

# Pull-through, a salvage technique?

## Summary

The *pull-through technique* with deferred anastomosis was described in 1961 by *Turnbull* and *Cutait*. Although classically used for the treatment of Hirschsprung's disease, its indications have been expanded over time, and it is currently applied for salvage surgery or as a primary option in surgery for benign or malignant pathology of the rectum in patients requiring ultra-low anastomosis. Because it represents a salvage for avoiding a permanent ostomy, it is an important technique in the colorectal surgeon's arsenal. The aim of this article is to review the technique, its indications and the results obtained with it.

**Keywords:** pull-through, anastomotic leak, salvage surgery, rectal cancer

Volume 5 Issue 1 - 2024

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**Received:** January 05, 2024 | **Published:** January 22, 2024

## Introduction

*Pull-through* is a surgical technique that consists of trans-anal mobilization of the colon. It was first described in 1932 by *Babcock*.<sup>1</sup> In 1950, *Swenson* described the technique accompanied by immediate colo-anal anastomosis for benign and malignant pathology of the rectum, however, with considerable rates of dehiscence and pelvic infection.<sup>1,2</sup> Subsequently, in 1961, it was described with deferred anastomosis by *Turnbull* and *Cutait*, who also used the technique in the treatment of Hirschsprung's disease.<sup>1,2</sup> Despite the advances in the approach to the pathology of the rectum, the surgical treatment of neoplasms of the mid-lower rectum is a technical challenge for the surgeon, who seeks an oncological safe surgery (R0), combined: with a reasonable preservation of sphincteric function; intestinal continuity and acceptable morbidity.<sup>1,3</sup>

The *standard* technique for this is Anterior Resection of the Rectum with immediate coloanal anastomosis with or without intersphincteric resection (total or partial), depending on the involvement of the internal sphincter.<sup>4</sup> Considering the risk of pelvic sepsis associated with this procedure, a temporary ostomy should be considered. Temporary ileostomies are associated with morbidity in 43 % of patients and in 20 % of patients after closure<sup>5</sup> and have a significant impact on quality of life. In addition, they do not prevent the complications associated with anastomosis – leakage, fistulas, etc. – whose resolution is often complex (due to inflammation, local fibrosis, and involvement of the sphincteric complex) and can lead to a permanent ostomy or to delays in adjuvant treatment.<sup>6</sup> The *pull-through* is, therefore, a useful resource in the colorectal surgeon's arsenal when in the presence of an unfavorable pelvis or anastomosis-related complications.<sup>1</sup>

## Objectives

The aim of this article is to review the surgical technique, indications and results of this procedure.

## Material and methods

Bibliographic search in PubMed about the surgical technique and its application in the context of salvage surgery and as a primary option. Presentation of the description of the technique, and bibliographic review of its indications and results.

## Results

### Surgical technique

Three fundamental times are considered in the performance of the technique: (i) Abdominal and pelvic; (ii) Perineal; (iii) Reconstruction.<sup>3,7,8</sup>

#### i. Abdominal and pelvic time

The splenic angle and the left colon are mobilized so that they can be brought to the pelvis without tension. To do this, it is necessary to have ligate the inferior mesenteric vein and artery, as well as divide the transverse mesocolon. In the presence of previous procedures, the existing colonic segment should be released/mobilized to the pelvis in order to maintain its viability. Subsequently, the rectum is dissected to the pelvic floor according to the TME technique. When the *puborectalis muscle* is reached the dissection is centripetal towards the rectal wall. In the presence of previous surgeries, isolation of the rectal stump should be performed.

#### ii. Perineal time

With the support of a Lone Starr *retractor*, mucosectomy is performed at the level of the dentate line. The dissection then extends through the intersphincteric plane up to the abdominal dissection. 4 cardinal points of the anal canal (involving the internal sphincter) are referenced with resorbable monofilament sutures. The operative specimen and the rest of the colon are, if possible, trans-anal exteriorized and the colon is sectioned, being fixed to the four cardinal points. During exteriorization, it is essential to avoid eversion of the mucosa of the anal canal.

#### iii. Reconstruction

It may be immediate in the absence of significant risk factors for dehiscence. In this case, a J-pouch can be made with the latero-terminal coloanal anastomosis. The anastomosis is performed in a single layer, with separate, resorbable stitches. It can be deferred due to considerable risk of leakage, treatment of complications, or the need to avoid a temporary ostomy. The colic stump, measuring 5-10 cm, remains externalized for 7 to 10 days, anchored only to the cardinal sutures and wrapped in moist gauze. In the second stage, a termino-terminal anastomosis is performed in a single layer, with separate and resorbable suture, avoiding damage to the adhesions formed between the anal canal and the colon.

## Indications and results

### A. Salvage surgery

Classically, *pull-through* is a suitable technique for patients with Hirschsprung's disease, complex fistulas, pelvis hostage in the irradiating content, chronic pelvic infection and as salvage surgery for complications of colorectal anastomoses.<sup>1</sup> That is, situations that would otherwise lead to a permanent ostomy and abdominoperineal amputation.<sup>8</sup> Because it is a factor that decreases the quality of life of patients, the option of *pull-through* is not recommended in patients with known fecal incontinence, marked sphincteric hypotonia, or pelvic floor destruction with extensive sphincteric involvement.<sup>8</sup>

The results of five centers<sup>7-11</sup> with the use of the technique as salvage

surgery in patients with chronic pelvic infection due to complex fistulas (due to Crohn's disease, radiotherapy, previous surgeries, etc.) or resulting from complications of previous colorectal anastomoses are presented below (Table 1). In this context, most patients already had a temporary ostomy performed as a previous attempt to treatment or to control pelvic sepsis. In most of the remaining cases, a temporary loop ostomy was constructed at the time of the intervention (only 8 cases were excluded). The anastomosis was performed in a deferred manner in most patients, and the procedure occurred between the 7<sup>th</sup> and 12<sup>th</sup> postoperative day. Thus, providing minimal manipulation in a hostile territory and allowing the patient to benefit from the adhesions/sealing formed between the mucosa of the anal canal and the colic serosa.

**Table 1** Summary of the analysis of 5 studies using pull-through in salvage surgery for postoperative complications of colorectal/colorectal anastomosis, chronic pelvic infection in the context of complex fistulas, or a hostile pelvis

Author	Patsouras et al. <sup>7</sup>	Hallet et al. <sup>8</sup>	Ryckx et al. <sup>9</sup>	Barugola et al. <sup>10</sup>	Maggiore, et al. <sup>11</sup>
N	34	7	20	9	24
Indication	Chronic pelvic infection: 59% in the context of complications from previous colorectal anastomoses.	Salvage surgery after complications of colorectal anastomoses (leak, rectovaginal or rectovesical fistulas, and ischemia of the colic canal).	Chronic pelvic infection due to: colorectal anastomotic leak after resection of the rectum (n=15), rectovaginal fistula (n= 2), rectourethral fistula (n=2), Crohn's disease (n=1)	1 patient with post-RT rectovaginal fistula; 7 patients with chronic pelvic infection secondary to anastomotic leak, 6 of them with rectovaginal fistula. 1 patient with endometriosis and short post-Hartmann rectal stump	Chronic pelvic infection due to previous colorectal or colorectal anastomotic leak (n=15); rectovaginal fistula (n=9)
Prior temporary ostomy	19	6	18	8	11 (8 patients did not have a derivative ostomy at any time during treatment)
Immediate vs deferred anastomosis	-	7	18 vs. 2	1 vs. 8	24
Type of anastomose	-	Terminal-Terminal	16 terminals and 4 with J-pocket	-	Terminal-Terminal
Complications	41%: IFO (5); pelvic hematoma (1); pelvic abscess due to anastomotic leak (2); UTI (2); Ileus (2); enterocutaneous fistula (1); intra-abdominal collection (1); Pre-Sacred Collection (1); ureter injury (1),	5 out of 7 patients: UTI (2), Ileus (1); pelvic abscess (1); Necrosis of the Colonic Duct (1)	60%: UTI (1); Anemia (1); Ileus (1); IR (1); IFO (1); pelvic abscess (2); anastomotic leak (2); Biloma (1); Ureter Injury (2)	Pelvic abscess (2), treated conservatively	54%: 8 minor and 5 major (Clavien-Dindo ≥ III – 3 pelvic abscesses; 1 parastomal strangulated hernia)
Anastomotic leak	Feb-34	0	10%	-	-
Anastomose stenosis	4, Treatment with dilatation	0	6/20, dilatation treatment	2, Treatment with dilation	2, Treatment with permanent ostomy
Re-establishment of intestinal continuity	31/34, 1 required permanent colostomy	4 patients with re-establishment, 1 waiting, 1 refused, 1 required definitive colostomy and AAP	70%	8	5 patients had a permanent ostomy due to: chronic pelvic infection (2), anastomotic stenosis (2), poor functional outcome (2)
Functional Outcome	n=24: 38% without complaints; 38% had preserved continence, but with defecatory urgency; 17% mild incontinence; 1 defecatory obstruction; 1 complete incontinence.	None of the patients required an ostomy due to poor functional results	-	At 12 months: defecatory urgency (2); Solid stool incontinence (1); fecal fragmentation (4); Incontinence for watery stools or gas (6).	Medium LARS 22±9 (9–39)

IFO, Surgical wound infection; UTI, Urinary Tract Infection; AAP, Abdominoperineal amputation; RI, Respiratory infection; RT, radiotherapy.

The rate of complications after the procedure ranged from 41-60%, however, most did not require surgical reintervention. Of the 94 patients included in the set of 5 studies, the following were reintervened: 3 patients with ureter lesions, 2 patients with pelvic abscesses - who underwent laparoscopic drainage, one patient with ischemia of the colic conduct, and one patient with a strangulated parastomal hernia. The rest received conservative treatment for their complications. Re-establishment of bowel continuity was achieved in most patients. Regarding the functional results, the formal evaluation was performed in only three of the studies. Patsouras *et al.*<sup>7</sup> reported: 17% of mild incontinence, 1 case of complete incontinence, 38% of normal function and 38% of normal continence, but with defecatory urgency. Barugola *et al.*<sup>10</sup> present an analysis of the results from 6 to 24 months, with an improvement in complaints with biofeedback treatment. At 24 months, 1 patient had defecatory urgency and 4 had gas incontinence. Maggiori *et al.*<sup>11</sup> reported a mean LARS  $22 \pm 9$  (with an interval of 9–39).

## B. Primary option

The perception of *pull-through* as a highly selective technique

**Table 2** Summary of results of the systematic review and meta-analysis<sup>4</sup>

	Immediate anastomosis + ileostomy	Deferred Anastomose	Conclusions
N	519	386	-
Post-operative complications	21%	13%	No statistically significant differences
Pelvic sepsis	14%	7%	Significantly smaller in deferred anastomosis
Risk of permanent ostomy	2%	2%	No statistically significant differences

Due to the heterogeneity in this meta-analysis, no overall functional results are reported. There seems to be a trend towards improvement in functional outcomes over time, as seen in the previous section. Regarding the use of *scores*, some series reported Wexner at 2 years of less than 10 years and at 5 years less than 5.5.<sup>4</sup>

A multicenter randomized trial by Biondo *et al.*,<sup>5</sup> included in the previous analysis, seems of particular interest. The rate of anastomotic leakage was 23.9% in the IA group (immediate anastomosis) and 13% in the DA group (deferred anastomosis),  $p = 0.28$ . From a functional point of view, results were obtained in 1 year for 28 patients in the IA group and 37 DA patients. There were no statistically significant differences between the groups at 1 year with the *LARS* (30.5 vs 36) and *Wexner* (11.5 vs 13) scores.<sup>5</sup> Majbar *et al.*<sup>13</sup> – published after the previous meta-analysis – compares, through a retrospective and observational study, the results obtained in 45 patients who underwent ultra-low resections of the rectum with immediate anastomosis (IA) with J-pouch and loop ileostomy (n=26) vs. deferred anastomosis (DA) (n=19). The two groups were homogeneous for demographic and oncological characteristics. Regarding the occurrence of severe complications (defined as *Clavien-Dindo*  $\geq$  IIIb), there were no differences between the AI: 26.9% and AD: 26.3% groups. Anastomotic leak rates were also similar: AI 42.3%; AD 31.6%,  $p=0.46$ . However, in the group that performed the immediate anastomosis with loop ileostomy most of the leaks were type A, and in the group that performed the deferred anastomosis most were type B. It should be noted that in this analysis the median time for closure of ileostomies was 22 weeks and these patients had more readmissions at 90 days.<sup>13</sup>

It should be noted that the deferred anastomosis allows a laparoscopic and perineal approach, with extraction of the operative specimen through the trans-anal route, avoiding some complications associated with the manipulation of the abdominal wall – “no scar

in the management of rectal pathology has been changing in recent years.<sup>6,12</sup> It is currently an option in the reconstitution of intestinal continuity in resection of the lower rectum.<sup>4</sup> It reduces the rate of patients with ostomies (temporarily or permanently).<sup>6</sup> Patients with low rectum neoplasia requiring ultra-low anastomoses, without sphincteric involvement, and without incontinence or sphincter dysfunction prior to the intervention are considered candidates for this technique.<sup>4,6</sup> From a technical point of view, the available options include trans-anal extraction of the specimen, immediate anastomosis, and temporary ostomy; and *Pull-through* with deferred anastomosis. The results of each option are explored below.

In a 2022 systematic review and meta-analysis, Raja *et al.*<sup>4</sup> evaluates the results of a group of 905 patients with neoplasia of the lower rectum, who underwent RAR with TME (Total Mesocolon Excision). Of these, 386 underwent *pull-through* with deferred anastomosis and the remaining 519 underwent immediate anastomosis and loop ileostomy. Postoperative complications (with *Clavien-Dindo*  $\geq$  III), pelvic sepsis due to anastomotic leak, and the risk of permanent ostomy, as shown in Table 2, were compared between the groups.

*surgery*”.<sup>6</sup> However, it should be borne in mind that this type of extraction is not possible in all patients, especially in males, those with narrow pelvises, obese and large tumors.

## Conclusion

Permanent ostomies are associated with morbidity and decreased quality of life. *Pull-through* is a technique that offers patients who have good sphincteric function, but unfavorable local conditions or complications from previous colorectal anastomosis, a “last chance” to avoid an ostomy, with reasonable functional results.

More recently, the indications for the procedure have been extended to patients with rectal cancer requiring ultra-low resections. In these patients, two options may be offered: immediate anastomosis with temporary ileostomy or deferred anastomosis. As for the rate of anastomotic leakage, the options seem to be equivalent. There appears to be a trend towards a lower risk of pelvic sepsis in patients with deferred anastomoses. Data on functional results are scarce and difficult to evaluate, although acceptable and with few cases reported of need for permanent ostomy due to dysfunction.

## Sponsorships

Not applicable.

## Conflicts of interest

The authors have no conflict of interest to declare.

## Contributions

R.V.M. carried out the bibliographic research and planned the manuscript; R.V.M., F.A. and J.R. reviewed the literature and contributed to the preparation of the manuscript. R.R., P.A. and P.M. reviewed the article.

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