

Do radiologic studies correlate with each other and with surgical findings in intussusception?

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SUMMARY: Yalçın Ş, Çiftçi AÖ, Karaağaoğlu E, Haliloğlu M, Şenocak ME, Tanyel FC, Büyükpamukçu N. Do radiologic studies correlate with each other and with surgical findings in intussusception? Turk J Pediatr 2008; 50: 336-341.

In this research, we aimed to evaluate the accordance of radiologic study results with each other and with surgical findings with regard to presence and/or absence of intussusception. One hundred and seventy-nine patients treated for intussusception between 1993 and 2003 inclusive were retrospectively reviewed to compare results of initial ultrasonography, colonography, follow-up ultrasonography after conservative management (reduction with barium enema and/or air insufflation) and surgical findings to determine their accordance within each other with regard to diagnosis of intussusception. Results of initial ultrasonography were not in accordance with results of colonography. There was accordance between conservative management and follow-up ultrasonography results. Conservative management results were not in accordance with surgical findings. There was no accordance between follow-up ultrasonography results and surgical findings. Discordance of radiologic examination results with each other and with surgical findings indicates that intussusception is still a clinical diagnosis and clinical parameters deserve more importance in surgical decision-making. Radiologic examinations should be considered as complementary studies, not as definitive discriminators of childhood intussusception to achieve appropriate diagnosis and treatment.

Key words: intussusception, ultrasonography, colonography, treatment, child.

Intussusception is one of the most common abdominal emergencies of early childhood, with a peak incidence between the 4th and 10th months of age, and with a male predominance of 2:1¹. The diagnosis is made by the evaluation of clinical characteristics and physical examination findings. Apart from these, radiologic studies play an important role both in diagnosis and treatment. Plain abdominal X-ray, abdominal ultrasonography (USG), and colonography with barium and/or air are the major radiologic procedures performed to achieve the accurate diagnosis. The aim of this study was to evaluate the accordance between the above-mentioned radiologic examinations and their accordance with the surgical findings with regard to presence and/or absence of intussusception, with a brief analysis of treatment results.

Material and Methods

All patients who were treated in our unit with the diagnosis of intussusception between 1993 and 2003 inclusive were investigated retrospectively. Information recorded for each patient included age, gender, past medical history, clinical symptoms, physical examination findings at presentation, and detailed analysis of various radiologic examinations, including plain abdominal radiography, initial USG, colonography with barium or air, and follow-up USG after conservative management, and finally the surgical outcome with pathological evaluation. Radiologic studies were performed by the chief residents of the radiology unit. Presence of "pseudokidney sign" on USG and filling defect of intussusceptum on

colonography were considered to be definitive for intussusception². The criterion for successful conservative management was reduction of intussusception with reflux of barium or air into the terminal ileum. Results were expressed as mean±SD. Basic descriptive statistics were used along with the chi-square test and Kappa (K) coefficient to evaluate the accordance of radiologic examination results in and with the surgical findings with regard to presence and/or absence of intussusception. A probability value of less than 0.05 was considered to be statistically significant.

This research was approved by the Medical, Surgical and Pharmaceutical Research Ethics Committee of Hacettepe University Medical Faculty (registration number: LUT 05/47).

Results

There were 119 boys and 60 girls with a mean age of 1.8±2.5 years treated for intussusception. Of these 179 patients, 67% were younger than 1 year of age. The most common presenting symptom was vomiting (94.4%) followed by bloody stool (61%), abdominal pain (36%) and diarrhea (23%). Abdominal distention and tenderness

were the most common physical examination findings, noted in 90% of the patients.

The accordance of radiologic examination results in between and with the surgical findings is shown in Table I. Of 160 patients with the diagnosis of intussusception on USG, 14 had no such finding in colonography. Five patients with normal USG results had sign of intussusception in colonography. Since clinical findings were not in accordance with absence of intussusception in USG, colonography was performed in those 5 patients. Of 5 patients having surgery after failure of conservative management, 4 had manual reduction, and 1 had no surgical finding of intussusception but had Meckel diverticulitis perforation instead. There was no accordance between the results of USG and colonography (K=-0.05; p=0.50). Of 35 patients with failure of conservative management, only 3 had no sign of intussusception in follow-up USG performed after trial of reduction. Of 65 patients with successful reduction by conservative management, only 6 had sign of intussusception in follow-up USG. Thus, there was accordance between the results of conservative management and follow-up USG (K=0.8; p=0.00). Of 61

Table I. Correlation Between Radiologic Study Results and Surgical Findings

Preoperative ultrasonography	Colonography		Total
	Intussusception negative	Intussusception positive	
Intussusception negative	0	5	5
Intussusception positive	14	146	160
Total	14	151	165

After conservative management	Follow-up ultrasonography		Total
	Intussusception negative	Intussusception positive	
Intussusception negative	59	6	65
Intussusception positive	3	32	35
Total	62	38	100

After conservative management	Surgery		Total
	Intussusception negative	Intussusception positive	
Intussusception negative	3	5	8
Intussusception positive	10	51	61
Total	13	56	69

Control ultrasonography	Surgery		Total
	Intussusception negative	Intussusception positive	
Intussusception negative	1	1	2
Intussusception positive	9	37	46
Total	10	38	48

patients with failure of conservative management, 51 had the surgical finding of intussusception. Of 8 patients with successful reduction, 5 had ileoileal intussusception, 1 hamartomatous polyp, 1 mass of lymphoma and 1 no abnormality at laparotomy. Persistence of intussusception in follow-up USG performed after conservative reduction led to surgery in those patients. There was no accordance between the results of conservative management and surgical findings ($K=0.16$; $p=0.15$). Of 46 patients with diagnosis of intussusception in follow-up USG performed after failure of conservative management, 9 had no such surgical finding. Of 2 patients without sign of intussusception on follow-up USG, 1 had intussusception and the other had Meckel diverticulitis perforation at surgery, which was performed because of persistent clinical findings. There was no accordance between the results of follow-up USG and surgical findings ($K=0.10$; $p=0.29$).

Analysis of treatment results revealed that of 134 patients who had sign of filling defect of intussusceptum in colonography with barium, 68 (51%) had successful reduction. Of the 20 patients having this sign in colonography with air insufflation, 12 (60%) were successful. There was no significant difference between the success rates of reduction with either modality (chi-square test, $p=0.37$). No complication related to conservative management was encountered.

The success rate of conservative management was lower in patients with air-fluid level on plain radiography ($n=66$, 34.8%) and free fluid on USG ($n=44$, 38.6%) compared to those without air-fluid level ($n=98$, 55.1%) ($p=0.039$) and without free fluid ($n=133$, 47.4%) ($p=0.001$). The surgical complication rate was higher in patients with air-fluid level on plain radiography ($n=66$, 15.2%) compared to those without this radiologic sign ($n=98$, 7.1%) ($p=0.009$).

In 6 patients with failure of initial attempt, conservative management was repeated. Four of them had failed reduction again with second trial of barium enema. One patient had no success in repeated air insufflation. In 1 patient with failure of barium reduction, a second attempt with air insufflation was successful. There was no significant difference between the patients with success or failure of conservative management with regard to

the mean duration of symptoms (successful: $n=79$, mean 2.18 ± 1.62 days; failed: $n=68$, mean 2.58 ± 2.74 days; t test; $p=0.08$).

Ninety-eight of 179 patients (54.7%) were surgically managed. Of 98 patients, 24 (24.5%) had surgery as first step of treatment, 66 (67.3%) after failed management with barium enema and 8 (8.2%) after failure of air reduction. The indications for primary surgery were diagnosis of ileoileal intussusception ($n=10$), toxic appearance ($n=6$), severe intestinal obstruction ($n=3$), peritonitis ($n=2$), older age ($n=2$) and confirmed abdominal mass ($n=1$). Detection of ileoileal intussusception in initial USG in 3 patients and absence of intussusception in colonography with evidence of pseudokidney in follow-up USG in 7 patients led to primary surgery. Of those 10 patients, 1 had no surgical finding of intussusception and 9 had ileoileal intussusception. Of 9 patients, 5 had a preceding surgery and the other 4 had a leading point, as vitellointestinal duct remnant, hamartomatous polyp, ileal duplication and mass of lymphoma. Fourteen of the surgically managed patients (14.2%) had no surgical finding of intussusception. Failure of conservative management and/or presence of intussusception in follow-up USG in addition to clinical findings led to surgery in those 14 patients, of whom 5 had edema in ileocecal region, 1 had Meckel diverticulitis perforation, 2 had cecal mass of lymphoma, 1 had hamartomatous polyp, 1 had necrotic intestinal segment, and 4 had no abnormality at laparotomy. Of 84 patients with proven intussusception in surgery, 68 (81%) were successful, 14 (16.6%) had failed manual reduction, and 2 (2.4%) had spontaneous reduction. Thirty-five of the surgically managed patients (35.7%) had resection; 33 had primary anastomosis and the other 2 had ostomy. Twenty of 98 patients (20.4%) had surgical complications, including serosal defects ($n=15$) and intestinal perforation ($n=5$). The complication rate of surgery was higher in patients operated primarily (41.6%) when compared to those operated after failure of reduction with barium enema (13.8%) or air insufflation (12.5%) (chi-square test, $p=0.019$). Lead point was recognized in 32 of the surgically managed patients (32.6%), and included mass in ileocecal region ($n=7$), lymphadenopathy >2 cm ($n=7$),

Meckel diverticula (n=5), polyp (n=4), band (n=4), heterotopic pancreatic tissue (n=1), ileal ectopic tissue (n=1), ileal duplication (n=1), ileal cyst (n=1) and ascariasis (n=1). It was detected that the rate of lead point positivity significantly increased with age (25% in the age group of 0-1.9 years, 40% in 2-4.9 years, 64.3% in 5-15 years; chi-square test, $p=0.014$). Resection rate was found to be significantly higher in the presence of lead point compared to the absence of this sign (59.3% vs 21.8% respectively, chi-square test, $p=0.00$). The pathological specimens were reported as hemorrhagic necrosis and lymphoid hyperplasia of intestinal segment (n=20), lymphoid hyperplasia of appendix (n=7), Meckel diverticula (n=5), non-Hodgkin lymphoma (n=5), hamartomatous polyp (n=2), Burkitt lymphoma (n=1), heterotopic pancreatic tissue (n=1), ileal duplication (n=1), vitellointestinal duct remnant (n=1), and leukocytoclastic vasculitis of appendix (n=1). Four patients (2.2%) had recurrent intussusception during hospitalization. Two of them had successful reduction of the first intussusception with barium enema and manual reduction for the recurrent one. One patient had manual reduction after failure of barium reduction for the first and manual reduction once more for recurrence. The last patient had successful barium reduction of first intussusception and manual reduction for the second. In this case, resection-anastomosis was performed after manual reduction because of Meckel diverticulitis perforation. Five patients (2.7%) had recurrent intussusception after discharge. There was no mortality in our series. Of 11 long-term complications encountered in 6 patients after discharge, 9 were adhesive obstruction and 2 were intestinal perforation. Adhesive obstruction was managed with resection-anastomosis in 2 patients and the remainder were treated conservatively. In 1 patient who had intestinal perforation twice, resection and ileostomy was performed at each stage.

Discussion

We would like to discuss mainly two points: first, management scheme, and secondly, the value of radiologic studies based on the accordance between them and with surgical findings.

The epidemiological findings of this research related to the mean age (1.8 ± 2.5 years), boy:girl

ratio (1.9:1), most frequent age (6-7th month), symptom (vomiting) and season (spring) at presentation were in accordance with the results of previous studies³⁻⁵. In some of the previous surveys, the success rate of conservative management was found to decrease with prolonged duration of symptoms^{2,6-8}. However, no correlation between duration of symptoms and success of conservative management was detected in our study, as also previously noted^(9,10). In the case of prolonged duration of intermittent symptoms, the probability of chronic intussusception should be considered, and clinical findings instead of duration of symptoms should have more importance in deciding therapeutic modality.

In our survey, conservative management was repeated after failure of the initial attempt in only 6 patients, of which 1 was successful with air reduction following failure with barium enema. However, the success rate of repeated conservative management was reported to be at least 50% in many studies^{5,11-13}. Therefore (although not our policy), based on the literature findings, we think that a second trial of conservative management, preferably by an alternative method, could be attempted prior to surgery if the patient is clinically stable.

The findings of this study related to indications of primary surgery and rates of manual reduction, spontaneous reduction and resection are in accordance with literature findings¹⁴⁻¹⁷. Mass in ileocecal region was found to be the most common lead point in our study unlike the other surveys in which Meckel diverticula was the most common^{17,18}. The increased incidence of lead point positivity with age was also noted in other series¹⁵. One patient in our survey had recurrent intussusception during hospitalization after successful reduction of the first with barium enema. The recurrence was managed with resection-anastomosis because of Meckel diverticulitis perforation. Therefore, the probability of lead point should not be ignored despite successful conservative management and the clinical signs should be carefully evaluated in regard to recurrence during the follow-up period.

The complication rate of primary surgery was found to be higher compared to surgery performed after failure of conservative management. This could be related to the advanced cases with signs of toxicity, peritonitis and intestinal obstruction

in whom surgery is performed as the first step of treatment. Recurrence rate after discharge and the finding of adhesive obstruction as the most common long-term complication in this study were in accordance with previous reports^{5,15,17,19}.

This survey is unique with regard to its comparison of accordance between radiologic studies and between radiologic studies and surgical findings in such a large patient population. Radiologic studies play an important role both in diagnosis and therapeutic management of intussusception. Plain abdominal radiography can provide a preliminary suggestion about the diagnosis and therapeutic approach in suspected intussusception, as mentioned both in this study and a previous one²⁰. USG is the preliminary step for confirmation of diagnosis when intussusception is suspected based on erect abdominal X-ray and particularly clinical findings. It both aids in differential diagnosis of other acute abdominal emergencies and can also detect lead points that can easily be overlooked even with successful reduction by barium or air^{3,21}. Correlation of sonographic patterns of intussusception (thickness of external ring of the “doughnut”, trapped fluid within head of intussusception, and lack of color flow within tip of intussusceptum on Doppler examination) with its reducibility has been searched in many studies²²⁻²⁴.

After confirmation of diagnosis with USG, colonography with barium or air should be performed both as a diagnostic and therapeutic procedure. Air insufflation was found to be effective and safe with higher success and lower complication rates when compared to barium in many studies^{1,5,25,26}, but in our research there was no significant difference in success rates.

Even though radiologic tools have great importance in the therapeutic schedule of intussusception, the possibility of false-positive or false-negative diagnoses should not be ignored at each step, as detected in our survey. False-positive interpretation of intussusception in USG may be due to inflammation, edema, bowel wall thickening due to hemorrhage, lymphoma or Crohn's disease, or rarely an unusual appearance of stool within the lumen^{23,27}. High diagnostic accuracy rate especially in such cases is closely related to the experience of the ultrasonographer.

Presence of intussusception in the follow-up USG with no such finding in colonography should alert to the possibility of ileoileal intussusception in addition to false-positivity. Presence of intussusception in USG and/or as a surgical finding even after successful reduction with conservative management may be related to its recurrence even in such a short time interval. Similarly, absence of intussusception in follow-up USG and/or perioperatively after failure of conservative management may be due to spontaneous reduction. In our survey, of 14 patients without surgical sign of intussusception, 5 who were operated after failure of conservative management had edema in the ileocecal region. Persistent filling defect in the cecum after apparently complete hydrostatic reduction without reflux of contrast into terminal ileum could be due to edema of ileocecal valve, not persistence of intussusception. Improvement in clinical findings in such cases could warrant avoidance of any further treatment²⁸.

The pediatric surgeon should be the chief observer of the patient from presentation to the end of management to detect any delicate change in clinical findings, especially in the presence of discordance between the radiologic studies, since intussusception is a dynamic diagnosis. Continuation of symptoms of irritability and vomiting and clinical signs of abdominal distention-tenderness and a palpable mass even after notification of reduction radiologically should alert the surgeon to reevaluate the patient. Similarly, disappearance of presenting symptoms and clinical signs rapidly despite the insistence of radiologic evidence of intussusception may warrant a follow-up period during which the radiologic study could be undertaken by a more experienced radiologist before doing surgery. The use of laparoscopy for diagnosis of failure of reduction of intussusception and the hydrostatic reduction by saline enema during laparoscopy can be alternative methods to prevent unnecessary laparotomy, as mentioned recently^{29,30}.

In conclusion, intussusception is a common emergent condition that on one hand can be conservatively treated while on the other could even be fatal, which points out the importance of correct diagnosis and treatment. The discordance between radiologic study results and their discordance with surgical findings indicate that intussusception is still

a clinical diagnosis and clinical parameters deserve more importance in surgical decision-making. Radiologic examinations should be considered as complementary studies, not as definitive discriminators of childhood intussusception, to achieve appropriate diagnosis and treatment. Repeated physical examination by an experienced surgeon is still the milestone of successful treatment.

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