ADULT INTUSSUSCEPTION: CURRENT PERSPECTIVE

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ABSTRACT

Intussusception, the invagination of a segment of the bowel into the lumen of a contiguous segment, is an uncommon cause of abdominal pain and bowel obstruction in adults. Due to the often incomplete nature of the obstruction, presentation in the adult patient may be delayed and the diagnosis is either missed or made at *exploratory laparotomy* in regions where sophisticated imaging facilities such as *computed tomography* (CT) scan are not readily affordable or available. A high index of suspicion is required for the earlier detection of this condition in the adult patient for prompt and successful surgical intervention.

Keywords: Adult Intussusception, Abdominal Pain, Incomplete Obstruction, Index of Suspicion, Late Diagnosis.

INTRODUCTION

Intussusception, derived from Latin words *intus* (within) + *sus-cipio* (to take up) is the clinical condition involving the invagination of a bowel segment (Intussusceptum) into the lumen of the immediate adjoining part (Intussuscipiens).[1] The direction of the slide is commonly distal (antegrade) but may be retrograde in rare cases. Intussusception or *"introsusception"* as it was previously called, was first described by Paul Barbette of Amsterdam in 1674.[2] Cornelius Velse recorded the first successful laparotomy for adult intussusception.[3] In 1789, John Hunter described the post mortem pathology.[4]

The aetiology, clinical features and management of paediatric intussusception are quite different from the adult disease (table 1) Adult intussusception (AI) is an infrequent cause of abdominal pain and intestinal obstruction. The clinical symptoms may be acute, sub acute or chronic.[5,6] Most cases present with incomplete bowel obstruction. Unlike childhood intussusception which is classically characterized by the triad of colicky abdominal pain, presence of a palpable abdominal lump and the passage of

Table 1 Differences between adult and childhood intussusceptions

S/No	DIFFERENCES	CHILDREN	ADULT
1.	Percentage of all intussusceptions	95%	5%
2.	Cause of intestinal obstruction	Frequent	Rare (5% of all intestinal obstructions)
3.	Aetiology	90% idiopathic (Peyer's patch enlargement in nearly 50%).	Rarely idiopathic; Cause identified in 70%-90%
4.	Clinical symptoms (Classic triad: Colicky Abdominal pain, Abdominal lump & Red currant jelly stool).	Usually present	Occurs in only 2%
5.	Treatment	Mainly by attempts at non-operative (pneumatic or barium hydrostatic) reduction	Surgical resection almost always required.

red currant jelly stool, the abdominal pain of the adult disease is often nonspecific and elusive.[7]

Therefore, the diagnosis can be challenging as the intermittent abdominal pain which is the main symptom often settles comparatively quickly. Clinical examination and routine investigations are often negative and these patients will probably be labeled as having peptic ulcer disease or any of the other numerous differentials.[8] These factors account for the often missed diagnosis which characterize AI. Multi-Detector Computed

Tomography (MDCT) scan is crucial in distinguishing AI from other causes of abdominal pain. In resource poor regions with limited access to ancillary investigation facilities such as the CT scan, majority of the adult disease are ultimately diagnosed at exploratory laparotomy. In order to achieve good outcomes from the management of this condition, early clinical recognition and prompt surgical treatment are pivotal.

EPIDEMIOLOGY

Intussusception in patients older than 16-years of age is an uncommon condition, unlike in young children in whom it is the leading cause of intestinal obstruction and the second most common cause of acute abdomen after appendicitis.[9] The annual incidence of the adult disease is 2 – 3 cases per population of one million.[6] It only represents about 1% of bowel obstruction in the adult population, 0.08% of all abdominal operations and < 0.1% of overall hospital admissions among adults.[7,10,11]

Children are afflicted more than adults with an approximate ratio of 20 to 1.[12] Due to the rarity of intussusception in the adult population, available medical literature on AI has been limited to case reports, case series and retrospective surveys with no prospective publications, in contrast to childhood intussusception.

Adult intussusception has no definite gender predilection, contrary to the male preponderance often seen in the paediatric age group.[13,14] Case series on AI which cite unequal gender distribution are deemed not to be representative.

The median age at presentation of AI varies. Most publications report the 5th and 6th decades of life.[14,15]

No region of the world is exempt as AI has been reported from every part of the globe.

AETIOLOGY.

Any intestinal disease or condition which alters the normal pattern of peristalsis in the gut would increase the risk of intussusception.[2-4] Aetiologically, AI may be primary (idiopathic) or secondary (either to a benign or malignant lesion).

In the pre-CT era, idiopathic intussusception, of which no underlying lesion was found, accounted for 10 - 20% AI. The remaining 80 – 90% of cases were secondary to an identifiable pathology, being either a benign or malignant condition. The reverse is the case with paediatric intussusception of which 80 - 90% are idiopathic.

However, in the modern era, the frequent use of CT scan has led to the identification of idiopathic intussusception in 30 - 40% of AI in some centres.[15,16] This discordance is likely the result of the CT identifying a new subset of patients with incidental asymptomatic intussusception.[15] Secondary intussusception is due to the presence of either intra- or extra-luminal bowel conditions. As such, recent trauma and operative factors (eg suture lines, submucosal bowel oedema, anastomotic strictures, gastrojejunostomy stoma, adhesions, feeding jejunostomy tubes, appendix stump) could produce a kink and initiate the invagination which leads to small bowel intussusception in adults.[17]

Other non-neoplastic causes are Meckel's diverticula, endometriosis, Henoch–Schönlein purpura, coeliac disease, Crohn's disease, lymphadenitis and human immunodeficiency virus related infections.

The ingestion of plantains (*Musa paradisiaca*) which contain 5-hydroxytryptamine (Serotonin), presence of ascariasis, mobile caecum, antihelminthics and amoebiasis were some of the aetiological factors specifically associated with the caecocolic variety of intussusception seen in Western Nigeria in the past.[6,18,19,20,21]

Several tumours (benign or malignant; primary or metastatic) could serve as lead points in AI. They include inflammatory fibrous polyps, Peutz-Jeghers syndrome polyps, lipomas, leiomyomas, haemangiomas, carcinoid tumours, leiomyosarcomas, malignant fibrous histiocytomas, lymphomas, gastrointestinal stromal tumour, adenocarcinomas and secondaries from melanoma, breast and lung cancers.

Generally, more cases of adult small bowel intussusceptions are due to benign pathologies in contrast with adult colonic

intussusceptions which are associated with a higher incidence of malignant tumours.

Statistically, previous reports attributed 30 – 35% of adult small bowel intussusception to malignancies, 60 - 70% to benign lesions and 10% were idiopathic.[5,17,23-26] Conversely, adult large bowel intussusception was associated with malignancies in 65–70% of cases while about 30% were by benign pathologies.

PATHOLOGY

Intussusception occurs when a segment of bowel slides (intussusceptum) into the adjoining bowel lumen (intussuscipiens) along with its mesentery. The mechanism of production of intussusception is usually a proximal area of contraction invaginating into a distal area of relaxation. With an organic lesion in the bowel, there is a focus to be pulled ahead by the peristaltic wave into the adjacent segment of relaxed bowel. In most cases, the direction of this invagination is antegrade but few retrograde intussusceptions occur.

AI may occur anywhere in the gastrointestinal tract. Over 90% present in the small and large bowel. The remaining 10% are gastroduodenal, jejunogastric, coloanal and surgically created stomal intussusceptions.[25]

Common locations of intussusceptions in adults involve the intestinal segments lying between the freely moving bowel loops and attachments of any kind, such as the anatomical attachments to the retroperitoneum or bowel segments tethered by adhesions.[27]

Depending on the length of intussusception, the underlying aetiology and the extent of vascular compromise of the affected segment, various degrees of abdominal pain, intestinal obstruction (complete or incomplete), bowel ischaemia and peritonitis (sepsis) develop. Initially, the intussusception may be reducible. Late cases develop irreducibility and may become gangrenous or perforated.

Structurally, the mass called intussusception is composed of 3 layers of bowel wall comprising the entering (or inner) wall, the returning (or middle) wall and the outer (or receiving) wall (fig. 1).
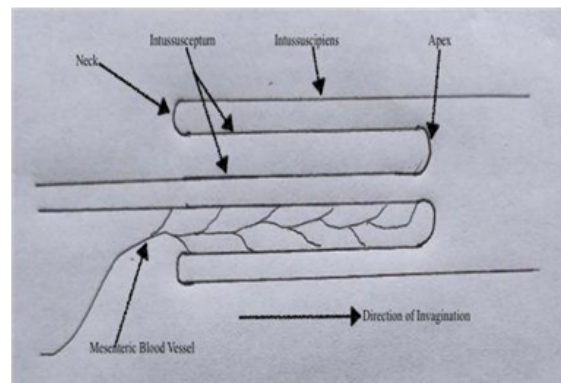

Fig. 1. Schematic Diagram of Intussusception

The entering and returning walls constitute the "Intussusceptum" while the outer wall (or sheath) is the "Intussuscipiens". The junction between the entering and returning walls is the "apex" (or lead point) whereas the junction between the returning and outer walls is the "neck". Lesions aetiologically associated with secondary intussusception are located at the apex where they produce a kink which serves as the lead point for AI.

Anatomically, intussusception is classified into 4 standard types based on both the site of location of the lead point and the bowel segment(s) involved. These are enteroenteric, ileocolic, ileocaecal and colocolic. Besides these, rarer miscellaneous forms exist namely: gastroduodenal, sigmoido-rectal, coloanal, and stomal intussusceptions.

Infrequently, a patient may develop retrograde intussusception (eg the jejunogastric intussusception), synchronous multiple intussusceptions or the compound type such as ileo-ileal-colic presentation.[9]

STANDARD TYPES

a.   Enteroenteric Intussusception:

This is the commonest form of AI in most series, constituting 70% in the report by Onkendi et al.[15,27] In this variety, both the lead point and the entire intussusception are confined to the small bowel. Enteroenteric intussusception may be further subclassified into duodeno-jejunal, jejuno-jejunal, jejuno-ileal or ileo-ileal depending on the small bowel segment(s) involved.[28]

b.   Ileocolic Intussusception

In this form, the ileum prolapses through a stationary ileocaecal valve into the colon. This was the commonest variety of AI seen in Jos, Nigeria but accounted for only 6% of cases elsewhere.[15,29] Therefore the type of intussusception seen in different geographical regions and even at different era in a particular geographical location could vary widely.

c.   Ileocaecal Intussusception.

The lead point of the intussusception in this category is the ileocaecal valve. This type of AI is relatively rare in many places. It accounted for 8% and 15% of cases managed at Rochester USA and Lagos Nigeria respectively.[15,30] However, in a series of transient intussusception detected by CT scan, ileocaecal intussusception was the most common type identified by Catalano.[31]

d.   Colocolic Intussusception.

The lead point and the intussusception in this variety are both confined to the large bowel. More than 65% of this type are associated with malignancies in adults. Contemporary reports from some centres identified the colocolic form of AI as the 2nd most common variety.[15,30]

Historically, the caecocolic intussusception was curiously and uniquely the commonest variety of AI seen in Ibadan, South-Western Nigeria in the early 1950's to the late 1960's. At the time, it accounted for >70% of cases in that locality, a peculiar prevalence which was not observed from any other region across the world. This earned caecocolic intussuscepion the unique sobriquet "Ibadan intussusception", otherwise described by Davey as "non-infantile idiopathic caecocolic intussusception".[18-21]

However, contemporary reports in the 21st century indicate the erstwhile unique variety appears to have changed. In a more recent publication by Irabor et al from the same institution at Ibadan, there was no incidence of caecocolic intussusception among the 3 cases of AI seen over a period of 10 years from 1990 – 2000. The cause for the dramatic change in incidence is still uncertain. Consequently, it's been suggested that the appellation "Ibadan intussusception" for caecocolic intussusception may have ceased to exist at the present era.[32]

MISCELLANEOUS TYPES

e.   Gastroduodenal intussusception

Gastroduodenal intussusception is usually caused by the prolapse of a benign gastric tumour into the duodenum, with subsequent invagination of a portion of the stomach wall.[33]

f. Sigmoido-rectal and Coloanal intussusceptions

Sigmoido-rectal and Coloanal intussusceptions usually occur in the setting of a benign or malignant tumour, with 50% attributable to a malignant lesion.[34,35] When the sigmoido-rectal intussusception reaches the anal canal or protrudes through it, this becomes sigmoido-anal or otherwise coloanal intussusception. It is important to differentiate these from rectal prolapse, which can be done by a careful clinical examination. In rectal prolapse, the entire anorectum is everted along with the dentate line.

Therefore, continuity can be palpated between the perianal tissue and the protruding lump, whereas in intussusception there is no palpable continuity and the finger can be freely passed between the anorectal wall and the prolapse throughout the circumference. This differentiation between intussusception and rectal prolapse is critical because the treatment of both conditions is different.[36]

g.   Retrograde and Stomal intussusceptions

Retrograde intussusception may occur denovo in an intact bowel or may develop as a rare post-operative complication of gastric operations such as gastrojejunostomy, Billroth II gastrectomy and Roux-en-Y gastric bypass which is usually performed for duodenal ulcer, gastric outlet obstruction, malignancy and weight loss.[37,38] When retrograde intussusception occurs through a surgically created stoma, it is known as stomal intussusception.

The exact mechanism for retrograde intussusception is not entirely clear. However, many reasons have been postulated vis-à-vis

motility disorder from the divided bowel, long afferent loop, increased intra-abdominal pressure, retrograde peristalsis, jejunal spasm with abnormal motility, increased mobility of the efferent loop and adhesions which could lead to the intussusception of a more mobile segment into a fixed segment.[37,39,40]

CLINICAL PRESENTATION

Adult intussusception (AI) has no characteristic symptom and no pathognomonic clinical signs. Therefore the clinical presentation of intussusception in the adult population is usually non-specific and elusive. Few are asymptomatic. Between 2% - 19% asymptomatic adult patients with intussusception were detected incidentally on abdominal MDCT imaging performed for other reasons.[15,24,41]

Intermittent abdominal pain is the most common symptom of AI present in >70% of cases in most series.[24] Oftentimes, this may be the only complaint. In some cases, the abdominal pain is due to transient intussusception which is a self-resolving invagination process at the early stages of the disease. The frequent use of Multi-Detector Computed Tomography (MDCT) scanners in abdominal imaging in the developed world has led to the identification of self-limiting "transient (non-obstructing) intussusception" as a clinical entity.[28] Transient intussusception may in some instances progress to persistent intussusception when it becomes irreducible with potential for significant clinical manifestations and complications.[42]

The presentation of AI is often subacute, or chronic and enigmatic which explains the delayed or missed diagnosis typically associated with this condition particularly, but not exclusively, in resource limited regions where CT scans are not readily accessible. The initial subacute or chronic symptoms may eventually progress to the acute state when complete intestinal obstruction supervenes with attendant bowel ischaemia, gangrene, perforation or peritonitis and the patient presents as a surgical emergency.

In the review article by Onkendi et al, the mean duration of symptoms between onset and hospital presentation was 69 days (range 1 day – 3 years), representing a significant delay in presentation which was shared by several others.[15,10,43] The duration of symptoms was longer in patients with benign and small bowel lesions compared to those with malignant and colonic pathologies.[10]

Other wide ranging non-specific clinical features of intussusception in the adult population include anorexia, nausea, fever, vomiting, rectal blood loss, abdominal distension and change in bowel habit characterised by diarrhoea, constipation or both. The ambiguity of these clinical findings and their similarity to many other more common conditions such as inflammatory bowel diseases, bowel obstruction due to peritoneal adhesions, and infectious gastro-enteritis make the clinical diagnosis of AI rather challenging. The frequency of these symptoms varies from one report to another. The most common symptoms associated with AI were abdominal pain (73 - 94%), nausea (36 - 82%), vomiting (36 - 65%), diarrhoea (18 - 30%) and bloody stools (15 - 29%).[25,26,44-46]

When AI coexists with a malignant tumour, the clinical features may include weight loss, melaena, or a palpable abdominal mass. Less than 25% of cases of AI present with the clinical finding of a palpable abdominal lump.[47]

The classic diagnostic triad pathognomonic of acute intussusception in infants and young children, comprising colicky abdominal pain, palpable sausage-shaped lump and passage of red currant jelly stool, occur in only 2% of adult patients with intussusception.[15]

When significant or complete intestinal obstruction supervenes, abdominal distension and constipation develop. Unfortunately, this is often the acute stage many of these patients become admitted into hospital for surgical operation. In fact, only one-third of AI cases were diagnosed prior to surgery in some series.[48]

Eisen et al. reported that only 40% of diagnoses were made before operative exploration, while Reijnen et al. obtained a preoperative diagnoses rate of 50%.[13,24] Consequently, majority of AI are still diagnosed on the operating table at emergency exploratory laparotomy.

DIFFERENTIAL DIAGNOSIS

The non-specific and transient symptoms of AI often mimic other disease conditions. Depending on the predominant clinical features in the patient at the time of presentation, cases of AI have been confused with other disease entities notably peptic ulcer disease, irritable bowel syndrome, gastroenteritis, cholecystitis, inflammatory bowel disease, pyelonephritis, intestinal helminthiasis and ureteric colic.[49]

The differential diagnosis of the complicated cases who present late with intestinal obstruction, bowel ischaemia, gangrene, perforation or peritonitis would include acute pancreatitis, mesenteric ischaemia, sigmoid volvulus, perforated peptic ulcer disease, typhoid intestinal perforation or perforated diverticulitis. In women, consideration may be given to ovarian torsion, ruptured ectopic gestation, tubo-ovarian abscess and acute pelvic inflammatory disease.

In the absence of sophisticated diagnostic imaging facilities, clinical signs and routine investigations are seldom adequate to resolve the attendant diagnostic dilemma occasioned by the non-specific symptoms and signs of AI. Consequently, most cases become diagnosed either on the operating table or in extreme situations at post mortem. Therefore, the widespread use of CT scan for the investigation and evaluation of adult patients with ambiguous nonspecific abdominal pains would significantly increase the rate of preoperative diagnosis of AI.

INVESTIGATIONS

Various imaging modalities could be used to establish the diagnosis of adult intussusception.[50] Yet, the diagnosis is frequently confirmed only during surgical intervention either due to non-availability of the appropriate imaging facility or late presentation at which time the safest management option would be an emergency operative exploration.

1. The radiological diagnostic investigation of choice for AI is contrast abdominopelvic CT scan. CT has emerged as a useful imaging modality for AI. It is often performed for the primary or secondary assessment of acute, subacute and chronic gastrointestinal symptoms of unclear origin, leading to the diagnosis of intussusception in patients with atypical presentations or unreliable history and physical exam findings.[44] The sensitivity and specificity are 71.4 – 87.5% and 100% respectively.[47] This makes CT the most sensitive diagnostic method in making a preoperative diagnosis of AI, especially in patients presenting with non-specific abdominal pain.[17,51]

Pathognomonic features of intussusception on CT scan include the 'target', 'bull's-eye' or 'doughnut' signs as well as a sausage-shaped double-ring mass lesion or hay-fork image.

Furthermore, CT scans also provide other critical information such as the length and diameter of the intussusception, three dimensional views of the bowel and surrounding viscera, possible lead point, type of and location of the intussusception, the intestinal segments involved, status of the supplying mesenteric vasculature, possibility of strangulation, the likelihood of partial or complete bowel obstruction, status of loco-regional lymph nodes, bowel perforation and the identification of other synchronous lesions.[52,53] CT scan is also useful for staging any underlying bowel malignancy associated with AI as well as the identification of metastasis from various primary sites (lung or breast, malignant melanoma, osteosarcoma, and lymphoma).

In centres where CT is widely used in various clinical scenarios, this has consequently increased the detection rates of otherwise obscure gastrointestinal pathologies such as the incidental AIs.[47]

The setbacks of CT scanner are the radiation risk, contrast hazards and the cost. The last renders it less affordable and available in resource-limited communities. However, as more local centres acquire CT scanners and more adults enrol into the National Health Insurance Scheme (NHIS), the limitation of accessibility to CT scans may someday become history in Nigeria.

2. Abdominal ultrasonography scan (AUSS) which is the diagnostic investigation

of choice for childhood intussusception has lesser success and value in adults. The pathognomonic ultrasonography findings in intussusception are the 'target' or 'doughnut' signs on transverse view, the 'pseudo-kidney' sign on oblique view and the 'trident' sign on longitudinal view.[50,54-56] The availability, cost-effectiveness, portability, rapidity and absent radiation risk associated with AUSS are strong advantages of this diagnostic imaging device over the CT scanner.

However, several factors limit the usefulness of AUSS when used for the diagnostic evaluation of adult patients with intussusception. They include the presence of bowel oedema in the patient, air-fluid levels, larger faecal loads, thick abdominal walls in the obese adult and operator dependency.[57]

However, in adults presenting with a clinically palpable abdominal mass, the USS has more than 90% accuracy for the detection of intussusception.[57,58]

3.　　Plain abdominal X-ray (AXR) is often used as the first diagnostic tool in our environment because the patients usually present late with features of bowel obstruction. While X-ray findings are not specifically diagnostic of AI, features such as distended bowel loops, absent caecal gas and multiple air-fluid levels seen with other causes of intestinal obstruction would indicate the need for operative exploration. In cases with small bowel intussusception, AXR might rarely show the "air crescent sign" which is intraluminal air trapped between the walls of the intussusceptum and intussuscipiens. These findings nevertheless lack the specificity and sensitivity to diagnose intussusception.[59,60]

4.　　Endoscopic approaches such as flexible sigmoidoscopy, colonoscopy, capsule endoscopy and small bowel enteroscopy may be useful in establishing the diagnosis of AI in elective patients with subacute or chronic abdominal pains.[50,61] They facilitate the confirmation of the intussusception, the location and biopsy of the lead point lesion in order to establish the diagnosis and plan definitive treatment.[62,63]

In particular, flexible sigmoidoscopy and colonoscopy are important modalities in the diagnosis and management of adult colonic or rectal intussusception.[63,64] This is especially true when patients present with signs and symptoms of large bowel obstruction. Colonic intussusceptums in adults often represent malignant lead-points. Colonoscopy provides direct visualization of the intussuseptum and associated intraluminal pathology and allows for biopsy and tissue diagnosis. In one centre, colonoscopy was used in the preoperative evaluation of 11% (1/9) of their AI cases.[65]

However, the use of sigmoidoscopy and colonoscopy as diagnostic tools should be treated with caution as they carry a risk of perforation or reduction of potentially malignant intussusception.[7,26]

Capsule endoscopy or small bowel enteroscopy are useful for the diagnostic assessment of elective patients suspected of having small bowel intussusception in whom there are no features of intestinal obstruction. They help to exclude intraluminal lesions especially in the younger patients in whom the small bowel intussusception may be a physiologic normal peristalsis representing idiopathic transient intussusception.

5.　　Contrast lower gastrointestinal studies such as barium enema are diagnostic of those forms of AI with colonic involvement. The presence of "claw" sign or "coiled-spring appearance" between the intussusceptum and intussuscipiens is strongly suggestive of intussusception.[66,67] In centres where CT scan is not available, barium enema is a good alternative for the preoperative diagnostic evaluation of suspected cases of subacute or chronic intussusception with large bowel involvement.

6.　　Upper gastrointestinal endoscopy could be an important diagnostic tool for the detection of gastroduodenal intussusception and retrograde jejuno-gastric intussusception associated with gastric operations such as gastrojejunostomy stoma, Billroth II gastrectomy and Roux-en-Y anastomosis.[40,68]

7.　　Diagnostic laparoscopy is a minimally invasive procedure useful for the

confirmatory diagnosis of AI in patients with enigmatic abdominal pain. When the diagnosis of intussusception is equivocal despite CT imaging, diagnostic laparoscopy can assist in decision making, surgical planning, and treatment.[27,69]

Diagnostic laparoscopy also offers the additional advantage of distinguishing transient intussusception from persistent intussusception, the later requiring immediate surgical treatment.[43] In the case series reported by El-Sergany, one patient was spared a needless open laparotomy when diagnostic laparoscopy demonstrated a resolved transient intussusception.[65]

8. Magnetic Resonance Imaging (MRI) is an important diagnostic tool for AI sited within the pelvic cavity. In cases of intussusception extending to the recto-anal lumen, defecating MRI has several advantages over CT.[70] The dynamic nature of MR defaecography allows accurate assessment of the presence of enterocele, rectocele, and anismus, which are often associated with intussusception.[71]

In addition, MR defaecography allows for global assessment of pelvic floor movements, which can inform operative planning.[72]

TREATMENT

Surgical treatment was once argued to be universally appropriate for AI. However, with the increased use of advanced imaging, newer literature is demonstrating that this is not true in all cases. CT scan has been used to predict the likelihood of self-resolution of AI.[73,74] Transient small bowel intussusception, in the absence of underlying pathology, presents with nonspecific symptoms which could be successfully managed conservatively when the history, clinical picture and MDCT indicate low probability of a neoplasm and absent bowel obstruction.[27]

For idiopathic transient intussusception with lengths shorter than 3.5cm and diameters smaller than 3.2cm in whom there are no CT findings of an underlying pathologic lead point lesion, some authors have advocated for the implementation of a close follow up regimen

with imaging and endoscopic surveillance as these forms of the disease are unlikely to progress and would rarely require surgery.[73,75] Of 37 cases of AI diagnosed by CT, Lvoff et al reported that 84% of these patients were successfully managed non-operatively, while the remaining 16% who had an identifiable lead point received surgery.[73] Another recent study suggested that up to 82% of the radiologic intussusceptions can successfully and safely be treated non-operatively.[75]

Therefore, CT where available and affordable has the potential to guide management and reduce the prevalence of unnecessary surgery in carefully selected cases.[28,47]

But in centres where CT scan is not accessible, surgical exploration (either open or laparoscopic) becomes inevitable for the treatment of AI whether for the acute presentation or otherwise, due to the higher incidence of secondary lesions in AI and the significant risk of underlying malignancy. This approach serves the four-fold benefits of confirming the diagnosis, resecting the intussuscepted bowel segment, preventing or treating the resultant bowel complications (such as intestinal obstruction, gangrene, perforation or peritonitis), as well as obtaining sufficient tissue for histological diagnosis in order to ascertain the malignancy status of the lead point lesion.

Intra-operatively, one school of thought recommend an initial attempt at the reduction of the uncomplicated entero-enteric intussusception prior to limited resection of the involved small bowel segment. This practice may significantly conserve the small bowel length to be sacrificed and therefore averts short gut syndrome.[26,76]

However, a different school of thought strongly advise against this practice based on the theoretical risks of venous embolization, intraluminal seeding of tumor cells if present and the possibility of perforating the ischemic, friable, edematous bowel which may lead to dissemination of microorganisms into the peritoneal cavity.[13,17,51] On the other hand, when the intussusception involves the large bowel, the consensus of opinion favours an outright en-bloc resection, without attempting a

reduction, due to the higher malignancy potential of the colonic disease.

When the intussusception is either entero-enteric or involves the right side of the colon up to the mid-transverse colon, a primary anastomosis can be safely performed after either a preliminary segmental small bowel resection or right hemicolectomy respectively. Adult intussusception involving the distal transverse colon up to the left colon would benefit from a left hemicolectomy, on-table colonic irrigation and primary restoration of bowel continuity. In the absence of colonic irrigation, a temporary colostomy is created. Those AI extending to the distal sigmoid colon and rectum would benefit from sphincter sparing anterior resection with a preliminary on-table colonic irrigation or a Hartmann's procedure on the alternative. The latter approach would be followed by restoration of bowel continuity at a subsequent operation. The introduction of on-table colonic irrigation favours primary left colonic anastomosis, which otherwise would necessitate performing a staged procedure.[77]

Non-operative methods of reducing colonic intussusception by either pneumatic (air) or hydrostatic (normal saline, Hartmann's solution or barium enema) insuflation are unsafe in AI as opposed to childhood intussusception in whom majority are idiopathic.[78,79] Malignancies are associated with most cases of colonic intussusception in adults and therefore would necessitate operative resection & tissue diagnosis.

Patients with retrograde intussusception are rare. Treatment of cases associated with gastrojejunostomy consists of reducing the intussuscepted bowel and transfixing the reduced loop to the abdominal wall and/or transverse mesocolon either laparoscopically or through the open procedure.[40] Should the attempted reduction fail or in the presence of bowel ischemia, perforation or peritonitis, resection and revision of the anastomosis become imperative.[68]

Laparoscopic surgery is increasingly being used for the treatment of the adult intussusception in selected cases.[65] When feasible, this minimally invasive procedure offers numerous advantages over the traditional open exploratory laparotomy. Laparoscopic surgery is associated with much smaller operation wound, minimal and better looking surgical scar, less blood loss, reduced overall complications, quicker recovery, shorter hospital stay and earlier return to patient's employment.[68]

CONCLUSION

The clinical diagnosis of adult intussusception is often missed entirely or delayed due to the vague, varied and non-specific clinical features of this disease. Prompt and more frequent use of CT scan for the evaluation of adults with enigmatic abdominal pain facilitates an earlier preoperative diagnosis. While the definitive treatment of most cases is surgical (open or laparoscopic), selected cases are amenable to conservative management in the modern era if well laid out guidelines are followed.

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