

Specialty Corner

Produced by:



PISSA

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Journal review

by Aadil Ahmed and Mala Modi

Soboleski D, Theriault C, Acker A. Unnecessary irradiation to non-thoracic structures during pediatric chest radiography. *Pediatr Radiol* 2006; 36: 22 – 25.

This article highlights the fact that our present positioning techniques for paediatric chest radiographs result in unnecessary radiation exposure to non-thoracic structures.

Pearls:

- Infants and young children have a higher sensitivity than older children and adults to radiation exposure and the potential for harmful side-effects.
- The ratio of radiation exposure to non-thoracic structures increases as the age of the patient decreases.
- \pm 43% of the length of the chest radiographs in this study was of non-thoracic structures and it was also demonstrated that no significant additional information was obtained by including the neck or abdomen in chest radiographs done for cardiorespiratory pathology.

Defining new landmarks for positioning/collimation is necessary to eliminate this problem and also to satisfy the ALARA (as low as reasonably acceptable) principle.

Fung E, Ganesan V, Cox TSC. Complication rates of diagnostic cerebral arteriography in children. *Pediatr Radiol* 2005; 35: 1174 – 1177.

Cerebral arteriography (CA) in children is investigated, and the differences between adults and children in terms of local and neurological complications are compared. This article is particularly relevant as most CA articles either have an adult bias, or are relatively outdated – and there have been significant technological advances.

CA is useful in the evaluation of cerebral arteriovenous malformations and aneurysms and has a continuing role to play in the detection and characterisation of arteriopathies in children with arterial ischaemic stroke, for example, moyamoya syndrome, embolic disease and inflammatory processes.

Pearls:

- CA can be technically challenging in a small infant with extra adipose tissue so that local complications may be more common than in adults.
- Conversely, the absence of co-morbid factors, such as diabetes and hypertension, or of widespread arterial disease, means that neurological complications are likely to be less common in children than in adults.
- CA is a superior technique to standard MRA sequences as it provides dynamic information regarding the cerebral circulation.
- CTA is more freely available, and its value has been proven in adults, even though it uses both iodinated contrast and ionizing radiation
- A comparative study of helical CTA, MRA and DSA in children has demonstrated that helical CTA is superior to MRA in the identification of the intracranial vasculature (venous and arterial) and is almost as good as DSA.

The author and his group performed CAs under GAs which in itself can be a deterrent, as well as the fact that patients require a 2-day admission.

This retrospective study carried out in a tertiary care institution concluded that CA has a continuing role to play in evaluating cerebrovascular pathologies in kids.

In experienced hands neurological complications are rare and local complications are not uncommon (around 5% in this study) but are not usually serious (the commonest being groin haematomas and bleeding at the puncture site).

News: indecent 'imaging' of children

By Savvas Andronikou

A doctor was struck from the General Medical Register in the UK after he pleaded guilty to making indecent images of children. A panel found that he downloaded images from the internet deliberately. 'The public interest includes protecting patients and maintaining public confidence in the profession and maintaining proper standards of professional behaviour and conduct.' Children's rights must be protected on their behalf and medical practitioners including radiologists should be instrumental in bringing injustices to light particularly with regard to abuse and sexual abuse. Child pornography is sexual abuse! Reference: GMC Newsletter Issue 5 December 2005.

Workshop on paediatric fluoroscopic imaging and paediatric ultrasound technique

On Saturday 25 February the first workshop for paediatric imaging in South Africa took place in Johannesburg under the auspices and sponsorship of the College of Radiology of South Africa and the Paediatric Imaging Society of South Africa (PISSA). This was organised by Mala Modi and her team of registrars (Lee Kramer and Jeanie Jennings). Over 75 doctors attended this compact course which answered practical issues relating to procedure performance. These included MCUG, contrast swallow/meal, tube oesophagogram, ultrasound for UTI, head ultrasound and imaging of hypertrophic pyloric obstruction. There was also a speak-off on the current management of intussusception by Dr Aadil Ahmed of Baragwanath Hospital and Professor Savvas Andronikou of Tygerberg Hospital, which is mirrored in this publication. There was also an interactive session on interpretation of neonatal ICU films including tube and line placement and recognition. The workshop was free to delegates and PISSA is grateful to the President of the College of Radiologists for its new educational initiative in sponsoring the airfare for Professor Andronikou to run the course.

Controversy and consensus on the management of intussusception. Guidelines to diagnosis and management for suggested safe practice – a literature review

Aadil Ahmed and Mala Modi, Dept of Radiology, University of the Witwatersrand and Chris Hani Baragwanath Hospital

Intussusception is the invagination of a segment of bowel (the intussusceptum) into the contiguous segment (the intussusciptum). The peak incidence is between 6 months and 2 years.¹ Most cases are idiopathic, but in a small number there is a pathological lead point. Common sites are ileocolic and ileoileocolic.^{1,2} The classic clinical triad of abdominal pain, red currant jelly stool and palpable abdominal mass is present in less than 50% of children.²

Imaging diagnosis

1. **Sonography** is reported to be sensitive. A 100% negative predictive value has been reported in some series and is used as the modality of choice for diagnosis and exclusion in many centres. Intussusception has a characteristic appearance. A 3 - 5 cm soft-tissue mass is demonstrated, more often on the right side of the abdomen, and usually found just deep to the abdominal wall. The 'crescent in doughnut' sign and 'pseudokidney' sign have been described. Sonography is also useful in documenting the presence or absence of a pathological lead point or excluding other abdominal pathology. The presence of free fluid is a common finding and is not a contraindication to reduction. Non-visualisation of blood flow in the intussusception by colour Doppler is not a contraindication to reduction, but cautious reduction should be undertaken.²

2. No reported study has demonstrated **plain radiographs** to be as good as sonography, however, its importance, especially a horizontal beam radiograph, in detecting free air, cannot be overemphasised.^{1,2} Some characteristic signs include the 'meniscus' sign and the 'target' sign.

3. A **diagnostic enema** was considered the gold standard until the value of sonography was recognised. It is more invasive, requires radiation exposure and may not demonstrate the presence of other intra-abdominal pathology.

Radiological management

The major advantages of radiological management are decreased invasiveness and morbidity, lower costs and shorter hospital stays.³ The general contraindications include: (i) clinical evidence of dehydration, shock or peritonitis; and (ii) radiographical evidence of a perforation with free air.

Pneumatic reduction will be discussed as this technique is used in many centres worldwide as well as in our institution, and is generally considered the optimal technique.³⁻⁵

- The patient must be fully resuscitated with an IV line *in situ*.
- Informed consent must be obtained from a parent or guardian.
- The local paediatric surgeon should be aware of the procedure and a doctor trained in paediatric resuscitation should be in the room.
- Fluoroscopically guided reduction is used due to ease of use and familiarity.
- Ultrasound guidance has the advantage of no radiation, but can be technically chal-

lenging, and recognition of perforation may also be difficult.

- Methods to improve reduction success are variable and of limited use with no significant increase in reduction rates:
- Medications: (i) antispasmodics are not routinely indicated; (ii) sedation is of questionable value, may have an unpredictable response and has the disadvantage of masking the patient's condition; and (iii) consider analgesia as an alternative.^{3,4}
- Delayed repeated attempts; the time interval varies from 30 minutes to 24 hours and is only applicable in a minority of patients and depends on local and clinical circumstances.
- The catheter used is a local decision, but a large-bore tube or catheter is suggested
- Meticulous strapping of buttocks is suggested, as a good anal seal is of utmost importance in maintaining a sustained pressure.
- The initial attempt should be at pressures of 60 - 80 mmHg.
- Three attempts of 3 minutes each are usually sufficient and safe.
- It is generally recommended that each attempt at reduction should be for a maximum of 3 minutes, with approximate 3-minute intervals between attempts (Rule of 3's).^{1,4,5}
- Increasing pressure with subsequent attempts, to a maximum pressure of 120 mmHg is recommended.^{4,5}
- A pressure release valve with a cut-off at 120 mmHg is an alternative in the absence of a pressure manometer.
- Successful reduction is usually defined as free flow of air into the distal ileum. If no reflux of air into the ileum is seen, the patient may be observed and management decided on the child's clinical state.
- Complications: (i) the major complication is bowel perforation, a large pneumoperitoneum can be relieved by needle puncture of the abdomen to prevent the rare complication of tension pneumoperitoneum; (ii) hypovolaemic shock requiring resuscitation; and (iii) the risk of bacteraemia.
- In some instances sonography may play a role, post reduction or attempted reduction: (i) to confirm reduction; (ii) to assess for pathological lead point; and (iii) to delineate the presence of unreduced component.
- Regular audits of intussusception figures should be undertaken. Successful reduction rates of > 50% should be aimed for.⁴

1. Dahnert W. *Radiology Review Manual*. 5th ed. Lippincott Williams and Wilkins, 2003:835 - 837.

2. Daneman A, Navarro O. Intussusception: A review of diagnostic approaches. *Pediatr Radiol* 2003; 33: 79 - 85.
3. Daneman A, Navarro O. Intussusception: An update on the evolution of management. *Pediatr Radiol* 2004; 34: 97 - 108.
4. British Society of Paediatric Radiology. *Guidelines for Intussusception Reduction*. 2003.
5. Rosenfeld K, McHugh K. Survey of intussusception reduction in England, Scotland and Wales: how and why we could do better. *Clin Radiol* 1999; 54: 452 - 458.

Comments on intussusception reduction – the Tygerberg Hospital experience

By S Andronikou, A Erlank, M Strachan, G Dekker: Radiology Department, Tygerberg Hospital and University of Stellenbosch

In view of your review article on air reduction of intussusception, we would like to comment as follows:

Precautions and Preparations

- If you do use ultrasound for the diagnosis, be confident about a positive diagnosis; if you are confident about the diagnosis of exclusion of an intussusception do not proceed with any procedure.
- No positive ultrasound finding for intussusception is a contraindication for air reduction.
- Only proceed to air reduction if a paediatric surgeon and adequate resuscitation equipment are available on site.
- Check films for features of bowel perforation (free air) and for features of colitis (mural air) and cancel the procedure if present.
- Insist on attendance of surgical staff.
- Insist on intravenous access.
- Have large-bore needles available – place in the attending surgeon's hands.
- We do not wait for fluid resuscitation because we lose valuable time.
- Do not sedate the patient; it only confuses patient monitoring.

Some advice on the procedure itself

- Use a balloon catheter (24 F) to get a good seal and keep it neat¹ (Figs 1a and b)

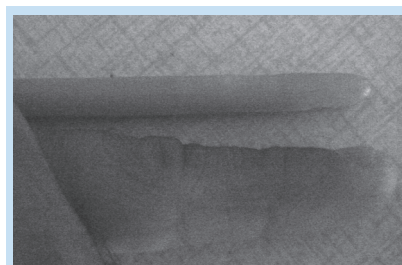


Fig. 1a. A little finger which is accepted for PR examinations in young children is much larger than a 24F Foley catheter.

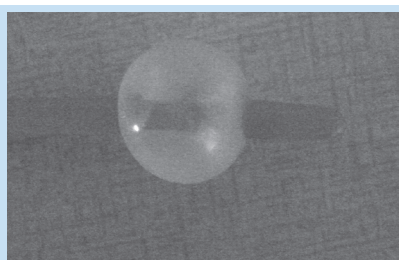


Fig. 1b. The balloon that is inflated in the rectum acts as a seal to prevent air leakage.

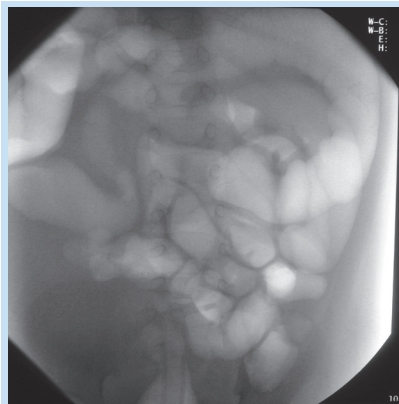


Fig. 2. We recommend this preliminary film which shows the amount of central gas prior to reduction attempt and is a valuable record when the free flow into the small bowel is not actually visualised.

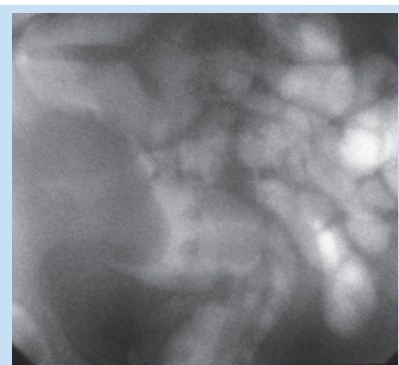


Fig. 3. An early image stored as a 'grab' is of low quality but is sufficient to demonstrate the intussusception being forced back by the column of air. Note that air on fluoroscopy is 'white' and that the sigmoid is in a 'mirror image' position because the procedure is performed prone by our team.

- Store an image before air is going in – it helps to see the central gas paucity later when confused about free flow into the small bowel (Fig. 2)
- Prone position helps hand grasp seal
- Be prepared for direction of sigmoid when prone (Figs 3 - 5)
- Do not infuse air until watching with fluoroscopy
- Rotate tasks with many people
- Try hard.

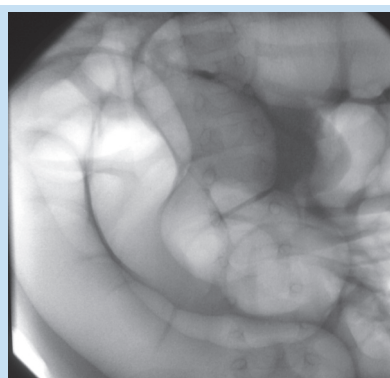


Fig. 4. Later during the procedure the intussusceptum is driven even further. Note that this image was recorded as a spot film resulting in a high quality image. Note the reversed position of the sigmoid once again, due to prone positioning.

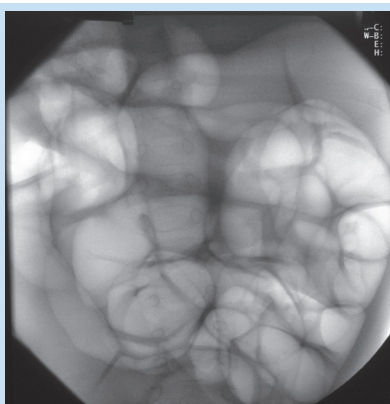


Fig. 5. Post reduction, there has been free flow of air into the small bowel indicating success of the procedure. Comparison with the initial image (Fig. 2) is useful.

Procedure rules

- There are no rules
- Try as many times as you like
- Come back as many times as you like
- 120 mmHg is not an absolute; you can go more but we do not recommend this; do not panic about small elevations above this.

Caution

- When perforation occurs remember the air is white on fluoroscopy – take a spot film to look for free air (Fig. 6); deflate the balloon; turn the patient; stick needles in the abdomen and resuscitate the patient
- Move fast because diaphragms are high in the chest due to high pressure.

Why are we not succeeding?

- We do not try long enough or hard enough
- Our patients present late (anecdotal success rate in the UK is about 90% and in SA about 60%)

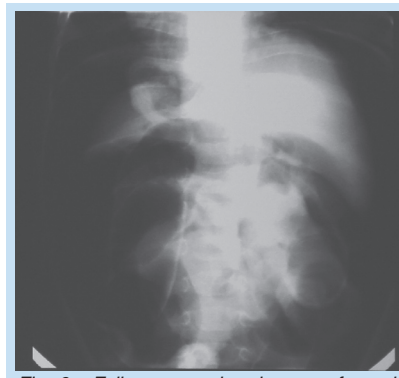


Fig. 6. Full exposure has been performed and the image contrast reversed to demonstrate free air in the recognisable 'black' form after perforation.

- Perforation probably happens in patients with bowel necrosis and not from too-high pressures.

1. McAlister WH, Parker B. Appropriateness criteria for imaging and treatment decisions. Expert panel on pediatric imaging. Possible acute or chronic sinusitis. *Radiology* 1998;206:595-598.

Reportage: Can the radiologist consult directly with the patient?

According to regulation 17 of the regulations relating to the specialties and subspecialties in medicine, which were published in government notice no. R590 of June 2001, any specialist may treat any person who comes to him or her directly, without referral by another medical practitioner. In essence this means that a patient can present to a radiologist and request a CT scan. The radiologist is the best person to decide on the appropriate investigation, and this may seem completely logical and ethical. There are many pitfalls, however when the radiologist has not or cannot perform the full clinical examination and take the complete history into account. Appropriate use of this regulation is for example for mammography, which is usually a screening test. Referral of a patient to the clinical specialist can occur if pathology is identified.