

# Current recommendations in pediatric interventional digestive endoscopy

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## ABSTRACT

Interventional digestive endoscopy in the pediatric population is major procedure in the diagnostic and therapeutic algorithm in children with different pathologies in the gastrointestinal spectrum and with a marked evolution in the current medical practice. This article attempts to describe all the situations where this technique is required electively or as a matter of urgency, providing a description of the method, the indications, as well as the complications that may arise.

The interventional procedure is performed by a pediatric gastroenterologist or endoscopy technician, sometimes with the assistance of gastroenterologist for adults, under general anesthesia with orotracheal intubation or under conscious sedation. A good prognosis in such cases depends on the patient's status, the available equipment, the expertise of the pediatric gastroenterologist, as well as on working together in the interdisciplinary team.

**Keywords:** endoscopy, interventional procedure, child

## INTRODUCTION

Interventional gastrointestinal endoscopy covers a collection of procedures performed both for diagnostic purpose and particularly for therapeutic purposes. The procedure seeks to manage emergency and elective situations alike in the pediatric population: upper/lower gastrointestinal hemorrhaging, the ingestion of foreign bodies or corrosive substances, strictures, stenoses, polypectomies, endoscopic retrograde cholangiopancreatography, endoscopic ultrasound, percutaneous endoscopic gastrostomy.

### Variceal/non-variceal gastrointestinal bleeding

The prevailing cause for esophageal varices is portal hypertension due to liver cirrhosis. The risk of bleeding depends on the size of the varices, the Child-Pugh score for cirrhosis, and other comorbidities.

Current guidelines recommend endoscopic intervention within less than 12 hours, particularly in cases of significant blood loss via hematemesis or melena, and requiring immediate transfusion (1,2).

The techniques currently employed in cases of upper gastrointestinal hemorrhage caused by varices include endoscopic (band) ligation and sclerotherapy, the latter being less frequently used (Fig. 1). The ligation technique entails applying a band at the base of the varices, which favors the obliteration of the blood vessel and induces its fibrosis. This method is deployed a while after the hemorrhagic episode and has a low rate of repeat bleeding (26%) compared to sclerotherapy (45%), which uses injections of sodium morrhuate, polidocanol or ethanolamine, and may determine local necrosis and/or mediastinitis (2,3).

Non-variceal upper gastrointestinal hemorrhage results in cases of gastric/duodenal ulcers, hemor-

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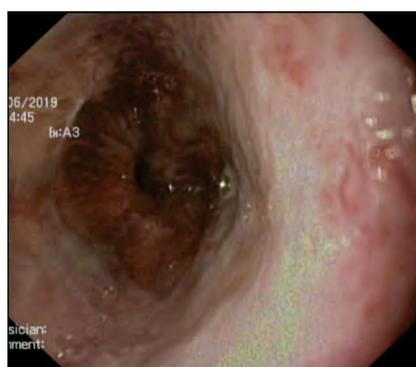
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**FIGURE 1.** Esophageal varices banding in a 15-year-old teenager with liver cirrhosis



**FIGURE 2.** Follow-up endoscopy after 6 weeks, same patient

rhagic gastritis, Zollinger Ellison syndrome, Dieulafoy lesions, Mallory-Weiss syndrome, angiodysplasia. The endoscopic treatment must be deployed as a matter of urgency within maximum 12 hours and shall be performed by injecting substances such as adrenaline (1/10,000), saline solution, alcohol, cyanoacrylate, thrombin, sclerosing substances, or thermocoagulation, photocoagulation and electrocoagulation (mono-, bi- or multipolar). The patient is urgently given PPIs in bolus, then via endovenous perfusion, and then orally every 72 hours (2,4). A new hemostasis technique uses a mineral powder with coagulation properties that is applied on the bleeding site and is very effective in the management of non-variceal gastrointestinal hemorrhage (4,5).

### Lower gastrointestinal bleeding

Lower gastrointestinal hemorrhage translates into bleeding occurring below the ligament of Treitz, clinically appearing as hematochezia or rectorrhagia. Lower gastrointestinal endoscopy (rectosigmoidoscopy or pancolonoscopy up to the cecum) is performed both for diagnostic and therapeutic purposes. Before initiating the colonoscopy, it is very important to rule out any extra-digestive pathologies, foods or medication preceding the onset of symptoms – which can be a cause of the bleeding (6,7).

In the case of lower gastrointestinal hemorrhages, bleeding is not substantial as in the case of upper gastrointestinal ones, therefore guidelines recommend endoscopic intervention within the first 24 hours only if the hemodynamic function is compromised. The most frequent causes include colorectal polyps, diverticula, inflammatory bowel disorders (Crohn's disease, ulcerative colitis), as well as angiodysplasia, hemorrhoids and anal fissures (1,6).

### Foreign body ingestion

Foreign body ingestion is very frequently encountered in the pediatric population, the majority of such foreign bodies being toys, food remains, coins, keys, batteries, magnets, lens, pins, etc. The therapeutic approach varies function of the type and location of the



**FIGURE 3.** Sigmoid pedunculated polyp, endoscopic polypectomy

foreign body. The child may be asymptomatic or may present symptoms like dysphagia, dry cough, retrosternal pain, dyspnea, and even acute respiratory failure (8).

Management includes performing a thoracoabdominal X-Ray that may reveal radio-opaque objects or an MRI-type investigation for radio-transparent objects. Upper gastrointestinal endoscopy is performed as a matter of urgency (<2 hours) if the patient presents with signs of acute respiratory failure, the foreign body is lodged in the esophagus and entails a risk of perforation if very sharp or longer than 5 cm. Also, ESPGHAN recommends the extraction of sharp foreign bodies from the stomach/proximal duodenum within less than 2 hours, even if the patient does not present with any symptoms. In symptomatic children, the removal of the foreign body shall be performed urgently (< 2 hours), while the removal of blunt objects from the stomach or duodenum shall be per-



**FIGURE 4.**  
*Endoscopic extraction of a coin impacted in the esophagus*



**FIGURE 5.**  
*Endoscopic extraction of a chicken bone impacted in the esophagus*



**FIGURE 6.** *Endoscopic extraction of a popsicle stick from the stomach*

formed if the patient presents with any symptoms or if the foreign body is > 2.5 cm in diameter or >6 cm in length. Foreign bodies in the stomach can be monitored and retrieved if they produce symptoms or are not spontaneously eliminated within 4 weeks. If the foreign body is lodged in the duodenum, surgery shall be considered if the object remains there for more than 7 days and cannot be retrieved via gastrointestinal endoscopy. In the case of batteries, upper GI endoscopy is recommended within less than 2 hours if the patient presents with symptoms, if they also ingested a magnet, or if they have an anatomic malformation of the digestive tract, and within less than 24 hours, respectively, if the patient presents with no symptoms. Patient evolution must be monitored by performing a follow-up thoracoabdominal radiography after 48 hours in the case of round batteries in the stomach and after 7-14 days in the case of cylinder-type batteries. (4,8,9).

### Ingestion of corrosive substances

As far as the ingestion of corrosive substances is concerned, upper GI endoscopy is only indicated in the case of symptomatic patients (oral lesions, vomiting, dyspnea, hematemesis, abdominal pain) within the first 24 hours. Alkaline substances are much more aggressive on the esophageal or gastric mucosa than acid substances; short term complications include hemorrhaging and perforations, while long term complications include bacterial superinfections, motility disorders, obstructions or strictures (8,9).

### Dilation of stenoses and structures

Strictures are defined as an “anatomic restriction” of the lumen, resulting from the fibrosis of the esophageal stratified squamous epithelium, as well as of the muscle tissue in the esophageal wall structure (3,9). From a clinical point of view, esophageal stenosis presents with dysphagia and vomiting, with long term consequences on the nutritional status. Endoscopic



**FIGURE 7.** Round battery extracted endoscopically from the esophagus

dilations can be performed using a bougie or with balloon-type devices. If the strictures are refractory to endoscopic treatment, recommendations include applying Mitomycin C or a temporary stent (9).

### Endoscopic retrograde cholangiopancreatography (ERCP)

ERCP is an interventional endoscopic procedure indicated in mechanical jaundice, suggesting a gall bladder or pancreatic pathology, acute pancreatitis caused by the gall bladder calculi, inserting a stent for malignant/benign strictures, sphincterotomy for sphincter of Oddi dysfunction type 1 or 2, papillary stenosis, common bile duct lithiasis, dilation of intra-bile duct strictures, etc. These are the general indications for the procedure, while pediatric applications are rather limited. Acute pancreatitis remains the most frequent complication; other occurrences may also include post-sphincterotomy hemorrhage, infections or duodenal perforation (4,10). The procedure can be performed under conscious sedation or general anesthesia, while the patient is in ventral or left lateral decubitus. The endoscope is introduced progressively, then introducing a catheter up to the duodenal papilla, injecting contrast substance to view the biliary tree and pancreatic tree radiographically.

ESPGHAN indicates diagnostic ERCP in children under the age of 1 with liver cholestasis, only if non-invasive imaging investigations are not sufficiently

conclusive, so as to avoid unnecessary surgery if biliary atresia is ruled out, or to allow for surgery as soon as possible if bile duct atresia is present (6).

### Endoscopic ultrasound (EUS)

Endoscopic ultrasound is a diagnostic method for congenital esophageal strictures, liver and gall bladder pathologies (2-3 mm calculi) or pancreatic pathologies where the other non-invasive procedures failed to produce a clear diagnosis. EUS also has therapeutic applications, for instance guided drainage of pancreatic pseudocyst.

The advantage of echo-endoscopy is that it produces detailed, high resolution images using the ultrasound probe at the end of the endoscope, as well as the possibility of performing biopsies that allow for certain diagnosis based on anatomopathological examination. During the procedure, the patient can also benefit from an elastographic evaluation, which assesses the rigidity of the pathologic tissue, and may thus guide the diagnosis towards a malignant or benign lesion (5,6).

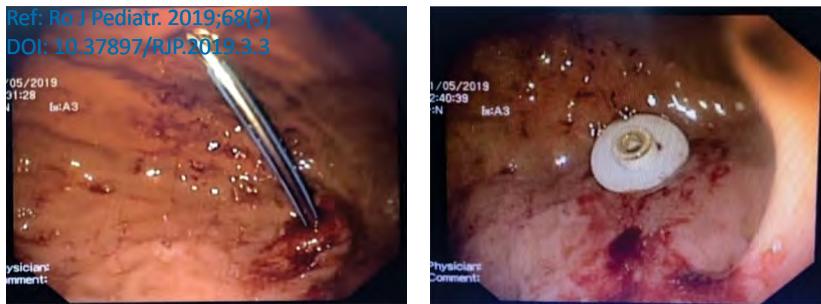
The procedure is performed under sedation or general anesthesia, being similar to the gastrointestinal endoscopy in terms of both technique and prior preparation. There may be certain risks during or after the intervention, such as bleeding, perforation, infection, gastric juice aspiration, or acute pancreatitis. Endoscopic ultrasound proved its utility in the pediatric population for assessing and monitoring pancreatic pathologies, gallstones, congenital anomalies, eosinophilic esophagitis, as well as inflammatory bowel disorders. Interventional procedures during echo-endoscopy include endoscopic cystogastrostomy, celiac plexus neurolysis and biliary access in the bile ducts, having an increasing applicability (11).

### Percutaneous endoscopic gastrostomy (PEG)

Percutaneous endoscopic gastrostomy is indicated in the pediatric population for patients with various pathologies requiring extended nutritional support via



**FIGURE 8.** Endoscopic dilations using bougies: Viewing stenosis area, introduction of guidewire



**FIGURE 9.** PEG insertion in a 10-year-old patient with neurological pathology

nasogastric tube in order to improve the nutritional status.

The procedure is performed by a multidisciplinary team comprised of a gastroenterologist, surgeon and anesthesiologist. The procedure entails performing an upper GI endoscopy, positioning the endoscope in the area allowing for optimal transillumination, disinfecting the tegument in the respective area with iodine solution, making a 3-5 mm incision using the scalpel, introducing the trocar in the gastric cavity until its tip can be viewed using the endoscope. A guidewire is introduced and retrieved using a snare, then the endoscope is retrieved, and the gastrostomy tube is introduced using this wire. The internal disc is brought up to the gastric wall, without applying pressure so as to avoid the risk of necrosis, and the external gastrostomy tube is fastened on the tegument using a bandage. Tube permeability is then checked using serum. The

nutrition is commenced using the classic approach, 24 hours after insertion. The PEG can be used for a period of 2 weeks up to 14 months (4,12).

## CONCLUSIONS

Interventional gastrointestinal endoscopy sets pediatric gastroenterology at the border of minimally invasive surgical specialties. Endoscopic foreign body extraction, hemostasis, polypectomy and dilations need to be performed in all profile centers in Romania and organizing on call lines for pediatric endoscopy should become a priority. Putting together a trained multidisciplinary team (pediatric gastroenterologist, gastroenterologist, pediatric surgeon, anesthesiologist) is ideal for solving complex situations that can arise.

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## REFERENCES

- Wayne Wolfram, Robert K. Pediatric Gastrointestinal Bleeding Treatment & Management, emedicine.medscape.com.
- Tony E Yusuf, Praveen K Roy, Manoop S Bhutani, Francisco Talavera, Douglas M Heuman. Esophagogastroduodenoscopy, emedicine.medscape.com.
- N. Angelescu. *Tratat de Patologie Chirurgicala*, Editura Medicală, București, 2013; 1323-1325.
- Andrea Tringali, Mike Thomson, Jean-Marc Dumonceau. Pediatric gastrointestinal endoscopy: European Society of Gastrointestinal Endoscopy (ESGE) and European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) Guideline Executive summary, 2017; 49: 83-91.
- Yau AH, Ou G, Galorport C et al. Safety and efficacy of hemostatic spray in upper gastrointestinal bleeding. *Can J Gastroenterol Hepatol*. 2014; 28:72-76.
- L Michaud. L'endoscopie digestive interventionnelle chez l'enfant. *Archives de pédiatrie*, Volume 13, n° 4, 399-404.
- Nadeau D, Laberge S, Gauthier M, Lapierre G, Farrell CA. Frequency of upper gastrointestinal bleeding in a pediatric intensive care unit. *Critical Care Medicine* [01 Jan 1992, 20(1):35-42.
- Smaranda Diaconescu, Nicoleta Gimiga, Ioan Sarbu, Gabriela Stefanescu, Claudia Olaru, Ileana Ioniuc, Iulia Ciongradi, Marin Burlea. Foreign Bodies Ingestion in Children: Experience of 61 Cases in a Pediatric Gastroenterology Unit from Romania Gastroenterology. *Research and Practice* Volume 2016, Article ID 1982567.
- Seyed Ali Jafari, Mohammad Ali Kiani, Hamid Reza Kianifar, Mohammad Mansooripour, Elahe Heidari, Maryam Khalesi. Etiology of gastrointestinal bleeding in children referred to pediatric wards of Mashhad hospitals. *Iran*, 2018 Feb; 10(2): 6341-6345.
- Susan Owensby, Kellee Taylor, Thad Wilkins. Diagnosis and Management of Upper Gastrointestinal Bleeding in Children. *The Journal of the American Board of Family Medicine* January 2015, 28 (1) 134-145.
- Lakhole A., Liu Qy. Role of Endoscopic Ultrasound in Pediatric Disease. *Gastrointestinal Endoscopy Of North America*, 2016 Jan; 26(1):137-53.
- RB Heuschkel, F Gottrand, K Devarajan, H Poole, J Callan, JA Dias, S Karkelis, A Papadopoulou, S Husby, F Ruemmele, MG Schappi, M Wilschanski, P Lionetti, R Orel, J Tovar, N Thapar, Y Vandenplas. ESPGHAN Position Paper on Management of Percutaneous Endoscopic Gastrostomy in Children and Adolescents. *JPGN* Volume 60, Number 1, January 2015.