

## Case report

### **Inverted Meckel's Diverticulum and literature review – 3 Case Reports**

#### **Abstract**

Inverted Meckel's Diverticulum causing intussusception is an extremely rare condition, in which the diverticulum inverts on itself. Very few cases of inverted Meckel's diverticulum have been reported in the literature till date. Inverted Meckel's diverticulum is a novel entity with real diagnostic challenge to the Surgeon/Gastrointestinal Surgeon diagnose pre-operatively. Acute intestinal obstruction caused by inverted Meckel's Diverticulum is a rare phenomenon. The most common presentations in inverted Meckel's Diverticulum are bleeding 50%, intestinal obstruction intussusception (20-25%) of presenting cases.

Here in, we are presenting three interesting cases of inverted Meckel's Diverticulum, which includes two adult cases and one pediatric case of 11 years girl. All cases are diagnosed on plain X-ray abdomen, Ultrasonography & Confirmed and CT abdomen. In adult we did explorative laparotomy with segmental resection and end to end anastomosis. In a 11 years girl, we did successful laparoscopic reduction of ileo-ileal intussusception with the help of atraumatic small bowel forceps followed by endoscopic Meckel's Diverticulectomy by applied endostapler, keeping adequate luminal space of small bowel.

#### **Keywords**

Inverted Meckel's Diverticulum, intussusception, small bowel obstruction, Hemorrhage or bleeding, Laparoscopic surgery, abdominal pain & Endostapler

#### **Introduction**

Meckel's Diverticulum was first coined by the German anatomist Johann Friedrich Meckel in 1809. Meckel's Diverticulum is a true diverticulum containing three layers of small bowel, resulting from persistence of the vitelline duct, which should obliterate by 7-10<sup>th</sup> weeks of gestation. [2,6]. Meckel's Diverticulum is most common congenital malformation of the gastrointestinal tract and is commonly known by the "Rule of 2" and found within 2 feet proximal to the ileocaecal junction, affecting 2 % of population and 2 inches in length and often contains gastric & pancreatic tissue, causing mucosal bleeding. [2,6].

**Comment [UdW1]:** Avoid the personal verb. It is better to say: Here are three cases...

**Comment [UdW2]:** Avoid the personal verb. It is better to say: they were carried out successfully.

**Comment [UdW3]:** After the author you should put [1], since it is the first bibliographical citation in the text. And make it coincide with the first citation of the bibliography.

**Comment [UdW4]:** Omit since it appears in the quote made: [1]

**Comment [UdW5]:** Citations must appear in ordered consecutive numeric form.

The most common presentation of Meckel's Diverticulum is gastrointestinal bleeding, intestinal obstruction, Intussusception diverticulitis & perforations. [2, 4,6]. The majority of Meckel's Diverticulum are found in pediatric age group, in first decades. Inverted Meckel's Diverticulum containing a lipoma gastric and pancreatic tissues resulting in intussusception are extremely rare and only few cases reported in the literature. [3, 4,6].

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The life time risk of complications in adult Meckel's Diverticulum is 4-16% [6]. Patient commonly becomes symptomatic in the first decade of life. Men are more affected than women, present with symptomatic Meckel's Diverticulum [4]. Many patients may remain asymptomatic in their life time, with Meckel's Diverticulum discovered incidentally on imaging or autopsy gastrointestinal bleeding is a major cause of presentation. Bowel obstruction are a common cause of hospitalization resulting in emergency abdominal surgery. Inverted Meckel's Diverticulum acts as a leading point of intussusception. [2,4,6,8].

## Case reports

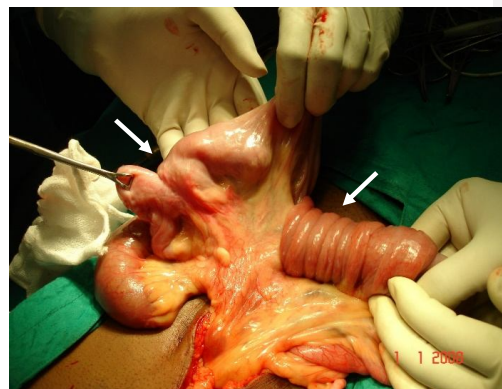
### Case 1

A 25 years male patient presented with complaints of pain in abdomen, distention of abdomen for 2 days with vomiting. Patients was admitted at Jatal Hospital & Research Centre, Latur on 1<sup>st</sup> January 2008. Laboratory investigations were normal. Abdominal x-ray and ultrasonography was suggestive of acute small bowel obstruction. Patients was having palpable lump in right iliac fossa. So CT scan was done. CT scan revealed small bowel intussusception and target sign positive, suggesting ileo-ileal intussusception.

The patients underwent emergency explorative laparotomy. Intra operative findings were suggestive of ileo-ileal intussusception (**Figure 1 & 2**).



**Figure 1 – Showing intra operative photograph of ileo-ileal intussusception**



**Figure 2 – Procedure of hydrostatic reduction by "pull and push" technique**

So we did hydrostatic reduction with push and pull technique for reduction of intussusception. Hydrostatic reduction is simple and effective methods for the treatment of early intussusception. After complete reduction of intussusception there was lumpish mass inside the small bowel. 10 cm of small bowel segment was resected and ileo-ileal anastomosis was performed.

After gross examination of specimen, a large polypoidal mass size 5x3x2 cm, with ulceration at the base of Meckel's Diverticulum due to ectopic gastric tissue, acts as a leading point of intussusception(**Figure 3**). The final pathology reveled Meckel's Diverticulum with ectopic gastric tissue (**Figure 4**). Patient discharge on seventh post-operative day with good recovery.

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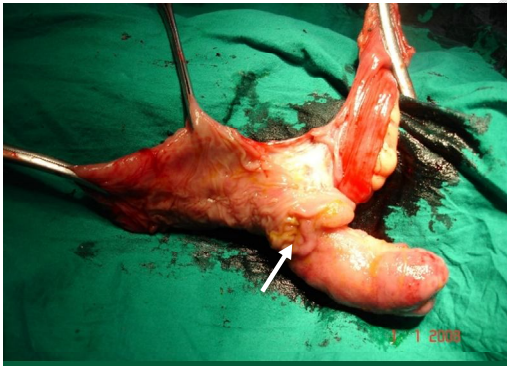


Figure 3 – Gross specimen of inverted Meckel's diverticulum with ulceration

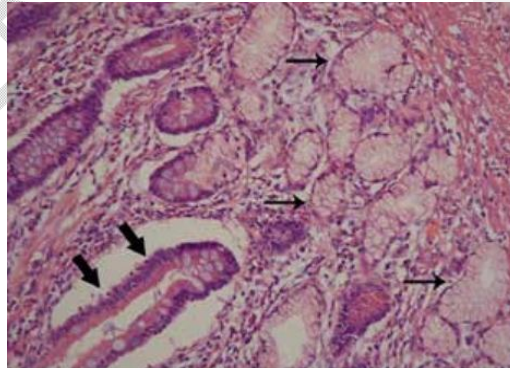


Figure 4 – Microphotograph showing nests of heterotopic gastric epithelium (thin black arrows).

### Case 2

A 65 year old patient admitted complaining of severe abdominal pain, which was associated with bilious vomiting, abdominal distention & constipation over 3 days. Physical examination was notable for abdominal distention and tenderness in Right lower quadrant of abdomen. On investigation for Plain x-ray abdomen, ultrasonography and CT abdomen shows ileo-colic intussusception. The patients was scheduled for emergency explorative laparotomy and bowel was inspected, there was ilio-colic intussusception which was nonreducible, so emergency right side hemicolectomy was done (**Figure 5**).

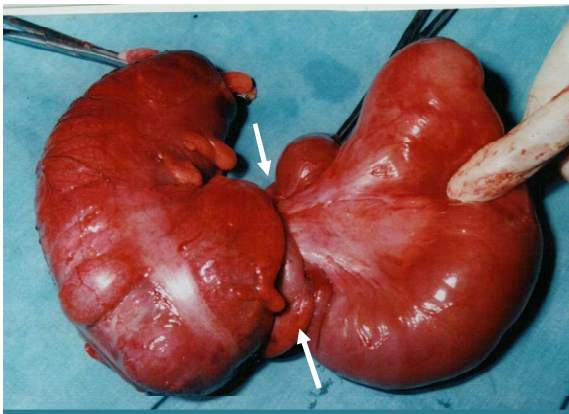


Figure 5 – Showing intra operative photograph of ileo-colic intussusception

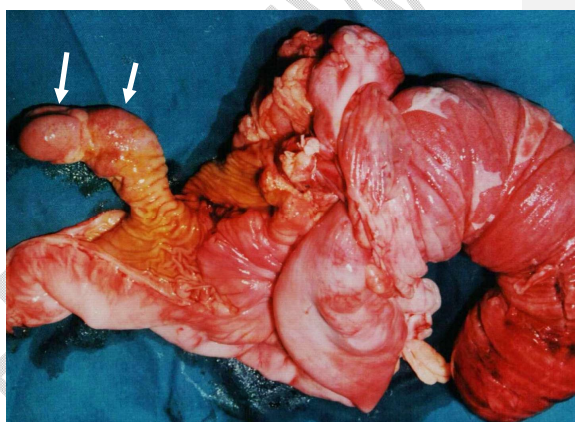


Figure 6 – Gross specimen of inverted Meckel's diverticulum

Gross pathology of the specimen(**Figure 6**) revealed a firm, elongated and polypoidal intussuscepted mass size 6x3x2 cm in length. Microscopic examination showed a Meckel's Diverticulum with no ectopic tissue. Post-operative hospital course was uneventful and patient discharged home on the seventh postoperative day.

### Case 3

An 11 years girl, was admitted to Jatal Hospital and Research Centre, Latur on 3<sup>rd</sup> August 2021. She had been having severe pain in abdomen, vomiting and tenderness at Right Iliac

fossa physical examination, her abdomen was found distension and there was mild tenderness of the right lower abdomen. Abdominal ultrasonography showed the multiple concentric rings, signs of ileo-ileal intussusception, which was confirmed by CT abdomen(**Figure 7 A & B**), there was ileo-ileal intussusception in right iliac fossa.



Figure 7 (A & B) Showing Sagittal and coronal section of CT Abdomen showing "Target sign"

### Laparoscopic surgery

The patient underwent general anesthesia and three trocars were placed. 10 mm trocars through open technique at supraumbilical incision and diagnostic laparoscopy performed.

There was ileo-ileal intussusception 10 cm in length then two 5 mm trocars were placed Right and Left iliac fossa, with the help of atraumatic small bowel forceps, laparoscopic reduction of intussusception was done by gentle pulling of small bowel. To my surprise at the end of pulling, the inverted Meckel's Diverticulum came out and endostapler applied to the base of Meckel's Diverticulum by keeping adequate lumen of small bowel. (Figure 8 A, B C).

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Figure 8 (A- ileoileal intussusception B- Showing inverted Meckel's diverticulum C- Applied Endostapler)

As a prophylactic measures, we performed an appendectomy during surgery. The Meckel's Diverticulum removed through 10 mm supraumbilical port. Laparoscopy is the safe and efficient method for reduction of intussusception and Meckel's Diverticulectomy. The second technique is "trans-umbilical laparoscopic assisted (TULA) Meckel's Diverticulectomy, Which allows the exteriorization of the diverticulum through the umbilicus and performers of the Diverticulectomy outside of the abdomen with its repair.

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Gross specimen of Meckel's Diverticulum sent for histopathology and confirmed the Meckel's Diverticulum and there was no ectopic tissue. Patient extubated and shifted to recovery. On 5<sup>th</sup> post-operative day patient discharged home.

### **Discussion**

The true incidence of Meckel's Diverticulum ranges from 1 to 3% with only 4.6% being symptomatic, males are more prone to complications. Meckel's Diverticulum is usually an incidental findings in pediatric population. Meckel's Diverticulum can contains gastric, pancreatic, colonic, jejunal& duodenal ectopic tissue. Gastric mucosa is the most common in both non-inverted and inverted Meckel's Diverticulum. [1, 3, 6,]. The life time risk of complications associated with an adult Meckel's Diverticulum is 4-16%. Painless hemorrhage is the most common presentation in the pediatric population 50%, secondary to peptic ulceration from gastric/pancreatic juice. Usually the mechanism of bleeding is the ulceration of the adjacent antimesenteric wall of the small bowel due to acid secretion, by the ectopic gastric mucosa within the diverticulum.

Intestinal obstruction is another common complication most commonly seen in adults, and may be due to volvulus of small bowel around a Meckel's band or intussusception due to inverted Meckel's Diverticulum, strangulation of the diverticulum in a hernia (litter's hernia) and entrolith formation in the diverticulum[1,3,6]. 20-30 % cases presents with acute intestinal obstruction. Inverted Meckel's Diverticulum leading to intussusception in adult patient is 1%.

### **The pathology of an inverted Meckel's Diverticulum causing intussusception in which the diverticulum inverts on itself.**

1. Meckel's Diverticulum base becomes inflamed due to ectopic gastric tissue, ulceration of gastric tissue creates abdominal peristaltic contributions resulting in the invention of Meckel's Diverticulum. The inverted Meckel's Diverticulum acts as

leading point allowing telescoping of proximal small bowel in to distal small bowel

i.e. intussusception, so ileo-ileal intussusception is more common than ileo-colic intussusception.[1,3,6].

2. Another explanation is that because Meckel's Diverticulum is not fixed to the mesentery or the intestine, it increase the likelihood of inversion.
3. Furthermore, the presence of a lipoma of the tip with in the inverted Meckel's Diverticulum increase the chance of intussusception.[3]

### Diagnosis

1. Ultrasonography should be the first modality used in diagnosing intussusception as it shows the classic "target or doughnut sign".
2. CT scan confirms 100% possible scan, shows a sausage or target shaped soft tissue mass or an intraluminal mass with central area of fat reporting the inverted Meckel's Diverticulum.
3. Capsule endoscopy can locate the Meckel's Diverticulum.
4. Double balloon enteroscopy used for the diagnosis.
5. Technetium 99 pertechnetate isotope scan, Gastric mucosa and ectopic gastric tissue take up, which allow diagnosis of Meckel's Diverticulum containing ectopic gastric mucosa.
6. CT anigraphy shows bleeding from Meckel's Diverticulum
7. Small bowel barium studies can demonstrate Meckel's Diverticulum.[2,4,6]

### Literature review

1. Recently published study from 2006-2014 with a diagnosis of intestinal intussusception were reviewed. Diagnosis of intussusception was confirmed intraoperatively in all patients and pathological examination identified two cases of ileal lipoma, ileal duplication cyst of small bowel, juvenile polyposis syndrome and inverted Meckel' diverticulum.

Rutherford et.al studied 107 surgical specimen and found heterotrophic tissue in 57%. The type of ectopic tissue were gastric, pancreatic, colonic and duodenal. The most common complication of inverted Meckel's diverticulum is hemorrhage about 50% in the pediatric population. Intestinal obstruction is another common complication in adult is intestinal obstruction intussusception & strangulation of the Meckel's diverticulum in a litter's hernia.

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**Comment [UdW11]:** Avoid colloquial expressions in scientific work. Try to cancel it and the paragraph wins in argument

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2. The PubMed database was searched from its inception to February 2022 using the keyword “Inverted Meckel’s diverticulum” in total 94 related articles were retrieved. There were 29 articles of 74 adult and 9 pediatric cases. These included 55 male and 28 females patients with onset age of 2 to 78 years.

A pediatric case of Inverted Meckel’s diverticulum is diagnosed on abdominal ultrasonography causing hemorrhage and ileo-iliac intussusception. Painless hemorrhage is most common presentation in the pediatric population, however, intestinal obstruction is the most common presentation in adult.

Adult intussusception represents of all cases of intussusception and accounts for only 1% intestinal obstruction in adults. In adults almost 90% of cases of intussusception are carcinoma, polyp, benign neoplasms or inverted Meckel’s diverticulum. Among these causes inverted Meckel’s diverticulum is rare. [9]

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## Conclusion

To conclude, preoperative diagnosis of inverted Meckel’s Diverticulum is the real the diagnostic challenge to Surgeon & Gastrointestinal surgeon. Early radiological diagnosis and emergency explorative laparotomy/Laparoscopic surgery is the key to avoid untoward complications and morbidity/mortality related to the disease. Ideal treatment is surgical, includes segmental resection and end to end anastomosis.

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**Comment [UdW14]:** Revisar si esta primera bibliografía coincide con la primera cita en el texto, sino, arreglar.

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