



## Outcomes after fecal diversion for colonic and perianal Crohn disease in children



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### ABSTRACT

**Background:** Temporary fecal diversion by means of an ileostomy or colostomy has been used in the surgical management of refractory colonic and perianal Crohn disease (CD). The aims of our study were to evaluate the outcomes after fecal diversion in pediatric patients with colonic and perianal CD.

**Methods:** The records of patients who underwent fecal diversion for colonic and perianal CD at Children's Hospital of Wisconsin between July 2000 and June 2014 were reviewed retrospectively. Patient demographics, medication use, onset and extent of disease, response to fecal diversion, rate of stoma reversal and relapse rate after stoma reversal were recorded.

**Results:** We identified 28 consecutive patients (20 females, 8 males; median age 13.9 years) undergoing fecal diversion for refractory colonic (n = 21) and perianal CD (n = 7). Median duration of follow-up after fecal diversion was 2.26 years (range, 0.79–10.2 years). The response to fecal diversion was sustained clinical remission in 13/28 (46%), temporary clinical remission in 10/28 (36%), no change in 5/28 (18%). Intestinal continuity was restored in 14/28 (50%) patients; however, 3 (21%) required permanent stoma after reconnection. Classification tree analysis identified that female patients without perianal CD had higher rates of stoma reversal (p = 0.008). **Conclusions:** Fecal diversion can induce remission in pediatric patients with refractory colonic and perianal CD. Restoration of intestinal continuity was achieved in about 39%. Female patients without perianal CD carried no risk of a permanent stoma.

**Level of evidence:** Level III study.

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Crohn disease (CD) mainly affects adults, but 7% to 20% of the cases are diagnosed in childhood [1]. CD is often described as more severe and aggressive in children than in adults [2,3], whereas others have found no differences [4]. In CD, surgery is often recommended, when medical treatment has failed. Growth retardation in pediatric patients with localized disease may also lead to early surgical intervention [5]. Historically, 50–90% of adult patients with CD will need bowel resection at some time [5–8]. A recent study showed cumulative 5-year surgery rates for CD from time of diagnosis in pediatric and adult patients of 18% and 21%, respectively [4].

Temporary fecal diversion has been used to achieve remission in colonic CD [9–14]. It was also utilized to allow severe perianal disease to settle, thereby avoiding proctectomy [15–17]. Previous studies have reported restoration of intestinal continuity in 20% to 79% of patients

with colonic and perianal CD who require fecal diversion [18–24]. Restoring the intestinal passage carries the risk of recurrent disease activity, possibly resulting in a decreased quality of life compared to the situation with fecal diversion [25].

The role of fecal diversion for the treatment of colonic and perianal CD with the goal of reestablishing intestinal continuity in children remains unclear. The aims of this study were, therefore (1) to examine the effectiveness of fecal diversion for the treatment of colonic and perianal CD, (2) to determine rates of successful diverting ostomy reversal after fecal diversion, and (3) to identify risk factors predicting no permanent stoma carriage.

### 1. Methods

#### 1.1. Study population

This study was a retrospective chart review. The study was approved by the Institutional Review Board of the Children's Hospital of Wisconsin. We included patients diagnosed with CD who had ileostomy or

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colostomy, between July 2000 and June 2014, for management of refractory colonic and perianal CD. Diagnoses are coded using the International Classification of Diseases, 9th edition, clinical modification codes (ICD-9-CM) while procedures are coded with an ICD-9-CM and/or a current procedural terminology (CPT) code. Exclusion criteria included ulcerative colitis or indeterminate colitis and temporary ostomy before J-pouch creation, patients without CD, patients for whom diverting ostomy was not performed for colonic and perianal CD treatment and patients in whom the intention of the initial diversion procedure was for permanent stoma. Manual chart review of all eligible patients was performed by one of the study investigators to identify eligible patients. A diagnosis of CD was established using accepted clinical, endoscopic, and radiologic criteria [1].

### 1.2. Variables

Information on age at diagnosis, gender and growth parameters was extracted from review of the medical records. Date of ostomy creation was confirmed in the surgical record, and follow-up notes were queried to date of the last follow-up to evaluate for disease recurrence or for restoration of intestinal continuity over the follow-up period. Exposure to steroids, immunomodulator therapy and biological therapy was recorded. Extent of disease, duration of disease, indications for diversion, stoma type and concomitant procedures with diversion were also recorded. Disease behavior was classified as stricturing, penetrating or both stricturing and penetrating disease according to Paris Classification for Pediatric CD. Data was also extracted about endoscopic and radiologic investigations performed, and the mode of confirmation of disease recurrence. Remission was defined as clear, subjective or objective improvement in the patient's condition based on Physician Global Assessment (PGA) [26]. Remission was classified as: (1) sustained remission: improvement that lasted throughout the review without relapse (2) temporary remission: improvement that lasted more than 3 months but the disease later relapsed; and (3) no response: the disease was not alleviated or become worse. Relapse was defined as the recurrence of symptoms in the absence of other causes.

### 1.3. Statistical analysis

For continuous variables, a non-parametric Mann–Whitney *U* test was used to compare groups. For categorical variables, the Fisher's exact test was used to compare groups. Classification tree analysis was performed on significant variables using ostomy reversal status as the dependent variable. A *p*-value <0.05 was used to determine as statistically significant difference. Kaplan–Meier curves were constructed to examine proportion of patients undergoing reconnection and time to reconnection. We also examined the proportion of patients who required a repeat ostomy in those undergoing reconnection initially. Subgroup analyses were performed for three groups of patients based on disease location and type of surgery; colonic CD with fecal diversion alone, colonic CD with fecal diversion and concomitant colectomy, and perianal CD.

## 2. Results

### 2.1. Patient data

We identified 28 patients who underwent fecal diversion for refractory colonic (*n* = 21) or perianal CD (*n* = 7) (Table 1). Twenty patients (71%) were female. The median age of the cohort was 13.9 years (range, 6.11–20.6) at the time of diversion. The median weight-for-age *z* score at the time of diversion was  $-0.73$  (range,  $-5.2$ – $2.01$ ), height-for-age *z* score was  $-0.46$  (range,  $-4.0$ – $1.33$ ) and body mass index (BMI) *z* score was  $-0.65$  (range,  $-3.70$ – $1.96$ ). Median duration of follow-up after fecal diversion was 2.26 years (range, 0.79–10.2 years). Disease location included 100% with colonic involvement, 57% with ileal involvement, 71% with disease proximal to ligament of Treitz, and 32% with perianal involvement. None of the patients had perianal disease alone.

**Table 1**  
Baseline characteristics of study population (*n* = 28).

Characteristic	Number
Male (%)	8 (29)
Median age at fecal diversion (range), y	13.9 (6.1–20.6)
Median growth parameters at diversion (range)	
Weight <i>z</i> -score	$-0.73$ ( $-5.2$ – $2.01$ )
Height <i>z</i> -score	$-0.46$ ( $-4.0$ – $1.33$ )
BMI <i>z</i> -score	$-0.65$ ( $-3.70$ – $1.96$ )
Medications use (%) <sup>a</sup>	
Steroids	27 (96)
Immunomodulators	25 (89)
Biologics	25 (89)
Combination therapy	18 (64)
Location of CD (%) <sup>b</sup>	
Colonic	28 (100)
Total/Segmental	18 (64)/10 (36)
Ileal	16 (57)
Proximal disease	20 (71)
Perianal	9 (32)
Behavior of CD (%)	
Non-stricturing/non-penetrating	8 (29)
Stricturing	3 (11)
Penetrating	10 (36)
Stricturing/Penetrating	7 (25)
Indication for diversion (%)	
Proctocolitis	21 (75)
Perianal disease	7 (25)
Type of surgery (%)	
Diversion	11 (39)
Diversion + concomitant colectomy	17 (61)
Type of colectomy (%)	
Total vs.	9 (53)
Segmental colectomy	8 (47)
Type of Stoma (%)	
Ileostomy	21 (75)
Colostomy	7 (25)
Mode of surgery (%)	
Laparoscopic	16 (57)
Open	12 (43)

<sup>a</sup> Patients may have more than one medication use.

<sup>b</sup> Patients may have more than one location of CD.

Total colonic disease was found in 46% of patients. Behavior of disease included 29% with nonstricturing nonpenetrating disease, 11% with stricturing disease, 36% with penetrating disease, and 25% with both stricturing and penetrating disease. The median Hgb level at the time of diversion was 9.9 g/dL (range, 7.8–13.3) (normal range 12–15), WBC count was  $9.3 \times 10^3/\mu\text{L}$  (range, 4.3–47.8) (normal range 4.0–10.5), platelets  $461 \times 10^3/\mu\text{L}$  (range, 221–873) (normal range 150–450), ESR was 45 mm (range, 6–100) (normal range 0–10), CRP was 5.5 mg/dL (range, 0.3–26.5) (normal range 0–1.0) and albumin level 3.4 g/dL (range, 1.8–4.6) (normal range 3.8–5.4).

Most patients (89%) were on immunomodulators (thiopurines, 78% or methotrexate, 21%) before the diversion. Twenty-four of 28 (86%) patients received biological therapy before fecal diversion and 22/28 of patients (78%) had biological therapy continued after diversion. Fourteen of 28 of patients (50%) had more than one biological therapy before fecal diversion. Eighteen of 28 patients (64%) were on combination therapy with biologics and thiopurines, and 27/28 (96%) had exposure to steroids before diversion. Eleven patients (39%) had fecal diversion alone and 17 (61%) had fecal diversion with concomitant colectomy. Of 17 patients who had concomitant colectomy, nine (53%) required total proctocolectomy and eight (47%) required segmental proctocolectomy. Twenty-one patients (75%) required ileostomy and 7 (25%) required colostomy.

### 2.2. Effectiveness of fecal diversion for the treatment of colonic and perianal CD

The response to fecal diversion was sustained clinical remission in 13/28 (46%), temporary clinical remission in 10/28 (36%), and no change in 5/28 (18%). The median time to relapse in patients with

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