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Pouchogram Prior to Ileostomy Reversal after Ileal Pouch-Anal Anastomosis in Pediatric Patients: Is it Useful in the Setting of Routine EUA?

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ABSTRACT

Purpose: To determine if there is a role for routine pouchogram before ileostomy reversal after IPAA in pediatric patients.
Methods: The medical records of pediatric patients who underwent pouchogram between 2007 and 2017 prior to ileostomy reversal after IPAA at two affiliated hospitals were reviewed for concordance between exam under anesthesia (EUA) and pouchogram findings, management of abnormal pouchogram findings, and short and long-term outcomes after ileostomy reversal. Clinical notes were used to find patient-reported symptoms at the time of pouchogram.
Results: Sixty patients (57% female) underwent pouchogram before planned ileostomy reversal. The median time from IPAA formation to pouchogram was 60.5 days (IQR: 46–77) and median follow-up was 4 years (IQR: 1–6). Fifty-seven patients (95%) were asymptomatic prior to reversal. Of the 40 asymptomatic patients with a normal EUA, pouchogram detected one stricture (3%), but reversal proceeded as planned. In the 16 patients with strictures on EUA, pouchogram only detected six (40%). One of 50 (2%) asymptomatic patients with normal pouchogram had anastomotic dehiscence found on EUA. Despite normal pouchogram and EUA, four asymptomatic patients required subsequent diversion for pouch-related complications between 13 and 60 months after ileostomy reversal. Three patients had pelvic pain prior to pouchogram; associated symptoms included perineal pain (n = 1) hematochezia (n = 1), and tenesmus (n = 1). EUA and pouchogram were concordant in two patients (n = 1 anastomotic complication, n = 1 pouch septum) and ileostomy reversal was delayed. In the remaining symptomatic patient, pouchogram detected an anastomotic leak where EUA detected only a stricture, and this prompted a delay in reversal. Long term, none of these patients required diversion or excision of their pouch.
Conclusion: Routine pouchogram in asymptomatic pediatric patients does not change management and can be omitted, thereby sparing patients discomfort and unnecessary radiation exposure. Pouchogram may have diagnostic value in symptomatic patients.
Level of Evidence: III.
Type of Study: Study of Diagnostic Test.

Ileal pouch-anal anastomosis (IPAA) is the operation of choice for restoration of intestinal continuity in children with medically refractory ulcerative colitis (UC) or familial adenomatous polyposis (FAP). Patients with UC are commonly diverted at the time of IPAA due to poor nutritional status or systemic immunosuppression [1,2], while patients with FAP may undergo IPAA with or without a protective diverting ileostomy [3,4]. Before reversal of a protective ileostomy, some surgeons choose to perform pouchogram to assess the integrity of the anastomosis. The evidence in support of the use of routine pouchogram comes from the adult literature where studies found that an abnormal pouchogram can predict future pouch failure and thus allows earlier intervention to attempt to reduce this risk [5–7]. With low rates of long-term IPAA failure [8], the relationship of a routine pouchogram to longer term outcomes and pouch failure in pediatric patients is unknown.

Routine use of pouchogram has been questioned in children due to exposure to radiation, discomfort of the procedure, and lack of evidence that radiologic finding changes clinical decision-making in pediatric patients [9,10]. Similar observations were first reported in adults, and these studies

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argued that pouchogram does not alter management at the time of planned ileostomy reversal in adults and is thus unnecessary [11–14]. Despite these observations, many centers still utilize pouchogram on all patients [5].

We sought to determine the concordance between EUA and pouchogram in a larger series of pediatric patients, and we hypothesized that routine pouchogram in asymptomatic pediatric patients undergoing routine EUA adds little diagnostic value and does not change clinical decision-making before diverting ileostomy reversal after IPAA.

1. Methods

1.1. Setting

Following approval from the Institutional Review Board, children who underwent routine pouchogram between 2007 and 2017 prior to ileostomy reversal after IPAA at two affiliated tertiary referral centers, center A (n = 56) and B (n = 4), were retrospectively reviewed.

1.2. Patients and EUA/Pouchogram Finding Definitions

Pediatric patients who underwent IPAA formation with diverting ileostomy and diverting ileostomy closure at center A or B during the study period were considered for inclusion. Patients who did not have a pouchogram prior to ileostomy reversal (n = 2) were excluded. The approach/stage (one-, two-, modified two-, or three-stage) is dependent upon diagnosis, surgeon experience, and, in the case of UC, whether the patient had a preceding subtotal colectomy.

Institutional practice is to perform pouchogram around 6–8 weeks following IPAA formation. The pouchogram is performed in the radiology suite, using water soluble contrast instilled through a small caliber enema tip. Patients have pouchograms scheduled the day prior or day of planned ileostomy reversal.

The standard practice at the two institutions is to perform an EUA in the operating room prior to ileostomy closure. Stricture was defined by operative reports noting a stricture with significant bleeding, difficult dilation, or balloon dilation. Any stricture that was cited as a reason for delay in ileostomy reversal was also classified as a stricture. Leak was defined as any evidence of anastomotic disruption on EUA or pouchoscopy or the presence of extravasation or contrast collection on pouchogram. Fistula was defined as a fistula found on EUA or passage of contrast from the pouch to specific anatomic location, such as the vagina, on pouchogram. Refractory pouchitis was defined as >4 episodes of pouchitis that did not respond to antibiotic therapy.

1.3. Data

Charts were reviewed for presenting diagnosis, operative details, and postoperative course for both IPAA and ileostomy reversal. Pouchogram indications and radiology reports were also reviewed. Clinical notes were screened for patient-reported symptoms, including fevers, abdominal pain, pelvic pain, pain with defecation, nausea, vomiting, abnormal discharge, hematochezia, or melena. The primary outcome was delay in ileostomy reversal to facilitate healing of the IPAA anastomosis at the time of planned ileostomy reversal. Secondary outcomes included the occurrence of pouchitis, future diagnosis of Crohn's disease of the pouch, or the need for pouch diversion or pouch excision at any point during follow-up after diverting ileostomy reversal. Patients were followed until the last recorded clinical or correspondence note in chart.

1.4. Analysis

Continuous variables with normal distribution were summarized with mean and standard deviation, while non-parametric continuous variables were summarized with medians and interquartile ranges (IQRs). Categorical variables were summarized with frequency counts and percentages. Results of pouchogram were compared directly with the results of EUA. All statistical analyses were performed using STATA 15.1 (College Station, Texas).

2. Results

2.1. Patient demographics and operative details at time of IPAA creation

Ninety-one patients had IPAA performed over the study period and all were J-pouches. Of these, 30 patients (33%; n = 21 one-stage and n = 9 modified two-stage) were not initially diverted at the time of IPAA creation. Two patients (2%; n = 1 one-stage and n = 1 modified two-stage) were diverted in the immediate post-operative period due to anastomotic leak and were included in the analysis. The remaining 28 patients were excluded from analysis. Three patients were excluded because either no pouchogram was performed prior to ileostomy reversal (n = 1), ileostomy reversal occurred at another institution (n = 1), or reversal had not occurred (n = 1).

Sixty patients underwent pouchogram and EUA prior to ileostomy reversal with demographic and operative characteristics found in Table 1. Overall, 5 patients experienced a leak prior to or at the time of pouchogram. Three patients had leaks noted within 30 days of operation and prior to pouchogram, and of these, two required diversion. The remaining two leaks were detected on pouchogram in symptomatic patients. Patients with handsewn anastomoses more frequently had strictures requiring delay in takedown, but this did not reach statistical significance (14% versus 0%, p = 0.08).

2.2. Findings on pouchogram and EUA at time of planned ileostomy reversal

Pouchogram was performed a median of 60.5 days [IQR: 46,77] after IPAA creation. The test was performed the day prior to or morning of planned EUA for all patients, and the results of these two tests are compared in Table 2. Fifty-seven patients (95%) were asymptomatic at the time of the routine pouchogram. An EUA was found to be normal in 40 asymptomatic patients; however, pouchogram detected a stricture in one patient. Reversal proceeded as planned after dilation during the same anesthetic. A stricture was found by EUA in 16 asymptomatic patients, while pouchogram detected only 6. Five patients with strictures had reversal postponed—2 strictures were found on both pouchogram and EUA and 3 were found only on EUA. One anastomotic dehiscence was found on EUA and missed by pouchogram, and this patient experienced a delay in reversal.

Three patients had symptoms of pelvic pain prior to pouchogram. Associated symptoms included perineal pain (n = 1), hematochezia (n = 1), and tenesmus (n = 1). EUA and pouchogram were concordant in two patients (n = 1 anastomotic complication, n = 1 pouch septum) and ileostomy reversal was delayed. Both patients had long periods, 177

Table 1
Patient demographics and operative details at time of IPAA.

N		60
Age in years, median (IQR)		16 (14, 17)
Sex	Male	26 (43%)
	Female	34 (57%)
Diagnosis	Ulcerative Colitis	49 (82%)
	Indeterminate Colitis	6 (10%)
	Familial Adenomatous Polyposis	5 (8%)
Stage	Three-stage	31 (51%)
	Two-stage	27 (45%)
	One-stage	1 (2%)
	Modified Two-stage	1 (2%)
Approach	Laparoscopic	51 (85%)
	Open	7 (11%)
	Conversion to open	2 (4%)
Anastomosis	Handsewn	36 (60%)
	Stapled	24 (40%)

Table 2
Pouchogram versus EUA Findings in asymptomatic patients.

		EUA		
	Finding	*Normal*	*Stricture*	*Anastomotic complication*
Pouchogram	*Normal*	39*	10	1
	Stricture	1	6	0
	Anastomotic Complication	0	0	0
	Pouch Septum	0	0	0

* 1 patient developed an anastomotic leak after normal pouchogram and EUA.

and 292 days, between IPAA formation and planned takedown. The first patient had some abnormal discharge and pain on rectal examination performed in the office. The decision was made to give antibiotics and to observe the patient for signs of further infection prior to reversal. The second patient had a leak in the immediate post-operative period. Discussions between the patient and provider reflected a desire to wait a longer period before pursuing ileostomy reversal.

In the remaining symptomatic patient, pouchogram detected an anastomotic leak whereas EUA detected only a stricture. The patient complained of pelvic pain but did not present with other symptoms concerning for pelvic sepsis. He underwent an early pouchogram at 41 days following IPAA. Reversal was delayed to manage the leak and stricture.

2.3. Outcomes following ileostomy reversal

All 60 patients eventually underwent successful ileostomy reversal at a median of 70 days [IQR: 53, 84] after IPAA. Nine takedown operations were delayed because of EUA and/or pouchogram findings. Within 30 days of ileostomy reversal, two of the patients had IPAA-related complications. One (2%) asymptomatic patient developed a pelvic abscess despite normal EUA and pouchogram, while one (2%) symptomatic patient with an anastomotic leak on pouchogram and EUA developed a pouch-vaginal fistula. Long-term, at a median follow-up of 4 years (IQR: 1–6), a majority (n = 38, 63%) of patients were diagnosed with pouchitis at least once. Most patients (n = 32, 90%) responded to medical management consisting of antibiotics. A total of six patients had refractory pouchitis. Five patients (8%) were eventually diagnosed with Crohn's disease, with four of these patients having had refractory pouchitis.

Four patients, who were asymptomatic prior to ileostomy takedown, required re-diversion between 13 and 60 months after ileostomy reversal. All 4 patients had a normal EUA and pouchogram at the time of reversal. Reasons for diversion included Crohn's disease of the pouch (n = 2), severe pouch dysfunction (n = 1), and en bloc resection of an intra-abdominal desmoid tumor (n = 1) in a patient with FAP. No patients with abnormal pouchogram required diversion or excision of their pouch.

3. Discussion

The present study found that routine pouchogram in asymptomatic patients added little value to EUA at the time of planned ileostomy reversal among children who have undergone IPAA. However, pouchogram was a useful diagnostic tool in symptomatic patients. Though some surgeons routinely obtain a pouchogram prior to ileostomy reversal in patients who have undergone IPAA, this test can likely be omitted in asymptomatic patients presuming an EUA is performed and is normal. In the present study, clinical examination done just prior to planned ileostomy reversal was largely concordant with pouchogram findings, and in asymptomatic patients, demonstrated better ability to detect clinically significant abnormalities.

Other authors have commented that pouchogram has numerous false positives, particularly strictures, that are found radiographically but do not have clinical significance [9,15]. These data found pouchogram to be poorly sensitive for stricture; it actually failed to detect a number of clinically significant strictures that required intervention at the time of ileostomy reversal. While pouchogram and EUA detected 17 strictures among asymptomatic patients, only 5 experienced delayed reversal as a direct result of the stricture, making these the most clinically significant strictures. More than half of these clinically significant strictures were not evident on pouchogram. The decision to delay reversal was surgeon-specific and reflects the perceived force or, in some cases, balloon-assisted dilation required to treat the stricture. Interestingly, clinically significant strictures were only observed among patients with handsewn anastamoses, though this did not reach statistical significance. Larger studies have observed increased stricture rates among handsewn anastomoses [16,17], making it possible that we were underpowered to detect this difference.

Notably, pouchogram is not intended for detection of stricture but rather to diagnose an asymptomatic leak or pouch fistula. In this series, pouchogram missed one anastomotic dehiscence in an asymptomatic patient that was detected on EUA. EUA has been shown to have similar performance to pouchogram in assessing low pelvic anastomoses in adults [14,18]. Data is more limited in pediatric patients, but Lawal et al. found that EUA showed perfect concordance in 1 child with anastomotic leak, 2 children with strictures, and 26 children with normal findings on pouchogram [9]. Our data adds to the previous studies in children that suggest EUA is at least equivalent to pouchogram at detecting IPAA complications before ileostomy reversal in asymptomatic patients.

This study found that the use of routine pouchogram did not change management in any asymptomatic patients. In symptomatic patients, it changed management in a single case—the symptomatic patient with leak identified on pouchogram that was not appreciated on EUA. This finding echoes those seen in a study of adult patients by da Silva et al., where pouchogram prior to ileostomy reversal changed management in only 1 of 84 cases [9]. Lawal et al. found that pouchogram did not alter management in any of the three children with abnormal radiographic findings, as all findings were apparent on EUA [9]. The majority of symptomatic patients in our study actually had pouchograms delayed due to other clinical circumstances. Symptomatic patients, of course, may have a number of studies including CT scan, MRI, and even pouchoscopy to assess for complications [19,20]. As some authors have pointed out, these more advanced imaging and diagnostic techniques may also render pouchogram unnecessary.

We did not find a relationship between an abnormal pouchogram and future pouch failure. If abnormal pouchogram was shown to predict future pouch failure, this would support its routine use; but the studies demonstrating this finding have been chiefly in adult patients [6,7]. Tsao et al. found that the rate of pouch failure and anastomotic stricture was much higher among patients with abnormal pouchogram compared to patients with a normal study [6]. More recently, an analysis of adult patients found that pouchogram with contrast extravasation was predictive of pouch failure and pouch-related complications [7]. In our cohort, we had 4 patients that underwent re-diversion following ileostomy takedown. This small number precludes statistical analysis; however, neither stricture nor leak was found on EUA or pouchogram.

Our results indicate that pouchogram has poor positive predictive value (PPV) among asymptomatic children, and it should be reserved for patients with symptoms suggestive of leak or fistula. This difference in children compared to adults could be due to a lower incidence of anastomotic complications. Pediatric rates of pelvic sepsis following IPAA are estimated between 8 and 14% [21], while larger adult series have reported rates of 5–25% [22–24]. This fact would support that pouchogram is really most valuable in symptomatic children, where the probability of detecting a leak is much greater. Lower rates of anastomotic complications also lead to fewer abnormal pouchograms. Indeed abnormal pouchogram prior to reversal is rare in the pediatric literature—Lawal et al. only reported 1 patient with a leak demonstrated on pouchogram and the present study demonstrated only 2 abnormal

pouchograms with contrast extravasation [9]. It is unclear whether a larger number of pouchograms demonstrating leak in children might correlate with long-term outcomes.

One final note is that routine pouchogram may also cause harm without adding clinical value. There is insufficient evidence to support the use of pouchogram as a screening tool for complications, and the procedure is both uncomfortable and increases radiation exposure [9,10,25–27]. Children with inflammatory bowel disease are at increased risk for lymphoma and gastrointestinal malignancy; and it has been suggested that frequent radiation exposure may be a significant contributor to such risk [25,26].

This study should be interpreted in the context of its limitations. The retrospective nature of the study introduces bias. For example, clinicians were aware of the pouchogram findings prior to their EUA, making it unlikely that they would fail to recognize abnormal findings when abnormalities were noted on the contrast study—a limitation shared by previous studies [5,6]. The EUA performed by each surgeon is not standardized, making it possible that some surgeons completed a more extensive exam than others with prior knowledge of the patient's pouchogram results. This limitation could only be overcome by a prospective blinded study comparing pouchogram and EUA. Our analysis was also limited to pouchograms performed at the time of planned ileostomy reversal, and thus patients may have had previously abnormal pouchogram prompted by symptoms not represented in the study.

4. Conclusion

Routine pouchogram in asymptomatic pediatric patients at the time of planned ileostomy reversal after IPAA does not change management. If patients are without symptoms, this test should be omitted, sparing children the discomfort and unnecessary radiation exposure. Pouchogram may aid in the diagnosis of symptomatic patients or as an adjunct to additional radiologic studies. The correlation of abnormal pouchogram with long term outcomes among children deserves further study.

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