Colo-anal Pull-through For The ‘Hostile Pelvis’
Revisited: Technical Considerations From A

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Background: Although there is no consensus concerning the definition of the ‘hostile’ pelvis, variant colo-anal pull-through procedures may be used for salvage surgery. This paper reports a single surgeon experience of these operations providing technical caveats for their use. Methods: Retrospective single surgeon analysis of cases between 1993 and 2015 Results: The main techniques included Soave and Duhamel reconstructions for an eclectic range of colorectal conditions including post-obstetric rectovaginal fistulae, the management of anastomotic leakage after low anterior resection and neoadjuvant chemoradiation, rectoprostatic fistulae, extralevator anorectal fistulae and intractable Crohn’s proctitis. The complication rate was 31.8% with 86.4% avoiding a permanent stoma. Fifty percent of patients reported normal continence during a median follow-up of 29 months. Conclusion: Modifications of the colo-anal pull-through procedure are successful as salvage for a range of chronic colorectal conditions. A randomized trial is required to determine the place for a staged delayed anastomosis.

Key Words: Colo-anal pull-through; hostile pelvis; colo-anal anastomosis; Duhamel; Soave rectosigmoidectomy

INTRODUCTION:

There is no uniform definition of a ‘hostile pelvis’ although surgeons generally recognize it when they see it. A range of conditions lead to an inhospitable pelvis including more commonly those patients with advanced pelvic malignancy, pelvic sepsis (particularly following a disrupted low colorectal or pouch-anal anastomosis), extensive intra-abdominal adhesions and severe Crohn’s disease. One of the safest operative options in those cases with a hostile pelvis is to remain inside the bowel lumen in an effort to reduce the likelihood of damage to adjacent extrarectal structures (ureters, vagina, iliac vasculature and pelvic nerves) with the creation of a colorectal pull-through and a colo-anal anastomosis in an effort to avoid permanent diversion. The variant colo-anal pull-through procedures are relatively under-utilized and an appreciation of their uses reflects an understanding of the chronological development of the different techniques employed for Hirschprung’s disease and high congenital anorectal anomalies which have been translated to the difficult pelvis.

Romualdi was the first to perform extramucosal dissection of the rectum in 1955 (although not published until 1960) with an adaptation of the technique by Kiesewetter and Turner for high anorectal malformations with associated urethral fistulae. This approach was translated and adapted by Franco Soave to those children with Hirschprung’s disease. Soave’s technique established an anastomosis in normally ganglionated tissue and distinguished itself from Swenson’s procedure which formed a coloanal anastomosis whilst leaving a small residuum of diseased bowel above the anastomosis. Further modifications included the Duhamel procedure creating a retro-rectal pull-through and a GIA-stapled enlargement of the front wall of a Duhamel anastomosis advocated by Lester Martin in 1962. The Turnbull-Cutait operation which fashioned a delayed colo-anal anastomosis as a second-stage procedure became popular in the management of low rectal cancers during the pre-stapling era. Recently, this approach has been revived primarily performed laparoscopically by Jarry and Faucheron in Grenoble for selected patients with adult onset severe constipation where the purported benefits include an ability to assess the vascularity of the prolapsed colonic segment with a reduced need for permanent diversion. This study reports a retrospective single-surgical experience over time of a variety of colo-anal pull-through pro-
cures and modifications used as salvage operations for an eclectic group of intractable pelvic and rectal conditions which presented with a hostile pelvis. Technical ca-
evates for intra-operative decision making dependent upon the local pelvic circumstances and the differing indications for salvage surgery are discussed.

**PATIENTS AND METHODS:**

Ethical permission was obtained to conduct a retrospective case file review. Examination of the medical records revealed 29 patients eligible for analysis in an unselected series operated upon by the author between January 1993 and December 2015. Of these, 7 cases were excluded, 4 where a sleeve pouch advancement was performed for a pouch-vaginal fistula (3 referred) and 3 further patients who underwent an anterior pelvic exenteration. This left 22 patients (Table 1) for analysis including 9 males (median age 49 years; range 11-78 years). The median follow-up was 29 months (range 6-99 months). Amongst the group there were 10 with rectovaginal fistulae (5 external referrals) all of whom had undergone prior perineal repairs (median 3 repairs; range 2-9 repairs). Two patients presented with a rectoprostatic/urethral fistula, one following prostate cancer template seeded brachytherapy and the other with a recurrent high urethral fistula following a prior posterior sagittal anorectoplasty as a child. Seven patients presented with a disrupted low rectal anastomosis, all of whom had undergone neoadjuvant therapy with a mean of 45cGy radiotherapy. Of these 2 had a fistula at the time of surgery and each patient had a diverting stoma.

At the time of analysis, 2 patients are awaiting decision regarding ileostomy closure. One of these cases underwent a colo-anal pull-through procedure combined with a left nephroureterectomy for an associated infected pelvic ectopic kidney. Two further patients presented with a translevator fistula-in-ano following rectal perforations (both referred). Both patients had undergone prior presacral drainage elsewhere and both presented with pelvic abscesses. There was one patient with Crohn’s proctitis and a coincident rectal cancer who had previously undergone a segmental left hemicollectomy in the United Kingdom and who was primarily referred during a course of neoadjuvant chemoradiation where the decision was made to use a pre-emptive colo-anal pull-through procedure. Overall, 18 patients (81.8%) presented with a pre-existing colostomy or ileostomy, with 9 cases (40.9%) having been irradiated.

A basic protocol was established early on for this generic type of patient where in malignant cases CAT scanning, MR imaging and PET scanning was used (where available and appropriate) to exclude persistent or recurrent pelvic malignancy prior to reoperation. Frozen section histology was used in 2 cases (both negative). Anal sphincter function and integrity were assessed preoperatively in all cases with endoanal sonography and conventional water-perfused anorectal manometry incorporating elicitation of the rectoanal inhibitory reflex. No formal continence survey was employed but patients’ overall continence status was recorded in the notes.

**COLO-ANAL PULL-THROUGH PROCEDURE**

All patients received oral bowel preparation and intravenous antibiotic therapy and in those cases with a stoma, distal irrigation. All patients underwent routine

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**TABLE 1**

<table>
<thead>
<tr>
<th>Cause</th>
<th>Patient number</th>
<th>Clinical history</th>
<th>Operative type</th>
</tr>
</thead>
<tbody>
<tr>
<td>RVF*</td>
<td>10</td>
<td>5 referred from Elsewhere#</td>
<td>6 Soave</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 Duhamel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 Martius graft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 Dermal flaps</td>
</tr>
<tr>
<td>RPF</td>
<td>2</td>
<td>1 prostate BT</td>
<td>Duhamel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Congenital</td>
<td>Duhamel</td>
</tr>
<tr>
<td>Anastomotic leak</td>
<td>7</td>
<td>All reop RT</td>
<td>7 Soave + omentoplasty</td>
</tr>
<tr>
<td>High extra-sphincteric fistula</td>
<td>2</td>
<td>Rectal perforation</td>
<td>2 Soave</td>
</tr>
<tr>
<td>Crohn’s roctitis</td>
<td>1</td>
<td>Supervening Ca</td>
<td>Martin procedure</td>
</tr>
</tbody>
</table>

*RVF-rectovaginal fistula, RPF-rectoprostatic fistula, BT-brachytherapy (prostatic seeds), RT-radiotherapy, #Prior procedure included 6 direct closures and 4 prior Martius grafts (one with bilological mesh)
ureteric catheterization. An abdominal approach was conducted with the patient placed in the Lloyd-Davies position which was for perineal reconstruction converted when appropriate to a lithotomy position. Complete splenic flexure mobilization was routinely performed with high inferior mesenteric ligation where appropriate. In some cases the rectal stump was identified by on-table rectoscopy whereas in other cases the bowel was transected where comfortable. The rectal stump was opened after passage of a short vein stripper under microscopic guidance with dissection of the submucosal plane away from the muscularis and with a 2/0 Vicryl suture stitched in place around the exit point of the stripper lumen. Division of the rectal mucosa was performed one centimeter above the dentate line with initial mucosectomy from below developed (after 1:200000 epinephrine injection) and with dissection carried as high as possible in those cases which were adherent (those with prior rectovaginal fistulae and extraspincteric fistulæ). The stripper was withdrawn rectally to complete the mucosectomy similar to a technique used for a full-thickness transhiatal oesophagectomy.\(^{15}\) Hegars dilatation was conducted in those cases with a narrowing chronic pelvic abscess cavity.

The distal colon is pulled through the rectal stump (once denuded of its mucosa) in a Soave style approach or in those cases with a rectovaginal fistula via a retrorectal Duhamel approach. In both settings, it is advised to bring the mesentery of the pull-through laterally so that if there is postoperative sepsis it may be drained directly posteriorly through the anastomosis with safety. With a Soave pull-through a hand-sutured anastomosis is performed after transection of the colon at an appropriate length without tension. In the event that a Duhamel technique is used, the anastomosis is performed with a GIA (Ethicon) stapler. Where a Martin modification was used the serosa of the rectal stump and the anterior colonic wall were sutured together prior to a second endorectal firing of a GIA stapler to pre-emptively enlarge the anastomosis. In selected cases an omentoplasty based on either gastro-epiploic arcade was used as interposition for a rectovaginal fistula with secondary lengthening of the omental flap by distal division taking notice of the peripheral Barkow’s arcade.\(^{13,14}\)

Where required, vaginal reconstruction was performed by direct suture, by a Martius labial fat pad graft\(^ {15}\) in those cases where less than one-quarter of the vaginal surface was denuded and by a groin-based full-thickness dermal graft\(^ {16,17}\) if a larger part of the vaginal wall had been lost (Figures 1 and 2). A temporary loop ileostomy was employed in those cases where there was no pre-existing proximal fistula. The pelvis was routinely drained with two pelvic suction drains. Stomas were closed at a minimum of 6 months after preliminary combined radiologic and endoscopic assessment.

**RESULTS:**

Table 1 shows the indications for and types of surgery in the patient cohort. All rectovaginal fistulæ in the cohort were post-obstetric in nature. Of the 5 referred from outside, 4 had already undergone a failed Martius graft and one a failed mesh interposition. Of the in-house failed fistulæ, all had undergone at least one prior failed Martius graft. Nine of the 10 cases had healing of their fistula with stomal closure and with the non-healing case maintaining her diverting ileostomy at latest follow-up (Table 2). This non-healing patient re-presented at 3 months with a recurrent rectovaginal fistula in the same locale as previously after being dry following the coloanal pull-through procedure for the first 3 postoperative months.

The overall postoperative complication rate was 31.8% (7 cases) as shown in Table 2. One patient presented at 6 weeks with abdominal and pelvic pain with a CAT scan showing a collection. Percutaneous drainage revealed clear fluid with a high creatinine content. This patient underwent retrograde pyelography with evidence of extravasation of the distal ureter without proximal contrast. Two double-J ureteric stents were able to be successfully deployed jump bypassing a localized ureteric transection most likely caused by cautery dissection injury at the initial operation which had not been recognized. This patient also presented with a calf deep vein thrombosis. One further case presented 4 months after surgery with an ischiorectal abscess with a translevator extension. This was formally drained with a translevator irrigating drain after an MR image failed to demonstrate any suprarelevator disease. At 12 postoperative months there has been no sign of clinical recurrence. During follow-up two patients presented with anastomotic strictures, one of which responded to Hegar’s dilatation and the other which was more extensive and which was successfully managed by endoscopic balloon dilatation.

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**TABLE 2**

<p>| COMPLICATIONS FOLLOWING A COLO-ANAL PULL-THROUGH SALVAGE PROCEDURE |
|----------------|----------------|</p>
<table>
<thead>
<tr>
<th>Complication</th>
<th>Patient number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ureretic injury</td>
<td>1</td>
</tr>
<tr>
<td>Pelvic collection</td>
<td>1</td>
</tr>
<tr>
<td>Rectovaginal fistula</td>
<td>1</td>
</tr>
<tr>
<td>Ischiorectal abscess</td>
<td>1</td>
</tr>
<tr>
<td>Wound infection</td>
<td>3</td>
</tr>
<tr>
<td>Urosepsis</td>
<td>1</td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>1</td>
</tr>
<tr>
<td>Anastomotic stricture</td>
<td>2</td>
</tr>
</tbody>
</table>
Three patients have persistent ileostomies in the total cohort with 19 patients (86.4%) avoiding a permanent stoma. In 4 cases continence status was not adequately recorded and in the patient who had undergone a prior repair of a congenital anomaly, there was a history of moderately frequent solid leakage preoperatively. Eleven patients (50%) had normal continence recorded with 5 (22.7%) having occasional leakage and one (4.5%) new onset complete incontinence. This last patient also presented with combined evacuatory difficulty and was the Crohn’s patient with a supervening carcinoma who had undergone a pre-emptive Martin procedure. This patient who had shown no preoperative rectoanal inhibitory reflex with a low resting anal pressure and heterogeneous internal anal sphincter defects on endoanal ultrasonography, has been offered repeat diversion.

**DISCUSSION:**

There is no uniform definition of a hostile pelvis but it most simply reflects any pelvis where the anatomy renders dissection particularly difficult. There are limited data to suggest that preoperative pelvimetry can accurately predict the likelihood of an inhospitable pelvis, where recently Jones et al.\(^{18}\) using CAT parameters to determine pelvic volume showed that a decreasing volume correlated with an increased risk for deep space infection and a higher likelihood in a range of pelvic malignancy types for sepsis and fistula after salvage surgery. Although radiologic pelvimetry has been used extensively in obstetric practice,\(^{20}\) preoperative demonstration of a smaller pelvis has predicted for increased operative times in laparoscopic rectal cancer surgery\(^{20}\) and for a higher risk of resection margin involvement in prostate cancer surgery\(^{21}\). This type of data may be potentially extrapolated to the use of salvage surgery in those patients presenting with a hostile pelvis and in the future it may be of value to perform preoperative pelvimetry in an effort to predict operative difficulty and to assist in decision making concerning the use of an elective colo-anal pull-through as well as in the counseling of such patients.

The decision to perform a colo-anal pull-through operation as a salvage procedure for a complex colorectal condition obviates the dangers of a perirectal dissection, significantly reducing the risk of injury to adjacent structures and the likelihood of pelvic bleeding. It also brings healthy colon subjacent to a complex anorectal or recto vaginal fistula resulting in a greater healing potential. Full colonic mobilization will permit an anastomosis which is sufficiently distal to the old fistula site; an anatomical feature which will limit the ideal length of the colonic sleeve used and which will be governed by the intraoperative tension of the pull-through segment. In those where there is limited room between the fistula and the dentate line the staged Turnbull-Cutait approach can be valuable where there is concern regarding either the viability of the prolapsed segment or if there is mild or moderate tension of the colonic pull-through segment.\(^{8,10}\) This has not so far been required in the author’s experience but is an important theoretical consideration.

**FIGURE 1**

MARTIUS VASCULARIZED LABIAL FAT GRAFT USED FOR LIMITED SURFACE VAGINAL CLOSURE.

Duhamel approach is recommended in those with anterior or middle pelvic pathology and in cases with a rectourethral or rectoprostatic fistula with the Martin modification selectively employed when an anastomotic stricture is anticipated. The lateral disposition of the mesentery in the pull-through is potentially advantageous if there is the development of a pelvic collection which can then be safely drained through the anastomosis without the risk either of bleeding or of devascularization of the distal colon.

The complication rate reported in this series is comparable with that previously reported for such salvage surgery,\(^{22,25}\) with advantage in the performance of a coincident mucosectomy.\(^{26}\) Controversy remains in the literature over the merits of a delayed Turnbull-Cutait approach in these cases. Historically, because of a relatively high incidence of anastomotic leakage and pelvic sepsis following an immediate coloanal anastomosis, the Turnbull-Cutait delayed approach had been used as a primary option in some mid-rectal cancers as well as in a range of disorders including Hirschprung’s disease, chagasic megacolon and even ulcerative colitis. The older literature by Turnbull and Cutait comparing delayed with immediate anastomosis in a pull-through configuration did show a reduction in the incidence of septic complications such as presacral abscesses and for anastomotic leakage in the delayed group.\(^{28,29}\) For this type of indication, the advent of stapling devices and experience with low rectal anastomoses changed the indication for use of the Turnbull-Cutait procedure. Despite this strategic change, patients were often not strictly comparable where there frequently were inherent differences in patient age, associated comorbidity and the exposed dosage of preoperative radiation (when used) between the immediate and delayed anastomotic cases.
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Recent data by Remzi et al. retrospectively comparing their Turnbull-Cutait patients with immediate coloanal anastomosis cases did not in show any difference in overall continent outcome with nearly three-quarters of the Turnbull-Cutait cases reporting a near normal postoperative continence status. In a systematic analysis of the clinical outcome of delayed colo-anal anastomosis by Hallet et al. there was a decreased incidence of anastomotic leak and pelvic sepsis without any difference between delayed and immediate anastomosis in the mean number of postoperative daily stools. In our cohort, there were no cases where a delayed anastomosis was used although the literature comparing immediate with delayed colo-anal anastomosis would suggest that deferring the anastomosis may reduce pelvic morbidity. This needs to stand alongside the disproportionately high permanent stoma rate of 25% achieved in the Remzi study which may reflect the patient population for which the Turnbull-Cutait operation was utilized. In their paper it was used as a last resort either for a range of complex anorectal disorders or for the management of high-risk low rectal cancer where the only other alternative would itself have been a permanent stoma. Nowadays, decision making concerning a return to a Turnbull-Cutait approach where more complex pelvic cases are being salvaged will require a randomized, controlled clinical trial. The interpretation of this data is, however, likely to be limited by confounding variables and bias. A delayed anastomosis will also preclude the use of a colonic J-pouch in selected cases.

From personal involvement during training with cases performed during the 1980’s and early 1990’s, the author’s anecdotal experience concerning continence after a delayed Turnbull-Cutait operation was that it was severely compromised particularly in those patients where there was no pre-existing internal anal sphincter function either on manometry or later if on endoanal endosonography there was evidence of heterogeneous internal anal sphincter damage. This observation would be consistent with the reported continence outcomes in patients with similar manometry and sonography undergoing an Altemeier’s-type perineal anastomosis for rectal prolapse.

Our approach was to routinely employ ureteric stents based upon a retrospective review by Halabi et al. which suggested that reoperative rectal surgery represented a considerable risk of ureteric injury. Other groups advocating colo-anal pull-through procedures as salvage surgery do not use ureteric stents citing the fact that the planes of dissection are different if the aim is to remain intrarectally and that stents may not be palpable (or visible) in a fibrotic pelvis. It is our view that ureteric stents are more likely to aid in the identification of an injured ureter during reoperative surgery although this is likely to be injury type-dependent. Stenting did not prove valuable in the one case where there was a late presentation of a ureteric injury, most likely the result of diathermy damage during dissection. The author has no experience in the use of lighted ureteric stents in reoperative cases.

In those patients where a prior colectomy or rectal resection precludes a tension-free pull-through, alternatives would include either a Deloyers procedure utilizing a rotated vascularized ileocecal segment for restoration of intestinal continuity or reconstruction using a modified Jinling approach normally reserved for the management of slow-transit constipation stapling the caecum to the rectal stump. The author advocates the performance of a pre-emptive anterior rectotomy to avoid the risk in the chronic fibrotic pelvis of a delayed extra- or supra-rectal stricture and generally does not advise excision of the rim of a long-standing abscess cavity wall as there is the risk of collateral damage. In summary, a single-surgeon experience of the colo-anal pull-through procedure with immediate anastomosis is presented. Modifications of the technique are required dependent upon the local pelvic circumstances, the nature of the prior surgery leading up to the salvage procedure and the constraints of available colon. Knowledge of the alternatives in colo-anal reconstruction for such complex surgery is required. The technique may be used in the presence of active sepsis.
provided that the anastomosis is performed without tension away from the septic field and it may often be combined with variant options for en passant vaginal resurfacing.

SUMMARY

Iako ne postoji konsenzus oko definicije “nepogodne” karlice, varijanta colo-analne “pull-trough” procedure može biti primenjena kao reoperacija. Rad prezentuje iskustvo jednog hirurha uz akcenat na tehnička upozorenja prilikom izvođenja ovih operacija.

Metode: Retrospektivna analiza pacijenata operisanih u period 1993-2015 godina.

Results: Glavna tehnika koja je uzeta u razmatranje je Soave i Duhamel rekonstrukcija primenjena kod širokog dijapazona kolorektalnih oboljenja-rektovaginale fistule, tretman dehisencije anastomoze posle niskih resekcija rektuma i neoadjuvantne hemioradioterapije. Fistule između rektuma i prostate, ekstralevatorne anorektalne fistule i dugotrajnog Crohn prokritis. Nivo komplikacija bio je 31,8% kod kojih je u 86.4% izbegnuta stalna stoma. Pedeset procenata bolesnika imalo je normalnu kontinenciju u toku priroda praćenja od 29 meseci.

Zaključak: Modifikacija koloanalne pull-trough procedure je uspešna kod reoperacija u mnogim hroničnim stanjima. Randomizovane trajal studije su neophodne u perspektivi da bi se zauzeo stav u vezi ove problematike.

REFERENCES:


