Introduction

Intussusception is one of the most common surgical emergencies encountered in infancy and early childhood.\(^1,2\) It develops when the proximal segment of bowel (intussusceptum) telescopes into the distal segment (intussuscepiens) causing obstruction.\(^3\)

Nonobstructing intussusception is frequently misdiagnosed clinically and is also a challenging diagnosis for a radiologist. Knowledge of presenting complaints and imaging features is essential for early diagnosis of intussusception to start timely management, thus preventing patient morbidity and complications.

In this pictorial case series, there are 10 cases in which all the patients presented with pain abdomen, few of them had episodic colicky pain and remaining had nonspecific chronic pain (►Table 1). None of the patients had typical symptoms of intestinal obstruction. Radiological diagnosis was of immense importance in these cases.

Case 1

A male patient of 12 years had complaints of colicky recurrent abdominal pain for 3 to 4 months, diarrhea, and vomiting on and off for 2 months. Target sign with hypoechoic lesion was seen on ultrasonography (USG; ►Fig. 1A, B). Magnetic resonance (MR) enterography was done (►Fig. 1C, D). Multiple intussusceptions, namely, jejunojejunal, ileoileal, and ileocolic types with multiple hyperplastic polyps were confirmed on surgery (►Fig. 1E, F). On histopathology, it was diagnosed as associated with Peutz-Jegher syndrome.

Case 2

A 3-year-old female patient presented with vomiting on solids and liquids and constipation since 2 months with no relief on medication. After 15 days, she developed bloody stools with colicky abdominal pain and distension. Barium study revealed dilated cecum and ascending colon.
<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Sex</th>
<th>Age</th>
<th>Presenting complaint</th>
<th>Obstruction</th>
<th>Red currant jelly stools</th>
<th>Chronic/acute</th>
<th>Radiography</th>
<th>USG/CT</th>
<th>Therapeutic reduction</th>
<th>Postoperative finding</th>
<th>Lead point</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>M</td>
<td>12 years</td>
<td>Colicky recurrent abdominal pain for 3 to 4 months, diarrhea, and vomiting on and off for 2 months</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Not done</td>
<td>USG: target sign with hypoechoic lesion in target</td>
<td>Saline enema reduction not done</td>
<td>Multiple intussusceptions, namely, jejunojejunal, ileoileal and ileocolic types</td>
<td>Multiple hyperplastic polyps</td>
</tr>
<tr>
<td>2.</td>
<td>F</td>
<td>3 years</td>
<td>Vomiting on solids and liquids, constipation for 2 months, no relief from medication, bloody stools with colicky pain, and abdominal distension for 15 days</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Dilated cecum and ascending colon, increased transit time from ascending colon to transverse colon, narrowing of transverse colon</td>
<td>USG: typical target lesion with a hypoechoic lymph node within it</td>
<td>Saline enema reduction done thrice</td>
<td>Beocolic intussusception</td>
<td>Lymph nodal mass, on BHC diagnosed as Burkitt lymphoma</td>
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<tr>
<td>3.</td>
<td>M</td>
<td>2 years</td>
<td>Colicky abdominal pain, later loose stools</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Not done</td>
<td>USG: target lesion with a thick-walled cystic lesion and echogenic contents within relation to it</td>
<td>Saline enema reduction done</td>
<td>Beocolic intussusception</td>
<td>Meckel’s cyst</td>
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<tr>
<td>4.</td>
<td>M</td>
<td>12 years</td>
<td>Recurrent on–off colicky abdominal pain for 3 months, nausea and vomiting for 1 month</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Not done</td>
<td>USG and CT findings: target lesion with soft tissue density lesion in left hemiabdomen</td>
<td>Not done</td>
<td>Colocolic intussusception</td>
<td>Non–Hodgkin’s lymphoma</td>
</tr>
<tr>
<td>5.</td>
<td>F</td>
<td>2 years</td>
<td>Recurrent pain abdomen which was not relieved by medicines</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Gas filled bowel loops in left half of abdominal cavity</td>
<td>USG: target lesion with compressible cystic lesion CT: target sign, thick walled cystic lesion seen</td>
<td>Saline enema reduction done</td>
<td>Beocolic intussusception</td>
<td>Duplication cyst</td>
</tr>
<tr>
<td>6.</td>
<td>F</td>
<td>16 years</td>
<td>Chronic on and off pain abdomen since 2 months</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Not done</td>
<td>USG: target lesion in left hemiabdomen, suspicious echogenic lesion supposed to be a lead point CT: target lesion containing a round intraluminal fat density mass within it</td>
<td>Not done</td>
<td>Colocolic intussusception</td>
<td>Lipoma</td>
</tr>
<tr>
<td>7.</td>
<td>M</td>
<td>3 years</td>
<td>On-off colicky abdominal pain for 1 month</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Not done</td>
<td>USG: target lesion with a thick-walled cystic lesion filled with echogenic contents seen in relation to it</td>
<td>Water enema reduction done</td>
<td>Beocolic intussusception</td>
<td>Meckel’s cyst</td>
</tr>
<tr>
<td>8.</td>
<td>M</td>
<td>8 years</td>
<td>Recurrent abdominal pain since 1 month</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Not done</td>
<td>USG: typical target lesion with a large hypechoic mass within it</td>
<td>Not done</td>
<td>Beocolic intussusception</td>
<td>None–Hodgkin’ lymphoma</td>
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<tr>
<td>9.</td>
<td>M</td>
<td>6 months</td>
<td>Incessant crying with leg pulling, fever, blood in stools since 2–3 days.</td>
<td>Absent</td>
<td>Absent</td>
<td>Acute</td>
<td>Not done</td>
<td>USG: S-shaped target lesion with thickened hypechoic bowel wall</td>
<td>Not done</td>
<td>Beocolic intussusception with gangrenous bowel</td>
<td>Polyp</td>
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<tr>
<td>10.</td>
<td>M</td>
<td>3 years</td>
<td>Nonspecific abdominal pain for 15–20 days</td>
<td>Absent</td>
<td>Absent</td>
<td>Chronic</td>
<td>Not done</td>
<td>USG: target lesion with thick walled cyst filled with echogenic fluid</td>
<td>Not done</td>
<td>Beocolic intussusception</td>
<td>Duplication cyst</td>
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</tbody>
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Abbreviations: CT, computed tomography; F, female; M, male; USG, ultrasonography.
increased transit time from ascending colon to transverse colon, and narrowing of transverse colon (► Fig. 2A–D). On USG, typical target lesion with a hypoechoic lymph nodal mass showing vascularity on color Doppler was seen within it (► Fig. 2E, F). Findings were suggestive of ileocolic intussusception. Saline enema reduction was done for therapeutic purpose. The findings were confirmed surgically and histopathologically lymph nodal mass was proven to be as Burkitt lymphoma.

Case 3

A 2-year-old male child presented to OPD with colicky recurrent abdominal pain for 5 to 6 days and loose stools for 3 days. On USG, a target lesion was seen in right lower abdomen. A thick walled cystic lesion filled with echogenic contents was noted in close relation to this which was the probable lead point (► Fig. 3A–C). It was provisionally diagnosed as ileocolic intussusception later proven surgically. The cyst was histopathologically identified as Meckel’s cyst.

Case 4

A 12-year-old boy had complaints of multiple episodes of on and off colicky abdominal pain for 3 months and nausea and vomiting for 1 month. USG showed a target lesion in left side of abdominal cavity with a hypoechoic mass within it (► Fig. 4A). Non-contrast computed tomography (NCCT) with oral contrast was done which showed intussusception with a soft tissue density lesion in descending colon (► Fig. 4B, C). Postoperatively, it was confirmed as colocolic...
intussusception with non-Hodgkin’s lymphoma as the lead point (►Fig. 4D, E).

Case 5

A 2-year-old female patient presented with recurrent pain abdomen which was not relieved on medication. No other clinically relevant history was present. X-ray abdomen showed gas filled bowel loops in left half of abdominal cavity. On USG, target lesion with a compressible cystic lesion was seen (►Fig. 5A, B). On contrast-enhanced computed tomography (CECT), ileocolic intussusception with a thick walled cystic lesion was identified in relation to it (►Fig. 5C). Saline enema reduction done to relieve the symptoms. Later surgery was done which confirmed ileocolic intussusception with a duplication cyst as lead point (►Fig. 5D).

Case 6

A 16-year-old female patient had chronic abdominal pain without any other significant complaints. On USG, a target lesion with a round echogenic lesion within it was noted in left of abdominal cavity (►Fig. 6A). NCCT was done to confirm USG findings. CT findings were similar to that of USG findings and the round lesion picked up on USG was a fat density lesion suggestive of lipoma (►Fig. 6B, C). The findings were confirmed surgically as colocolic intussusception and the lead point was proven to be a lipoma on histopathological examination (►Fig. 6D–F).

Case 7

A 3-year-old male child had recurrent chronic pain abdomen and vomiting on and off for 1 month. On USG, bowel within bowel appearance was seen as a target sign and a cyst filled with fluid having internal echoes was noted adjacent to it (►Fig. 7A, B). Therapeutic saline enema reduction was done multiple times. Postoperatively, it was

![Fig. 3](image1.png) **Fig. 3** A 2-year-old boy had colicky abdominal pain, later loose stools. Ultrasonography images showing typical pseudokidney sign of intussusception in longitudinal view (A) and well defined cystic lesion (arrow) in the intussusception (B and C) which was proven post operatively Meckel’s cyst acting as a lead point.

![Fig. 4](image2.png) **Fig. 4** A 12-year-old boy had complaints of recurrent on–off colicky abdominal pain for 3 months, nausea and vomiting for 1 month. Ultrasonography image (A) shows typical target lesion (star). Coronal (B) and axial (C) contrast-enhanced computed tomography images showing target lesion (arrow) involving colon seen in left lower quadrant with thick soft tissue density mass (thin arrow) in intussusceptum. (D and E) shows intraoperative and postoperative specimen of the resected bowel showing mass in wall of involved bowel loop. On histopathological examination it was proven as lymphoma.
confirmed to be an ileocolic intussusception with Meckel’s cyst (►Fig. 7C).

**Case 8**
An 8-year-old male patient had complaints of nonspecific chronic pain abdomen since 1 month. USG was done as screening test to find out any cause of pain. Typical target lesion with hyperechoic mass with internal vascularity on color Doppler was detected in right side of abdomen (►Fig. 8A, B). In CECT, abdomen with intravenous (IV) and rectal contrast, ileocolic intussusception with soft tissue density mass was noted (►Fig. 8C). After surgery and histopathological examination, it was proven as non-Hodgkin’s lymphoma with ileocolic intussusception.

**Case 9**
A 6-month-old male infant came with incessant crying and pulling of legs towards abdomen, fever, and bloody stools. USG examination showed S-shaped target lesion with thickened and hypoechoic wall, without vascularity on color Doppler (►Fig. 9A, B). No lead point was picked up on USG. Postoperatively, it was confirmed as ileocolic intussusception with necrotic bowel wall. Polyp was identified as the causative lead point.

**Case 10**
A 3-year-old male patient came with chronic pain abdomen. On USG, a target lesion with thick-walled cyst in relation to ileocolic junction with proximally dilated ileal loops (arrow). The cyst was diagnosed as duplication cyst on histopathology.
ileocolic intussusception. Postoperatively duplication cyst with ileocolic intussusception was confirmed.

Results and Discussion

Intussusception typically occurs in children aged 6 months to 4 years. In neonates and children older than 2 years, intussusception have high incidence of associated bowel abnormality with a lead point. Similar results were observed in our study. Out of 10 cases of intussusception with pathologic lead point, 9 cases included patients aged 2 years and/or above and one case was of 6 months of age. In our study, incidence was more in male population as compared with female population. Out of 10 cases, 7 were male and 3 were female.

The classical triad of symptoms of colicky abdominal pain, vomiting, and bloody stools occur in <25% of patients. A wide spectrum of symptoms may range from painless intussusception to constipation, dehydration, diarrhea, rectal prolapse, rectal bleeding, sepsis, shock, syncope, vomiting, and altered mental status (lethargy and irritability).

Patients in our study presented with colicky pain abdomen (acute and chronic type) with nausea, vomiting, loose stool, constipation, and bloody diarrhea. None of them had classical triad of symptoms of intussusception or symptoms typical of intestinal obstruction.

Ileocolic type of intussusception is common and generally idiopathic. Other variety of intussusceptions include jejunojejunal, ileoileal, and colocolic. These are far less common than ileocolic type. In our study, ileocolic intussusception was commoner than other types. Out of 10 cases, 7 were of ileocolic and 2 were of colocolic types. One case was of multiple intussusceptions including jejunojejunal, ileoileal, and ileocecal.

Colonic intussusception usually have a malignant lead point but small intestinal intussusception most of the time have benign lead point. We noticed similar results in our study.

Meckel’s cyst, duplication cyst, multiple polyps of nonfamilial polyposis syndrome, Burkitt lymphoma, and non-Hodgkin’s lymphoma were present in two, two, one, one, and one cases of ileocolic intussusception, respectively. In jejunojejunal intussusception familial polyposis syndrome (Peutz-Jegher syndrome) was the lead point. In colocolic intussusception cases, the lead point was non-Hodgkin’s lymphoma and lipoma in one case each.

Lead point causes alteration in normal peristaltic movements which leads to propulsion of bowel distal to it, predisposing to intussusception.

Plain radiography is the first imaging modality but it lacks sensitivity. USG remains the standard modality. Its
sensitivity (98–100%) and specificity (88–100%) is high but is clearly operator dependent.8,16

All 10 cases in our study were diagnosed on USG and confirmed postoperatively as intussusception with lead points, however, was not clinically suspected.

Lead point was picked in 9 out of 10 cases on USG, identified as cyst or suspicious lesion in close relation to the intussusception. In one case where the lead point was not picked up sonographically, it was identified intraoperatively.

In another case of ileocolic intussusception, thickened and hypoechoic wall of invaginating bowel segment suggesting possibility of necrosis/ischemia was identified on USG which was later confirmed intraoperatively.

Intussusception is seen on USG as target/bull’s eye/doughnut sign in the form of alternate concentric hypoechoic and hyperechoic rings on transverse view.17 In longitudinal view, peripheral hypoechoic and central echogenic area is seen, termed as pseudokidney sign.18 Central echogenicity of pseudokidney sign is contributed by mesentery due to its fat content. Color Doppler study has an important role in detection of bowel viability.

The invaginating segment or intussusceptum undergoes ischemia due to compression of mesenteric vessels which are pulled along with its mesentry. It can complicate into necrosis of bowel wall resulting in perforation, peritonitis, and shock.19 Superimposed infection may deteriorate the condition. Such patients can develop fever. Sloughing of mucosa presents as red currant jelly stools.20

Although CT is gold-standard investigation for diagnosing intussusception but it is usually done only in cases of doubtful diagnosis or to confirm suspected lead point, since it involves radiation and frequently necessitates sedation of children.16,21 In our study, it was done in two cases of colocolic type and one case of ileocecal intussusception with non-Hodgkin’s lymphoma. MR enterography was done in one case of multiple intussusceptions with Peutz-Jegher syndrome to confirm USG diagnosis.

In our study, saline enema reduction was attempted in 5 out of 10 cases; however, it was not a sonographically guided hydrostatic reduction. Both hydrostatic reduction and air insufflation reduction are safe without any complications during or after procedure and can be attempted before surgery.21,22 These have high success rate and are perfect method for the nonoperative treatment of pediatric intussusception and can be widely used as routine therapy.23,24 The main benefits of USG-guided hydrostatic reduction apart from avoidance of exposure to radiation include less patient discomfort, shorter hospital stay, and less morbidity and mortality compared with surgical modality of treatment.25 Knowledge of optimum pressure needed for successful reduction is the main prerequisite of the procedure. Successful reduction of intussusception eliminates the need of surgery in many cases.

**Conclusion**

Pain abdomen (acute and recurrent types) can be the only presenting symptom/feature of pediatric intussusception. Pathologic lead point can be a causative factor for intussusception in children. It should be kept as one of the less common differential in pain abdomen patients of pediatric age group.

USG remains gold standard in diagnosis. Early diagnosis and, thereby, early treatment helps in reducing mortality and morbidity.

**Conflict of Interest**

None declared.

**References**