



# Early Life Events Related to Prematurity Can Lead to Increased Rates of Video Capsule Retention in Children

**Jericho H\*; Verma R; Sentongo T; Semrad C**

Department of Pediatrics, Section of Gastroenterology, Hepatology and Nutrition, University of Chicago Celiac Disease Center-Comer Children's Hospital, Chicago, IL 60637, USA.

**\*Corresponding Author(s): Hilary Jericho**

Department of Pediatrics, Section of Gastroenterology, Hepatology and Nutrition, University of Chicago Celiac Disease Center-Comer Children's Hospital, Chicago, IL 60637, USA.

Email: jericho@peds.bsd.uchicago.edu & smilary@gmail.com

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## Introduction

Video Capsule Endoscopy (VCE) allows examination of the entire length of the small bowel not visualized by standard Esophagogastroduodenoscopy (EGD) and colonoscopy. The main indications are for suspected small bowel bleeding and diagnosis and management of small bowel Crohn's disease (CD). It is a safe procedure to perform in adults and children with the greatest risk being capsule retention. Contraindications to VCE include patients with gastrointestinal obstructions, strictures or fistulas and patients with implanted electromedical devices.

The overall capsule retention rates in pediatrics ranges from 1-3% with the greatest risks reported in small bowel CD [1]. Additional high-risk patients include those with previous small bowel resection, abdominal radiation therapy and chronic use of high-dose non-steroidal anti-inflammatory drugs (NSAIDs) [2]. Patency Capsule (PC) and cross-sectional imaging are studies that can safely and easily assess for small bowel patency prior to VCE, helping to limit the risk of retention.



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We describe 2 patients with histories of prematurity who underwent VCE for evaluation of occult Gastrointestinal (GI) bleeds with subsequent capsule retention despite a lack of obstructive symptoms and pre-capsule imaging demonstrating bowel patency.

### Cases

An 18-year-old female, ex 29-week preemie, with h/o ileal atresia, s/p small bowel resection, short gut, serial transverse enteroplasty procedure, and recurrent small intestine bacterial overgrowth (SIBO) presented with recurrent Iron Deficiency Anemia (IDA) requiring IV iron infusions and Packed Red Blood (PRBC) cell transfusions. Extensive blood testing, upper endoscopy, colonoscopy and abdominal CTA were normal. CTE showed findings of short gut with unchanged functional dilatation of small bowel without obstruction. The patient denied any active GI symptoms. Given imaging negative for stricture and lack of obstructive symptoms, the patient did not additionally undergo a PC. A VCE was performed demonstrating a large ulcer with an associated bowel stricture in the distal small bowel at the site of her anastomosis (Figure 1). Given persistent GI bleeding, the patient underwent an elective surgical resection of the anastomosis, ulcer and stricture 5 months following the VCE. The capsule was removed at the time of surgery.

A 3-year-old female, ex 23-week preemie presented with recurrent IDA requiring recurrent IV iron infusions and PRBCs. Extensive blood testing, meckelogram, upper endoscopy, colonoscopy and small bowel follow-through were normal and without signs of obstruction. The family denied active GI symptoms or any additional medical or surgical history. Given imaging negative for stricture, a lack of obstructive symptoms, and the need for endoscopic placement of a PC, the patient did not undergo a PC. A VCE was performed with findings of a large ulcer with bowel stricture noted in the distal small bowel at the site of her anastomosis (Figure 2). Following the procedure, additional outside hospital records were received reporting her history of Necrotizing Enterocolitis (NEC) and intestinal perforation treated with drain placement. Given persistent GI bleeding, the patient underwent an elective surgical resection of the stricture and ulceration 2 weeks following the VCE. The capsule was removed at the time of surgery.

### Discussion

VCE is a relatively non-invasive means of evaluating the entire length of the small bowel in patients with suspected small bowel disease. VCE is indicated in patients with suspected small bowel bleeding and for the diagnosis and management of CD. It can be used in both adults and children 2 years of age and older. The main risk of VCE is Capsule Retention (CR), defined as remaining in the digestive tract for a period of greater than 14 days, and may require medical, endoscopic or surgical interventions for passage or retrieval.

There is an overall video capsule retention rate of 1.4% in adult patients [3] and 2.6% in children [1] and is perceived to be more dependent on the patient's underlying medical condition, as opposed to the age or size of the patient [4]. When delineated by disease process in adults, rates are approximately 1.2% for occult GI bleeds, 2.6% for Crohn's disease and 2.1% for neoplastic lesions [3] and 1.6% for occult GI bleed, 2.5% for Crohn's disease and 1.3% for polyps in children [1]. Given the high rates of VCE retention in known CD, this patient subset should receive a Patency Capsule (PC), or cross-sectional imaging, prior to VCE

to limit capsule retention [5].

Pre-VCE PC studies and the use of cross-sectional imaging greatly reduce the risk of CR. The PC is a product similar in size and shape to the video capsule but is capable of spontaneous disintegration after 24 hours of exposure to bowel contents, allowing for passage. The patency capsule is radiolucent allowing for detection on x-ray studies. If the PC fails to pass in the stool by 24 hours an abdominal x-ray is obtained. If the PC remains in the small bowel, this is concerning for a narrowing of the bowel lumen and VCE should not be performed. If the PC has passed in the stool, or is present in the colon at 24 hours, then this suggests bowel patency and safety for VCE. The PC test has been found to have a sensitivity of 97% (95% CI, 93–99%) and a specificity of 83% (95% CI, 65–94%) [6].

On the contrary, both small bowel follow-through (SBFT) and abdominal Computed Tomography (CT) have been demonstrated to be highly inaccurate [7]. Dedicated small bowel cross-sectional imaging techniques, including CTE and MRE, are better modalities for assessing small bowel wall thickening and strictures, risks factors for CR, though still remain largely sub-optimal [8].

Abdominal x-ray and CT, are used for localization of the retained capsule. In asymptomatic patients, close clinical monitoring is acceptable, while assessing if medical treatments of the underlying disease will lead to spontaneous capsule passage. Patients with obstructive symptoms may require more urgent interventions such as deep enteroscopy or surgery for removal. Asymptomatic patients with capsule retention beyond 3-6 months may also warrant further endoscopic or surgical interventions for retrieval, as the likelihood of spontaneous passage beyond this time is unlikely [7], though case reports demonstrate that patients can tolerate long term capsule retention with few clinical sequelae [9].

Strictures pose a large risk for CR. While high-grade strictures lead to early clinical symptoms in most patients, low-grade anastomotic strictures may go completely unidentified. Both preterm infants and those with NEC have altered gut microbiomes and a propensity for stricture formation [10].

A retrospective analysis evaluated the risk of capsule retention in 4 pediatric patients with past medical histories of NEC, gastroschisis, and jejunal atresia. All patients received a PC or cross-sectional imaging prior to VCE with no reports of CR. However, there was no mention of the number of patients receiving the PC versus imaging, limiting the understanding of which pre-VCE test for patency is superior [11].

We report 2 patients with histories of prematurity, SGS, SIBO and NEC, both with negative imaging for obstruction, albeit one had only a SBFT, and no active obstructive symptoms, who experienced CR requiring surgical resection secondary to missed small bowel strictures. Our study highlights the inadequacy of imaging and clinical symptomatology to identify strictures, and risk for CR, in this specific population, and demonstrates the need for pre-capsule PC in all patients with these high-risk identifiers.

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