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History of Ostomy Surgery

Dorothy B. Doughty

In the Beginning . . .

The history of ostomy surgery is much like the history of WOC nursing; it is an inspiring story characterized by tremendous challenges, determined providers, and very courageous patients. This is their story—and our heritage.

Development of Colostomy: Indications and Construction

Only sporadic accounts of ostomy surgery can be found before the 1700s. Throughout the 18th century, accepted management of intestinal perforation was to close any open abdominal wound and “hope for the best.” This treatment plan was (not surprisingly) associated with extremely high mortality rates. The earliest stomas were actually fistulas that developed spontaneously following bowel perforation; one surgeon noted the correlation between spontaneous fistula development and patient survival and stated in his journal that perhaps surgeons should “take a lesson from Mother Nature” and construct planned stomas in such cases.1,2 Any surgical advance during this period was significantly complicated by the absence of anesthesia and asepsis, which of course resulted in extremely reluctant patients and dismal outcomes.

In the late 18th century (1793), an innovative surgeon performed a colostomy on a 3-day-old infant with an imperforate anus; to prepare for the procedure, he practiced on the bodies of dead babies he obtained from the city’s poorhouse. The surgery was successful, and the patient lived to the age of 45, though we lack any data as to how he actually managed the stoma.1,2

Following the development of anesthesia during the mid-1800s, surgery became a realistic treatment option; surgeons in the mid-1800s to late-1800s used diverting colostomy to manage bowel obstruction and also tried to cure patients with rectal cancer by surgical excision of the rectum (narrow abdominal perineal resection of rectum [APR]). Unfortunately, these early attempts to cure rectal cancer with APR were associated with a 100% recurrence rate, because only the rectum and anal canal were removed. Surgeons learned quickly from these failures, and in the early 1900s surgeons Mayo and Miles modified the APR procedure to include radical resection of the perirectal tissue and lymphatics as well as the rectum and anal canal.1,4 During the early 1900s, surgeons also found that proximal colostomy could be used to protect a distal anastomosis and to reduce postoperative complications.1

Early decompressive and protective colostomies were typically constructed as skin-level “loop” ostomies. They provided effective decompression of an obstructed bowel but only partial diversion of the stool, and they proved quite difficult to manage. In 1888, the support rod was introduced to prevent retraction of the loop stoma until it had granulated to the abdominal wall. The use of rods was a major advance, in that it produced a protruding stoma that provided almost complete diversion of the fecal stream.1,5 At this time, the standard of care was to leave the loop stoma closed until several days following surgery, at which point the anterior wall of the loop was opened with cautery at the patient’s bedside. The procedure was not painful but it frequently was traumatic since the patient could smell the burning tissue, and it meant that the stoma had to “self-mature” via gradual self-eversion to expose the mucosal layer of the bowel. This changed in the 1950s, when Dr Bryan Brooke made surgical maturation the standard of care for ileostomy; subsequently surgical maturation became the standard of care for colostomy construction as well.1,5,6

Henry Hartmann popularized the concept of delayed anastomosis (and the Hartmann’s Pouch) when he lectured in America during the early 1900s on his technique for managing obstructing sigmoid tumors: removal of the involved segment of bowel, closure of the distal stump, and formation of an end colostomy.1,5 Mikulicz-Radecki proposed another option for temporary diversion following bowel resection; he recommended bringing the proximal and distal segments of the bowel out as 2 side-by-side skin-level stomas, and he further recommended using a crushing clamp to create a fistula between the 2 loops of bowel (and thus restore intestinal continuity) once it was deemed safe for stool to pass through the distal bowel. He
called this procedure a double-barrel colostomy. This procedure never gained popularity, and over time the term double-barrel colostomy came to indicate a proximal colostomy with a distal mucous fistula.

**Development of Colostomy: Location and Management**

In the early 1800s the standard of care was to site a colostomy in the lumbar area. This site was selected through cadaveric work and showed that the posterior wall of the colon could be accessed and brought to the surface without involving the peritoneum, a critical consideration in the days preceding asepsis. Once aseptic technique became the standard of care, the lumbar location was replaced by an anterior approach. Nevertheless, the specific site was determined by the area of pathology, which meant that many stomas were located in the inguinal area. Both the lumbar and inguinal location rendered colostomy management challenging, and construction of most stomas at skin level added to the difficulty. It was not until the 1950s, when Dr Rupert Turnbull began to focus on ostomy patient rehabilitation and established the Enterostomal Therapist (ET) role, that preop stoma site marking became the standard of care.

Colostomy formation became more and more common throughout the 20th century; however, there were no ostomy supply companies and few options when selecting a pouching system prior to the 1970s and 1980s. Fortunately, in 1924 an innovative surgeon originated the concept of colostomy irrigation. He worked with a supply company manager to develop the equipment. Irrigation remained the standard of care for colostomy patients until the late 1980s, at which time odor-proof pouching systems were available and patients could be given the choice between routine irrigation and management with pouching.

**Continent Colostomy**

There have been multiple unsuccessful attempts to develop a continent colostomy. One involved creation of an aperistaltic abdominal reservoir attached to an abdominal stoma; intussusception of the bowel between the reservoir and the stoma provided continence (a colonic version of the Kock Pouch). Not surprisingly, this attempt failed because the formed stool normally found in the colon could not be effectively drained through a catheter. Another approach involved a strip of muscle wrapped around the bowel just proximal to the stoma to create a neosphincter; the developers hoped that over time patients would be able to recognize colonic distention so that they could apply a pouch when needed. This procedure was associated with poor results and high complication rates. The third approach involved implantation of a metallic ring into the peristomal tissue; a magnetic cap with an obstructing plug was then inserted into the stoma to obstruct the bowel and prevent stool elimination. The patient was taught to irrigate to stimulate evacuation on a routine basis and to use the obstructing cap at all other times to prevent stool leakage. This procedure was associated with multiple complications related to foreign body reactions and soft tissue infections, and the continence rates were no better than those obtained with routine colostomy irrigation. Currently, routine colostomy irrigation is considered the best option for providing modified continence for patients with descending or sigmoid colostomies.

**Current Status: Indications, Construction, and Management of Colostomy**

To some extent, the indications for colostomy remain the same: temporary colostomy is still indicated for decompression of an obstructed colon, and wide abdominal-perineal resection and permanent colostomy is still the treatment of choice for low rectal cancers. However, several significant changes have occurred. For example, routine diversion is no longer recommended in cases involving perforation or traumatic disruption of the bowel; studies have shown lower complication rates with single-stage procedures (resection of the damaged bowel with end-to-end reanastomosis) so long as there are no significant impediments to repair. In addition, when temporary diversion is indicated for protection of a distal anastomosis, loop ileostomy is now recommended as opposed to loop colostomy; this is based on a number of studies showing lower morbidity rates with diverting ileostomy as opposed to diverting colostomy.

The guidelines for curative resection of rectal tumors have been revised (based on multiple pathology studies) to require a distal margin of only 1 to 2 cm, as opposed to 5 cm. Thus many patients who would formerly have required APR and permanent colostomy can now be managed with low anterior resection, in which the rectum is removed and the colon is anastomosed to the anal canal; this sphincter-sparing procedure eliminates the need for permanent colostomy, though temporary diversion may be required to permit anastomotic healing. Coloanal anastomosis is initially associated with significant fecal urgency and frequency; thus surgeons in the 1990s developed the
colonic reservoir (coloanal J-pouch) to serve as a neorectum and provide temporary fecal storage.12

Surgical construction of colostomy stomas has changed very little; loop stomas are still supported by rods or similar devices, and surgical maturation remains the standard of care for both end stomas and loop stomas. However, the gold standard for construction of an end stoma is now a slightly protruding stoma as opposed to a skin-level stoma. Similarly, colostomy management has not changed significantly in recent years; patients may either manage with odor-proof pouching systems or may choose to regulate bowel function with routine colostomy irrigation (so long as the stoma is located in the descending or sigmoid colon).

Development of “Continent ileostomy”

As noted, surgeons in the first half of the 20th century introduced a number of refinements designed to reduce post-operative complications and to produce protruding stomas, which tremendously improved quality of life for ileostomy patients. In 1969, Swedish surgeon Nils Kock13,14 introduced an alternative approach to improving the quality of life for patients requiring proctocolectomy: creation of an aperistaltic internal pouch with a continent catheterizable stoma (a continent ileostomy).13,15 This innovative procedure provided good initial results, but over time many patients experienced failure of the intussusception that provided continence. Surgeons responded with a number of modifications to the continence mechanism; the most successful was a “living collar” introduced by Barnett (a loop of bowel encircling the intussuscepted bowel and communicating with the internal pouch, which filled as the pouch filled and provided additional support for the continence mechanism).16 The Barnett Continent Ileal Reservoir significantly reduced the reoperation rate, and remains the most successful and popular version of the continent ileostomy; patients typically intubate the internal reservoir 3 to 4 times a day, and most report high levels of satisfaction.

Indications and Construction

The first ileostomy was performed in the late 19th century as a temporary diversion for a patient with an obstructing lesion in the ascending colon. Early ileostomies were constructed as skin-level stomas and were associated with severe skin breakdown and high morbidity and mortality rates, which meant that they were performed only as a last resort for patients with severe and refractory inflammatory bowel disease. The first major advance in ileostomy construction came in 1912, when a protruding ileostomy was created by bringing several inches of bowel out through the incision and using a metal clamp to prevent retraction back into the abdomen; the distal end of the stoma sloughed off, and the remaining stoma “self-matured,” a slow process of mucosal eversion that was associated with severe inflammation and partial obstruction but that did finally produce a more pouchable stoma.1,13 Ileostomy management was further advanced in the 1920s when a surgeon and a patient collaborated on the development of a rubber appliance that could be belted and glued into place; the combination of a protruding stoma and a secure appliance made ileostomy construction a realistic alternative for patients whose inflammatory bowel disease could not be controlled with medical therapy.1,13 The next major advance came in the mid-1950s, when Dr Bryan Brooke pioneered surgical maturation of the stoma, which provided a protruding stoma while eliminating the complications related to spontaneous maturation.5,11,14 This minor change in stoma construction significantly improved clinical outcomes for ileostomy patients and quickly became the standard of care.

Evolution of Urinary Diversion:

Indications and Construction

From the mid-1800s to the mid-1900s there were 2 very different approaches to urinary diversion: ureterostomy and ureterosigmoidostomy. Ureterostomy was a simple procedure in which the ureters were anastomosed to the abdominal wall; however, these stomas were associated with a high incidence of stenosis and infection (because there was no antireflux mechanism to protect the kidneys from organisms introduced through the stoma), and they were problematic for the patient because they were small skin-level stomas that were difficult to pouch. Ureterosigmoidostomy was initially viewed as the preferred procedure. The ureters were implanted into the sigmoid colon and elimination of the urine-stool mixture was controlled by the anal sphincter. This avoided the need to create an external appliance.17

Development of Sphincter-Sparing “Pelvic Pouch”

In the late 20th century, surgeons began to build on techniques used to create the continent ileostomy to provide yet another option for patients requiring proctocolectomy for benign disease. Specifically, they realized that they could remove the colon and rectum while preserving the anal canal and sphincter mechanism. This technique permitted them to create an aperistaltic reservoir and to connect that reservoir to the patient’s own sphincter.13,17 It was expected that these pelvic reservoirs would serve as rectal substitutes and that use of the native sphincter mechanism would provide better continence when compared to man-made mechanisms required for the continent ileostomy. In addition, the pelvic reservoir provided patients with a stoma-free, near-normal pattern of defecation. Clinical outcomes and patient satisfaction are variable; patients with good outcomes report stool frequency of about 4 to 6 per day and good bowel control following the initial adaptation phase. However, a number of patients report persistent problems with stool frequency and anal incontinence, and up to 50% of patients develop pouchitis, an inflammatory condition associated with cramping, malaise, stool frequency, and fecal urgency. Research is ongoing into the causes and management of pouchitis.18
The Indiana Reservoir is constructed using the isolated ileocecal segment of bowel. The cecum is detubularized to create a noncontractile reservoir, the ureters are tunneled along the tenia coli to provide antireflux protection, continence is provided by the ileocecal valve supported by surgical plication (tapering) of the ileal segment, and the stoma is constructed by attaching the distal end of the tapered ileal segment to the abdominal wall. The patient drains the reservoir every 3 to 4 hours using clean catheterization technique, and most patients have excellent outcomes.

While the Indiana Reservoir is the most common approach to continent urinary diversion, in 2008 there are many variations on this general approach. For example, various segments of bowel can be used to construct a noncontractile reservoir, and for patients with benign conditions the patient’s native bladder can be used as the reservoir (with or without augmentation). Similarly, a variety of structures are used to create a continent catheterizable channel, including the appendix.19

**Orthotopic Neobladder**

In 1985 and 1988, surgeons reported on creation of an acontractile cecal reservoir with anastomosis to the distal urethra and continence provided by the striated urethral sphincter. This procedure was subsequently modified to include the addition of an ileal segment proximal to the urinary reservoir, to which the ureters are anastomosed; this results in reduced tension on the uretero-cecal anastomoses and improved long-term outcomes. While these procedures are performed with increasing frequency in major medical centers, there are 2 major problems that may be experienced by these patients: incomplete emptying and persistent leakage. In order to empty the reservoir, the patient must effectively relax the sphincter while performing a Valsalva maneuver; patients who are unable to effectively empty the reservoir must learn to perform clean intermittent catheterization. Initial nocturnal leakage is very common because tone in the striated muscles is reduced during sleep; for some patients this is a persistent problem that requires consistent use of absorptive products.25

**Introduction and Impact of Enterostomal Therapists**

The first ostomy patients were truly pioneers and very much on their own; there were no appliances available and no one to turn to when they had questions or problems. There are anecdotal reports of individuals being ostracized by their families and friends due to persistent fecal odor and soiling, and individuals who required an ileostomy also suffered severe skin breakdown. At that time the only treatment available for peristomal denudation was to place the patient prone on a special mattress with a cutout for the stoma and a drainage receptacle placed underneath to catch the effluent. All of this began to change in the mid-20th century, when Dr Rupert Turnbull recognized the many unmet needs of his ostomy patients and recruited a dynamic ileostomy patient (Norma Gill) to work with his ostomy patients as an Enterostomal Therapist. In addition to
References