awareness and training among radiologists to ensure that the most effective methods are employed for pediatric intussusception reduction.

Limitations:

The cross-sectional study design and small sample size do not allow us to make assumptions about causal relationships between parameters; therefore, generalizability may be limited. Our survey relied on respondent recall and data collection through a face-to-face questionnaire might lead to social desirability and recall bias. Even though respondents could remain anonymous, they may have been hesitant to admit sharing their experiences. As without similar other surveys, fluoroscopy times, use of continuous or pulsed fluoroscopy, or radiation dose per study were examples of important information that we did not acquire via our questionnaire. Another limitation of the study was that radiologists practicing in non academic centers (which constitute majority of the practitioners in Pakistan) were underrepresented and most of the respondents were from teaching institutes. Also, the sample was drawn from the annual national conference, providing room for selection bias.

Future Recommendations:

To gain a better understanding of practices for intussusception reduction, a cross-sectional study covering the entire country is recommended. This would provide a more accurate picture of practices compared to international guidelines. Additionally, since practices may vary by region, a randomized or cluster sampling of hospitals and practitioners across the country would provide a more precise estimate.

Conclusion

The strategies for reducing intussusception in Pakistan exhibit wide variation. Further research is necessary to evaluate the efficacy of various methods and consequently establish unified guidelines for the optimal strategy of intussusception reduction.

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ETHICS APPROVAL: Since the study is survey based and maintained confidentiality of all participants involved, an ethical waiver was granted by the Ethics Review committee at Aga Khan University. The reference number of which is 5027-Rad-ERC-17.

DISCLAIMER: RSNA digital presentation 2019.

COMPETING INTERESTS: None to declare.

References

1. Clark AD, Hasso-Agopsowicz M, Kraus MW, Stockdale LK, Sanderson CF, Parashar UD, Tate JE. Update on the global epidemiology of intussusception: a systematic review of incidence rates, age distributions and case-fatality ratios among

children aged< 5 years, before the introduction of rotavirus vaccination. International journal of epidemiology. Aug 2019; **48(4):** 1316-26.

2. Jiang J, Jiang B, Parashar U, Nguyen T, Bines J, Patel MM. Childhood intussusception: a literature review. PloS one. Jul 2013; **8(7):** e68482.

3. Edwards EA, Pigg N, Courtier J, Zapala MA, MacKenzie JD, Phelps AS. Intussusception: past, present and future. Pediatric radiology. Aug 2017; **47:** 1101-8.

4. Marsicovetere P, Ivatury SJ, White B, Holubar SD. Intestinal intussusception: etiology, diagnosis, and treatment. Clinics in colon and rectal surgery. Feb 2017; **30(01):** 030-9.

5. Stein-Wexler R, O Connor R, Daldrup-Link H, Wootton-Gorges SL. Current methods for reducing intussusception: survey results. Pediatric Radiology. May 2015; **45:** 667-74.

6. Sadigh G, Zou KH, Razavi SA, Khan R, Applegate KE. Meta-analysis of air versus liquid enema for intussusception reduction in children. American Journal of Roentgenology. Nov 2015; **205(5):** W542-9.

7. Naiditch JA, Rigsby C, Chin A. Delayed repeated enema and operative findings after unsuccessful primary enema for intussusception. European Journal of Pediatric Surgery. Jul 2012: 404-8.

8. Fike FB, Mortellaro VE, Holcomb III GW, Peter SD. Predictors of failed enema reduction in childhood intussusception. Journal of pediatric surgery. May 2012; **47(5):** 925-7.

9. Khorana J, Singhavejsakul J, Ukarapol N, Laohapensang M, Siriwongmongkol J, Patumanond J. Prognostic indicators for failed nonsurgical reduction of intussusception. Therapeutics and Clinical Risk Management. Aug 2016: 1231-7.

10. Bartocci M, Fabrizi G, Valente I, Manzoni C, Speca S, Bonomo L. Intussusception in childhood: role of sonography on diagnosis and treatment. Journal of ultrasound. Sep 2015; **18:** 205-11.

11. Laali KK, Greves WJ, Correa-Smits SJ, Zwarycz AT, Bunge SD, Borosky GL, Manna A, Paulus A, Chanan-Khan A. Novel fluorinated curcuminoids and their pyrazole and isoxazole derivatives: Synthesis, structural studies, Computational/ Docking and in-vitro bioassay. Journal of Fluorine Chemistry. Feb 2018; **206:** 82-98.

12. Feldman O, Weiser G, Hanna M, Devir O, Balla U, Johnson DW, Kozer E, Shavit I. Success rate of pneumatic reduction of intussusception with and without sedation. Pediatric Anesthesia. Feb 2017; **27(2):** 190-5.