

Factors influencing the practice of Hydrostatic Reduction of Intussusception amongst Radiologists in a Developing Country.

T. A. Lawal¹, O.M. Atalabi², A.J. Adekanmi², O.O. Ogundoyin¹

¹Division of Pediatric Surgery, Department of Surgery and ²Department of Radiology, College of Medicine, University of Ibadan and University College Hospital, Ibadan, Nigeria

Abstract:

Background: Intussusception is a major cause of intestinal obstruction in children and can be treated operatively or non-operatively. Surgery is associated with mortality rates, in developing countries of 8.5% to 18%. Hydrostatic reduction is a cost effective treatment that can lower the mortality rate in resource poor settings. However, the technique is not widely performed in spite of the advantages.

Objective:

We reviewed factors influencing the current practice of hydrostatic reduction of intussusception by radiologists in Nigeria.

Materials and methods:

A survey of Radiologists was conducted using structured self administered questionnaires. Strength of association between the practice of hydrostatic reduction and variables related to the workforce was evaluated using Fisher's exact test.

Results:

Fifty-one participants were studied. Three (18.8%) hospitals have at least one consultant radiologist focusing on pediatric radiology, while thirteen hospitals have one pediatric surgeon or more. Hydrostatic reduction is practiced in hospitals with a radiologist with interest in pediatric radiology, ($p = 0.002$). Lack of expertise was given as the main reason why the other hospitals have not commenced the procedure.

Keywords:

Intussusception, hydrostatic reduction, radiologists

Conclusion:

There is a low rate of utilization of hydrostatic reduction of intussusception in Nigeria because of lack of expertise.

Correspondence:

Dr. Omolola M. Atalabi,
Department of Radiology,
College of Medicine, University of Ibadan, and
University College Hospital,
Ibadan, Nigeria
E-mail: omatalabi@yahoo.co.uk

Background:

L'Intussusception est une cause importante d'obstruction intestinale chez les enfants et peut être traité en état de fonctionnement ou non-operatively. La chirurgie est associée aux taux de mortalité, dans les pays en développement de 8,5% à 18%. La réduction hydrostatique est un traitement rentable qui peut abaisser le taux de mortalité dans des arrangements de pauvres de ressource. Cependant, la technique n'est pas largement exécutée malgré les avantages.

Objectif:

Nous avons passé en revue des facteurs influençant la pratique actuelle de la réduction hydrostatique d'intussusception par des radiologues du Nigéria.

Matériaux et méthodes: Une enquête des radiologues a été menée utilisant les questionnaires administrés par individu structurés. La force de l'association entre la pratique de la réduction hydrostatique et les variables liées à la main d'oeuvre a été évaluée utilisant l'essai précis de Fisher.

Résultats:

Cinquante et un participants ont été étudiés. Trois (18,8%) hôpitaux ont au moins un radiologue de conseiller se concentrant sur la radiologie pédiatrique, alors que treize hôpitaux ont un chirurgien pédiatrique ou plus. La réduction hydrostatique est pratiquée des hôpitaux avec un radiologue avec l'intérêt pour la radiologie pédiatrique, ($p = 0,002$). Le manque d'expertise a été donné comme raison principale pourquoi les autres hôpitaux n'ont pas débuté la procédure.

Conclusion:

Il y a un à bas taux de l'utilisation de la réduction hydrostatique d'intussusception du Nigéria en raison de manque d'expertise.

Introduction:

Intussusception is the most common non-congenital cause of intestinal obstruction in infants^{1,2}. The management of the illness is facilitated by prompt recognition, adequate resuscitation and either non-operative or operative intervention^{3,4,5}. While mortality rates from treatment of intussusception in developed countries are well under 0.5%, studies from

developing countries report mortality rates of 8.5% to 18%^{6,7,8,9}. The crux of management in developing countries remains late presentation with mean interval between onset of symptoms and presentation of three days^{8,9}. This might be attributed to the fact that over sixty percent of the population in developing countries still resides in the rural areas where there are challenges in transportation of the patients to urban centers with facilities both in staff and equipment necessary for surgical and non surgical intervention. Nevertheless, an increasing number of patients with intussusception in developing countries now present within 24 hours of onset of symptoms¹⁰.

Most of the literature from developing countries report an overwhelming preponderance of cases managed surgically rather than non-operatively^{2,7,8,9}. In contrast, non-operative measures such as pneumatic reduction or hydrostatic reduction under fluoroscopy or ultrasound guidance respectively are the mainstay of treatment in developed countries^{11,12,13}. We and others have demonstrated the utility and feasibility of hydrostatic reduction under ultrasound guidance and pneumatic reduction respectively in the management of children with intussusception in resource poor settings^{10,14}. The relative affordability of ultrasonographic scan, widespread utilization of the technique and absence of radiation exposure has endeared radiologists and pediatric surgeons in developing countries to the use of ultrasound in the diagnosis of intussusception^{15,16}. However, there is no report in the literature documenting the practice of hydrostatic reduction of intussusception under ultrasound guidance by radiologists in developing countries. We therefore aimed to review the current practice of hydrostatic reduction of intussusception by radiologists in Nigeria, identify factors that encourage the practice of the procedure or otherwise and offer suggestions to improve the utilization of non-operative measures in treating children with intussusceptions.

Materials And Methods:

A cross-sectional survey of participants at a regional conference of radiologists was conducted using structured questionnaires administered to 62 participants whose practices were based in urban and rural areas. A total of 51 (82.3%) questionnaires were returned completed.

The questionnaire contained items on demographic details of the participants, location of practice, length of practice, the number of radiology and pediatric surgery specialists as well as the practice of hydrostatic reduction of intussusception in the hospital. Items from the returned questionnaires were computed and analyzed using SPSS version 19 (SPSS, Chicago, IL). Descriptive statistics were computed

using appropriate summary measures of mean (\pm standard deviation SD), median and range. Strength of association between variables and the performance of hydrostatic reduction was tested using Fisher's exact test with the level of significance set at 5%.

Results:

A total of 51 radiologists participated in the study of which 47 (92.2%) were males and 4 (7.8%) were females. The mean age of the study participants was 38.5 years (SD = 6.9 years, range of 28 to 55 years). The age distribution is as shown in Table 1.

Table 1: Age distribution of the study participants

Age (years)	Number	%
26 - 35	22	43.1
36 - 45	20	39.2
46 - 55	9	17.6
Total	51	100.0

The 51 study participants were from 16 different hospitals spread across the country, of which; twelve (75%) are teaching hospitals, three (19%) are general rural hospitals and one is a military hospital (6%).

Specialty Workforce

There is an average of 11 radiology residents in each hospital, where the study participants were based, (SD = 10, range of 0 to 30). The mean number of consultant radiologists practicing in each hospital was 5 (SD = 3, range of 1 to 12). Only three centers (18.8%), all in urban setting have a consultant radiologist focusing on pediatric radiology, while the remaining 13 centers (81.2%) do not have such.

About 40% of the participants had practiced radiology for five years or less and 60% had been in the specialty for upwards of five years (Table 2).

Table 2: Length of time the participants had been practicing radiology

Length (years)	Number	%
1 - 5	21	41.2
6 - 10	18	35.3
11 - 15	6	11.8
16 - 20	2	3.9
> 20	4	7.8
Total	51	100.0

Thirteen (81.3%) of the 16 hospitals have at least one pediatric surgeon; four hospitals have three pediatric surgeons each, seven have two each and two hospitals have one pediatric surgeon each. In the three hospitals without pediatric surgeons, all in the rural areas, the treatment of children with intussusception is performed by general surgeons.

Practice of Hydrostatic Reduction of Intussusception

Each of the hospitals manages between five and twenty-five cases of intussusception annually. Hydrostatic reduction under ultrasound guidance is practiced in three hospitals (18.8%) while 13 (81.2%) are yet to commence hydrostatic reduction of intussusception in their centers. The pediatric surgeons perform the hydrostatic reduction in one of the three hospitals where the procedure is performed, the radiologists in another while both pediatric surgeons and radiologists cooperate to perform the procedure in the third hospital. All the participants from centers that had not commenced the practice of hydrostatic reduction gave "lack of expertise" as the reason for non-commencement of the modality of treatment.

The participants were asked to comment on suitability of hydrostatic reduction of intussusception (if hypothetically or actually performed in their centre) in selected clinical scenarios. If the patient presented less than 24 hours after the onset of symptoms and fever was absent, 40 out of 42 participants (95.2%) who responded to the item will attempt a hydrostatic reduction under ultrasound guidance. However, if the child presented after 24 hours but still within 48 hours of development of symptoms and fever was absent, only 11 participants (26.2%) will opt for hydrostatic reduction. Forty-eight participants (94.1%) will mandate a plain erect chest radiograph before the reduction is attempted whereas three (5.9%) consider this investigation as optional. All three participants who would not mandate plain chest radiographs are from centers where hydrostatic reduction is not being performed at present.

Factors influencing the practice of hydrostatic reduction

Four variables were tested for association with the practice of hydrostatic reduction of intussusception in hospitals: number of consultant radiologists, presence of radiologists focusing on pediatric radiology in the hospital, number of radiology residents in each center and the availability of pediatric surgeons in the hospital (Table 3). Hydrostatic reduction is practiced in all the three hospitals that have a consultant radiologist focusing on pediatric radiology, whereas none of the 13 hospitals lacking a radiologist focusing

on pediatric radiology perform the procedure (p = 0.002). There were no significant associations between the practice of hydrostatic reduction and; number of consultant radiologists, number of radiology residents and availability of a pediatric surgeon (Table 3).

Table 3: Test of association between variables and the practice of hydrostatic reduction in each of the hospitals (using Fisher's exact test)

Variable	Hydrostatic reduction practiced			p - value
	Yes (%)	No (%)	Total (%)	
(a) Number of consultant radiologists				
< 5	1 (11.1)	8 (88.9)	9 (100.0)	0.550
.	2 (28.6)	5 (71.4)	7 (100.0)	
Total	3 (18.8)	13 (81.2)	16 (100.0)	
(b) Radiologist focusing on pediatric radiology				
None	0 (0.0)	13 (100.0)	13 (100.0)	0.002*
At least one	3 (100.0)	0 (0.0)	3 (100.0)	
Total	3 (18.8)	13 (81.2)	16 (100.0)	
(c) Number of radiology residents				
Ten or fewer	1 (11.1)	8 (88.9)	9 (100.0)	0.550
More than ten residents	2 (28.6)	5 (71.4)	7 (100.0)	
Total	3 (18.8)	13 (81.2)	16 (100.0)	
(d) Presence of pediatric surgeon				
None	0 (0.0)	3 (100.0)	3 (100.0)	1.000
At least one	3 (23.1)	10 (76.9)	13 (100.0)	
Total	3 (18.8)	13 (81.2)	16 (100.0)	

* Statistically significant

Suggestions for improvement in the practice of hydrostatic reduction

Suggestions by the respondents for improving the practice of hydrostatic reduction in the country included: better collaboration with pediatric surgeons (11, 21.6%), provision of required equipment (4, 7.8%), increasing the awareness of general practitioners and other physicians about early referral of children with intussusception (6, 11.8%) and training of radiologists in performing the procedure (30, 58.8%).

Discussion:

The management of intussusception in children has undergone changes in recent times with transition from surgery to non-operative reduction and from hydrostatic to pneumatic reduction^{12,13}. In spite of the advantages offered by pneumatic reduction, which

includes; early diagnosis of small perforations, less messy nature of the procedure and greater success rate with more challenging cases of intussusception, hydrostatic reduction using normal saline is still favored as the means of non-operative treatment in many parts of the world^{4,12,13,16}. In addition to avoidance of ionizing radiation, hydrostatic reduction of intussusception under ultrasound guidance is associated with reduction rates that are equivalent to that obtained from using fluoroscopic guidance^{11,13}. Ultrasound guided reduction is cost-effective, in addition, not only does ultrasound avoid the discomfort that would have been experienced by the patient; it also removes parental anxiety normally associated with barium enema^{16,17,18}.

The present study showed a low rate of utilization of hydrostatic reduction as a means of treating intussusception in Nigeria. The vast majority of hospitals in Nigeria still use conventional surgery to treat intussusception. Ekenze and Mgbor in a retrospective review of 87 cases of intussusception seen over a ten year period in one such country showed that open surgery was used to treat all the cases⁹. Similarly, Bode in a review of 174 children who had intussusception over a five year period reported a surgical intervention rate of 100% in a resource poor setting⁸. The major reason that has been alluded to for the overwhelming use of surgery for the treatment of intussusception in developing countries was, prior to now, delayed presentation. In the study by Bode, the mean duration of symptoms before presentation was 2.8 days, which was responsible for a mortality rate of 12%⁸. Delay in presentation has been shown to lead to higher incidence of non-viability of the bowel, higher failure rate for non-operative reduction and greater use of surgical intervention⁷.

However, this study has shown that apart from the delayed presentation, lack of expertise to perform non-operative reduction of intussusception is an additional obstacle, even when patients present early. In the aforementioned study by Ekenze and Mgbor, 15% of the children presented within 24 hours of onset of symptoms, yet all were operated upon. The major reason, in the present study, for non-performance of hydrostatic reduction was "lack of expertise"⁹. This is reflected in the suggestion of over 90% of the study participants that to improve the practice of hydrostatic reduction in developing countries, there should be adequate training of radiologists, early diagnosis and collaboration with pediatric surgeons.

The likelihood of hydrostatic reduction of intussusception being performed in hospitals in developing countries is greater with at least one of the radiologists focusing on pediatric radiology. All three hospitals where hydrostatic reduction is presently practiced in this study have at least one consultant

radiologist with interest in pediatric radiology. This will engender particular interest in the advancement of the subspecialty, since there is no formal pediatric radiology residency in Nigeria. The cost effectiveness, relative availability of expertise to perform ultrasound scan and ease of teaching the skill makes hydrostatic reduction under ultrasound guidance a veritable tool to use in the treatment of intussusception in resource poor settings¹⁹. The role of ultrasound in the management of intussusception includes; diagnosis of intussusception with a sensitivity of 98-100% and specificity of 88-100%, exclusion of differential diagnoses, assessment of reducibility and viability of the intestinal segment using Doppler ultrasound and reduction of intussusception^{11,20}.

The fact that the respondents were aware that intussusception can be reduced under ultrasound guidance shows that with the required expertise, more centers will attempt reduction of intussusception under ultrasound guidance. In addition, if the patient presented after 24 hours but within 48 hours, the majority will not attempt hydrostatic reduction. This would suggest a good theoretical background for the participants as far as the basic principles of management of intussusception is concerned.

A limitation noticed in this study was the information about pediatric surgery workforce, which was obtained from radiologists, and not from pediatric surgeons themselves. A follow up survey will address this limitation.

Conclusion:

This survey of the practice of hydrostatic reduction of intussusception in Nigeria shows a low rate of utilization of the procedure due to lack of expertise of pediatric radiologists and the absence of pediatric surgeons. The few hospitals mainly in the urban cities where hydrostatic reduction is performed have one or more consultant radiologist focusing on pediatric radiology and encouraging the introduction of the procedure in respective hospitals. Therefore, based on the findings from this study, there is a gap of expertise that has to be filled, hence the need for sub-specialization in pediatric radiology in order to encourage the practice of the procedure. We believe this will improve the practice of the technique, thus reducing mortality and morbidity from this disease condition, and alleviating the socioeconomic burden of the cost of the surgical treatment of the disease.

REFERENCES

1. Hajivassiliou CA. Intestinal obstruction in neonatal/pediatric surgery. *Semin Pediatr Surg* 2003; 12 (4):241-253.
2. Ogundoyin OO, Afolabi AO, Ogunlana DI, Lawal TA, Yifeyeh AC. Pattern and outcome of childhood intestinal obstruction at a tertiary hospital in Nigeria. *Afr Health Sci* 2009; 9 (3):170-173.
3. Beasley S. Intussusception. *Pediatr Radiol* 2004; 34 (4):302-304. Doi:10.1007/s00247-003-1074-7.
4. Jenke AC, Klaassen-Mielke R, Zilbauer M, Heining U, Trampisch H, Wirth S. Intussusception: incidence and treatment-insights from the nationwide German surveillance. *J Pediatr Gastroenterol Nutr* 2011; 52 (4):446-451. doi:10.1097/MPG.0b013e31820e1bec
5. John SD. The value of ultrasound in children with suspected intussusception. *Emergency Radiology* 1998; 5 (5):297-305.
6. Kombo LA, Gerber MA, Pickering LK, Atreya CD, Breiman RF. Intussusception, infection, and immunization: summary of a workshop on rotavirus. *Pediatrics* 2001; 108 (2):E37.
7. Meier DE, Coln CD, Rescorla FJ, OlaOlorun A, Tarpley JL. Intussusception in children: international perspective. *World J Surg* 1996; 20 (8):1035-1039; discussion 1040.
8. Bode CO. Presentation and management outcome of childhood intussusception in Lagos: a prospective study. *Afr J Paediatr Surg* 2008; 5 (1):24-28. Doi:10.4103/0189-6725.41632.
9. Ekenze SO, Mgbor SO. Childhood intussusception: the implications of delayed presentation. *Afr J Paediatr Surg* 2011; 8 (1):15-18. doi:10.4103/0189-6725.78662.
10. Atalabi O, Ogundoyin O, Ogunlana D, Onasanya O, Lawal T, Olarinoye A. Hydrostatic reduction of intussusception under ultrasound guidance: An initial experience in a developing country. *Afr J Paediatr Surg* 2008; 4 (2):68-71.
11. Applegate KE. Intussusception in children: imaging choices. *Semin Roentgenol* 2008; 43 (1):15-21. Doi:10.1053/j.ro.2007.08.003.
12. Daneman A, Navarro O. Intussusception: the debate endures. *Pediatr Radiol* 2005; 35 (1): 95-96.
13. del Pozo G. Intussusception: still work in progress. *Pediatr Radiol* 2005; 35 (1):92-94
14. Abantanga FA, Amoah M, Adeyinka AO, Nimako B, Yankey KP. Pneumatic reduction of intussusception in children at the Komfo Anokye Hospital, Kumasi, Ghana. *East Afr Med J* 2008; 85 (11):550-555.
15. Justice FA, de Campo M, Liem NT, Son TN, Ninh TP, Bines JE. Accuracy of ultrasonography for the diagnosis of intussusception in infants, in Vietnam. *Pediatr Radiol* 2007; 37 (2):195-199. doi:10.1007/s00247-006-0381-1.
16. Krishnakumar, Hameed S, Umamaheshwari. Ultrasound guided hydrostatic reduction in the management of intussusception. *Indian J Pediatr* 2006; 73 (3):217-220.
17. Bucher BT, Hall BL, Warner BW, Keller MS. Intussusception in children: cost-effectiveness of ultrasound vs diagnostic contrast enema. *J Pediatr Surg* 2011; 46 (6):1099-1105. doi:10.1016/j.jpedsurg.2011.03.034.
18. Henrikson S, Blane CE, Koujok K, Strouse PJ, DiPietro MA, Goodsitt MM. The effect of screening sonography on the positive rate of enemas for intussusception. *Pediatr Radiol* 2003; 33 (3):190-193. Doi:10.1007/s00247-002-0848-7.
19. Groen RS, Leow JJ, Sadasivam V, Kushner AL. Review: indications for ultrasound use in low-and middle-income countries. *Trop Med Int Health* 2011; Sep 1. doi: 10.1111/j.1365-3156.2011.02868.x. [Epub ahead of print]
20. Shanbhogue RL, Hussain SM, Meradji M, Robben SG, Vernooij JE, Molenaar JC. Ultrasonography is accurate enough for the diagnosis of intussusception. *J Pediatr Surg* 1994; 29 (2):324-327; discussion 327-328.