Air insufflation for the treatment of intussusception in the Radiology Department at the University Hospital of the West Indies (UHWI) between 1998 and 2003

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Citation

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Abstract

Objectives: Intussusception, a common cause of an acute abdomen in children less than 2 years old can lead to bowel ischaemia with associated gangrene in undiagnosed cases with potentially fatal consequences. Air insufflation fluoroscopy is the method most commonly utilized at the Radiology Department of the University Hospital of the West Indies (UHWI) for both diagnosis and treatment of this condition. Internationally accepted rates of reduction are in excess of 70%, and perforation rates 3% or less. The reduction and perforation rates at the UHWI were previously undocumented.We aim to compare the reduction and perforation rates by air insufflation at the UHWI with the current standards in the literature. We also aim to identify potential causes of differences in rates and possible solutions for improving reduction rates. We also plan to propose a protocol to be instituted for all patients presenting for investigation and management of intussusception at UHWI.Method: A retrospective review of all cases performed between 1998 and 2003 was done using the logbooks available in the x-ray department.Results: There were 91 cases of suspected intussusception, Ages ranged from 6 weeks to 16 months. 51 cases were confirmed. The reduction rate was 56%. The perforation rate was 3.3%, not statistically significant from reports in the literature.Conclusions: Our reduction rate was found to be below the internationally accepted standard. This was thought to be due to lack of standard equipment and level of operator experience.

INTRODUCTION

Intussusception represents the telescoping of a segment of bowel into an adjacent segment. The proximal segment is the intussusceptum and the distal segment the intussuscipiens. It is a very common cause of an acute abdomen in children less than 2 years old, most commonly occurring between 6 months to 2 years of age and is typically idiopathic in this age group. In older children (>5 years) or adults, it is typically associated with a 'lead point' ([1]). Post surgical fibrotic changes and congenital disorders such as Meckel's diverticulum or duplication cysts may serve as lead points. Tumours including lymphoma, carcinoid, primary adenocarcinoma and metastases may also be culprits. Intussusception predominantly affects the small bowel, and may be ileo-colic or ileo-ileal. Ileo-colic intussusceptions are the most common variety and are the type is most commonly seen in young children. Ileo-ileal intussusceptions are likely to be associated with a tumourous lead point ([1]).

The typical clinical presentation of intussusception includes abdominal pain, passage of bloody stool (currant jelly) and an abdominal mass may be palpated. Despite this, the clinical findings are often confusing. In addition, only 30-68% of patients with typical clinical features are confirmed to have intussusception [[2345678]]. The detection of intussusception is crucial, as bowel ischaemia with associated gangrene is the end point in undiagnosed cases with potentially fatal consequences.

The investigation of intussusception is radiological. The modalities utilized are:

- Plain Radiography
- Fluoroscopic enemas
- Ultrasound
- Computed Tomography (CT)

Plain films may demonstrate a rounded soft tissue density

"mass" typically in the right side of the abdomen. It may also demonstrate evidence of perforation or other causes of the patient's symptoms. Fluoroscopic enemas using barium as contrast was the first investigation used. Fluoroscopic enemas cannot be used to diagnose ileo-ileal intussusceptions

Ultrasound is a quick and relatively simple method for identifying an intussusception and does not involve the use of ionizing radiation, a major benefit in the paediatric population. It can be used to identify both ileo-colic and ileo-ileal intussusceptions. In many institutions it is the first investigation, reliably excluding an intussusception. It can also be used to guide hydrostatic (using water) reductions with a 76-95% reduction rate [9].

CT is used as a problem solver. If sonographic findings are equivocal, CT can be used to diagnose an intussusception, and if negative in this regard, can be used to identify other causes of an acute abdomen. Due to the high radiation dose, and the fact that sedation may be necessary, CT should be used when only necessary. CT cannot be used for radiological reduction.

Radiological intervention (ie reduction) is the first and commonly the only necessary option. Surgical intervention is only used when:

- Repeated attempts at radiological reduction fails
- Perforation occurs at radiological intervention
- If signs of peritonism or perforation are present clinically (an absolute contraindication to radiological reduction).
- The intussusception is determined to be other than ileo-colic. Radiological intervention is also contraindicated in this situation.

Fluoroscopy using air or hydrostatic means is probably the most common method of reduction. Barium or water-soluble contrast may be used to hydrostatically reduce the intussusception. Hydrostatic reduction (barium/water soluble contrast) has a reduction rate of about 80% [18,10,11]. There is however a significant radiation dose to the infant. Peritoneal contamination with barium with associated peritonitis can be a major problem if perforation occurs. Water-soluble contrast carries a lesser risk of peritonitis if perforation occurs [12].

Air insufflation is advocated in many institutions. Its benefits include:

- Quick
- Clean
- High reduction rate (78-95%) [910]
- Smaller perforations compared to barium reductions[9]
- Contamination and peritonitis not a significant problem compared to barium
- Lower radiation dose [31314]

The risk of perforation is slightly higher compared to hydrostatic methods [9].The overall rate of perforation for all methods ranges between 0-3% [15].

At the Radiology Department at UHWI, cases present from both Bustamante Children's Hospital (BCH) and UHWI. The majority of cases are from BCH. A parent/guardian and a nurse typically accompany patients. Many patients present to the department with inadequate resuscitation and without a pediatric surgeon. Patients presenting from BCH are not admitted to UHWI. They present directly to the Radiology department at UHWI for investigation and management without the involvement of the paediatric surgeons at UHWI. Air insufflation enema is the current modality used in the investigation and management of intussusception. Ultrasound was recently introduced in the investigation of these patients. The use of ultrasound is not universal in this department however. There have been a few attempts at the use of ultrasound guided hydrostatic reduction in this department.

There is no written protocol for the management of children with intussusception. As a result, there is no uniformity in the approach to management in terms of:

- Number of attempts
- Pressures used
- Use of sedation

METHOD

A manual search of all the air insufflation studies done at the UHWI for the 5-year period between 1998-2003 was done.

Records before this period were unavailable.

Data recorded included the following:

- Age
- Sex
- Admitting hospital
- Positive or Negative finding
- Number of attempts
- Success or failure of reduction (success being defined as retrograde filling of the small bowel with air)
- Complications

There was an initial plan to obtain data from the patient's notes. The majority of the patients were from the BCH. Access to the records proved difficult for several reasons including:

- The logistical problem with the difference in location of the hospital sites. The patients were sent to the UHWI for reduction, but were not admitted there. The notes commonly did not accompany the patient.
- Finding the notes retrospectively at BCH was difficult, as many patients did not have registered names, their names being given as "Baby of: Mothers Name". At the time data gathering for this study, the patients already had registered names.

As a result many of the notes could not be found. Only two patients were recorded as being admitted to the University Hospital of the West Indies. As a result of this, it was decided to not include data from the notes.

RESULTS

A total number of 91 patients were found from review of the departmental records. All patients underwent air insufflation. The records did not consistently demonstrate whether ultrasound was done. Of the 91 patients, 51 were diagnosed with intussusception. Of these, only 32 were reduced (Table 1.). This represents a reduction rate of 56%.

Figure 1

Table 1

Positive	Negative	Reduced	Failed	Perforation
57	34	32	25	3

There were 3-recorded perforations, representing a perforation rate of 3.3% (Table 2).

Figure 2

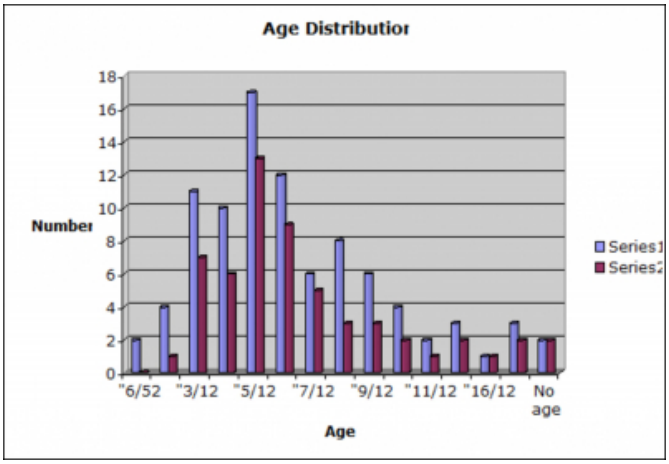
Table 2

Reduction Rate	56%
Number of repeated attempts	2
Perforation rate	3.3%
Males	61%
Females	37%

Of all the patients referred, 53 (58%) were male, and 36(40%) were female. Of those diagnosed with intussusception, 35 (61%) were male and 21 (37%) were female. No gender was recorded for 2 of the cases. The youngest patients referred were 6 weeks of age. There were 2 such patients, and both were negative for intussusception. The youngest age where there was a positive result was 2 months, where there was one case. The most common age was five months, where there were 13 cases. Figure 1 demonstrates the age distribution.

Figure 3

Figure 1



DISCUSSION

The rate of reduction of intussusception at UHWI is 56%.

The British Society of Paediatric Radiology draft guidelines for suggested safe practice includes the following:

- Radiological reduction should only be done in a hospital where the radiologist has appropriate continuing experience and surgeons and anaesthetists competent to deal with the complications are available.
- Target of treatment should be >65-70% reduction rate
- A minimum target of 50% reductions is recommended
- Centres with reduction rates <50%: consider re-training or transferring patients to another hospital.
- Regular audits of intussusception figures should be undertaken

The rates are above that which would recommend cessation of the service. The reduction rate is however less than the target of greater than 65-70%. The general literature states reduction rates of 78-95% %) [$_{910}$]. The perforation rate of 3.3% is higher than the upper limit of 3% recommended. It is therefore apparent that there is significant room for improvement at the UHWI.

There are several factors which were identified which may have contributed to the less than optimal performance. These were classified into four main groups as follows:

- Referral source
- Patient characteristics
- Radiologist factors
- Facilities and Equipment

Greater than 90% of patients were referred from BCH. In some cases, the patients were referred to the BCH from another outlying hospital, health centre or GP practice. Adding to this was the persistent difficulty of transporting the patient from the BCH to the UHWI. This was due to frequent non-availability of ambulances as well as nursing staff to accompany the patients. In some cases, the parents of the children arranged their own transportation, which included taxis. As a result of this, many patients were referred to the radiologist at the UHWI greater than 24 hours after the onset of symptoms.

It was difficult to determine whether any intravenous hydration was administered during the transfer process. None of the radiology reports mentioned this. The reports also did not mention the status of the medical staff accompanying the patient. It was the personal experience of the authors however to note that these infants were frequently accompanied by nursing assistants who were not qualified to monitor or administer the required fluid regime, hence it is likely that the lack adequate resuscitation was contributory to poor success rates.

As a result of the factors outlined above, many patients were not ideal or even suitable candidates for reduction by the time they presented to radiology. Once presented to the UHWI, the patients remained in the radiology department during their treatment. There are no observation wards at the UHWI therefore there was no place to house and monitor the children during the typical 2-6hr rest interval between attempts. As a result of this, the number of attempts was limited to one in all except 2 cases. These two cases were admitted to UHWI. This limited number of attempts was due to the fact that. If the attempt was unsuccessful, the patient was sent back to the BCH. No patients were sent back for a second attempt.

During the period of this audit (1998-2003), only a single radiology resident was on call during emergency hours. Most patients presented during these hours. These residents performed the reductions either alone or with the assistance of the pediatric surgeon (if one accompanied the patient). No documentation as to whether the radiology consultant was informed or attended. There was also no documentation by these residents with regards to:

- Resuscitation status
- Presence of a Pediatric surgeon
- Ultrasound done prior to reduction
- Pressures used during attempts
- Difficulties encountered

The reports themselves were brief, frequently only stating whether an intussusception was identified or not and whether or not reduction was successful. Only a few reports mentioned the location of the intussusception. The success of reduction was staff dependent. Some residents were never successful in their attempts, while some had rates greater than 75%. Several factors might have contributed to this.

The successful residents performed more reductions, and their success is likely to be related to experience. These residents tended to have a more aggressive approach to the performance of investigations and intervention in general. The last but probably most significant factor is the absence of a consultant radiologist in these cases.

The current equipment used for air insufflation is a modified sphygmomanometer attached to a Foley catheter. This provides intermittent busts of air during the reduction process. Maintenance of continuous pressures is almost impossible. This fluctuating pressure head may have been contributory in the low reduction rates. Quality control of this equipment was never done. Hence it is not possible to determine whether the pressures indicated were accurate.

Given these many shortfalls, it is not surprising that the success rate is just above acceptable. These shortfalls must be addressed if an improved service is to be achieved.

There are no written guidelines or protocol at present to address the management of these patients at the UHWI. We suggest that such a document be produced with the contribution by the radiologists, pediatric surgeons, anesthetists and emergency medicine physicians. The following are suggestions to be included in these guidelines:

- Transferal of all patients to UHWI for admission, to facilitate:
    - Improved resuscitation
    - Improved monitoring
    - Repeated attempts
    - Quick recourse to surgery if needed
- Experienced radiologist performs or directly supervises procedure.
- Ultrasound must be done first. This would :
    - Identify the intussusception and indicate the type
    - Assess reducibility
    - Identify other problems
- Pediatric surgeon must accompany patient
- At least 3 attempts should be done
- Better equipment is also needed. There are specialized pump systems that are available for this purpose, which can deliver continuous non-fluctuating pressures. As per the recommendations by the British Society of Paediatric Radiology, frequent audits of the service should be done.

If these factors are addressed, it is likely that the success rates will improve. It is the intention of the authors to re-audit the service once these factors have been addressed.

CONCLUSION

Intussusception is a very common cause of acute abdomen in infants. At present air insufflation reduction is the modality used at UHWI for initial treatment. This is a safe and successful method. The success of this technique at UHWI, though above the minimum standard, is still well below the ideal. Several factors contributing to this have been identified. If these are addressed, it is likely that the success rates will improve.

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